Year 9 Knowledge Organiser
Term 2

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

Painting

Watercolour

A step by step guide:

Watercolour paints can be solid in tins or wet in tubes. In school we have solid tins.
You have to add water to these to create your paint. The more water you use the lighter and thinner the paint will be. The less water the stronger the colour will become.

Techniques:

There are many techniques for using watercolour. You can use these techniques by themselves to create a piece or you can use multiple techniques on the same piece!
Some examples of techniques such as wet on wet and dry brush are below.

Techniques:

You can also use watercolours with other materials for example as a **resist** with oil or wax crayons. **Salt** absorbs the water and creates a sparkly textured effect. You can also use **sponges or clingfilm** to create texture.

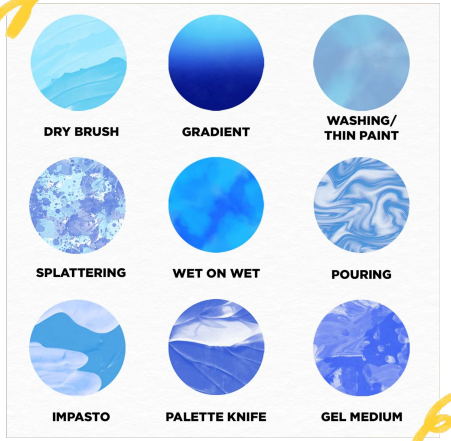
Watercolour Video Tutorials:

Classic techniques Part 1:
https://www.youtube.com/watch?v=338aXj4Bqgs
Classic techniques Part 2:
https://www.youtube.com/watch?v=JbQfyU0BvOc
Experimental techniques:
https://www.youtube.com/watch?v=czbxop_pCl8
Underpainting:
https://www.youtube.com/watch?v=Zy1KcEJ2YkA

Acrylic

Techniques:

There are many techniques for using watercolour. You can use these techniques by themselves to create a piece or you can use multiple techniques on the same piece!
Some examples of techniques such as wet on wet and dry brush are below.



Keywords	
Technique	How you apply your material to your work.
Tone	How light or dark your colour is to create the illusion of 3 dimensional shape.
Composition	The layout of your work.

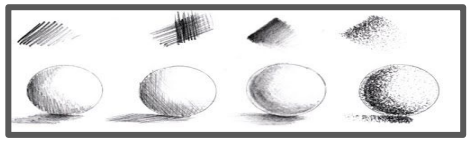
Tutorials:

Basic Techniques:
https://www.youtube.com/watch?v=cDzcoyeaRKI
Underpainting:
https://www.youtube.com/watch?v=jISDMmC7CI4

Printmaking

There are many ways to create a print by transferring ink to paper. Here are two ways!

Mono printing



Hatching
Cross Hatching
Blending
Pointillism

BEFORE YOU GET INK OUT- Get your station READY!

A step by step guide:
Monoprinting:

Wear an apron- Ink is VERY messy!

- Use masking tape to attach a photograph or drawing to your paper. Make sure you have a pen or pencil.
- Roll ink **evenly** onto the table or plastic sheet.
- Blot excess away with scrap paper or newspaper.
- Carefully lay down your work with the blank paper face down.
- QUICKLY draw over the drawing or photograph.

Techniques: Press harder for darker marks and lighter for lighter marks.
Add **marks** to add **texture**: you can use dots, lines, hatching, cross hatching and any marks you can think of!
If your lines are not coming out- your ink has dried. You will need to wash you table and start again.

Relief printing

A step by step guide:
Poly Block printing:

Wear an apron- Ink is VERY messy!

- Draw your outline very lightly in marker pen or felt pen.
- Draw over the line with a sharp pen or pencil to create a groove in the poly block.
- Roll ink over your block (If creating a relief this colour will be your background/ base colour)
- Carefully lay your poly block on your paper.
- Gently rub your palm across the back of your block pushing hard to transfer all the ink.
- To create a new layer wash your poly block (GENTLY!) draw a new layer removing more of the surface and reprint using another colour.

Key Characteristics:

No two prints are ever the same. Depending on how hard you push or how go over a line at a different angle or add a little more or less ink for a colour.

- **NO TWO PRINTS ARE EVER THE SAME!**
- **The grainy quality of the image**
- **Mark Making: Using dots, lines and marks which create texture**
- **Block colours create a graphic style in lino and Poly Block prints.**

Video Tutorials:

How to Monoprint: https://www.youtube.com/watch?v=ql2_7tecOzk
Poly Print- Basic one colour: https://www.youtube.com/watch?v=jEFhzylTgR4
Poly Print- Multiple layers (Relief technique): https://www.youtube.com/watch?v=BESZ8XUpM0Y

Year 9 – Natural Forms

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 Natural Forms. 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, squ[illegible], re[illegible]ngle[illegible] t[illegible]angles.

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!

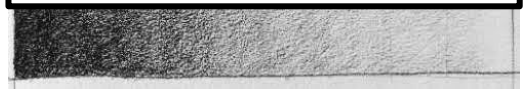
Pencil pressure: The harder you push down the darker your shading will be. Gently press down for lighter shades.

Remember: DRAW IT LIGHT TILL YOU GET IT RIG

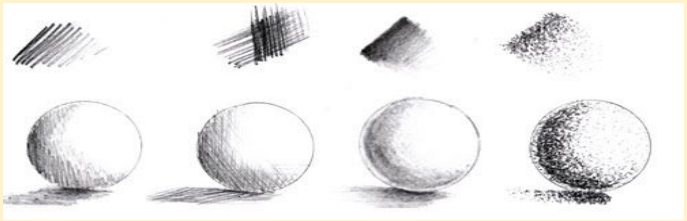
need to add shading to your outline or 2D drawings. You should add a range of tones, areas f highlight (where light is reflected)and shade (darker areas where the light does not reach). To enhance your drawing you should also add shadows if they appear around your objects.

Tonal Ladder

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



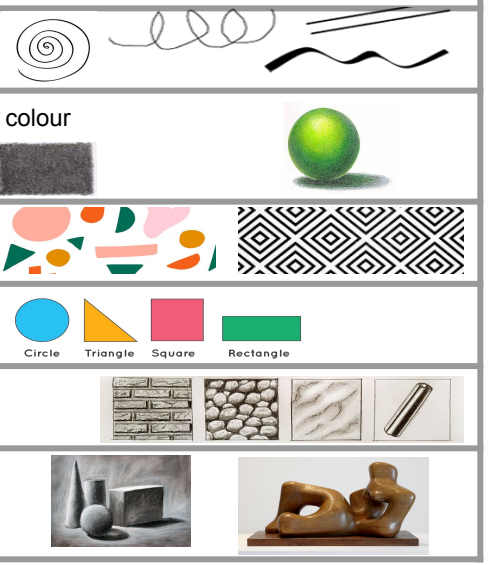
Shading techniques



Hatching | Cross Hatching | Blending | Pointillism

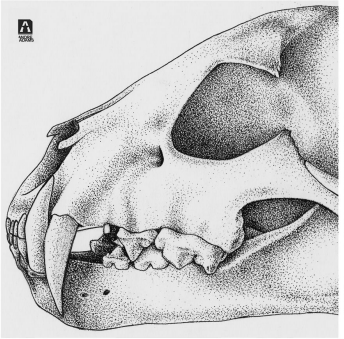
FORMAL ELEMENTS OF ART

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.



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.



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.**

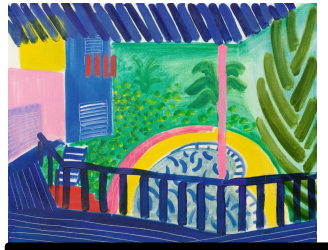
In Art you are rewarded for **REFLECTING** on your work and **RECOGNISING** what has gone well and which areas you need to improve on. This must be **RECORDED** in **ANNOTATIONS.**

ARTISTS

Georgia O'Keeffe

Janet Fish

David Hockney



Lisa Stevens

Bryan Nash Gill

Karl Blossfeldt

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.

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

Key Terms

Algorithm: A set of instructions or code used to solve a problem.
Syntax: The rules of the programming language that need to be followed in order for it to work.
Variables: Data that is stored in memory that is likely to change.
Program: Code compiled together to perform a specific function.

Inputs

To allow your Python program to get information from the user you will need to use the **input** command. Make sure you use the correct command for what you are asking for.
String inputs (such as a name)
input("Enter your name")
Integer Inputs (for whole number responses):
int(input("What is your age?"))
Float Inputs (for decimal number responses):
float(input("What is your shoe size?"))
To use these examples you need a variable at the start!

Outputs

To **print** out a statement or a **variable** we use the code below:
Printing a new message:
print("Hello World");
Printing the value of a variable:
print(x);
Printing a message with variables included:
print("Hello",name,"you are",age,"years old")

Data Types

String: A Variable data type that can store a combination of letters, characters and numbers.
Integer: A Variable data type that can store whole numbers.
Float: A Variable data type that can store decimal numbers.
Boolean: A Variable data type that stores either TRUE or FALSE

Iteration

Iteration is used to repeat a set of instructions or commands in a program. It saves having to write them all out over and over again.
There are two loops in Python programming:
While - Checks if a condition is true and while it is true will keep repeating it.
For - Runs for a specific amount of times and stops when it reaches the desired number.
Examples:
while answer != "London":
answer = input("What is the capital of London?");
Or
for i in range(5):
movie = input("What is one of your top 5 favourite movies?")

Selection

Selection is used to allow the program to make a choice and take a different path. The keywords used in Python are:
if - checks if the **condition** is true, if so the program runs the indented code below it.
elif - if the first if fails then this elif condition is checked, there can be multiple of these.
else - if all if and elif statements are not true then the code indented below else will run.

Example:
colour = input("Enter your favourite colour");
if colour == "Red":
print("Reminds me of tomatoes");
elif colour == "Blue":
print("Reminds me of the sea!");
else:
print("If it isn't Red or Blue then it doesn't matter!")

Variables

Variables are simply a place on the computer's memory that is given a name in order for it to remember it.
In Python you create a variable by writing the name of the variable followed by an =.
Examples:
name = "Spongebob"
age = 14

Design and Technology

Materials and their Properties: Papers & Boards

BOARDS

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

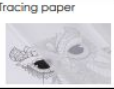
TYPES:

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.

PAPERS

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

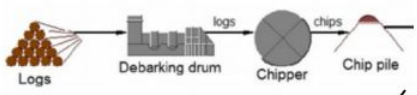
TYPES:

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.

SOURCE/ORIGIN

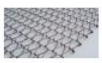
Paper and boards come from finely shredded wood but has been prepared in a special way to make what you know as paper and boards. This is how they are made:

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:

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:

- 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.

- 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.

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 3 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.

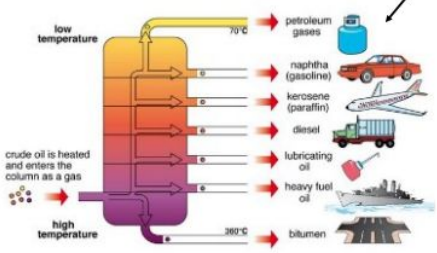
SOURCE/ORIGIN

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.

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.

26 Fe Iron 55.845

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.

26 Fe Iron 55.845

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.

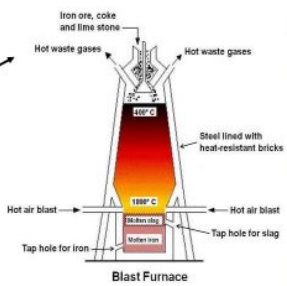
Source/Origin

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

Blood Brothers

Context

***Blood Brothers* was written by Willy Russell and was first staged in 1983.**
William Russel (born 23rd August 1947) is an English dramatist, lyricist and composer. His most popular works include *Educating Rita*, *Shirley Valentine* and *Blood Brothers*. Russell is from Liverpool and wrote his first play *Keep Your Eyes Down* in 1971.
Margaret Thatcher was a Conservative politician who was elected Prime Minster of the United Kingdom in 1979, four years before Blood Brothers was first performed. Seeing British manufacturing as uncompetitive, she blamed trade unions as being too strong in calling strikes on weakened employers. So, she reduced union's powers and sold off and closed uncompetitive companies.
Much of Russell's work is influenced by his own working-class background. He was a child in a low-income family, with a father that struggled with drug addiction. His father worked in a factory and his mother was a nurse. At the age of 15, Russell left school, with no academic qualifications, and he became a hairdresser. He did not return to education until age 20. Russell's love of music is evident in most of his plays.
A short-term effect of companies being closed and sold was that there was an economic downturn across the UK. Unemployment soared. This particularly effected more industrialised northern areas of the country. Liverpool was a prime example of this. Liverpool's docks, a major source of employment in the city, were allowed to fold, causing thousands of households to fall to poverty and unemployment. Crime levels increased, drug use sky-rocketed, and housing deteriorated in poorer areas.
Marilyn Monroe was an extremely famous Hollywood actress, whose fame went beyond her Hollywood films. She was presented in the media as a 'fantasy' woman who lived a perfect life. Her reality was very different. Monroe became addicted to antidepressants and died of an overdose. She remains a symbol of beauty and confidence.
One of the pivotal beliefs in Thatcher's system was that success and wealth came to those who chose to work hard. In Blood Brothers, Russel demonstrates opposition to that view, suggesting that opportunities are more limited to those that are raised in working class backgrounds, when compared to those from the middle classes. This divided society is demonstrated through showing the effect of different upbringings on a set of twins.

Dramatic Devices

Dramatic Irony	The audience is aware throughout the play that Mickey and Edward are twins, but the characters do not know this until the very last scene.
Dramatic Tension	The events leading up to the final scene, including Edward and Linda's affair, and
Stage Directions	The precise directions detailing how Mickey 'uncontrollable with rage', 'waves'
The Fourth Wall	The Narrator and Mrs Johnstone break the fourth wall when they speak to the audience directly at the beginning and end of the play.

