Year 9 Cycle 1

Knowledge Organisers

Contents

Design and Technology Vocabulary

Aesthetics	The study of the shape or form of every day products; as in … "That product is aesthetically pleasing"
Analysis	Looking in detail at the design problem, what the problem involves what needs to be looked at (researched), and who needs to be consulted for advice.
Anthropometrics	The measurements of humans, e.g. heights, arms / leg lengths, hand widths, head sizes, or similar.
Batch Production	The production of products in 'batches'. E.g. batches of different types of bread products …brown then white bread … large and then small loaves, etc. batches of red china mugs, then blue ones, etc. A batch of benches for a park, or a batch of children's seating for a McDonalds restaurant.
BSI	British Standards Institute has responsibility of devising standards that particular products must meet, for a variety of reasons. For example toys must be tested to BS EN 71, for safety reasons. The full definition is at http://www.bsieducation.org/Education/14-19/default.shtml
CAD	Computer software that helps the designer to create designs, plan, technical drawings and 3-D images of the design being explored.
CAM	Computer software programs and Computer Numeric Control (CNC) machinery, such as a milling machine lathe or vinyl cutter machine, that allows CAD produced designs to be made by the CAM machinery.
Compressive strength	The ability to resist a pressing force, e.g. concrete or cast iron.
Conductivity (Electricity)	The ability of a material to conduct electricity e.g. copper, aluminium, gold.
Conductivity (Heat)	The ability of a material to conduct / transmit heat, e.g. copper.
Corrosion	The tendency of a material to rust (iron/steel) or corrode (aluminium)
Corrosion Resistance	The ability for a material to resist corrosion / discolouring /rotting, e.g. copper, lead, gold, silver.

Design and Technology Vocabulary

DTP (Desk Top Publishing)	Computer software that is designed for producing leaflets, booklets and text-based documents.
Ductility	The ability of a material to be drawn / stretched pulled into thin strands, e.g., copper electrical cables.
Durability	The ability of a material or product to last a long time. The ability to do its job for a long period.
End User	A person who uses the product for its intended purpose, but may not have bought it.
Ergonomics	The study of 'Man in his Environment', e.g. work space, activity space, sitting, working heights or similar.
Flexibility	The ability of a material to bend and change shape, without cracking or breaking.
Gantt Chart	A method of planning that places tasks down the left hand side of the page and dates across the top, to enable you to see what needs to be done by when.
Malleability	The ability of a material to be bent, shaped, hollowed, etc. into a complex shape, e.g. steel sheets pressed into car body panels or copper sheet shaped into hot water cylinders.
Media	The general term for paper, card, paint, printer print-outs and other materials that are used in producing design work and products (mainly in Graphic Products).
Manufacturer	A person or company that will make the product.(See also One OFF production, Batch Production and Mass Production)
Market Research	The process of finding out what customers require from a product, e.g. questionnaires and interviews.
Mass Production	The continuous production on one product: e.g. motor cars, TVs, aluminium cans, plastic vending beakers, etc. The product may be produced around the clock and once it has commenced, the (sometimes automated?) machinery is made maximum use of.
Model	An attempt to build a version of your design to see if it works, if it is the right size or if it looks good. This could be done using CAD.

Design and Technology Vocabulary

One-off production	The design and manufacture of one product only, e.g. a sculpture for a shopping centre or a signboard for a shop front.
Patent	A form of Intellectual Property Protection that applies to the function of a newly invented product.
Pattern	(See Template)
PCB	Printed Circuit Board
Planning	The process of sorting out how the design work will be done, how the product will be made, which processes get done first and the time needed for all of these activities.
Plasticity	The ability to change shape, to deform or to mould. (Similar to malleability).
Product Designer	A person who designs the overall shape and appearance of a product and concerns themselves with the aesthetics of the product, shape size, form etc.
Product Life	The period of time that a product is designed to last. (Related to planned obsolescence).
Prototype	The first model made to decide if the design works, if it is the right size, comfortable, safe, attractive or suited to the user's needs. This allows changes to be made, before the final version is made.
Quality Assurance	The guarantee a company can give that their product will be reliable based upon the reliability of the tests carried out when the product was made.

Design and Technology Vocabulary

Quality Control	Individual tests carried out to check the product is being assembled correctly during production.
Questionnaire	A list of questions that are given to potential customers to find out their needs and preferences.
Recycle	Recycling involves processing used materials into new products in order to prevent waste.
Reduce	Reduce everything about the product. Reduce the size of the product making it less of an impact on the environment. Reduce the energy consumption when making the product. Reduce the number of batteries in the product.
Refuse	Refuse to use certain materials because they are not sustainable. Refuse to buy products that are not made ethically. Refuse to make products that are not sustainable.
Registered Design	A form of Intellectual Property Protection that applies to the outward appearance of a product. For example the glass coke bottle design was registered in 1937. Design registration lasts up to 25yrs.
Repair	Repair the product, don't throw it away. Graphics – facelift. Systems – fix it. Design for disassembly so parts are not thrown away.
Research	Gathering information to help with design work. The process of looking at existing ideas, designs and listing good and bad features. Gathering other information that will assist with design work.
Retailer	A person who sells products through shops directly to consumers.
Rethink	Designing products by "re-thinking" about the needs and wants for the product. Is the product REALLY needed? Is the product ONLY wanted, but not needed. Re-thinking the types of material to make the product.
Reuse	Reuse the product when it has come to end of its lifecycle. Reuse food. Rechargeable batteries. Reuse textiles. Reuse containers. Reuse the product in some way. Don't throw it away

Design and Technology Vocabulary

Rigidity	To make a product or structure stiff and resist deformation
Six Rs of Sustainability	Sustainability canbe refined down into 6 'R's those being 'Refuse', Rethink, Repair, Reduce, Reuse, Recyle.
Shelf life	The period of time a product remains safe to sell and / or safe to eat.
Smart Material	Smart materials are materials that have one or more property that can be significantly altered in a controlled fashion by external stimuli, such as stress, temperature, moisture, pH, electric or magnetic fields. E.g. Nitinol Wire, Thermochromic pigments, Thermochromic film.
Star diagram	A diagram that compares the good and bad features of a product.
Stiffness	(See Rigidity)
Strength	The ability of a material to resist pressure / loads.
Sustainable Design	Designing a product using the philosophy of RETHINK, REFUSE, REDUCE, REUSE, REPAIR, RECYCLE in order to reduce the use of energy and environmental impact of products. (each is defined in this glossary)
Target Group	When producing new products, the likely purchaser or user's needs and preferences are considered by the designer and manufacturer.
Template	A paper or card cut-out showing the shape of a product. Used to improve / finalise a shape and to transfer it to the chosen manufacturing material.
Tensile strength	The ability to resist a pulling force, e.g. a tow rope or lift cable.
Testing	The process of trying out a product to see if it does it's job or to see if it is strong enough or durable enough.
Toughness	Similar to durability. The ability to withstand repeated force, impact and rough use.

Homework 1 https://forms.office.com/e/tLFBcFh2p8

Nutrition recall

Balanced diet definition: Eating a wide variety of foods in the right proportions, and the right amount of food and drink to achieve and maintain a healthy body weight.

8 tips for a healthy diet

1. Base your meals on higher fibre starchy carbohydrates.
2. Eat lots of fruit and veg.
3. Eat more fish, including a portion of oily fish.
4. Cut down on saturated fat and sugar.
5. Eat less salt: no more than 6g a day for adults.
6. Get active and be a healthy weight.
7. Do not get thirsty.
8. Do not skip breakfast.

VITAMINS AND THEIR FUNCTIONS

	Function (what does it do?)	Source (foods found in)
A	• Healthy skin • Helps us see in the dark	• Animals – liver and milk • Plants – carrots and red peppers
B	• Releases energy from food	• Bread, fish, broccoli, liver, milk, peas, rice
C	• Keeps connective tissue healthy • Helps absorb iron	• Oranges, blackcurrants, broccoli, red and green peppers
D	• Helps the body absorb calcium	• Butter, eggs, milk, oily fish

MINERALS AND THEIR FUNCTIONS

	Function (what does it do?)	Source (foods found in)
Calcium	Build strong bones and teeth	Yoghurt, cheese, milk, tofu
Sodium (salt)	Keeps the correct water balance in the body	Cheese, ready meals, salted nuts, bacon
Iron	Keeps red blood cells healthy	Dark green vegetables, beans, fish, egg yolk, red meat

Questions:

1. What should we cut down on eating too much of?
2. Which vitamin helps the body absorb calcium?
3. Which vitamin helps the body absorb iron?

Homework 2 https://forms.office.com/e/TfRLhqkKWw

Diet, nutrition & Health

Over vs under-nutrition

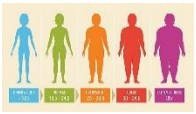
Over-nutrition – eating too much food, or too much of a certain food.
Under-nutrition - eating too little food or too little of a particular nutrient

Definitions:

- Obesity, or being obese, means being very overweight.
- Cardiovascular disease covers a group of diseases, including diseases of the heart and blood vessels.
- CHD (coronary heart disease) occurs when blood vessels to the heart become blocked with fatty deposits.
- Type 2 diabetes is the most common type of diabetes in the UK. It causes the sugar in the blood to get too high.

The main health problems linked to obesity?

- Type 2 diabetes
- Coronary heart disease
- Stroke
- Cancers
- Arthritis
- Depression



The main the risk factors are for CHD

- High blood pressure
- Smoking
- High cholesterol
- Diabetes
- Not exercising enough
- Being overweight or obese
- DNA
- Ethnic background

The signs of type 2 diabetes

- Feeling tired all the time
- Feeling thirsty
- Passing more urine than normal

Normal

Blocked

Questions:

1. What are the main health problems associated with obesity?
2. What is coronary heart disease? Explain
3. What is the difference between type 1 and 2 diabetes?
4. How can you treat type 2 diabetes?

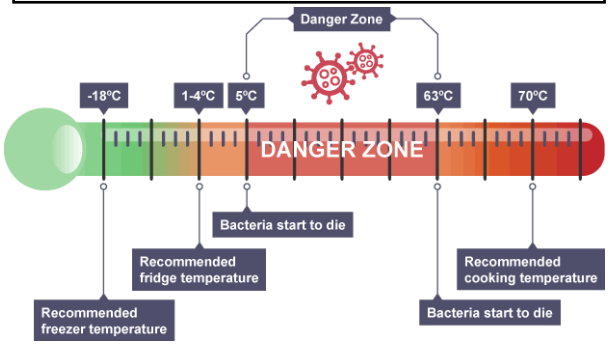
Homework 3 https://forms.office.com/e/ChZMtFxpu0

Food Poisoning bacteria, symptoms and causes

Food safety advice when handling food:

How do bacteria grow?

Bacteria double every 10-20 minutes in the right conditions (asexual) e.g. 1 becomes 2, then 4, then 8 …… through binary fission



Definitions:

- Food poisoning is an illness caused by eating contaminated food. It's not usually serious and most people get better within a few days without treatment. In most cases, food is contaminated by bacteria.
- High-risk foods: ready-to-eat foods high in moisture and protein

Food poisoning bacteria and symptoms

Name of bacteria	Foods it can come from
Salmonella	Undercooked poultry Eggs Unpasteurised milk
Listeria	Soft cheeses, pate
Campylobacter	Poultry, milk and milk products
E-coli	Undercooked meat – especially burge Unwashed contaminated fruit

Symptoms of food poisoning:

- Vomiting
- Diarrhoea
- Nausea
- Stomach pains
- Dehydration

Questions:

1. What are the 5 main things that bacteria need to grow?
2. What are the main symptoms of food poisoning?
3. How could you control or stop bacterial growth?

Homework 4 https://forms.office.com/e/6M8QazRs50

Seasonality and food waste

Some foods are seasonal. This means that they are only available and grown at certain times of the year.

How is food wasted?

There are 2 main reasons we waste food at home:

1. We make too much
2. We don't use food before it goes off

Using leftovers

You could use leftover food to make another dish such as:

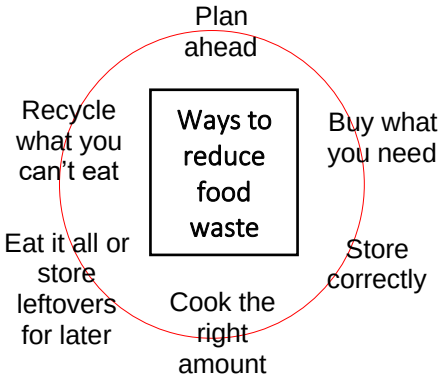
- Rice and pasta in salads
- Bread for breadcrumbs. Used to coat fishcakes, chicken goujons
- Potatoes used for bubble and squeak or frittata
- Chicken used in chicken curry or pie

Advantages of seasonal foods

- More likely to be grown in the UK
- Reduced food miles and carbon footprint
- Supports local businesses
- Can be fresher than buying out of season
- More available which makes them cheaper

Disadvantages of seasonal foods

- They can be used a lot during some seasons which means people could become bored of them
- There can be too much of some foods that will be wasted if they are not eaten



Questions:

1. What does 'seasonal' mean?
2. Give 2 advantages and 2 disadvantages of seasonal foods
3. What are the 4 seasons in the UK?
4. Create a meal that could be made using leftovers from a roast chicken dinner.

Mark Wheeller (Knowledge Organiser)

About the Playwright — Mark Wheeller started his career as a **Secondary School Drama Teacher** and is now a **full time playwright** and part time **Artistic Director for the Romsey School Community Youth Theatre.**

Although Mark's name is not well-known outside schools and colleges, he is one of the most-performed playwrights in Britain. **Too Much Punch For Judy** (about the dangers of drink driving) has been performed over **6,000** times. **Hard to Swallow** based on Catherine Dunbar's battle with anorexia is now a GCSE set text alongside world renowned playwrights William Shakespeare and Bertolt Brecht. His most recent play **I Love You, Mum—I Promise I Won't Die** focuses on teenage drug use (in particular MDMA/Ecstasy).

