Year 9 Knowledge Organiser
Term 3

This booklet contains some of the key content we want the students to learn this term. Knowledge Organisers are placed in the relevant Google Classroom.

How students and parents can use a Knowledge Organiser to maximise learning:

- Pick a subject to recall and memorise
- **Look** at the pages for that subject
- **Read** the page information for that subject
- **Cover** the page of information
- **Write** the information for that subject from memory
- **Check** what you have written. Correct mistakes and add anything you have missed
- Your teacher will **quiz** you in class to see what you can recall
- **Repeat** the process over time and focus on the information you keep missing or make mistakes on

Contents

Art

Year 9 ART – Man Made

Assessment Objectives:

AO1 – Developing ideas through research
AO2 – Using resources, experimenting with different media and ideas
AO3 – Recording ideas (photos & drawings)
AO4 – Personal response

Overview of Topic

In this project you will investigate the theme of Man made objects. Working from primary and secondary sources you will learn how to respond to a theme using a variety of materials. You will explore creating work using pencil, fine liner, watercolour and acrylic paints. You will then develop skills in printmaking working on monoprints and relief printing. Finally you will learn key skills for GCSE presentation in research and responding to an artists work relevant to the theme.

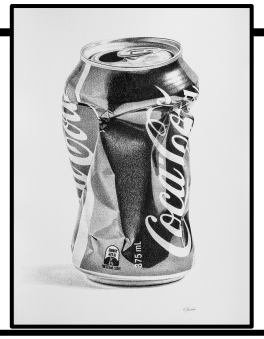
TONAL PENCIL DRAWING: A step by step guide:

Begin by lightly mapping out accurate shapes of the objects you are drawing or use a grid method. Artists often break complex objects down into basic shapes such as circles, squares, rectangles and triangles.

Then begin shading. Start at the darker areas and slowly shade towards the lighter parts. Build up layers of pencil slowly- try not to start too dark!

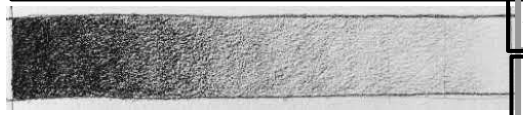
Pencil pressure: The harder you push down the darker your shading will be. Gently press down for lighter shades.

Remember: DRAW IT LIGHT TILL YOU GET IT RIGHT!



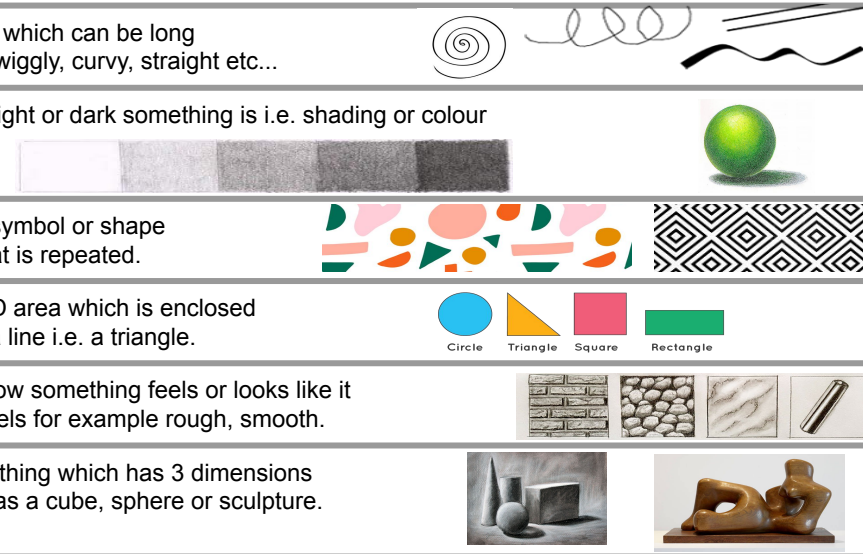
Tonal Ladder

All tonal shades from dark to light should be present in your drawing.



FORMAL ELEMENTS OF ART

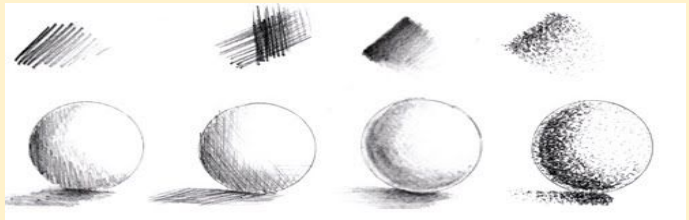
Colour	What you see when light is reflected from a surface. Red, Yellow and Blue are primary colours and can mix to make other colours.
Line	A mark which can be long Short, wiggly, curvy, straight etc...
Tone	How light or dark something is i.e. shading or colour
Pattern	A symbol or shape that is repeated.
Shape	A 2D area which is enclosed by a line i.e. a triangle.
Texture	How something feels or looks like it feels for example rough, smooth.
Form	Something which has 3 dimensions such as a cube, sphere or sculpture.



Making objects look 3D:

To create a 3D effect you need to add shading to your outline or 2D drawings. You should add a range of tones, areas f highlight (where light is reflected)and shade (darker areas where the light does not reach). To enhance your drawing you should also add shadows if they appear around your objects.

Shading techniques



Hatching | Cross Hatching | Blending | Pointillism

Directional shading:

When shading your object it's important to shade in the direction of the form. For example when shading a circle into a sphere you must use curved lines to follow the shape of your object, not straight lines.

Art

How to present an Artist Research Page

Key information you MUST include:

- **Title: Name** of the artist
- **When** (just the year) and **where** they were born.
- What **materials** and **techniques** do they use?
- Why you have chosen their work- **which KEY aspects interest or inspire you.** This could be subject matter, techniques or materials they use.

You must then **recreate one of their work** (this could be a full piece or section but must be **A4 in size**) and **ANALYSE your response.** What has made it **successful**? What could you **improve on.**

In Art you are rewarded for **REFLECTING** on your work and **RECOGNISING** what has gone well and which areas you need to improve on. This must be **RECORDED** in **ANNOTATIONS.**

Why study the work of other artists?

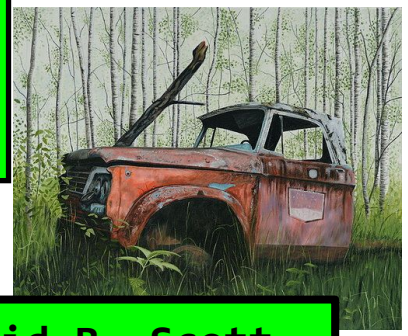
Artists study the work of masters and other artists to:

- **Explore a theme** or topic of your study, whether given to you by the teacher or chosen.
- **Learn techniques** from copying the work of highly skilled artists.
- To **gain inspiration** or ideas for your own work.

ARTISTS

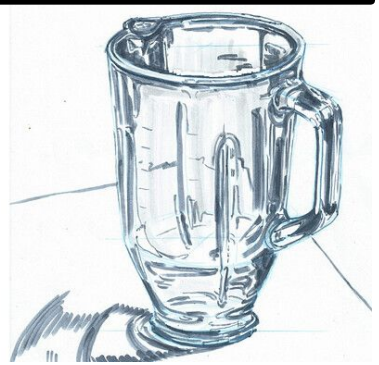
Janet Fish

David B. Scott

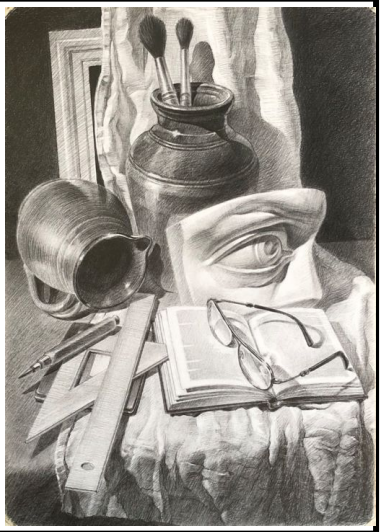


Jim Dine

Helen Gu Gousseva



Dmitry Klyucharev



Development Writing Frame - ART

Using the questions/statements below, discuss your developed work. Use the sentence starters to help you.

The image that I have created is of… *describe your artwork in detail: how does it respond directly to your chosen question/theme?*
The key technical factors that I have used to create this image are… materials, composition, techniques, focal point, subject matter, shape, line, colour, tone, patterns
This work is developed from my artist's work because in their work, they have used the idea of…. *Is it a certain style? Or a particular thing or group of things?*
and in my own work I have… *describe what you have done to change the work to make it your own, have you used a similar style but a different subject? Have you developed your work from your own photos or changed key elements to link to you personally or your own ideas?*
I think my work is successful because…. *Describe the best elements of your work: Is it impactful? Does is evidence the technical aspects of materials used like painting technique or ceramics? Is it unique, different or original? Does the background work well with the piece? Have you reflected and improved as you worked? How?*
The symbolic elements of my artwork convey a message by…
To refine and develop my work, I will… *Is there anything that you can do to enhance the audience interpretation, is the message explicit? How would you change your artwork if you could do it again? How would this make it more effective?*

Computing

1.6 – Ethical, Legal, Cultural and Environmental Impacts of Digital Technology

Ethical Issues

- Ensuring public safety.
- Cyber bullying.
- Unequal access to materials.
- The Digital divide.
- Virtual Currencies.
- Social pressure to be online and keep up with the latest technology.
- Access to inappropriate / illegal content.

Environmental Issues

Positive	Negative
• Industries such as manufacturing and agriculture are becoming more efficient • Increase in renewable energy options. • Electronic communication reduces the need to travel.	• Extraction of natural resources depletes them. • Electronic components require precious metals • Devices need large amounts of energy • Large amounts of e-waste • People want the latest devices, causing old devices to go to waste

Legal Issues

- Illegally sharing personal data
- Stealing money or information
- Illegally copying and sharing films and music
- Extorting information or blackmailing
- Electronic Spying

Cultural Issues

- Automation can improve the production process at the cost of jobs
- Technology has allowed jobs to be moved abroad where costs are lower
- Not everyone is proficient with technology
- Not everyone can afford technology
- Internet access may be poor in rural areas

Privacy Issues

- Devices may be tracked
- Social media encourages people to post about themselves online
- Unwanted images and people may be put online
- Big data allows information from many different sources to be put together
- Electronic information can be more easily copied
- Once information is online it is very difficult to remove it
- Not everyone is aware how to correctly use privacy settings

The Data Protection Act 2018

Personal data must:

- Data must be collected and used fairly.
- Data must only be held and used for the reasons which it was gathered.
- Data can only be used for registered purposes .
- Data held must be adequate, relevant and not excessive.
- Data must be accurate and up to date.
- Data cannot be kept for longer than necessary.
- Data must be kept safely and securely.
- Data cannot be transferred outside of the EU unless suitable laws are in place.

Key roles:

- **Information Commissioner** has overall responsibility for enforcing the Data Protection Act.
- **Data Controller** The person or organisation responsible for the data
- **Data Subject** The person who's data is collected

Copyright Designs and Patents Act 1988

- Gives creators of digital media the right to control how their work is used and distributed.
- Music, books, videos, games and software are covered by the act.
- Anything you design or code is automatically copyrighted and may not be copied without permission.

Software Licenses

Open Source	Proprietary
• Free and available to anyone • Can be modified to suit different needs • Encourages collaboration • Quick to fix issues • Can include more bugs • Less secure • No official support	• Licence can be expensive • Support from the manufacturer • Usually more secure • Bugs issues fixed regularly • Usually has user documentation • Cannot modify the code • Copyrighted by a company or owner

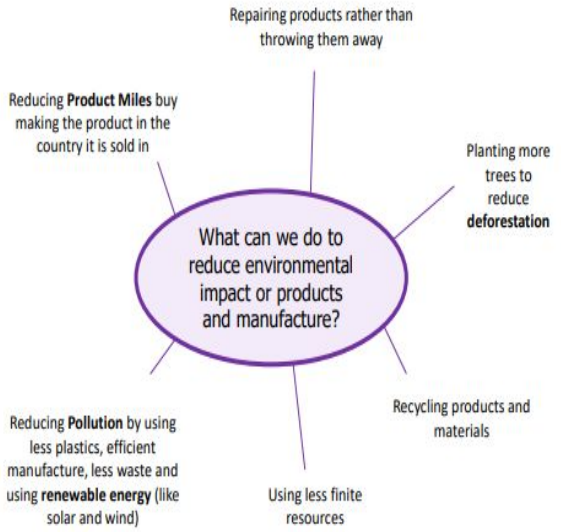
Computer Misuse Act 1990

- It is illegal to access data stored on a computer unless you have permission to do so.
- It is illegal to access data on a computer when that data will be used to commit further illegal activity, such as fraud or blackmail.
- It is illegal to make changes to any data stored on a computer without permission. This includes installing a virus or other malware which damages or changes the way the computer works.
- The maximum punishment for breaking this law is a £5,000 fine or several years' imprisonment.
- It must be proved that access was intentional, and not accidental as a result of poor configuration

Design and Technology

Environment

The 6Rs	Meaning
Reuse	To use a product again either for the same purpose or a different one
Reduce	To have less of material/packaging/pollution when making products by making them more efficient
Recycle	Breaking down and forming the material into another product
Refuse	Customers not buying or supporting products that make an environmental impact
Rethink	Designers and customer rethinking their decisions when making and buying products.
Repair	Fixing a product rather than throwing it away. Extending its life rather than using more resources to make another Often products are **Designed for Maintenance** so can easily be repaired. E.g. Using screws so even non-specialists can take a product apart, or using components that can easily be replaced like fuses or batteries



Life Cycle Assessment

This is when a designer looks at the environmental impact a product makes over its life time and how it could be reduced. Including:

- Impact of materials
- Impact of processes
- Product Miles (how far a product has to travel to get from factory to consumer)
- Impact while in use
- Impact when disposed of (6Rs)

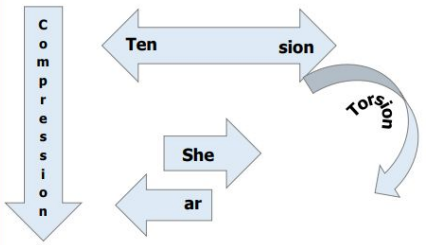
Sustainability is maintaining our planet and its resources and making a minimal negative impact

Finite Resources *Will run out of eventually*	**Infinite Resources** *Can be re-grown and re-bread. Will not run out of*
Plastics	Paper
Metals	Boards
Polymers (Textiles)	Natural Timbers
	Cotton
	Leather

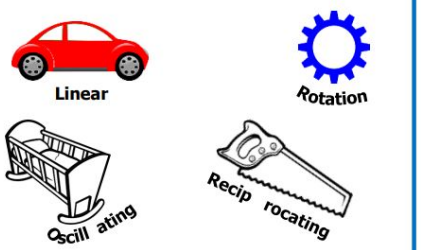
Planned Obsolescence	This is where products "die" after a certain amount of time. E.g. Disposable cups, Phones, Lightbulbs, Printer Ink, etc This can have a big environmental impact as customers are throwing away lots of products, and resources are being used to create new ones.

Mechanical Systems

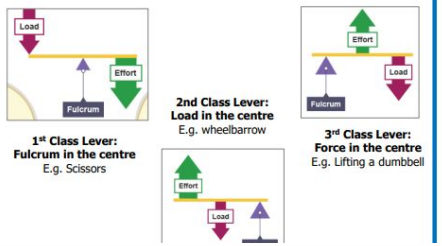
Forces



Motion



Levers



1st Class Lever: Fulcrum in the centre
E.g. Scissors

2nd Class Lever: Load in the centre
E.g. wheelbarrow

3rd Class Lever: Force in the centre
E.g. Lifting a dumbbell

Gears and Pulleys

A Pulley is a grooved wheel, that has a belt running through it

This uses rotary motion and is often used to help with heavy loads, and transfer force from a motor to a tool in machines like drills, etc

Gears have teeth that mesh together with each other (like teeth on a zip)

They mainly focus on rotary motion on tools and machinery e.g. car steering and pillar drills

Scales of Production

Name/ Type	How many it makes	Key Info	Examples of Products
One-off Production	1	• Also known as Bespoke or Prototype manufacture • Custom-made products • Specialist workers/ skills • Specialist machines and materials • High Quality but expensive	• Towers / Bridges • One-off Houses • Custom made clothes
Batch	10s-1000s	• Uses a mix of workers and machinery • Uses jigs, moulds and templates to help make identical products • Stations of workers e.g. cutting station, painting station, etc • Can have some variation e.g. colour, finish, flavour	• Baked foods • Limited edition car • Socks • Chairs
Mass	10,000s - 100,000s	• Big assembly lines (and sub-assembly lines) • Heavily automated • Standard and identical products • Little worker input	• Cars • Bottles • Microchips • Plain shirts
Continuous	100,00s +	• 24/7 production • Heavily automated • Standard and identical products • Little worker input	• Energy • Water • Paper • Plastic

One-off Production	
Advantages	**Disadvantages**
• Custom made • High Quality Materials • High Quality Craftsmanship	• Time consuming • Specialist training for workers • Expensive to buy

Batch Production	
Advantages	**Disadvantages**
• Lower cost than one-off • Jigs, moulds and templates help products look identical • Can have some variety	• High storage costs • Jugs, moulds and templates have to be checked • Workers can become bored on their station

Mass Production	
Advantages	**Disadvantages**
• Large amounts made at once • All products are identical and to same standard • Using automation reduced human error	• Initial starting costs are high • If production line stops, the product can't be made • Workers become bored monitoring machines and repetitive tasks

Continuous Production	
Advantages	**Disadvantages**
• Large amounts made at once • All products are identical and to same standard • Using automation reduced human error	• Initial starting costs are high • If production line stops, the product can't be made • Workers become bored monitoring machines and repetitive tasks

Design and Technology

Materials and their Properties: Polymers (Plastics)

THERMOFORMING

This group of polymers are able to be formed into a different shape over and over again. Known as thermoplastics.

These are generally more flexible, especially when heated.

These are easier to recycle.

Can be formed into complex shapes.

TYPES:

Name	Characteristics	Uses
Polyethylene terephthalate 1 PETE	Easily blow moulded and fully recyclable.	Bottles, food packaging, sheeting and some food wraps.
High density Polyethylene 2 HDPE	Lightweight, rip and chemical proof.	Milk bottles, pipes, hard hats and wheelie bins.
Polyvinyl Chloride 03 PVC	Flexible, high plasticity, tough and easily extruded.	Raincoats, pipes, Electrical tape and blow up mattresses.
Low density Polyethylene 4 LDPE	Very flexible and tough with a high strength to weight ratio.	Plastic carrier bags and black bin bags.
Polypropylene 5 PP	Flexible, tough, lightweight, easily cleaned and safe with food.	Kitchen, medical and stationery products.
High Impact Polystyrene (HIPS). 6 PS	Flexible, impact resistant, lightweight and can be food safe. Toxic when burned.	Vacuum formed products such as food containers or yoghurt pots.
Acrylic 7 OTHER	Tough but brittle, easily scratched . Common in school workshop for the laser cutter.	Car lights, display stands, trophies, jumpers, hats and gloves.

Polymorph

Non toxic, easily mouldable and re-mouldable when heated. Used for modelling or personalisation of hand grips.

THERMOSETTING

This group of polymers, once set in shape CANNOT be reformed. Known as thermosets.

These are generally more rigid before and after they've been heated.

These are harder to recycle.

Make excellent electrical insulators.