Characters

Mickey	Biological twin of Mrs Johnstone, the twin that Mrs Johnstone chooses to keep, has a harsh working-class upbringing, honest and sincere, gets his girlfriend – Linda – pregnant, gets laid off from his industrial job, becomes cynical after his time in prison, becomes addicted to anti-depressants
Edward	Biological twin of Mickey, the twin Mrs Johnstone gives to Mrs Lyons to raise as her own, honest and sincere, luxury upbringing, benefits from every advantage in life, attends private school and university, uses his position as councilman to help
The Narrator	All-knowing and slightly menacing, takes on multiple roles in the play, sometimes stands back and comments on the action as it unfolds, reminds the audience of the tragic events that are to come
Linda	Begins the play as a tomboy and enjoys playing with Mickey and Edward, soon becomes the object of their desire, seems solely attracted to Mickey at the start and tells him she loves him before their first kiss, at the end of the play she turns to Edward for comfort and the two begin an affair
Mrs Johnstone	Biological mother of Mickey and Edward (as well as several other children), deeply superstitious, struggles to get by but has a good heart, strong sense of right and wrong, gives up one of her twins as she believes she has no choice after her husband has left, as the play progresses she is overcome by regret but always remains kind and loving
Mrs Lyons	Opposite of Mrs Johnstone, arrogant, snobbish, can't have children, adopts Edward and brings him up as a wealthy, middle-class boy, racked with guilt from separating the twins, creates a superstition to keep Mrs Johnstone away, eventually becomes so unhinged and paranoid that she will lost her son that she attempts to kill Mrs Johnstone

Blood Brothers

Scene-by-scene Summary

Act 1	The play moves forward in time and we meet Mickey at the age of seven. He looks up to his older brother, Sammy, and plays games on the street with his neighbours, involving pretend guns. Mrs Johnstone tells Mickey he is not allowed to play near the big houses nearby. While he is sulking, Edward arrives outside the Johnstones' home and the boys start talking. They quickly become friends and find that they share the same birthday. Unaware that they are really related, Mickey and Edward decide to become blood brothers.
	When Mickey and Edward try to play together, both of their mothers realise who the other boy is and order them not to play together. However, when Mickey and his friend Linda go to Edward's house, he sneaks out to play with them. They get caught throwing stones at windows by a police officer and he takes the children home. The police officer warns Mrs Johnstone that if any of her children (who are often naughty) get into more trouble then she could be taken to court. However when he takes Edward home, he tells Mr and Mrs Lyons that it was just a childish prank.
Act 2	Act Two opens seven years later, when the twins are around 14 years old and in secondary school. The Johnstone family are much happier, although Sammy gets into trouble a lot, first at school and then with the police. Mickey and Linda are still friends and actually love each other, but Mickey is too shy to act on his feelings. After being rude to a teacher at his secondary modern school, Mickey is suspended. At the same time, Edward gets suspended from his boarding school for refusing to remove Mrs Johnstone's locket. Mickey and Edward meet and quickly return to their close friendship. This time, Mrs Johnstone is happy for them to be friends.
	Mickey, Edward and Linda spend their teenage years as best friends. Mickey leaves school and starts work at a factory, making cardboard boxes. Upset about leaving his best friends, Edward tells Mickey and Linda that he is going to university the night before he leaves. Even though he is secretly in love with Linda himself, Edward tells Mickey to ask Linda to be his girlfriend, showing how much he cares about his blood brother.
	Mickey and Linda get married after Linda falls pregnant. Immediately afterwards, like many others, Mickey loses his job (in the song Take a Letter, Miss Jones, sung by Mr Lyons) at the factory as a sign of the times. Edward comes back from university and tries to have fun with Mickey but Mickey is angry and frustrated at being unemployed and Edward can't understand why. Edward sees Linda and tells her he loves her, not knowing that she is married to Mickey and going to have his child.
	Mickey is desperate to support his family and Sammy persuades him to be a lookout while he robs a garage. Sammy shoots someone and they are both arrested. Mickey is jailed for seven years. While in prison, Mickey becomes depressed and is given pills to help with this. After being released two years early for good behaviour, Mickey continues to take anti-depressants, upsetting Linda because she thinks they stop him being himself. Edward is now known as Councillor Lyons and Linda turns to him for help, he gets Mickey and Linda a council house and finds Mickey a job, all without Linda telling Mickey.
	Linda and Edward start a light romance, which Mrs Lyons (who has gone mad with bitterness) reveals to Mickey, pointing them out to him. Furious at the betrayal of his best friend and wife, Mickey gets Sammy's gun from its hiding place and goes to the council chambers to confront Edward. Mrs Johnstone follows Mickey and tells him that he and Edward are really twins. Mickey tells his mother that he wishes she had given him away instead of Edward. He waves the gun around in anger, pointing it at Edward as he shouts, I could have been him! The gun goes off and kills Edward. The police open fire and kill Mickey.
	The play ends with the bodies of the twins on stage and the Narrator asking if superstition is to blame for their deaths or if it is really the class system.

Themes

Class and Money	The themes of class and money are dominant as they both control the actions of the characters and significantly impact on their lives. E.g. Mrs Johnstone giving one of the twins away comes about because she cannot afford to keep them both. Class then heavily influences the paths that the twins then follow.
Coming of Age	Although much of the play focuses on dark and complex ideas, one of the lighter themes within the play is the theme of the boys 'coming of age'. Although the play ends tragically, much of
Fate and Superstition	The voice of fate is provided over and over again throughout the play by the Narrator, who reveals at the outset of the play that the twins will die. Mrs Lyons plays on Mrs Johnstone's belief
Nature vs Nurture	As Mickey and Edward are twins, they are genetically as similar as can be. Therefore, Russell is suggesting that is, in fact, nurture that causes their contrasting behaviours, actions and

English

‘Checking Out Me History’ by John Agard

Agard explores the effects of colonial oppression on subjugated people who are forced to learn about the history and identity of their colonial masters rather than their own.

Message:

Agard attacks the cultural genocide brought on subjugated people by colonisers and demonstrates the power of learning about your own history, culture and identity.

Themes:

- The effect of colonial oppression on history and identity

Form + Quotations:

- Dramatic monologue with irregular stanza lengths. Indented, lengthier stanzas are used when talked about African and Caribbean historical and cultural heroes
- “Dem tell me / Wha dem want to tell me”
- “Bandage up me eye with me own history / Blind me to me own identity”
- “1066 and all dat” / “Dick Whittington and he cat” / “de cow who jump over de moon” / “Lord Nelson and Waterloo” / “ole King Cole was a merry ole soul”
- “Toussaint a slave with vision” / “Toussaint de beacon” / “Nanny see-far woman” / “Mary Seacole… a healing star among the wounded a yellow sunrise to the dying”
- “But now I checking out me own history / I carving out me identity.”

‘Kamikaze’ by Beatrice Garland

‘Kamikaze’ explores the experience of war from a daughter’s perspective. It reveals how society’s understanding of patriotism and honour can affect familial relationships.

Message:

Garland suggests the conflict between love and honour, personal desire and patriotic duty, can lead to greater isolation and feelings of shame and resentment.

Themes:

- Patriotism, honour, shame

Form + Quotations:

- Narrative divided into sestets featuring lots of enjambment
- “Her father embarked at sunrise” / “a shaven head / full of powerful incantations”
- “A green-blue translucent sea” / “dark shoals of fishes” / “built cairns of pearl-grey pebbles” (imagery and symbolism of nature and memory)
- “my mother never spoke again / in his presence” / “neighbours… treated him / as though he no longer existed”
- “To live as though / he had never returned” / “this was no longer the father we loved”
- “He must have wondered / which had been the better way to die.”

‘Exposure’ by Wilfred Owen

Wilfred Owen's poem focuses on the misery felt by World War One soldiers waiting overnight in the trenches. Although nothing is happening and there is no fighting, there is still danger because they are exposed to the extreme cold and their wait through the night is terrifying.

Message:

Owen wanted to expose the monotony and futility of war.

Themes:

- The monotony and futility of war

Form + Quotations:

- Dramatic monologue
- “But nothing happens” (refrain)
- “Merciless iced east winds that knive us” / “Dawn massing in the east her melancholy army” (personification)
- “Slowly our ghosts drag home” (metaphor)

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

Types of fish and shellfish
There are over 33,000 fish species in the world, but people often prefer to eat a few species that are easier to catch and eat.

The 'big five' are the most common seafood items that are eaten in the UK. They are:

- cod;
- haddock;
- tuna;
- salmon
- prawns.

Recommendations
Fish is part of the Beans, pulses, fish, eggs, meat and other proteins food group in the Eatwell Guide.

Around one-sixth of the food that people consume should come from this group in the diet.
It is recommended to consume two portions (one portion is 140g) of sustainably sourced fish per week.

Nutrients provided by fish
Fish provides a range of nutrients, including:

- Omega-3 fats (in some fish);
- protein;
- vitamin D (in some fish);
- B vitamins;
- iodine.

Oily fish
The UK Eatwell Guide states that one of the recommended two portions of fish a week should be oily.

Salmon and **trout** are classified as 'oily fish', which means they contain a type of healthy fat called Omega-3. Omega-3 is important for brain development and heart health.

Mackerel, herring and **sardines** are types of small oily fish that are mostly sold in cans. Kippers are herring that have been filleted, salted and smoked. The skin and bones of whole sardines are soft and edible and can provide extra calcium.

White fish
Cod and **haddock** are the most popular fish in the UK. They are flaky, white fish when cooked. Most of the cod and haddock eaten in the UK is breaded or battered.
Plaice, sole, halibut and **turbot** are all types of flatfish that are classed as white fish.

Tuna
Fresh tuna used to be classed as an oily fish but new research shows that there are not enough healthy Omega-3 fatty acids in tuna for it to be called oily.

Shellfish
Shrimp and prawns are a wide group of small shellfish. The words 'shrimp' and 'prawn' are used to describe many different species.

Mussels and oysters are 'bivalve molluscs'. Bivalve means that they have two shells that close around the soft body inside. Cockles, whelks and winkles are small shellfish that are common around the UK.

Squid and octopus
Squid and octopus are not fish but cephalopods, along with cuttlefish and some other species. Squid is often called 'calamari' when it is used in dishes.

To find out more, go to: https://bit.ly/3DHagr9

Catching fish at sea (trawling)
Most fishers go out to sea in boats and use nets to catch a large number of fish at one time.
When the boat is in the right position, the fishers drop their nets. Once dropped, the boat then tows the net around, scooping up fish. This is known as trawling.

Catching fish at sea (trolling)
Some fish are caught on lines, rather than nets.
Some other fish, like mackerel, can also be caught on lines by a method called 'trolling'.
Trolling is similar to trawling, but instead of dragging a net, the boat drags many lines with hooks to catch the fish.

Preparing fish
Whole fish usually require preparation before they can be eaten.
This could include: descaling, gutting, filleting and pin boning.

To **descale** a fish, the knife should be run along the scales of the fish, in the opposite direction to the scales.
Gutting removes the entrails of the fish.
Filleting results in portions of fish that are separated from the head, tail and major bones.
Pin boning removes the remaining small bones.

Marine Stewardship Council
The MSC logo means that this fish has been caught in a way that is more sustainable.

Logo© Marine Stewardship Council

Cooking with fish
Fish can be cooked in a variety of ways, such as being grilled, baked, sautéed, fried or barbequed.

Grilling and baking are usually healthier cooking methods and they can also help to bring out the flavour of many fish.
Some fish can be eaten raw (e.g. sushi).

Growing mussels
Mussels can be grown on ropes, so they can be easily collected in large numbers. 'Seed' mussels stick to the rope and grow in place before harvesting.

Key terms
Oily fish: A fish that contain a type of healthy fat called Omega-3.
Omega-3: A type of polyunsaturated fatty acid found in fish.
Shellfish: An aquatic shelled mollusc or crustacean that is edible.
MSC: Marine Stewardship Council logo, a logo that means fish has been caught sustainably.

Wild fishing

Advantages
- Wild fish have a more varied diet than farmed fish and therefore may taste different.

Disadvantages
- Can be less sustainable due to overfishing and may become more expensive.
- Nets can damage the seabed.

Farming fish

Advantages
- Prevents wild fish from being overfished.
- Can provide fish to communities where wild fish is scarce.
- Can allow for fish farmed that are hard to catch.

Disadvantages
- Disease can be more common if many fish are kept close together.
- Farmed fish may harm wild fish if they escape.
- If waste from the fish farm is not disposed of correctly it can cause pollution.

Preparing shellfish safely
Many shellfish are filter feeders. This means that they can gather up bacteria and viruses from their environment.
The best way to avoid illness is to make sure that shellfish are properly cooked.
When cooked in the shell, mussels, clams and oysters will open.
Raw shrimp and prawns will turn pink and firm up when properly cooked.

Task
Create an infographic that highlights all the reasons we should eat fish.
Include the recommendations, the nutrients in fish and how we can cook them in healthier ways.

Geography

A) what are the four spheres?

- The lithosphere is the outer rocky layer of the earth including rocks, soils and sand.
- The biosphere is all living matter on earth including plant and animal life.
- The hydrosphere is the water on the earth's surface including the oceans, rivers and lakes.
- The atmosphere is the thin layer of gases that surrounds the earth (you call it the sky).

B) The UK's weather and climate (atmosphere)

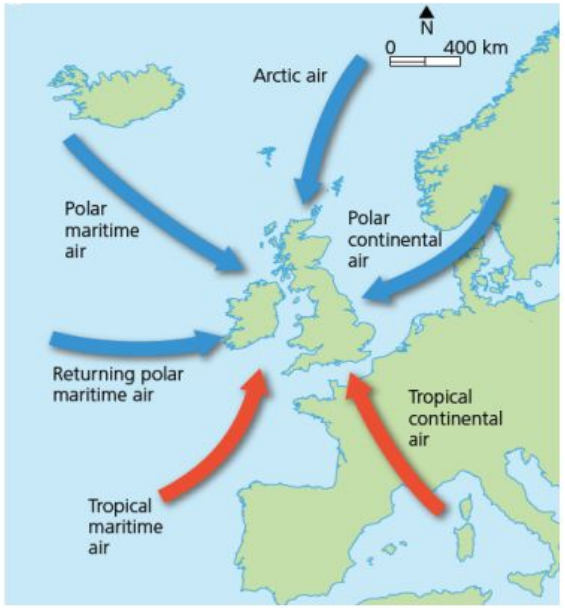
- Weather is the day-to-day conditions that we experience (sun, wind, rain, snow).
- Climate is the long-term average conditions. It is what you would normally expect.

C) The UK has a temperate climate. What is this like?

- A temperate climate means that we rarely have extremes of heat or cold
- Winters are colder and summers are warmer but never really freezing or really boiling hot, instead we have mild weather.
- The weather is changeable

D) How do air masses affect the UK's climate?

- Air masses are bodies of moving air that blow to the UK from other places
- The north of the UK is affected by air masses from colder poler regions. This makes the north of the UK colder than the south.
- The south of the UK is affected by air masses from the warmer tropical regions. This makes the southern part of the UK warmer.
- The west of the UK is affected by air masses that blow over the ocean. This makes the west side of the UK wetter than the east.
- The east side of the UK is affected by air masses that blow over the land. This makes the east side dryer than the west.



E) What is air pressure?

Air pressure is the weight of the air on the earth's surface. It is important because the way that the air moves can cause rainfall.

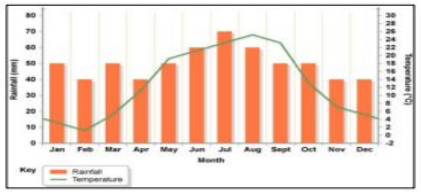
1. Rising air away from the earth's surface = low pressure
2. Sinking air pressing down on the earth's surface = high pressure

F) Why does it rain?