Documentary Theatre

Most of Mark's plays are based on **true stories** and can be categorised as **Documentary Theatre or Docu-Drama.** This is a style/genre of *theatre* making where ***documentary material*** such as **interviews, reports, media material and transcripts** are used as the **primary** source for the script.

In the case of **Hard to Swallow** Mark used **Maureen Dunbar's book 'Catherine'** as the basis for the play alongside **interviews** with Maureen and Catherine's actual **diaries** to create the script.

His plays could also be categorised as **'Theatre in Education'** as they often have a clear **target audience** and strong **educational message.**

Key Terminology

Physical Theatre — A style of theatre where movement and music is equal or more important than dialogue when telling a story. Mark Wheeller's plays include Car Crashes, Fairground Rides, Burning Buildings and Rooftop Plunges. Wheeller encourages these moments to be as physical and creative as possible.

Body Props — An element of Physical Theatre where actors use their bodies to become any required props or set in a performance.

Precis Theatre/Two Touch Theatre — A device where a sentence is condensed into just one or two words.

Sound Collage — Actors layer their voices (words or sounds) to suggest a mood, location or atmosphere.

Direct Address — When performers talk directly to the audience.

Monologue — An uninterrupted speech by an actor.

Multi-roling— When an actor plays more than one role in a play.

Split Stage — When the stage is divided and two scenes take place at the same time.

Chorus — A group of actors working together using vocal and movement skills to communicate thoughts, feelings and ideas.

Areas of the Stage

Crossover

Wings	**Upstage Right**	**Upstage Centre**	**Upstage Left**
	Centre Stage Right	**Centre Stage**	**Centre Stage Left**
	Downstage Right	**Downstage Centre**	**Downstage Left**

Audience

Raked Stage/Seating

Older theatres used a sloping or **Raked Stage** to improve the view for the audience.

Modern theatres use **Raked Seating** for the same reason.

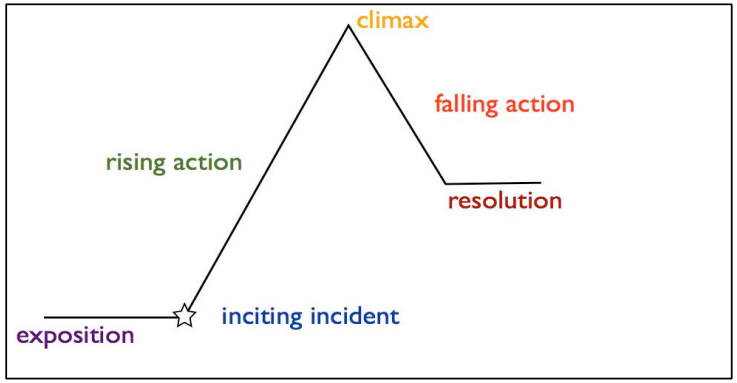
Year 9 English – Narrative Writing: Structure

Structure is the arrangement or organisation of ideas within a whole text; how different parts of something are put together.

Writers structure their writing to engage the reader and to achieve their desired effect. Explore the different effects various structural devices can have in the table below.

Key Words: Structure		
Method	Definition	General Effect:
cyclical structure	When the ending of the text reflects the beginning	shows how much a character and their situation have (or haven't) changed
contrast	The presentation of things that are opposite to each other	highlights the difference between two things
chronological	In time order (e.g. chronological story structure = told in the order in which it happened)	allows the reader to follow the events of a story as they are experienced by the character; aids empathy
flashback	When a story goes back to a moment in the character's past	allows the reader access to significant events in the character's past
links back	When an idea in a text reminds us of something that we read earlier in the piece	helps us to notice how ideas have changed or developed
foreshadow	To hint at something that will (or might) happen later in the text	creates intrigue as we want to know whether our predictions are correct.
repetition	Using a significant word, phrase or idea on multiple occasions	makes a word / idea stand out: it will usually be significant

Freytag's Pyramid: A simple, narrative structure



Extension and revision: additional structural methods for narrative writing		
Method	Definition	General effect
establish	o set up or introduce a topic / setting / character at the beginning.	introduces the reader to the setting / character / mood of the text
develop	To build up details about a topic / setting / character within a text	gives the reader more information about important aspects of the text
zoom in	To move from a broad, general description to focus on a more specific area	focuses the reader in on significant details – makes them important
zoom out	To move from a small focus area to a broader, more general description	allows the reader to see the wider context of characters / events
external action / description	Description of things that are happening in the outside world of the character; things that a person in the character's world would be able to perceive.	allows us to see what a character's world is like and what is happening
internal thoughts	Access to the character's inner personal thoughts and feelings; being metaphorically 'in the character's head'.	creates a personal tone; helps us to understand the character's thoughts and feelings; guides our response to the character
dual perspective	A story told from two different narrative viewpoints / two different characters' experiences.	gives alternative viewpoints; can allow us to view events going on in different places / at different points in time

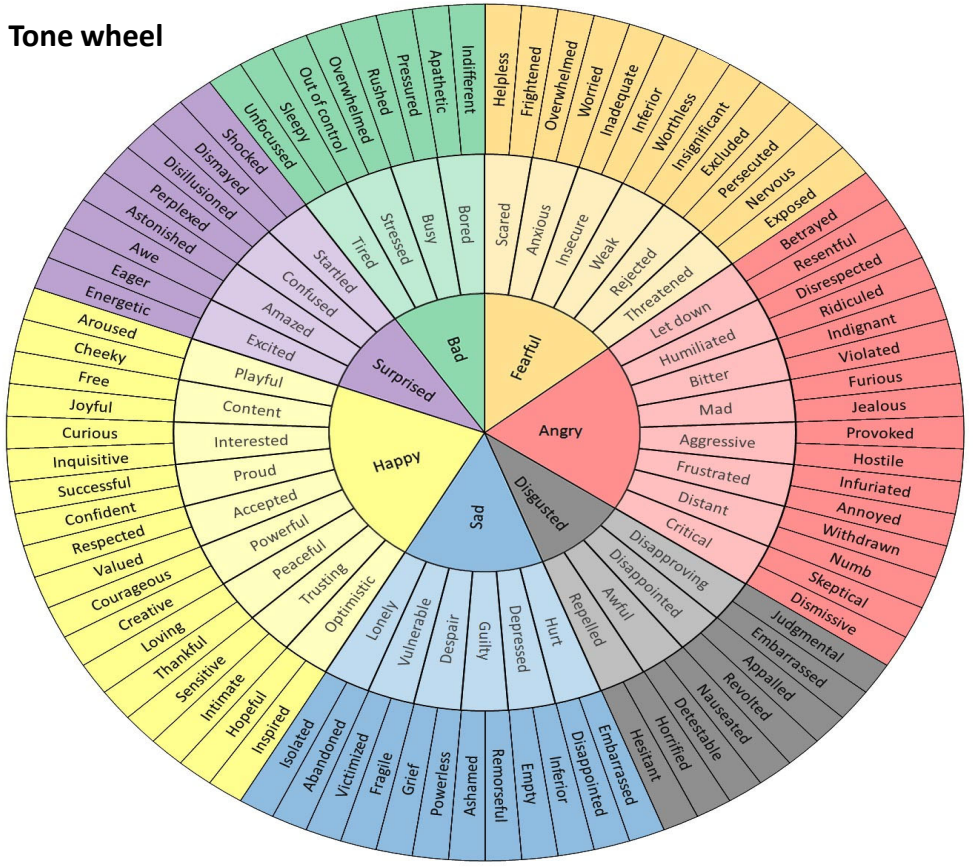
Year 9 English – Narrative Writing: Language

A **narrative** is a story; a spoken or written account of events.
Short stories are even shorter than novellas (like Animal Farm) — just as their name implies. They're **complete** narratives **focused** around a core event or ideas

Key language methods to help craft your narrative writing			
Method	Definition	General Effect:	Example
semantic field	A group of words that belong to the same topic area / theme.	Used to highlight or develop a key theme or atmosphere	Overheard, the **army** of clouds **massed** as they prepared to **attack**. Each **battalion** edged closer and closer – ready for **battle**.
short sentence	A sentence with a limited number of words (often fewer than 5 words).	Highlights a significant idea or event within the text.	It was over. It had ended.
sensory imagery	The use of language that helps a reader to imagine sights, sounds, tastes, smells and textures. Sensory imagery may include descriptions of one or more of these senses.	Many writers use **sensory imagery** to help their readers to imagine the setting of their story.	It was **too hot. Too bright.** The **smell of donuts** wafted over the bright courtyard. The **sound of laughter** heard of the busy road.
immersive description	The writer uses precise descriptive details	To help the reader to imagine that they are within the world of the story and almost experience the world that they are reading about.	It was too hot. Too bright. The white walls of the veranda glared stridently in the sun. The bougainvillea hung about it, purple and magenta, in livid balloons.

Tone: The mood created by the author's language choices; the way the text makes us feel.

Tone wheel



Year 9 English – Narrative Writing: Language

Extension and Revision: Language methods			
Method	Definition	General Effect:	Example
imagery	A general term for descriptive language that helps the reader to *imagine* something that is being written about.	Enables the reader to create a mental picture of a situation, particularly an unfamiliar one or one created by the writer in fiction.	The snowflake danced to the ground as the view turned a pearly white before his eyes.
metaphor	A form of imagery where one thing is described as *being* something else.	Allows the reader to create a vivid mental picture; can convey emotions through implication.	**The lake was glass** in the moonlight.
simile	A form of imagery where one thing is described as being similar to something else, using the words 'like' or 'as'	Allows the reader to create a vivid mental picture, often by comparing something new with something more familiar.	She crept towards the doorway – **as quiet as a mouse.**
personification	A form of imagery where a non-living object is described using human actions, features or emotions.	Allows the writer to assign emotions to the object; often helps to develop atmosphere.	**The sofa hugged the weary traveller** – comforting them after their terrible journey.
colour imagery	Use of colours to form part of the description.	Can allow the writer to use connotations of the colours to develop meanings.	The **green blue** translucent sea.
adjectives	Words that describe what a person, place, thing or emotion is like.	Enables the reader to develop a vivid mental picture. Look for connotations.	The **iridescent** lake glistened in the **wintery**, but yet **warming**, sunlight.
verbs	Words that name actions or states of being. Every sententence must contain at least one.	Think about the connotations of the verbs used.	Lenny **slashed** at Curley with his fists.

Geography Knowledge Organiser

Year	9	Cycle	1	Topic	Superpowers

(If you cannot access the QR code, ask your teacher to share the folder with your school email)

Ready to test your key term knowledge? Scan this QR code to access Quizlet

Subject vocabulary

Globalisation	The process whereby places become interconnected (linked to each other) by trade and culture.
Containerisation	Is a system of standardized transport that use a common size of a steel container to transport goods. These can be easily transferred between different modes of transport.
Transnational corporations (TNCs)	TNCs or multinational corporations (MNCs) are companies that operate in more than one country. They often have factories in countries that are not as economically developed because labour is cheaper. Offices and headquarters tend to be located in HICs.
A superpower	A superpower is an extremely powerful country, especially one capable of influencing international events and the acts and policies of less powerful countries. It's power can be felt all over the world.
Geopolitics	Geopolitics is the study of the effects of Earth's geography (human and physical) on politics and international relations. Geopolitics focuses on political power linked to geographic space.
Colonialism	The act of one nation controlling another for economic gain. An example of colonialism was England's control over India.
Cultural imperialism	The practice of promoting and imposing a culture, usually that of a politically powerful nation, over a less powerful society.
Unipolar world system	Where most of the world region's economic, social, cultural aspects are influenced by a single state/country.
Bipolar world system	A system of world order in which the majority of global economic, military and cultural influence is held between two states.
Multipolar world system	Power is distributed at least among 3 significant poles (countries).
Contested	In competition for a position of power
Sovereignty	The authority of a state to govern itself
Exclusive economic zone (EEZ)	An area of the ocean, typically 200 nautical miles (230 miles) beyond a nation's territorial sea, within which a coastal nation has control over both living and non-living resources.
Fast fashion	Inexpensive clothing produced rapidly by mass-market retailers in response to the latest trends.
Inter-governmental organisation (IGO)	These are international groups, made up of a number of different countries who play a large part in the making of international laws.
Global shift	An increase in the proportion of global manufacturing carried out in NEEs and LICs. This has been achieved through better technology and transport.
Consumerism	Refers to the theory that spending money and consuming goods is good for the economy and a person's happiness.
Neo-colonialism	The practice of using capitalism, globalisation, cultural imperialism, and conditional aid to influence a developing country instead of the previous colonial methods of direct military control or indirect political control.
Global commons	Resource domains or areas that lie outside of the political reach of any one nation state. It is a term used to describe supra-national 'spaces' in which common shared resources can be found.