TYPES:

Name	Characteristics	Uses
Epoxy resin 	Stronger than other resins, expensive and heat resistant.	Bonding different materials together.
Melamine formaldehyde 	Food safe, hygienic and lightweight.	Kitchenware - but it can't be put in the microwave
Urea formaldehyde 	Heat resistant and very good electrical insulator	Electrical fittings, casings, buttons and handles.
Polyester resin 	Reasonably strong, heat resistant and a good electrical insulator.	Waterproof coatings and flooring.
Phenol formaldehyde 	Very hard and brittle. An excellent electrical insulator.	Electrical components, mechanical parts.

BIOPOLYMERS

Newer plastics are made from **vegetable starches** and can be composted - these are great for the environment. Here are some:

PLA - Polylactic Acid

Non toxic, easily shaped and typically used for 3D printers.

Used for pens, phone cases, disposable food and drinks containers.

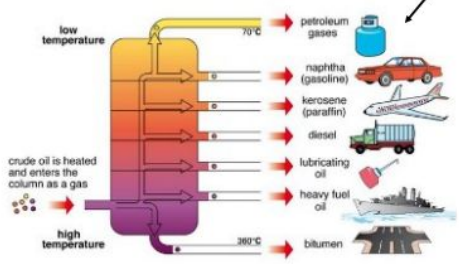
SOURCE/ORIGIN

Polymers come from **crude oil.** They can also come from **gas** and **coal.** This can be found beneath the Earth's surface. Below is how we get it and change it into polymers:

1. The oil is **extracted** from beneath the surface and stored. This can be done on land or in the sea.

2. This oil is then **transported** via a **crude tanker** to somewhere called an **oil refinery.**

3. When at the refinery, the oil is heated and at **different temperatures** this creates the different **products.**



ENVIRONMENTAL IMPACT

Polymers are considered a **finite resource** - this means that it will run out eventually as we only have a limited amount. However with development in technology there are some **biodegradable** ones, here are some of the impacts:

✗ - Do not biodegrade easily so release harmful toxins in landfills.

- Causes **air, visual** and **water pollution.**

- Takes a lot of energy to produce.

✓ - Some are able to be recycled so they don't use raw material (brand new e.g. crude oil).

- New technology has given way to fully biodegradable ones - **biopolymers,** so they are non toxic and not from a finite resource.

Materials and their Properties: Papers & Boards

BOARDS

The thickness of boards is measured in microns. 1000 microns = 1mm.

TYPES:

Name	Characteristics	Uses
Corrugated card 	1000-5000 microns, strong and lightweight. Insulative and easily printed on.	Packaging, boxes and impact protection.
Duplex board 	200-500gsm, stiff, lightweight coatings to improve functionality.	Cheaper version of white card used for packaging boxes. Waxy coating for protection.
Foil lined board 	200-400gsm, stiff, foil reflects heat and a water and oil resistant coating enables food and liquid based products to be contained.	Takeaway containers and lids, used to retain heat for longer.
Foam board 	3-10mm thick, lightweight and rigid in all directions. Can crease and crack under pressure.	Architectural models, model making, prototyping, mounting and framing of photographs.
Ink jet card 	120-350gsm medium to thick card treated to hold a high quality photo image.	High quality photographic images
Solid white board 	200-500gsm, stiff board, holds colour well, easily cut or creased.	Any uses including greeting cards, packaging and advertising.

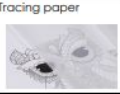
✗ - Processing of paper can release chemicals into the environment which is not good for the atmosphere.

- If put into a land fill, it will release methane over time which is bad for the atmosphere.

PAPERS

Paper is measured by weight in grams per square metre (GSM). This is how heavy it will be.

TYPES:

Name	Characteristics	Uses
Bleed proof paper 	70gsm, coated to stop solvent based markers staining. Ink stays on the surface.	Marker pens when designing and final designs.
Cartridge paper 	120-150gsm, completely opaque and more expensive.	Pencil and ink drawings, sketching and water colour.
Grid paper	Usually printed onto 80gsm paper with faint lines and often in blue.	Used for graphical, scientific and mathematical diagrams.
Layout paper 	40-60gsm, semi translucent, takes pencil and most media well.	Creating sketches and working ideas.
Tracing paper 	10-120gsm, translucent, takes pencil and most colour well.	Copying and tracing images.

ENVIRONMENTAL IMPACT

Paper is considered a **sustainable resource** which means it is something that can continue going as it can be **replenished** (replaced) for example, you cut down a tree, plant 2 new ones or a new one. Here are some of the impacts on the environment:

✓ - Sustainable resource

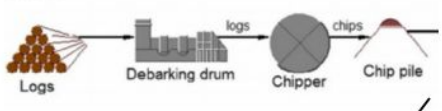
- Can be recycled over and over again

- Decomposes over time if it does go into a land fill or if left on the ground.

SOURCE/ORIGIN

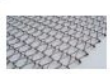
Paper and boards come from finely shredded wood but has been prepared in a special way to make what you know as paper and boards. This is how they are made:

1. **Pulp** - this is the finely shredded wood. Logs are **debarked** into fine chips. These are added to a chemical solution and cooked under pressure to make them into a paper pulp. These are called **cellulose fibres.** Depending on the colour, the fibrous liquid is then bleached or coloured.



2. **Sizing** - this is a process where chemicals or other additives are beaten into the fibrous liquid. This stops it being so absorbent. This means it can then be photocopied, printed or painted onto.

Papers such as toilet roll or kitchen roll have little sizing so that they can absorb moisture. Otherwise they wouldn't work as toilet or kitchen roll.



3. **Converting Pulp to Paper** - the pulp (so the liquid fibrous) goes on a mesh conveyor belt to drain the excess water. It goes through lots of rollers to squeeze the last of the water out of the paper. Then through **drying rollers**, so it dries and finally through a set of **calender rollers** which give the paper the finish e.g. satin or matt. Here's a picture of the overall process together:

Design and Technology

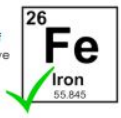
Materials and their Properties: Metals & Alloys

Ferrous

This group of metals all contain iron.

Most of these metals are magnetic and will rust if they are exposed to moisture without a protective finish.

Iron is what causes the metals to rust quicker. They tend to have a higher melting point.



Types:

Name	Characteristics	Uses
Low Carbon Steel (Mild Steel) 	Tough and ductile, easily machined, formed, brazed or welded.	Construction, nails, screws, nuts and bolts. Many car bodies.
High Carbon Steel 	Less ductile and harder than mild steel. Very hard wearing and keeps and edge well.	Garden or workshop tools, blades, scissors, wood and metal cutting tools.
Cast Iron 	Hard but brittle. Easily cast into complex shapes but some are hard to machine.	Kitchen pots and pans, machine bases and bodies, drain covers and vices.

Non Ferrous

This group of metals do NOT contain iron.

Most of these metals are not magnetic and do not rust.

These can **Oxidise**. React with oxygen that causes the surface to change colour.

They include precise metals such as gold, silver and platinum and others such as lead and mercury which are poisonous.

Types:

Name	Characteristics	Uses
Aluminium 	Lightweight, high strength to weight ration, ductile and difficult to weld.	Pots and pans, sports car body panels, bike frames, drinks cans, foil or takeaway trays.
Copper 	Ductile, malleable and a good electrical conductor.	Plumbing supplies, and electrical cables.
Tin 	Soft, malleable and ductile, a good electrical conductor.	Used to produce cans and plating surfaces to make them last.
Zinc 	Fair electrical conductivity, malleability and ductility; however, better when alloyed.	Mainly used to galvanise steel to prevent rusting.

Alloys

This group of metals is a mixture of at least one pure metal and another element.

The reason metals are alloyed is so that the added element makes the metal better - it improves it in some way.

These are more difficult to recycle as the metal has been mixed with something else.

Types:

Name	Characteristics	Uses
Brass 	A heavy alloy of zinc and copper that is malleable, easy to cast and machine.	Musical instruments, bushes and plumbing filaments.
Stainless Steel 	Hard very smooth but difficult to weld. A ferrous metal alloyed with chromium, nickel and manganese.	Cutlery, kitchen and medical equipment.
High Speed Steel 	Able to withstand the high temperatures created when machining at high speed, keeps cutting edges well.	Cutting tools such as drill bits, mill cutter, taps and dies.
Duralumin 	Alloy of aluminium, copper, magnesium and manganese. Creates greater hardness and tensile strength.	Aircraft components sports car wheels and casings.

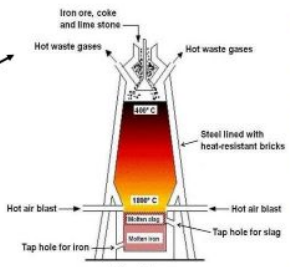
Source/Origin

Metals come from the **ground/rocks** typically the Earth's crust - this is known as the source or origin of the material.

This is how we **extract** (remove) metals from the ground and create **iron ore.**

1. The material is mined using machines - the main two types are **surface mining** and **underground mining.**

2. These rocks are then **transported** to a factory to be separated from waste material.



Blast Furnace

3. To create the **iron ore**, the rocks are placed through the top of the furnace and it is heated.

As it heats, it starts to become a liquid and this sinks to the bottom.

As it becomes a liquid it is carried away from the bottom to be **refined** further into metals.

The waste material leaves in the other direction and is known as the **slag.** Waste material also leaves as gases.

Environmental Impact

Metal is considered a **finite resource** - this means that it will run out eventually as we only have a limited amount. These are some of the impacts that metal has on the environment:

- Finite resource so it will run out eventually.
- Causes **air pollution** from the gases that are released.
- Causes **visual pollution** from the mines that are created to get the raw material.
- Takes a lot of energy to produce.

- Can be recycled over and over again. The quality will always be the same as the original so the material won't weaken over time.
- Lasts a long time and so it won't need to be replaced.
- Most metals can be recycled.

Materials and their Properties: Timbers & Manufactured Boards

Hardwoods

They are deciduous trees which means that in winter, they lose their leaves.

These trees are broadleaved, bushy and slow growing.

Overall they tend to be harder to work with and more expensive than other types of timbers.

They are less porous and denser cell structure which makes them harder wearing and less prone to rotting.

Types:

Name	Characteristics	Uses
Ash 	Flexible, tough and shock resistant, laminates well. Pale brown/cream.	Sports equipment and tool handles.
Beech 	Fine finish, tough and durable. Dense close grain with an	Children's toys, models and furniture.
Mahogany 	Easily worked, durable and finishes well. Rich reddish brown in	High end furniture and joinery.
Oak 	Tough, hard and durable, high quality finish possible. Light brown with variable grain.	Flooring, furniture, and railway sleepers.
Balsa 	Very soft, and lightweight but can snap. Pale cream/ white in colour. Unusually fast growing	Prototyping and modelling - especially in model aircraft.

Softwoods

They are coniferous trees which means that they keep their leaves in winter = evergreen.

These trees are tall and 'Christmas tree' tree shaped.

Overall they tend to be easier to work with and less expensive than other types of timbers.

They are more porous (holes) and if unprotected will rot. They have cones for leaves and grow quickly.

Types:

Name	Characteristics	Uses
Larch 	Durable, tough and good water resistance. Machines well.	Exterior cladding, flooring, machine mouldings and furniture.
Pine 	Lightweight, easy to work but can split.	Interior construction, cheaper furniture and decking.
Spruce 	Easy to work, high stiffness to weight ratio.	Construction, furniture and musical instruments.
Redwood 	Easy to work and machines well, some rot resistance.	Outdoor furniture, beams, posts and decking.
Cedar 	Easy to work, can blunt tools, finishes well and naturally resistant to rot.	Outdoor furniture, fences and cladding for buildings.

Manufactured Boards

They are sheets of processed natural timber and adhesives - so they are human made boards

These are usually made from waste wood, low-grade and recycled timber.

Can be covered by thin slices of high quality wood known as veneer to make it look aesthetically pleasing.

Cheaper than natural timber. They come in boards and have no grain.

Types:

Name	Characteristics	Uses
MDF 	Rigid and stable, good value with a smooth easy to finish surface.	Flat pack furniture, toys and kitchen units.
Plywood 	Stable in all directions as alternating layers. Flexible versions available.	Furniture, shelving, toys, interior and exterior construction.
Chipboard 	Good compressive strength, not water resistant and prone to chipping on edges.	Flooring, low end kitchen units and worktops.
OSB 	Rigid and even strength, good water resistance.	Construction in interior and exterior house building.
Block board 	Stable, tough and heavy. Finishes well.	Furniture, doors, shelving and indoor construction.
Hardboard 	Flexible, even strength and easily damaged by water.	Furniture and photo frame backing.

Source/Origin

Timber comes from **trees** - this is known as the source or origin of the material. This is how we change into timber.

1. When trees are cut down, this is known as **felling.** This can be through machine or chain saws, just like the image.

2. Branches are cut off and the logs are stored until they are transported to a **sawmill.**

3. When at the sawmill, machines such as **band saws** and **circular saws** are used to create boards/planks.

Environmental Impact

Wood is considered a **sustainable resource** as new trees can be grown to replace those felled. Here are some **issues and positives** surrounding the impact that wood is having on the environment:

- In many places, wood is being used at a greater rate which means it is unsustainable.
- Illegal felling is leading to deforestation as people aren't replanting trees.
- Deforestation helps with global warming.

- To make sure you are buying sustainable timber, you need to make sure it is approved by the **Forest Stewardship Council** or the **Endorsement of Forest Certification.**

FSC

Drama

Radio Plays

Key Vocab

DJ	A person who plays recorded music for an audience over the radio.
Hot Seating	A drama strategy in which a character or characters are interviewed in role.
Podcast	A digital audio file made available on the internet for downloading to a computer or mobile device, typically available as a series, new instalments of which can be received by subscribers automatically.
Presenter	A person who introduces the items in a particular programme.
Radio play	A play written for broadcasting on radio.
Script	The written text of a platy, film or broadcast.
Sound Effects (SFX)	Recorded sound that can add to the atmosphere of a play or film.

Examples of Radio Plays

50 Berkeley Square	**Rare Earth**
Damned, Damned, Damned	**The Archers**
Danger 2023	**The Hitchhikers Guide to the Galaxy**
Maydays	**The War of the Worlds**
Peking Noir	**Where this Service will Separate**

Podcasts

Podcasts are radio shows that are available via the internet.

They became popular in 2014, when true crime shows entered mainstream entertainment.

Most podcasts are free to access, and can be found on streaming sites such as Spotify and YouTube.

Anyone can make a podcast - all you need is audio recording equipment (which you have on your phone!)

Elements of Radio Drama

Action	What happens in the drama.
Focus	The ideas, feelings or characters that the playwright wants us to concentrate on in a particular moment.
Place/Setting	Where the action takes place.
Role	Characters in the play.
Tension	Conflict within and between characters and their environment.
Time	When the action is taking place.

Examples of Podcasts

Answer Me This Podcast	**Shade**
Conflict of Interest	**The Greatest Game**
Crime Weekly	**The Rest is History**
Dead Honest	**Wild Thing**
Love Island: The Morning After	**You're Wrong About**

Drama

Monologues and Duologues

Key Vocab

Audible	Being able to be heard by the audience throughout your performance.
Communication	Showing the audience the meaning of the piece, as well as the feelings of the characters.
Confidence	The feeling or belief that you can perform in front of others, without getting things wrong.
Context	The circumstances that form the setting for a scene or situation, which can provide understanding for the actor.
Performance Skills	The skills that an actor uses to portray a character.
Rehearsal Skills	The skills that an actor uses during rehearsals, to create a well-rounded performance.
Scenes	A sequence within a play in which characters perform dialogue.

Key Considerations

What is your character's background?
How does your character change throughout the play?
How do the characters feel? Does this change throughout the scene?
Where is the scene set? When is the scene set?
What is happening in the scene?

Monologue vs Duologue

Monologue	Duologue
Monologues are speeches performed by one actor, which is directed towards another character.	Duologues are scenes involving two actors having a conversation.
These speeches can range from confrontations to declarations of love, so it is important to know the context of the monologue.	Duologues can also range in topic, so the context is important, but it is also important to know the relationship between the characters.

Key Skills

Characterisation	You will have to represent specific characters, thinking about how they move, how they talk, how they might interact with other characters on stage etc.
Evaluation	As you progress through the unit, you will be asked to evaluate the skills that you are using, and use this evaluation to guide you in rehearsals.
Rehearsals	You will be expected to rehearse your scenes outside of class time, consistently improving your pieces based on feedback given in lesson. This will help you make progress with your piece, and experiment with different ideas.
Remembering Lines	Part of this assessment will involve learning your lines in an accurate way. By doing this, you will be able to develop your characters in a more interesting way. This is also a requirement at GCSE level, so it's good practice.
Team Work	When performing duologues, you must be able to work closely with your partner. This involves supporting each other, giving each other feedback, and relying on each other. This is a very important skill to develop, not just for school but for everyday life.

Food spoilage
As soon as food is harvested, slaughtered or processed it starts to change. This happens for two main reasons:
- autolysis – self destruction, caused by enzymes present in the food;
- microbial spoilage – caused by the growth of micro-organisms, i.e. bacteria, yeasts and moulds.

Food spoilage: Autolysis – enzymes
Enzymes are chemicals which can cause food to deteriorate in three main ways:
- ripening – this will continue until the food becomes inedible, e.g. banana ripening;
- browning – enzymes can react with air causing certain foods to discolour, e.g. apples;
- oxidation – loss of nutrients, such as vitamin C from food, e.g. over boiling of green vegetables.

Food spoilage: Microbial spoilage
Spoilage can be caused by the growth of:
- bacteria – single celled micro-organisms which are present naturally in the environment;
- yeasts – single celled fungi;
- moulds – fungi which grow as filaments in food.

Food contamination
Food contamination can lead to food poisoning. There are three ways which food can be contaminated: **bacterial**, **chemical** and **physical**.

Chemical contamination
Chemical contamination can occur in a variety of ways at different stages of food processing and production. For example, chemicals from the farm; cleaning products used in the processing plant and fly spray used in the kitchen.

Physical contamination
This can occur in a variety of ways at different stages of food processing and production. Some examples are:
- soil from the ground when harvesting;
- a loose bolt from a processing plant when packaging;
- a hair from a chef in the kitchen.

Bacterial contamination
Most bacteria are harmless but a small number can cause illness. These are known as pathogenic bacteria. Food which is contaminated with pathogenic bacteria can look, taste and smell normal.
Bacteria can be transferred onto food through cross-contamination, via equipment, people or pests, or can be naturally present in the food. Some bacteria can produce toxins which can cause food poisoning.

Micro-organisms
Micro-organisms need conditions to survive and reproduce these can include:
- temperature;
- moisture;
- food;
- time;
- oxygen and pH level.

Temperature
Bacteria need warm conditions to grown and multiply.
- The ideal temperature for bacterial growth is 30°C – 37°C.
- Some bacteria can still grow at 10°C and 60°C.
- Most bacteria are destroyed at temperatures above 63 °C.
- Bacterial growth danger zone is 5°C - 63°C.

At very cold temperatures, bacteria become dormant – they do not die, but they cannot grow or multiply.

Moisture
Where there is no moisture bacteria cannot grow. However, bacteria and moulds can both produce spores which can survive until water is added to the food.

To find out more, go to: https://bit.ly/3nE9fpE

Food
Bacteria need a source of food to grow and multiply, these food are usually high in moisture, fat and protein, and may be ready to eat. Food where bacteria rapidly multiply in is called a **high risk food**. For example:
- meat, meat products and poultry;
- milk and dairy products;
- eggs – uncooked and lightly cooked;
- shellfish and seafood;
- prepared salads and vegetables;
- cooked rice and pasta.