1. Warm air can hold water vapour (water in its gas state)
2. Warm air rises into the atmosphere carrying with it water vapour
3. As the air rises is cools down
4. When the air cools down the water vapour condenses (water turns from a gas to a liquid)
5. The condensed water now forms small rain droplets high in the atmosphere
6. These gather together around dust particles to form clouds
7. When the clouds become heavy enough it rains

G) What is a climate graph?

A climate graph is a graph that shows average rainfall and temperature throughout the year. Bars always show rainfall amounts and the line always shows temperature.



Geography

H) Math in Geography

Averages are useful in geography because an average gives us one number that can tell us a lot about a set of numbers, averages help us to see patterns. There are different types of average

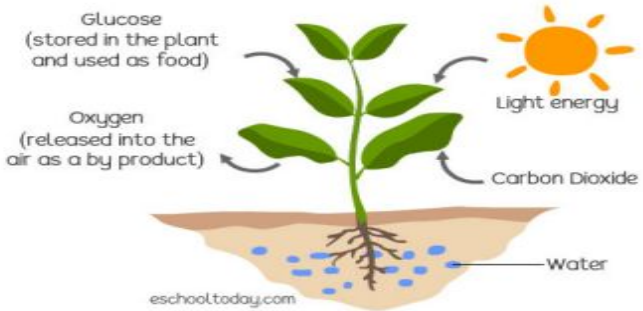
1. The mean can be calculated by adding up all the numbers and dividing by the total number of values
2. The median can be found by putting the numbers in order from smallest to highest and finding the middle number
3. The range can be found by taking the smallest number away from the largest

I) What is a biome?

- A biome is a very large area covering countries and continents with a distinct climate. This means the climate (temperature and rainfall) is unique to that place.
- A desert and a tropical rainforest are examples. You know that deserts are hot and dry and this is what makes a desert a desert.
- The distinct and unique climate affects the types of vegetation (plants and trees) that can grow there.
- The UK is in a **temperate deciduous** biome
- **Temperate** means we have a mild climate that isn't extreme
- **Deciduous** means that our main vegetation (trees) lose their leaves in autumn. The leaves fall off the trees.

J) Why are producers and decomposers important?

- Vegetation absorbs light energy from the sun, it then converts this light energy to chemical energy (glucose). This type of energy can be passed on to the herbivores (the animals that eat vegetation).
- Decomposers also play an important role. They are responsible for breaking down dead matter in the ecosystem. Leaves on the forest floor will be decomposed and their nutrients will return to the soil. Once in the soil the nutrients can then be recycled by the trees as they can be absorbed. This is called the nutrient cycle.



E) How is soil made and why is it important?

- Soil is a thin layer on the earth's surface and is one of our most important resources
- It is made when rocks are broken down by weathering (by the rain, wind, ice and roots of plants) into much smaller pieces
- When plants and leaves die they are broken down by decomposers to form a layer of humus on top of the soil
- Worms helps to mix this humus (layer of dead leaves) into the soil
- The broken up rock and dead matter provide the soil with nutrients
- Nutrients make soil fertile. Meaning it can support new life.
- Without soil vegetation would not be able to grow

History

Year 9 Interwar years and WW2 1918 - 1945.

Events that ended WW1

The Russian revolution - In 1917, the people of Russia rebelled against their leader killing the whole Royal Family, meaning the biggest ally Britain had withdrew from the war.

Sinking of the Lusitania - In May 1915, German U boats sank an American passenger ship, the Americans joined the war on the side of the allies in 1917.

German home front - Ordinary German citizens had reached breaking point and British battleships had blockaded Germany meaning food and vital supplies couldn't get through leading to 500,000 people dying of starvation. There were riots all over Germany, particularly due to the rationing of bread.

Rise of Hitler

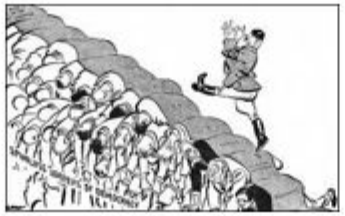
Germany in the 1920s - Germany was very unstable and the economy was in ruins with millions unemployed. The Kaiser had abdicated and been replaced with democracy. However, the new government was very weak and could not control the country. Lots of fighting between armed groups and Democracy was not working. A small party led by Adolf Hitler started to become popular and they blamed foreigners, communists, Jews and other groups for Germany's problems and promised to fix things.

Germany in the 1930s (countdown to war) The Nazi party took charge in 1933 and began to take control by "tearing up" the T.O.V by rearming and rebuilding the military. They had a plan to build a new German empire, but needed space to do this from other countries. Finally, they would unify all German people into one country.

Sudetenland Crisis September 1938. -Hitler wanted to take over the border around Czechoslovakia because 3 million Germans lived there. -France wanted war, but Britain not ready. Instead, British PM (Chamberlain) gave Hitler what he wanted in the hope that Hitler would stop. This was called (appeasement).

Invasion of Czechoslovakia -Hitler now thought the League of Nations + Britain and France were weak and would not stop him. -I He invades the rest of Czechoslovakia. And the Allies realise that only a war would stop Hitler from conquering other countries.

Nazi-Soviet pact August 1939 -Both USSR (Russia) and Nazi Germany hated each other but, also do not like western powers (Britain, France etc) -They made a deal not to fight each other. Also, make a secret deal to invade and split up Poland.



Invasion of Poland September 1939 1st Sept, Germany invades Poland. 3rd Sept Britain and France declare war on Germany. WW2 had now begun.

Treaty of Versailles

The Treaty of Versailles (T.O.V) – At the end of WW1 the allies imposed a harsh peace treaty on Germany which included that Germany must pay for war damages (reparations), take the blame for causing the war, give up parts of their country to other nations (13%) and limit their army to only 100,000 men. Germany were also left vulnerable as they had NO AIRFORCE, the Navy could only have six battleships and no submarines.

Causes of WW2

Lots different factors could be blamed for starting the war.

Failure of the League of Nations

Its organisation made the League weak. Its lack of army meant it couldn't force nations to do anything. Membership - countries could leave, the USA never joined and USSR and Germany were not allowed to join at first. Countries like Japan and Italy kept attacking other countries, and the League could do little to stop them.

Hitler was to blame

Hitler promised to overturn the T.O.V and take Lebensraum (living space). This was the basis of his foreign policy and meant he would have to invade countries. This could start a war.

Appeasement

Appeasement aimed to stop another war and is linked with British PM Chamberlain. Many believe he made a mistake by trusting Hitler. He thought that by giving Hitler what he wanted it would stop a World War. Instead, it just made Hitler demand more.

Nazi-Soviet pact

-This agreement meant Germany wouldn't have to fight Russia.

-This made Germany feel brave enough to take on Britain and France.

-Allowed the invasion of Poland to happen. Direct cause of war!

-Big mistake for USSR as Germany would later betray them and attack anyway.

Key events 1918-1945

1919- Treaty of Versailles
1924-Hitler writes 'Mein Kampf'
1933- Hitler takes control of Germany.
1936 (March)-German troops enter the Rhineland
1936 (Nov) - Germany becomes allies with Italy + Japan.
1938 (Mar) – German Anschluss with Austria.
1938 (Sept) - German army occupies Sudetenland.
1939 (Mar) – German army invades Czechoslovakia.
1939 (Aug) – Nazi-Soviet Pact agreed.
1939 (Sept 1st) – Poland invaded.
1939 (Sept 3rd) – Britain and France declare war. WW2 begins.
1940 (May) - Evacuation from Dunkirk
1940 (June) - France surrenders.
1940 (Aug) – Battle of Britain
1941 (June) - Germany attacks USSR.
1941 (Dec)- German army stopped outside Moscow
1941 (Dec) - Japan attacks Pearl Harbour.
1942 (June) – Battle of Midway
1942 (Aug) – Battle of Stalingrad
1942 (Oct)-Battle of El Alamein
1943 (July) – Battle of Kursk
1943 (July) – Allies invade Sicily
1944 (June 6th) – D-day
1945 (June 7th) - Germany surrenders, war in Europe ends 8th May.
1945- Japan announces surrender on 15th Aug after being hit by two nuclear bombs.

History

Keywords

Appeasement- Giving someone what they want to make them stop doing something.
Nazi-Soviet Pact- Agreement between USSR + Nazis not to fight.
Blitzkrieg- German tactic of using tanks + planes together to attack very quickly.
Atomic bomb – Nuclear weapon capable of destroying whole cities.
USSR- collection of countries led by Russia, also called Soviet Union.
Treaty of Versailles – Peace treaty that ended WW1.
Anschluss-Nazi plan to unify Austria + Germany into one country.
Lebensraum- 'Living Space' room for German people to build empire.
Nazi Party- Political party led by Adolf Hitler.
League of Nations- First try at creating a U.N, was supposed to keep the peace and stop wars.
Mein Kampf- Hitler's book, means my struggle. Outlines his plans.
Anti-Semitism – anti-Jewish, strong hatred of Jewish people
Holocaust - The mass murder of Jews under the German Nazi regime during the period 1941–5. More than 6 million European Jews, as well as members of other persecuted groups, were murdered at concentration camps such as Auschwitz.

Key people

Adolf Hitler- Leader of the Nazi party and leader of Germany.
Mussolini- Leader of Italy, good friends with Hitler.
Emperor Hirohito- Emperor of Japan, made Japan agree to surrender at end of war.
Winston Churchill -Leader of Britain after Chamberlin resigned.
Neville Chamberlain -Leader of Britain at start of war. Responsible for policy of appeasement.
Franklin Roosevelt President of the USA.
Joseph Stalin Leader of the USSR

Holocaust

Hitler's Persecution of the Jews:

- 1st April 1933: Hitler's first action directly against the Jews was a Boycott of all Jewish businesses
- April 11, 1933 - Nazis issue a decree defining a non-Aryan as "anyone descended from non-Aryan, especially Jewish, parents or grandparents."
- May 10, 1933 - Burning of books in Berlin and throughout Germany.
- Summer 1935 Placards saying Jews not wanted displayed in resorts, public buildings, restaurants and cafes. (these were removed during the 1936 Olympic Games).
- A massive, coordinated attack on Jews throughout the German Reich on the night of November 9, 1938 into the next day, has is known as Kristallnacht or The Night of Broken Glass

The Road to the Holocaust World War Two.

The Nazis invaded Eastern Europe and used the Einsatzgruppen who were special mobile killing squads created in 1939. In 1941 the Einsatzgruppen would move through Nazi controlled areas and round up Jews, gypsies, undesirables and disabled people. They rounded them up and shot them.

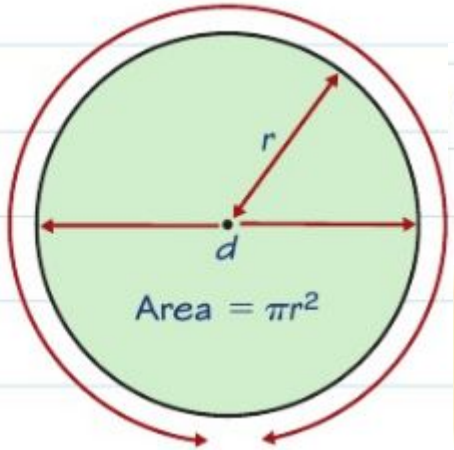
The Final Solution

The Wannsee Conference was a meeting of senior government held in the Berlin suburb of Wannsee on 20 January 1942. It was decided whereby most of the Jews of German occupied Europe would be deported to occupied Poland and murdered via work and death camps.

The Death Camps: Auschwitz Birkenau, Treblinka, Belzec, Sobibor

The death camps used gas chambers to murder Jews and others on an industrial scale. Jews were brought from all over Europe.
Selection happened when you arrived. Women with children, the Elderly and the unfit went straight to the gas chambers. The Jews were told they were being taken to showers but the showers were in fact gas chambers.
People of usually 14 years of age upwards who were fit and healthy (as well as children taken from parents) were taken to showers to clean them up. The showers were either really hot or extremely cold. They would then be tattooed with a number their hair shaven and given a uniform.

Circle

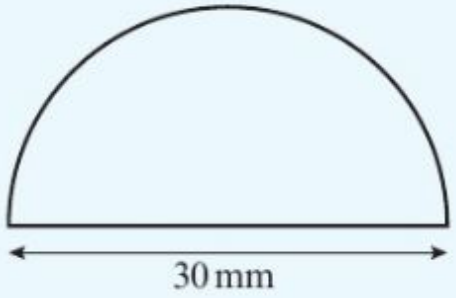


Circumference = $2\pi r$
$= \pi d$

Area of circle

$$A = \pi r^2$$

The diagram shows a game counter in the shape of a semicircle.

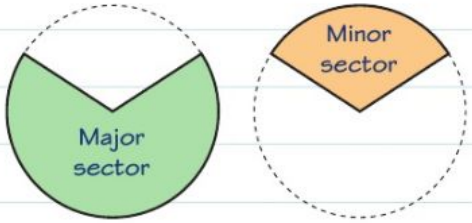


Work out the area of the counter. Give your answer correct to 2 significant figures. **(3 marks)**

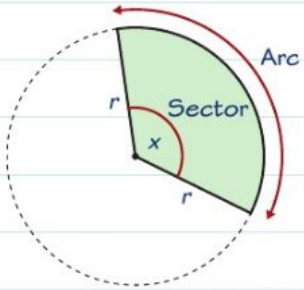
Radius = 30 ÷ 2 = 15 mm
Area of circle = πr^2
$= \pi \times 15^2$
$= 706.8583...$ mm²
Area of counter = 706.8583... ÷ 2
= 350 mm² (2 s.f.)

Sectors of circles

Each pair of radii divides a circle into two sectors, a **major sector** and a **minor sector**.



You can find the area of a sector by working out what fraction it is of the whole circle.



For a sector with angle x of a circle with radius r:

Sector = $\frac{x}{360°}$ of the whole circle so

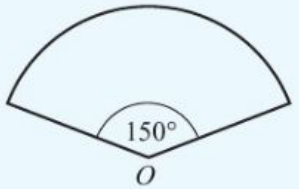
Area of sector = $\frac{x}{360°} \times \pi r^2$

Arc length = $\frac{x}{360°} \times 2\pi r$

LEARN IT!

You can give answers in terms of π.
There is more about this on the previous page.

The diagram shows a minor sector of a circle of radius 13 cm.



Work out the perimeter of the sector. **(4 marks)**

Arc length = $\frac{x}{360°} \times 2\pi r$
$= \frac{150°}{360°} \times 2\pi \times 13$
$= 34.033\,92...$
Perimeter = Arc length + Radius + Radius
$= 34.033\,92... + 13 + 13$
= 60 cm (2 s.f.)

