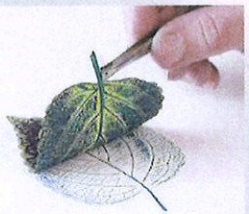
Fowey River Academy
Year 10 Knowledge Organiser

Autumn Quadmester

Year 10 Art/Textiles

Printmaking

THIS SEMESTER WE WILL BE EXPLORING A VARIETY OF PRINTMAKING AND DESIGN SKILLS. YOU WILL CREATE A PRINTING PORTFOLIO. THIS WILL INCLUDE POLY TILE PRINTING, SCREEN PRINTING, LINO PRINTING AND COLLOGRAPH PRINTING. ALONGSIDE THESE SKILLS YOU WILL DEVELOP DESIGN AND COMPOSITION UNDERSTANDING.



WHY DO WE USE SKETCHBOOKS?

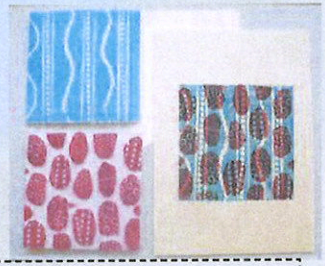
YOUR SKETCHBOOK IS A JOURNAL OF YOUR EXPERIENCES AND SKILLS. IT SHOWS THE VIEWER WHAT YOU CAN DO/UNDERSTAND. IT DOES NOT HAVE TO ONLY SHOW PERFECT WORK. IT IS IMPORTANT YOU ALSO INCLUDE TRIALS, MISTAKES AS THIS SHOWS THAT YOU CAN REFLECT AND REFINE YOUR WORK.

What is the difference between printmaking and printing?

Printmaking is a process of hand making and pressing using inks, whereas prints are simply reproductions of an original painting or photograph.

PRINTMAKING TOOLS

LINO CUTTER - tool used to carve out lino
BENCH HOOK - wooden block to hold the lino in place.
SCREEN - a mesh screen used to push ink through to print with.
SQUEEGEE - a wooden and rubber scraper used for screen printing.
POLY TILE - polystyrene board used to print.
PRINTING INK - A thick paint used for printing.



KEYWORDS

PRINTING PRINTMAKING
COLLOGRAPH POLY TILE
LINO SCREEN COMPOSITION
DESIGN ILLUSTRATION

AO1

Develop ideas based on research

To annotate artist research, demonstrate that you understand what influenced the artist

To show the journey of your sketchbook is influenced by artists/designer

AO2

To explore a variety of materials and processes.

To refine techniques used in your sketchbook to show that you are getting better at new processes!

To adapt and improve outcomes based on written evaluations.

AO3

To record ideas, intentions and observations that link to your intention for your project.

To produce beautiful observational drawings consistently through your sketchbook

AO4

To create an outcome that is personal, skillful and linked to the theme in a meaningful way

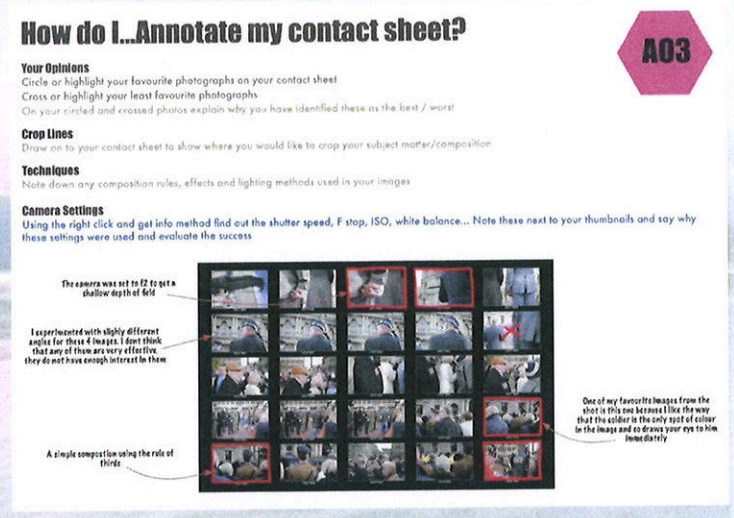
To show that you are able to create an outcome as a result of clear planning in your sketchbook.

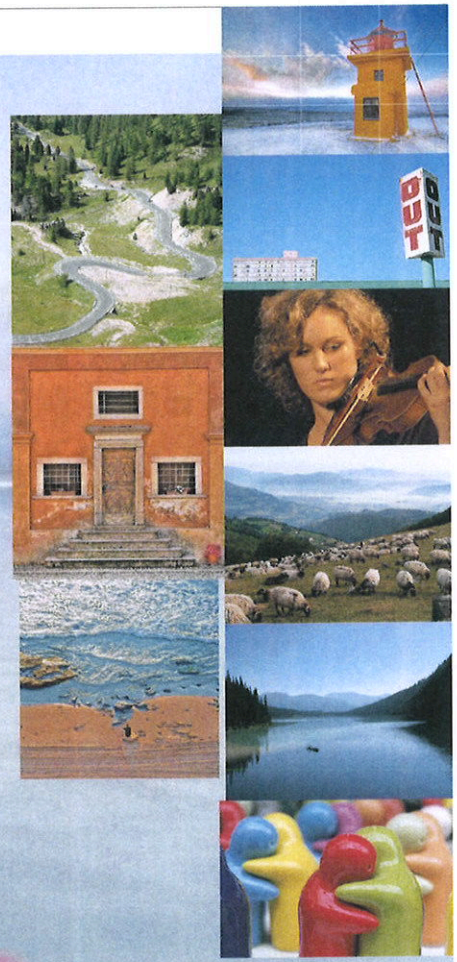
YEAR 10 PHOTOGRAPHY

Compositional Rules

Formal elements in Photography:

LINE FORM/SHAPE
PATTERN TONE
COLOUR TEXTURE
SPACE





Composition in photography is about what to include or leave out of your frame. It's also about how you decide to place the elements in the scene. Rather than thinking of these as "rules", think of them as guidelines for making your images more visually appealing and interesting.

Compositional rules:

Rule of Thirds
Framing
Leading Lines
Depth of Field
Cropping
Pattern and Symmetry
Balancing Elements
Viewpoints
Backgrounds
Depth of Field

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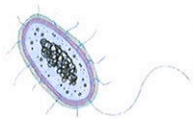
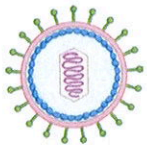
Infection and Response Knowledge Organiser – Foundation and Higher

Communicable Disease

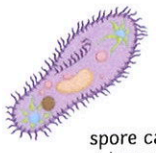
Pathogens are **microorganisms** that enter the body and cause communicable disease (infectious). Plants and animals can be infected by them.



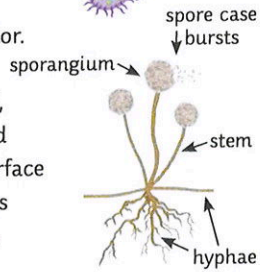
Bacteria are small cells that can reproduce very quickly in the body. They produce **toxins** that make you feel ill, damaging your cells and tissues.



Viruses are much smaller than bacteria; they can also reproduce quickly in the body. Viruses live inside your cell where they replicate. They then burst out of the cell, releasing new viruses.



Protists are eukaryotes (multicellular). Some are parasites which live on or inside other organisms, often carried by a vector.



Fungi are sometimes single celled, others have hyphae that grow and penetrate human skin and the surface of plants. They can produce spores which can spread to other plants.

How Pathogens Are Spread

Pathogens can be spread in many ways, for example:

Water – by drinking dirty water, e.g. cholera.

Air – carried by air and breathed in, e.g. influenza.

Direct contact – touching contaminated surfaces including the skin, e.g. athlete's foot.

Viral Diseases

Measles is spread by droplets of liquid from sneezes and coughs etc., symptoms include a red rash on the skin and a fever. Measles can be serious or even fatal, it can lead to pneumonia. Most people are vaccinated against measles when they are very young.

HIV is spread by sexual contact or exchanging body fluids. HIV can be controlled be antiviral drugs; this stops the viruses replicating. The virus attacks the cells in the immune system. If the immune system is badly damaged, the body cannot cope with other infections. This is the late stage and is called aids.

Tobacco mosaic virus affects plants, parts of the leaves become discoloured. This means plants cannot carry out photosynthesis; this will affect the plants growth.

Fungal and Protist Diseases

Fungal

Rose black spot shows as black spots on the leaves of the plant, this means less photosynthesis occurs. As a result, the plant does not grow as well. It is spread by the wind or the water. They can be treated by using fungicides and taking the leaves off the infected plant.

Protists

Malaria is caused by a protist, mosquitoes are the vectors. They become infected when they feed on an infected animal. The protist is inserted into the blood vessel. Malaria can cause fever, it can also be fatal.

Bacterial Diseases

Salmonella bacteria causes food poisoning. Symptoms include fever, stomach cramps, vomiting and diarrhoea. The symptoms are caused by the toxins produced by the bacteria. Food contaminated with salmonella can give you food poisoning. Most poultry in the UK will have had a vaccination against salmonella.

Gonorrhoea is a sexually transmitted bacterial disease, passed on by sexual contact. Symptoms include pain when urinating and thick yellow/green discharge from the vagina or penis. To prevent the spread, people should be treated with antibiotics and use a condom.

How to prevent the spread:

Being hygienic –

washing hands thoroughly.

Destroying vectors –

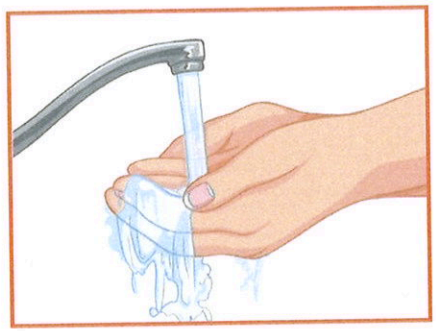
killing vectors by using insecticides or destroying their habitat.

Isolation –

isolating an infected person will prevent the spread.

Vaccination –

people cannot develop the infection and then pass it on.



Infection and Response Knowledge Organiser – Foundation and Higher

Fighting Diseases

Defence System

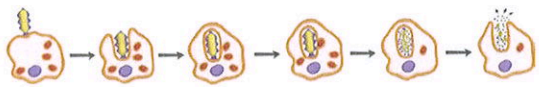
1. The skin acts as a barrier to pathogens.
2. Hairs and mucus in your nose trap particles.
3. The trachea and bronchi secrete mucus to trap pathogens. They also have cilia which move backwards and forwards to transport the mucus towards the throat. This traps any pathogens and the mucus is usually swallowed.
4. The stomach contains hydrochloric acid to kill any pathogens that enter the body via the mouth.

The Immune System

This kills any pathogens that enter the body.

White blood cells:

- **Phagocytosis** is when white blood cells engulf pathogens and then digest them.
- They produce **antitoxins** to neutralise the **toxins**.
- They also produce **antibodies**. Pathogens have **antigens** on their surface, antibodies produced by the white blood cells lock on to the antigen on the outside of the pathogen. White blood cells can then destroy the pathogens. Antibodies are specific to one antigen and will only work on that pathogen.



Vaccinations

Vaccinations have been developed to protect us from future infections. A vaccination involves an injection of a **dead** or **weakened** version of the pathogen. They carry antigens which cause your body to produce antibodies which will attack the pathogen. If you are infected again, the white blood cells can produce antibodies quickly.

Pros	Cons
Helps to control communicable diseases that used to be very common.	They don't always work.
Epidemics can be prevented.	Some people can have a bad reaction to a vaccine – however, that is very rare.

Fighting Disease – Drugs

Painkillers relive the pain and symptoms, but do not tackle the cause.

Antibiotics kill the bacteria causing the problem, but do not work on viruses. Viruses are very difficult to kill because they live inside the body cells.

Developing Drugs

There are three main stages in drug testing:

Pre-clinical testing:

1. Drugs are tested on human cells and tissues.
2. Testing carried out on living animals.

Clinical testing:

3. Tested on healthy human volunteers in clinical trials. Starts with a very low dose, then tested on people with the illness to find the optimum dose.

Placebo is a substance that is like the drug, but does not do anything.

Placebo effect is when the patient thinks the treatment will work even though their treatment isn't doing anything.

Blind trial is when the patient does not know whether they are getting the drug or the placebo.

Double-blind trial is when both the doctor and the patient do not know whether they are getting the drug.

Drugs from Plants

Chemicals produced by plants to defend themselves can be used to treat human diseases or help with symptoms.

Drug	Plant/Microorganism
aspirin	willow
digitalis	foxglove
penicillin	mould - penicillium

New drugs are now made by chemists, who work for the pharmaceutical industry, in laboratories.

Key Vocabulary

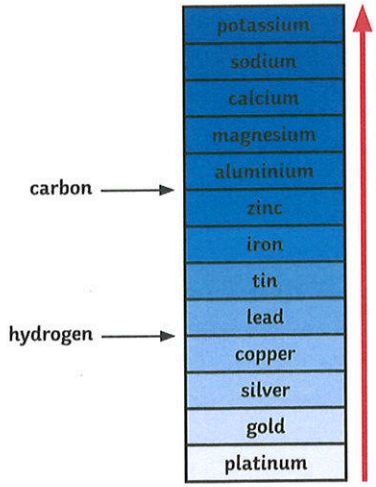
antibodies
antigens
antitoxins
bacteria
blind trial
double-blind
fungus
microorganism
phagocytosis
placebo
protist
toxins
vaccination
vector
virus

AQA GCSE Chemistry (Combined Science) Unit 4: Chemical Changes Knowledge Organiser

The Reactivity Series

Here's a mnemonic to help you learn the order:

purple (potassium)
slime (sodium)
can (calcium)
make (magnesium)
a (aluminium)
careless (carbon)
zebra (zinc)
insane (iron)
try (tin)
learning (lead)
how (hydrogen)
camels (copper)
surprise (silver)
gorillas (gold)



The reactivity series is a league table for metals. The more reactive metals are near the top of the table with the least reactive near the bottom. In chemical reactions, a more reactive metal will displace a less reactive metal.

Reactions of Metals with Water

Metals, when reacted with water, produce a metal hydroxide and hydrogen.

lithium + water ⟶ lithium hydroxide + hydrogen

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

The more reactive a metal is, the faster the reaction.

Reactions of Metals with Dilute Acid

Metals, when reacted with acids, produce a salt and hydrogen.

Sodium + hydrochloric acid ⟶ sodium chloride + hydrogen

$2Na + 2HCl \longrightarrow 2NaCl + H_2$

Metals that are below hydrogen in the reactivity series **do not** react with dilute acids.

Reactions of Acids

The general formula for the reaction between an acid and a metal is:
acid + metal ⟶ salt + hydrogen

For example: hydrochloric acid + sodium ⟶ sodium chloride + hydrogen

$2HCl + 2Na \longrightarrow 2NaCl + H_2$

When an acid reacts with an alkali, a neutralisation reaction takes place and a salt and water are produced.

The general formula for this kind of reaction is as follows:

acid + alkali ⟶ salt + water

hydrochloric acid + sodium hydroxide ⟶ sodium chloride + water

$HCl + NaOH \longrightarrow NaCl + H_2O$

Naming Salts

The first part comes from the metal in the metal carbonate, oxide or hydroxide. The second part of the name comes from the acid that was used to make it.

For example, sodium chloride.

Acid Used	Salt Produced
hydrochloric	chloride
nitric	nitrate
sulfuric	sulfate

Redox Reactions (Higher Tier Only)

When metals react with acids, they undergo a redox reaction. A **redox reaction** occurs when both **oxidation** and **reduction** take place at the **same time.**

For example:

$2H^+ + Ca \longrightarrow Ca^{2+} + H_2$

The ionic equation can be further split into two half equations.

$Ca \longrightarrow Ca^{2+} + 2e^-$

Oxidation is loss of electrons.

$2H^+ + 2e^- \longrightarrow H_2$

Reduction is gaining of electrons.

Reactions with Bases

The general formula for the reaction between an acid and a metal oxide is:
acid + metal oxide ⟶ salt + water

sulfuric acid + copper oxide ⟶ copper sulfate + water

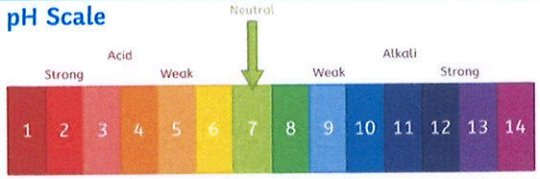
$H_2SO_4 + CuO \longrightarrow CuSO_4 + H_2O$

Reactions with Carbonates

The general formula for the reaction between an acid and a carbonate is:
acid + carbonate ⟶ salt + water + carbon dioxide

hydrochloric acid + calcium carbonate ⟶ calcium chloride + water + carbon dioxide

pH Scale



In aqueous solutions, acids produce H^+ ions and alkalis produce OH^- ions.

Neutral solutions are pH7 and are neither acids or alkalis.

For example, in neutralisation reactions, hydrogen ions from an acid react with hydroxide ions from an alkali to produce water:

$H^+ + OH^- \longrightarrow H_2O$

Making Soluble Salts

1. Make a saturated solution by stirring copper oxide into the sulfuric acid until no more will dissolve.

2. Filter the solution to remove the excess copper oxide solid.

3. Half fill a beaker with water and set this over a Bunsen burner to heat the water. Place an evaporating dish on top of the beaker.