Time
Given the right conditions, one bacterium can divide into two every 10-20 minutes through a process called binary fission.

People at high risk of food poisoning
Elderly people, babies and anyone who is ill or pregnant needs to be extra careful about the food they eat.

Symptoms of food poisoning
Food poisoning can be mild or severe. The most common symptoms are:
- feeling sick;
- being sick;
- diarrhoea;
- abdominal pain.

Campylobacter
Sources
Raw and undercooked poultry, unpasteurized milk, contaminated water.
Signs and symptoms
Onset 2 – 5 days (can be longer). Fever, headache and dizziness for a few hours, followed by abdominal pain.

E Coli 0157
Sources
Raw and undercooked meat and poultry. Unwashed vegetables. Contaminated water.
Signs and symptoms
Onset usually 3-4 days. Diarrhoea, which may contain blood, can lead to kidney failure or death.

Listeria
Sources
Unpasteurised milk and dairy products, cook-chill foods, pâté, meat, poultry and salad vegetables.
Signs and symptoms
Onset 1-70 days. Ranges from mild, flu-like illness to meningitis, septicaemia, pneumonia.
During pregnancy may lead to miscarriage or birth of an infected baby.

Salmonella
Sources
Raw meat, poultry and eggs. Flies, people, sewage and contaminated water.
Signs and symptoms
Onset 6-48 hours. Headache, general aching of limbs, abdominal pain and diarrhoea, vomiting and fever. This usually lasts 1 – 7 days, and rarely is fatal.

Staphylococcus aureus
Sources
Humans: nose, mouth and skin. Untreated milk.
Signs and symptoms
Onset 1 – 6 hours. Severe vomiting, abdominal pain, weakness and lower than normal temperature.
This usually lasts 6 – 24 hours.

Key terms
Bacteria: Small living organisms that can reproduce to form colonies. Some bacteria can be harmful (pathogenic) and others are necessary for food production, e.g. to make cheese and yogurt.
Binary fission: The process that bacteria uses to divide and multiply.
Cross-contamination: The transfer of bacteria from one source to another. Usually raw food to ready-to-eat food but can also be the transfer of bacteria from unclean hands, equipment, cloths or pests. Can also relate to allergens.
Food spoilage: The action of enzymes or microorganisms which make the food unacceptable to consume.
Food poisoning: Illness resulting from eating food which contains food poisoning micro-organisms or toxins produced by micro-organisms.
Toxin: A poison produced by some bacteria which can cause food poisoning.

Allergens
Allergenic ingredients can cause adverse reactions in some people. Care must be taken at each stage of food processing to prevent contamination.

Desirable food changes
Desirable changes that can be caused by micro-organisms include:
- bacteria in yogurt and cheese production;
- mould in some cheeses, e.g. Stilton;
- yeast in bread production.

Task
Explain in detail the conditions bacteria need to survive and reproduce. Give examples of controls to reduce the likelihood of bacterial multiplication and risk of food poisoning.

Food Technology

Functions of ingredients
Ingredients provide a variety of functions in recipes.

Carbohydrate, protein and fat
Carbohydrate, protein and fat all have a range of properties that make them useful in a variety of food products.

Carbohydrates perform different functions in food.
They can:
- help to cause the colour change of bread, toast and bakery products (dextrinisation);
- contribute to the chewiness, colour and sweet flavour of caramel;
- thicken products such as sauces and custards (gelatinisation).

Maillard reaction
Foods which are baked, grilled or roasted undergo colour, odour and flavour changes. This is primarily due to a group of reactions involving amino acids (from protein) and reducing sugars.

Dextrinisation
When foods containing starch are heated they can also produce brown compounds due to dextrinisation. Dextrinisation occurs when the heat breaks the large starch polysaccharides into smaller molecules known as dextrins which produce a brown colour.

Caramelisation
When sucrose (table sugar) is heated above its melting point it undergoes physical and chemical changes to produce caramel.

Gelatinisation
When starch is mixed with water and heated, the starch granules swell and eventually rupture, absorbing liquid, which thickens the mixture. On cooling, if enough starch is used, a gel forms.

Proteins perform different functions in food products.
They:
- aerate foods, e.g. whisking egg whites;
- thicken sauces, e.g. egg custard;
- bind ingredients together, e.g. fishcakes;
- form structures, e.g. gluten formation in bread;
- gel, e.g. lime jelly.

Gluten formation
Two proteins, gliadin and glutenin, found in wheat flour, form gluten when mixed with water. Gluten is strong, elastic and forms a 3D network in dough. In the production of bread, kneading helps untangle the gluten strands and align them. Gluten helps give structure to the bread and keeps in the gases that expand during cooking.

Gelation
Gelatine is a protein which is extracted from collagen, present in animal connective tissue. When it is mixed with warm water, the gelatine protein molecules start to unwind. On cooling, a stable, solid network is formed, trapping the liquid.

Denaturation
Denaturation is the change in structure of protein molecules. The process results in the unfolding of the protein's structure. Factors which contribute to denaturation are heat, salts, pH and mechanical action.

Coagulation
Coagulation follows denaturation. For example, when egg white is cooked it changes colour and becomes firmer (sets). The heat causes egg proteins to unfold from their coiled state and form a solid, stable network.

Aeration
Products such as creamed cakes need air incorporated into the mixture in order to give a well-risen texture. This is achieved by creaming a fat, such as butter or baking spread, with sugar. Small bubbles of air are incorporated and form a stable foam.

Fats performs different functions in food.
They help to:
- add 'shortness' or 'flakiness' to foods, e.g. shortbread, pastry;
- provide a range of textures and cooking mediums;
- glaze foods, e.g. butter on carrots;
- aerate mixtures, e.g. a creamed cake mix;
- add a range of flavours.

Plasticity
Fats do not melt at fixed temperatures, but over a range. This property is called plasticity.

Raising agents
Raising agents include anything that causes rising within foods, and are usually used in baked goods. Raising agents can be:
- biological, e.g. yeast;
- chemical, e.g. baking powder;
- mechanical, e.g. adding air through beating or folding.

Functional ingredients
These are ingredients that are specifically included in food for additional health benefits. They include:
- probiotics – 'good' bacteria that may have a positive impact on human health;
- prebiotics – food ingredients that promote the growth of beneficial microorganisms in the gut;
- sterols/stanols – compounds that can lower cholesterol;
- healthy fats (e.g. omega-3);
- added vitamins and minerals (more than in the original food).

Colloidal systems
Colloidal systems give structure, texture and mouthfeel to many different products.

System	Disperse phase	Continuous phase	Food
Sol	Solid	Liquid	Unset jelly
Gel	Liquid	Solid	Jelly
Emulsion	Liquid	Liquid	Mayonnaise
Solid emulsion	Liquid	Solid	Butter
Foam	Gas	Liquid	Whipped cream
Solid foam	Gas	Solid	Meringue

Why is food prepared and cooked?
Food is prepared and cooked to:
- make the food more palatable – improves flavour, texture and appearance;
- reduce the bulk of the food;
- provide variety and interest to meals.

Methods of cooking food
The methods of cooking are divided up into groups. These are based on the cooking medium used.
They are:
- moist/liquid methods, e.g. boiling;
- dry methods, e.g. grilling;
- fat-based, e.g. frying.

Selecting the most appropriate way of preparing and cooking certain foods is important to maintain or enhance their nutritional value.
- Vitamins can be lost due to oxidation during preparation or leaching into the cooking liquid.
- Fat-based methods of cooking increase the energy (calories) of the food.
- The use of different cooking methods affects the sensory qualities of the food.

There are three ways that heat is transferred to food.
- Conduction – the exchange of heat by direct contact with foods on a surface.
- Radiation – energy in the form of rays.
- Convection – currents of hot air or hot liquid transfer the heat energy to the food.

Key terms
Conduction: The exchange of heat by direct contact with foods on a surface.
Convection: Currents of hot air or hot liquid transfer the heat energy to the food.
Functional ingredients: Included in food for additional health benefits.
Heat transfer: Transference of heat energy between objects.
Radiation: Energy in the form of rays.

Tenderisation
- Mechanical tenderisation – a meat cleaver or meat hammer may be used to beat the meat. Cutting into small cubes or mincing can also help.
- Chemical tenderisation (marinating) –the addition of any liquid to flavour or soften meat before cooking.

Tasks
1. Choose a recipe that you enjoy or have made recently and explain in detail the functions of the ingredients.
2. Explain the function of raising agents, giving examples of recipes.

Food Technology

Where food comes from
Food can be grown, reared or caught.

Plants are grown in an environment where light, food (soil) and water are available to help them grow and photosynthesise.

Food production and processing ensures that food is edible and safe.

Historical changes
Throughout the ages, people have hunted animals and gathered plants for food, relying on what was growing locally and animals that were easy to catch. The discovery of fire meant animals and plants could be cooked to eat and taste better. The industrial revolution in the 19th century led to greater mechanisation of food production allowing for the development of new products and increased volumes of production, as well as jobs outside of the home or even the local area.
Today, other factors that affect food production include:

- domestication of animals and crops;
- preservation methods;
- development of villages and towns;
- changes of land ownership;
- transport and travel;
- war;
- religion and culture;
- famine, drought, flood, disease,
- research and development of food ingredients.

Diets have changed too and the need for cooking in the home has been reduced by the availability of processed foods.

Food provenance
Food provenance is about where food is grown, caught or reared, and how it was produced.
Food certification and assurance schemes guarantee defined standards of food safety or animal welfare. There are many in the UK, including:


Farming systems
Agriculture in the UK can be grouped into the following:

- **Intensive** – a system of production using large amounts of labour and capital relative to land use (high input/high output);
- **Extensive** – a system of production using small amounts of labour and capital in relation to area of land being farmed (low input/lower output);
- **Conventional** – a system that may include the use of artificial and natural pesticides (to control pests, weeds and diseases), artificial fertilisers and organic manures; other techniques used may include concentrated animal feeding/rearing operations, includes both intensive and extensive approaches;
- **Organic** – a system where artificial fertilisers are not allowed to be used, soil fertility is built through crop rotation, and inorganic pesticide use is severely restricted. It is a form of extensive farming;
- **Free-range** – a system where animals, for at least part of the day, can roam freely outdoors. This may be done within a conventional or an organic system;
- **Regenerative farming** – a cropping system and grazing practice that, among other benefits, reverses climate change by rebuilding soil organic matter and restoring degraded soil biodiversity, resulting in both carbon capture and improving the water cycle.



Farming types in the UK
There are seven main types of farming in the UK:

- **aquaculture** – farming fish in fresh or sea water;
- **arable** – growing of crops and cereals;
- **horticulture** – production of flowers, fruit, vegetables or ornamental plants;
- **market gardening** – small scale production of fruit and vegetables;
- **mixed farming** – combination of arable and pastoral;
- **pastoral** – rearing and production of animals, including pigs, chickens, hill farming sheep, beef and dairy cattle;
- **viticulture** – grapes.

For more information, go to: https://bit.ly/398qABo

Farming across the UK
Some parts of the UK have excellent soil for crops, while others are used for cattle, sheep, pigs and poultry.

North West England, Wales and Scotland	Sheep and beef cattle are most suited to the land and colder temperatures.
Northern Ireland	Sheep, cattle, pigs and dairy are the largest commodity sectors.
South West England	Dairy farming is suited to this region due to the quality grass grown.
East of England	Arable crops such as wheat and barley and vegetables are grown.
South East of England and lowlands of Scotland	Grain, potatoes and sugar beet are grown along with vegetables.

Hydroponics
Hydroponic vegetables are grown in a nutrient solution rather than soil. Tomatoes, peppers and lettuce are increasingly grown this way. Growing vegetables hydroponically enables them to be grown in a controlled environment with less chance of disease, faster growth and greater yield.

Genetic modification and biotechnology
Genetic modification of plants and crops can help:

- improve crops resistance to pests, disease or drought;
- extend shelf life;
- improve nutrition and taste;
- produce higher yields;
- animals may be made more resistant to disease, produce less fatty meat, grow faster or be more fertile.

Key terms
Food provenance: Knowing where food was grown, caught or raised and how it was produced.
Genetic modification: The direct manipulation of an organism's genes using biotechnology.
Hydroponics: The process of growing plants in sand, gravel, or liquid, with added nutrients but without soil.
Organic farming: A system of farming and food production. Certification is legally required to grow, process or market organic products.
Photosynthesis: The process by which green plants and some other organisms use sunlight to synthesise nutrients from carbon dioxide and water.
Seasonality: Fruit and vegetables naturally grow in cycles, and ripen during a certain season each year.

Seasonality in the UK
Fruit and vegetables naturally grow in cycles and ripen during a certain season each year. When they are in season they are harvested.
Buying and eating food that is season means that it is fresh, has the best flavour, texture and colour, and has optimum nutritional value. Other benefits include lower cost, supporting local growers, reduced energy needed to grow and transport the ingredients and food.

World food
There are a wide variety of ingredients and foods that are not readily available in the UK, due to the climate. These are imported from other countries.

The availability of these ingredients and foods provides consumers with a wide choice throughout the year.

The variety of ingredients and foods that are now readily available have been introduced to the UK over a long period of time.

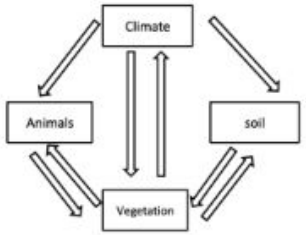



Tasks
1. The Red Tractor food assurance scheme requires strict standards of animal welfare. List the main requirements for cows, sheep and pigs.
2. Create a presentation about farming in your local area. Include how it has changed over time.

Geography

Ecosystems

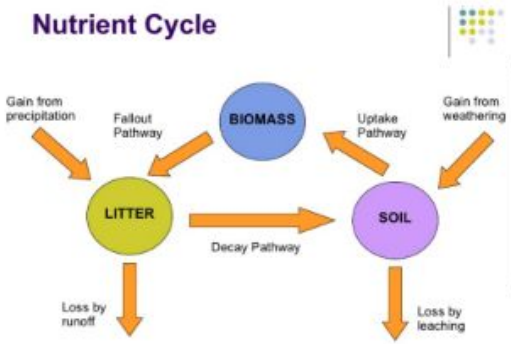
An ecosystem is the relationship between the living (biotic) and non-living (abiotic) components/parts of an environment



Producer	Any form of vegetation that can photosynthesise. Producers absorb light energy from the sun and covert this into chemical energy (glucose) that can be used by the plant and herbivores that eat the plant.
Consumer	An organism that eats to gain its energy. So, all animals are consumers. Herbivores/primary consumers eat only vegetation Carnivores/secondary consumers each other animals Omnivores eat vegetation and other animals Tertiary consumers are at the top of the food chain
Decomposer	Bacteria and/or fungi that breaks down dead matter

Nutrient Cycle

The nutrient cycle is vital for the continuation of life in the ecosystem. In the UK's deciduous ecosystem leaves fall off the trees every autumn. These leaves are broken down by decomposers on the forest floor. The nutrients are then returned to the soil, earthworms help to mix them in. Once in the soil they are absorbed by plants and trees so they can grow.



Biomass – this is where nutrients are stored in living matter such as trees.

Litter – leaf litter on the forest floor. Nutrients are now stored here.

Soil – nutrients are returned to the soil so they can be used again

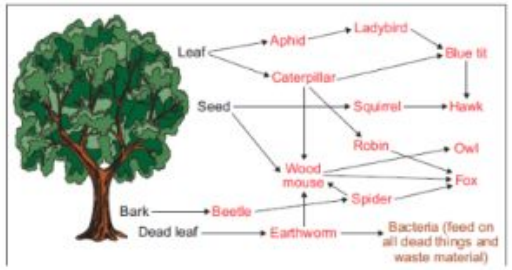
Food Chain

The connections between different organisms (plants and animals) that rely on one another as their source of food.

Oak Tree → Caterpillar → Shrew → Owl

Food web

A food web is made up of different food chains. It is a more complex and detailed picture of what eats what.. This shows many different links.



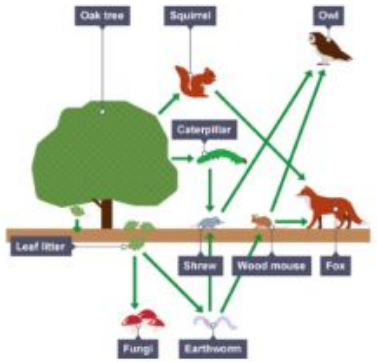
Only 10% of energy gets passed on at each stage of the food web. 90% of the energy is lost because it is used formovement/growth/respiration.

Energy is also lost as bones and skin are not always eaten.

An example of a UK ecosystem – Oak tree is a small-scale ecosystem (as is a pond)

1. Producer = oak tree. Provides energy for the rest of the ecosystem
2. Herbivores = caterpillar, squirrel, earthworm. These consume vegetation.
3. Carnivores = wood mouse, fox, owl. These consume other animals.
4. Decomposers = Fungi live off dead matter. These are then eaten by other consumers passing the nutrients along the food chain once again.

Make sure you can name the different parts and describe what they do



Geography

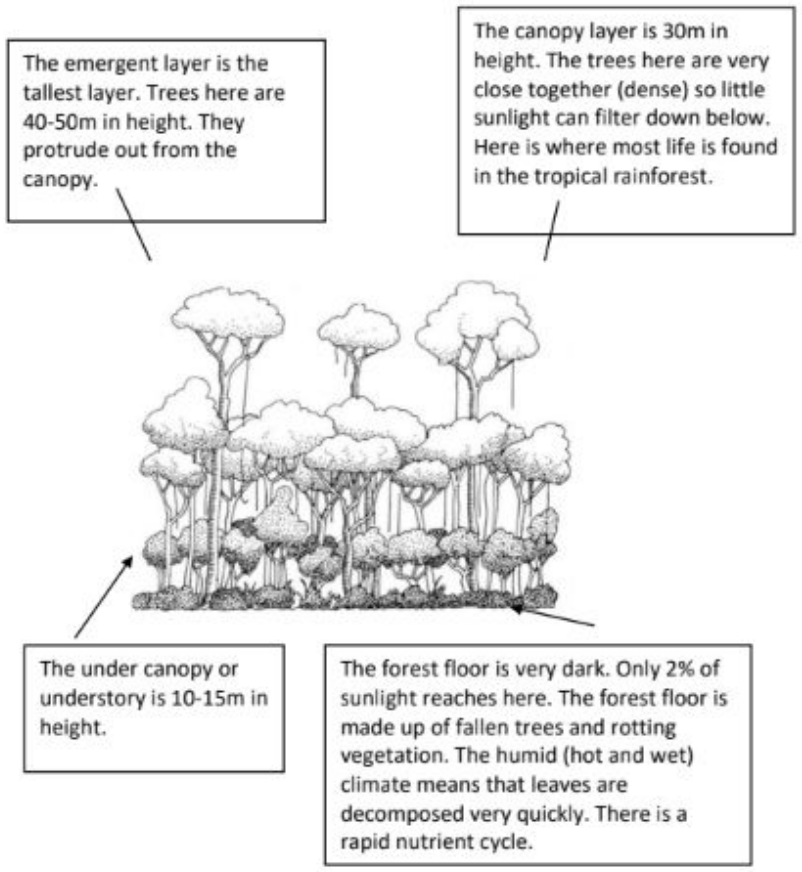
Changes to the ecosystem

Natural Changes	Vegetation takes nutrients and water from the soil allowing it to grow. If there was a drought the soil would be too dry then the vegetation would die. The squirrel and caterpillar would have less food and could reduce in numbers.
Changes Caused by Humans	Deforestation can occur, removing the producer (tree). If so then there will be no more leaf litter to be decomposed, less nutrients for the soil and a reduction in vegetation. Killing animals can alter a food chain, for example fox hunting. Pollution into waterways and rivers. For example the release of mercury into rivers in the Amazon during the process of mining for gold.