Lesson content

1. Globalisation	This lesson introduces the term 'globalisation'. This is a multi-layered word, emphasising how the world is becoming more interconnected in social, economic, cultural and political elements. The use of more sophisticated technology and transport has meant that industry has relocated in NEEs and LICs to reduce production costs. An example of Apple's iPhone is used to convey this. Lastly, the humble 'container' is heralded as a turning point in global trade- enabling a universal mode of transport for goods, making global trade more efficient and effective.
2. Flip flops journey	We map and describe the journey of a pair of flip flops, from extraction of raw materials to the end product. This emphasises the interdependence of countries through a supply chain of a product. This lesson enables us to see the 'dark side' of globalisation- through the sheer inequalities existing in multiple countries.
3. What is a superpower	A superpower country is identified as 'an extremely powerful country, especially one capable of influencing international events and the acts and policies of less powerful countries'. We identify the most important factors that enable a country to be classed as a superpower: Resources, large population, geographical land mass, cultural (soft) power, military strength and a strong economy. We learn how different countries have been able to exploit one or more of these traits to gain superpower status.
4. The rise and fall of of the British Empire	To be able to understand the current and future trend of superpower geography (geopolitics), we must first understand the past; we look at how Britain's Empire was once the only 'superpower' (through a strong navy and technological superiority) and the events that led to the collapse of it. We take note of an event called the Suez-crisis in Egypt, that marked an ideological demise of Britain being the 'top dog', and the USA emerging in the ashes as a global superpower.
5. Emerging superpowers	In a multi-polar world system, a number of countries are emerging and gaining power and influence. We look at the BRIC nations (Brazil, Russia, India and China) as emerging economies. We calculate % changes in GNI and population size, and consider other social measures over the last 35 years to determine which of the BRIC nations has gained the most influence. We then look at the 'new kids on the block' – the MINT nations (Mexico, Indonesia, Turkey and Nigeria) as upcoming countries with a global significance.
6. South China Sea	The South China Sea is a contested space; we identify that multiple country's EEZs overlap in this area, causing friction when exploiting the sea. It is an important sea for world trade, fishing grounds and resources, but China claim to have a historic claim to the majority of the area called the '9 dash line'. We then suggest what will happen in the future, especially as tensions rise. If time allows, a 'South China Sea' simulation game will be played, and help you understand how the less powerful nations struggle in their dispute against China.
7. Global fashion industry	We are all consumers in the global fashion industry, but very little know that it is ranks second as a polluter of water sources globally. We look into a mystery of 'why is Rahman missing three months of school' to identify the social and environmental consequences of the cotton industry in Uzbekistan. One of the most devastating effects is the shrinking of the Aral Sea, as cotton requires a lot of water to grow.
Mid cycle assessment	
8. Inter-governmental organisations	Intergovernmental organisations have emerged as mediators, platforms to discuss and respond to world issues, and to hold countries accountable for their actions on the world stage. We look at examples of IGO in areas of: security, trade, the environment, economics and health. The United Nations and the IMF are the most well known examples of IGOs. A simulation game will then be played; there is crisis at the border between two countries, West Reeson and Oatenland. Can you make the appropriate decisions based on field intelligence to secure peace in the region?
9. China: the workshop of the world?	We have all seen 'Made in China' written on various items, but what led to China's exponential industrial growth? We identify 9 key factors responsible for its growth and rank them based on available evidence. We then look at the 'Foxconn Factory' in Shenzhen, which produce many electronic devices (including iPhones) as the 'dark side' of this growth. Lastly, we consider China's global shift (manufacturing industries locating somewhere else in the world where it is cheaper) as middle classes emerge from society in China, demanding better pay, working conditions and are also key consumers in society.
10. China in Laos	China has been accused of taking advantage of the country of Laos, through the medium of 'neo-colonialism'. You will be given three pieces of evidence based on this charge, it is your job to think critically about each source of evidence. Will you find China guilty or innocent?
11. India's space race	We begin this lesson by identifying the key human and physical features of India. We then start an enquiry into 'why is India in a race for space?'. Many are unaware of India's space programme. Perhaps because it is very controversial (lots of disagreements); the $70 million budget for the programme is quite low compared to other countries, but do the benefits of this outweigh the fact that nearly a quarter of its population live below its official poverty limit?
12. The American dream?	America came out of the cold war bipolar world order as the champion superpower, but is it still living the American dream? We examine the 'building blocks' of superpower status (Economic, military, geographical and cultural base) to determine whether the USA is still the 'top dog'
13. Russia- the fossil fuel superpower	Russia, the largest country in the word, a variety of biomes and many ethnic groups, but quite a low population comparatively. So how did it become a powerful nation? It has great stores of oil and gas, meaning some countries are dependent on Russia for their energy security. We use cartographic techniques to create a choropleth map to show which countries import the most of their oil/gas from Russia, and proportional arrows to show the top 10 importers.
14. Russia in the Arctic	Why did Russia plant their flag on the sea bed of the north pole? This lesson identifies the tensions over territory and resources in the Arctic, but also identifies the negative impact on the environment, animals and indigenous people as a result of exploiting Arctic regions.
15. Who owns Antarctica?	We begin this lesson with more cartographic techniques; we map the continent of Antarctica, identify its key features and create a cross section based on the relief across its major mountain range. We identify Antarctica as a global common, which must be used in a **sustainable** manner. We examine the Antarctic treaty as a way of maintaining this exceptional place. But what will the future entail for Antarctica, as supplies of fossil fuels decline?

Key concepts

Place — A space or location with meaning. Different cultures and people have different perspectives on place.

Inequality — This means unequal. This normally is applied in human geography when looking at development, migration and resources.

Inter-dependence — When two ore more components rely on each other. Often referred to as a web of connections.

Sustainability — Meeting our needs today without compromising future generations to meet their own needs.

Knowledge Organiser – Year 9 Cycle 1a – Women's Rights Movement

Key events

Date	Event
1897	**NUWSS** formed. **Millicent Fawcett** is leader.
1903	**WSPU** is formed by **Emmeline Pankhurst** and daughters.
1905	**Militant** campaign begins – Christabel Pankhurst and Annie Kenney arrested
1909	**Hunger strike** and **force feeding** starts – Marian Wallace Dunlop becomes the first hunger striker.
18th Nov 1910	Black Friday – A protest march in London is met with violence by police. 150 women are physically and sexually assaulted.
1913	**Militant** bomb and **arson** campaigns and increasing arrests which results in the passing of the **'Cat and Mouse Act'**, under which **hunger strike**rs were temporarily released then rearrested to prevent them dying in police custody
1913	**Emily Wilding Davison** attempts to pin a **Suffragette** scarf onto the King's Horse at the Derby. She is struck by the horse and dies four days later.
1914	World War 1 starts – **Suffragette** leaders urge women to join the war effort. **NUWSS** continues to campaign for recognition for their work.
1918	The **Representation of the People Act** is passed, allowing men over 21 and women over 30 to vote.

Key terms

Key Word	Definition
arson	Deliberately setting fire to property to try to cause extensive damage.
Cat and Mouse Act 1913	Permitted suffragettes on **hunger strike** to be released but re-arrested once well again to complete their sentences.
franchise	The right to vote.
force feeding	Imprisoned suffragettes on **hunger strike** were sometimes force fed. A rubber tube was inserted into the throat or nose and liquidised food being poured in.
hunger strike	Refusing to eat as a form of protest. Usually done in prison.
martyr	Someone who dies or suffers for their cause.
militant	To hold extreme views. Use aggressive or violent behaviour to achieve your aims.
NUWSS	The National Union of Women's **Suffrage** Societies (NUWSS) - formed in 1897 and brought together many smaller organisations. Believed in peaceful protest.
petition	A formal written request or application, especially one signed by many people, to a particular individual or group, for example, a government.
Representation of the People Act 1918	A law which granted the vote to women over 30 who were also householders, the wives of householders, owners of property worth over £5 or university graduates. The Act also granted the **franchise** to all men over the age of 21.
suffrage	The right to vote in political elections.
suffragette	A campaigner for women's **suffrage** willing to use violence or break the law.
suffragist	A campaigner for women's **suffrage** who believed in peaceful and legal methods of campaigning.
WSPU	Women's Social and Political Union a more **militant** group of women's rights protestors. Formed by **Emmeline Pankhurst.** 'Deeds not Words' was their slogan.

Key People

Emmeline Pankhurst – WSPU

Led the WSPU from October 1903. Took more **militant** action such as windows smashing, **arson** and **hunger strikes**. Arrested numerous times, went on **hunger strike** and was force fed. Died in 1928.

Christabel Pankhurst - WSPU

Became a speaker for the WSPU in 1905. She trained as a lawyer but could not practice as woman. Arrested with her mother. Fled England in 1912 for fear of being arrested again. Unsuccessfully ran for Parliament in 1918.

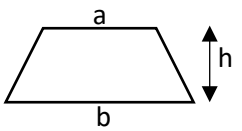
Emily Wilding Davison – WSPU

Joined WSPU in 1906. 3 years later, left job as a teacher and became a **suffragette** full time. Frequently arrested for number of crimes inc. setting fire to post box. By 1911, become increasingly **militant**. 1913 killed at Epsom Derby by king's horse Anmer.

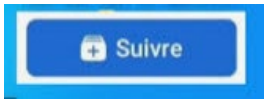
Millicent Fawcett - NUWSS

Leading **suffragist** and led **NUWSS** from 1897-1919. Played a key role in getting women the vote. Dedicated to using legal means, and argued that **militancy** was counter-productive.

Y9C1 Maths Key knowledge

Item	Description
Simultaneous	Means '*at the same time*'
P(A)	Means '*the probability of event A occurring*' Eg. P(A) = 0.2 means there is a 0.2 = 20% = $\frac{2}{10}$ chance of event A occurring.
Volume of a prism formula	$volume = area\ of\ cross\ section \times length$
Volume of a cone or pyramid formula	$volume = \frac{1}{3} base\ area \times height$
Volume of a sphere formula	$volume = \frac{4}{3}\pi \times radius^3$
The density formula	$density = \frac{mass}{volume}$
Truncation/truncate	To truncate something is to cut it off. Eg. Compare these statements: 3.7 can be **truncated** to 3 3.7 can be **rounded** to 4
Quadratic	Refers to the presence of a **square term** in an equation or expression. For example $\boldsymbol{x^2}$ and $\boldsymbol{b^2} + 3b - 4$ are quadratics x and $2b - 4$ are not quadratics
The quadratic formula	$x = \frac{-b \pm \sqrt{b^2 - 4ac}}{2a}$
Area of a trapezium	$Area\ of\ trapezium = \frac{1}{2}(a + b) \times h$ 
Area of a circle	$area = \pi \times radius^2$
Circumference of a circle	$circumference = \pi \times diameter$

Y9Fr LC1 SB1 Tu admires qui ? Who do you admire? French

Verb phrase	Verb	Noun	connective	adjective/noun	pronoun	verb phrase
J'admire…. (I admire…) Singers: Stromaë Angèle Actors: Thimothée Chalamet Omar Sy Melanie Laurent Pom Klementieff Influencers: Squeezie Michou Sports: Mbappé Zidane Louisa Nécib Eugénie Le Sommer Writers: Jules Verne Fred Vargas Simone de Beauvoir Françoise Sagan	il/elle est (He/she is)	chanteur chanteuse (singer) acteur actrice (actor) influenceur influenceuse (influencer) sportif sportive (sportsman/woman) auteur autrice (author) 	et selon moi il/elle est (and according to me he/she is)	extraordinaire (extraordinary) célèbre (famous) populaire (popular) une star (a star) riche (rich) unique (unique) spécial spéciale (special)	car il/elle (because he/she)	a une voix puissante (has a strong voice) chante des chansons populaires (sings popular songs) est à la mode (is trendy) a beaucoup d'argent (has lots of money) a une série de télé-réalité (has a reality series) est fort(e) en… (good at…) fait des clips vidéos amusants/intéressants (makes funny/interesting videos) est mon héros/mon héroïne (is my hero/heroine) m'inspire (inspires me) est ma star préférée (is my favourite celebrity)
					donc je vais (so I'm going to)	chanter/écouter ses chansons (sing/listen to his/her songs) lire ses romans/son contenu (read his/her novels/content) le/la suivre (follow him/her) regarder ses films/son émission à la télé (watch his/her films/TV shows) soutenir son équipe (support his/her team) regarder ses matchs/compétitions (watch his/her matches/competitions)

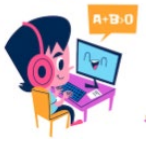
Y9Fr LC1 – SB2 – Les descriptions – il/elle est comment ? What is he/she/like? French

Verb	Verb	adjective	verb	adjective		
Je suis … (I follow) J'admire… (I admire) … m'inspire (…inspires me) J'écoute… (I listen to…) 	il/elle est (He/she is)	arabe (Arabic) britannique (British) canadien(ne) (Canadien) chinois(e) (Chinese) espagnol(e) (Spanish) français(e) (French) marocain(ne) (Moroccan) bouddhiste (Buddhist) chrétien(ne) (Christian) juif/ve (Jewish) musulman(e) (Muslim) bi (bisexual) hétéro (heterosexual) gay (gay) non-binaire (non-binary) transgenre (transgender) célibataire (single) marié(e) (married) Pacsé(e) (in a civil partnership) grand(e) (tall) petit(e)(small) jeune(young) vieux/vieille (old)	et je crois qu' il/elle est (and I beleive that he/she is)	agréable (pleasant) amusant(e) (funny) bavard(e) (chatty) beau/belle (beautiful) calme (quiet) drôle (funny) fier/fière (proud) fort(e) (strong) gentil(le) (kind) heureux/euse happy) intelligent(e) (intelligent) sérieux/euse (responsible) sensible (sensitive) timide (shy) vif/vive (lively)	il/elle parle (he/she talks about)	de la musique (music) de la culture (culture) de la littérature (literature) de la mode (fashion) de l'art (art) du sport (sport) du film (film) de tout (about everything)