4. Add some of the solution to the evaporating basin and heat until crystals begin to form.

5. Once cooled, pour the remaining liquid into a crystallising dish and leave to cool for 24 hours.

6. Remove the crystals with a spatula and pat dry between paper towels.

Strong and Weak Acids (Higher Tier Only)

A **strong** acid **completely dissociates** in a solution. For example: $HCl \longrightarrow H^+ + Cl^-$

Hydrochloric acid is able to completely dissociate in solution to form hydrogen and chloride ions.

Examples of strong acids include nitric acid (HNO_3) and sulfuric acid (H_2SO_4).

Weak acids in comparison only partially dissociate.

For example acetic acid **partially dissociates** to form a hydrogen and acetate ion.

$CH_3COOH \rightleftharpoons CH_3COO^- + H^+$

The **double arrow** symbol indicates that the reaction is **reversible**. Both the forward and reverse reaction occur at the same time and the reaction never goes to completion.

The Process of Electrolysis

Electrolysis is the **splitting up** of an ionic substance using **electricity.**

On setting up an electrical circuit for electrolysis, two **electrodes** are required to be placed in the electrolyte. The electrodes are **conducting rods.** One of the rods is connected to the **positive** terminal and the other to the **negative** terminal.

The **electrodes** are **inert** (this means they do not react in the reaction) and are often made from **graphite** or platinum.

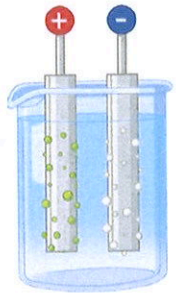
During the process of electrolysis, **opposites attract.** The positively charged ions will be attracted toward the negative electrode. The negatively charged ions will be attracted towards the positive electrode.

When ions reach the electrodes, the charges are lost and they become elements.

The **positive** electrode is called the **anode.**

The **negative** electrode is called the **cathode.**

Electrolysis of Aqueous Solutions



Gases may be given off or metals deposited at the electrodes. This is dependent on the reactivity of the elements involved.

If the metal is **more reactive** than **hydrogen** in the reactivity series, then **hydrogen** will be **produced** at the **negative cathode.** At the **positive anode,** negatively charged ions **lose** electrons. This is called **oxidation** and you say that the ions have been oxidised.

Using Electrolysis to Extract Metals

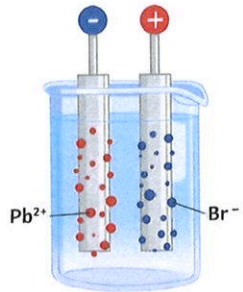
Metals are extracted by electrolysis if the metal in question reacts with carbon or if it is too reactive to be extracted by reduction with carbon. During the extraction process, large quantities of energy are used to melt the compounds.

Aluminium is manufactured by the process of electrolysis. Aluminium oxide has a high melting point and melting it would use large amounts of energy. This would increase the cost of the process, therefore molten **cryolite** is added to aluminium oxide to lower the melting point and thus reduce the cost.

Electrolysis of Molten Ionic Compounds – Lead Bromide

Lead bromide is an **ionic** substance. Ionic substances, when solid, are **not** able to conduct electricity. When molten or in solution, the ions are free to move and are able to carry a charge.

The **positive** lead ions are attracted toward the **negative cathode** at the same time as the **negative bromide** ions are attracted toward the **positive anode.**



Oxidation **i**s the **l**oss of electrons and **r**eduction **i**s the **g**aining of electrons. **OIL RIG** (Higher Tier Only).

We represent what is happening at the electrodes by using **half equations** (Higher Tier Only).

The lead ions are attracted towards the negative electrode. When the **lead ions** (Pb^{2+}) reach the cathode, each ion **gains two electrons** and becomes a neutral atom. We say that the lead ions have been **reduced.**

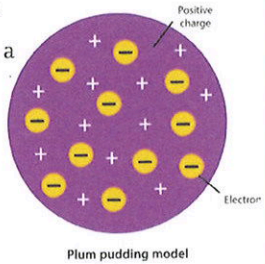
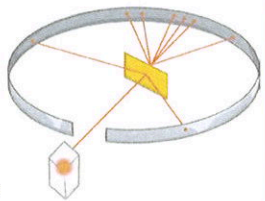
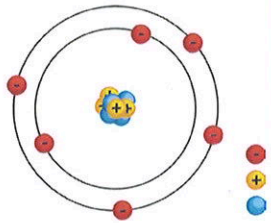
$Pb^{2+} + 2e^- \longrightarrow Pb$

The bromide ions are attracted towards the positive electrode. When the **bromide ions** (Br-) reach the anode, each ion **loses one electron** to become a neutral atom. Two bromine atoms are then able to bond together to form the covalent molecule Br_2.

$2Br^- \longrightarrow Br_2 + 2e^-$

Atomic Structure Knowledge Organiser – Foundation and Higher

Developing the Model of the Atom

Scientist	Time	Contribution
John Dalton	Start of 19th century	Atoms were first described as solid spheres.
JJ Thomson	1897	Thomson suggested the plum pudding model – the atom is a ball of charge with electrons scattered within it.  Plum pudding model
Ernest Rutherford	1909	Alpha Scattering experiment – Rutherford discovered that the mass is concentrated at the centre and the nucleus is charged. Most of the mass is in the nucleus. Most atoms are empty space. 
Niels Bohr	Around 1911	Bohr theorised that the electrons were in shells orbiting the nucleus. 
James Chadwick	Around 1940	Chadwick discovered neutrons in the nucleus.

Isotopes

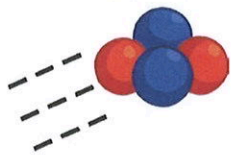
An isotope is an element with the same number of protons but a different number of neutrons. They have the same atomic number, but different mass numbers.

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

Some isotopes are unstable and, as a result, decay and give out radiation. Ionising radiation is radiation that can knock electrons off atoms. Just how ionising this radiation is, depends on how readily it can do that.

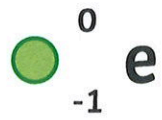
Alpha

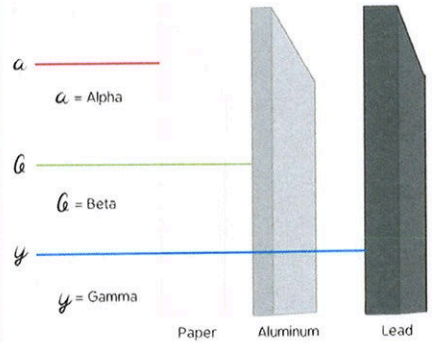
Alpha radiation is an alpha particle emitted from the nucleus of a radioactive nuclei. It is made from two protons and two neutrons. They can't travel too far in the air and are the least penetrating – stopped by skin and paper. However, they are highly ionising because of their size.



Beta

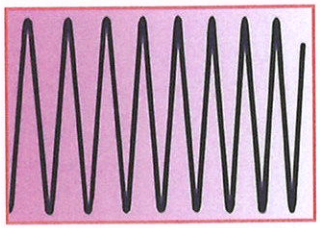
Beta radiation is a fast moving electron that can be stopped by a piece of aluminium. Beta radiation is emitted by an atom when a neutron splits into a proton and an electron.





Gamma

A gamma wave is a wave of radiation and is the most penetrating – stopped by thick lead and concrete.



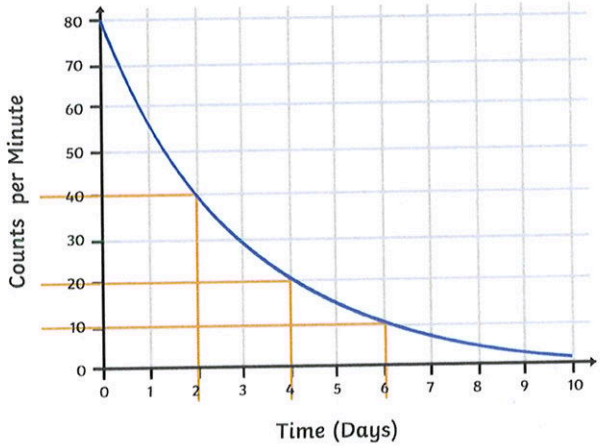
Half-life

The half-life is the time taken for the number of radioactive nuclei in an isotope to halve.

Radioactivity is a random process – you will not know which nuclei will decay. Radioactive decay is measured in becquerels Bq. 1 Bq is one decay per second.

Radioactive substances give out radiation from their nucleus.

A graph of half-life can be used to calculate the half-life of a material and will always have this shape:



Judging from the graph, the radioactive material has a half-life of two days.

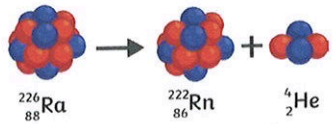
Irradiation

Irradiation occurs when materials are near a radioactive source. The source is sometimes placed inside a lead-lined box to avoid this.

People who work with radioactive sources will sometimes stand behind a lead barrier, be in a different room or use a remote-controlled arm when handling radioactive substances.

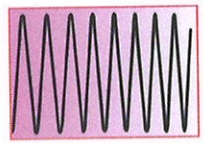
Alpha Decay Equations

An alpha particle is made of two protons and two neutrons. The atomic number goes down by two and its mass number decreases by four.



Gamma rays

There is no change to the nucleus when a radioactive source emits gamma radiation. It is the nucleus getting rid of excess energy.



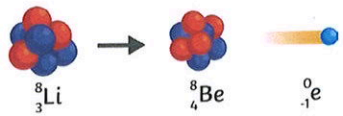
Contamination

When unwanted radioactive atoms get onto an object, it is possible for the radioactive particles to get inside the body.

Protective clothing should be worn when handling radioactive material.

Beta Decay Equations

A neutron turns into a proton and releases a an electron. The mass of the nucleus does not change but the number of protons increases.



Alpha radiation is more dangerous inside the body. It is highly ionising and able to cause a lot of damage. Outside the body it is less dangerous because it cannot penetrate the skin.

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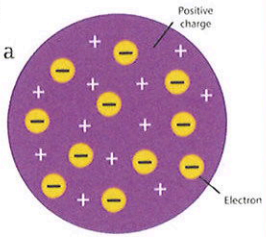
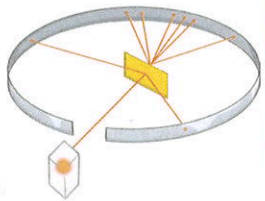
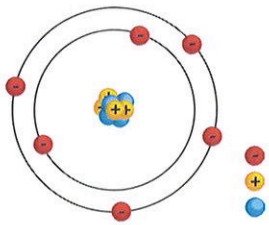
Atomic Structure Knowledge Organiser – Foundation and Higher Separate Science

Developing the Model of the Atom

Scientist	Time	Contribution
John Dalton	Start of 19th century	Atoms were first described as solid spheres.
JJ Thomson	1897	Thomson suggested the plum pudding model – the atom is a ball of charge with electrons scattered within it.  Plum pudding model
Ernest Rutherford	1909	Alpha Scattering experiment – Rutherford discovered that the mass is concentrated at the centre and the nucleus is charged. Most of the mass is in the nucleus. Most atoms are empty space. 
Niels Bohr	Around 1911	Bohr theorised that the electrons were in shells orbiting the nucleus. 
James Chadwick	Around 1940	Chadwick discovered neutrons in the nucleus.

Isotopes

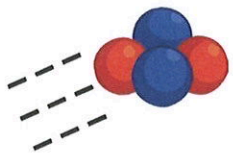
An isotope is an element with the same number of protons but a different number of neutrons. They have the same atomic number, but different mass numbers.

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

Some isotopes are unstable and, as a result, decay and give out radiation. Ionising radiation is radiation that can knock electrons off atoms. Just how ionising this radiation is, depends on how readily it can do that.

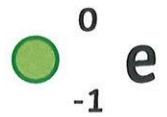
Alpha

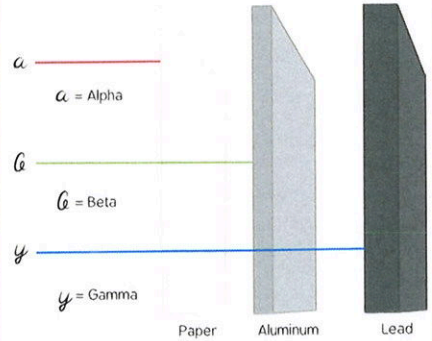
Alpha radiation is an alpha particle emitted from the nucleus of a radioactive nuclei. It is made from two protons and two neutrons. They can't travel too far in the air and are the least penetrating – stopped by skin and paper. However, they are highly ionising because of their size.



Beta

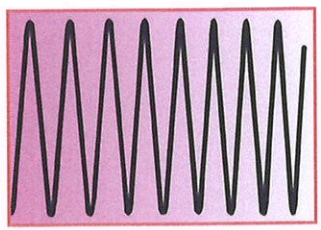
Beta radiation is a fast moving electron that can be stopped by a piece of aluminium. Beta radiation is emitted by an atom when a neutron splits into a proton and an electron.





Gamma

A gamma wave is a wave of radiation and is the most penetrating – stopped by thick lead and concrete.



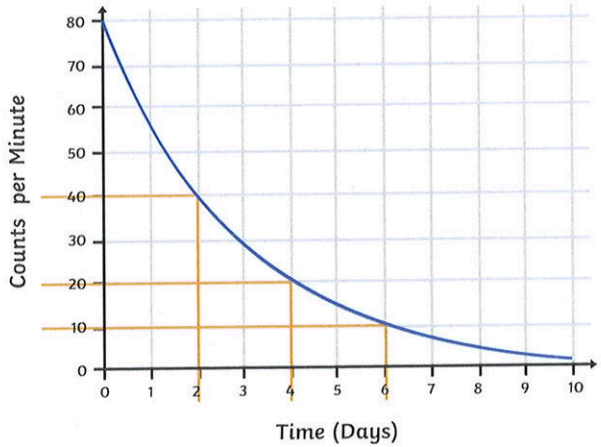
Half-life

The half-life is the time taken for the number of radioactive nuclei in an isotope to halve.

Radioactivity is a random process – you will not know which nuclei will decay. Radioactive decay is measured in becquerels Bq. 1 Bq is one decay per second.

Radioactive substances give out radiation from their nucleus.

A graph of half-life can be used to calculate the half-life of a material and will always have this shape:



Judging from the graph, the radioactive material has a half-life of two days.

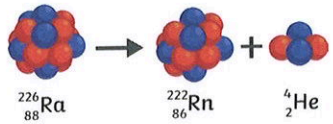
Irradiation

Irradiation occurs when materials are near a radioactive source. The source is sometimes placed inside a lead-lined box to avoid this.

People who work with radioactive sources will sometimes stand behind a lead barrier, be in a different room or use a remote-controlled arm when handling radioactive substances.

Alpha Decay Equations

An alpha particle is made of two protons and two neutrons. The atomic number goes down by two and its mass number decreases by four.



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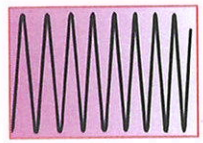

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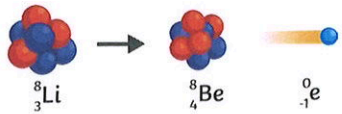

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Background Radiation

This comes from natural sources like rocks, food and air. It also comes from man-made sources such as nuclear weapons, nuclear waste or nuclear accidents. The dose of radiation people receive varies dependent on how close they are to the source. Too much exposure to radiation can cause radiation poisoning. Radiation dosage is measured in **sieverts (Sv).**

1000 millisieverts (mSv) = 1 sievert (Sv)

Uses of Nuclear Radiation

Although radiation can be dangerous, it also has its uses. The risks are always considered when using radiation. Gamma sources can be used as a medical tracer in the human body; isotopes can be injected or swallowed. As the isotope goes around the body, it can be monitored and medical issues can be spotted. Gamma radiation is emitted out of the body and does not cause the cells to become ionised. The isotope used will have a short half-life so it does not stay inside the body for too long. Tracers can be used to diagnose potentially life-threatening conditions which otherwise would not be spotted. The risk of using the radioactive tracer is much less than the risk of the condition they may diagnose.

Different Half-Lives of Radioactive Isotopes

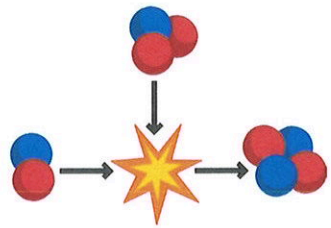
All radioactive isotopes have different half-lives. Some are very short and others are much longer. The uses of these will depend on the half-life. For example, you would use an isotope with a short half-life as a medical tracer so it is not in the body for too long.

Radiotherapy

High doses of radiation can be used to treat cancer. Gamma rays are focused directly onto the cancer cell, killing the cancer cell but not killing too many healthy cells. The damage to the healthy cells that may be close to the cancer can cause the patient to feel ill. However, killing the cancer cell makes it worth it.

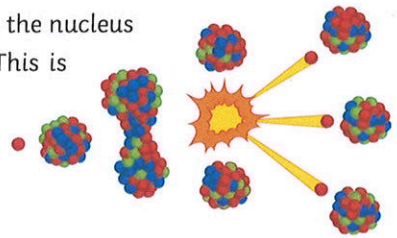
Fusion

Nuclear fusion is the joining together of smaller radioactive nuclei to make a larger atom. Fusion occurs in the sun. This whole process releases a lot of energy, much more than fission. However, a very high temperature and pressure is needed for fusion to occur, so it is not used in the production of energy yet.