Biome	Location	Climate	Vegetation and soil
Tundra	Tundra is in the northern hemisphere only. 60-70 degrees north and south of the equator.	Average temperature of -28 degrees Celsius. Growing season only 2 months of the year.	Layer of permanently frozen ground called permafrost. Mosses can grow in the 2-month growing season. Cannot support anything else, no trees.
Temperate deciduous	Around 50 degrees north and south of the equator. This is the UKs biome.	Mild climate. Summer highs of 26 degrees Celsius. Winter lows of 5 degrees Celsius. 70mm of rainfall in July. Summer is the wettest season. Around 1250mm of rainfall annually.	Dark earth nutrient rich soils. Rainfall helps to leach nutrients downwards, so soils are deep. Deciduous trees. Lose their leaves in autumn ready for winter.
Tropical rainforest	Located on or near the equator, between the tropics of Cancer and Capricorn. Usually around 10 degrees north and south of the equator.	Very small temperature range, lows of 27 highs of 29. No seasons, growing season is 12 months of the year. 2500mm of rainfall.	Latosol soil, nutrients are only present in the top few cms due to the rapid uptake by trees. Most biodiverse ecosystem in the world.
Desert	Located around 30 degrees north and south of the equator. Near to the tropics of Cancer and Capricorn.	Hot day time temperatures around 35-40 degrees Celsius. Less than 250mm of rainfall per year.	Dry and sandy soils support sparse vegetation. Soils are salty due to the rapid evaporation of water leaving behind salt on the surface.

Tropical Rainforest

Vegetation structure (4 distinct layers)



Biodiversity

The tropical rainforest biome is the most biodiverse in the world. The climate (hot and wet) promotes the growth in vegetation which in turn provides a food source for many different animals.

- There are 40,000 different plants in the Amazon Rainforest
- 20,000 species of beetle have been recorded in a single hectare

Geography

Plant adaptations

There are a number of challenges to adapt to

1. Heavy downpours of rain daily
2. Thin, shallow and nutrient poor soils. Trees absorb nutrients rapidly from the soil, so they never penetrate the lower levels
3. Dark on forest floor. Only 2% of sunlight reaches here
4. Competition for nutrients. All vegetation is a race to reach the sunlight in the canopy.

Adaptation	Explanation (link to climate and soil in the tropical rainforest)
Buttress roots	These help to support the tall trees so they can grow to reach sunlight in the canopy and emergent layers. Also, the shallow roots can take up nutrients from the thin layer found at the top of the soil.
Drip tips	The high level of rainfall (over 2000mm) means that the leaves need to lose the water droplets quickly or they will rot. Drip tips also allows water to fall through to the lower layers
Waxy coating on leaves	The high level of rainfall means that the leaves need to lose the water droplets quickly or they will rot.
Epiphytes	These plants live on the surface of other plants, mostly tree trunks and branches. This allows them to take nutrients from the tree, so they don't have to compete for the thin layer of nutrients in the soil. It also allows them to make the most of the sunlight in the canopy layer to ensure they can photosynthesise.
Large leaves near the forest floor	Large leaves allow more sunlight to be absorbed, especially in areas of the rainforest that are darker. This ensure that photosynthesis can take place and that the plant can create its own energy/nutrients.

Animal Adaptations

Animal	Adaptation	Explanation
Spider monkey	Long Limbs Tail is strong to use as extra limb	Majority of fruits are in the high up canopy so most animals live in the trees and never go on the floor – need to adapted to climbing.
Draco Lizard	These have set of elongated ribs, which they can extend into "wings"	This allows them to travel from tree to tree in search of food without the dangers of the forest floor i.e. predators
Swordbill Hummingbird	Has a beak longer than its body	This allows them to cope with the competition from other birds for nectar as they are the only bird only to reach nectar in long "tubed" flowers.

Deforestation in the Amazon Rainforest

Causes

1. **Cattle ranching** in the biggest cause, nearly 80% of deforestation in the Amazon is attributed to this (caused by this). Large areas of trees are deforested to make space for grazing land for cattle. This is big business. The beef is exported all around the world to countries like the USA and China.
2. **Subsistence farming** is smaller scale type of farming. Families move onto patches of land; they clear the land through a process called slash and burn. They then farm this land by growing crops or keeping a small number of cattle. This is for their own survival rather than a big business. After a few years the soil becomes infertile, exhausted of its nutrients. They then move on a start again on a new patch of land.
3. **Gold mining** is particularly damaging as not only are trees cleared so that gold can be dug for beneath the ground, but mercury is used to the mining process. This runs into waterways killing fish and disrupting ecosystems.
4. **Hydroelectric dam building** is happening at a rapid pace as countries aim to meet demands of energy. Hydroelectricity provides 70% of energy for countries in the Amazon Basin. There are 150 dams planned on the Amazon River. Water has to be stored behind the dam in a large reservoir. This means large areas of rainforest are cleared to provide space for the building of the reservoir.
5. **Population growth** means that more and more land is needed. As cities expand and grow rainforests are cleared to make space for this development. More people in a country means more jobs and resources are needed, putting the remaining rainforest at risk further. More people also mean demand for food increases so more areas of rainforest will be converted to farmland.
6. **Road building** gives people access to the forest. Roads are important, they help to join rural communities up to towns and cities, so they have better access to jobs, healthcare and education. However, roads also give illegal farmers, miners and loggers access to the rainforest. When a road is built deforestation increases beside the road. An example of a road is the Trans Amazonia Highway.

Impacts of deforestation

Local Environmental – soil erosion

When trees are removed the soil is no longer protected against the heavy rain. Heavy rainfall washes the nutrients out of the soil. This is called leaching. The roots of trees hold the soil together. Once these are removed the soil can be easily washed away by the heavy rainfall into rivers. Removing trees interrupts the nutrient cycle. There will be no leaf fall, which means nutrients are unable to return to the soil. Eventually it will become infertile.

Global Environmental – contribution to climate change

Trees are carbon stores. The absorb carbon out of the atmosphere and emit (give out) oxygen. When forests are logged and burnt this carbon is released into the atmosphere. More carbon is emitted from deforestation than from the worlds transport sector. 75% of Brazil's carbon emissions come from deforestation. Less remaining trees means less carbon is absorbed from the atmosphere. The greenhouse layer becomes thicker and more heat is trapped.

Economic – jobs and income

- Brazil earns money by exporting (selling to other countries) the products from its rainforest. Brazil earns around $10 million from exporting soy (a crop grown in the rainforest).
- Gold mining and road construction creates much needed employment in the country.
- The development of hydroelectric power (HEP) provides electricity for towns and cities. Improving this infrastructure encourages economic development.
- Brazil's economy is growing by 5% each year. The country are getting richer because of deforestation. MULTIPLIER EFFECT. Deforestation = jobs = more taxes paid = government has more money to invest into the country.

Geography

Why are tropical rainforests valuable to people and the environment?

1. They help to mitigate climate change by absorbing carbon dioxide
2. Tropical rainforests contain half of all plants and animals in the world.
3. Help continue the water cycle making sure the climate in those regions doesn't become too try
4. 25% of medicines come from rainforest plants
5. Provide valuable resources such a nuts, fruits and rubber
6. Provide a home for indigenous tribes

Sustainable Management of the Tropical Rainforest

Sustainable management – protecting and conserving the environment so that it can be used and enjoyed by people today as well as future generations ensuring that any negative impact is minimised.

1. Selective Logging and Replanting
2. Ecotourism
3. Debt Reduction
4. Conservation and Education
5. International Agreements

Selective logging and replanting

Selective logging involves selecting carefully the trees that will be cut down. If for example only the oldest trees are cut down, then the canopy remains and the structure of the rainforest is still in tact. This ensures the soil is protected and prevents soil erosion the forest will be able to regenerate. Felling a small number of trees can be beneficial as light is able to reach the forest floor, which may encourage the growth of new saplings.

Replanting involves planting new trees to replace the ones that have been felled. Some logging companies have to do this by law. By replacing the trees that have been cut down it means that the forest will be intact for future generations.

Ecotourism

Ecotourism is a form of tourism that doesn't harm the environment and benefits local people. Eco tourists will be people that are interested in wildlife and the environment and want to enjoy a holiday in a natural setting. Ecotourists will pay lots of money to stay in the tropical rainforest, local people will be employed to work in the lodges, to act as local guides or to cook local food. Ecotourism provides a different way for low skilled workers to earn money in LICs and NEEs, it gives poorer people economic opportunities so that they don't have to cut down trees in order to earn a living and provide for their families.

Conservation and education

Some local people do not know or understand the effects of deforestation. If local people are educated on the longer-term environmental effects, they may adopt more sustainable practices themselves that help to reduce the negative impact.
Conserving and protecting the rainforests that are still standing is key. The WWF has been working to save rainforests for more than 35 years. In Malaysia they work in schools and with small groups of adults to teach them how to earn a sustainably income from the rainforest and how they can help conserve it. National parks can be created. These are areas of land that are protected, they are patrolled by guards and watched carefully.

Debt reduction

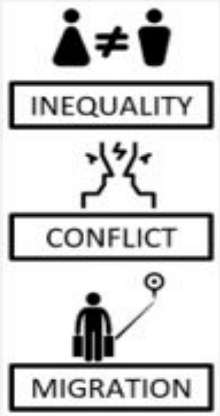
Most deforestation takes place in LICs or NEEs. The trees and forest are a natural resource that the country can exploit in order to encourage economic and social development. This is desperately needed as many of these countries are in debt to HICs, repaying this debt means that it is difficult to invest in the development of the country, deforestation is a way of earning money to pay back the debt. Reducing or cancelling the debt will mean that poorer countries don't have to cut down as many trees to pay back the loan.

International agreements on the use of hardwoods

The international tropical timber agreement was signed in 2006 by 71 countries. The aim of the agreement is to promote the trade of sustainably sources hardwood and trees that have been legally felled. Timber is marked with a registration number and can be checked against a data base to ensure it has been legally logged. Those countries that have signed the agreement will not buy or sell timber that is not on the data base. By agreeing not to sell illegally felled timber it makes it very difficult for the loggers to make any money from this practice and so will discourage them.

History

Year 9
1945 and beyond



Keywords

Immigration – The policy of people moving to one country from another country for work or to settle.
Equality – All races, genders & people treated the same.
NHS – National Health service, an organisation that look's after every citizen from birth to death for free (paid for in extra taxes)
Women's Liberation - A movement fighting for women to have more equal status and more freedom and choices.
Superpower - a very powerful and influential nation e.g. USA.

Communism – an economic and political system where all property is owned by the government/state
Capitalism – an economic and political system where trade and industry are controlled privately rather than by the state.
Berlin Wall - A wall dividing communist East and capitalist West Berlin from 1961-89
Iron Curtain – a non-physical boundary dividing Europe from the Soviet Union.
Space race – competition between the USA and Soviet Union to reach the moon first.
Arms race – the rapid increase in the quantity and quality of military power.

Britain after 1945

The damage both physically and economically of WW2 meant Britain had to change. This led to the building of new towns and cities, the welfare state and the NHS. This in turn meant there was a huge need for labour leading to a large influx of immigrant workers.

Migration to Britain

The **British Nationality Act of 1948** offered immigrants from the Commonwealth of old colonies British Citizenship and a passport if they came to Britain. The first migrants arrived on the **SS Empire Windrush from the Caribbean**. Many came from India & Pakistan, bringing new cultures, foods, music and attitudes to Britain leading to our multicultural society of today. The influx of foreign migrants to Britain led to some extreme political views and racial violence particularly in the black community. Many Britons felt that the immigrants were taking their jobs and it was time to send them home, leading to the creation of the National Front. Riots and protests grew more violent in the 1980s in London and other cities across the UK.

Britain and the Welfare state

The Labour government after WW2 believed if they could tackle poverty and intervene more and help people with issues in society, Britain would be healthier, fairer and stronger. So, a focus was put on education, health, industry and equality. THE NHS was started to care for the health of the nation and the Welfare state supported people in times of trouble that impacted their quality of life.

Cold war

A **cold war** is a state of tensions between two or more countries which stops just short of going to physical war. There have been many cold wars in history. The Cold War is one such example between the USA and the USSR.

USA v Soviet Union

The USA and USSR had been united in WWII in order to defeat Hitler's Germany. This alliance began to crumble once Germany had been defeated and ideological differences started to come to the surface. When Truman became president, relations deteriorated further as he and Soviet leader Stalin did not get on.
The USA was capitalist; the USSR was communist. These conflicting beliefs underpinned the entire Cold War as each power believed the other was trying to spread its ideology around the world. There was division between the capitalist democracies of the West and the Communist dictatorships of the East, marked by the **'Iron Curtain'.**

Women and equality

Women had been fighting politically since the mid-1800s for equality and after their contributions in WW1 and WW2 this become a priority for the women's groups. As the economic situation improved after WW2, almost everyone had a job and their own money including women. The introduction of the pill gave women more freedom in the choices they could make contributing to a more independent woman not having to settle for being a housewife. Lots of men supported the Women's Lib movement and equality for all too.

Key events 1945 and beyond

6th and 9th August 1945 - Atomic bomb dropped on Hiroshima and Nagasaki
8th May 1945- Victory in Europe day
15th August 1945 – Victory in Japan Day
1948 Empire Windrush arrives in Tilbury
5 July 1948 Introduction of NHS
1949 - The USSR tests their first atomic bomb
1961 The pill available
1962 - Cuba Missile Crisis
1967 Abortion Act
July 1969 – First landing on the moon
1969 Divorce Act
1989 - Fall of the Berlin Wall
1991 - Fall of Communism in the USSR
1975 Equal Pay Act
1975 Sex Discrimination Act
1979-90 Thatcher first female PM
1981 Toxteth Riots
1983-85 Miner's Strikes
2013 BlackLivesMatter movement
2018 Windrush Scandal

Fractions

You need to be able to work with fractions and mixed numbers confidently **without a calculator.**

1 Adding or subtracting fractions

Add or subtract the whole numbers

Write the fractions as fractions with the same denominator

Add or subtract the fractions

If you have an improper fraction then convert to a mixed number and add

$2\frac{2}{3} + 1\frac{1}{2}$

$= 3 + \frac{2}{3} + \frac{1}{2}$

$= 3 + \frac{4}{6} + \frac{3}{6}$

$= 3 + \frac{7}{6}$

$= 3 + 1\frac{1}{6}$

$= 4\frac{1}{6}$

2 Multiplying fractions

Convert any mixed numbers to improper fractions

Multiply the numerators and multiply the denominators, cancelling where possible

Convert any improper fractions to mixed numbers

$3\frac{1}{4} \times 2\frac{2}{3}$

$= \frac{13}{4} \times \frac{8}{3}$

$= \frac{13 \times \cancel{8}^{2}}{\cancel{4}_{1} \times 3}$

$= \frac{26}{3}$

$= 8\frac{2}{3}$

3 Dividing fractions

Convert any mixed numbers to improper fractions

Turn the second fraction 'upside down' and change ÷ to ×

Multiply the numerators and multiply the denominators, cancelling where possible

Convert any improper fractions to mixed numbers

$6\frac{1}{4} \div 1\frac{7}{8}$

$= \frac{\frac{25}{4}}{\frac{15}{8}}$

$= \frac{25}{4} \times \frac{8}{15}$

$= \frac{5}{1}\frac{\cancel{25} \times \cancel{8}^{2}}{\cancel{4} \times \cancel{15}_{3}}$

$= \frac{10}{3}$

$= 3\frac{1}{3}$

Worked example

Target grade 5

Work out $7\frac{1}{3} - 2\frac{3}{4}$ **(3 marks)**

$7\frac{1}{3} - 2\frac{3}{4} = \frac{22}{3} - \frac{11}{4}$

$= \frac{88}{12} - \frac{33}{12}$

$= \frac{55}{12}$

$= 4\frac{7}{12}$

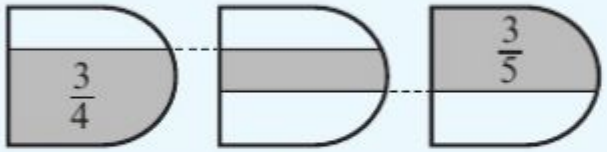
Remember you need to be able to do this **without** a calculator.

Fractions

Worked example

Target grade 5

The diagram shows three identical shapes.
$\frac{3}{4}$ of shape A is shaded and $\frac{3}{5}$ of shape C is shaded.



What fraction of shape B is shaded? **(3 marks)**

$1 - \frac{1}{4} - \frac{2}{5} = \frac{20}{20} - \frac{5}{20} - \frac{8}{20} = \frac{7}{20}$

Problem solved!

White area on A $= 1 - \frac{3}{4} = \frac{1}{4}$

White area on C $= 1 - \frac{3}{5} = \frac{2}{5}$

So shaded area on B $= 1 - \frac{1}{4} - \frac{2}{5}$

Examiners' report

On the non-calculator paper, students often lose marks on basic arithmetic. Learn your times tables, and check your working!

Real students have struggled with questions like this in recent exams – **be prepared!**

Decimals

Terminating decimals can be written exactly. You can write a terminating decimal as a fraction with denominator 10, 100, 1000, and so on.

$0.24 = \frac{24}{100} = \frac{6}{25}$

Recurring decimals have one digit or group of digits repeating forever. You can use dots to show the recurring digit or group of digits.

$\frac{2}{3} = 0.6666\ldots = 0.\dot{6}$ The dot tells you that the 6 repeats forever.

$\frac{346}{555} = 0.623\,4234\ldots = 0.62\dot{3}4\dot{}$

These dots tell you that the group of digits 234 repeats forever.

Recurring or terminating?

To check whether a fraction produces a recurring decimal or a terminating decimal, write it in its simplest form and find the prime factors of its **denominator**.

Prime factors only 2 and 5 → Terminating decimal

Prime factors other than 2 or 5 → Recurring decimal

Problem solved!

You could also write the denominator as a product of prime factors: $\frac{7}{50} = \frac{7}{2 \times 5^2}$

The only factors are 2 and 5 so $\frac{7}{50}$ produces a terminating decimal.

Worked example

Target grade 5

(a) Show that $\frac{7}{50}$ can be written as a terminating decimal. **(1 mark)**

$\frac{7}{50} = \frac{14}{100} = 0.14$

(b) Show that $\frac{11}{24}$ **cannot** be written as a terminating decimal. **(2 marks)**

$\frac{11}{24} = \frac{11}{2^3 \times 3}$

Denominator contains a factor other than 2 or 5 so decimal is recurring.

Decimals

Worked example

Target grade 5

(a) Show that $\frac{2}{9}$ is equivalent to 0.222… **(1 mark)**

$$9\overline{)2.^{2}0^{2}0^{2}0\ldots} \quad 0.2\,2\,2\ldots$$

(b) Hence, or otherwise, write 0.7222… as a fraction. **(3 marks)**

$$0.7222\ldots = 0.222\ldots + 0.5$$
$$= \frac{2}{9} + \frac{1}{2}$$
$$= \frac{4}{18} + \frac{9}{18} = \frac{13}{18}$$

You could also use long division for part (a).