Area conversions

$1\,cm^2 = 10^2\,mm^2 = 100\,mm^2$

$1\,m^2 = 100^2\,cm^2 = 10\,000\,cm^2$

$1\,km^2 = 1000^2\,m^2 = 1\,000\,000\,m^2$

Volume conversions

$1\,cm^3 = 10^3\,mm^3 = 1000\,mm^3$

$1\,m^3 = 100^3\,cm^3 = 1\,000\,000\,cm^3$

$1\text{ litre} = 1000\,cm^3$

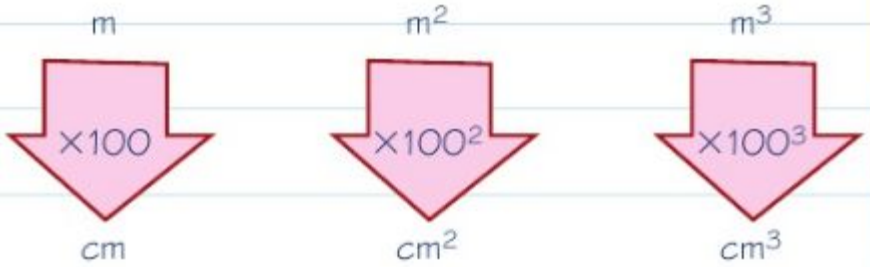
$1\,ml = 1\,cm^3$

LEARN IT!

Unit conversion checklist

The multiplier for an area conversion is the length multiplier squared. ✓

The multiplier for a volume conversion is the length multiplier cubed. ✓



Lead has a density of 11350 kg/m³.
An antique lead model has a volume of 400 cm³.
Calculate the mass of the model in kg.

(3 marks)

$400 \div 100^3 = 0.0004$

Volume $= 0.0004\,m^3$

Mass = Density × Volume

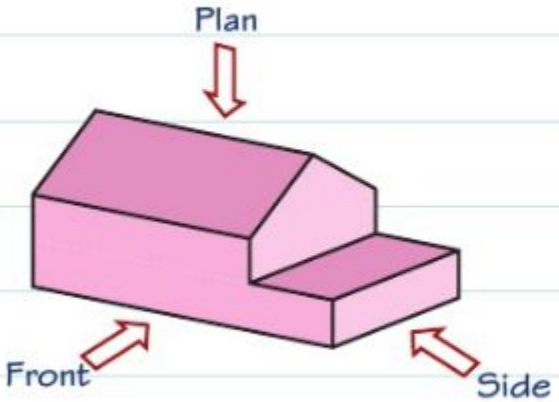
$= 11350 \times 0.0004$

$= 4.54\,kg$

Maths

Plans and elevations

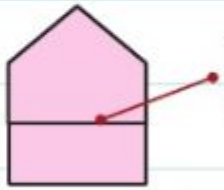
Plans and elevations are 2-D drawings of 3-D shapes as seen from different directions.



The **plan** is the view from above.

Front elevation

The **front elevation** is the view from the front.



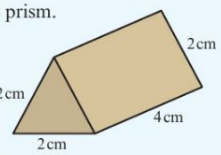
Side elevation

This line shows a change in depth.

The **side elevation** is the view from the side.

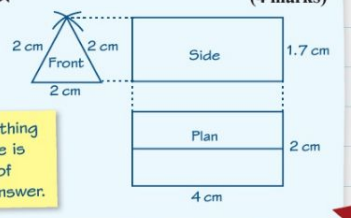
Worked example Target grade 5

The diagram shows a triangular prism. Accurately construct a plan and elevations for this prism.



(4 marks)

Front

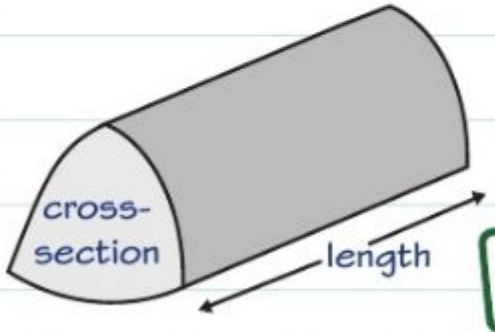


Everything in blue is part of the answer.

Prisms

Volume

A prism is a 3-D solid with a **constant** cross-section. Use this formula to calculate the volume of a prism.



LEARN IT!

Volume = Area of cross-section × Length

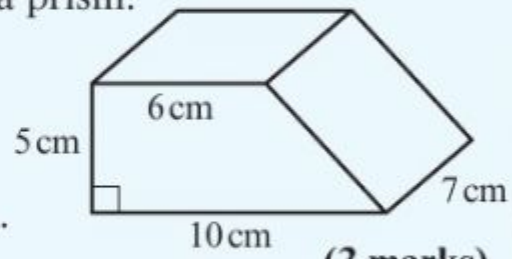
Worked example

Target grade 4

The diagram shows a prism.

The cross-section is a trapezium.

Work out the volume of the prism.



(3 marks)

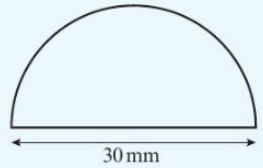
Area of cross-section (trapezium)

$= \frac{1}{2} \times (6 + 10) \times 5 = 40\,cm^2$

Volume of prism $= 40 \times 7 = 280\,cm^3$

Worked example

The diagram shows a game counter in the shape of a semicircle.



Work out the area of the counter. Give your answer correct to 2 significant figures. **(3 marks)**

Radius = 30 ÷ 2 = 15 mm

Area of circle $= \pi r^2$

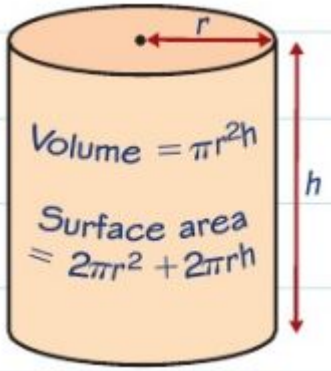
$= \pi \times 15^2$

$= 706.8583...\ mm^2$

Area of counter = 706.8583... ÷ 2

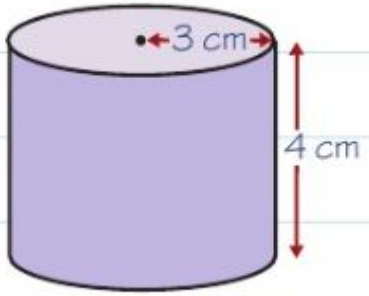
$= 350\,mm^2$ (2 s.f.)

Cylinder



In terms of π

Unless a question asks you for a specific degree of accuracy, you can give your answers as a whole number or fraction multiplied by π. An answer given in terms of π is an **exact answer** rather than a **rounded answer**.



Volume of cylinder $= \pi r^2 h$

$= \pi \times 3^2 \times 4$

Exact answer

Volume $= 36\pi\,cm^3$

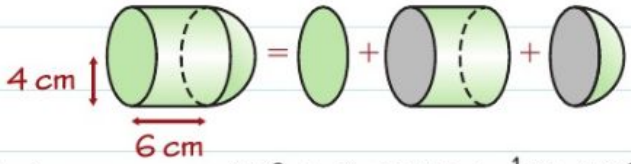
Rounded answer

Volume $= 113\,cm^3$ (to 3 s.f.)

Surface area

Compound shapes

You can calculate the surface area of more complicated shapes by adding together the surface area of each part.

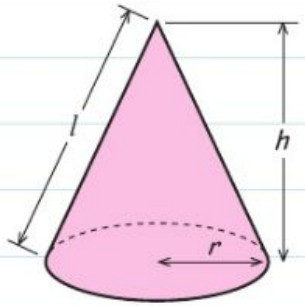


Surface area $= \pi(4)^2 + 2\pi(4)(6) + \frac{1}{2}[4\pi(4)^2]$
$= 96\pi\,\text{cm}^2$

Cone

The formula for the **curved surface area** of a cone will be given if you need it for a question.

Curved surface area of cone $= \pi rl$



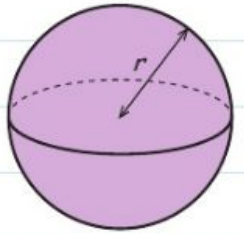
Be careful! This formula uses the slant height, l, of the cone.

To calculate the **total** surface area of the cone you need to add the area of the base.
Surface area of cone $= \pi r^2 + \pi rl$

Sphere

The formula for the surface area of a sphere will be given if you need to use it.

Surface area of sphere $= 4\pi r^2$



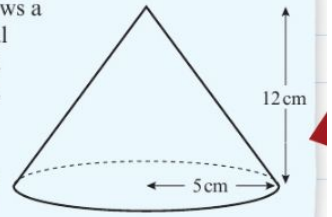
For a reminder about areas of circles and surface areas of cylinders have a look at page 83.

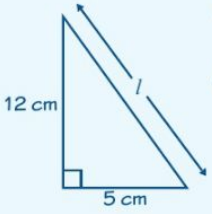
A hemisphere is half a sphere, so the area of the curved surface of a hemisphere is $\frac{1}{2} \times 4\pi r^2$

Worked example

Target grade 5

The diagram shows a cone with vertical height 12 cm and base radius 5 cm. Work out the curved surface area of the cone. **(4 marks)**





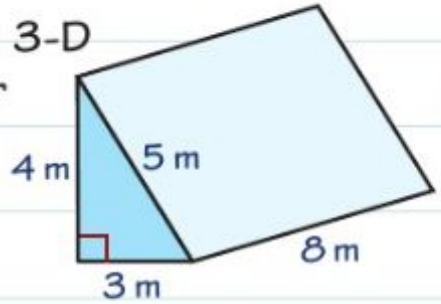
$l^2 = 12^2 + 5^2 = 169$
$l = 13$ cm
Curved surface area
$= \pi rl$
$= \pi \times 13 \times 5$
$= 65\pi\,\text{cm}^2$

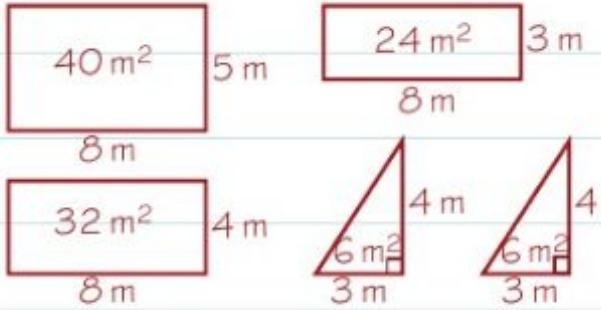
Surface area

To work out the surface area of a 3-D shape, you need to add together the areas of all the faces.

It's a good idea to sketch each face with its dimensions.

Remember to include the faces that you can't see.



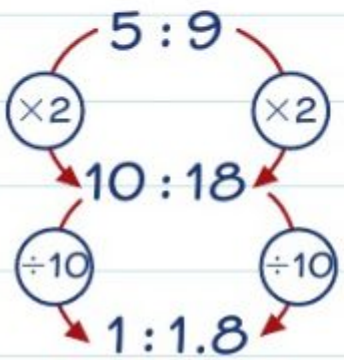


Surface area $= 40 + 32 + 24 + 6 + 6 = 108\,\text{m}^2$

Ratio

Ratios are used to compare quantities.

You can find equivalent ratios by multiplying or dividing by the same number.



This equivalent ratio is in the form 1 : *n*. This is useful for calculations.

Simplest form

To write a ratio in its simplest form, find an equivalent ratio with the smallest possible whole number values.

Simplest form
5 : 1 10 : 9
2 : 3 : 4

Not simplest form
10 : 2 1 : 0.9
1 : 1.5 : 2

Worked example

Target grade 4

Alexis and Nisha share a flat. They decide to split their phone bill in the ratio 3 : 5 Alexis pays £78. How much does Nisha pay?

(2 marks)

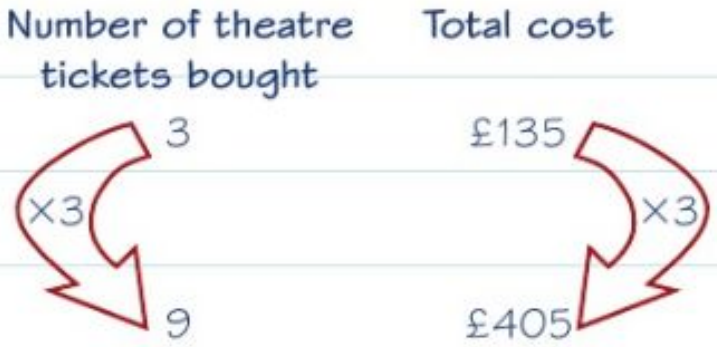
78 ÷ 3 = 26

26 × 5 = 130

Nisha pays £130

Proportion

Two quantities are in **direct proportion** when both quantities increase at the same rate.



Two quantities are in **inverse proportion** when one quantity increases at the same rate as the other quantity decreases.

Divide or multiply?

You can use **common sense** to work out whether to divide or multiply in proportion questions.

6 people can build a wall in 4 days.

$6 \times 4 = 24$ so 1 person could build the wall in 24 days.

Multiply because it would take 1 person **longer** to build the wall.

$24 \div 8 = 3$ so 8 people could build the wall in 3 days.

Divide because it would take 8 people **less time** to build the wall.

Worked example

Target grade 4

Here are the ingredients for apple crumble.

Apple crumble	
Serves 6 people	
900 g apples	90 g butter
180 g sugar	150 g flour

(a) Henry wants to make apple crumble for 11 people.
Work out the amount of sugar he needs. **(2 marks)**

Amount needed for 1 person $= \frac{180}{6} = 30$ g

Amount needed for 11 people $= 11 \times 30 = 330$ g

(b) Carla makes an apple crumble using 2250 g of apples. Work out how many people her apple crumble will serve. **(2 marks)**

$2250 \div 900 = 2.5$

$6 \times 2.5 = 15$

The apple crumble will serve 15 people.

Worked example

Target grade 5

Alice wants to buy some lemonade for a party. She compares the prices of a two-litre bottle and a multi-pack of eight cans.

- Two-litre bottle £1.29
- Eight 330 ml cans £1.99

Which option offers the better value? **(3 marks)**

Cost in pence per ml:

Two-litre bottle: $129 \div 2000 = 0.0645$

Cans: $199 \div (8 \times 330) = 0.075\,37...$

Lemonade costs less per ml in a two-litre bottle so that is the better value.

Proportionality formulae

You can answer some questions involving proportion by constructing a **formula**. On this page you can revise finding formulae for the two basic proportionality relationships.