Fission

Nuclear fission is the splitting of large radioactive nuclei into smaller ones. A neutron is absorbed by a large unstable radioactive nucleus. Next, the nucleus splits into smaller nuclei. As this happens, more neutrons and energy are released. The neutrons released go on to cause more reactions. This is called a chain reaction.



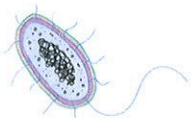
Fission is carried out in a nuclear reactor in order to generate energy. It is controlled by control rods which, when they are lowered down, slow down the reaction process. When they are raised, the reaction speeds up again. If this process is not controlled, then a nuclear weapon has been produced.

AQA Infection and Response Knowledge Organiser

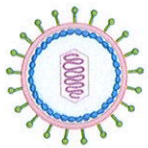
Communicable Disease

Pathogens are **microorganisms** that enter the body and cause communicable disease (infectious). Plants and animals can be infected by them.

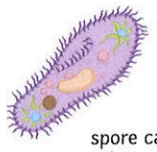
Bacteria are small cells that can reproduce very quickly in the body. They produce **toxins** that make you feel ill, damaging your cells and tissues.



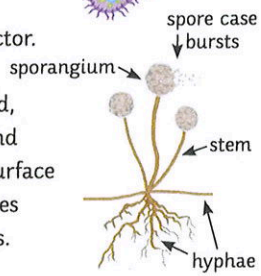
Viruses are much smaller than bacteria; they can also reproduce quickly in the body. Viruses live inside your cells where they replicate. They then burst out of the cell, releasing new viruses.



Protists are eukaryotes (multicellular). Some are parasites which live on or inside other organisms, often carried by a vector.



Fungi are sometimes single celled, others have hyphae that grow and penetrate human skin and the surface of plants. They can produce spores which can spread to other plants.



How Pathogens Are Spread

Pathogens can be spread in many ways, for example:

Water – by drinking dirty water, e.g. cholera.

Air – carried by air and breathed in, e.g. influenza.

Direct contact – touching contaminated surfaces including the skin, e.g. athlete's foot.

Viral Diseases

Measles is spread by droplets of liquid from sneezes and coughs etc. Symptoms include a red rash on the skin and a fever. Measles can be serious or even fatal and it can lead to pneumonia. Most people are vaccinated against measles when they are very young.

HIV is spread by sexual contact or exchanging body fluids. HIV can be controlled be antiviral drugs; this stops the viruses replicating. The virus attacks the cells in the immune system. If the immune system is badly damaged, the body cannot cope with other infections. This is the late stage and is called Aids.

Tobacco mosaic virus affects plants. Parts of the leaves become discoloured. This means plants cannot carry out photosynthesis; this will affect the plants growth.

Fungal and Protist Diseases

Fungal

Rose black spot shows as black spots on the leaves of the plant. This means less photosynthesis occurs. As a result, the plant does not grow as well. It is spread by the wind or the water. They can be treated by using fungicides and taking the leaves off the infected plant.

Protists

Malaria is caused by a protist; mosquitoes are the vectors. They become infected when they feed on an infected animal. The protist is inserted into the blood vessel. Malaria can cause fever and it can also be fatal.

Bacterial Diseases

Salmonella bacteria causes food poisoning. Symptoms include fever, stomach cramps, vomiting and diarrhoea. The symptoms are caused by the toxins produced by the bacteria. Food contaminated with salmonella can give you food poisoning. Most poultry in the UK will have had a vaccination against salmonella.

Gonorrhoea is a sexually transmitted bacterial disease, passed on by sexual contact. Symptoms include pain when urinating and thick yellow/green discharge from the vagina or penis. To prevent the spread, people should be treated with antibiotics and use a condom.

How to prevent the spread:

Being hygienic –

washing hands thoroughly.

Destroying vectors –

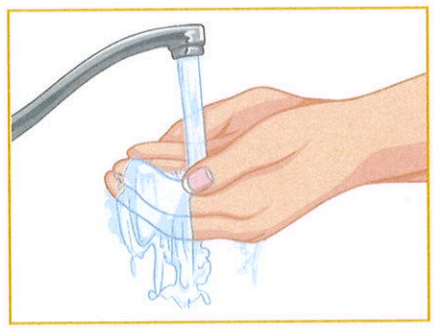
killing vectors by using insecticides or destroying their habitat.

Isolation –

isolating an infected person will prevent the spread.

Vaccination –

people cannot develop the infection and then pass it on.



AQA Infection and Response Knowledge Organiser

Plant Diseases and Defences

Plants need ions from the soil. If there isn't enough, then the plants suffer deficiency symptoms.

Ion	Symptoms
nitrates	stunted growth
magnesium	yellow leaves

Plant Diseases – common signs include stunted growth, spots on the leaves, patches of decay, abnormal growth, malformed stems or leaves and discolouration.

Plants have physical, chemical and mechanical defences to stop pathogens.

Physical – waxy cuticle, cell walls, layer of dead cells.

Mechanical – thorns, hairs, leaves that droop or curl and some plants can mimic other organisms.

Fighting Diseases

Defence System

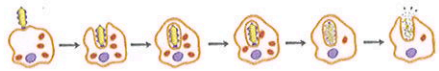
1. The skin acts as a barrier to pathogens.
2. Hairs and mucus in your nose trap particles.
3. The trachea and bronchi secrete mucus to trap pathogens. They also have cilia which move backwards and forwards to transport the mucus towards the throat. This traps any pathogens and the mucus is usually swallowed.
4. The stomach contains hydrochloric acid to kill any pathogens that enter the body via the mouth.

The Immune System

This kills any pathogens that enter the body.

White blood cells:

- **Phagocytosis** is when white blood cells engulf pathogens and then digest them.
- They produce **antitoxins** to neutralise the **toxins**.
- They also produce **antibodies**. Pathogens have **antigens** on their surface. Antibodies produced by the white blood cells lock on to the antigen on the outside of the pathogen. White blood cells can then destroy the pathogens.
  Antibodies are specific to one antigen
  and will only work on that pathogen.



Vaccinations

Vaccinations have been developed to protect us from future infections. A vaccination involves an injection of a **dead** or **weakened** version of the pathogen. They carry antigens which cause your body to produce antibodies which will attack the pathogen. If you are infected again, the white blood cells can produce antibodies quickly.

Pros	Cons
Helps to control communicable diseases that used to be very common.	They don't always work.
Epidemics can be prevented.	Some people can have a bad reaction to a vaccine – however, that is very rare.

Fighting Disease – Drugs

Painkillers relive the pain and symptoms, but do not tackle the cause.

Antibiotics kill the bacteria causing the problem, but do not work on viruses. Viruses are very difficult to kill because they live inside the body cells.

Developing Drugs

There are three main stages in drug testing:

Pre-clinical testing:

1. Drugs are tested on human cells and tissues.
2. Testing carried out on living animals.

Clinical testing:

3. Tested on healthy human volunteers in clinical trials. Starts with a very low dose, then tested on people with the illness to find the optimum dose.

Placebo is a substance that is like the drug but does not do anything.

Placebo effect is when the patient thinks the treatment will work even though their treatment isn't doing anything.

Blind trial is when the patient does not know whether they are getting the drug or the placebo.

Double-blind trial is when both the doctor and the patient do not know whether they are getting the drug.

Drugs from Plants

Chemicals produced by plants to defend themselves can be used to treat human diseases or help with symptoms.

Drug	Plant/Microorganism
aspirin	willow
digitalis	foxglove
penicillin	mould - penicillium

New drugs are now made by chemists, who work for the pharmaceutical industry, in laboratories.

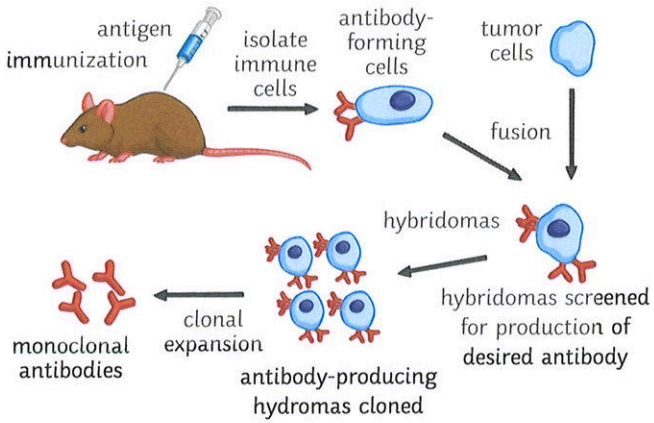
Key Vocabulary

antibodies
antigens
antitoxins
bacteria
blind trial
double-blind
fungus
microorganism
phagocytosis
placebo
protist
toxins
vaccination
vector
virus

Monoclonal Antibodies

Monoclonal antibodies are identical antibodies. Antibodies are produced by B lymphocytes.

It is possible to fuse a B lymphocyte from a mouse with a tumour cell to create a cell called a hybridoma - these can be cloned. They will all produce the same antibodies; the antibodies can be collected and purified.



There are many uses of monoclonal antibodies. For example:

Pregnancy testing: HCG hormone is found in the urine of women when pregnant. Pregnancy testing sticks detect this hormone. The HGC binds to the antibodies on the stick and changes the colour if you are pregnant. If the woman is not pregnant, there is no HCG. This means there is nothing to stick to the blue beads on the test strip, so it does not go blue.

Treating diseases: anti-cancer drugs can be attached to monoclonal antibodies. They can target specific cells (cancer cells) by binding to the cancer marker. This kills the cancer cells, but not the normal body cells.

Research to find specific substances: used to bind to hormones and chemicals in the blood to measure levels. Also used in blood tests for pathogens and locating molecules on a cell or in tissue.

Problems: they have more side-effects than originally thought. For example: fever, vomiting, low blood pressure. They are not used by doctors as much as was first thought.

AQA GCSE Chemistry (Separate Science) Unit 3: Quantitative Chemistry

Relative Formula Mass (M_r)

The **relative atomic mass (A_r)** of an element is an elements relative mass compared to the mass of an atom of carbon-12. A_r values are given in the periodic table.

The **relative formula mass (M_r)** of a compound is the **sum** of all the relative atomic masses (A_r) of the atoms in the formula.

Example 1: hydrochloric acid (HCl) consists of one hydrogen atom (A_r 1) and one chlorine atom (A_r 35.5).

The M_r of HCl = 1 + 35.5 = 36.5

Example 2: sulfuric acid (H_2SO_4) consists of two hydrogen atoms (A_r 1), one sulfur atom (A_r 32) and four oxygen atoms (A_r 16).

The M_r of H_2SO_4 = (1 × 2) + 32 + (16 × 4) = 98

Neither A_r or M_r values have any units.

Law of Conservation of Mass

The **law of conservation of mass** states that during a chemical reaction, no atoms are lost or made.

For example: $2Mg + O_2 \longrightarrow 2MgO$

In a chemical reaction, mass is never lost or gained. What **goes in** must **come out**. The **total mass of the reactants** at the beginning of the chemical reaction **equals** the **total mass of the products** made at the end of the reaction.

For example, imagine if we used building bricks to represent the atoms in a chemical reaction: atoms, like building bricks, can be completely rearranged. However, the total mass of the atoms will stay the same. Rearranging the building blocks in different structures takes a little **energy**, just like in a chemical reaction.

Reactions in Closed and Non-Enclosed Systems

If a reaction occurs in a **closed system**, the **mass** in a chemical reaction will remain **constant**.

In an **non-enclosed system, changes in mass can occur,** such as when a gas is released. It is important to remember that **no atoms are created or destroyed,** they are just **rearranged**. If a gas escapes a non-enclosed system, the total mass will look as if it has decreased. Similarly, if a gas is gained, the total mass will look as if it has increased. However, the **total mass** will **remain the same** if the mass of the gas is included in the reaction calculation.

In this **closed system** (the classroom), the mass in the reaction remains constant. As the system is a closed one, no children are allowed to leave or enter.

In this **non-enclosed system** (the classroom), the mass in the reaction can look as if it has changed as children are allowed to leave the classroom at any time.

Uncertainty

Whenever a measurement is made, there is always some degree of **uncertainty** about the result. Uncertainty is a **measure** of the **variability** in scientific data.

Uncertainty can be measured by considering the **resolution** of the scientific equipment being used or from the **range** of a set of scientific data.

There are two types of errors: **random error** and **systematic error.**

Random errors may be caused by **human error** such as a poor technique when taking measurements or by **equipment** that is **faulty**. For example, three mass balances all showing different mass values for the same object. Random errors are **random** and not something that can be predicted.

Systematic errors are errors that are produced **consistently**: if the experiment is repeated, the **same error** will occur. For example, not taring a mass balance properly or problems with the experimental method.

$$\text{uncertainty} = \frac{\text{range of results}}{2}$$

The **range** is the difference between the **largest** and **smallest** value.

For example, student A carried out a practical to determine how much dilute sulfuric acid is needed to react with exactly 50.0cm^3 of a sodium hydroxide solution.

Repeat	1	2	3	Mean
Volume of H_2SO_4 needed to react with 50.0cm^3 of NaOH.	23.13	24.00	23.56	23.56

Calculate the range:

range = 24.00 – 23.13 = 0.87cm^3

Calculate the uncertainty of the mean:

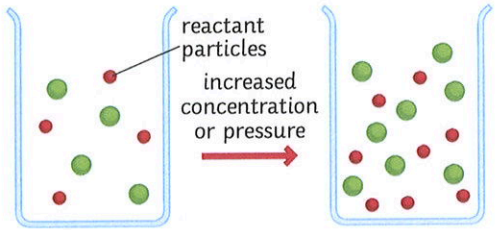
uncertainty = 0.87 ÷ 2 = 0.44cm^3

The mean with uncertainty:

23.56 ± 0.44cm^3

Concentration of Solutions

Concentration is a **measure** of the amount of a **substance** in a **volume** of liquid. The higher the concentration, the more particles of a substance are present in the solution.



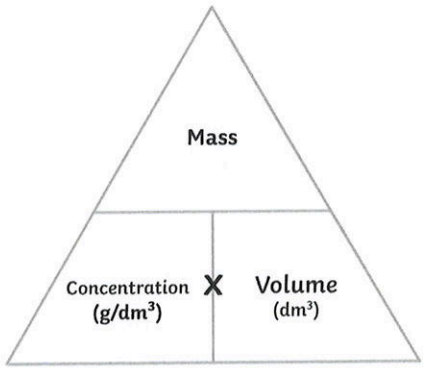
In chemistry, there are two ways to measure the concentration of a solution. This can be done by calculating the **mass** of the substance in grams or by calculating the number of **moles**.

In order to calculate concentration, you must be working in dm^3.

If it is not, it may mean that you need to do a conversion.

$cm^3 \longrightarrow dm^3$ = ÷ 1000

$m^3 \longrightarrow dm^3$ = × 1000



Calculate the **concentration** of a solution with a mass of 2.15g and a volume of $5dm^3$.

concentration = mass ÷ volume

concentration = $2.15g \div 5dm^3$

concentration = $0.43g/dm^3$

Calculate the **mass** of sodium chloride that you would need to dissolve in $400cm^3$ of water to make a $20g/dm^3$ volume solution.

mass = concentration × volume

convert $cm^3 \longrightarrow dm^3$

$400cm^3 \div 1000 = 0.40dm^3$

mass = $20g/dm^3 \times 0.40dm^3 = 8g$

Calculate the **volume** of liquid required to add to 8.80g of a solid to make $42g/dm^3$ solution.

volume = mass ÷ concentration

volume = $8.80g \div 42g/dm^3$

concentration = $0.210dm^3$

The Mole – Higher Tier Only

When we talk about moles, we are not talking about the moles that live underground.

A **mole** (mol) is a **measurement** that is used in chemistry.

Example 1

Look at this reaction:

$2Mg + O_2 \longrightarrow 2MgO$

The reaction shows that **two moles** of magnesium react with oxygen to produce **two moles** of magnesium oxide. Using moles in a **balanced symbol equation** shows the **ratio** of **reactants** to **products**.

Avogadro's Constant

1 mole = 6.02×10^{23}

The number is known as **Avogadro's constant or Avogadro's number** and is named after the Italian scientist Amedeo Avogadro. The mole is abbreviated to **mol**.

This number is very important and one that you should remember. The mass of one mole of a substance in grams is equal to its relative formula mass. For example, one mole of carbon-12 has a mass of 12g

A mole is the amount of a substance that contains **6.02×10^{23}** particles of that substance. The particles could be atoms, molecules, ions or electrons.

For example, 1 mole of carbon will contain the same number of atoms **(6.02×10^{23})** as you would have molecules in 1 mole of water.

Calculating the Number of Particles

The number of particles can be calculated using Avogadro's constant if the number of moles is known.