Fractions and decimals

To convert a fraction into a decimal, divide the numerator by the denominator.

$\frac{2}{5} = 2 \div 5 = 0.4$

It's useful to remember these common fraction-to-decimal conversions:

Fraction	$\frac{1}{100}$	$\frac{1}{20}$	$\frac{1}{10}$	$\frac{1}{2}$	$\frac{1}{5}$	$\frac{1}{4}$	$\frac{3}{4}$
Decimal	0.01	0.05	0.1	0.5	0.2	0.25	0.75

Maths- Foundation

What you need to know:

Percentage of an amount – Non calculator

To calculate any percentage it is useful to start with 10%.

30% of 120: 10% = 120 ÷ 10 = 12
30% = 3 x 12 = 36

To find 10% we divide by 10.

To find 30% we multiply 10% by 3.

45% of 80: 10% = 80 ÷ 10 = 8
40% = 4 x 8 = 32
45% = 40% + 5% = 32 + 4 = 36
5% = 8 ÷ 2 = 4

5% is half of 10% so we divide by 2.

To find 1% we divide the starting amount by 100.
1% of 30 = 30 ÷ 100 = 0.3.

Percentage of an amount – Calculator

When we have a calculator we can use a multiplier; this is the decimal equivalent of the percentage.

80% of 120: 80% = 0.80
80% of 120 = 0.80 x 120 = 96

Change the percentage to a decimal and then multiply.

33% of 90: 33% = 0.33
33% of 90 = 0.33 x 90 = 29.7

Be careful if the percentage is less than 10.

4% of 88: 4% = 0.04
4% of 88 = 0.04 x 88 = 3.52

Take care using decimal percentages, still divide by 100.

12.5% of 42: 12.5% = 0.125
12.5% of 42 = 0.125 x 42 = 5.25

Key Terms:

Percentage: Out of one hundred.
Decimal: A decimal is a fraction written in a special form e.g. 0.6.
Multiplier: This is used to calculate percentages when we have a calculator.
Increase: When an amount goes up.
Decrease: When an amount goes down.
Simple interest: The amount of interest is fixed over period of time.
Compound interest: The interest earned over time will continue to increase.

Hegarty maths clip numbers

Percentage of Amount: 84 – 87

Percentage Increase/Decrease: 88 – 90

Simple and Compound Interest: 91 – 94

hegartymaths

You need to be able to:

- Calculate a percentage of an amount.
- Use a multiplier to calculate a percentage of an amount.
- Calculate a percentage increase.
- Calculate a percentage decrease.
- Calculate simple interest.
- Calculate compound interest.

Maths- Foundation

What you need to know:

Percentage increase and decrease

Increase: To calculate a percentage increase we calculate the percentage and add the value on to the original amount.

Non Calculator: Increase 70 by 65%

10% = 70 ÷ 10 = 7 5% = 7 ÷ 2 = 3.5

60% = 6 x 7 = 42

65% = 60% + 5% = 42 + 3.5 = 45.5

Calculate 65% by splitting into 10% and 5% and then add the answer on to the original amount.

70 + 45.5 = **115.5**

Calculator: Increase 130 by 26%

Calculate 26% using a multiplier and add this answer onto the original amount.

26% of 130 = 0.26 x 10 = 33.8

130 + 33.8 = **163.8**

Decrease: To calculate a percentage decrease we calculate the percentage and subtract the value off the original amount.

Non Calculator: Decrease 20 by 35%

10% = 20 ÷ 10 = 2 5% = 2 ÷ 2 = 1

30% = 3 x 2 = 6

35% = 30% + 5% = 6 + 1 = 7

Calculate 35% by splitting into 10% and 5% and then subtract the answer off the original amount.

20 - 7 = **13**

Calculator: Decrease 65 by 14%

Calculate 14% using a multiplier and subtract this answer off the original amount.

14% of 65 = 0.14 x 65 = 9.1

65 – 9.1 = **55.9**

Simple interest

To calculate simple interest we start by calculating the percentage and multiplying it by the period of time.

Example: £250 is in a bank account which is paying 5% simple interest per year. How much will be in the bank account at the end of 3 years?

5% = 0.05

0.05 x 250 = £12.50

Multiply by 3 because the question asks for 3 years.

3 x £12.50 = £37.50.

Add your answer to the original amount in the question.

£250 + £37.50 = £287.50

Compound interest

To calculate compound interest we use powers as the amount changes at the end of each year.

Example: £250 is in a bank account which is paying 4% compound interest per year. How much will be in the bank account at the end of 5 years?

Interest means an increase so 100% + 4% = 104% which as a multiplier is 1.04

4% increase = 1.04

Power of 5 because the questions asks for 5 years.

1.04^5 x 250 = £304.16

This is the final answer

Mixed Numbers

Mixed numbers contain a whole number and a fraction.

whole → $2\frac{1}{4}$ ← fraction

Improper Fractions

An improper fraction has a numerator which is greater than or equal to the denominator.

$\frac{5}{3}$

Convert an Improper Fraction to a Mixed Number

$\frac{9}{4}$

$9 \div 4 = 2r1$ → $2\frac{1}{4}$

Divide the numerator by the denominator.

This shows you the whole number and the fraction.

Convert a Mixed Number to an Improper Fraction

Multiply the whole by the denominator to make an improper fraction.

$2\frac{5}{6} = \frac{12}{6} + \frac{5}{6} = \frac{17}{6}$

Add the fractions together.

Adding and Subtracting Fractions

To add or subtract fractions with denominators that are multiples of the same number, we must change one fraction to have the same denominator.

$\frac{1}{3} + \frac{1}{3} = \frac{2}{3}$

$\frac{4}{5} - \frac{3}{5} = \frac{1}{5}$

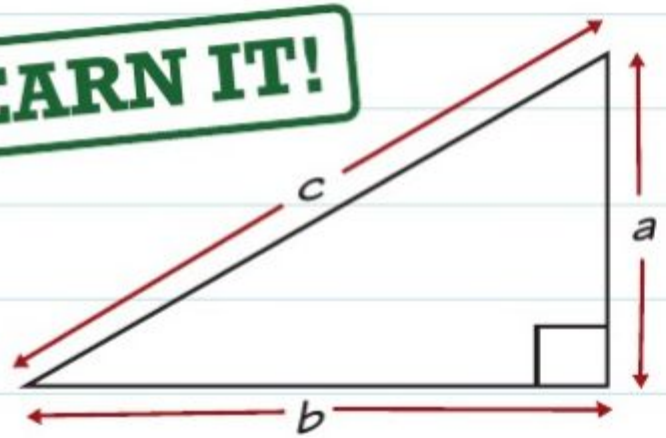
$\frac{1}{4} + \frac{3}{8} = \frac{2}{8} + \frac{3}{8} = \frac{5}{8}$

$\frac{5}{6} - \frac{2}{3} = \frac{5}{6} - \frac{4}{6} = \frac{1}{6}$

Pythagoras' theorem

Pythagoras' theorem is a really useful rule. You can use it to find the length of a missing side in a right-angled triangle.

LEARN IT!



$$a^2 + b^2 = c^2$$

Pythagoras checklist

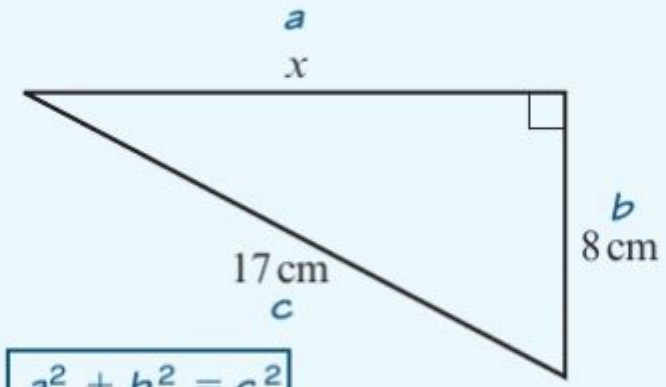
- $\text{short}^2 + \text{short}^2 = \text{long}^2$ ✓
- Right-angled triangle. ✓
- Lengths of two sides known. ✓
- Length of third side missing. ✓
- Learn this. ✓

Pythagoras' theorem

Worked example

Target grade 4

This right-angled triangle has sides x, 17 cm and 8 cm.



$a^2 + b^2 = c^2$

Show that $x = 15$ cm. **(2 marks)**

$x^2 + 8^2 = 17^2$

$x^2 = 17^2 - 8^2$

$= 225$

$x = \sqrt{225} = 15$ cm

Examiners' report

This question asks you to **show that** $x = 15$, so don't assume this at the start of your working. Work out the value of x using the other information given, and show **every step** of your working.

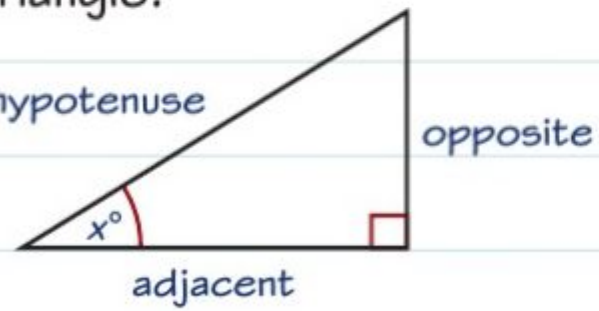
Real students have struggled with questions like this in recent exams – **be prepared!**

Be careful when the missing length is one of the shorter sides.

1. Label the longest side of the triangle *c*.
2. Label the other two sides *a* and *b*.
3. Write out the formula for Pythagoras' theorem.
4. Substitute the values for *a*, *b* and *c* into the formula.
5. Rearrange the formula and solve.

Trigonometry 1

You can use the trigonometric ratios to find the size of an angle in a right-angled triangle. You need to know the lengths of two sides of the triangle.



The sides of the triangle are labelled relative to the **angle** you need to find.

Trigonometric ratios

LEARN IT!

$\sin x° = \frac{opp}{hyp}$ (remember this as S^{O}_{H})

$\cos x° = \frac{adj}{hyp}$ (remember this as C^{A}_{H})

$\tan x° = \frac{opp}{adj}$ (remember this as T^{O}_{A})

You can use $S^{O}_{H}C^{A}_{H}T^{O}_{A}$ to remember these rules for trig ratios.

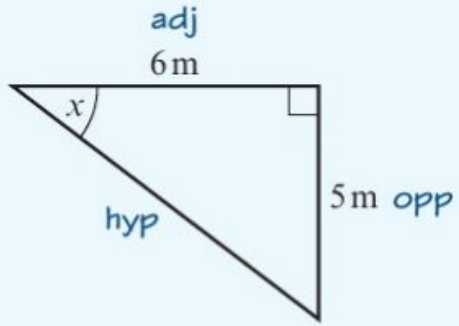
These rules only work for **right-angled** triangles.

Trigonometry 1

Worked example

Target grade 5

Calculate the size of angle x. **(3 marks)**



$$\tan x^\circ = \frac{\text{opp}}{\text{adj}} = \frac{5}{6}$$

$$x^\circ = 39.805\,57109^\circ = 39.8^\circ \text{ (to 3 s.f.)}$$

Label the **hyp**otenuse first – it's the longest side.

Then label the side **adj**acent to the angle you want to work out.

Finally, label the side **opp**osite the angle you want to work out.

Remember $S^O{}_H C^A{}_H T^O{}_A$. You know **opp** and **adj** here so use $T^O{}_A$.

Do **not** 'divide by tan' to get x on its own. You need to use the $\tan^{-1}$ function on your calculator.

$\tan^{-1}\left(\frac{5}{6}\right)$

39.80557109

Write all the figures on your calculator display and then round your answer.

Using your calculator

To find a missing angle using trigonometry you have to use one of these functions:

$\sin^{-1}$ $\cos^{-1}$ $\tan^{-1}$

These are called **inverse trigonometric** functions. They are the inverse operations of sin, cos and tan.

Make sure that your calculator is in degree mode. Look for the D symbol at the top of the display.

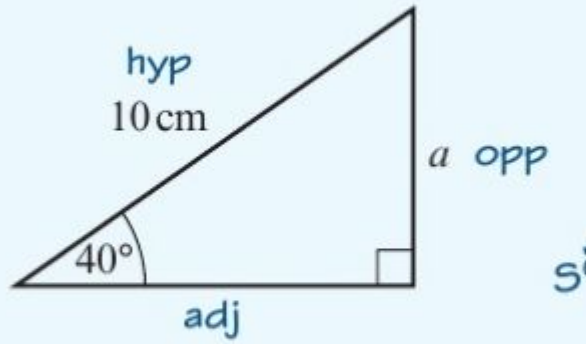
Trigonometry 1

You can use the trigonometric ratios to find
right-angled triangle. You need to know the
the acute angles.

Worked example

Target grade 5

Calculate the length of side a. **(3 marks)**



S O H C A H T O A

$$\sin x° = \frac{\text{opp}}{\text{hyp}}$$

$$\sin 40° = \frac{a}{10}$$

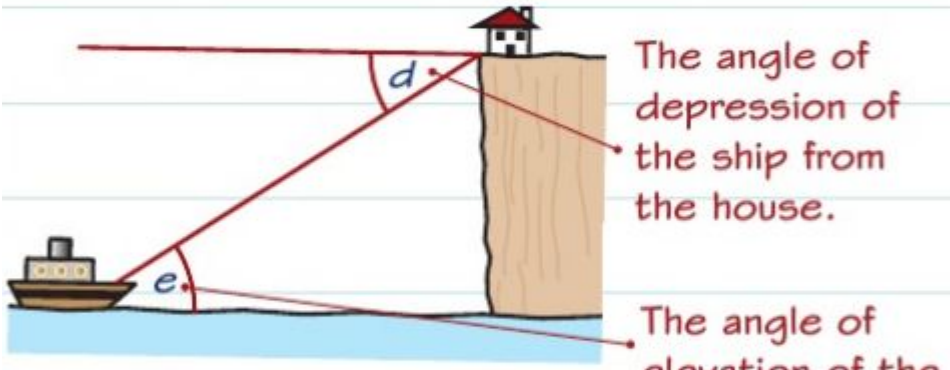
$$a = 10 \times \sin 40°$$

$$= 6.427\,87\ldots$$

$$= 6.43 \text{ cm (to 3 s.f.)}$$

Angles of elevation and depression

Some trigonometry questions will involve angles of elevation and depression.



Angles of elevation and depression are always measured from the horizontal.

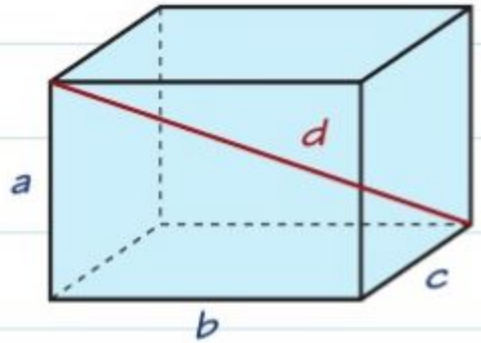
In this diagram, $d = e$ because they are alternate angles.

Pythagoras in 3-D

To tackle the most demanding questions, you need to be able to use Pythagoras' theorem in 3-D shapes.

You can use Pythagoras' theorem to find the length of the longest diagonal in a cuboid.

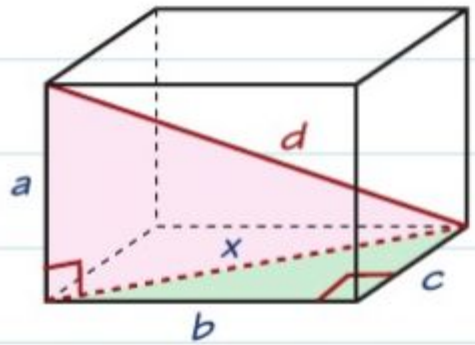
You can also use Pythagoras to find missing lengths in pyramids and cones.

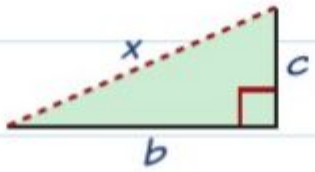


$$a^2 + b^2 + c^2 = d^2$$

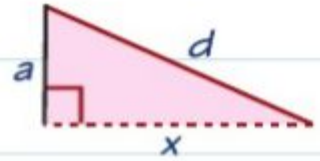
Why does it work?

You can use 2-D Pythagoras twice to show why the formula for 3-D Pythagoras works.





$$x^2 = b^2 + c^2$$



$$d^2 = a^2 + x^2$$
$$= a^2 + b^2 + c^2$$

Maths- Higher

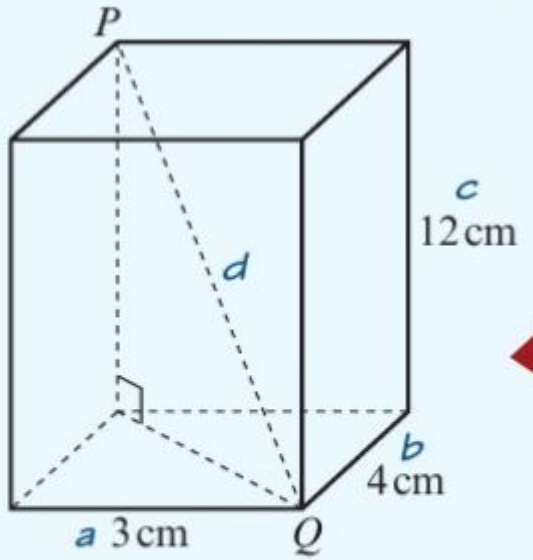
Pythagoras in 3-D

Worked example

Target grade 7

The diagram shows a cuboid. Work out the length of PQ.

(3 marks)



$d^2 = a^2 + b^2 + c^2$

$PQ^2 = 3^2 + 4^2 + 12^2$

$= 169$

$PQ = \sqrt{169} = 13$

So PQ is 13 cm.

Everything in blue is part of the answer.

Population Pyramids

Shows distribution of ages in a population, in numbers or proportion/percentages.
They are used to compare two sets of data, usually genders or two geographical areas.
When comparing the data look at the shape of the distribution.

- If it looks like a pyramid with smaller bars at the top that means there is a higher proportion of younger people in the population and less older people. This could be because if short life expectancy (how long people live), high birth rates or high death rates.
- If the diagram looks more or less straight that means there is a similar proportion of older and younger people in the population which could be because of lower birth/death rates or that the life expectancy is increasing.
- An upside-down pyramid with larger bars at the top and smaller bars at the bottom shows that the population has a larger proportion of older people compared to younger people. This could be because of low birth/death rates, longer life expectancy or the location might be far from the city or a coastal area where older people are retiring to.

Choropleth Maps (not Chloropeth)

Think colour by numbers.
They split a geographical area into different regions which are then shaded.
The darker the shading the higher the frequency for that area.
Each map has a key to show what the shading represents.
Interpreting:
The area of the map which is shaded darkest has the highest proportion/percentage.
Look at the key for the shading to read off percentages/numbers.

Histograms

Represents continuous data from grouped frequency tables.

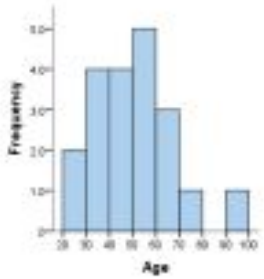
No gaps between bars.

Equal Class Widths

x-axis = data

y-axis = frequency

Looks like bar charts without gaps.