Y9Fr LC1 L'identité – SB3 – mes passions – my interests (contrasting tenses) French

	noun	time marker	past tense phrase	connective time marker	future tense phrase	future tense	adjective
Ma passion est (My passion is)	la lecture. (reading) la cuisine. (cooking) la musique. (music) la mode. (fashion) la natation. (swimming) les jeux vidéos. (video games) le sport. (sport) le cinéma. (film) le shopping. (shopping)	Hier (Yesterday)	j'ai lu un livre (I read a book) j'ai fait un repas (I made a meal) j'ai écouté des chansons (I listened to songs) j'ai acheté des vêtements (bought some clothes) je suis allé(e) à la piscine (I went to the pool) j'ai joué sur ma console (I played on my console) j'ai joué au + sport (I played…) j'ai regardé un film (I watched a film) j'ai fait les magasins (I went to the shops)	mais demain (but tomorrow)  	je vais lire un livre (I'm going to read a book) je vais faire un repas (I'm going to make a meal) je vais écouter des chansons (I'm going to listen to songs) je vais acheter des vêtements (I'm going to buy clothes) je vais aller à la piscine (I'm going to the pool) je vais jouer sur ma console (I'm going to play on my console) je vais jouer au + sport (I'm going to play + sport) je vais regarder un film (I'm going to watch a film) je vais faire les magasins (I'm going to go to the shops)	ce sera (it will be)	passionnant (exciting) amusant/ drôle (funny) agréable (pleasant) bien (good) formidable (terrific) génial (great) nul (rubbish) barbant (boring)

Y9Fr LC1 SB4 Que fais-tu sur ton portable ? What do you do on your phone? French

Future tense	noun		verb phrase	connective	adjective	opinion	adjective
Ce soir je vais utiliser (This evening I'm going to use) Demain je vais utiliser (Tomorrow I'm going to use) Je ne vais pas utiliser (I'm not going to use)	mon portable (my smartphone) mon ordinateur (my computer) ma tablette (my tablet) ma liseuse numérique (my e-reader) ma console de jeux (my games console)  	pour (for)	faire des achats (making purchases) surfer sur internet (surfing the internet) regarder des vidéos/la télé (watching videos/TV) suivre des influenceurs (following influencers) lire des e-mails/messages/SMS/livres (reading emails/messages/texts/books) prendre des photos/des selfies (taking photos/selfies) écrire des e-mails/messages/SMS (writing emails/messages/texts) jouer aux jeux (playing games) aller sur les réseaux sociaux (go on social media) les applis (apps) aller sur un site de streaming (streaming)	car c'est (because it's) car ce n'est pas (because it isn't) mais c'est (but it 's) mais ce n'est pas (but it isn't)	cher (expensive) dangereux (dangerous) inquiétant (worrying) moderne (modern) puissant (powerful) rapide (quick) intéressant (interesting) sûr (safe) facile (easy) gratuit (free) utile (useful)	je pense que c'est (I think it's)	bon pour la santé (good for the health) mauvais pour la santé (bad for the health) une perte de temps (a waste of time) essentiel (essential) amusant (fun) nul (rubbish)

Year 9 Learning Cycle 1 Sentence Builder 1:

¿Por qué es importante estudiar un idioma? = Why is it important to study a language?

Part 1

Está claro que = it's clear that	es importante estudiar los idiomas/las lenguas = it's important to study languages	porque = because	te permite = it lets you	abrir la mente = open the mind apreciar otros países = appreciate other countries aumentar tus posibilidades = increase your possibilities ayudar a tu cerebro = help your brain conocer a gente distinta = get to know different people conocer nuevos sitios = get to know new places encontrar un trabajo = find a job encontrar tu media naranja = meet your soulmate estudiar en el extranjero = study abroad descubrir otras culturas = discover other cultures hacer nuevos amigos = make new friends mejorar tu inglés = improve your English mejorar tus oportunidades = improve your opportunities trabajar en el extranjero = work abroad

Part 2

En el futuro = in the future 	quiero = I want to voy a = I am going to	hablar = to speak entender = to understand comprender = to understand	el español = Spanish el francés = French el alemán = German el italiano = Italian el chino = Chinese el catalán = Catalan el vasco = Basque el gallego = Gallcian

Year 9 Learning Cycle 1 Sentence Builder 2:
¿Qué es el Día de los Muertos? = What is Day of the Dead?

Interrogative	Verb		Verb	Noun		Verb	Adjective
Cuando = when 	fui = I went fuimos = we went	al Día de los Muertos = to the Day of the Dead	me gustó = I liked	el ambiente = the atmosphere la ofrenda el desfile = the procession la comida típica = the local food la historia = the history la cultura = the culture	y = and	fue = it was	aburrido = boring alegre = cheerful animado = lively apropiado = appropriate asqueroso = disgusting decepcionante = disappointing diferente = different distinto = different divertido = fun emocionante = exciting estupendo = amazing excelente = excellent extraño = strange fascinante = fascinating genial = great gracioso = funny guay = cool hermoso = beautiful importante = important increíble = incredible interesante = interesting loco = crazy maravilloso = marvellous raro = weird peligroso = dangerous relajante = relaxing tolerante = tolerant único = unique útil = useful
			me gustaron = I liked	los colores vivos = the bright colours los disfraces = the fancy dress las flores = the flowers las decoraciones = the decorations			

Year 9 Learning Cycle 1 Sentence Builder 3:

¿Qué ocurre durante los festivales españoles? = What happens during Spanish festivals?

Time Phrase	Auxiliary Verb	Verb	Festival		
En el futuro = in the future	Me gustaría = I would like Voy a = I am going to	ir a = to go to visitar = to visit participar en = to participate in ver = to see	los Sanfermines de Pamplona	se puede = you can para = (in order) to	correr con los toros = to run with the bulls ir a la plaza de toros = go to the bullring ver una corrida = to watch a bullfight
			las Fallas de Valencia		comer paella = to eat paella saltar sobre los fuegos = jump over the fires ver los fuegos artificiales = to see fireworks
			La Tomatina de Buñol		beber vino = to drink wine pasarlo bien = to have a good time tirar tomates = to throw tomatoes
			La Feria de Málaga		escuchar flamenco = to listen to flamenco ir a un concierto = to go to a concert tocar una guitarra = to play the guitar
			La Semana Santa en Sevilla		apreciar los pasos = appreciate the 'pasos' ir a la iglesia = to go to church ver los desfiles = to see the processions

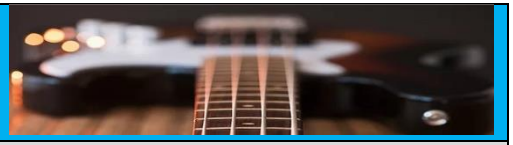
*a + el = al

Year 9 Learning Cycle 1 Sentence Builder 4:
¿Cómo se celebran días festivos en España? = How do they celebrate festival days in Spain?

Noun	Noun	Verb phrase	Verb	Connective	Verb	Adjective
El Día de Reyes = In Epiphany En Navidad = In Christmas En Nochebuena = In Christmas Eve En Nochevieja = In New Year's Eve En Semana Santa = In Easter En Diwali = In Diwali En Eid = In Eid En Jánuca = In Hanukkah En los cumpleaños = In the birthdays Para las bodas familiares = for family weddings	mi familia y yo = my family and I mis hermanos y yo = my siblings and I mis amigos y yo = my friends and I mis compañeros y yo = my colleagues and I	abrimos los regalos. = we open the presents. comemos doce uvas. = we eat 12 grapes. tenemos una gran fiesta. = we have a big party. vamos a la iglesia/ a la plaza/ a la mezquita/ a la sinagoga / al templo. = we go to the church/ town square/ mosque/ synagogue/ temple.	Nos encanta = We love (it) Nos gusta = We like (it) No nos gusta = We don't like (it) Nos encantan = We love (them) Nos gustan = We like (them) No nos gustan = We don't like (them)	porque = because	es = it is	aburrido = boring alegre = cheerful animado = lively apropiado = aprropriate asqueroso = disgusting decepcionante = dissapointing diferente = different distinto = different divertido = fun emocionante = exciting estupendo = amazing excelente = excellent extraño = strange fascinante = fascinating genial = great gracioso = funny guay = cool hermoso = beautiful importante = important increíble = incredible interesante = interesting loco = crazy maravilloso = marvellous raro = weird peligroso = dangerous relajante = relaxing tolerante = tolerant único = unique útil = useful

Y9 C1 KO All About the Bass-Blues & Rock n Roll

Exploring Bass Clef, Reading Notation and Common Bass Line Musical Patterns through Blues & Rock n Roll



BASS CLEF & BASS CLEF NOTATION

BASS CLEF is a symbol used to show **low**-pitched notes on the stave

It is often used by low instruments that play the **BASS LINE**

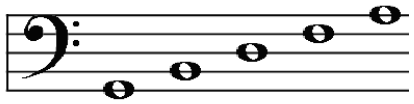
STAVE - five lines where musical notes are written.

The position of notes on the stave or staff shows their **PITCH** (how high or low a note is).

The stave or staff is made up of 5 **LINES** and 4 **SPACES**.

Notes on the **LINES** of the **BASS CLEF**: **G, B, D, F, A**

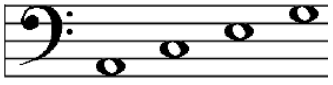
Green **B**uses **D**rive **F**ast **A**lways



G B D F A

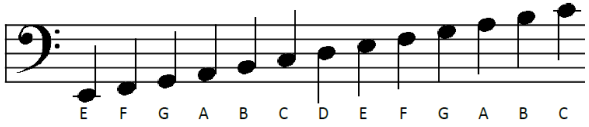
Notes in the **SPACES** of the **BASS CLEF: A, C, E, G**

All **C**ows **E**at **G**rass



A C E G

Bass Clef **STAFF NOTATION**:



E F G A B C D E F G A B C

COMMON INSTRUMENTS USED IN BLUES/JAZZ/REGGAE (BC = USES BASS CLEF)

Voice

Guitar

Drum Kit

Trumpet

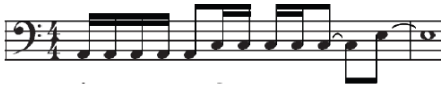
Trombone (BC)

Piano (LH uses BC)

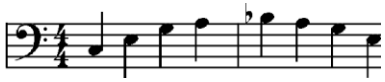
Double Bass/Bass Guitar (BC)

COMMON BASS LINES & CHORD SEQUENCES

BASS RIFFS – Short, repeated, 'catchy' and memorable Bass Line Patterns used in Blues, Jazz, Rock'n'Roll, Rock, Rap, Hip Hop, R'n'B, and Pop songs often performed on Bass Guitar. Bass Riffs 'fit' with the notes in the chord.



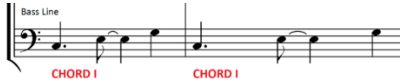
WALKING BASS – used in Jazz, Blues, Rhythm and Blues, and Rock'n'roll, and featuring **a note on every beat**. Using the **ROOT, THIRD** and **FIFTH** of the chord, and '**EXTRA**' notes (called **PASSING NOTES**) to create a smooth bass line often moving mainly in steps.



ARPEGGIO - playing the notes of the chord separately

BROKEN CHORD – Playing the notes of a chord separately but **not necessarily in strict order**

Both often create a repeated musical pattern.



THE TWELVE BAR BLUES IN C

This is a common **chord sequence** used in Blues, Jazz and Rock n Roll. It is 12 bars long and uses chords I, IV and V.

CHORD C	CHORD C	CHORD C	CHORD C
CHORD F	CHORD F	CHORD C	CHORD C
CHORD G	CHORD F	CHORD C	CHORD C

MORE COMMON KEY WORDS – JAZZ & BLUES

RIFF/OSTINATO – Short, repeated musical patterns

IMPROVISATION – music created 'on the spot'

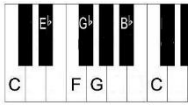
CHORD – 3 or more notes played together

TRIAD- 3-note chord (root (1), third and fifth). **C** = C, E, G (triad) *play one, miss one, play one*

7th Chord – a triad that has an added note 7 notes above the root eg **C7** = C, E, G, Bb

BLUES SCALE – a series of notes often used for IMPROVISING in blues, jazz and Rock'n'roll. **Blues Scale in C - C, Eb, F, Gb, Bb, C**

BLUES - a genre of music from the slave era in America which has African music influence. Key features include slow tempo, improvisation and melancholy lyrics.



Year 9 Cycle 1 Sport and PE Knowledge Organiser https://www.youtube.com/watch?v=oVNTx_Fa82o (video voice over)

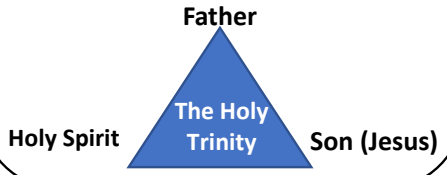
Week 1 and 2	Week 3 and 4	Week 5 and 6	Week 7 and 8	Week 9 and 10	Week 11 & 12
Injury Prevention	**Treatment - RICE**	**Environmental risk factors**	**Acute injuries**	**Chronic injuries**	**Symptoms of common conditions**
Sports coaches and athletes try to prevent injuries from happening. There are two factors in injury prevention, **Extrinsic** and **Intrinsic**. **Extrinsic Factors**: - Coaching & supervision – following rules and ensuring correct technique. - Equipment – Sport specific protective equipment. - Correct clothing & footwear - Environmental - weather, playing surface and other performers. **Intrinsic Factors:** - Physical preparation – warming up, being fit to play, balance of muscle strength. - Psychological factors – motivation, aggression level and anxiety level. - Individual factors – gender, age, sleep & nutrition	What do we need to know about treating injuries? - The TYPE of injury - The CAUSE of injury - The SYMPTON(S) of injury - The TREATMENT of injury **The assessment:** S - See A - Ask L - Look T - Touch A – Active movement P – Passive movement S – Strength testing **The Types:** - Heat - Massage - Bandaging - Splints & slings **RICE** – to treat *most* injuries; R - Rest I - Ice C - Compression E - Elevation	**The type of activity will often present different types and levels of risk** - The **weather** – rain, ice and snow can change the playing surface and fog can affect visibility. - The **playing surface** can affect the level of risk: Concrete, astro, ice, wooden floor etc. - **Other participants** – sometimes, an individual will have no control over the actions and decisions made by others around them. Good officiating can limit this kind of risk. - **Equipment** in the area of play – e.g. football posts or sponsor signage. 	Acute injuries are caused as a result of a sudden trauma to the body. Commonalities of acute injuries: - Immediate pain - Swelling - Loss of function - 'hard' tackle or impact with equipment. Examples: - Broken bone - Torn ligament - Instant concussion - Dislocation Acute injuries often include shock of some kind. 	These types of injuries occur and develop over a period of time. They are sometimes known as OVERUSE injuries. They are a result of continuous stress on one area of the body. If spotted and diagnosed early, they can be prevented. This will usually involve active rest or complete rest and sometimes a change in technique. Examples: - Tendonitis - Shin splints - Tennis elbow 	There are two main medical conditions: **Epilepsy:** Symptoms: - Seizures and or fits - Blurred vision - Tingling sensations - Sudden emotion - unresponsiveness Treatment: - Follow emergency care plan of individual - Keep calm - Offer reassurance - Keep airway clear **Asthma:** Symptoms: - Coughing & wheezing - Chest tightness - Pale and clammy skin Treatment: - Reassurance - Inhaler - Emergency services

Beliefs & teachings: Christianity

Key beliefs

Christianity is a **monotheistic** religion – they believe in **ONE** God.