1 Direct proportion

These all mean the same thing:

- y is directly proportional to x
- y varies directly with x
- $y \propto x$
- $y = kx$

k is called the **constant of proportionality.**

2 Inverse proportion

These all mean the same thing:

- y is inversely proportional to x
- y varies inversely with x
- $y \propto \frac{1}{x}$
- $y = \frac{k}{x}$

Worked example Target grade 6

Winnie drops a stone down a well. The speed of the stone, v m/s, is directly proportional to the time, t seconds, since she dropped it.
After 0.5 seconds the stone is travelling at 4.9 m/s.

(a) Find a formula for v in terms of t. **(3 marks)**

$v = kt$
$4.9 = k(0.5) \quad (\div 0.5)$
$k = 9.8$
$v = 9.8t$

(b) Calculate the speed of the stone after 1.2 seconds. **(1 mark)**

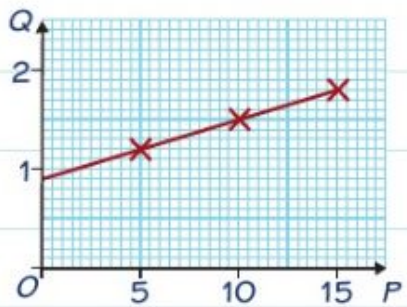
$v = 9.8(1.2) = 11.76$ m/s

Checking for proportionality

You can use a graph to check whether two quantities are directly proportional.

P	5	10	15
Q	1.2	1.5	1.8

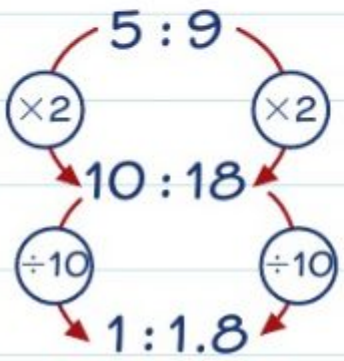
The graph doesn't go through the origin so P and Q are not directly proportional.



Ratio

Ratios are used to compare quantities.

You can find equivalent ratios by multiplying or dividing by the same number.



This equivalent ratio is in the form 1 : *n*. This is useful for calculations.

Simplest form

To write a ratio in its simplest form, find an equivalent ratio with the smallest possible whole number values.

Simplest form
5 : 1 10 : 9
2 : 3 : 4

Not simplest form
10 : 2 1 : 0.9
1 : 1.5 : 2

Worked example

Target grade 4

Alexis and Nisha share a flat. They decide to split their phone bill in the ratio 3 : 5 Alexis pays £78. How much does Nisha pay?

(2 marks)

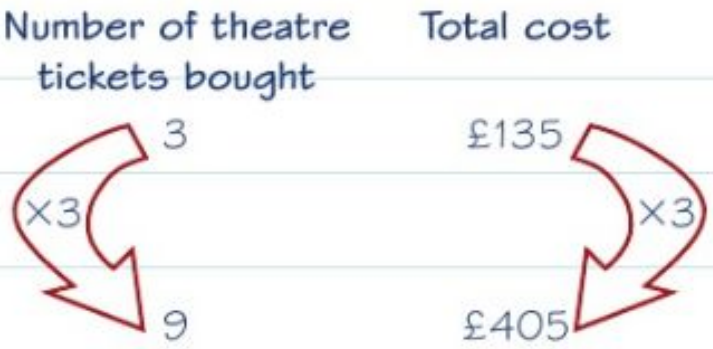
78 ÷ 3 = 26

26 × 5 = 130

Nisha pays £130

Proportion

Two quantities are in **direct proportion** when both quantities increase at the same rate.



Two quantities are in **inverse proportion** when one quantity increases at the same rate as the other quantity decreases.

Divide or multiply?

You can use **common sense** to work out whether to divide or multiply in proportion questions.

6 people can build a wall in 4 days.

$6 \times 4 = 24$ so 1 person could build the wall in 24 days.

Multiply because it would take 1 person **longer** to build the wall.

$24 \div 8 = 3$ so 8 people could build the wall in 3 days.

Divide because it would take 8 people **less time** to build the wall.

Worked example

Target grade 4

Here are the ingredients for apple crumble.

Apple crumble	
Serves 6 people	
900 g apples	90 g butter
180 g sugar	150 g flour

(a) Henry wants to make apple crumble for 11 people.
Work out the amount of sugar he needs. **(2 marks)**

Amount needed for 1 person $= \frac{180}{6} = 30$ g

Amount needed for 11 people $= 11 \times 30 = 330$ g

(b) Carla makes an apple crumble using 2250 g of apples. Work out how many people her apple crumble will serve. **(2 marks)**

$2250 \div 900 = 2.5$

$6 \times 2.5 = 15$

The apple crumble will serve 15 people.

Worked example

Target grade 5

Alice wants to buy some lemonade for a party. She compares the prices of a two-litre bottle and a multi-pack of eight cans.

- Two-litre bottle £1.29
- Eight 330 ml cans £1.99

Which option offers the better value? **(3 marks)**

Cost in pence per ml:

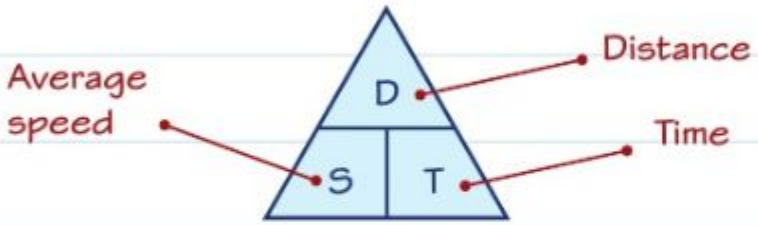
Two-litre bottle: $129 \div 2000 = 0.0645$

Cans: $199 \div (8 \times 330) = 0.075\,37...$

Lemonade costs less per ml in a two-litre bottle so that is the better value.

Speed

This is the formula triangle for speed.



$$\text{Average speed} = \frac{\text{Total distance travelled}}{\text{Total time taken}}$$

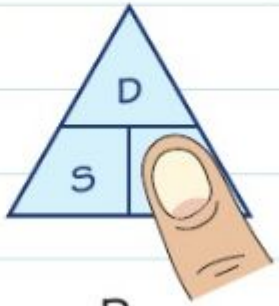
$$\text{Time} = \frac{\text{Distance}}{\text{Average speed}}$$

$$\text{Distance} = \text{Average speed} \times \text{Time}$$

LEARN IT!

Using a formula triangle

Cover up the quantity you want to find with your finger.



The position of the other two quantities tells you the formula.

$$T = \frac{D}{S} \qquad S = \frac{D}{T} \qquad D = S \times T$$

Worked example Target grade 5

The speed of light in a vacuum is approximately 1.08×10^9 km/h.

Light from the Sun takes approximately 8 minutes and 15 seconds to travel to Earth.

Estimate the distance from the Earth to the Sun. **(3 marks)**

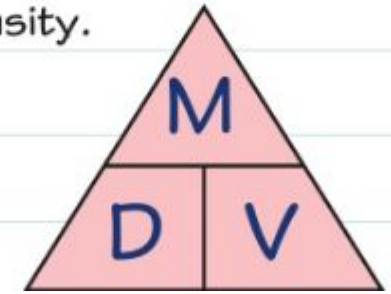
8 mins 15 secs $= 8.25$ mins $= \frac{8.25}{60}$
$= 0.1375$ hours

$D = S \times T$
$= 1.08 \times 10^9 \times 0.1375$
$= 1.485 \times 10^8$ km

Density

The density of a material is its mass per unit volume.

This is the formula triangle for density.



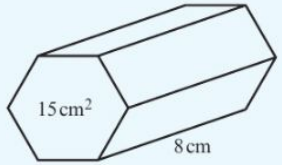
LEARN IT!

$$\text{Density} = \frac{\text{Mass}}{\text{Volume}}$$

$$\text{Volume} = \frac{\text{Mass}}{\text{Density}}$$

$$\text{Mass} = \text{Density} \times \text{Volume}$$

Worked example Target grade 4



The diagram shows a solid hexagonal prism.
The area of the cross-section of the prism is 15 cm^2.
The length of the prism is 8 cm.
The prism is made from wood with a density of 0.8 grams per cm^3.
Work out the mass of the prism. **(4 marks)**

Volume of prism
= Area of cross-section × Length
= 15 × 8
= 120 cm^3

$M = D \times V$
= 0.8 × 120
= 96

The mass of the prism is 96 g.

Units

The most common units of density are:
- grams per cubic centimetre: g/cm^3
- kilograms per cubic metre: kg/m^3

Examiners' report

Make sure you write down the formula triangle for density and that you **know how to use it**.
In this question you want to find the **mass**. If you cover up M the formula triangle tells you that:

Mass = Density × Volume

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

Worked example Target grade 4

An iron bar has a volume of 1.2 m^3 and a mass of 9444 kg. Calculate the density of iron. **(2 marks)**

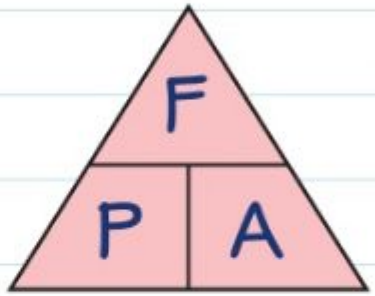
$D = \frac{M}{V} = \frac{9444}{1.2} = 7870\,kg/m^3$

Other compound measures

Compound measures are made up of two or more other measurements. **Speed** is a compound measure because it is calculated using distance **and** time. **Density** is a compound measure because it is calculated using mass **and** volume. You need to be able to work with other compound measures as well.

Pressure

Pressure is a measure of the force applied over a given area. The most common units of pressure are newtons per square centimetre (N/cm^2) and newtons per square metre (N/m^2). You can use the formula triangle on the right to calculate with pressure.



$$\text{Pressure} = \frac{\text{Force}}{\text{Area}}$$

$$\text{Area} = \frac{\text{Force}}{\text{Pressure}}$$

$$\text{Force} = \text{Pressure} \times \text{Area}$$

LEARN IT!

Worked example Target grade 4

At a depth of 15 m, water has a pressure of 14.7 N/cm^2. Calculate the force applied to a diving mask with a surface area of 360 cm^2. **(2 marks)**

Force = Pressure × Area
= 14.7 × 360
= 5292 N

Rates

If the 'bottom' unit in a compound measure is **time**, then it is a **rate**. Here are some examples.

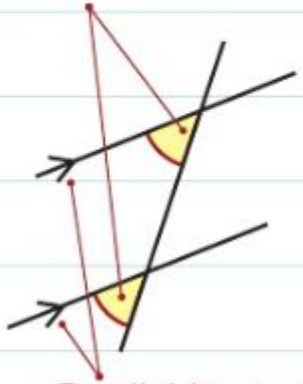
$$\text{Speed} = \frac{\text{Distance}}{\text{Time}} \qquad \text{Rate of flow} = \frac{\text{Volume}}{\text{Time}}$$

$$\text{Rate of climb} = \frac{\text{Height}}{\text{Time}} \qquad \text{Rate of pay} = \frac{\text{Salary}}{\text{Time}}$$

Angle properties

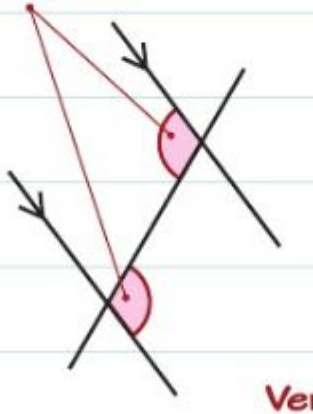
You need to remember all of these angle properties and their correct names.

Corresponding angles are equal.

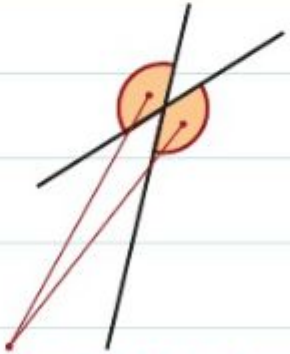


Parallel lines are marked with arrows.

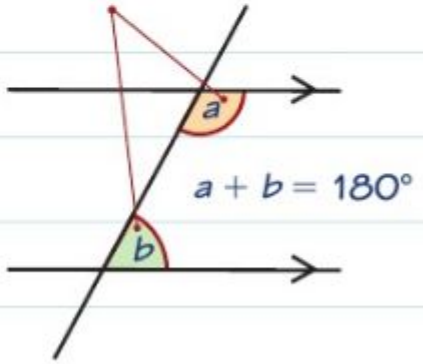
Alternate angles are equal.



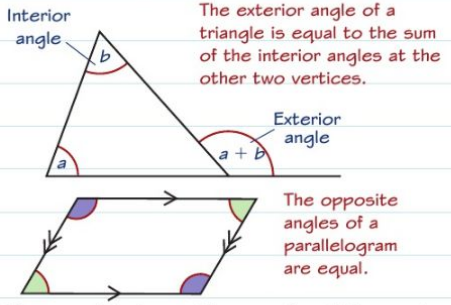
Vertically opposite angles are equal.



Co-interior or allied angles add up to 180°.



These are useful angle facts for triangles and parallelograms:



You need to know the proofs of the angle properties of triangles and quadrilaterals.

Golden rule

When answering angle problems, you need to give a reason for each step of your working.

Angle sums

You need to remember these two angle facts:

1. The angles in a triangle add up to 180°.
2. The angles in a quadrilateral add up to 360°.

Solving angle problems

You might need to use angle properties to solve problems in your exam. Remember to give reasons for every step of your working.

Reasons

Use these reasons in angle problems:

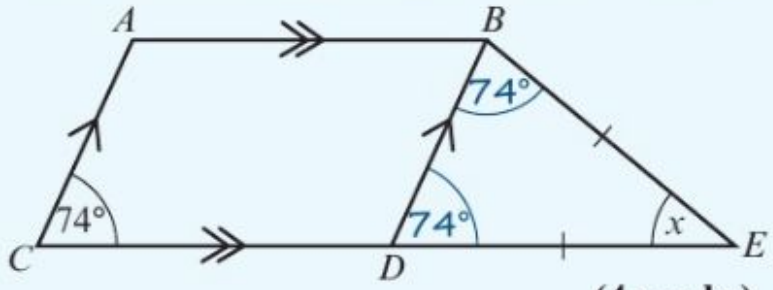
- Angles on a straight line add up to 180°.
- Angles around a point add up to 360°.
- Opposite angles are equal.
- Corresponding angles are equal.
- Co-interior angles add up to 180°.
- Alternate angles are equal.
- Angles in a triangle add up to 180°.
- Angles in a quadrilateral add up to 360°.
- Base angles of an isosceles triangle are equal.

Use the properties on the diagram:
AB is parallel to *CD*.
AC is parallel to *BD*.
BE is equal to *DE*.

Worked example

Target grade 5

Work out the size of the angle marked x.
Give reasons for each step of your working.