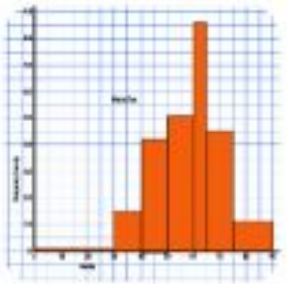


Unequal Class Widths

Area of bar = frequency

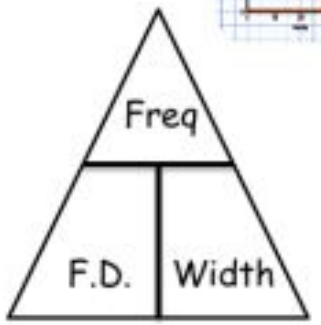
Y-axis = Frequency Density (not frequency)

The idea is that the frequency density reflects the 'concentration' of things within each range of values.



$$Frequency\ Density = \frac{Frequency}{Class\ Width}$$

$$Frequency\ Density \times Class\ Width = Frequency$$



Drawing Histograms:

1. Calculate class widths for each class interval
2. Calculate frequency density for each class interval using FD = F/CW formula.
3. Draw a suitable scale on y-axis labelled frequency density.
4. Draw bars using frequency density data. (Remember the bars have no gaps in between)

Estimating frequencies from histograms:

With these questions you are using the class widths and frequency density from the histogram to work out frequencies. Be careful when calculating class width as some intervals may not include the entire bar.

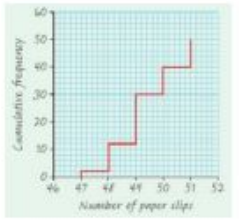
1. Find the bars that cover the range you need from the question.
2. Work out the frequency for each bar using the FD X CW = F formula.
3. Add the frequencies.

To compare histograms, they need to have the same class intervals and frequency density scales.

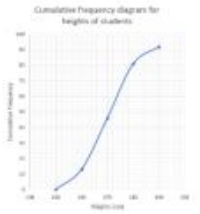
When comparing histograms, describe the shape of the distribution and what this shows.

Cumulative Frequency Diagrams

Cumulative frequency is a running total of the frequencies.
To work out CF for a class interval, add all the frequency for that class interval and the CF of the previous class interval.
Use upper bounds for x-axis when plotting points.



CF Step Polygons – Use for **discrete** data.
Plot the points using upper bound of class interval and join points using straight lines by going *across then up*.



CF Curves – Use for **grouped continuous** data.
Plot points using upper bound of class interval and connect with a *smooth curve.*

Estimating values from CF diagrams:

- Median
  - Work out median value by dividing total frequency by 2.
  - Find on Y-axis
  - Draw horizontal line from that value to curve/line
  - Read off value from x-axis
- Interquartile Range (IQR)
  - Work out 25% and 75% values
  - Find on y-axis
  - Draw horizontal line from that value to curve/line
  - Read off values from x-axis
  - Subtract them (Big one – small one)
- Estimating more than/greater than values
  - Draw a vertical line from the value in the question on the axis to the curve.
  - Read off corresponding y-axis value.
  - Subtract from total frequency.

Interpercentile Range (IPR)

The difference between 2 percentiles.

Percentiles – divide the data into 100 equal parts.

Gives a more flexible view of the spread of the data e.g. could be used to analyse the gap between highest and smallest earners.

$$\textit{Interpercentile Range (IPR)} = \textit{Value of larger percentile} - \textit{Value of smaller percentile}$$

1. Divide the percentiles you need by 100, then multiply that decimal by the total frequency. E.g. for 70^{th} percentile with frequency 80, (70/100)*80 = 56^{th} position.
2. Find the position on the y-axis of your graph and read across to find the corresponding x-values.
3. To find the interpercentile range, subtract the two percentiles that you calculated.

If calculating IPR from a table, carry out linear interpolation as you would when finding median from a table.

Interdecile Range

The difference between 2 deciles – usually the difference between the first and ninth deciles.

Deciles – divides the data into 10 equal parts.

$$\textit{Interdecile Range} = 9\textit{th decile} - 1\textit{st decile}$$

Estimate Median using Linear Interpolation:

1. Use ½ n to find the median position.
2. Find Cumulative Frequency (CF) of the frequency column until you reach the class interval that contains the ½ nth value. This is the group that contains the median.
3. Find the median's position in the group and see how many more values you need in that class to get to the median.
   Do this by subtracting the CF of the group above from your ½ nth value.
4. Divide this number by the frequency for the median class.
5. Multiply your answer by the class width.
6. Add your answer to the lower bound for the class interval. This is your estimate for the median value.

Standard Deviation (SD)

A measure of **how far all the values are from the mean** value, or how spread out they are.
The smaller the SD, the closer the data is to the mean,
The larger the SD, the more spread out the data is from the mean.

Discrete Data

Formulae: $\sigma = \sqrt{\frac{1}{n}\sum(x-\bar{x})^2}$ **OR** $\sigma = \sqrt{\frac{\sum x^2}{n} - (\frac{\sum x}{n})^2}$ $\bar{x}$ = mean, σ= standard deviation

Using the first formula:

1. Calculate the mean.
2. Subtract the mean from each data value and square the answer – it might be useful to do this in a table.
3. Add up all the answers to step 2.
4. Divide by the number of values.
5. Square root.

Using the second formula:

1. Calculate the mean.
2. Square each value
3. Add up the answers to step 2.
4. Divide by number of values.
5. Subtract the square of the mean from your answer to step 4.
6. Square root.

Frequency Table (not grouped)

Formulae: $\sigma = \sqrt{\frac{\sum f(x-\bar{x})^2}{\sum f}}$ **OR** $\sigma = \sqrt{\frac{\sum fx^2}{\sum f} - (\frac{\sum fx}{\sum f})^2}$

$\sum f = n$ (total frequency)

$\frac{\sum fx}{\sum f} = mean$

Using the first formula:

1. Calculate the mean.
2. Create a new column for $\boldsymbol{x} - \bar{\boldsymbol{x}}$. Subtract mean from each value in the first column.
3. Square each answer to step 2 – create new column.
4. Multiply each answer in step 3 by corresponding frequency – create new column.
5. Add answers to step 4 – add the last column.
6. Divide answer to step 5 by total of frequency column.
7. Square root.

Using the second formula:

1. Add three columns: *fx, x^2 and fx^2* and calculate these values. Remember to add these columns.
2. Calculate the mean.
3. Substitute your values into the formula and work out the answer.

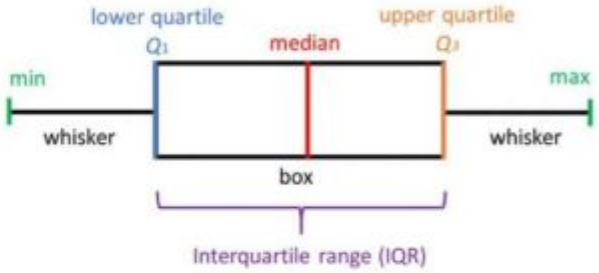
Grouped

For grouped frequency tables, follow the same step as for frequency table but use the midpoint for *x*. You may need to create an extra column to your table for the midpoint before carrying out the above steps.

Box Plots

Divide the data into sections that each contain approximately 25% of the data in that set.
Represents important features of the data and gives a summary of the spread/skew of the data.
Box Plots include 5 pieces of information about the data:

1. Minimum Value – the lowest score, shown at the far left of the diagram
2. Lower Quartile (LQ) – 25% of data is below this
3. Median – Mark the middle of the data – 50% of the data is above/below this value
4. Upper Quartile (UQ) – 25% of data is above this value/75% of data is below it.
5. Maximum Value – The highest score, shown at the far right of the diagram



The total length of the box plot represents the range.
The box represents the middle 50% and the IQR.

Drawing Box Plots:

1. Calculate your LQ, UQ, median and identify your minimum and maximum value.
2. Mark these 5 points on your diagram – the minimum and maximum values with small lines and the other three with bigger lines.
3. Draw a box around the big three lines.
4. Connect the box to the min/max points using horizontal lines.

Outliers

Values that are far from the rest of your data and don't fit the general pattern.
Can show errors in the data
Including outliers may misrepresent your data but not including them could falsify your data.
They distort the data so you need to identify them.

Outliers are more than 1.5 X IQR above UQ or below LQ.

$$Outliers\ are\ values > UQ + (1.5 \times IQR)$$
$$or < LQ - (1.5 \times IQR)$$

1. Work out IQR
2. Find 1.5 x IQR
3. Subtract this value from LQ and add to UQ.
4. These values are now your new min/max points for your box plot. Any values in your data outside of this range are outliers.
5. Mark outliers with an X on your box plot.

Outliers can also be found using the mean and standard deviation – they are values more than 3 SD away from the mean.

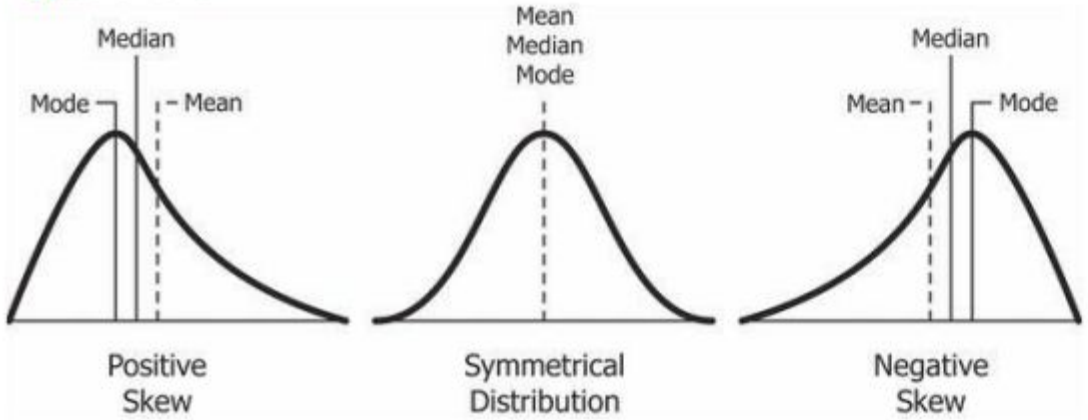
$$Outliers = Values\ outside\ \bar{x} \pm 3\sigma$$

Interpreting box plots – Compare median for measure of average and range or IQR for measure of spread.
Remember to compare in context of the question for full marks.
Compare skewness of both box plots.

Skewness

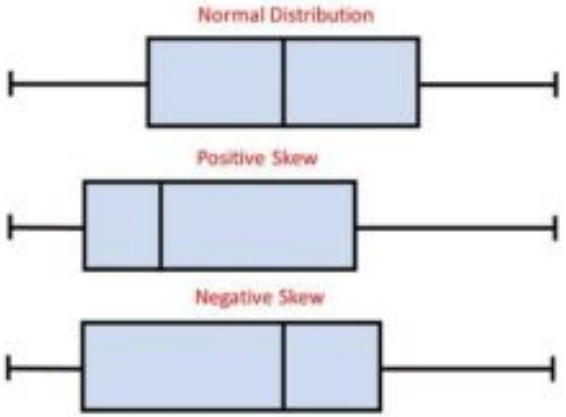
Describes the shape of the distribution and tells you how the data is spread out.
If the data is skewed, it means most of the values are more on one side of the median.

Types of Skew:



- Positive Skew – most values are at the beginning of the data set and values towards the end are more spread out. The majority of the data is low and there are very few higher values. The tail of the curve goes in the positive direction of the x-axis.
  Mean > Median > Mode
- Negative Skew - most values are at the end of the data set and values towards the beginning are more spread out. The majority of the data is higher and there are very few low values. The tail of the curve points towards the negative direction of the x-axis.
  Mean < Median < Mode
- Symmetrical – There is no skew. The data is evenly distributed on both sides of the median.
  Mean = Median = Mode

Skewness on Box Plots:



- Normal Distribution/Symmetrical – When median is halfway between LQ and UQ.
- Positive Skew – Median closer to LQ.
- Negative Skew – Median closer to UQ.

Skewness using the Formula:

Formula: $$Skewness = \frac{3(mean - median)}{standard\ deviation}$$

- Positive Value = positive skew. The larger the value, the larger the skew.
- Negative Value = Negative Skew. The smaller the value, the stronger the skew.
- Value of 0 = No Skew/Symmetrical.

Comparing Data Sets

Compare using **a measure of average (mean/median/mode) and spread (range/IQR/SD)** or skewness.
Always make reference to individual values and mention which data set is larger/smaller than the other clearly.
Always interpret in context – link back to the scenario in the question and labels on axes.

Example Comparisons and Interpretations of Data

Replace 'data sets' and 'results' with appropriate keyword from the question.

- Comparing Averages:

Mean/median/mode for data set A is larger than mean/median/mode data set B so on average data set A is more … than data set B.

- Comparing spread:

Range/IQR/SD for data set A is larger than that of data set B so the 'results' of data set A are more spread out/less consistent than those of data set B.
Data A has a smaller range/IQR/SD than data set B which means the 'results' for 'data set A' are more consistent.
Remember lower SD means values are closer to the mean and therefore similar.

- Comparing Skew:

Box Plot for data set A is positively skewed so majority of 'results' were low with few higher 'results'.
Box plot for data set A is negatively skewed so majority of 'results' were high with few lower 'results'.

When comparing data make sure to pair the appropriate values of average and spread.

Average	Measure of Spread
Mode	Range
Median	Range/IQR
Mean	Range/SD

PE

Knowledge Organiser: PE Year 9 Athletics

Running Events

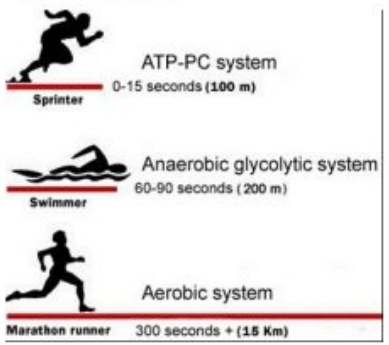
Key Words	Coaching Points	Rules and Tactics
Sprinting 100m, 200m,	Types of strength for sprinting **Strength endurance**, means you can keep up with muscle-pumping activities for extended periods of time **Explosive strength,** is maximum force over minimal time **Starting strength** is your ability to speed up instantly from a stationary position **Speed strength** is the capability to exert a lot of force in a short period of time.	The time is registered when the runner's torso (chest) passes the finish line. That is the reason why most athletes lunge forward when they approach the finish line
Middle distance running 800m ,1500m	There are three energy systems I Phosphagen system used for short burst of intense activity about 5 seconds Anaerobic/lactate system used for intense activity lasting 1-3 minutes Aerobic system used for lower intensity activity lasting longer term	In the 1500m, tenacity and a well-developed sense of strategy are important assets besides speed and endurance. The third lap becomes the most critical lap and any error from here on may be hard to rectify.
Relay 4x100 4x 400	4 x 400m Here you will be jostling for position ,there is no reason to get as explosive a start as in a 4x100m race. To receive the baton you will stand facing the inside of the track with your left arm out-stretched to receive the baton. Hold the hand nice and high so your tired team mate has a good target to aim at. It is important you take the baton in your LEFT hand as it significantly reduces the chances of it getting knocked out of your hand as you go into the first bend. It is okay to	Runners have a 20 m box in which to transfer the baton. The first transfer is made within the staggered lane lines; for the second and third transfers, runners typically line up across the track despite the fact that runners are usually running in line on the inside of the track.

Distance	Aerobic	Anaerobic
200m	29%	71%
400m	43%	57%
800m	66%	34%
1500m	84%	16%

Components of fitness

Component of fitness	Definition	Example of use in the game
Body composition	The percentage of body weight which is fat, muscle and bone	The body composition of a 1500m runner will differ greatly from that of a shot putter
Balance	The ability to maintain the body's centre of mass above the base of support.	To ensure that throwers do not come out the front of the circle
Flexibility	Range of movement (ROM) at a joint	High jumpers need a lot of flexibility in their backs

Energy Systems



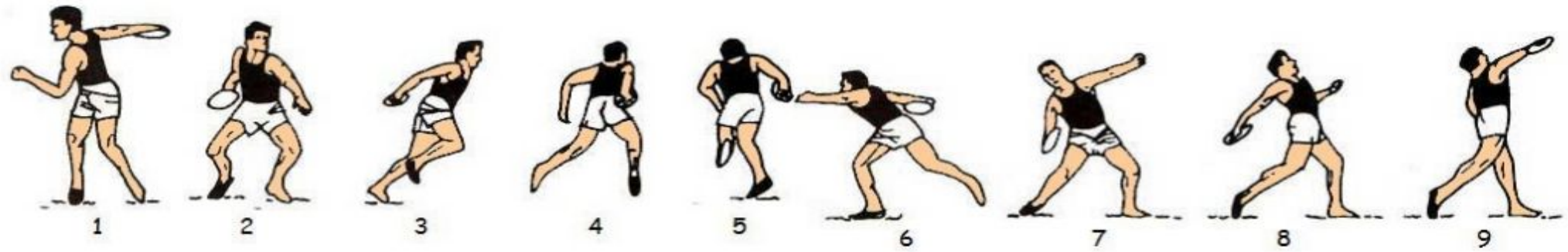
PE

Knowledge Organiser: PE Year 9 Athletics

Throwing Events

Key Words	Coaching Points	Rules and Tactics
Shot put	Spin Technique **Static Start**: The athlete should go into a slight squat straddling in the center of the ring at the rear of the circle, with the flat feet about shoulder width apart **The Wind up:** The wind up should be with the upper body turning to the right, with little weight shift of the lower body. The athlete executes the wind up with the feet flat or slightly up on the toes. **Out of the back**: At the back of the circle the thrower's weight is shifted to left leg, then the right leg is picked up. As the right leg is picked, the thrower sinks or drops onto the left leg.	Fouls A player does not pause within the circle before throwing motion A player allows the shot to drop below the shoulder The shot lands outside the boundaries of the sector or touches the sector line A player leaves the circle before the shot has landed or the competitor fails to leave the circle from the back half The player touches the top/end of stop board, the top of the iron ring, or steps or touches on/ outside of the line of the circle
Javelin	Achieving greater velocity Run straight during the approach Hold body weight over the rear leg Keep a straight throwing arm during the pull phase with an upward facing palm Keep elbow along the line of throwing direction Keep the javelin pointing in the direction of the throw	The javelin must be thrown with an over-the-shoulder motion. The competitor can't turn his back to the throwing area until the javelin is airborne
Discus	Spin Phases 1. Grip 2. Stance 3. Wind up 4. Starting the throw 5. Beginning to turn to the centre of the ring 6. Completing the turn to the centre of the ring 7. turn to power position 8. power position 9. Release	During the course of throw, the athletes are prohibited from touching the top of the rim. However, they can touch the inner part of the rim.