Christians believe God is:
Omnipotent *(all powerful)*
Omniscient *(all knowing)*
Omnipresent *(everywhere)*
Benevolent *(loving)*
Transcendent *(beyond understanding)*
Immanent *(personal)*
Eternal *(no beginning and no end)*
Forgiving *(he will forgive sins)*



Reasons for believing in God

The Design Argument

Our world is too **complicated** and full of intricate working systems, to have just happened by chance. If we came across a watch, we would assume it has been 'designed' due to its **complexity**. Like the watch, some assume our world had a designer.

The Cosmological Argument

We live in a world of **'cause and effect'.** Something must have 'caused' our world to have come into existence. The only being powerful enough to do this is God – the 'uncaused cause'.

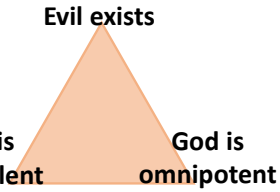
The Moral Argument

We all have a sense of **right** and **wrong**, and feel feelings of guilt when we do bad things. Christians believe this **moral conscience** comes from God and supports their belief that He is real.

Christian upbringing

Many people are Christians because they were **brought up** to be a Christian. Having spent so much time around other Christians, a belief in God would come very **naturally** to them.

The problem of evil

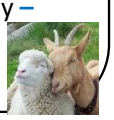


Moral evil = suffering caused by humans
Natural evil = suffering caused by nature

Responses:

1. Suffering is a **necessary** part of life
2. Suffering is **temporary**
3. Suffering is a punishment for **sin**
4. Suffering is caused by humanity's **free will**
5. Suffering is a part of God's **plan**
6. Suffering is a **test of faith**

Christians believe they will be **judged** on their actions in this life on judgement day – **Parousia.**



Creation

Science tells us that our universe is approx. 14bn years old, and our planet is approx. 4bn years old. An explosion (The Big Bang) led to the creation of all space, time and matter. Humans have evolved over time, through a process of **natural selection**. This is called '**evolution**'.

Genesis 1 &2 says that God created the world in 6 days, and on the 7th He rested. Some Christians take this **LITERALLY** and read this story as **fact (fundamentalist).** Others see the Genesis story as a **symbolic** story **(Liberal)**

Life after death

HEAVEN

Heaven is traditionally seen as a physical place where God is. Jesus called it *"paradise"* or *"my Father's house".* A more modern view is that heaven is simply 'with God'.

PURGATORY

Roman Catholics believe there is a place before heaven, where people go to have their sins cleansed. People say prayers for **souls** to be released from Purgatory.

HELL

Hell can be an actual place of torment and suffering OR it can be when man is separated from God.

Soul

Our souls are:
- Immortal
- God-given
- Eternal
- Make us distinct from the rest of creation
- Return to God when we die

"Mutual respect for and tolerance of those with different faiths and beliefs and for those without faith"

Beliefs & teachings: Christianity 'Jesus'

The suffering of Christ

One of the most detailed stories we have from the whole of Jesus' life is the account of how he died. He was sentenced to death by Pontius Pilate, the Roman Governor, and his death was to be by crucifixion.

Even though Christians believe that Jesus was the son of God, it does not mean that he was somehow spared the pain and horror of his crucifixion.

There are several ways in which the crucifixion affects Christians today:

- It gives them **confidence** that if they accept Jesus' sacrifice, sin can no longer destroy their loves because God forgives those who faithfully ask for forgiveness
- They believe that suffering is a part of life, just as it was a part of Jesus' life and that, having experienced it, **God understands** what the sufferer is going through.

Incarnation

Christians believe Jesus is the Son of God. He is God in **human form**, or God **'incarnate'.**

"The word became flesh and made his dwelling among us"

- Jesus gave humanity an **example** to follow.
- Even though Jesus is God in human form, he valued everyone equally: ***"For you are all one in Christ".***
- God **sacrificed** himself on the cross to take away the sins of human beings: ***"For God so loved the world that He gave His only Son"***
- Jesus is both immanent and personal

Jesus' resurrection & ascension

Matthew 28:1-7; Mark 6:1; Luke 24:1-12; John 20:1-9

According to the accounts of Jesus' burial in the NT, he was placed in a tomb late Friday afternoon (Good Friday). How long he remained there is unclear, but we know that some of Jesus' female followers went to the tomb to anoint the body. Though details of the story vary between the 4 gospel accounts, they all make it clear that Jesus was nowhere to be found. The belief that Jesus rose from the dead is known as the **resurrection** and is a key teaching in the Christian faith. For Christians, it is **significant evidence** of the divine nature of Jesus.

Only Mark and Luke's gospels finish off their story by telling their readers that, after meeting his disciples and asking them to carry on his good work, Jesus left them for the last time and **ascended,** body and soul, into Heaven.

Salvation

Salvation means **'to be saved from a bad situation'.** In Christianity, this bad situation is sin, and the consequences of sin.

Sin has separated humans from God, and salvation enables humans to get close to God again.

Christians believe that Jesus' death makes up for the **original sin** committed by Adam & Eve and so can bring people back to god.

Jesus knew his death was **necessary** to restore the relationship between god and the believers and make the opportunity for salvation available to all people.

Jesus (as the Son of God) could have easily avoided being crucified. His crucifixion was the result of human evil against an innocent man. It needed to happen, in order to **atone** for the sins of humanity.

"Mutual respect for and tolerance of those with different faiths and beliefs and for those without faith"

Parables

A story used to teach a lesson or a moral

The Good Samaritan

"Love your neighbour"

The sheep & the goats

"Whatever you did for the least of these brothers of mine, you did for me"

Miracles

An act which seems to break the laws of nature

Calming the storm

This is a miracle over **NATURE**

Water into wine

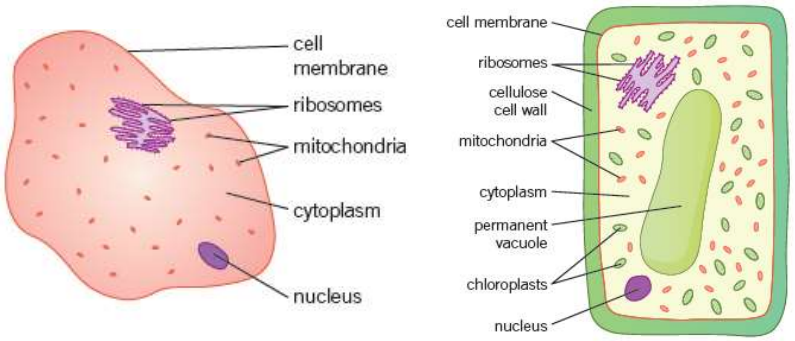
This was Jesus' **first** miracle

Healing a paralysed man

This is a **HEALING** miracle

Cells

Animal Cell **(Eukaryotic cells)** **Plant Cell**



Nucleus	Controls the activities of the cell by containing all the genes on chromosomes that carry instructions for making proteins needed to build new cells and organisms
Cytoplasm	Where most chemical reactions occur
Cell membrane	Controls what substances pass in and out of the cell
Ribosomes	Where proteins are made
Mitochondria	The place where aerobic respiration takes place, releasing energy for the cell.
Cell wall	Made of cellulose and strengthens the cell and gives it support
Permanent vacuole	Contains cell sap (sugar and salt solution), which helps keep the cells rigid to support the plant
Chloroplasts	Found in all green parts of the plant as they contain chlorophyll. Chlorophyll absorbs light so the plant can photosynthesise and make its own food.

Specialised Cells

Sperm cells – has a tail to swim to the egg. Has lots of mitochondria to provide energy to swim. Enzymes in the head digest through the cell membrane of the egg.

Nerve cells – carry electrical signals around the body. Are long cells with branched connections at the end to connect to other nerve cells.

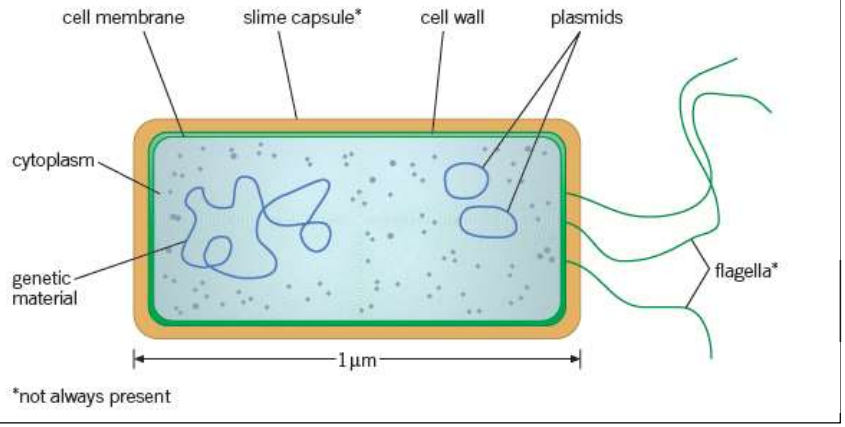
Muscle cells – have to contract quickly. Contain lots of mitochondria to provide energy for each contraction.

Root hair cells – found on the surface of plant roots. Have a large surface area to absorb water and minerals.

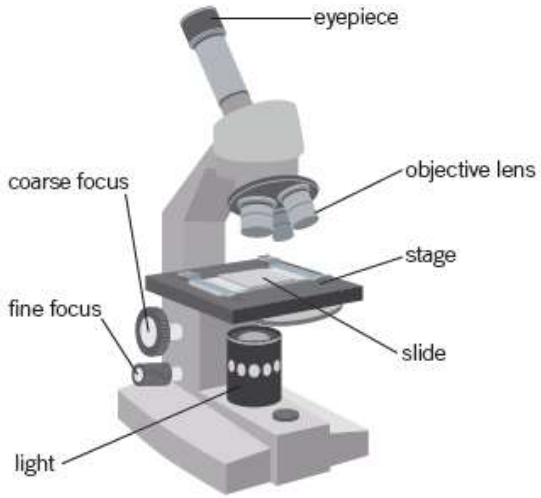
Phloem and Xylem – transport substances around plants. Cells are long and joined end to end to form tubes. Xylem cells are hollow and phloem cells have few subcellular structures so substances are able to flow through them.

Bacteria Cell

Bacteria are **prokaryotes** meaning they do not have a nucleus.



Light microscope diagram



To calculate the magnification of the microscope:

Objective lens x eyepiece lens

E.g. **40 x 10 = x400**

Unit Conversions
1km = 1000m 1m = 100cm 1cm = 10mm 1mm = 1000µm 1µm = 1000nm

Light microscope	Electron microscope
Uses a beam of light	Uses a beam of electrons
Lower magnification	Higher magnification
Lower resolving power	Higher resolving power

Magnification – the number of times bigger an image appears compared to the size of the real object

Resolution – The ability to distinguish between two separate points. The resolving power of a microscope affects how much detail it can show.

Required practical 1 – Microscopy

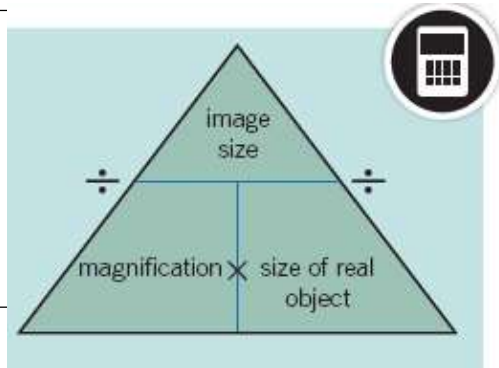
1. Place slide on the stage
2. Use the lowest power objective lens first to get a wider field of view
3. Switch on the light so light can pass through
4. Move the stage as close to lens as possible without touching it
5. Turn the coarse focussing knob so the slide moves away from the stage and until the image comes into focus
6. Use the fine focussing knob to get a sharp image
7. Change the objective lens to increase the magnification
8. Refocus the slide using the focussing knobs
9. Calculate the total magnification by multiplying the eyepiece lens magnification by the objective lens magnification.