(4 marks)

$\angle BDE = 74°$ (corresponding angles are equal)

$\angle DBE = 74°$ (base angles in an isosceles triangle are equal)

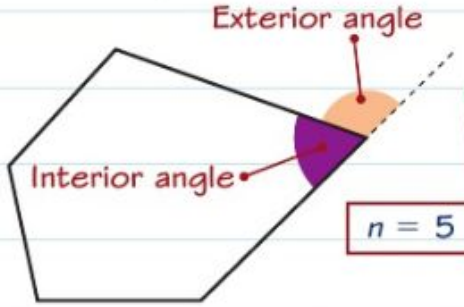
$x + 74° + 74° = 180°$ (angles in a triangle add up to 180°)

$x = 180° - 148°$

$x = 32°$

Angles in polygons

Polygon questions are all about interior and exterior angles.



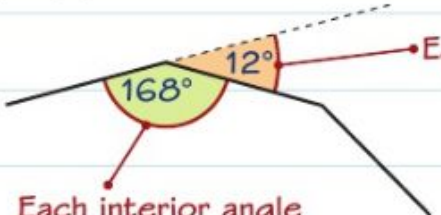
LEARN IT!

Use these formulae for a polygon with n sides:

Sum of interior angles $= 180° \times (n - 2)$

Sum of exterior angles $= 360°$

This diagram shows part of a **regular** polygon with 30 sides.



Each exterior angle is $\frac{360°}{30} = 12°$

Each interior angle is $180° - 12° = 168°$

Don't try to draw a 30-sided polygon!

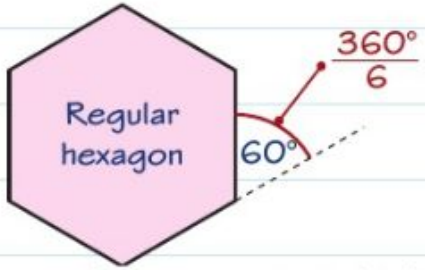
If there's no diagram given in a polygon question, you probably don't need to draw one.

Regular polygons

In a regular polygon all the sides are equal and all the angles are equal.

If a regular polygon has n sides then each exterior angle is $\frac{360°}{n}$

LEARN IT!



You can use the fact that the angles on a straight line add up to 180° to work out the size of one of the interior angles.

Share this p

Worked example

Target grade 6

The diagram shows part of a regular polygon. The interior angle and the exterior angle at a vertex are marked.
The size of the interior angle is 7 times the size of the exterior angle.
Work out the number of sides of the polygon. **(3 marks)**

$180° \div 8 = 22.5°$

$\frac{360°}{22.5°} = 16$

The polygon has 16 sides.

Area conversions

$1\,cm^2 = 10^2\,mm^2 = 100\,mm^2$

$1\,m^2 = 100^2\,cm^2 = 10\,000\,cm^2$

$1\,km^2 = 1000^2\,m^2 = 1\,000\,000\,m^2$

Volume conversions

$1\,cm^3 = 10^3\,mm^3 = 1000\,mm^3$

$1\,m^3 = 100^3\,cm^3 = 1\,000\,000\,cm^3$

$1\text{ litre} = 1000\,cm^3$

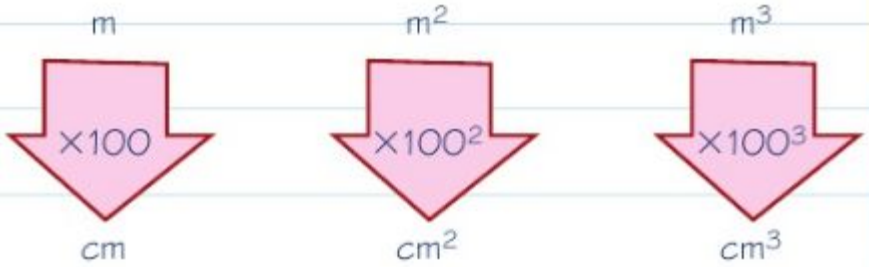
$1\,ml = 1\,cm^3$

LEARN IT!

Unit conversion checklist

The multiplier for an area conversion is the length multiplier squared. ✓

The multiplier for a volume conversion is the length multiplier cubed. ✓



Lead has a density of 11350 kg/m³.
An antique lead model has a volume of 400 cm³.
Calculate the mass of the model in kg.

(3 marks)

$400 \div 100^3 = 0.0004$

Volume $= 0.0004\,m^3$

Mass = Density × Volume

$= 11350 \times 0.0004$

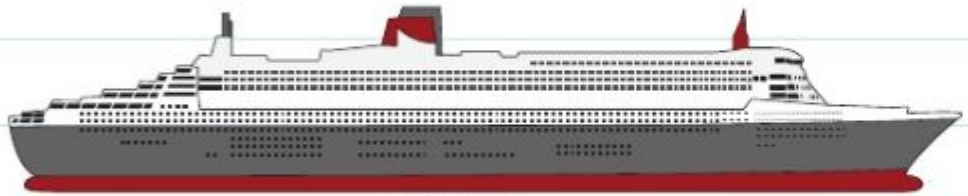
$= 4.54\,kg$

Maths- foundation

Scale drawings and maps

This is a **scale drawing** of the *Queen Mary II* cruise ship.

Scale = 1 : 500



69 cm

You can use the scale to work out the length of the actual ship.

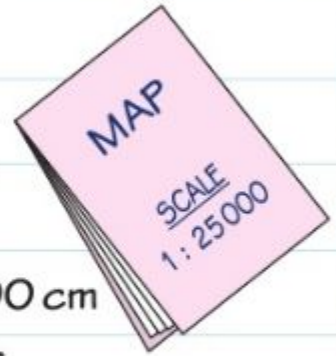
69 × 500 = 34 500

The ship is 34 500 cm or 345 m long.

Map scales

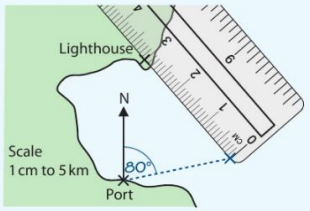
Map scales can be written in different ways:

- 1 to 25 000
- 1 cm represents 25 000 cm
- 1 cm represents 250 m
- 4 cm represent 1 km.



Worked example Target grade 4

The diagram shows a scale drawing of a port and a lighthouse.

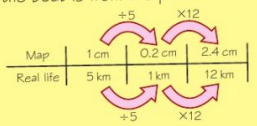


A boat sails 12 km from the port in a straight line on a bearing of 080°.

How far away is the boat from the lighthouse? Give your answer in km. **(3 mark)**

15 km

First, you need to mark the position of the boat accurately on the scale drawing. Then work out how far the boat is from the port.



Now place the centre of your protractor on the port with the zero line pointing north. Put a dot at 80°. Line up your ruler between the port and the dot. Draw a cross 2.4 cm from the port.

Examiners' report

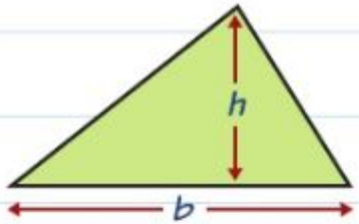
3 cm on the drawing represents 15 km in real life. Make sure you have a millimetre ruler **and** a protractor with you in the exam.

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

Maths- foundation

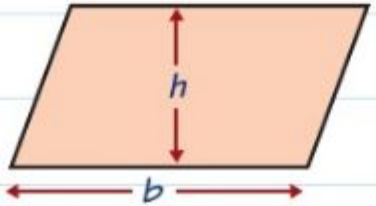
Perimeter and area

Triangle



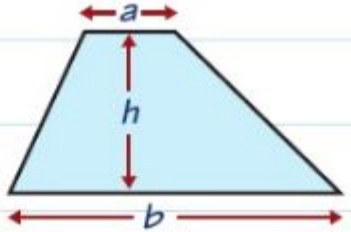
Area $= \frac{1}{2}bh$

Parallelogram



Area $= bh$

Trapezium

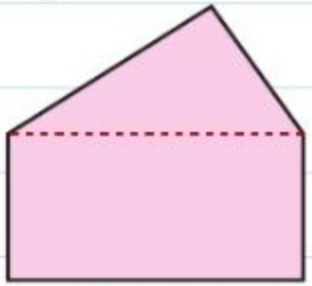


Area $= \frac{1}{2}(a + b)h$

LEARN IT!

You can calculate areas and perimeters of more complex shapes by splitting them into parts.

You might need to draw some extra lines on your diagram and add or subtract areas.



Area =
Rectangle + Triangle

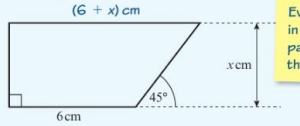
Area =
Triangle − Rectangle

Area basics

- Lengths are all in the same units. ✓
- Give units with the answer. ✓
- Lengths in cm means area units are cm^2. ✓
- Lengths in m means area units are m^2. ✓

Worked example Target grade 6

This diagram shows a trapezium with base 6 cm and height x cm.



Everything in blue is part of the answer

The area of the trapezium is A cm^2.

(a) Write a formula for A in terms of x. Give your answer in its simplest form. **(3 marks)**

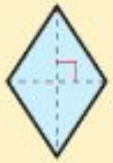
Area $= \frac{1}{2}(a + b)h$

$A = \frac{1}{2}(6 + 6 + x)x = 6x + \frac{1}{2}x^2$

(b) The height of the trapezium is 5 cm. Find the area of the trapezium. **(2 marks)**

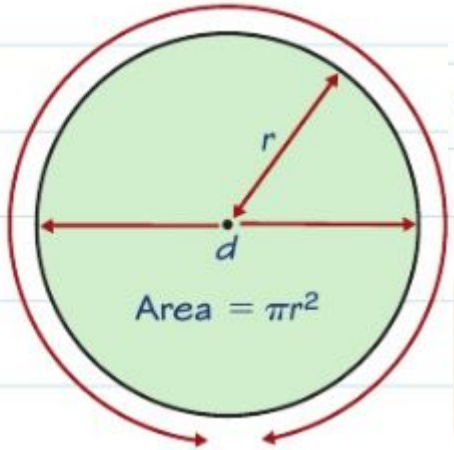
$A = 6 \times 5 + \frac{1}{2} \times 5^2 = 42.5\,cm^2$

The **properties** of a shape are facts about its sides, angles, diagonals and symmetry.
Here are some of the properties of some well-known quadrilaterals.

Square 	• all sides are equal in length • opposite sides are parallel • all angles are 90° • diagonals bisect each other at 90°
Rhombus 	• all sides are equal in length • opposite sides are parallel • opposite angles are equal • diagonals bisect each other at 90°
Kite 	• 2 pairs of sides are equal in length • no parallel sides • 1 pair of equal angles • diagonals cross each other at 90°
Rectangle 	• opposite sides are equal in length • opposite sides are parallel • all angles are 90° • diagonals bisect each other
Parallelogram 	• opposite sides are equal in length • opposite sides are parallel • opposite angles are equal • diagonals bisect each other
Trapezium 	• 1 pair of parallel sides
Isosceles trapezium 	• 2 sides are equal in length • 1 pair of parallel sides • 2 pairs of equal angles

Maths

Circle

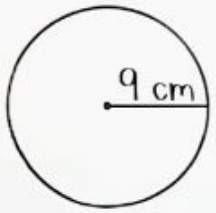


Circumference = $2\pi r$
$= \pi d$

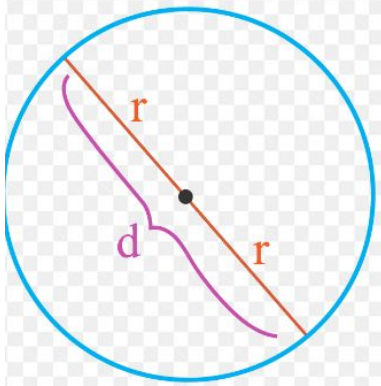
Area of circle

$$A = \pi r^2$$

Find the area of the following circle.

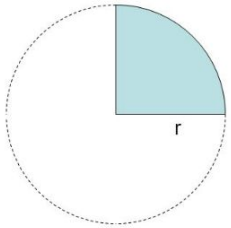


$A = \pi r^2$
$= \pi (9\text{ cm})^2$
$= \pi (9\text{ cm})(9\text{ cm})$
$= \boxed{81\pi\text{ cm}^2}$



$C = 2\pi r$
or
$C = \pi d$

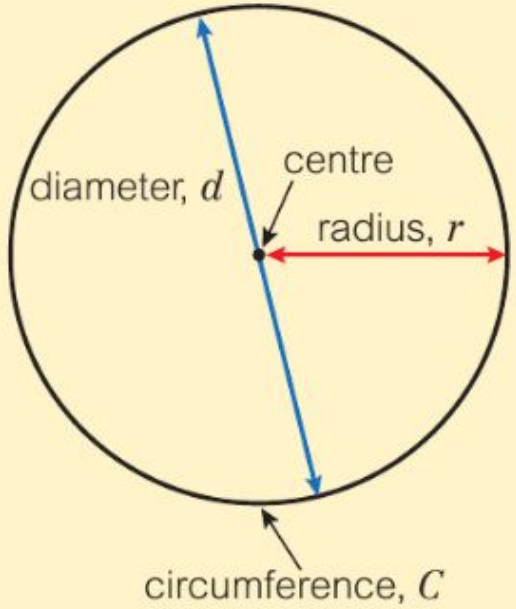
Perimeter of quarter-circle



Circumference of a circle = π d
Perimeter of a semi-circle = π × Radius + Diameter
= πr + d
Perimeter of quadrant = $\frac{1}{2}\pi r + 2r$

Key point

The **circumference** (C) is the perimeter of a circle.
The **centre** of a circle is marked using a dot.
The **radius** (r) is the distance from the centre to the circumference.
The plural of radius is **radii**.
The **diameter** (d) is a line from one edge to another through the centre.



PE

Basketball

Rules of The Game

Attacking Rules

- The player must bounce, or dribble, the ball with one hand while moving both feet. If, at any time, both hands touch the ball or the player stops dribbling, the player must only move one foot. The foot that is stationary is called the pivot foot.
- The basketball player can only take one turn at dribbling. In other words, once a player has stopped dribbling, they cannot start another dribble. A player who starts dribbling again is called for a double-dribbling violation and loses the basketball to the other team. A player can only start another dribble after another player from either team touches or gains control of the basketball, this is usually after a shot or pass.
- The ball must stay in bounds. If the offensive team loses the ball out of bounds the other team gets control of the basketball.
- The players hand must be on top of the ball while dribbling. If they touch the bottom of the basketball while dribbling and continue to dribble this is called carrying the ball and the player will lose the ball to the other team.
- Once the offensive team crosses half court, they may not go back into the backcourt. This is called a backcourt violation. If the defensive team knocks the ball into the backcourt, then the offensive team can recover the ball legally.