In chemistry, Avogadro's constant is given the symbol N_A. To calculate the number of particles in a substance, the following equation can be used:

$N = n \times N_A$

N = the number of particles in a substance

n = the number of moles (mol)

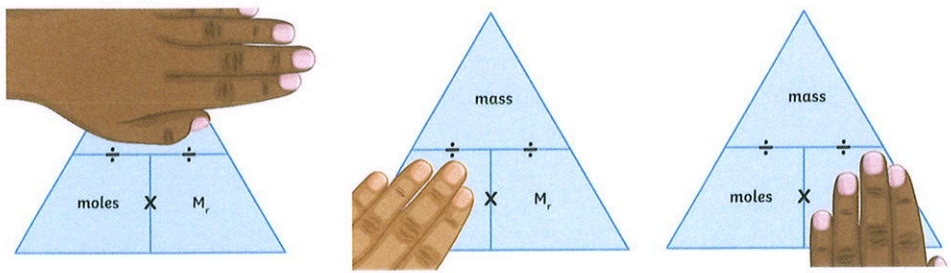
N_A = Avogadro's constant 6.02×10^{23}

For example, calculate the number of helium molecules in 10 mol of helium.

$N = n \times N_A$

$N = 10 \times (6.02 \times 10^{23}) = 6.022 \times 10^{24}$

Calculating Moles, Mass and M_r



Calculating Moles, Mass and M_r

Calculate the number of **moles** in 330g of K_2S.

K_2S consists of two potassium atoms (A_r 39) and one sulfur atom (A_r 32).

Calculate the M_r of the compound = $(39 \times 2) + 32 =$ **110**

moles = mass ÷ M_r

moles = 330 ÷ 110 = 3 moles

Calculate the **mass** of 0.9 moles of $Fe(NO_3)_3(H_2O)_9$.

Calculate the Mr of the compound.

$(16 \times 3) + 14 = 62$

$62 \times 3 =$ **186**

$(1 \times 2) + 16 = 18$

$18 \times 9 =$ **162**

$56 + 186 + 162 =$ **404**

mass = moles × M_r

mass = 0.9 × 404 = 363.6g

Relative Atomic Mass (A_r)

iron (Fe) = 56

oxygen (O) = 16

nitrogen (N) = 14

hydrogen (H) = 1

Amount of Substances in Equations – Higher Tier Only

How do we know the masses involved in the equation?

To work out the masses involved, write in the relative atomic mass (A_r) for an element and the relative formula mass (M_r) for a compound.

Example

Step 1: Write down the **balanced** symbol equation. $2Mg + O_2 \longrightarrow 2MgO$

Step 2: Write in the relative atomic and relative formula masses for the **reactants** and **products** involved in the chemical reaction. $(2 \times 24) + (2 \times 16) \longrightarrow 2 \times (24 + 16)$

48g + 32g ⟶ 80g

Masses in Equations

$Fe + \mathbf{2}HCl \longrightarrow FeCl_2 + H_2$

$56 + 2\,(1 + 35.5) \longrightarrow (56 + 2(35.5) + (1 \times 2))$

56g + 73g ⟶ 127g + 2g

One mole of iron **reacts** with two moles of hydrochloric acid to **produce** one mole of iron chloride and one mole of hydrogen.

Calculate the **mass of water** made when burning **300g of methane**.

Step 1: Balance the equation.

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

Step 2: Write down the relative formula mass of each compound.

$(12 + (1 \times 4)) + 2(16 \times 2) \longrightarrow 2((1 \times 2) + 16) + (12 + (16 \times 2))$

16g + 64g ⟶ 36g + 44g

Relative Atomic Mass (A_r)

Carbon (C) = 12

oxygen (O) = 16

hydrogen (H) = 1

We know from the equation that **16g of methane** reacts to produce **36g of water**.

The question asks us to calculate the mass of water made when burning **300g of methane**.

$\frac{\text{known mass}}{M_r} \times M_r$ of unknown mass $\qquad \frac{300}{16} \times 36 = 675g$

Limiting Reactants

A chemical reaction ends once one of the **reactants** is used up. The other reactants have nothing to react with and so some are left over.

The **limiting reactant** is the reactant that is **completely used up** in a chemical reaction. This reactant is the one that determines the amount of product that is made.

The reactant in **excess** is the one that is left over and could further react if there was another reactant to react with.

The **amount of product** that is produced during a chemical reaction is **dependent** upon the **amount of the limiting reactant**.

Calculating the maximum mass of a product formed during a chemical reaction can be done by the following:

a. Writing a balanced equation.

b. Calculating the mass (g) of the limiting reactant.

c. The A_r and M_r of the product and limiting reactant.

Determine the **maximum mass of hydrogen** that can be produced when 36g of magnesium (Mg A_r 24) reacts completely with excess hydrochloric acid (HCl) to produce magnesium chloride ($MgCl_2$) and hydrogen (H_2).

$$Mg + 2HCl \longrightarrow MgCl_2 + H_2$$

number of moles = mass ÷ A_r

number of moles = 36 ÷ 24 = 1.5 mol

From the equation, 1 mol of magnesium forms 1 mol of hydrogen. Therefore, 1.5 mol of magnesium forms 1.5 mol of hydrogen.

mass of hydrogen = M_r × number of moles

= 2 × 1.5

= 3g

Balancing Equations

By using the masses of the products and reactants, it is possible to work out the balancing numbers in an equation.

For example, 12g of magnesium (Mg A_r 24) reacts with 8g of oxygen (O_2 M_r 32) to produce magnesium oxide (MgO M_r 40). Determine the balanced symbol equation for the reaction.

Calculate the amount of each of the reactants.

Mg = 12 ÷ 24 = 0.5 mol

O_2 = 8 ÷ 32 = 0.25 mol

Divide both values by the smaller amount.

Mg = 0.5 ÷ 0.25 = 2

O_2 = 0.25 ÷ 0.25 = 1

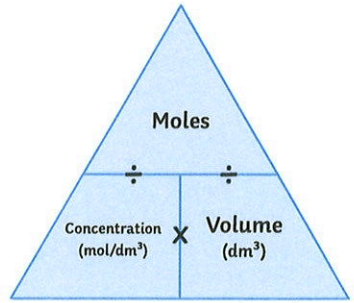
The equation shows that on the left-hand side of the equation, 2 mol of the reactant (Mg) reacts with 1 mol of oxygen. Using this information, it is then possible to balance the rest of the equation in the normal way.

$$2Mg + O_2 \longrightarrow 2MgO$$

Calculating Concentrations

The concentration of a solution can have the units g/dm³ or mol/dm³.

Concentration can be calculated using the mass of dissolved solute or the volume of the solvent or solution in dm³.



Example:

Student A dissolved 1 mol of sodium hydroxide in 4dm³ of water. Determine the concentration of the sodium hydroxide solution he made.

concentration = 1 mol ÷ 4dm³

concentration = 0.25mol/dm³

Converting between Units

To convert between g/dm³ and mol/dm³, the relative formula mass of the solute is used.

Multiply by the M_r to convert from **mol/dm³ to g/dm³**.

Divide by the M_r to convert from **g/dm³ to mol/dm³**.

Example:

Determine the concentration of 0.8mol/dm³ sodium hydroxide **(M_r 40)** solution in g/dm³.

concentration = 0.8 × 40 = 32g/dm³

Volumes of Solutions

By rearranging the concentration equation, it is possible to calculate the amount of a solute in a given volume of solution if the concentration is known.

amount of solute (mol) = concentration (mol/dm^3) × volume (dm^3)

Example:

Determine the amount of 0.2mol/dm^3 sodium hydroxide in 75cm^3 of solution.

Step 1: Convert the volume to dm^3.

75cm^3 = 75.0 ÷ 1000 = 0.075dm^3

Step 2: amount of solute (mol) = concentration (mol/dm^3) × volume (dm^3)

= 0.2mol/dm^3 × 0.075dm^3

= 0.015 mol

Calculating the Mass

Using the example above, calculate the mass of sodium hydroxide (M_r 40) in 75cm^3 of solution.

mass = amount × M_r

mass = 0.015 mol × 40

mass = 0.6g

Percentage Yield – Chemistry Only

The percentage yield can be calculated from the following equation.

$$\text{percentage yield} = \frac{\text{actual mass of product made}}{\text{maxium theoretical mass of product}} \times 100$$

The **theoretical yield** is **the maximum mass** that can be made during a chemical reaction. The law of conservation states that during a chemical reaction, no atoms are lost or made. It's not always possible to obtain the maximum calculated amount of product.

The loss of product may be due to some of the product being lost when filtered. Some of the reactants may not react as expected and so may not produce enough product. The reaction may be a reversible one and as a consequence, the reaction may not go to completion.

Example:

1.8g of copper sulfate crystals are made during a chemical reaction. The theoretical yield for this reaction is **2.0g**. Calculate the percentage yield of copper sulfate.

$$\text{percentage yield} = \frac{1.8g}{2.0} \times 100$$

percentage yield = 90%

Atom Economy – Chemistry Only

The percentage atom economy can be calculated from the following equation.

$$\text{atom economy} = \frac{\text{relative formula mass of desired product from equation}}{\text{sum of relative formula masses of all reactants from equation}}$$

The **atom economy** is a measure of the amount of starting materials (reactants) that end up as **useful products**. It is important for sustainable development and for economic reasons to use reactions with **high atom economy**. However, not all atoms end up as the desired product and may form other products. We call these **byproducts**.

Example:

When glucose (M_r 180) is fermented, ethanol (M_r 46) is produced.

$C_6H_{12}O_6 \longrightarrow 2CH_3CH_2OH + 2CO_2$

Calculate the atom economy for this reaction.

$$\text{atom economy} = \frac{2 \times 46}{180} \times 100$$

atom economy = 51.1%

Reaction Pathways – Higher Tier Only

There is often more than one way to make a substance. Reaction pathways **describe** the **reactions** that have taken place to form the **desired product**. Choosing a particular pathway is dependent upon a number of factors:

1. percentage yield
2. atom economy
3. rate of reaction
4. position of the equilibrium
5. usefulness of any byproducts

The raw materials needed for a particular reaction may affect its chosen pathway. For example, crude oil is a **non-renewable resource**; the resource will run out if we continue to use it. However, plant sugars are **renewable** and can be replenished as long as other plants are replanted.

Ethanol can be made through the fermentation of glucose or the hydration of ethene.

Method of Ethanol Production	Percentage Yield (%)	Atom Economy (%)	Rate of Reaction
fermentation	15	51.1	low
hydration	95	100	high

The hydration of ethene has a 100% atom economy; all atoms react to form the desired product. On the other hand, fermentation has an atom economy of 51.1%. However, its rate of reaction is low in comparison to the hydration method and only has a percentage yield of 15%. Therefore, hydration is the best method for making ethanol.

A byproduct of the fermentation process is carbon dioxide. The gas is sold to fizzy drinks manufacturers to provide the bubbles for some well known fizzy drinks. As the byproduct produced is one that can be useful, it means that the atom economy can be increased to 100%.

Ethene hydration is a reversible reaction. The position of the equilibrium lies to the left. Therefore, only 5% of the ethene supplied to the reaction is actually converted to ethanol. A 95% yield is achieved by recirculating the unreacted ethene.

Avogadro's Law – Higher Tier Only

When the temperature and pressure stay the same, Avogadro's law states that different gases that have the same volume contain equal numbers of molecules.

For example, 1 mol of methane gas occupies the same volume as 1 mol of argon gas.

$H_2 + Cl_2 \longrightarrow 2HCl$

When hyrdogen and chlorine react, hydrogen chloride is produced. In terms of the molar ratio, $10cm^3$ of hydrogen reacts completely with $10cm^3$ of chlorine. Therefore, the ratio between hydrogen and chlorine is 1:1.

The molar ratio between hydrogen and hydrogen chloride is 1:2. For example, $10cm^3$ of hydrogen reacts to produce $20cm^3$ of hydrogen.

Molar Gas Volume

The volume of one mole of any gas at room temperature and pressure (20°C and 1 atmosphere pressure) is $24dm^3$ (**$24\ 000\ cm^3$**).

To calculate a known volume of a gas:

volume = amount in mol × molar volume

For example, determine the volume of 0.55 mol of carbon monoxide at room temperature and pressure.

volume = amount in mol × molar volume

volume = 0.55 × 24

= $13.2dm^3$

Calculating the Amount of Gas

By **rearranging the equation,** it is possible to calculate the amount of a gas in moles.

For example, determine the amount of hydrogen gas that occupies $198cm^3$ at room temperature and pressure.

$$\text{amount in mol} = \frac{\text{volume}}{\text{molar volume}}$$

$$\text{amount in mol} = \frac{198}{24\ 000}$$

amount in mol = 0.0083 mol

Calculating a Volume from a Mass

When 3.5g of sodium reacts with water it produces sodium hydroxide and hydrogen gas.

$2Na + 2H_2O \longrightarrow 2NaOH + H_2$

1. Determine the molar amount of sodium (A_r 23).

$$\text{amount in mol} = \frac{\text{mass}}{\text{atomic mass}}$$

$$\text{amount in mol} = \frac{3.5}{23}$$

amount in mol = 0.15 mol

2. Determine the molar amount of hydrogen.

The molar ratio of **sodium to hydrogen**, according to the balanced symbol equation, is **2:1**.

Therefore, 0.15 mol of sodium produces 0.075 mol of hydrogen.

3. Determine the volume of hydrogen.

volume = amount in mol × molar volume

volume = 0.075 × $24dm^3$

= $1.8dm^3$

4. Calculating the mass from a volume.

Sodium reacts with chlorine to produce sodium chloride.

$2Na(s) + Cl_2(g) \longrightarrow 2NaCl(s)$

5. Determine the mass of sodium chloride (Mr 58.5) that can be produced from $685cm^3$ of chlorine.

amount of chlorine = $685cm^3 \div 24\ 000$ = 0.029 mol

From the equation, the mole ratio between chlorine and sodium chloride is 1:2. Therefore, 0.029 moles of chlorine would produce (0.029 × 2) = 0.058 mol.

mass of sodium chloride = 0.058 × 58.5 = 3.393g

AQA English Language Paper 2 Section A

Knowledge Organiser

What are the differences between Language Paper 1 and Paper 2?

Paper 1 focused on **fiction** texts, so stories that aren't about real people or events – at least elements of them will be mean created in the writer's imagination.

Paper 2 focuses on **non-fiction** texts so the writers are looking at real events, people and places. Rather than creating a story to entertain or engage the reader, the two texts you get in the exam will be there to make you think, challenge the way you think about a topic now, try to persuade you to think something, to argue the case for something, or to explain ideas.

Paper 2 has **two texts** for you to study and analyse because normally the two texts have very different **attitudes and perspectives**. This allows you to think about how these attitudes might be similar or different, but to **compare** how the writers use language and structure to get across their ideas to their readers.

Normally one of the texts in the exam is from a very different time, so from the Victorian period or earlier. This is an important factor to think about as a writer making texts in that period will probably be looking at topics in a very different way to a writer from our own time period.

Purpose:	WRITING TO ARGUE	WRITING TO PERSUADE	WRITING TO ADVISE	WRITING TO EXPLAIN/INFORM
What is it?	Giving the case for one side of a debate	Convincing someone that your opinion is right	Providing ways forward for someone.	Explaining your opinion on a topic to your reader.
What does it involve?	Being aware of the other side of a debate	Using your language to convince your leader.	Not telling someone what to do but giving them options.	You are not convincing people or advising.
What key features do you often find in this type of writing?	Includes counter-arguments, rhetorical questions, facts, statistics, emotive language	Includes triplets, repetition, emotive language, rhetorical questions, direct address and more…	Includes modal verbs, imperatives, an understanding tone but one that is direct. Provide helpful information.	Includes facts, opinions, an unbiased and neutral tone.

	Purpose	Audience	Form	Tone
What is it?	Why a text has been written, what the writer was trying to achieve by writing it (see the table above)	The specific people a writer is trying to target through their writing.	A specific type of writing, for instance letters, speeches, essays and so on.	The sound or mood of a piece of writing.
Why is it important?	The purposes of the two texts given to you in the exam can affect how they are written and the particular language features used. For instance, a persuasive article is going to include more DAFORREST techniques, for instance.	The texts you will analyse in the exam won't necessarily be written for you, they maybe written for other people in other places, times, positions and contexts. Reflect on this as you consider what the writer's attitude is and how they address their audience. If they are giving a speech to a group of doctors then their writing will be different comparing to writing a diary entry for themselves.	You may be given two articles in the exam, but you could be given two completely different types of texts (a letter and a speech, for instance). Always consider the types of writing given to you and how this form of writing will impact on style, tone, register, language features, structure and so on.	Understanding the tone of a text in the exam helps you to understand their attitude and perspective better. Are they angry? Are they sad? Are they quite neutral about the topic? The two texts you are given will likely have very different tones.

Beginnings / Endings

How a writer begins and finishes a text is incredibly important. How does a writer engage you right from the start and what kind of thoughts or feelings do they want you to have at the end of the article, letter, speech or essay? Know these different beginnings and endings so you can discuss which ones are being used in the exam text you have been given and what effects you think they have on the reader. Additionally, use can use these techniques in your own writing for Question 5/Section B!

Beginnings

A puzzle! Hook your reader in with something that isn't clear at the beginning, perhaps something unusual has happened?

Direct address. Talk directly to your readers as a way of engaging them.

Visual hook. Use a powerful image or description to engage the reader at the start.

Amusing hook. Use a joke to establish a comedic tone at the beginning of your text. It's a great way to make a reader feel at ease and lure them into a difficult or controversial topic.