Discus Spin



PE

Knowledge Organiser: PE Year 9 Athletics

Jumping Events

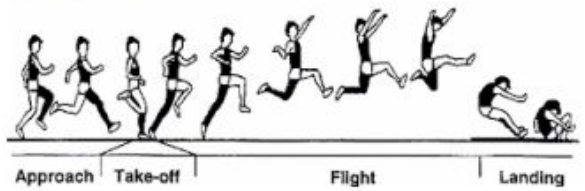
Key Words	Coaching Points	Rules and Tactics
Long jump	Hitch Kick Following take-off, the free leg is straightened and swung back and down as the take-off leg folds up beneath the hips and comes forward bent. The take-off leg then continues forward, straightening for landing. The free leg completes its backward swing behind	Even if the athlete takes off from behind the foul line, the starting point is still considered to be the front edge of the foul line, rather than the athlete's actual point of take off. **Somersaults are not permitted** during the jump.
High jump	**The approach**: Important factors of the approach are acceleration, maximum velocity, and curve running. Athletes run on a curve to lean away from the bar by creating pressure against the ground. The last 2 steps of the approach are the most important. The penultimate step must land flat, and on the imaginary curve line, with the hips and torso moving over this foot as quickly as possible. **Takeoff**: The takeoff action is also known as a push-through-and-pull action. The push-through is the hip moving over the penultimate foot. The pull is the hip of the free leg coming through because of the active negative motion of the takeoff leg. On takeoff the foot should be pointing roughly towards the far corner of the landing area. **Bar rotation**: The Fosbury Flop ends with the athlete landing on their upper back. To clear the bar an athlete will need to arch and then un-arch the body.	In case there is a tie, following two conditions may be applied to decide the winner. The player who has fewer misses at the height at which the tie has occurred, is declared as winner. The player who has fewest misses in the overall tournament is declared as winner.
Triple jump	**The 3 Phases:** **Hop** The main point of the hop is to takeoff and land on the same foot, whilst gaining distance, maintaining horizontal velocity and making sure the body is in a position to complete the next phase. **Step** The main point of the step phase is to land on the other foot to which was used to takeoff from the board and during the hop phase. **Jump** The final phase is the jump where the athlete should still attempt to gain distance, maintain horizontal velocity and prepare the body for the landing. **The Landing** When the athlete lands they need to continue the forward movement by flexing the hips and knees. This will allow the athlete's bum to reach their heels. As this happens the athlete must kick their feet out of the sand, so their bum can land in the footprints, to maintain the distance	Jumpers take off in the "hop" phase and land on the takeoff leg. They take one step onto the other foot (step phase), then jump. Otherwise, triple jump rules are identical to those of the long jump

Effects of exercise

Short term
Rise in muscle temperature
Blood temperature rises
The blood vessels near the skin open to allow heat to be lost

Long term
Muscles get bigger (Hypertrophy)
Increased number of capillaries in muscles
Increased oxygen delivered to and carbon dioxide removed from the body

Long jump Hitch kick



PE

Knowledge Organiser: PE Year 9 Rounders

Skills

Key Words	Description	Tactics /Coaching points
Fielding and positioning	Throwing on the turn	This is an advanced technique, used to prevent rounder's. Technique: Run inside line of ball. Pick up ball alongside right foot. Step onto left foot.. Jump, turning in the air.. Aim at target with left arm. Throw while still in the air
Bowling	Donkey drop	The ball is bowled above the target area, and then drops into it when reaching the batter's box just below head height, making it a legal ball. It forces the batter to hit the ball upwards and therefor making it easier for the fielders to catch the ball.
Batting	Back hand / disguising	The backhand technique is used for tactical reasons to trick the opposition. You start out in a normal batting stance facing bowler and once the bowler releases the ball, you bring the bat across your body and strike the ball using a backhand hit. If executed with accuracy, the ball should be placed between first an the back line where many teams wont have a fielder in position.

Donkey Drop Bowl

Effects of exercise

Short term
Rise in muscle temperature
Blood temperature rises
The blood vessels near the skin open to allow heat to be lost

Long term
Muscles get bigger (Hypertrophy)
Increased number of capillaries in muscles
Increased oxygen delivered to and carbon dioxide removed from the body

Throwing on the Turn

Components of fitness

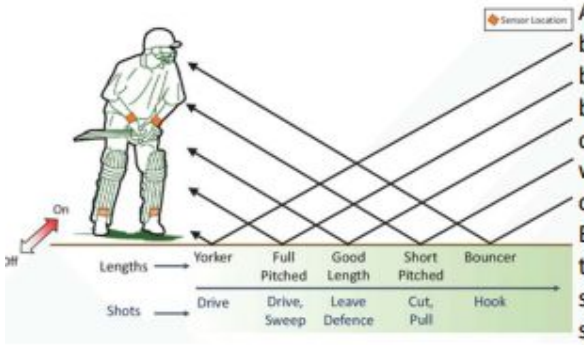
Component of fitness	Definition	Example of use in the game
Body composition	The percentage of body weight which is fat, muscle and bone	Players must be well conditioned in order to perform athletic moves such as jumping
Balance	The ability to maintain the body's centre of mass above the base of support.	To maintain control when batting
Flexibility	Range of movement (ROM) at a joint	To allow greater range of movement when bowling

PE

Year 9 PE: Linking skills together to effectively outwit an opponent through Cricket

Cricket Key Skills and Techniques

Bowling length



A good length or full pitched bowl is the desired length of a bowl. This sees a drive mainly being used but is the most common method for a wicketkeeper to catch a batter out.

Bowlers should aim for the ball to be hitting between the off stump of the batter and "fourth stump" to entice the batter to play a shot.

A bowl bowling "over the wicket" means that the arm that they are bowling with is the one that is closer to the stumps at the bowlers end of the wicket, whilst bowling "around the wicket" is when the bowler's arm is the furthest away from the stumps.

The Hook Shot

This is played when the ball is short of a length and the line is either on the wickets or on the leg side. This technique sees the batter aim the shot between square leg and mid wicket.
The batter swings the bat horizontally in a low to high movement to hit the ball into the air to make it go over fielders or to attempt a six!

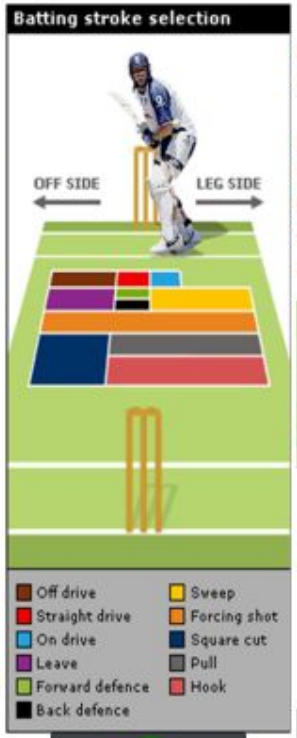
The Cut Shot

This is played when the ball is short of a length and the line is either on the off side outside of fifth stump. This technique sees the batter aim the shot between gully, point and cover.
The batter swings the bat horizontally in a high to low movement to hit the ball into the ground to make it harder to catch for any nearby fielders. This shot is mainly used when a bowl is wide on the off side.

LBW- Leg Before Wicket- this is when the ball hits the batter on the legs and the ball would go on to hit the wickets/stumps if the legs were not in the way. The ball must pitch on the off side and must hit the legs in line with the wickets.

Basic Cricket Rules and Regulations

- For a bowl to be legal the bowler's front foot needs to be on or behind the batting crease line. The ball should be below the waist on the batter if there is no bounce with one bounce being common but a bowl is permitted to bounce twice.
- Batters can only hit the ball once per bowl with their bat however they can be OUT through a range of ways including be caught off the bat or glove, bowled, stumped, ran out and hitting their own stumps.



Batting shot select

Depending on the line and length of the bowl, dictates the shot the batter selects.

The Straight Drive

Performed when the ball is pitched full or a good length seeing the batter step forwards with their front foot into a mini lunge then swing with a vertical bat in the direction of the bowl. The ball should then travel to either mid on or mid off fielding position.

The Cover Drive

The same as the straight drive but with the front foot stepping towards the cover fielding position with the bat following in this position. This shot is played when the bowl is full or a good length but is width of the stumps.

The Pull Shot

This is played when the ball is short of a length and the line is either on the wickets or on the leg side. This technique sees the batter aim the shot between square leg and mid wicket.
The batter swings the bat horizontally in a high to low movement to hit the ball into the ground to make it harder to catch for any nearby fielders.

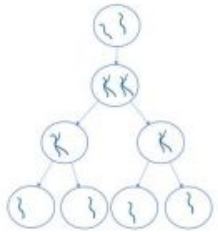
Exit Routes: Aston Manor CC, Walmley CC, Highcroft Cricket Club

Wider reading/ videos: International Cricket Council (icc-cricket.com) The Ashes | Latest News & Reaction | BT Sport The cricket straight drive - Cricket - essential skills and techniques - GCSE Physical Education Revision - OCR - BBC Bitesize

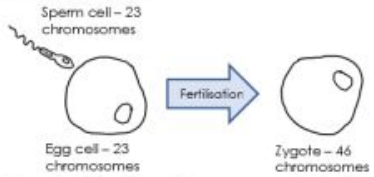
Science

Meiosis

1. Cells in reproductive organs divide by meiosis to form **gametes**
2. Meiosis halves the number of chromosomes in gametes



3. When a cell divides in meiosis: **copies** of the genetic information are made and the cell then divides twice to form **four** gametes, each with a **single set** of chromosomes. This makes the gametes genetically different from each other
4. Gametes join at **fertilisation** to form a **zygote** with the normal number of chromosomes.



5. After fertilisation, the new cell divides by mitosis and the number of cells increases. As the embryo develops, cells differentiate.

Types of reproduction

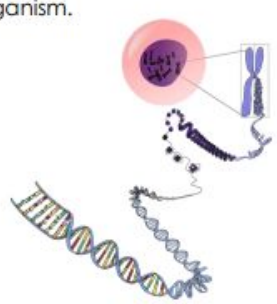
6. Organisms use either sexual or asexual reproduction to reproduce.
7. **Sexual reproduction** involves the joining (fusion) of male and female gametes:
   - **sperm and egg cells** in animals
   - **pollen and egg cells** in flowering plants.

In sexual reproduction there is mixing of genetic information which leads to **variety** in the offspring.

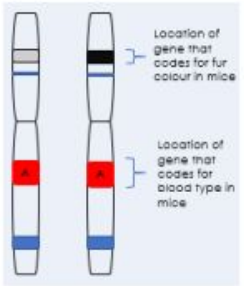
8. **Asexual reproduction** involves only one parent and no fusion of gametes. There is no mixing of genetic information so this leads to genetically identical offspring **(clones).**

DNA, genes and chromosomes

9. DNA is a **polymer.** It is made of two strands which form a **double helix.**
10. The DNA is contained in structures called **chromosomes.**
11. **A gene** is a small section of DNA on a chromosome. Each gene codes for a **particular sequence of amino acids,** to make a specific protein.
12. The **genome** of an organism is the entire genetic material of that organism.

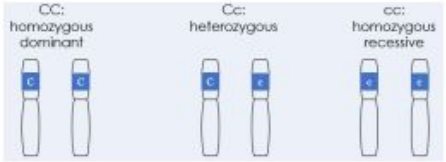


13. Every chromosome is one of a pair so there are two copies of each gene in every genome
14. Different versions of genes are called **alleles.**



Inheritance

15. Some characteristics, for example fur colour in mice or red-green colour blindness, are controlled by one gene
16. The set of particular alleles present is called the **genotype.** The genotype (e.g. brown allele of the fur colour gene) is expressed to make the **phenotype** (e.g. brown fur).
17. A **dominant** allele is always expressed when present even when only one copy is present. A **recessive** allele is only expressed when there are two copies of it (i.e. no dominant allele)
18. If the two alleles present are the same, either both dominant or both recessive, then this is described as **homozygous.** If the one allele is dominant and one is recessive then this is described as **heterozygous**

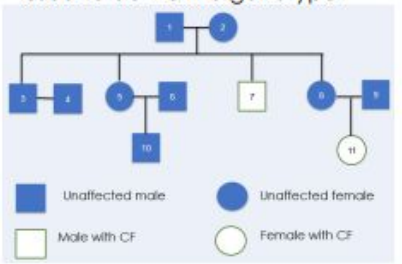


19. Most characteristics are the result of the interaction of many genes
20. **Punnett square** diagrams can be used to predict the genotypes of offspring. Capital letters are used to denote dominant alleles and lower-case letters are used to denote recessive alleles

	C	c
c	Cc	cc
c	Cc	cc

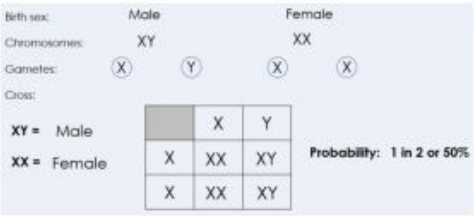
Inherited disorders

21. **Polydactyly** is an inherited disorder where sufferers have extra digits; it is caused by a dominant allele.
22. **Cystic fibrosis** is an inherited disorder where sufferers have lung problems due to a faulty cell membrane protein; it is caused by a recessive allele
23. An individual can be a **carrier** of a recessive disorder, but not of a dominant disorder.
24. **Family trees** show over several generations which individuals had a particular phenotype. This can be used to derive the genotype



Sex determination

25. Ordinary human body cells contain 23 pairs of chromosomes. 22 pairs control characteristics only, but one of the pairs carries the genes that determine sex.
26. In females the sex chromosomes are the same (XX). In males the chromosomes are different (XY).



Reactivity and Using Metals

1. Some metals are more **reactive** than others
2. Some metals **tarnish** because they **react** with **oxygen** in the air
3. The tarnishing of **iron** is called **rusting**
4. Rusting occurs when iron reacts with **oxygen** in the presence of **water**
5. The **reactivity series** is a list of metals in order from most reactive at the top to least reactive at the bottom
6. When a **metal** reacts with an **acid**, a **salt** and **hydrogen** gas are made
7. Bubbles observed in the solution indicate that a gas is being made in the reaction
8. By observing the reactions of metals and acids, it is possible to deduce the order of reactivity of the metals
9. The reactivity series can be used to make predictions about the reactions of metals, such as whether a reaction will take place and how vigorous that reaction will be
10. Most metals are found in **naturally occurring compounds** and have to be extracted from them
11. **Ores** are rocks or minerals which contain enough metal that can be extracted economically
12. Carbon and hydrogen can be used to extract metals from their ores by **displacement reactions**
13. Carbon or hydrogen will displace a less reactive metals from their ores

Treating Water

14. Urban lifestyles and industrial processes produce large amounts of **wastewater** that require treatment before being released into the environment.
15. **Sewage treatment** includes screening and grit removal, sedimentation to produce sewage sludge and effluent, anaerobic digestion of sewage sludge and aerobic biological treatment of effluent.
16. Water that is safe to drink is called **potable water**.
17. Potable water is not pure water because it contains **dissolved solids**.
18. In the UK, rain provides (fresh) water with low levels of dissolved solids that collects in the ground and in lakes and rivers
19. Most potable water is produced by choosing an appropriate source of fresh water, passing the water through a **metal grid** and **filter beds**, and **sterilising** with chlorine, ozone or ultraviolet light.
20. If supplies of fresh water are limited, **desalination** of salty water or sea water may be required.
21. **Desalination** means to remove salt.
22. Desalination can be done by **distillation** or **reverse osmosis**. These processes require large amounts of energy.
23. Osmosis is the movement of **water** from a **dilute solution** (low solute concentration) to a **concentrated** one (high solute concentration) through a **semi-permeable membrane**.
24. This process can be reversed by forcing water molecules through a semi-permeable membrane **against** their **concentration gradient**:

The Earth's Resources

25. The Earth's resources can be divided into two groups: finite and renewable.
26. **Finite resources** from the Earth, oceans and atmosphere are processed to provide energy and materials.
27. Finite resources are ones that are being used up more quickly than they are being made e.g., fossil fuels and uranium.
28. **Sustainable development** is development that meets the needs of current generations without compromising the ability of future generations to meet their own needs.
29. Glass is mainly made from **sand**, which has the chemical name silicon dioxide, SiO_2.
30. Most of the glass we use is **soda-lime glass**, made by heating a mixture of sand, sodium carbonate and limestone.
31. **Borosilicate glass** is made from sand and boron trioxide. This type of glass **melts at higher temperatures** than soda-lime glass.
32. Clay ceramics, including pottery and bricks, are made by **shaping wet clay** and then **heating in a furnace**.
33. Clay ceramics are strong and hard and have high melting points. They are unreactive but brittle.
34. A **composite** is made of two or more materials with different properties.
35. When these materials are combined, they produce a material that has a combination of these properties.
36. Most composites are made of two materials:
    a. a **matrix** which surrounds and binds together fibres or fragments of the other material
    b. a **reinforcement**.
37. **Chipboard** can be used for making furniture.
38. It consists of wood chips and a resin glue.
39. Glass, ceramics and composites are all produced from **limited** raw materials.
40. These materials need to be extracted through mining and quarrying.

Environmental Impact

41. Life Cycle Assessments (LCAs) are used to assess the **environmental impact** of a product.
42. The assessment is broken into the following stages: extracting and processing raw materials, manufacturing and packaging, use and maintenance during its lifetime, disposal at the end of its useful life.
43. Transport and distribution is assessed at each stage.
44. Lots of products can be **reused** or **recycled** to reduce the energy needed to make new products.
45. By reducing, reusing and recycling, people can help the environment by
    a. Reducing the – often finite – **raw materials** that have to be extracted and processed.
    b. Reducing the **energy** needed to turn these raw materials into products.
    c. Reducing **waste**.
46. Almost all plastic is made from crude oil which is a **finite resource**.
47. Plastic can hang around for thousands of years in the environment because it is **non-biodegradable**. If it ends up as litter, it can pollute rivers, lakes and oceans and harm the wildlife that inhabit them.
48. Once a company has completed a **life cycle assessment** for a product, they then need to evaluate what their next steps will be from the information provided.

Science

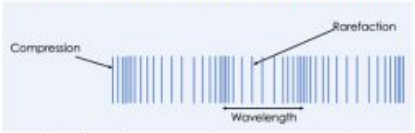
Types of wave

1. Waves transfer **energy**
2. There are two types of wave;

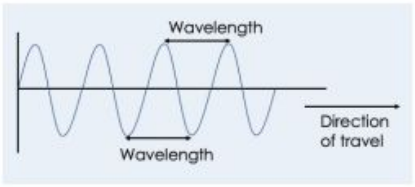
Longitudinal:

And **Transverse**:

3. Longitudinal waves have **oscillations parallel** to the direction of energy transfer



4. Longitudinal waves show areas of **compression** and **rarefaction**
5. A sound wave is an example of a longitudinal wave
6. Transverse waves have **oscillations perpendicular** to the direction of energy transfer
7. A light wave is an example of a transverse wave



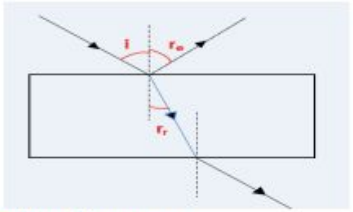
Properties of waves

8. Waves can be **reflected** or **refracted**
9. Reflection is when light bounces back the direction it came from at a boundary between materials
10. Refraction is when light changes speed as it moves from one medium to another, so light bends towards or away from the normal
11. **Frequency –** The number of waves that pass a point each second. The unit is Hertz (Hz)
12. **Period –** The length of time it takes one wave to pass a given point. The unit is seconds (s)
13. **Wavelength** - the distance from one point on one wave to the identical point on the next wave. The unit is metres (m)
14. **Amplitude** - the maximum distance of a point on the wave from its rest position
15. The **peak** is the highest point of the wave and the trough is the lowest point
16. Humans can only hear frequencies between 20 and 20000Hz. Anything above this is called **ultrasound**.