Defending Rules

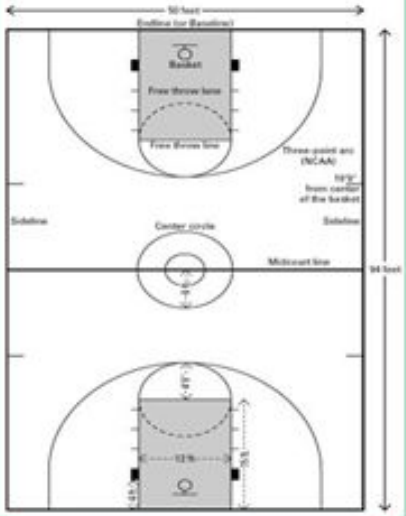
- The main rule for the defensive player is not to foul. A foul is described as gaining an unfair advantage through physical contact. There is some interpretation that has to be made by the referee, but, in general, the defensive player may not touch the offensive player in a way that causes the offensive player to lose the ball or miss a shot.
- Basketball players cannot kick the ball or hit it with their fist.

Positions

The Centre is usually the team's tallest and strongest player and is positioned under the basket. They are required to be physically domineering with more physical strength and athleticism.
Power Forward are usually the second tallest in the team and are the closest to the centre in terms of physical attributes and playing style but with more speed.
The Small Forward is usually the shorter of the two forwards on the team but plays the most versatile role out of the main five positions.
Shooting guard Potentially the shortest player on the team, the Shooting Guard is the team's best outside shooter. Besides being able to shoot well, they need to be good at dribbling fast, passing and having court vision.
The Point Guard is usually the shortest but the best ball handler on the team. Also known as the 'coach on the floor' or the 'floor general', a point guard is responsible for directing plays.

Pitch Markings

Along the length of the court, the borders are the side-lines. Along the ends, the borders are the end-lines, or baselines. Separating both halves of the court is a midcourt line. In the very centre of the midcourt line is the centre circle (12 feet in diameter), where the centre toss takes place to begin the game.



Basketball

Scoring

The winner of a basketball game is the team with the most points. You get points by throwing the basketball through the opponent's hoop or basket.

In regular play a basket made from within the three-point line is worth 2 points and a basket shot from outside the three point line is worth three points. When shooting a free throw, each free throw is worth 1 point.

When a player is shooting a foul shot, the remaining nine players on the court must stand in designated locations. They can stand in the blocks along the sides of the free-throw lane or back behind the free-throw shooter. The team whose player is not shooting free throws must be allowed to stand closest to the rim during the shot.

Key Terms

Alley-Oop: When one player jumps and catches a pass from another player and simultaneously dunks the ball or shoots it in before landing.
Box Out: When a shot goes up, players use this technique, which involves widening their stance and arms and using their body as a barrier to get in better rebounding position.
Carry: This penalty, which results in a turnover, occurs when a player holds the ball excessively at the apex while dribbling.
Charge: This penalty, which results in a turnover, occurs when an offensive player with the ball runs into a stationary defensive player and knocks him or her over.
Double Dribble: This penalty, which results in a turnover, occurs when a player dribbles the ball with both hands. It also occurs when a player dribbles, stops dribbling, and then begins to dribble again.
Fast Break: An offensive action where a team attempts to advance the ball and score as quickly as possible after a steal, blocked shot or rebound.
Free Throw: A free shot given to a player after a foul or a technical foul. The player shoots from the 15-foot free throw line while the rest of the players line up along the outside of the key.
Lay-Up: A shot taken close to the hoop, usually when a player is moving toward the basket.
Man-to-Man: A defensive strategy in which each player on the defensive team guards one person on the opposing team.

PE

Key Skills/Techniques	Rules/Tactics	Key words/Phrases
Dribbling Dribbling allows you to move the ball around the field without losing possession. Keep the ball close to your feet at all times, when running with it. Use the inside of your foot to control the ball when moving. Don't look down when running with the ball. Keep your head up. **Passing** Non-kicking foot is closest to the ball. Kicking foot needs to be at a right angle to the ball Body over the ball Eyes focused upon the ball and arms are to be used for balance **Shooting** Non kicking foot needs to be next to the ball and player needs to keep their body balanced with their head slightly over the top of the ball. Contact the ball either with the side of the foot (placement of ball) top of the foot (to generate power) Both legs need to be flexed but when striking the ball, kicking foot needs to be fully extended on the follow-through.	**Rules** Game is started by a kick off in the centre of the pitch, on the referee's whistle The main game has 11 players on the pitch(consisting of goal keeper, defenders, midfielders and strikers) A referee and 2 linesmen will officiate the game. If the ball is played outside of the pitch lines, then the possession is given to the opposing team either as a throw in, goal keepers kick (off the floor) or corner. If a foul is committed a free kick or a penalty is issued (depending on the incident) To score a goal, the ball must cross the opposition's goal line. The team with the most goals at the end of the game will win the game. **Tactics** Vary the passes that you make Play to your opponents weaknesses(if they are dominantly using their left foot, then play balls on their right) Move opponent around the pitch to tire them out Vary the pace and directions of strokes.	Dribbling Warm up Cool Down Side foot Attack Defend Foul Referee Volley Accuracy Reaction time

PE

Physical Education **Trampolining** **Beginner**

A - Safety rules:

1. Always inform your teacher before the lesson of any injuries or medical conditions
2. Always wear PE kit with socks
3. Keep long hair tied back and finger nails short
4. Remove all jewellery, watches and objects from your pockets
5. No chewing gum
6. Use the trampoline only in the presence of the teacher and only when given permission
7. Never use the equipment unless adequate spotters are available
8. Always face the performer and pay attention when spotting
9. Do not step on to the trampoline whilst someone else is bouncing as it is dangerous
10. Do not go underneath the trampoline
11. Do not attempt new skills without permission

B - Stopping:

Land with your feet 'flat' onto the bed.

Begin bending your knees as you touch down on the trampoline.

Keep your back straight and ensure you do not lean forwards or backwards.

C - Straight jumping:

Stand in middle of trampoline on the red cross.

Eyes focus on the end frame/mat throughout the jump

Knees and hips bend and push straight

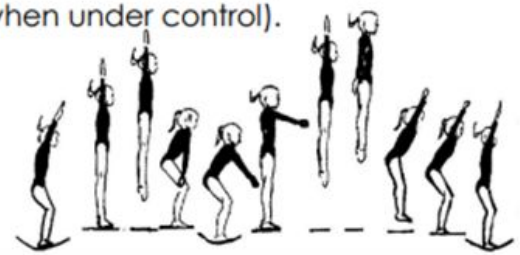
Toes and ankles push straight

Flex ankles on landing

Feet slightly apart but together in the air

Hips straight

Arms above head – (make circles – only when under control).



D - Seat landing:

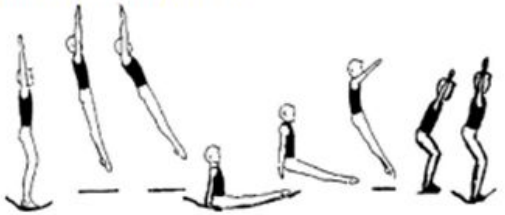
Press hips forward and upward during take-off to create rotation.

Focus on the end bed.

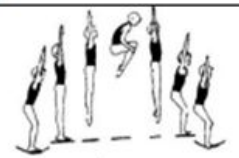
Legs straight hips to heels.

Hands are placed flat, slightly behind and to the side of the hips with the fingers pointing forwards.

Start with arms up and finish with them up on return to feet.



E - Shape Jumps:

Tuck	
Straddle	
Pike	

PE

Vocabulary and Information

Heart Rate: how many times the heart pumps blood around the body over a set amount of time. Usually 1 minute

Recovery: the ability for the heart rate to return to its resting rate. The quicker the better

Exercise: an activity requiring physical effort

Muscular Strength: is the amount of force a muscle can produce in a single effort. A weight lifter or sprinter are examples of sports that require muscular strength

Muscular Endurance: to repeatably use the same muscle or group of muscles for an extended period of time. Running, cycling and rowing are some sports that require muscular endurance. How many different sports involve running?

Flexibility: how much a muscle or joint can move through its full range of motion. How far do your muscles stretch? Gymnasts and dancers require a lot of flexibility

Cardiovascular Fitness: being able to sustain physical activity and the ability to deliver oxygen to the working muscles. Long distance running, boxing and any sport that requires high intensity physical activity need cardiovascular fitness

Diet: the kinds of food and drink that you intake

Personal Challenges – Be The Best You Can BE!

Personal challenges are a great way to motivate yourself and provide a bit of competitiveness. The great thing is that it is purely about YOU! No one else. It doesn't matter how anyone else does. Have a go and set a score. Can you improve it to get a personal best? Even if it's only a small improvement.

Growth Mindset

Having a growth mindset is associated with having the fundamental belief that your abilities and outcomes are influenced by hard work

Lifestyle

A healthy active lifestyle is essential for physical and mental health and wellbeing. You should be physically active for at least 60 minutes a day. 30m in school, 30m at home #active60

Your diet is also important. A healthy diet involves eating from the 5 food groups: Carbohydrates, Protein, Fruit and Veg, Dairy (if applicable) and Fats

Short Term Effects

When you exercise you will experience some changes. Your heart rate and breathing will increase and you will breath heavier. You may start to get hot, sweaty and your face might go redder in colour. Some of your muscles will start to ache.

You will need to rest after exercise as there is a risk of injury without any rest!

Long Term Effects

During exercise the body systems respond immediately to provide energy for the muscles to work. After regular and repeated exercise, these systems adapt to become more efficient.

You may be able to run further and quicker. Heart rate lowers (resting and active). Increase your muscle strength, endurance and flexibility. Some muscles might become more visible and less body fat.

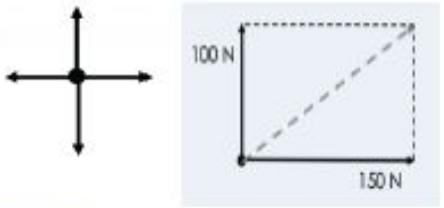
Circuits

Circuit training is a brilliant way to train in all aspects of your fitness. A circuit can be designed to train all during the same circuit or focus on a specific one such as flexibility. You can use a circuit to see how your heart rate changes after different kinds of exercise!

Science

Scalars and Vectors

1. **Scalars** are quantities which only have **size** (magnitude), such as distance, speed, mass and energy.
2. **Vectors** are quantities with **size** and **direction**, such as displacement, velocity, acceleration, force and weight.
3. **Resultant force** is a **vector** quantity
4. Forces acting in the same direction can be added together
5. Forces acting in opposite directions can be subtracted
6. Resultant forces can be **resolved** into their horizontal and vertical **components**



Newton's Laws

7. Newton's **Third** Law states that **every action has an equal and opposite reaction**
8. Newton's **First** Law states than an **object's motion will not change unless acted upon by an unbalanced force**
9. If the resultant force is 0 N a stationary object will remain stationary
10. If the resultant force is 0 N an object in motion will continue moving at the same velocity
11. If the resultant force is not 0 N a stationary object will accelerate in the direction of the resultant force
12. If the resultant force is not 0 N an object in motion will accelerate in the direction of the resultant force

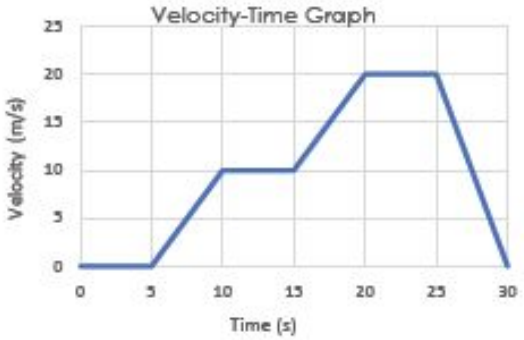
Acceleration

13. Acceleration is the **rate of change of velocity**
14. Change in velocity is calculated using final velocity minus initial velocity
15. Acceleration happens when there is **change in velocity (speeding up, slowing down or a change in direction)**
16. Negative acceleration (slowing down) can be called **deceleration**
17. The SI unit for acceleration is **m/s²**
18. An object moving in a circle is accelerating because it is constantly changing direction
19. Objects near Earth's surface experience gravitational acceleration of 9.8 m/s²
20. **Air resistance/drag increases with speed**

$$Acceleration = \frac{Change\ in\ velocity}{Time}$$

Velocity-Time Graphs

21. Velocity-time graphs can be used to describe motion
22. A **horizontal line** shows a **constant velocity**
23. A straight line with a **positive gradient** (slope) shows that an object has a **positive acceleration** (speeding up)
24. A straight line with a **negative gradient** (slope) shows that an object has a **negative acceleration/deceleration** (slowing down)
25. **Acceleration** can be calculated by calculating the **gradient**
26. **Distance** can be calculated from the **area under the graph**
27. A **curved** line shows that **acceleration** is **changing**



Biodiversity

1. Biodiversity is the **variety** of different species in an **ecosystem**
2. Biodiversity can be measured by using **sampling** techniques to count the **abundance** of different species
3. A quadrat is a piece of equipment (a frame) used to count the abundance of species

4. **Random** sampling is used to measure the abundance of a species in a particular habitat, using quadrats placed at random coordinates
5. **Systematic** sampling is used to measure the effect of a factor on the distribution of a species, using a **transect** with quadrats placed at regular intervals
6. High biodiversity makes an ecosystem **stable** because each species is not dependent on just one other

How Humans affect Biodiversity

7. Many human activities are **reducing biodiversity** on Earth
8. The global population is increasing, so more resources are needed and more **waste** is being produced
9. Pollution is caused when waste is not properly treated
10. Pollution can be very harmful to plants and animals and **reduce biodiversity**
11. Pollution does not always affect all species equally, as some may be more resistant
12. **Biodiversity** is reduced by humans using land for building, quarrying, farming and waste disposal
13. **Peat** from peat bogs is used for compost for gardens and farms, destroying habitats
14. Scientists and other citizens are using different methods to **counteract** some of the negative impacts of humans on biodiversity:
    - Protecting rare **habitats**
    - Maintaining **nature reserves**
    - **Breeding** programmes for endangered species
    - **Recycling** resources to reduce landfill waste
    - Reducing deforestation
    - Growing **hedgerows** on farms to allow more crops to grow

Global Warming

15. Levels of carbon dioxide and methane (**greenhouse gases**) in the atmosphere are increasing, contributing to global warming
16. Human activities contribute to greenhouse gas **emissions**, particularly the burning of **fossil fuels** in industry and transport
17. There are many **biological consequences** to global warming including:
    - Melting polar ice caps
    - Rising sea levels
    - Extreme weather patterns
    - Flooding
    - Loss of habitats
    -