Dialogue. Have people talking to each other right from the beginning to establish a relevant example to the topic being discussed.

Subtle hook. Hint at what is going to happen in the rest of the text.

Atmospheric hook. Use your descriptive language to build up a particular tone and atmosphere right at the very beginning. It be using a particular example to engage the reader with the topic of the text.

Endings

Cyclical ending: where the ending returns back to the beginning of the text, often using to emphasise the original point.

Twist: a complete change in direction from where the text was going.

Summing up: The writer reflects back on all the topics covered in their text to provide the reader with a summar

Short sentence: Making your final sentence very, very short can leave the readers with one final 'punch' or impactful idea to take away from the whole text.

A final question: Asking the readers a rhetorical question or question at the end of a text means the responsibility or onus is on the reader to make up their own minds.

Repeating examples: A writer could refer back to a specific example they made during their text. For instance, if they spoke about a particular person or place earlier on in the text to provide evidence for their argument, they made decide to repeat that example again for further emphasis:

Maybe if we change our ways, people like Bob would no longer have to suffer.

Reading and Planning (5-10 mins):

Read the sources very carefully. Source A and B.
Annotate for key language techniques and key structural techniques.

Q1 (5 mins, 4 marks):

Shade **FOUR** true statements about a section of the source chosen.
Read the question carefully – make sure you answer for the right part.

Q1: Read again the first part of Source A from lines ___ to ——.
Choose four statements below which are true.
- Shade the circles in the boxes of the ones that you think are true.
- Choose no more than four statements.
- If you make an error cross out the whole box.
- If you change your mind and require a statement that has been crossed out then draw a circle around the box.

[4 marks]

You're marked on AO1 for this question. The skills being looked at are:
- Identifying key information
- Interpreting a text
- Being able to understand explicit (made obvious) and implicit (hinted at or suggested) ideas
- Selecting key quotes to support your ideas

Q2 (10 mins, 8 marks):

This is the summary question.
You need information from both texts.
Are you looking at similarities or differences?
Only facts, not opinions.
Include short, regular quotes.
What does each quote tell the reader? Why? Think icebergs.

You need to refer to **Source A** and **Source B** for this question. Use details from both sources to write a summary of the **[similarities/differences]** between ______________

[8 marks]

You're marked on AO1 for this question. The skills being looked at are:
- Identifying key information
- Interpreting a text
- Being able to understand explicit (made obvious) and implicit (hinted at or suggested) ideas – icebergs!
- Selecting key quotes to support your ideas

Success criteria:
- Relevant information on the same topic (the differences between the writers' experiences)
- Quotes to support ideas.
- Connectives to link paragraphs.
- Only facts, not opinions.
- Icebergs (Explaining what quotes suggest to the reader)

Adding connectives, to add to your initial ideas:
Moreover
Furthermore
In addition
Additionally
Similarly
As well as this

Contrasting connectives, to show a different perspective or idea:
However
On the other hand
Alternatively
Despite this
In contrast
Conversely
In spite of this

Possible sentence starters to use for Q2:
Both sources show very different perspectives on ______________. In Source A, the writer shows ______________ to be ______________ when he says: "…" This shows the reader that… because…
On the other hand, in Source B, the writer shows ______________ to be ______________ when he says: "…" This shows the reader that… because…
Moreover, in Source A, the writer says: "…" which shows to the reader… because… In comparison, in Source B the writer says: "…" which shows… because…

SEIZE

Q3 (15 mins, 12 marks):

This is a SEIZE question.
It is only **ONE** source.
Read the question carefully – what is it asking you to focus on?
Include quotes, techniques and **effects** of the techniques on the reader.

Q3) You now need to refer only to Source B.
How does the writer use language to try to [influence/entertain/affect] their readers?

[12 marks]

You're marked on AO2 for this question. The skills being looked at are:
- Explaining, commenting on and analysing how a writer uses language in a text to create effects and affect their readers
- Within analyses, using key terms and language features to support your ideas
- Using specific quotes to support interpretations

Try to avoid using common terms like 'it makes the reader want to read on' or 'it is interesting for the reader'. So many students try to use those and they don't really explain or analyse anything.

What is the writer's attitude in the text? What perspective are they trying to get across to the reader? Whatever topic has been chosen for your exam, the two texts given to you on that topic will have very different and/or very distinctive views. Work those out and explain how the writer uses language to get across their opinions to the reader.

Success criteria:
This is the SEIZE (Statement, Evidence, Inference, Zoom, Effect) question, so:
- Make your statement clear.
- Use a quote to support your idea.
- Make inferences from this quote – two different ones would show a high level of analysis.
- Zoom in on a particular word or phrase, identify terminology (if any)
- Explain what effect this could have on a reader

Possible sentence starters to use:

The writer uses a range of techniques to get across their ideas and make them influence the reader. A good example is "…" because it shows the reader that…The technique used in this quote is ________ which emphasises to the reader… In particular, the words "…" and "…" from the quote show the reader that… Therefore, the writer is able to use [technique] to influence his reader about their opinions on ________________ [Link].

Use a SEIZE structure of writing for 2-3 SEIZE paragraphs explaining how the writer is able to use different language techniques to influence their readers.

Q4 (25 mins, 16 marks):

This is the **comparison question.**
L SEIZE C SEIZE.
Make sure you focus on the links between the two texts.
Is it asking you about **similarities or differences?**
Include **connectives** to link your ideas together.
Include analysis of both quotes and techniques for both sources.
Think about **purpose and audience** for each text in this answer.

Success criteria:

This is another language analysis question, but this time you have to **compare** the two texts.
- L SEIZE C SEIZE
- Use connectives to link ideas together.
- Ping Pong (Table Tennis) – Switch between texts, don't write in big blocks about each one.

For Q4 you are assessed on AO3:
Compare writers' ideas and perspectives, as well as how these are **conveyed (or got across to reader),** across two or more texts

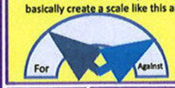
Q4) For this question, you need to refer to the whole of **Source A**, together with **Source B.**
Compare how the two writers convey their [similar/different] attitudes to ______________.
In your answer, you could:
· compare their different attitudes
· compare the methods they use to convey their attitudes
· support your ideas with references to both texts

[16 marks]

In both sources, … [Link] For instance, in Source A… This is shown with: "…" because.. In particular, the use of ________ [technique] makes clear to the reader that… because… Moreover, the words "…" and "…" help the writer to emphasise that… as…
However, in Source B – in comparison to Source A – has a very different attitude, as shown with: "…" because… The use of ___________ [technique] makes clear to the reader, unlike in Source A, that… because… Additionally, the words "…" and "…" illustrate to the reader that… which is in contrast to in Source A.

Continue to L SEIZE C SEIZE for another 3-4 comparisons.

For some students it helps to create **speedometers** when comparing two texts on a similar topic. You basically create a scale like this and place the two texts on the scale, like so:



Normally the exam texts will have very different perspectives on a similar topic, so for instance the topic might be homelessness and one article blames homelessness on the people themselves whereas the other article argues the government and charities should be doing more to help them.

Angry | Relaxed | Calm | Sad | Neutral and balanced | Confused

When you analyse the two texts you've been given, you need to think about several key areas:

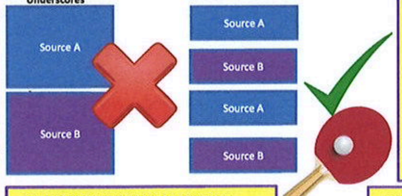
Their attitudes (What does each writer think about the same topic? Why?)
Their perspective (How do they see the topic they are talking about? What context were they writing in? Why do you they feel and think the way they do? How does the topic affect them? Why?)
Their tone (Are they angry? Are they sad? Are they confused by what they are talking about? Think carefully about the tone of their writing and how it helps to get across their ideas to the reader).

Language features

It's really important to know as many language features or techniques as you can, but it's even more important to know how they can affect a reader. You might be able to name 10-15 language features really easily, but if you put "it makes the reader want to read on" then you're not really discussing the effects of the feature on the reader. Go one step beyond and learn the effects of different features! If you're really struggling with this, many teachers will talk about DAFORREST which is an acronym made up of different language features used in non-fiction writing.

Simile	Using like/as to compare one thing to another. The man was as tall as a skyscraper. She moved like a snail! Similes help readers to picture a particular object, person or place by comparing something they don't know to something they do. They can also be used for exaggeration.	Alliteration	This where a number of words begin with the same letter or sound. The angry, aggressive aardvark ate all the apricots. Mr W wrote wildly on the whiteboard. Alliteration creates a memorable sound in the readers' head that means they notice that particular line more or they can remember it quite well. This means it can be used to emphasise a particular point, idea or feeling.
Metaphor	Transforming one thing into another. He was a *monster truck* on the football field. She is *over the moon* about her exam results. Metaphors help readers to picture a particular object, person or place by transforming them into something they understand better. They can also be used for exaggeration.	Nouns and Verbs	Nouns are people, places or objects. E.g. table, window, ceiling, computer, Birmingham, etc. Verbs are actions or 'doing words'. E.g. run, skip, jumping, arguing, shouting, cry, crying, etc. Both can be used carefully to evoke or give off certain emotions or feelings.
Personification	This is a type of metaphor, where something non-human is described in a human way. The wind whistled past his face. The trees danced in the breeze. Metaphors help readers to picture a particular object or place by transforming them into something they understand better. They can also be used for exaggeration.	Adjectives and Adverbs	Adjectives are words that describe nouns. E.g. tall, short, wide, skinny, ugly, beautiful, amazing, spectacular, boring, etc. Adverbs are words that describe verbs. E.g. quickly, amazingly, powerfully, slowly, shockingly. They usually end in ly. These are both used to add to descriptions and help build specific images or feelings in the readers' heads. The terrifying, disgusting, powerful monster quickly and sharply jumped off the building.
Repetition	Repetition is where you repeat a word, phrase or idea again and again. E.g. "Run! Run! Run!" she shouted at him. Repetition helps to stick an idea in the readers' heads or helps to emphasise a particular idea or feeling.	Rhetorical questions	This is a question that is asked in order to create a dramatic effect or to make a point rather than to actually get an answer. Example: Why had they put me in this place?
Direct Address	This is where a writer will speak directly to their readers in their writing, often using the pronoun 'you'. You must see that this kind of inaction is wrong, you can do something to change it. Direct address makes the reader feel involved in the text, that they have a sense of responsibility for the topic the writer is explaining, arguing or persuading about. Direct address is a very common technique used in speeches as well.	Facts and Statistic	These are used to make a piece of writing sound more serious or official. Statistics and facts back up opinions and make them… E.g. 75… made up on the spot.
Opinions	It's important to know the differences between facts and opinions when it comes to Paper 2. An opinion is a belief that cannot be proven, but facts are statements of truth that can be proven. Liverpool are the best team in the world – opinion Liverpool beat Crystal Palace 4-3 in January 2019 – fact How do the writers in your two exam texts use facts and opinions? Do they get across a sense of bias or seeming to favour one side of an argument?	Hyperbole	Exaggerated ideas that aren't meant to be taken literally or at face value. Example: This is the worst day of my life. You see, it probably isn't the worst day of your life, but the use of hyperbole accentuates the point that this was an awful day.
Triplets	Sometimes these are called 'rules of three' or 'triples', but they all mean the same thing: three ideas in a row. Example: England were rampant, ferocious and destructive against Ireland in the Six Nations Putting three adjectives or ideas together provides emphasis, exaggeration and simply sounds pleasant to the ear. It's true!	Emotive language	This is a term for any words that try to evoke emotions from the reader, so to make them feel guilty, sad or responsible. Like so: Homelessness is a cruel nightmare that robs people of their dignity – it is hard to believe ordinary people could lead such atrocious lives in the 21st century. Emotive language is very useful for emphasis and exaggeration but also in winning over a read to your ideas.

Accentuates
Illustrates
Highlights
Exaggerates
Draw attention to
Focuses the reader on…
Maintains
Underscores

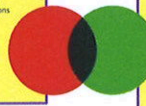


Adding connectives, to add to your initial ideas:
Moreover
Furthermore
In addition
Additionally
Similarly
As well as this

Contrasting connectives, to show a different perspective or idea:
However
On the other hand
Alternatively

Because you are being marked on your **comparisons** in this question, you want to avoid the trap of writing a massive chunk of writing on the first source and then move on to the next. You want to play 'ping pong', where you keep switching between the two sources, making links between them all the time. Use your connectives to link your ideas together and make comparisons between the following:

The writers' attitudes
The writers' perspectives
The writers' tones
How the writers use language features to get across their attitudes and perspectives



For Q4 try to make notes on how the attitudes and perspectives of the two writers are similar or different, depending on what the question is asking you to look at. Some students find Venn diagrams helpful for this (overlapping circles with similarities in the middle), or tables. However you want to do it think about making notes on the similarities or differences of the text, but focussed around:

Perspectives
Attitudes
Language
Tones

You could call this PALT if you really wanted to!

Paper 1: Living with the Physical Environment
Section A: Natural and Tectonic Hazards

AQA

What is the definition of a Natural Hazard?
A natural hazard is a natural event such as an earthquake, volcanic eruption, tropical storm or flood that poses risk of death, injury or damage to people and property.

What is the types of Natural Hazard?

Geological Hazards - these are caused by land and tectonic processes.	Atmospheric Hazards - these are caused by changes in weather and climate.
Earthquakes, volcanic eruptions, landslides, avalanches, mudflows and tsunamis.	Tropical storms, hurricanes, tornadoes, rain, drought and flooding.

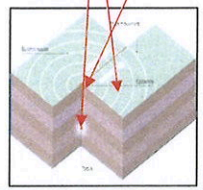
What is Hazard Risk?
Hazard risk is the chance or probability of being affected by a natural event.
People who live close to a river may be at risk to flooding. People who live near on a volcano may be at risk to an eruption.
People chose to put themselves at risk after weighing up the advantages and disadvantages and because such events don't happen very often, they decide to accept the risk. Some people may have little choice of where to live or knowledge that where they are living is dangerous.

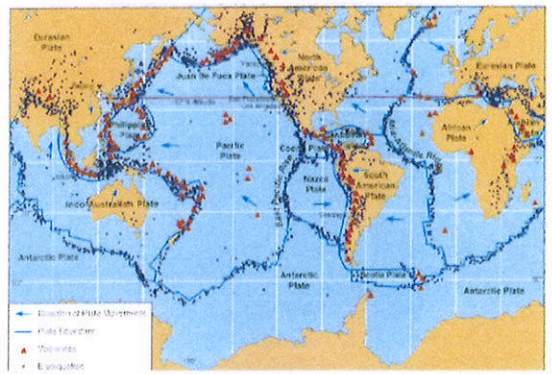
What factors affect Hazard Risk?
Urbanisation - Over 50% of world's population now live in cities. For examples Toyko and Los Angeles are at risk from earthquakes.
Poverty - In poorer parts of the world poverty may force people to live at risk. For example, in Caracas, Venezuela, a shortage of housing had led to people building on unstable slopes prone to floods and landslides.
Farming - When a river floods it deposits fertile silt on floodplains like that of the River Ganges in Bangladesh. The land is great for farming. When people live there they put themselves at risk to flooding.
Climate Change - In a warmer world the atmosphere will have more energy leading to more intense storms and hurricanes. Climate change may lead to some parts of the world becoming wetter and prone to flooding and other parts drier and prone to drought.

What is the Plate Tectonic Theory?
The Earth's crust is split into many plates about 100km thick. There are two types of crust - dense thin oceanic crust and less dense, thick continental crust. Plates move in relation to each other due to convection currents in the mantle. This is where the core heats molten rock in the lower mantle, causing it to become less dense and rise to the upper mantle, where it cools, becomes denser and sinks back down to the lower mantle creating a circular motion (convection current). This movement causes the plates to move which creates tectonic activity leading to earthquakes and volcanoes.

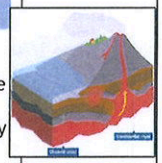
What is the global distribution of Earthquakes and Volcanoes?
An earthquake is a sudden violent period of ground shaking within the Earth's crust. Earthquakes are caused when two plates become locked causing friction to build up. From this stress, the pressure will eventually be released, triggering the plates to move into a new position. This movement causes energy in the form of seismic waves, to travel from the focus towards the epicentre. As a result, the crust vibrates triggering an earthquake.
Earthquakes occur at all plate margins, for example along the western coast of North and South America. The occurrence of earthquakes around the edge of the Pacific Ocean follows the plate boundaries. Some earthquakes do not occur at plate margins and are caused by human activity such as underground mining and extraction.
A volcano is a large and often conical-shaped landform usually formed over a long period of time by a series of eruptions. Like earthquakes, most volcanoes occur in long belts that follow plate margins, for example around the edge of the Pacific Ocean. This is known as the 'Pacific Ring of Fire'. There is also a belt of volcanoes through the middle of the Atlantic Ocean. This is the Mid-Atlantic Ridge which includes the Azores and Iceland which are volcanic islands. Volcanoes are fed by hot molten rock (magma) from deep within the Earth. This rises to the surface at constructive and destructive plate margins. Volcanoes also form at hot spots, where the crust is so thin that magma can pierce and break through to the surface. The Hawaiian Islands in the Pacific Ocean are a good example of a hot spot volcano.