Magnification calculations

Magnification = image size ÷ size of real object

Size of real object = image size ÷ magnification

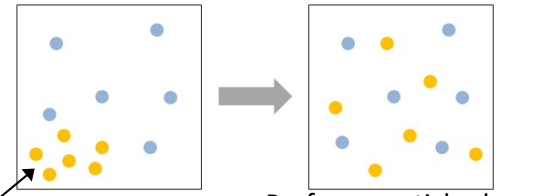
Image size = magnification x size of real object



Exchange of Substances

Diffusion (of gases or liquids)

The **spreading out** of particles from an area of **high concentration** to an area of **low concentration**.



High concentration of perfume particles

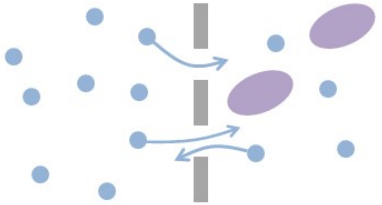
Perfume particles have diffused

The greater the concentration gradient the faster the rate of diffusion. A higher temperature also increase the rate of diffusion as particles have more energy, so move faster.

Osmosis

The movement of **water** particles across a **partially permeable membrane** from a **high concentration** to a **low concentration**.

A partially permeable membrane has very small holes in it, allowing water molecules to pass through but not larger molecules.



Water Sucrose solution

There is a net (overall) movement of water into the sucrose solution.

Exchange Surfaces

Lungs: oxygen diffuses into the blood from the alveoli. CO_2 moves in the opposite direction. Alveoli have a large surface area, very thin walls, a large blood supply and moist lining to maximise the rate of diffusion.

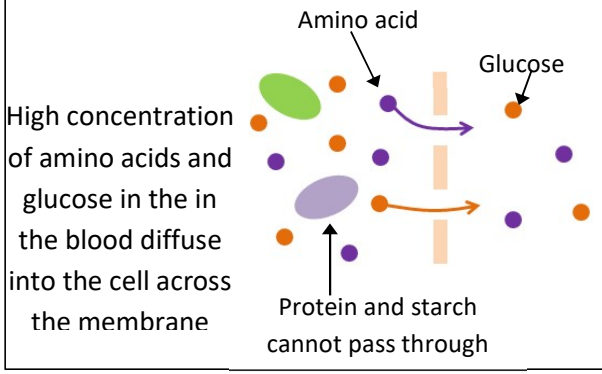
Villi: these increase the surface area of the small intestine. They have a single layer of cells and a large blood supply to maximise the rate of diffusion.

Fish gills: oxygen diffuses from the water into the fish's blood through the gills. Tiny structures called laminae increase the surface area of the gills.

Leaves: CO_2 needs to diffuse into the leaf for photosynthesis, O_2 and water diffuse out through stomata. Leaves are flat to increase the surface area for diffusion. There are also lots of air spaces inside the leaf to increase the area for diffusion to occur.

Diffusion across cell membranes

Cell membranes allow very small substances to diffuse across them (oxygen, glucose, amino acids, water). Large molecules cannot pass (starch, protein).



Diffusion happens both ways but overall particles will move from a high concentration to a low concentration. A larger surface area will increase the rate of diffusion.

Active Transport

A process that moves substances against the concentration gradient (from an area of low concentration to high concentration.

In **root hair cells** there is already a high concentration of **minerals** inside the cell compared to the soil. They take in more minerals by **active transport**.
Active transport require **energy** (from respiration).

Active transport allows substances (glucose, nutrients) to **move from the gut** (low concentration) **into the blood** (high concentration).

Cell division and stem cells

Cell cycle	The 3 stage process of cell division in body cells.
Mitosis	Part of the cell cycle where one set of new chromosomes is pulled to each end of the cell forming two identical nuclei during cell division.
Differentiate	The process where cells become specialised for a particular function.
Stem cells	Undifferentiated cells with the potential to form a range of different cell types.
Cloning	The production of identical offspring by asexual reproduction.
Zygote	The single new cell formed by the fusion of gametes in sexual reproduction.
Embryonic stem cells	Stem cells from an early embryo that can differentiate to form the specialised cells of the body.
Adult stem cells	Stem cells that are found in adults that can differentiate and form a limited number of cells.
Therapeutic cloning	Where an embryo is produced that is genetically identical to the patient so the cells are identical.

Purpose of mistosis:

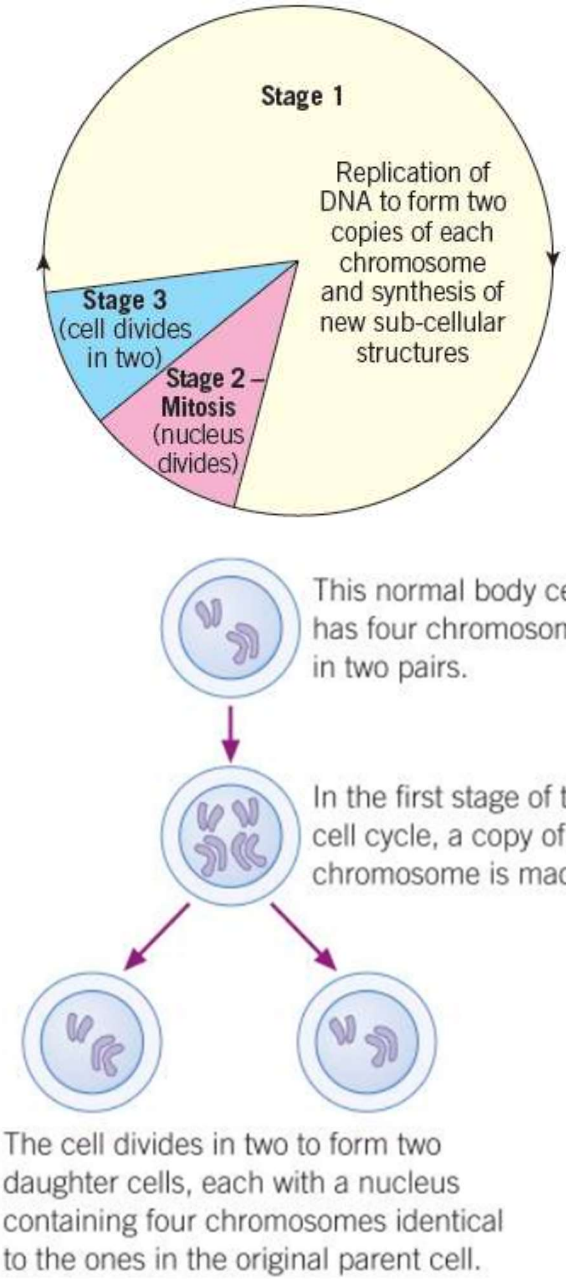
- Produces more cells needed for growth.
- Replace worn out or damaged cells
- Reapir damaged tissue
- Asexual replroduction

The cell cycle

Stage 1: Replication
The longest stage.
Cells grow bigger and increase in mass.
DNA replicates to form two copies of each chromosome.
All of the organelles are also doubled.

Stage 2: Mitosis
The contents of the cell are rearranged.
One set of chromosomes is pulled to each end of the cell and the nucleus divides.

Stage 3: Division
The cytoplasm and cell membranes divide to form **two identical daughter cells.**



Differentiation in animal cells

1. As an embryo, the cells are undifferentiated.
2. Cells are differentiated by turning some of their genes off and some of their genes on.
3. The combination of working or inactive genes decides what organelles the cell has and what the cell does.
4. The cell is now specialised for a particular function (for example, a muscle cell).
5. This does not change once the cell is mature.

Differentiation in plant cells

1. Undifferentiated cells are formed at active regions of the roots and shoots (meristems) through a plant's life.
2. These cells then differentiate into specialised cells.
3. This differentiation is not permanent. They are able to re-differentiate.
4. This means it is very easier to clone a plant.

Embryonic stem cells (animals)	Adult stem cells (animals)	Plant cells
Found in embryos in the early stages of life before the cells have differentiated. Grow and divide rapidly. Can differentiate into most different types of cells. If used to treat another unrelated person, the cells are less likely to be rejected. Some question the use of a potential human being as a source of cells. Embryo can not give permission so using it is a violation of its human rights. Religious beliefs cannot accept any interference with human reproduction.	Found in the bone marrow mostly and present in every adult. These can grow and replace similar damaged cells. Avoid the controversial use of embryonic stem cells. Adult stem cells might be infected with viruses, and so could transfer the infections to patients. If used to treat another unrelated person, they may trigger an immune response. The patient may need to take immunosuppressant drugs to stop their body rejecting the new cells.	Found in meristems. Are capable of growing into any tissue throughout the life of the plan. Allows plants to grow after they have been cut down.

Using stem cells:

- Injecting grown nerve cells into spinal cords to help restore movement in paralysed patients.
- Transplanted embryonic stem cells into eyes of patients with macular degeneration.
- Grow cells that are sensitive to blood sugar levels and produce insulin to help treat people with diabetes.
- Grow whole new organs for transplant.
- Making clones of rare plants to save them from extinction or use them for research.
- Cloning plants in horticulture, producing large numbers of plants such as orchids for sale.
- In agriculture to produce large numbers of identical crop plants with special features, such as disease resistance.

The future:

- Umbilical cord stem cells?
- Growing adult stem cells?
- Therapeutic cloning?

Infectious Disease

Keywords

Communicable disease - disease caused by pathogens that can be passed from one organism to another.

Pathogens - microorganisms that cause disease.

Non - communicable disease - are not infectious and cannot be passed from one organism to another.

Types of pathogen that make us ill

Bacteria – reproduce and release toxins
Virus – invade our cells, reproduce and cause the cell to burst
Fungi – grow and penetrate our skin, causing disease
Protists – single cell eukaryotes (no nucleus)

How pathogens cause disease

Bacteria – reproduce rapidly by splitting in two (binary fission). May produce toxins or damage cells directly.

Viruses – live and reproduce inside host cells, damaging and destroying them.

Common symptoms – high temperature, headache, rash.

How pathogens are spread

Water – drinking contaminated water, e.g. water infected with cholera (a bacterial infection) or fungal spores in splashes of water spread plant diseases.
Direct contact – transfer of pathogens by touching an infected organism.
Air – pathogens transferred through the air, often in droplets in humans from sneezing or coughing. Fungal spores also spread through the air.

Examples of Diseases

Disease	Caused by	Symptoms	Treatment/Prevention
Measles	Virus	Red skin rash & fever	Vaccination
HIV	Virus	Flu-like symptoms. Long term the body cannot fight other infections.	Antiretroviral drugs
Tobacco mosaic virus (TMV)	Virus	Mosaic pattern on plant leaves. Photosynthesis is inhibited.	
Rose black spot	Fungus	Purple or black spots on rose plant leaves. Photosynthesis is inhibited.	Fungicides. Cutting off the infected leaves.
Malaria	Protist Spread by mosquitos	Fever.	Protection from mosquito bites (nets and insecticides).
Salmonella	Bacteria from contaminated food.	Fever, stomach cramps, vomiting, diarrhoea	Poultry is vaccinated against Salmonella. Cook food properly.
Gonorrhoea	Bacteria A STD.	Pain when urinating. Discharge from penis or vagina.	Antibiotics. Using barrier methods of contraception.

Reducing Spread of Disease

Hygiene – washing hands before cooking and after sneezing.
Killing vectors – Insects that carry diseases are called vectors. Killing them or destroying their habitats can prevent the spread of disease.
Isolating infected people – prevents them passing the disease to anyone else.
Vaccination – the person cannot become infected and pass it on. Animals can also be vaccinated.

Fighting Disease

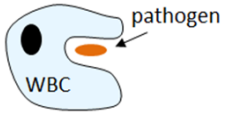
Biology

Non-specific defences

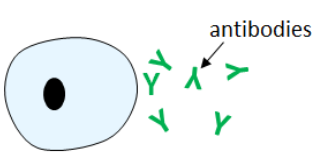
Skin - physical barrier. It also secretes antimicrobial substances to kill pathogenic bacteria. If you cut or damage skin, platelets help form a clot that dries to form a scab.
Nose hairs & mucus – traps pathogens
Trachea and bronchi – secrete mucus to trap pathogens. Cilia lining the tubes beat to waft the mucus up to the back of the throat.
Stomach acid - (hydrochloric) acid kills pathogens in mucus you swallow or take in through food and drink.

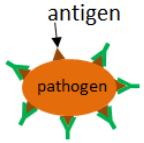
Immune System

1. White blood cells **engulf** pathogens and digest them.



2. White blood cells **produce specific antibodies** that bind to antigens on a pathogen. If the person gets infected with the same pathogen in the future, WBCs produce the antibodies rapidly and in larger quantities so the person does not feel ill – they are immune.





3. White blood cells release **antitoxins** to destroy toxins released by pathogens.

Vaccination

- An inactive or dead pathogen is injected into a person's bloodstream.
- This stimulates their white blood cells to release specifically shaped antibodies that lock on to the antigen and destroy the pathogen.
- If the person is infected with the real pathogen in the future, memory cells rapidly release antibodies in much larger quantities so the person does not feel ill.

Herd immunity

If a large proportion of the population is immune to a disease, the spread of the pathogen in the population is very much reduced and the disease may even disappear. The WHO want 95% of children to have two doses of measles vaccine to give global herd immunity. Current global figures show that 85% of children get the first dose and 56% get the second.

Antibiotic Resistance

1. You start taking an antibiotic.
2. Some bacteria are susceptible to the antibiotic (killed by it).
3. Some bacteria have a random **mutation** (change in the DNA), that makes them **resistant** to an antibiotic.
4. The antibiotics kill the susceptible bacteria but not the mutated resistant strain.
At this point, you may start to feel better and stop taking the antibiotic.
5. The **resistant bacteria will reproduce** as they have less competition for resources, increasing their population.
6. A resistant strain emerges that is very difficult to treat.