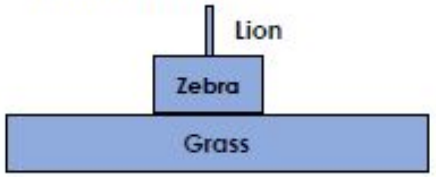
Human Waste

18. The increasing human **population** means that more resources are required and more waste is produced
19. More waste is also produced through the improved standard of living
20. If waste is not treated properly it results in pollution:
    - **Water pollution** is caused by poor sewage treatment and leaching of fertilisers
    - **Air pollution** is caused by smoke and acidic gases

- **Land pollution** is caused by landfill and toxic chemical waste

Pyramids of Biomass

21. Biomass is **lost** between **trophic levels** in a food chain
22. Producers (mostly plants and algae) transfer about 1% of the light energy they absorb for photosynthesis
23. Only approximately **10%** of biomass from each trophic level is **transferred** to the level above
24. Biomass is **lost** through waste (faeces, urine, sweat, gas) and through life processes such as **movement** and **thermoregulation**



Farming and Biotechnology

25. **Efficiency** of food production (between trophic levels) can be improved by **restricting** energy transfer from food animals to the environment
26. This includes **intensive** farming methods where movement of animals is limited and the temperature of their surroundings is controlled
27. Fish stocks in oceans are declining because of overfishing
28. Fish stocks need to remain at a high enough level for breeding to occur, to prevent the disappearance of some species
29. Fishing **quotas** are used to ensure that ocean fish stocks remain at a sufficient level and **net sizes** can be restricted to prevent juvenile fish being caught, so they can then have their own offspring
30. Modern **biotechnology** allows large quantities of **microorganisms** to be cultured for food
31. ***Fusarium*** fungus is used to produce mycoprotein (Quorn), a protein-rich food suitable for vegetarians
32. Fusarium is grown on glucose syrup in aerobic conditions before being harvested and purified
33. Genetically modified (GM) bacterium can be used to produce **insulin** to be harvested and purified to treat people with diabetes
34. **GM crops**, such as golden rice, can be used to provide increased nutritional value in areas where it is lacking

Food Security

35. Food security is having **enough food** to feed a **population**
36. Many factors can threaten food security:
    - Increasing **birth rate** means there is not enough food for the growing population
    - **Changing diets** in developed countries means that scarce food resources are being transported across the world
    - New **pests** and pathogens are affecting farming
    - Environmental changes, including **droughts**, which can lead to **famines**
    - Political instability and **conflicts** in some parts of the world threaten access to food and water
37. **Sustainable** methods must be found and used to feed Earth's population

Chemical reactions

1. **Chemical reactions** always involve the formation of one or more new substances.
2. Chemical reactions often involve a **temperature change**.
3. **Formulae** are used to show the elements bonded together in a compound e.g. H_2O contains 2 hydrogen atoms and one oxygen atom.
4. **Compounds** can only be separated into their **elements** by a chemical reaction
   a. e.g. $2H_2O \rightarrow 2H_2 + O_2$
5. In **chemical equations** the three **states of matter** are shown as:
   a. solid = (s); liquid = (l) and gas = (g)
   b. **aqueous solutions** are shown as (aq)
   c. e.g.
   d. $2Na(s) + 2H_2O(l) \rightarrow 2NaOH(aq) + H_2(g)$
6. An aqueous solution is a substance dissolved in water.

Relative formula mass

7. The **relative atomic mass** (A_r) is the average mass of the atoms of an element compared to the mass of carbon-12.

16
O
oxygen
8

8. The **relative formula mass** (**Mr**) of s substance is the sum of the A_r of all the atoms in the formula.
   a. e.g. What is the M_r of water (H_2O)?
   b. (A_r H = 1.0; O = 16.0)
   c. There are 2 x H and 1 x O in the formula
   d. (2 x 1.0) + (1 x 16.0) = 18.0
9. A_r and M_r have **no units** as they are relative masses.
10. In a balanced chemical equation:
    a. **sum M_r reactants = sum M_r products**
    b. e.g. $2H_2O_2 \rightarrow 2H_2O + O_2$
    c. *Mr* reactants = 2 x 34 = 68
    d. *Mr* products = (2 x 18) + 32 = 68
11. The percentage mass of an element in a compound can be calculated using the relative atomic mass and the relative formula mass.

$$\% \text{ by mass} = \frac{A_r \times \text{number of atoms in a compound}}{M_r \text{ of the compound}} \times 100$$

Conservation of mass and balancing equations

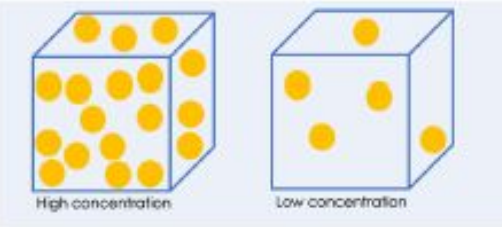
12. No atoms are lost or made during a chemical reaction.
13. **mass of products = mass of reactants**
14. Chemical reactions can be represented by symbol equations which are **balanced**.
15. This means the number of atoms of each element is balanced e.g.
16. $2Mg + O_2 \rightarrow 2MgO$
17. there are 2 magnesium atoms on each side of the equation.
18. Some reactions may appear to involve a change in mass, but this is normally because a reactant or a product is a **gas** e.g.
19. $Mg(s) + 2HCl(aq) \rightarrow MgCl_2(aq) + H_2(g)$
20. During the reaction hydrogen gas is produced. If the gas is free to leave the reaction container then the measured mass will decrease.

Uncertainty

21. Scientific uncertainty means there is a range of possible values within which the true value of a measurement lies.
22. Whenever a measurement is made, there is always some uncertainty about the result obtained.

Concentration

23. Many chemical reactions take place in solutions.



24. The more concentrated a solution the more particles it contains in a given volume.
25. The concentration of a solution can be measured in mass per given volume of solution e.g. grams per dm^3 (g/dm^3).
    a. $\frac{\text{mass of solute}}{\text{volume of solution}}$ = concentration
26. Volumes need to be in dm^3
27. 1 dm^3 = 1000 cm^3

Making soluble salts

28. Soluble substances dissolve in a solvent
29. Insoluble substances cannot dissolve in a solvent
30. Neutralisation reaction general equation is acid + base → salt + water
31. Metal + acid → salt + hydrogen
32. Metal oxide + acid → salt + water
33. Metal hydroxide + acid → salt + water
34. Metal carbonate + acid → salt + water + carbon dioxide
35. Soluble salts can be made from acids by reacting them with solid insoluble substances, such as metals, metal oxides, hydroxides, or carbonates.
36. The solid is added to the acid until no more reacts and the excess solid I filtered off to produce a solution of the salt.
37. Salt solutions can be crystallised to produce solid salts.
38. Copper oxide reacts with sulfuric acid solution to produce copper sulfate and water
39. This reaction can be represented with the equation $CuO(s) + H_2SO_4(aq) \rightarrow CuSO_4(aq) + H2O(l)$
40. Copper sulfate solution is a blue liquid
41. Copper sulfate crystals are blue

Spanish

Food and drinks

Food and drink

el agua (fem.)	water	*el bocadillo*	sandwich	*el pollo*	chicken
el agua mineral (fem.)	mineral water	*los entremeses*	hors d'oeuvres/ starters	*el queso*	cheese
el chicle	chewing gum	*el café*	coffee	*la receta*	recipe
el chocolate	chocolate	*el caramelo*	sweet	*la sal*	salt
el chorizo	Spanish sausage	*la carne*	meat	*la salchicha*	sausage
la chuleta	chop, cutlet	*la cerveza*	beer	*la salsa*	sauce
la ensalada	salad; lettuce	*la fruta*	fruit	*la sopa*	soup
la botella	bottle	*la galleta*	biscuit	*las tapas*	snacks
los mariscos	shellfish/seafood	*las gambas*	prawns	*la tarta*	flan/tart
la mermelada	jam	*el helado*	ice cream	*el tocino*	bacon
la mantequilla	butter	*la leche*	milk	*la tortilla española*	Spanish omelette
las legumbres	vegetables	*la lechuga*	lettuce	*la tortilla francesa*	omelette
las albóndigas	meatballs	*la mostaza*	mustard	*el azúcar*	sugar
los calamares	squid	*la nata*	cream	*el vino*	wine
el asado	roast; joint	*el pan*	bread	*el zumo/el jugo*	juice
las patatas fritas	chips/crisps	*el huevo*	egg	*el pescado*	fish
las verduras	green vegetables	*el pastel*	cake	*la bebida*	drink

¿Qué tipo de comida prefieres?	Prefiero la comida .... porque es ...
¿Cuál es tu plato preferido?	Mi plato preferido es ... porque me gusta ...
¿Te gusta cocinar?	No tengo tiempo para cocinar, pero me gustaría aprender ...
¿Qué piensas de los platos tradicionales?	Creo que es muy importante probar la comida regional ya que ...
Describe la última vez que fuiste a un restaurante.	El fin de semana pasado fui a .... comimos ... bebimos ...
¿Cómo sería tu cena ideal?	Sería ... comería ... bebería ...
¿Qué comida española te gustaría probar?	Me gustaría probar ... porque ...

La carta /el menú del día

Entrada	*De primero*
De Segundo	*De postre*
De beber	*Pescado/ Carne/ Verduras*

Ordering food in a restaurant

Quiero/Quisiera ...	¿Qué vas a tomar?	Y después ...	De postre...	De beber...
Voy a tomar...	De primero...	De Segundo...	¿y para ti?	Para mi...

Useful adjectives

asqueroso	disgusting	*sano/ saludable*	healthy
bueno	good	*salado*	salty
cremoso	creamy	*sabroso*	tasty
delicioso	delicious	*rico*	delicious
dulce	sweet	*refrescante*	refreshing
fresco	fresh	*picante*	spicy
grasiento	greasy	*malsano*	unhealthy
malo	bad		

To add extra emphasis to an adjective, add the ending ***-ísimo*** or ***-ísima*** after removing the final vowel, e.g. ***bueno → buenísimo***.

la comida rápida – fast food
la comida basura – junk food
la comida italiana/india/china/ mexicana – Italian/Indian/Chinese/ Mexican food

Cualquier is an adjective that means 'any' or 'any one' e.g. ***me gusta cualquier tipo de comida*** – I like any type of food.

Useful verbs

asar	to roast	*freir*	to fry
asar a la parilla	to grill	*merendar*	to have a snack
almorzar	to have lunch	*preparar*	to prepare
beber	to drink	*probar*	to taste/try
cenar	to have dinner	*saber (a)*	to taste (of)
cocinar	to cook	*servir*	to serve
comer	to eat	*tener hambre/ sed*	to be hungry/ thirsty
desayunar	to have breakfast	*tomar*	to take/have

Useful vocabulary

la vajilla	crockery	*la lata*	can	*la botella*	bottle
el vaso	glass; jar	*la olla*	pot	*la cocina*	kitchen
la cuchara	spoon	*la taza*	cup	*los comestibles*	groceries
el cuchillo	knife	*el horno*	oven	*los cubiertos*	cutlery
la ración	portion	*el tenedor*	fork	*el microondas*	microwave
el paquete	packet				

Spanish

Healthy diet

Useful verbs to talk about health

aconsejar	to advise	*emborracharse*	to get drunk
acostarse	to go to bed	*estar en forma*	to be fit
beber	to drink	*fumar*	to smoke
comer	to eat	*hacer daño*	to injure, harm
dormir	to sleep	*hacerse socio de*	to become a member of, to join
drogarse	to take drugs	*mantenerse en forma*	to keep fit

¿Llevas una vida sana?	Llevo una vida bastante sana porque ...
¿Qué haces para mantenerte en forma?	Hoy en día intento hacer ejercicio regularmente, por ejemplo ...
¿Cuáles son los beneficios de practicar el deporte?	Para mí, lo bueno es que... la actividad física es muy importante para la salud porque ...
¿Prefieres el deporte de equipo o individual?	Hay muchos beneficios de los deportes en equipo, por ejemplo ...
¿Hay un deporte que te gustaría probar?	No he probado ... me gustaría aprender a ...
¿Qué hiciste ayer para mantenerte en forma?	Ayer, jugué ... hice ... fui ...
¿Qué comida sana vas a comer mañana?	Mañana, voy a comer/comeré ... voy a beber/ beberé ...
¿Cómo podrías mejorar tu estilo de vida?	Debería beber mas agua y necesito acostarme más temprano. Además, me gustaría ...

Useful verbs to talk about sport

andar/caminar	to walk
bailar	to dance
correr	to run
escalar	to climb
esquiar	to ski
ganar	to win
hacer	to do
ir al gimnasio	to go to the gym
jugar	to play
marcar (un gol)	to score (a goal)
montar a caballo/en bici	to go horse riding/ cycling
nadar	to swim
participar	to participate
patinar	to skate
practicar	to practise/do/ take part in a sport
perder	to lose

Health vocabulary

los consejos	advice
una dieta equilibrada	a balanced diet
las drogas blandas/duras	soft/hard drugs
el ejercicio físico	physical exercise
el fumador	smoker
la salud	health
el ejercicio	exercise
el abuso del alcohol	alcohol abuse
una dieta malsana	an unhealthy diet
la drogadicción	drug addiction
el estrés	stress
la falta de ejercicio	lack of exercise
la obesidad	obesity
el riesgo	the risk
el sobrepeso	being overweight/obesity
el tabaquismo	addiction to tobacco
el dolor de cabeza/garganta	headache/ sore throat
la fiebre	fever, temperature
la enfermedad	illness

En el pasado no era una persona muy activa	In the past, I wasn't a very active person.
La actividad física es muy importante para la salud	Physical activity is very important for your health.
Es importante tener una dieta equilibrada	It's important to have a balanced diet.
Comer sano ayuda a reducir el riesgo de enfermedades	Eating healthily helps to reduce the risk of illnesses.

Talking about health and fitness in the past, present and future

Past	Present	Future
Ayer/la semana pasada/el año pasado/ en el pasado	***Ahora/hoy/ todos los días/ normalmente***	***Mañana/la semana que viene/ el año próximo/en el futuro***
fui ... jugué ... hice ... practiqué ... comí ... bebí ...	*voy ... juego ... hago ... practico ... como ... bebo ...*	*Voy a ir/jugar/hacer/ practicar/ comer/beber iré ...jugaré ... haré ... practicaré ... comeré ... beberé ....*

Saying how often you do something

a menudo	often
a veces	sometimes
diariamente	daily
nunca	never
siempre	always
regularmente	regularly
de vez en cuando	from time to time/once in a while
todos los días/cada día	every day
raramente	rarely
dos veces a la semana	twice a week
cada semana	every week