The point directly above the focus where the seismic waves reach first, is called the epicentre. Seismic waves travel out from the focus, which is the point at which pressure is released.



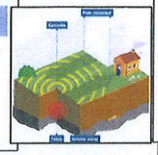


What are the processes at Destructive Plate Margins?
This is where two plates are moving towards each other. The oceanic dense plate subducts beneath the less dense continental plate. Friction between the plates causes earthquakes. As the oceanic plate moves downwards it melts. The magma here is very viscous (like jam) and forces its way to the surface to form steep sided composite volcanoes such as those found on the west coast of South America where the Nazca plate subducts beneath the South American plate. Eruptions are often very violent and explosive.



What are the processes at Constructive Plate Margins?
This is where two plates are moving apart like what is happening at the Mid-Atlantic Ridge where magma forces its way to the surface along the Mid-Atlantic Ridge. As it breaks through the overlying crust it causes earthquakes. On reaching the surface it forms volcanoes such as Eyjafjallajokull in Iceland. The magma here is very hot and fluid, it will flow a long way before cooling, resulting in typically broad and flat shield volcanoes.

What are the processes at Conservative Plate Margins?
This is where two plates are sliding alongside each other such as the San Andreas Fault in California. The faster-moving Pacific Plate is sliding in the same direction next to the slower North-America Plate. Friction between the two plates then causes earthquakes as stresses gradually build up over many years, they are released suddenly when pressure builds up and plates slip or shift. There are no volcanoes here.



What are the effects of, and responses to Tectonic Hazards?
Primary effects are caused by the ground shaking, and can include deaths, injuries and damage to roads and buildings. **Secondary effects** are the result of primary effects and include tsunami, homelessness, fires and landslides.

L'Aquila, Italy Earthquake (HIC) 6th April 2009- Magnitude 6.3		Kashmir, Pakistan Earthquake (LIC) 8th October 2005- Magnitude 7.6	
Primary Effects	**Secondary Effects**	**Primary Effects**	**Secondary Effects**
Around 300 people died. 1500 people seriously injured. Tens of thousands of buildings were destroyed Over 60,000 people were made homeless. A bridge near the town of Fossa collapsed, and a water pipe was broken near the town of Paganica.	Aftershocks hampered rescue efforts and caused more damage. Fires in some collapsed buildings caused more damage. The broken water pipe caused a landslide. Electricity and phone services were interrupted, although most were repaired within a day.	Around 80,000 people died. Tens of thousands of people were injured. Around 3 million people were made homeless. Water pipelines an electricity lines were broken, cutting up supply.	Landslides buried buildings and people. They also blocked access roads and cut off water and telephone lines. Diarrhoea and other diseases spread due to little clean water. Freezing winter conditions shortly after the earthquake caused more casualties and meant rescue and rebuilding operations were difficult.
Immediate Responses	**Long-term Responses**	**Immediate Responses**	**Long-term Responses**
Camps were set up for people made homeless, providing food, water and medical care. Ambulances, fire engines and the army were sent in to rescue survivors. Cranes and diggers were used to remove rubble. Free mobile phones were given out to the homeless.	New settlements were built to accommodate over 20,000 residents who used to live in the damaged city centre. Most of the city centre is being rebuilt, but there have been criticisms over delays. An investigation was set up into why modern buildings weren't built to withstand earthquakes.	International aid and equipment such as helicopters and rescue dogs were brought in. However, help didn't reach many areas for days or weeks, and many were rescued by hand. Tents, blankets and medical supplies were distributed.	40,000 people from one destroyed town have been relocated to a new settlement. Aid was given to rebuild schools and government money was given to people to rebuild their homes. After 3 years, 1000s of people were still living in temporary tents and students being taught outside 10 years later.

How can we manage and reduce the effects of a Tectonic Hazard?

Monitoring and Prediction	Protection	Planning
Seismometers are used to measure tremors before a main earthquake. Monitoring the water table (water tends to fuctuate before an earthquake). Satelitte monitor ground deformation.	Designing buildings and roads to withstand earthquakes. Increasing awareness.	Earthquake drills. Seismic maps can be made. Prepare emergency supplies.

What are the reasons why people continue to live in areas at risk from a Tectonic Hazard?
People living in poverty ridden areas have more important things to think about like food, money, security and family.
Plate margins often coincide with very favourable areas for settlement, such as coastal areas where ports have developed.
Fault lines associated with earthquakes allow water supplies to reach the surface. This is important in dry desert regions.
Better building design can withstand earthquakes so people feel less at risk.
Volcanoes can bring benefits such as fertile soils, rocks for building, rich mineral deposits, hot water and geothermal energy.
More effective monitoring of volcanoes and tsunamis waves enable people to receive warnings and evacuate before events happen.

Paper 1: Living with the Physical Environment
Section A: Weather Hazards

How can Tropical Storms be Managed?

Monitoring	Protection
Satellites monitor cloud patterns associated with tropical storms. NASA monitor weather patterns using unmanned drones called Global Hawk.	Reinforce buildings - hurricane shutters on windows and doors. Develop coastal flood defences. Create 'no-build zones' in low lying areas.
Prediction	**Planning**
Supercomputers give 5 days' warning and predict a location within 400km. Track forecast cones plot the tropical storms path. Approx. 70% occur within the cone.	Those living where it will hit can prepare disaster supply kits and ensure their car is fully fuelled. People should know where evacuation centres are.

What Weather Hazards do we experience in the UK?

Flooding (caused by heavy rain), droughts and heatwaves, storms and extremes of cold weather.

Beast from the East 2018

Causes: The Beast from the East (25 February) was caused by a change to the northern polar jet stream, which twisted its direction unexpectedly, drawing in cold air to the UK from the east. This bending was caused by a jump in temperatures high over the Arctic, known by meteorologists as sudden stratospheric warming. This unexpected warming weakened the jet stream that brings warm air in from the Atlantic to Ireland and Britain, this allowed COLD air in from the East
So cold air from thousands of miles away is dragged over to us, bringing a severe chill - though the air is a lot warmer when it arrives at our doorstep, having risen from -50°C. This air picked up moisture over the North Sea bringing SNOW
This affected mainly the East coast and dumped a huge amount of snow on the UK.

Social Impacts	Economic Impacts	Environmental Impacts
A man died in London after being pulled from a frozen lake, whilst there were 3 other reported deaths. Thousands of schools were shut.	The weather cost the UK millions. The AA estimated that there were 8,260 collisions roads from the snow chaos in just three days, with £10m insurance cost	Up to 50cm of snow in parts of Dartmoor, Exmoor Gusts of 60-70mph in parts of northern England

Management/Responses: Public Health England (PHE) urged people to plan ahead to ensure they have enough food and medicine

Is the UK Weather becoming more Extreme?

Extreme Weather is not new to the UK. However, the frequency of extreme weather in the UK is increasing. Since the 1980s, UKs temperatures have increased by about 1°C and winter rainfall has increased. There have been more weather records broken in recent years than ever before.

Extreme Weather Records

Temperature	Rainfall
December 2010 coldest on record for 100 years. **Warmest April was 2011.** **Highest temperature was 38.5°C in Kent in August 2003.** **Lowest temperature was -27°C in Scotland in 1995.**	**Highest two-day record of rainfall (405mm) was in 2015.** **Highest three - four-day rainfall records were both in 2009.** **Highest monthly total rainfall was 1296mm in 2015.** **Serious flooding has become more frequent in winters.**

What are future predictions for UK Weather?

Precipitation is expected to become more frequent.
Some rivers are expected to flood more frequently in winters.
Air temperature is expected to increase, causing more drought.

Climate change cannot be responsible for individual extreme weather events, yet scientists say it can be responsible for increased frequency in such events.

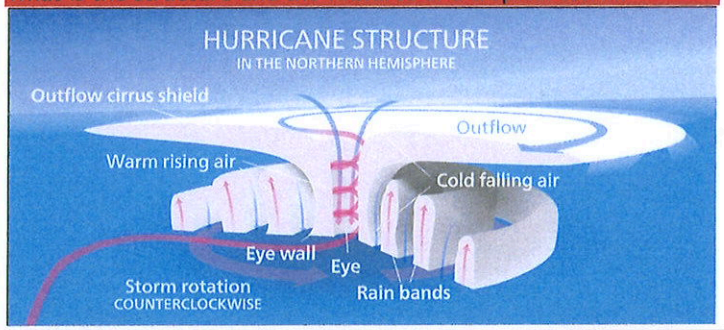
What is the global distribution of tropical storms?

Tropical storms are a natural hazard. They have different names depending on their location. They occur between 5° and 30°north and south of the Equator, between the tropic of Cancer and the tropic of Capricorn. This provides areas of intense low-pressure so that warm, moist air rises rapidly to reach high altitudes where it begins to spin (Coriolis effect). They don't occur on the equator because there is not enough spin from the rotation of the Earth. In the USA and Caribbean tropical storms are called Hurricanes. In south-east Asia and Australia, they are called cyclones, but in Japan and the Philippines they are called typhoons.

What are the Causes and Formation of a Tropical Storm?

1. The sun's rays heat large areas of the ocean in the summer and the autumn. When ocean temperatures reach 27°C, warm, moist air rises upwards drawing water vapour up from the ocean surface. This is a low-pressure system.
2. This evaporated air cools as it rises and condenses to form towering thunderstorm (cumulonimbus) clouds.
3. As the air condenses it releases heat which powers the storm and draws up more and more water from the ocean.
4. Several smaller thunderstorms join, to form a giant spinning storm. When surface winds reach an average 120km per hour (75mph) the storm officially becomes a tropical storm.
5. The storm now develops an eye at its centre where air descends (sinks) rapidly. The outer edge of the eye is the eyewall where the most intense weather conditions (strong winds and heavy rain) are felt.
6. As the storm is carried across the ocean by the prevailing winds, it continues to gather strength.
7. On reaching land the storm's energy supply (evaporated water) is cut off. Friction with the land slows it down and it begins to weaken as it approaches land. If the storm reaches warm seas after crossing the land, it may pick up strength again.

What is the structure and the features of a tropical storm?

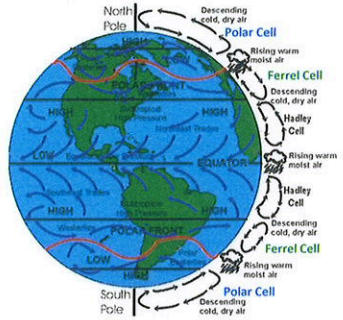


How might Climate Change affect Tropical Storms?

Climate change is expected to increase atmosphere and sea surface temperatures, and affect the tropical storms in the following ways:
Distribution: The location of tropical is not expected to change significantly, but there may be more in areas such as the South Atlantic and parts of the subtropics as sea surface temperatures increase.
Frequency: The overall frequency of tropical storms is expected to remain the same or decrease. However, the frequency of category 4 and 5 storms (strongest) is expected to increase, whilst the frequency of 1-3 storms (weaker) is expected to decrease.
Intensity: Since 1970s the number of the most severe category 4 or 5 tropical storms has increased. Every 1-degree Celsius increase in sea surface temperatures will mean a 3-5% increase in wind speed.

What is Global Atmospheric Circulation?

The atmosphere - the air above our heads - is a complex swirling mass of gases, liquids and solids. These include water droplets, water vapour, ash, carbon dioxide and oxygen - just to mention a few. Atmospheric circulation is the large-scale movement of air by which heat is distributed on the surface of the Earth. It involves many circular movements called *cells*. These cells all join to from the overall circulation of the earth's atmosphere.



Air at the equator is heated strongly so it rises in **low pressure** conditions. The air flows towards the North and South Poles. As warm air rises it cools and condenses. **Low pressure** therefore brings clouds and rain.
The air sinks at 30°north and south of the Equator under **high pressure**. **High pressure** weather brings dry and clear skies. This forms a convection (circular movements) cell called the Hadley cell.
Air at the polar latitudes is colder and denser (heavier) so the air sinks towards the ground surface under **high pressure** conditions. This air flows towards the Equator. The air warms as it reaches about 60°and again rises under **low pressure** conditions. This forms the Polar Cell.
Located between the Hadley cell and the Polar cell is the Ferrel Cell.

What are Surface Winds?

Surface winds are very important in transferring heat and moisture from one place to another. Winds on the surface of the Earth are experienced as air moves from high to low pressure belts in the convection cells. On the surface of the Earth, these winds bend due to the Coriolis effect as the Earth spins.

The UK is located about 55°north just below the 60° line of latitude putting the UK close the boundary of Polar air moving down from the north and warm sub-tropical air moving up from the south. The boundary between these two cold and warm air masses is unstable. Here there is rising air and low-pressure belts (the sub polar low) on the ground. Rising air cools condenses and forms clouds and rain. This is why it is often cloudy and wet in the UK.

What are the Effects and Responses to a Tropical Storm?

Primary effects are the impacts of strong winds, heavy rain and storm surges. **Secondary effects** are the effects of longer term impacts resulting from the primary effects.

Typhoon Haiyan, 2013 - Category 5 - hit the Philippines.

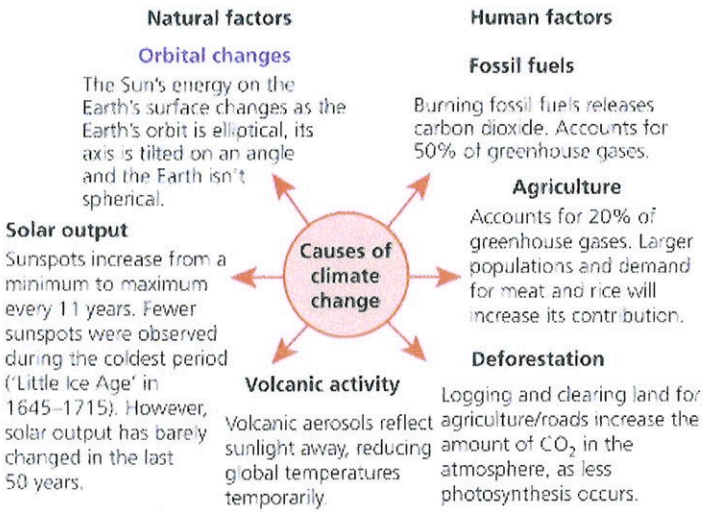
Primary Effects	Secondary Effects
• About 6300 people killed - most drowned from the storm surge. • Over 600 000 people displaced and 40 000 homes damaged or flattened - 90% of Tacloban city destroyed. • Tacloban airport was badly damaged. • 30 000 fishing boats destroyed. • Strong winds damaged power lines and crops. • Over 400mm of rain caused widespread flooding.	• 14 million people affected, many homeless and 6 million people lost their source of income. • Flooding caused landslides and blocked roads, cutting off aid to remote communities. • Power supplies in some areas cut off for a month. • Ferry services and flights disrupted for weeks, slowing aid relief efforts. • Shortages of water, food and shelter affected many people, including outbreaks of disease. • Many jobs lost, hospitals were damaged, shops and schools destroyed.
Immediate Responses	**Long-term Responses**
• International governments and aid agencies responded quickly with food aid, water and shelters. • US aircraft carrier George Washington and helicopters assisted with search and rescue and aid delivery. • Over 1200 evacuation centres set up to help the homeless. • Field hospitals were set up.	• The UN and countries including the UK donated financial aid, supplies and medical support. • Rebuilding of roads, bridges and airports. • 'Cash for work' - people paid to clear debris and rebuild the city. • Aid agencies such as Oxfam supported replacement of fishing boats - providing income.

Paper 1: Living with the Physical Environment
Section A: Climate Change

What are the possible Causes of Climate Change?

Climate change is the **long-term** change in weather. Global climate change occurs very slowly over thousands of years.

Evidence of climate change occurring before humans existed means climate change must be natural as well as human enhanced. Natural causes alone cannot account for the significant temperature increase since the 1970s. A thicker layer of greenhouse gases (carbon dioxide 77%, methane 14%, nitrous oxide 8% and CFCs 1%) caused by human activity means less of the Sun's energy is able to escape the Earth's atmosphere, so the temperature increases.



What is the evidence for Climate Change?

Since 1914 the Met Office has reliable climate change data collected using weather stations, satellites, weather balloons, radar and ocean buoys. Evidence includes:

- An increase in the average surface air temperature by 1°C over the past 100 years.
- The warmest ocean temperatures since 1850.
- A 19cm rise in sea levels since 1900.
- Artic sea ice has thinned by 65% since 1975.

Natural records like tree rings, ice cores (spanning 800, 000 years) and ocean sediments (spanning beyond the quaternary period), help estimate climate. The period of timeline that spans from **2.6 million years ago to the present day** is called the **Quaternary Period.** This period marks a time when there was a **global drop in temperature** and the most recent ice age began.

Ice cores are cylinders of ice drilled out of an ice sheet or glacier. The ice encloses small bubbles of air that contain a sample of the atmosphere - making it possible to measure the past concentration of gases in the atmosphere. Antarctic ice cores show us that the concentration of CO_2 was stable until the early 19th century.

How will Climate Change affect People and the Environment?