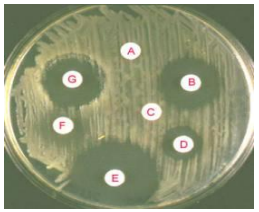
To help prevent the development of antibiotic resistant bacteria doctors should **not over-prescrib**e antibiotics and we should **finish the whole course**.
MRSA is an example of an antibiotic resistant bacteria.

Drugs

Painkillers reduce symptoms of a disease – aspirin, paracetamol

Antibiotics work inside your body to kill bacteria – penicillin.
Antibiotics **do not kill viruses** as they reproduce inside body cells.

Some antibiotics kill a wide range of bacteria whilst others are very specific.



Discovering drugs

Traditionally drugs were extracted from plants and microorganisms.
• The heart drug digitalis originates from foxgloves.
• The painkiller aspirin originates from willow.
• Penicillin was discovered by Alexander Fleming from the *Penicillium* mould.

Developing new drugs

New drugs must be:
1. Effective 2. Safe 3. Stable
4. Successfully taken into and removed from your body.

Stages of Drug Development

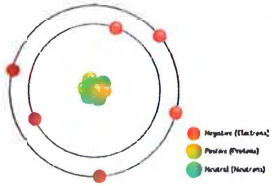
1. **Research**
   - researchers target a disease and make many possible new drugs.
2. **Preclinical testing**
   - test drugs on **human cell & tissues** in a lab for toxicity and efficacy. Many drugs fail at this stage.
   - Test on **live animals** to check the drug works on a whole living organism to predict how they may behave in humans.
   - Gain information about doses and side effects.

Atomic Structure and the Periodic Table – Foundation and Higher

Atoms

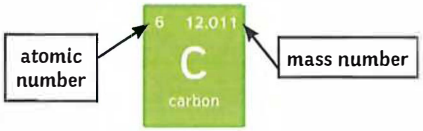
Contained in the nucleus are the **protons** and **neutrons**. Moving around the nucleus are the **electron** shells. They are negatively charged.

Particle	Relative Mass	Charge
proton	1	+1
neutron	1	0
electron	Very small	-1



Overall, atoms have no charge; they have the same number of protons as electrons. An ion is a charged particle - it does not have an equal number of protons to electrons.

Atomic Number and Mass Number



Elements

Elements are made of atoms with the same atomic number. Atoms can be represented as symbols.

N = nitrogen **F** = fluorine **Zn** = zinc **Ca** = calcium

Isotopes – an isotope is an element with the **same number of protons** but a **different number of neutrons**. They have the same atomic number, but different mass number.

Isotope	Protons	Electrons	Neutrons
$^{1}_{1}H$	1	1	1 - 1 = 0
$^{2}_{1}H$	1	1	2 - 1 = 1
$^{3}_{1}H$	1	1	3 - 1 = 2

Compounds – a compound is when two or more elements are chemically joined. Examples of compounds are carbon dioxide and magnesium oxide. Some examples of formulas are CO_2, NaCl, HCl, H_2O, Na_2SO_4. They are held together by chemical bonds and are difficult to separate.

Equations and Maths

To calculate the relative atomic mass, use the following equation:

relative atomic mass (A_r) =

$$\frac{\text{sum of (isotope abundance} \times \text{isotope mass number)}}{\text{sum of abundances of all isotopes}}$$

Balancing Symbol Equations

There must be the same number of atoms on both sides of the equation:

$CH_4 + 2O_2 \rightarrow 2H_2O + CO_2$

C = 1

O = 4

H = 4

Chemical Equations

A chemical reaction can be shown by using a **word equation.**

e.g. magnesium + oxygen → magnesium oxide

On the left-hand side are the reactants, and the right-hand side are the products.

They can also be shown by a **symbol equation.**

e.g. $2Mg + O_2 \rightarrow 2MgO$

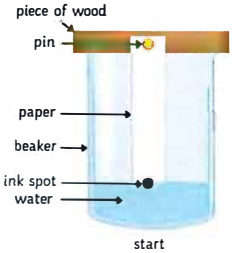
Equations need to be **balanced,** so the same number of atoms are on each side. To do this, numbers are put in front of the compounds.

$CH_4 + \mathbf{2}O_2 \rightarrow \mathbf{2}H_2O + CO_2$

Mixtures, Chromatography and Separation

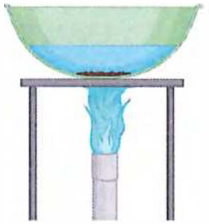
Mixtures – in a mixture there are no chemical bonds, so the elements are easy to separate. Examples of mixtures are air and salt water.

Chromatography – to separate out mixtures.



Filtration – to separate solids from liquids.

Evaporation – to separate a soluble salt from a solution; a quick way of separating out the salt.



Crystallisation - to separate a soluble salt from a solution; a slower method of separating out salt.

Separating out salt from rock salt:

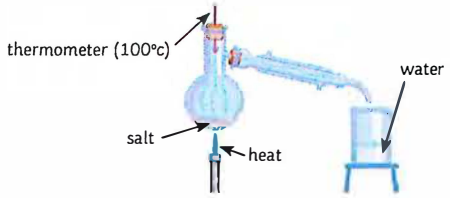
1. Grind the mixture of rock salt.
2. Add water and stir.
3. Filter the mixture, leaving the sand in the filter paper
4. Evaporate the water from the salt, leaving the crystals.

Atomic Structure and the Periodic Table – Foundation and Higher

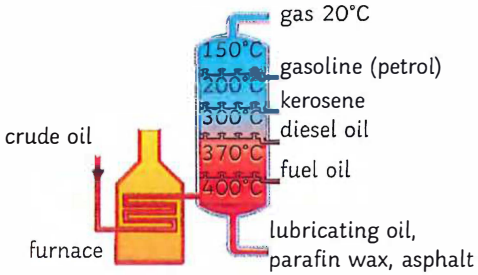
Distillation

To separate out mixtures of liquids.

1. **Simple distillation** – separating a liquid from a solution.



2. **Fractional distillation** – separating out a mixture of liquids. Fractional distillation can be used to separate out crude oil into fractions.



Metals and Non-metals

They are found at the **left** part of the periodic table. Non-metals are at the **right** of the table.

Metals

Are strong, malleable, good conductors of electricity and heat. They bond metallically.

Non-Metals

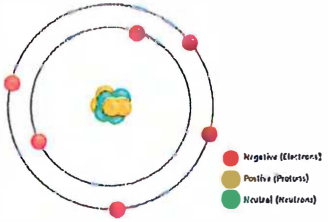
Are dull, brittle, and not always solids at room temperature.

History of the Atom

Scientist	Time	Discovery
John Dalton	start of 19th century	Atoms were first described as solid spheres.
JJ Thomson	1897	Plum pudding model – the atom is a ball of charge with electrons scattered.
Ernest Rutherford	1909	Alpha scattering experiment – mass concentrated at the centre; the nucleus is charged. Most of the mass is in the nucleus. Most atoms are empty space.
Niels Bohr	around 1911	Electrons are in shells orbiting the nucleus.
James Chadwick	around 1940	Discovered that there are neutrons in the nucleus.

Electronic Structure

Electrons are found in shells. A maximum of two in the most inner shell, then eight in the 2nd and 3rd shell. The inner shell is filled first, then the 2nd then the 3rd shell.



Group 7 Elements and Noble Gases

Halogens

The halogens are **non-metals**: fluorine, chlorine, bromine, iodine. As you go down the group they become less reactive. It is harder to gain an extra electron because its outer shell is further away from the nucleus. The melting and boiling points also become higher.

Noble Gases

The **noble gases** (**group 0** elements) include: **helium**, **neon** and **argon**. They are un-reactive as they have full outer shells, which makes them very stable. They are all colourless gases at room temperature.

The boiling points all increase as they go down the group – they have greater intermolecular forces because of the increase in the number of electrons.

Development of the Periodic Table

In the early 1800s, elements were arranged by atomic mass. The periodic table was not complete because some of the elements had not been found. Some elements were put in the wrong group.

Dimitri Mendeleev (1869) left gaps in the periodic table. He put them in order of **atomic mass**. The gaps show that he believed there was some undiscovered elements. He was right! Once found, they fitted in the pattern.

The Modern Periodic Table

Elements are in order of **atomic mass/proton number**. It shows where the metals and non-metals are. **Metals** are on the **left** and **non-metals** on the **right**. The **columns** show the **groups**. The **group number** shows the number of **electrons** in the **outer shell**. The rows are **periods** – each period shows another full shell of electrons.

The periodic table can be used to predict the reactivity of elements.

Alkali Metals

The alkali metals (**group 1 elements**) are soft, very reactive metals. They all have **one electron** in their **outer shell**, making them **very reactive**. They are low **density**. As you go down the group, they become more reactive. They get bigger and it is easier to lose an electron that is further away from the nucleus.

They form ionic compounds with non-metals.

They react with water and produce hydrogen.

E.g.

lithium + water → lithium hydroxide + hydrogen

$2Li + 2H_2O \rightarrow 2LiOH + H_2$

They react with chlorine and produce a metal salt.

E.g.

lithium + chlorine → lithium chloride

$2Li + Cl_2 \rightarrow 2LiCl$

They react with oxygen to form metal oxides.

AQA Combined Science: **Physics Topic 1 Energy**

Required Practical

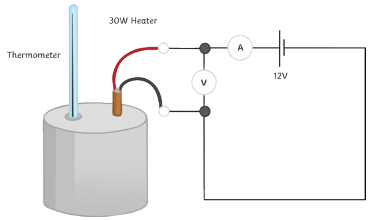
Investigating Specific Heat Capacity

independent variable – material

dependent variable – specific heat capacity

control variables – insulating layer, initial temperature, time taken

$\Delta E = m \times c \times \Delta\Theta$



Method:

1. Using the balance, measure and record the mass of the copper block in kg.
2. Wrap the insulation around the block.
3. Put the heater into the large hole in the block and the block onto the heatproof mat.
4. Connect the power pack and ammeter in series and the voltmeter across the power pack.
5. Using the pipette, put a drop of water into the small hole.
6. Put the thermometer into the small hole and measure the temperature.
7. Switch the power pack to 12V and turn it on.
8. Read and record the voltmeter and ammeter readings – during the experiment, they shouldn't change.
9. Turn on the stop clock and record the temperature every minute for 10 minutes.
10. Record the results in the table.
11. Calculate work done and plot a line graph of work done against temperature.

Equations

$E = \frac{1}{2}mv^2$

$E_p = mgh$

$E_e = \frac{1}{2}ke^2$

$\Delta E = m \times c \times \Delta\Theta$

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

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

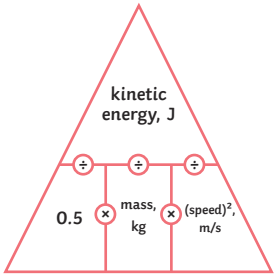
Kinetic and Potential Energy Stores

Movement Energy

kinetic energy = $\frac{1}{2}$ x mass x speed^2

$$E_k = \frac{1}{2}mv^2$$

(J) (kg)(m/s)

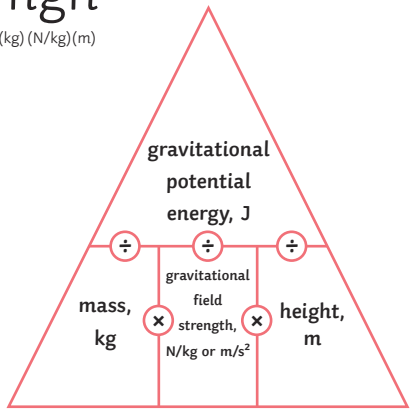


When something is off the ground, it has gravitational potential energy

gravitational potential energy = mass x gravitational field strength x height

$$E_p = mgh$$

(J) (kg) (N/kg)(m)



When an object falls, it loses gravitational potential energy and gains kinetic energy.

Stretching an object will give it elastic potential energy.

elastic potential energy = $\frac{1}{2}$ × spring constant × extension^2

$$E_e = \frac{1}{2}ke^2$$

(J) (N)(m)

Transferring Energy by Heating

Heating a material transfers the energy to its thermal energy store - the temperature increases.

E.g. a kettle: energy is transferred to the thermal energy store of the kettle. Energy is then transferred by heating to the waters thermal energy store. The temperature of the water will then increase.

Some materials need more energy to increase their temperature than others.

change in thermal energy = mass × specific heat capacity × temperature change

$$\Delta E = m \times c \times \Delta\Theta$$

(J) (kg) (J/kg°C) (°C)

Specific heat capacity is the amount of energy needed to raise the temperature of 1kg of a material by 1°C.

Energy Stores and Systems

Energy Stores	
kinetic	Moving objects have kinetic energy.
thermal	All objects have thermal energy.
chemical	Anything that can release energy during a chemical reaction.
elastic potential	Things that are stretched.
gravitational potential	Anything that is raised.
electrostatic	Charges that attract or repel.
magnetic	Magnets that attract or repel.
nuclear	The nucleus of an atom releases energy.

Energy can be transferred in the following ways:

mechanically – when work is done;

electrically – when moving charge does work;

heating – when energy is transferred from a hotter object to a colder object.

Conservation of Energy

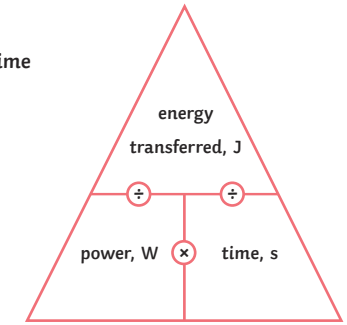
Energy can never be created or destroyed, just transferred from one form to another. Some energy is transferred usefully and some energy gets transferred into the environment. This is mostly wasted energy.