Investigating reflection and refraction

17. The method for investigating reflection and refraction is;

- Use the ruler to draw a straight line near the middle of the A3 paper.
- Use the protractor to draw the normal at right angles to the first line
- Place the first transparent block against the ruler line and draw around it.
- Place the slit (and lens if required) into the ray box and switch on the power.
- Direct the ray of light at an angle at the point where the normal line meets the block.
- You should observe incoming and outgoing rays. Mark these with crosses.
- Switch off the ray box and join up the crosses to make three straight lines. Then label these.
- Measure the angles of incidence, reflection, and refraction with the protractor and record these.



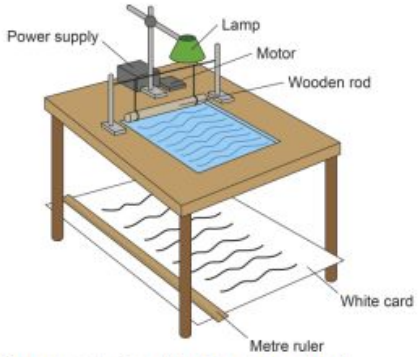
Velocity of waves

18. The velocity of a wave is the **speed** in the **direction** the wave is travelling
19. The equation that links velocity of a wave, displacement of a wave and time is;
    Velocity = displacement/time
20. The equation that links velocity of a wave, frequency and wavelength is:
    Velocity = frequency x wavelength
21. The unit of velocity is metres per second (m/s)
22. The unit of displacement is metres (m)
23. The unit of time is seconds (s)
24. Sound waves can travel through solids, causing vibrations in the solid
25. Sound waves can travel through air
26. People hear sound due to the sound wave vibrating the **ear drum**

Investigating waves

27. To investigate waves we can use a **ripple tank** or a **string** and frequency generator.
28. The method for finding the velocity of a wave in a **ripple tank** is;

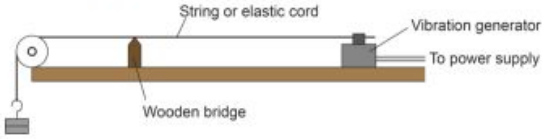
- Set up the equipment as per the diagram.



- Pour approximately 5mm depth of water into the tank.
- Adjust the wave generator so it is contact with the surface of the water (not submerged).
- Switch off the room lights and switch on the lamp and motor.
- Set the motor speed so as to produce low frequency waves.
- Set the lamp height so that the wave pattern is clearly visible.
- Using the ruler, measure the length across as many waves as possible, then divide by the number of waves. Record this as the 'wavelength'.
- Count the number of waves passing a fixed point in a given number of seconds (for instance, twenty seconds). Then divide by the number of seconds. Record this as the 'frequency'.
- Wave speed can be calculated with the equation:
  Wave speed = frequency x wavelength

29. The method for finding the velocity for a **wave on a string** is;

- Set up the equipment as per the diagram.



- Start the vibration generator and adjust the tension of the string, the position of the wooden bridge, and/or the vibration frequency until you see a clear stationary wave.
- Measure across as many half wavelengths as possible, then divide this length by the number of half waves. Double this number and record it as the 'wavelength'.
- Record the frequency of the signal generator as the 'frequency'.
- Repeat the experiment for different frequencies.
- Wave speed can be calculated with the equation:
  Wave speed = frequency x wavelength

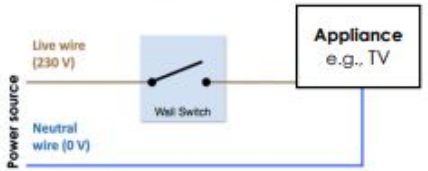
Using waves

30. Waves can be **absorbed**, **reflected** or **transmitted** at the boundary between materials
31. Ultrasound waves are **partially reflected** at the boundary between two materials. The **time taken** to reach a detector can determine **how far away** an object is
32. Ultrasound can be used for **seeing unborn babies**, finding cracks in pipes and finding how far away underwater objects are.
33. **Seismic waves** have helped us understand the **structure** of the **earth**
34. There are two types of seismic waves. **S-waves** and **P-waves**
35. S-waves cannot travel through a liquid. P-waves and S-waves provide evidence for the structure and size of the Earth's core.

Science

Mains Electricity

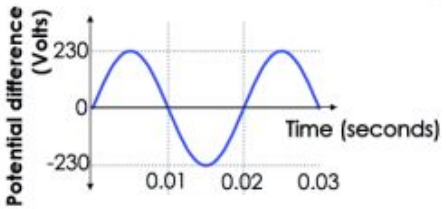
1. Voltage can also be called **potential difference** (p.d.)
2. Potential difference is measured in **Volts** (V) using a **voltmeter**.
3. A simple circuit has two wires - a **live** wire and a **neutral** wire.
4. The live wire (**brown**) goes from the power source to the appliance.
5. The neutral wire (**blue**) goes from the appliance back to the power source to **complete the circuit**.



6. It is important to have a **switch attached to the live wire** so that when an appliance or socket is switched off it is not live.

Direct and Alternating Current

7. **Direct current (d.c.)** travels in one direction only.
8. Cells and batteries supply direct current.
9. **Alternating current (a.c.)** continually reverses direction.
10. A.C. has a potential difference of 230 V and a frequency of 50 Hz.
11. This alternating current can be represented with a wave.



Plugs

12. In the UK, most appliances use a **three-core cable.**
13. The **neutral wire is blue**, the **live wire is brown**, and the **earth wire is green and yellow**.
14. The earth wire is a **safety feature** and is not needed to complete the circuit.
15. **The earth wire connects to the case of the appliance**, so that if a loose wire touches it, the case will not conduct electricity.
16. The earth wire is at a potential difference of 0 V.
17. Plastic is a poor conductor of electricity.
18. If a plus has a **plastic case**, it may not need an earth wire as the electricity cannot travel through the plastic to give you a shock.
19. The live wire is the most dangerous wire, since it has a voltage of 230 V.
20. **The live wire should never touch the earth wire** (unless the insulation is between them, of course!), because this would make a complete circuit from your mains supply to the ground (earth). A shock or fire would be highly likely.
21. Some countries do not have the added safety feature in their plugs of an earth wire (we say they are not earthed), so they have **2-pin plugs** instead of 3.

Power

22. The function of an appliance is to bring about an **energy transfer**.
23. The amount of energy an appliance transfers depends on **how long it is switched on for**, and **the power of the** appliance.
24. **Power is the rate at which energy is transferred or work is done.**

Measured in Watts (W) → Power = Energy / Time ← Measured in Joules (J); Measured in seconds (s)

$$P = \frac{E}{t}$$

25. 1 Watt of power = 1 joule of energy transferred each second.
26.

Energy transferred = Power x Time

$$E = P \times t$$

The Cost of Electricity

27. When we say we are 'using electricity', we are using energy which has been transferred electrically.
28. Electricity meters measure the number of units of electricity (energy) used in a home or other building. **The more units used, the greater the cost.**
29. When calculating the cost of electricity, we calculate energy transferred in kilowatt-hours (kWh).
30. kWh is a unit of **energy transferred**.
31.

Energy transferred = Power x Time

Units (kWh) = power (kW) × time (h)

32.

Total cost = number of units × cost per unit

Units (kWh)

33. We can also calculate power if we know the current flowing through an appliance and the p.d. across it.
34. Measured in Amps (A)

Power = Current x Potential Difference

Measured in Watts (W); Measured in Volts (V)

$$P = I V$$

35. We know that

$$E = P \times t$$

and..

$$P = I V$$

Putting these together we see that..

$$E = I \times V \times t$$

Which can also be written as..

$$E = I t V$$

36. To calculate the energy transferred by an appliance we use the equation:

Energy (Joules) = Power (Watts) x time (seconds)

E (J) = P (W) x t (s)

37. We can also use the equation:

Energy (Joules) = Charge flow (Coulombs) x Potential difference (Volts)

E (J) = Q (C) x V (V)

Energy Resources

38. Fossil fuels are **non-renewable** energy resources.
39. Examples of fossil fuels include **coal**, **oil** and **natural gas**.
40. Fossil fuels can be burned to heat water, which produces **steam**.
41. The steam turns a **turbine**, which powers a **generator** (to generate electricity).
42. **Nuclear energy** is obtained by the splitting up of atomic nuclei.
43. Examples of nuclear fuels are uranium and plutonium.
44. Nuclear energy does not produce carbon dioxide (or sulfur dioxide) in the reaction, meaning that it does not have the same contribution to global warming.
45. The use of nuclear energy is high risk, as accidents can damage the health of anyone in the area for a long time, if radioactive material is released.

46. A **renewable energy resource** is one that is being (or can be) replenished as it is used.
47. Examples of renewable resources are **biofuels**, **wind**, **hydroelectricity**, **geothermal**, **tidal**, **solar power** and **waves**.

Resource	Advantages	Disadvantages
Fossil fuels	• Reliable (can always be used to meet demand) • Release lots of energy	• Non-renewable (will eventually run out) • Release greenhouse gases
Nuclear	• Release lots of energy • Do not release greenhouse gases	• Expensive to store and dispose of material • Accidents are dangerous
Biofuels	• Renewable (new crops can be grown) • Lower emissions	• Large areas of land needed
Wind	• Renewable • No emissions	• Unreliable (not always windy) • Noisy, ugly and expensive
Hydroelectricity	• Reliable (can be used to meet surges in demand) • No emissions • Renewable	• Expensive to build • Can cause damage to local environment
Geothermal	• Renewable • No emissions • Less damage to environment	• Expensive to drill far enough underground
Tidal	• Renewable • Reliable • No emissions • Low running costs	• Expensive to build
Solar	• No emissions • Renewable	• Unreliable (not always sunny) • Expensive to build
Water waves	• No emissions • Reliable (there will always be waves)	• Expensive (large numbers needed) • Can be damaged by storms

The National Grid

48. The **national grid** is a system of **cables**, **pylons** and **transformers** which transfers electrical power from power stations to people's homes.
49. The national grid does not include power stations or peoples' homes, only the things in between that are used to transfer the electrical power
50. **Pylons** hold the cables up.
51. **Step up transformers** increase the potential difference to make electricity cheaper to transfer.
52. **Step down transformers** decrease the potential difference to make the electricity safe to use.

Static Electricity

53. **Everything of made of atoms**, and atoms themselves are made up of protons, neutrons and electrons.
54. Protons are **positively charged** and electrons are **negatively charged**.
55. Opposite charges **attract**.
56. Like charges (charges that are the same) **repel**.
57. Electrons can be transferred between atoms, unlike protons or neutrons.
58. When electrons are lost from an atom or object, the atom or object overall becomes positively charged.
59. A **static charge** is an electric charge that cannot move.
60. Static charge can build up on materials that are poor conductors of electricity (**insulators**).
61. Rubbing a balloon against a jumper or piece of clothing (or hair) for a few seconds **transfers electrons** from the jumper to the balloon.
62. The balloon is then negatively charged, and the jumper positively charged.
63. When the balloon is placed near the wall, the wall is now more positively charged than the balloon, so they attract each other.

Spain and Spanish-speaking countries: Holidays and tourism

Talking about a past holiday

me bañé	I bathed, swam
me bronceé	I got a tan
comí bien	I ate well
conocí la cultura del país	I got to know the culture of the country
probé platos nuevos	I tried new dishes
me senté en la playa/al lado de la piscina/bajo una sombrilla	I sat on the beach/next to the pool/under a sunshade
tomé el sol	I sunbathed
visité los monumentos	I visited monuments
compré recuerdos	I bought souvenirs
me alojé en un hotel	I stayed in a hotel
lo malo fue ...	the bad thing was that...
lo bueno fue que ...	the good thing was that ...

El hotel era (The hotel was)...
- *...estupendo* (great)
- *...un hotel de lujo* (a luxury hotel)

Tenía (It had)...
- *...buenas instalaciones* (good facilities)
- *...vistas al mar* (sea views)
- *...aire acondicionado* (air-conditioning)

Hizo (It was)...
- *...muy buen tiempo* (very good weather)
- *...un tiempo fatal* (terrible weather)

Me gustó (I liked)...
- *...la comida* (the food)
- *...la vida nocturna* (the nightlife)

Las vacaciones fueron... (The holidays were...)
- *...un fracaso total* (a total failure)
- *...fenomenales* (fantastic)

¿Qué tipo de vacaciones te gusta?	En general prefiero las vacaciones activas/de sol y playa porque soy una persona deportista/me encanta tomar el sol ...
¿Qué haces normalmente durante las vacaciones?	Normalmente voy de vacaciones con ... y nos alojamos en ... viajamos en ... hacemos muchas actividades, por ejemplo ...
¿Qué hiciste el verano pasado?	El verano pasado hice muchas cosas distintas. Primero fui ... hice ... visité ... también viajé a ... y lo pasé bien/mal ...
¿Crees que las vacaciones son importantes?	Creo que las vacaciones son esenciales porque ayudan a reducir el estrés y salir de la rutina. Además ...
¿Cómo serían tus vacaciones ideales?	Si tuviera muchísimo dinero, iría a una isla tropical ... viajaríamos en primera clase y nos alojaríamos en un hotel de cinco estrellas.

Types of holiday

el ecoturismo	ecotourism
el crucero	cruise
el turismo de bienestar/ aventura	wellbeing/adventure tourism
el turismo cultural	cultural tourism
el turismo de sol y playa	beach holidays
las vacaciones activas	active holidays
el paquete con todo incluido	all-inclusive package
las vacaciones de invierno/ nieve	winter/snow holidays

Accommodation

el alojamiento (de lujo)	(luxury) accommodation
alojarse	to stay, lodge
un albergue juvenil	youth hostel
un camping	a campsite, camping
una tienda	tent
un hotel (de tres estrellas)	a (three-star) hotel
una pensión	boarding house, B&B
el balcón	balcony
las instalaciones	facilities
la terraza	terrace
la cama	bed
la piscina	swimming pool

Booking a room

Quiero (I want)
Quisiera (I would like)
- *...pensión completa* (full board)
- *...media pensión* (half board)
- *...una habitación doble* (a double room)
- *...una habitación individual* (a single room)
- *...una habitación para dos noches* (a room for two nights)
- *...una habitación con vistas al mar* (a room with a sea view)

Advantages and disadvantages of tourism

Ventajas	Desventajas
Genera muchos empleos.	Está destruyendo la cultura y las tradiciones.
Crea experiencias positivas.	Algunos turistas se comportan mal y no respetan las costumbres regionales.
Tiene un efecto positivo en la economía.	La construcción de hoteles destruye el entorno natural.
Se han construido más carreteras y aeropuertos.	Tiene un efecto negativo en el medio ambiente.
Es una importante fuente de ingresos para el país.	

Spanish

Home and Locality: Transport

¿Cuál es tu medio de transporte preferido?	Prefiero viajar en ... porque en mi opinión es ...
¿Cómo vas al colegio cada día?	Normalmente voy al colegio a pie/en coche/en autobús, pero a veces voy ...
¿Te gusta hacer ciclismo?	Sí, me encanta hacer ciclismo porque es sano y práctico/ No, porque creo que es peligroso hacer ciclismo por las carreteras ... además ...
¿Cómo fuiste al colegio ayer?	Ayer fui al colegio a pie/en coche etc ... el trayecto fue rápido/corto etc. ...
¿Prefieres ir en coche o en autobús?	Prefiero el coche/el autobús porque ofrece muchas ventajas, por ejemplo ...
¿Cómo viajarás de vacaciones el año que viene?	El año que viene iré a España y viajaré en ... sería ...
¿Cómo mejorarías el transporte en tu región?	Primero, reduciría los precios de los billetes de tren, luego mejoraría ...

Useful vocabulary

el abono	season ticket	*el puerto*	port
la aduana	customs	*la gasolina*	petrol
el andén	platform	*el horario*	timetable
el asiento	seat	*el pasajero*	passenger
el atasco	traffic jam	*la parada (de auto-bús)*	(bus) stop
la autopista	motorway	*la estación*	station
el billete de ida/ de ida y vuelta	single/ return ticket	*el retraso*	delay
el conductor	driver	*la sala de espera*	waiting room
el destino	destination	*la tarifa*	fare
el equipaje	luggage		

Useful adjectives

a tiempo	on time	*moderno*	modern
barato	cheap	*puntual*	punctual
caro	expensive	*práctico*	practical
cómodo	comfortable	*rápido*	fast
eficaz	efficient	*retrasado*	delayed
gratuito	free	*ruidoso*	noisy
lento	slow	*tranquilo*	quiet
lleno	full	*vacío*	empty
incómodo	uncomfortable	*viejo*	old
ineficaz	inefficient		

Remember to make your adjectives agree!

Transport

el AVE	Spanish high-speed train
el avión	plane
el barco	boat, ship
la bicicleta	bike
el coche	car
el camión	lorry
el ferry	ferry
RENFE	Spanish rail
el tranvía	tram
el tren	train

Useful verbs

andar/caminar	to walk	*hacer cola*	to queue
aterizar	to land	*ir en bici*	to cycle
bajar	to get off	*llegar (a)*	to arrive
coger	to catch	*llevar*	to carry
conducir	to drive	*pagar*	to pay for
despegar	to take off	*salir (de)*	to leave
estar en huelga	to be on strike	*subir*	to get on
estar retrasado	to be delayed	*viajar*	to travel
esperar	to wait	*volar*	to fly

Quiero (I want) ...	Quisiera (I would like) ...
un billete de ida	a single ticket
un billete de ida y vuelta	a return ticket
reservar un asiento	to reserve a seat
reservar una excursión	to reserve a trip

Word families

Sometimes it can be helpful to remember words in 'families', e.g.

llegar (a) – to arrive /**la llegada** – arrival

salir (de) – to leave /**la salida** – departure

volar – to fly /**el vuelo** – flight

viajar – to travel /**el viaje** – journey/**el viajero** – traveller, passenger

Advantages and disadvantages of public transport

Ventajas	Desventajas
Reduce el número de vehículos en las carreteras.	Es incómodo y sucio.
Es beneficioso para el medio ambiente.	Siempre hay retrasos.
Es más barato que un vehículo privado.	Nunca queda un asiento libre en las horas punta.
Puede transportar a cientos de pasajeros.	El precio de los billetes es demasiado caro.
	Es menos eficaz que el transporte privado

Spanish

Uso internet Uso mi móvil	para	descargar / escuchar música sacar / subir fotos / selfis leer libros ver vídeos en YouTube ver series en Netflix chatear mandar mensajes hacer mis deberes	llamar a mis amigos por videollamada hacer la compra por internet jugar a videojuegos leer y escribir correos electrónicos buscar información usar internet navegar por internet usar mi móvil
Me encanta Me gusta Me mola No me gusta			

Uso internet / mi móvil Descargo / Escucho música Saco / Subo fotos / selfis Leo libros Veo vídeos en YouTube Veo series en Netflix Chateo por internet Mando mensajes Llamo a mis amigos por videollamada Hago la compra por internet Juego a videojuegos Leo y escribo correos electrónicos Hago mis deberes Busco información Navego por internet	raras veces a veces a menudo por la mañana por la tarde el fin de semana todos los días todo el tiempo	pero aunque sin embargo	no nunca	[another activity from column 1]
		y también		

Spanish

Mi aplicación favorita	es	...	porque ya que	es	divertida emocionante informativa sociable
				puedo	hablar con mis amigos mantenerme en contacto mirar las fotos de mis amigos relajarme
Mis aplicaciones favoritas son	son	...		son	divertidas emocionantes informativas sociables
Lo bueno es que				puedo	hablar con mis amigos mantenerme en contacto mirar las fotos de mis amigos relajarme
Una aplicación que no uso es	...	porque		es	aburrida adictiva
				me aburre	