Effects on People (social effects)	Environmental Effects
• Increase risk of diseases such as skin cancers and heat stroke as temperatures increase. • Winter-related deaths decrease with milder winters. • Crop yields affected - maize will decrease by 12% in South America, yet will increase in northern Europe and require more irrigation. • Less ice in the Arctic Ocean increases shipping and extraction of gas and oil reserves (because we can reach it). • Droughts reduce food and water supplies in sub-Saharan Africa. • Water scarcity in the south and south east of the UK. • Flood risk increase repair and insurance costs. • 70% of Asia at increased risk of flooding. • Declining fishing industry in the Lower Mekong delta will affect 40 million. • Skiing industry may decline in the Alps due to less snow.	• Increased drought in areas such as the Mediterranean region. • Lower rainfall causes food shortages for orang-utans in Borneo and Indonesia. • Sea level rise increases flooding and coastal erosion. • Ice melts so wildlife declines such as Adelie penguins on the Arctic peninsula and polar bears in the Arctic. • Warmer rivers affect marine life, for example the food supply will decrease for the Ganges river dolphin. • Increase in forest growth in northern Europe. • Forests in North America may experience more pests, disease and forest fires. • Coral bleaching - the decline in biodiversity such as at the Great Barrier Reef.

How can we adapt to Climate Change?

Patterns of rainfall and temperature will change. Extreme weather events such as heatwaves, droughts and floods will become more common and the distribution of pests and diseases will change. Some methods of adapting to these impacts include:

- moving production to another location due to changing temperatures and extreme weather,
- increasing irrigation in areas due to changing precipitation and
- Changing the crops grown and the times of year they are planted.

Potato Park in Peru have started to grow crops at higher latitudes.

As sea levels rise, rates of coastal erosion will increase. Fresh water supplies will become contaminated by saltwater and coastal areas will be prone to damage from storm surges. Some methods of adapting to these impacts include:

- Sea defences such as sea walls.
- Building houses that are raised off the ground using stilts.
- Construction of artificial islands up to 3m high so that people most at risk could be relocated.

Millions of people in Asia depend on rivers fed by snow and glacial melt for their domestic and agricultural water supply. In the Himalayas most of the 16 000 glaciers are receding rapidly due to global warming. This threatens the long-term security of water supply in the region. Artificial glaciers are being constructed to supply water to villages in Ladakh, India. Water is collected in winter through a system of diversion canals and embankments and it freezes. When the 'glacier' melts in spring it will provide water for the local villages.

How can we manage Climate Change?

The burning of fossil fuels to produce electricity, fuels vehicles and power industry contributes 87% of all human-produced CO_2 emissions. The rest comes from land uses changes such as deforestation (9%) and industrial processes such as making cement (4%).

Alternative Energy Provision: To help reduce carbon emissions many countries are turning to alternative sources of energy such as: hydro-electricity, nuclear power, solar, wind and tidal. These do not emit large amounts of CO_2. Some are also renewable and will last into the future. Nuclear power uses uranium to generate electricity but it does not emit CO_2 as a by-product. At current, in 2016, renewables produce more than 20% of the UK's electricity.

Carbon Capture and Storage: Coal is the most polluting of all fossil fuels. China gets 80% of its electricity from burning coal, India 70% and the USA 50%. Carbon capture and storage (CCS) uses technology to capture CO_2 produced from the use of fossil fuels in electricity generation and industrial processes. It is possible to capture up to 90% of the CO_2 that would otherwise enter the atmosphere. Once CO_2 is captured, the carbon gas is compressed and transported by pipeline to an injection well. It is injected as a liquid into the ground to be stored in suitable geological reservoirs such as sedimentary rock as this prevents it from escaping. The UK is the world leader in CCS.

Planting Trees: Trees act as carbon sinks, removing CO_2 from the atmosphere by the process of photosynthesis. They also release moisture into the atmosphere. This has a cooling effect by producing more cloud, reducing incoming solar radiation. Tree planting is well established in many parts of the world. Plantation forests can absorb CO_2 at a faster rate than natural forests and can do so effectively for up to 50 years. The UK has a £24.9 million project to reduce deforestation and increase reforestation in Brazil. It aims to tackle climate change by reducing 10.71 million tons of CO_2 emissions over 20 years by recovering 41,560 hectares of degraded forests.

International Agreement: Paris Agreement 2015 -

- 195 adopted the first ever universal and legally binding global climate deal.
- To peak greenhouse gas emissions as soon as possible and achieve a balance between sources and sinks of greenhouse gases in the second half of this century (2050-2100).
- To keep global temperature increase below 2°C and limited to 1.5°C above pre-industrial levels.
- To review progress every 5 years.
- $100 billion a year to support climate change initiatives in developing countries by 2020, with further finance in the future.
- There have been criticisms that many of these agreements are 'promises' or aims and not firm commitments.

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What you need to know:

Collecting like terms

Simplify the expression: **4w + 3 + 2w - 1**

$4w + 3 + 2w - 1$ (Now Group Like Terms)

$= 4w + 2w + 3 - 1$ (Combine Like Terms)

$= 6w + 2$

$= 6w + 2$ ✓

Note – you can only collect terms that have the same power eg $5x + 4x^2 \neq 9x^2$

$4x^2 + 3xy - 14x + 7xy + x^2$

$4x^2$ $3xy$ $-14x$ $7xy$ x^2

$5x^2 + 10xy - 14x$

Substitution

Evaluate (find the value of) the expressions, given that:

$a = 2, \quad b = 3, \quad c = -5$

Note – Always use the correct order of operations

1. $4b = 4 \times 2 = 8$
2. $7b - 3c = (7 \times 3) - (3 \times -5) = 21 - -15 = 21 + 15 = 36$
3. $5b^2 + 1 = 5 \times (3)^2 + 1 = 5 \times 9 + 1 = 45 + 1 = 46$
4. $2c^3 = 2 \times (-5)^3 = 2 \times -125 = -250$
5. $\frac{3ac}{2b} = \frac{3 \times 2 \times -5}{2 \times 3} = \frac{-30}{6} = -5$

For fractions work out the numerator and denominator separately first

You need to be able to:

- Identify an expression/equation/formula/identity from a list
- Manipulate and simplify algebraic expressions by collecting 'like' terms
- Substitute numbers into formulae
- Simplify expressions
- Use index notation and the index laws
- Multiply a single term over a bracket and simplify by factorising
- Expand double brackets
- Factorise quadratic expressions

Key Terms:

Formula: expresses the relationship between two or more unknown values

Expression: A sentence in algebra that does NOT have an equals sign

Identity: One side is the equivalent to the other side

Substitution: Replace the letter with a given value

Like terms: Variables that are the same are 'like'

Expand: Single brackets – each term inside the bracket is multiplied by the term outside the bracket.
Double brackets – each term in the first bracket is multiplied by all the terms in the second bracket.

Factorise: Putting an expression back into brackets

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What you need to know:

Linear expressions

Expand and simplify where appropriate

1) $7(3 + a) = 21 + 7a$

2) $2(5 + a) + 3(2 + a) = 10 + 2a + 6 + 3a$
$= 5a + 16$

Note – collect like terms to simplify

3) Factorise $9x + 18 = 9(x + 2)$

4) Factorise $6e^2 - 3e = 3e(2e - 1)$

Note – to 'factorise fully' means take out the HCF.

Quadratic expressions

Expand and simplify:

1) $(p + 2)(2p - 1)$
$= 2p^2 + 4p - p - 2$
$= 2p^2 + 3p - 2$

2) $(p + 2)^2$
$(p + 2)(p + 2)$
$= p^2 + 2p + 2p + 4$
$= p^2 + 4p + 4$

Factorise:

3) $x^2 - 2x - 3$
$= (x - 3)(x + 1)$

Factorise and solve:

4) $x^2 + 4x - 5 = 0$
$(x - 1)(x + 5) = 0$
Therefore the solutions are:
Either $(x - 1) = 0$
$x = 1$
Or $(x + 5) = 0$
$x = -5$

Solving Equations

Unknown on one side

Solve $2x + 1 = 9$

-1 -1
$2x = 8$
÷2 ÷2
$x = 4$

Solve $3(y - 7) = 9$

Always expand the bracket first

$3y - 21 = 9$
+21 +21
$3y = 30$
÷3 ÷3
$y = 10$

You can check your answers by substituting your answer back into the question

Unknowns on both side

Solve $2d - 7 = 5d - 10$

Start by subtracting the smallest amount of the variable from both sides

-2d -2d
$-7 = 3d - 10$
+10 +10
$3 = 3d$
÷3 ÷3
$d = 1$

Solve $3(2t + 4) = 2(2 - t)$

$6t + 12 = 4 - 2t$
+2t +2t
$8t + 12 = 4$
-12 -12
$8t = -8$
÷8 ÷8
$t = -1$

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What you need to know:

Multiples and factors

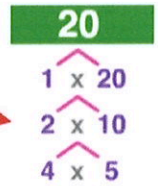
Multiples: The result of multiplying a number by and integer. It is the times table of a number.

Multiples of 4: 4, 8, 12, 16,20 ...
Multiples of 5: 5, 10, 15, 20, 25....

Multiples are the list of times tables.

Factors: A number that divides exactly into another number without a remainder. It is often helpful to write them in pairs.

Write them in pairs first so you don't miss any!



Factors of 20 = 1, 2, 4, 5, 10, 20

Prime numbers

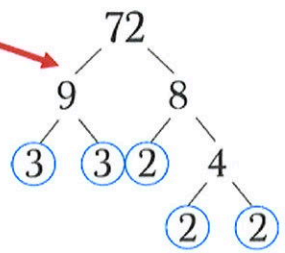
Prime: This is a number that has exactly 2 factors; 1 and itself.

2 is the only even prime. The first 10 prime numbers are:
2, 3, 5, 7, 11, 13, 17, 19, 23, 29

These are not the only prime numbers.

Prime factorisation: This is when we split a number into its prime factors using a factor tree. We circle the prime factors.

We need to find pairs of numbers that multiply to give the number above.



If a number is repeated we write it as a power.

$72 = 2^3 \times 3^2$

Key Terms:

Prime number: A prime is a number that has only two factors which are 1 and itself.
Multiple: A number in the given numbers times table.
Factor: A number that fits into another number exactly.
LCM: The smallest number that is in the times tables of the given numbers.
HCF: The biggest number that divides exactly into two or more numbers.

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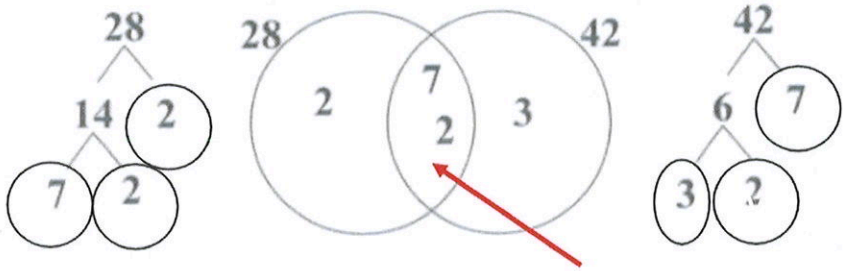
What you need to know:

HCF

This is where we find the biggest number that divides exactly into two or more numbers.



Remember numbers that appear in both prime factor tree's go in the middle of the venn diagram.

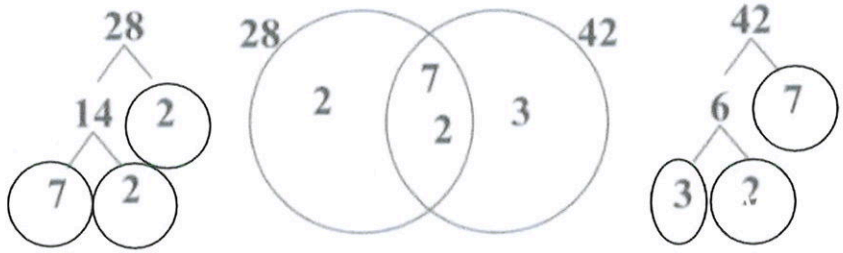
The prime numbers (the circled numbers go in the venn diagram.

To calculate the HCF we multiply all of the numbers in the intersection.

The HCF of 28 and 42 = 7 x 2 = 14

LCM

This is where we find the smallest number that appears in the given numbers times tables.



There are 2 different ways of calculating the LCM:

Method 1:
Multiply all of the numbers in the venn diagram = 2 x 7 x 2 x 3 = 84

Method 2:
Multiply the large number outside the venn diagram by the small numbers in the opposite circle:
28 x 3 = 84 or 42 x 2 = 84

All 3 calculations give you the same answer so you could do all 3 to check your answer is correct.

The LCM of 28 and 42 = 84

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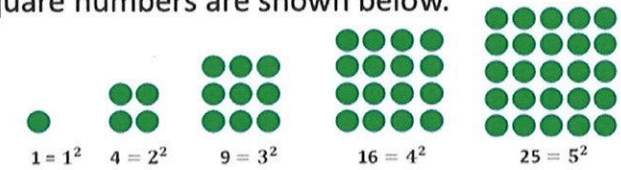
What you need to know:

Squares, cubes and roots

Square numbers: This is when we multiply a number by itself, the first 5 square numbers are shown below.



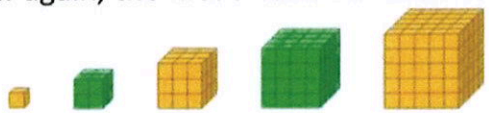
Square roots: This is the number that we started with to get the square numbers.

Remember the answer is 7 not 7x7.

$\sqrt{49}$ = 7 because 7x7 is 49

$\sqrt{100}$ = 10 because 10x10 is 10

Cube numbers: This is when we multiply a number by itself and then by itself again, the first 5 cube numbers are shown below.



1 8 27 64 125

Index form

Index number: An index number is a number which is raised to a power. The power, also known as the index, tells you how many times you have to multiply the number by itself.

2^5 is the index notation.

$2^5 = 2 \times 2 \times 2 \times 2 \times 2 = 32$

Key Terms:

Square: A square number is the result of multiplying a number by itself.

Cube: A cube number is the result of multiplying a number by itself twice.

Root: A root is the reverse of a power.

Indices: These are the squares, cubes and powers.

Operation: In maths these are the functions × ÷ + -.

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What you need to know:

Laws of indices

Multiplication law: When multiplying with the same base (number/letter) we add the powers.

General rule: $a^m \times a^n = a^{m+n}$

$2^5 \times 2^7 = 2^{5+7} = 2^{12}$ $\quad$ $x^3 \times x^8 = x^{3+8} = x^{11}$

When multiplying the terms we add the powers together.

Division law: When dividing with the same base (number/letter) we subtract the powers.

General rule: $a^m \div a^n = a^{m-n}$

$2^{14} \div 2^7 = 2^{14-7} = 2^7$ $\quad$ $x^{10} \div x^8 = x^{10-8} = x^2$

When dividing the terms we subtract the powers together.

Brackets law: When raising a power to another power we multiply the powers together.

General rule: $(a^m)^n = a^{m \times n}$

$(5^4)^2 = 5^{4 \times 2} = 5^8$ $\quad$ $(h^9)^3 = h^{9 \times 3} = h^{27}$

When raising to a power we multiply the powers together.

BIDMAS – order of operations

B Brackets

I Indices

D Division

M Multiplication

A Addition

S Subtraction

If a calculation contains the circled calculations then you need to work from left to right.

$5 \times 4 - 8 \div 2$

This question can be split into two separate calculations which are then combined to get the answer.

$20 \quad - \quad 4 \quad = \mathbf{16}$

We need to deal with the powers inside the brackets first by calculating 2^2.

$(2^2 + 6)^2 \times 4 - 8$

$(4 + 6)^2 \times 4 - 8$

$(10)^2 \times 4 - 8$

Once the bracket has been fully calculated we then look at the operations on the outside of the bracket.

$100 \times 4 - 8$

$400 - 8 = \mathbf{392}$

Year 10 Higher TRIGONOMETRIC GRAPHS AND EXACT VALUES

Key Concepts

For some angles in a right angled triangle, there is an exact trigonometric value.

HINT – Use the finger rule!
Label fingers from the BOTTOM as
0, 30, 45, 60, 90

For sine, fingers under, cos fingers above, The square root divided by 2.
For tan flip fingers over and square root top divided by square root bottom

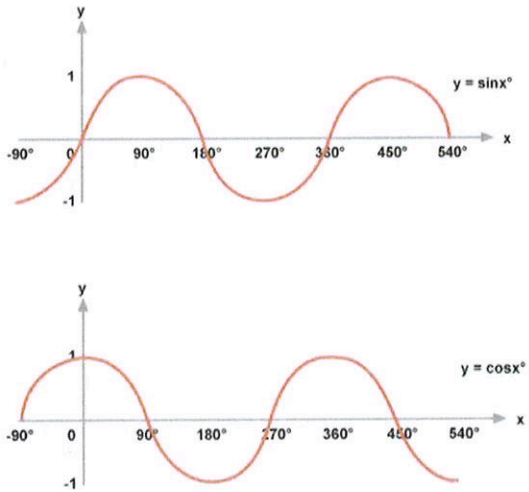
These are shown in the table below.