Power

Power is the rate of transfer of energy – the amount of work done in a given time.

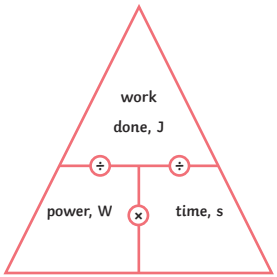
power = energy transferred ÷ time

P (W) = E (J) ÷ t (s)



power = work done ÷ time

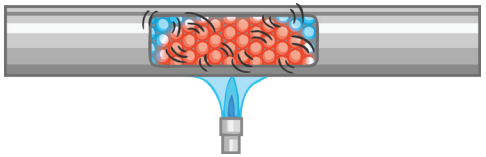
P (W) = W (J) ÷ t (s)



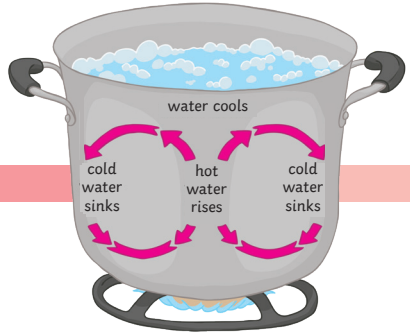
Energy Transfer

Lubrication reduces the amount of friction. When an object moves, there are frictional forces acting. Some energy is lost into the environment. Lubricants, such as oil, can be used to reduce the friction between the surfaces.

Conduction – when a solid is heated, the particles vibrate and collide more, and the energy is transferred.

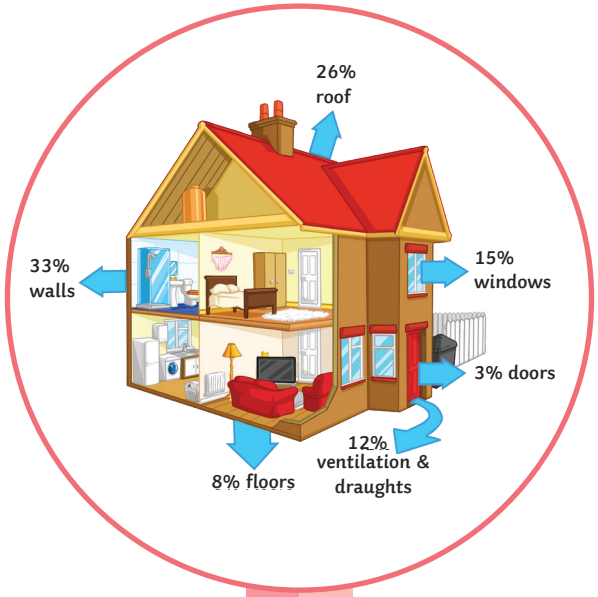


Convection – when a liquid or a gas is heated, the particles move faster. This means the liquid or gas becomes less dense. The denser region will rise above the cooler region. This is a convection current.



Insulation – reduces the amount of heat lost. In your home, you can prevent heat loss in a number of ways:

- thick walls;
- thermal insulation, such as:
- loft insulation (reducing convection);
- cavity walls (reduces conduction and convection);
- double glazing (reduces conduction).

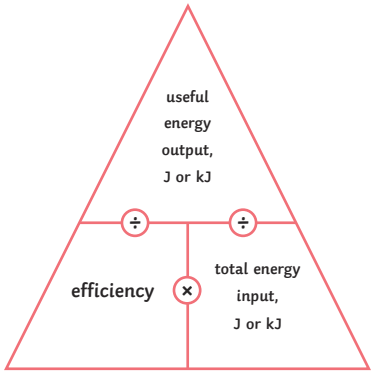


Efficiency

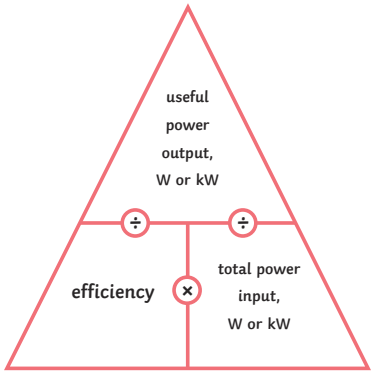
When energy is transferred, some energy is wasted. The less energy that is wasted during the transfer, the more efficient the transfer.

There are two equations to calculate efficiency:

$$\text{efficiency} = \frac{\text{useful output energy transfer}}{\text{total input energy transfer}}$$



$$\text{efficiency} = \frac{\text{useful power output}}{\text{total power input}}$$



Some energy is always wasted. Nothing is 100% efficient.

Efficiency

Non-renewable – coal, oil, gas - they will all run out, they damage the environment, but provide most of the energy.

Renewable – they will never run out, can be unreliable and do not provide as much energy.

Energy Resource	Advantages	Disadvantages
solar – using sunlight	Renewable, no pollution, in sunny countries it is very reliable.	Lots of energy needed to build, only works during the day, cannot increase power if needed.
geothermal – using the energy of hot rocks	Renewable and reliable as the rocks are always hot. Power stations have a small impact on environment.	May release some greenhouse gases and only found in specific places.
wind – using turbines	Renewable, no pollution, no lasting damage to the environment, minimal running cost.	Not as reliable, do not work when there is no wind, cannot increase supply if needed.
hydroelectric – uses a dam	Renewable, no pollution, can increase supply if needed.	A big impact on the environment. Animals and plants may lose their habitats.
wave power – wave powered turbines	Renewable, no pollution.	Disturbs the seabed and habitats of animals. Unreliable.
tidal barrages – big dams across rivers	Renewable, very reliable, no pollution.	Changes the habitats of wildlife, fish can be killed in the turbines.
biofuels	Renewable, reliable, carbon neutral.	High costs, growing biofuels may cause a problem with regards to space, clearance of natural forests.
non-renewable – fossil fuels	Reliable, enough to meet current demand, can produce more energy when there is more demand.	Running out, release CO_2, leading to global warming, and also release SO_2 which causes acid rain.

Trends in energy resources – most of our electricity is generated by burning fossil fuels and nuclear. The UK is trying to increase the amount of renewable energy resources. The governments are aware that non-renewable energy resources are running out; targets of renewable resources have been set. Electric and hybrid cars are also now on the market.

However, changing the fuels we use and building renewable power plants cost money. Many people are against the building of the plants near them and do not want to pay the extra in their energy bills. Hybrid and electric cars are also quite expensive.

AQA Combined Science: **Physics Topic 2 Electricity – Foundation and Higher**

Required Practical

Investigating Resistance in a Wire

Independent variable: length of the wire.

Dependent variable: resistance.

Control variables: type of metal, diameter of the wire.

Conclusion: As the length of the wire increases, the resistance of the wire also increases.

Investigating Series and Parallel Circuits with Resistors

Independent variable: circuit type (series, parallel).

Dependent variable: resistance.

Control variables: number of resistors, type of power source.

Conclusion: Adding resistors in series increases the total resistance of the circuit. In a parallel circuit, the more resistors you add, the smaller the resistance.

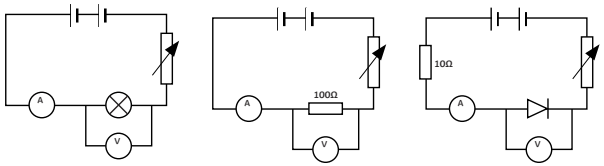
Investigating I-V Relationships in Circuits (Using a filament bulb, ohmic conductor, diode.)

Independent variable: potential difference/volts (V).

Dependent variable: current (A).

Control variable: number of components (e.g. 1 filament bulb, 1 resistor), type of power source.

Set up the circuits as shown below and measure the current and the potential difference.



Draw graphs of the results once collected.

Equations and Maths

Equations

Charge:	$Q = It$
Potential difference:	$V = IR$
Energy transferred:	$E = Pt$
Energy transferred:	$E = QV$
Power:	$P = VI$
Power:	$P = I^2R$

Maths

1kW = 1000W

0.5kW = 500W

Charge

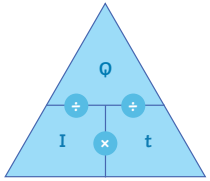
Electric current is the flow of electric charge. It only flows when the circuit is complete.

The **charge** is the current flowing past a point in a given time. Charge is measured in **coulombs (C)**.

Calculating Charge

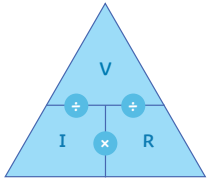
charge flow (C) = current (A) × time (s)

$Q = It$



potential difference = current x resistance

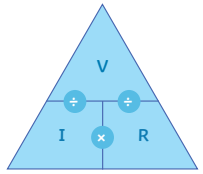
V (V) = I (A) × R (Ω)



Resistance

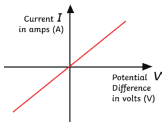
voltage (V) = current (A) × resistance (Ω)

V = IR

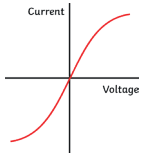


Graphs of I-V Characteristics for Components in a Circuit

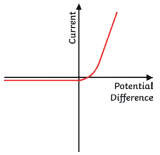
1. **Ohmic conductor**: the current is directly proportional to the potential difference - it is a straight line (at a constant temperature).



2. **Filament lamp**: as the current increases, so does the temperature. This makes it harder for the current to flow. The graph becomes less steep.



3. **Diode**: current only flows in one direction. The resistance is very high in the other direction which means no current can flow.

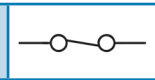
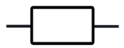
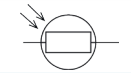
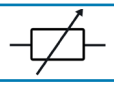
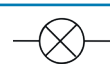
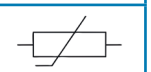
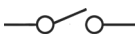
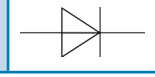


Current and Circuit Symbols

Current: the flow of electrical charge.

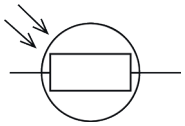
Potential difference (voltage): the push of electrical charge.

Resistance: slows down the flow of electricity.

cell		closed switch		fuse	
resistor		ammeter		LDR	
battery		voltmeter		LED	
variable resistor		bulb		thermistor	
open switch		diode			

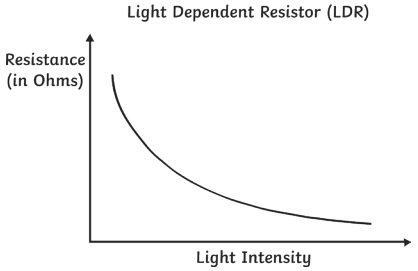
Circuit Devices

LDR – Light Dependent Resistor

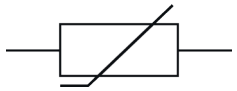


An LDR is dependent on light intensity. In bright light the resistance falls and at night the resistance is higher.

Uses of LDRs: outdoor night lights, burglar detectors.

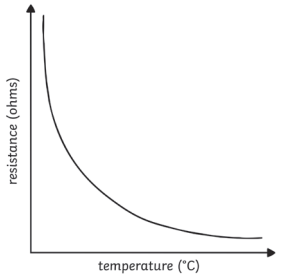


Thermistor



A thermistor is a temperature dependent resistor. If it is hot, then the resistance is less. If it becomes cold, then the resistance increases.

Uses of thermistors: temperature detectors.



Series and Parallel Circuits

Series Circuits

Once one of the components is broken then all the components will stop working.

Potential difference – the total p.d. of the supply is shared between all the components.

$V_{total} = V_1 + V_2$

Current – wherever the ammeter is placed in a series circuit the reading is the same.

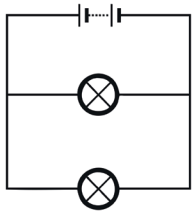
$I_1 = I_2 = I_3$

Resistance – In a series circuit, the resistance will add up to make the total resistance.

$R_{total} = R_1 + R_2$

Parallel Circuits

They are much more common - if one component stops working, it will not affect the others. This means they are more useful.



Potential Difference – this is the same for all components.

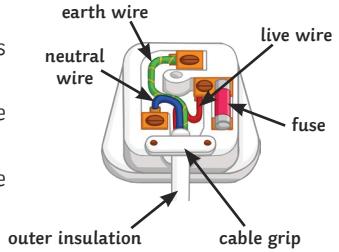
$V_1 = V_2$

Current – the total current is the total of all the currents through all the components.

$I_{total} = I_1 + I_2 + I_3$

Resistance – adding resistance reduces the total resistance.

Electricity in the Home



AC – alternating current. Constantly changing direction - UK mains supply is 230V and has a frequency of 50 hertz (Hz).

DC – direct current. Supplied by batteries and only flows in one direction.

Cables – most have three wires: live, neutral and earth. They are covered in plastic insulation for safety.

Live wire – provides the potential difference from the mains.

Neutral wire – completes the circuit.

Earth wire – protection. Stops the appliance from becoming live. Carries a current if there is a fault. Touching the live wire can cause the current to flow through your body. This causes an electric shock.

Energy Transferred – this depends on how long the appliance is on for and its power.

energy transferred (J) = power (W) × time (s) $E = Pt$

Energy is transferred around a circuit when the charge moves.

energy transferred (J) = charge flow (C) × potential difference (V) $E = QV$

power (W) = potential difference (V) × current (A) $P = VI$

power (W) = current^2 (A) × resistance (Ω) $P = I^2R$

The National Grid

The National Grid is a system of cables and transformers. They transfer electrical power from the power station to where it is needed. Power stations are able to change the amount of electricity that is produced to meet the demands. For example, more energy may be needed in the evenings when people come home from work or school. Electricity is transferred at a low current, but a high voltage so less energy is being lost as it travels through the cables.

Step-up transformers – increase the voltage as the electricity flows through the cables.

Step-down transformers – decrease the potential difference to make it safe.