	Sine	Cosine	Tangent
0°	0	1	0
30°			
45°			1
60°			
90°	1	0	Undefined

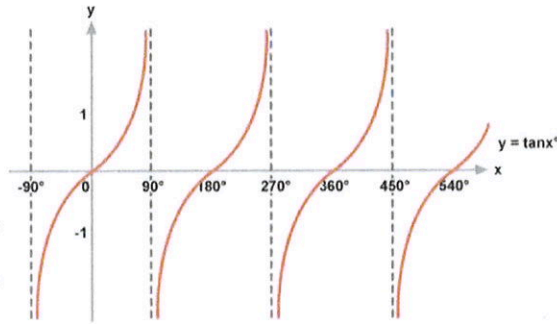
Key Words

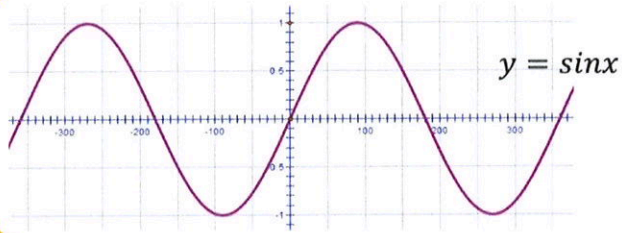
Right angled
Sine
Cosine
Tangent
Graph
Function
Angle
Theta θ

Examples



Trigonometric graphs





$sin30 = 0.5$

What other angles have a value of 0.5?

ANSWERS: -330°, -210°, 150°

THE SINE AND COSINE RULE

Key Concepts

Sine rule

To calculate a missing side:

$$\frac{a}{sinA} = \frac{b}{sinB} = \frac{c}{sinC}$$

To calculate a missing angle:

$$\frac{sinA}{a} = \frac{sinB}{b} = \frac{sinC}{c}$$

Cosine rule

To calculate a missing side:

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

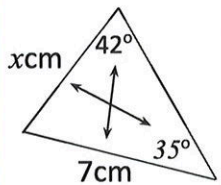
To calculate a missing angle:

$$cosA = \frac{b^2 + c^2 - a^2}{2bc}$$

Area of a triangle using sine

$$area = \frac{1}{2}absinC$$

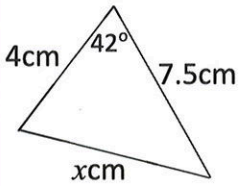
Examples



$$\frac{x}{sin35} = \frac{7}{sin42}$$

$$x = \frac{sin35 \times 7}{sin42}$$

$$x = 6.0cm$$

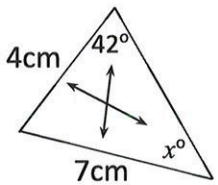


$$a^2 = b^2 + c^2 - 2bccosA$$

$$x^2 = 4^2 + 7.5^2 - 2\times4\times7.5\times cos42$$

$$x^2 = 27.66$$

$$x = \sqrt{27.66} = 5.26cm$$

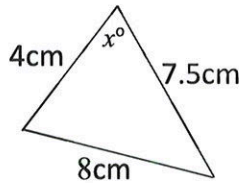


$$\frac{sinx}{4} = \frac{sin42}{7}$$

$$sinx = \frac{sin42 \times 4}{7}$$

$$x = sin^{-1}\left(\frac{sin42\times4}{7}\right)$$

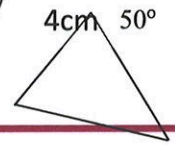
$$x = 22.5^o$$



$$cosA = \frac{4^2 + 7.5^2 - 8^2}{2\times4\times7.5}$$

$$A = cos^{-1}\left(\frac{4^2 + 7.5^2 - 8^2}{2\times4\times7.5}\right)$$

$$A = 82.1^o$$

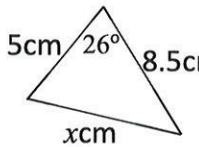


$$area = \frac{1}{2}\times4\times7.5\times sin50$$

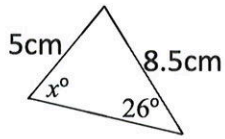
$$area = 11.49cm^2$$

Key Words

Sine
Cosine
Side
Angle
Inverse
2D



1a) Calculate x
b) Calculate the area of the triangle



2a) Calculate x
b) Calculate the area of the triangle

ANSWERS 1a) 4.57cm b) 9.32cm² 2a) 48.18° b) 20.45cm²

COMPOUND INTEREST AND DEPRECIATION

Key Concepts

We use **multipliers** to increase and decrease an amount by a particular percentage.

Percentage increase:

$Value \times (1 + percentage\ as\ a\ decimal)$

Percentage decrease:

$Value \times (1 - percentage\ as\ a\ decimal)$

Appreciation means that the value of something is going up or increasing.

Depreciation means that the value of something is going down or reducing.

Per annum is often used in monetary questions meaning **per year.**

Examples

Compound interest:

Joe invest £400 into a bank account that pays 3% **compound interest** per annum. Calculate how much money will be in the bank account after 4 years.

$Value \times (1 + percentage\ as\ a\ decimal)^{years}$
$= 400 \times (1 + 0.03)^4$
$= 400 \times (1.03)^4$
= £450.20

Compound depreciation:

The original value of a car is £5000. The value of the car **depreciates** at a rate of 7.5% per annum. Calculate the value of the car after 3 years.

$Value \times (1 - percentage\ as\ a\ decimal)^{years}$
$= 5000 \times (1 - 0.075)^3$
$= 5000 \times (0.925)^3$
= £3957.27

Key Words

Percent
Appreciate
Depreciate
Interest
Annum
Compound
Multiplier

1) Jane invests £670 into a bank account that pays out 4% compound interest per annum. How much will be in the bank account after 2 years?
2) A house has decreased in value by 3% for the past 4 years. If originally it was worth £180,000, how much is it worth now?

ANSWERS A 1) £724.67 2) £159352.71

PERCENTAGE CHANGE AND REVERSE PERCENTAGES

Key Concepts

Calculating percentages of an amount without a calculator:

10% = divide the value by 10
1% = divide the value by 100

Calculating percentages of an amount with a calculator:

Amount × percentage as a decimal

Calculating percentage increase/decrease:

Amount × (1 ± percentage as a decimal)

How do I know if I need to reverse a percentage?
Has something already been DONE to the original amoun t? If so, we reverse the process!

Percentage change:

A dress is reduced in price by 35% from £80. What is it's **new price**?

$Value \times (1 - percentage\ as\ a\ decimal)$
$= 80 \times (1 - 0.35)$
= £52

A house price appreciates by 8% in a year. It originally costs £120,000, what is the **new value** of the house?

$Value \times (1 + percentage\ as\ a\ decimal)$
$= 120{,}000 \times (1 + 0.08)$
= £129,600

Reverse percentages: This is when we are trying to find out the original amount.

A pair of trainers cost £35 in a sale. If there was 20% off, what was the **original price** of the trainers?

$Value \div (1 - 0.20)$
$= 35 \div 0.8$
= £43.75

A vintage car has increased in value by 5%, it is now worth £55,000. What was it worth **originally**?

$Value \div (1 + 0.05)$
$= 55{,}000 \div 1.05$
= £52,380.95

Examples

Key Words
Percent
Increase/decrease
Reverse
Multiplier
Inverse

1a) Decrease £500 by 6%
b) Increase 70 by 8.5%
2) A camera costs £180 in a 10% **sale**. What was the **pre-sale** price
3) The cost of a holiday, including **VAT** at 20% is £540. What is the **pre-VAT** price?

ANSWERS A 1a) £470 b) £75.95 2) £200 3) £450

EXPRESSIONS/EQUATIONS/IDENTITIES AND SUBSTITUTION

Key Concepts

A **formula** involves two or more letters, where one letter equals an **expression** of other letters.

An **expression** is a sentence in algebra that does NOT have an equals sign.

An **identity** is where one side is the equivalent to the other side.

When **substituting** a number into an expression, replace the letter with the given value.

Rearranging is an important part of manipulating equations or formulae

Key Words

Substitute
Equation
Formula
Identity
Expression
Rearrange
Solve
Balance
Function

Examples

1) $5(y + 6) \equiv 5y + 30$ is an identity as when the brackets are expanded we get the answer on the right hand side
2) $5m - 7$ is an expression since there is no equals sign
3) $3x - 6 = 12$ is an equation as it can be solved to give a solution
4) $C = \frac{5(F - 32)}{9}$ is a formula (involves more than one letter and includes an equal sign)
5) Find the value of $3x + 2$ when $x = 5$

   $(3 \times 5) + 2 = 17$
6) Where $A = b^2 + c$, find A when $b = 2$ and $c = 3$

   $A = 2^2 + 3$

   $A = 4 + 3$

   $A = 7$

Questions

1) Identify the equation, expression, identity, formula from the list

2) (a) $v = u + at$ (b) $u^2 - 2as$

(c) $4x(x - 2) = x^2 - 8x.$ (d) $5b - 2 = 13$

2) Find the value of $5x - 7$ when $x = 3$

3) Where $A = d^2 + e$, find A when $d = 5$ and $e = 2$

ANSWERS: 1) (a) formula (b) expression (c) identity (d) equation
2) 8 3) A = 27

Module 7 Vocabulaire

Les professions — Jobs

Ma mère/Mon père est …	*My mum/dad is a(n) …*
Je voudrais être …	*I would like to be a(n) …*
acteur/-trice	*actor/actress*
agent de police	*policeman/woman*
agriculteur/-trice	*farmer*
architecte	*architect*
boucher/-ère	*butcher*
boulanger/-ère	*baker*
caissier/-ère	*cashier*
coiffeur/-euse	*hairdresser*
créateur/-trice de mode	*fashion designer*
dentiste	*dentist*
directeur/-trice	*director*
électricien(ne)	*electrician*
employé(e) de bureau	*office worker*
facteur/-trice	*postman/postwoman*
fonctionnaire	*civil servant*
infirmier/-ère	*nurse*
informaticien(ne)	*computer scientist*
ingénieur(e)	*engineer*
journaliste	*journalist*
maçon(ne)	*builder*
mécanicien(ne)	*mechanic*
médecin	*doctor*
professeur	*teacher*
secrétaire	*secretary*
serveur/-euse	*waiter/waitress*
soldat	*soldier*
steward/hôtesse de l'air	*flight attendant*
vendeur/-euse	*sales assistant*
vétérinaire	*vet*
J'adore (la campagne).	*I love (the countryside).*
Je suis passionné(e) par (la loi et la justice).	*I'm passionate about (the law and justice).*
Je suis fort(e) en (maths).	*I'm good at (maths).*
Je suis (courageux/-euse).	*I am (brave).*
(Voyager), c'est ma passion.	*(Travelling) is my passion.*
(Les avions) me fascinent.	*(Planes) fascinate me.*
Je préférerais travailler (en plein air).	*I would prefer to work (outdoors).*
Je voudrais travailler avec (des enfants).	*I would like to work with (children).*
Je voudrais/J'aimerais travailler comme …	*I would like to work as …*
Je veux être …	*I want to be …*

L'orientation — Career paths

Dans quel secteur voudrais-tu travailler?	*In which area would you like to work?*
l'audiovisuel et les médias	*audiovisual and media*
l'informatique et les télécommunications	*IT and telecommunications*
l'hôtellerie et la restauration	*hotel and catering*
les arts et la culture	*arts and culture*
le commerce	*business*
le sport et les loisirs	*sport and leisure*
la médecine et la santé	*medicine and health*
les sciences et les technologies	*science and technology*
Ça m'intéresserait de travailler dans …	*I would be interested in working in …*
Mon rêve serait de faire carrière dans …	*My dream would be to have a career in …*
Mon ambition/Mon but est de trouver un poste dans …	*My ambition/aim is to find a job in …*
Le secteur/L'orientation qui m'attire/ m'intéresse (le plus), c'est …	*The sector/career path that attracts/ interests me (the most) is …*
L'important pour moi est d'avoir un métier bien payé.	*The important thing for me is to have a well-paid job.*
Le plus important est de …	*The most important thing is to …*
faire quelque chose de satisfaisant/ stimulant/gratifiant/d'intéressant	*do something satisfying/ stimulating/rewarding/interesting*
faire quelque chose pour améliorer la société/aider les autres	*do something to improve society/ help others*
Le salaire a moins d'importance/est très important pour moi.	*The salary is less/very important to me.*
À mon avis, c'est un secteur d'avenir.	*In my opinion, it's an area with prospects.*
Je suis … depuis (trois) ans.	*I have been a … for (three) years.*
C'est un métier (stimulant).	*It's a (stimulating) job.*
La chose qui me plaît le plus, c'est …	*What I like best is …*
L'inconvénient, c'est que …	*The disadvantage is that …*
les horaires sont très longs	*the hours are very long*
c'est fatigant	*it's tiring*
Le mieux/pire, c'est …	*The best/worst thing is …*
Je suis assez satisfait(e) de mon travail.	*I'm quite satisfied with my job.*
Avant, j'étais/je travaillais comme …	*In the past, I was/worked as …*
C'était affreux/stressant/mieux/pire.	*It was awful/stressful/better/worse.*
C'était mal payé.	*It was badly paid.*
Le travail était monotone.	*The work was monotonous.*
Il n'y avait aucune possibilité d'avancement.	*There was no chance of promotion.*
Je m'entendais mal avec mon patron.	*I didn't get on well with my boss.*
J'ai décidé de (suivre une formation).	*I decided to (take a course).*
Maintenant, je suis diplômé(e).	*Now I am qualified.*
Mon nouveau boulot est (plus créatif).	*My new job is (more creative).*
Mes collègues sont tous très sympa.	*My colleagues are all very nice.*

Les ambitions — Ambitions

Avant de continuer mes études, …	*Before I continue my studies …*
Après avoir terminé mes examens, …	*After having finished my exams …*
Après avoir quitté le collège, …	*After having left school …*
Plus tard/Un jour, …	*Later on/One day …*
Je veux/J'aimerais/Je préférerais/ J'espère …	*I want/I would like/I would prefer/ I hope to …*
J'ai envie de/d' …	*I want to …*
J'ai l'intention de/d' …	*I intend to …*
Mon rêve serait de/d' …	*My dream would be to …*
aller à l'université/à la fac	*go to university*
entrer en apprentissage	*do an apprenticeship*
faire du bénévolat/travail bénévole	*do charity/voluntary work*
prendre une année sabbatique	*take a gap year*
J'espère me marier/me pacser.	*I hope to get married/register a civil partnership.*
J'ai l'intention de faire le tour du monde.	*I intend to travel round the world.*
Mon but est de fonder une famille.	*My aim is to start a family.*
Je ne veux pas avoir d'enfants.	*I don't want to have children.*
Je n'ai aucune intention de m'installer avec mon copain/ma copine.	*I have no intention of moving in with my boyfriend/girlfriend.*

Au téléphone — On the telephone

Allô?	*Hello?*
Je voudrais parler avec …	*I would like to talk to …*
Sa ligne est occupée.	*His/Her line is busy.*
Est-ce que je peux laisser un message?	*Can I leave a message?*
Je vais vous transférer vers sa messagerie vocale	*I will transfer you to his/her voicemail.*
Ne quittez pas.	*Stay on the line.*
Je vous le passe.	*I'll pass you over to him/her.*
Je peux vous être utile?	*Can I help you/be of help?*
Au revoir!	*Goodbye!*

Un entretien d'embauche — A job interview

Enchanté.	*Pleased to meet you.*
Asseyez-vous.	*Sit down.*
Parlez-moi un peu de ce que vous faites actuellement.	*Talk to me a little bit about what you are doing at the moment.*
Actuellement, je suis (au lycée).	*At the moment, I am (in sixth form college).*
Je suis en train de (préparer le baccalauréat/mes examens de GCSE).	*I am in the middle of (preparing to take my baccalauréat/ my GCSE exams).*
Quelles matières étudiez-vous?	*What subjects are you studying?*
J'étudie (huit) matières, dont (l'EPS).	*I'm studying (eight) subjects, including (PE).*
Qu'est-ce que vous ferez après vos examens?	*What will you do after your exams?*
Si je réussis mes examens, j'espère (aller à l'université).	*If I pass my exams, I hope (to go to university).*
J'aimerais également (prendre une année sabbatique).	*I would also like (to take a gap year).*
Pourquoi vous intéressez-vous à ce poste?	*Why are you interested in this position?*
Je crois que ce serait une bonne expérience pour moi.	*I think it would be a good experience for me.*
Quelles sont les qualités personnelles que vous apporteriez à ce poste?	*What personal qualities would you bring to this position?*
Je suis quelqu'un de (bien organisé/ de très motivé/de créatif).	*I am a (well organised/very motivated/ creative) person.*

Mon boulot dans le tourisme — My job in tourism

Je suis étudiant(e) en …	*I am studying …*
J'apprends à devenir …	*I'm learning to become …*
Il y a six mois, j'ai commencé à travailler dans/chez/en …	*Six months ago I started work in/ with …*
Je voudrais travailler à plein temps/ mi-temps dans (le tourisme).	*I would like to work full-time/ part-time in (tourism).*
Lorsque j'étais plus jeune, je rêvais d'être (infirmier/-ière).	*When I was younger, I dreamed of being a (nurse).*
J'ai décidé de changer d'orientation à cause de …	*I decide to change direction because of …*
Mon travail consiste à (accueillir les clients).	*My work involves (welcoming clients).*
Je m'occupe aussi (des réservations).	*I also take care of (reservations).*
Je vends (des billets).	*I sell (tickets).*
Je suis passionné(e) par mon travail.	*I am passionate about my job.*
J'apprécie surtout (le contact avec les gens).	*I particularly enjoy (dealing with people).*
Le seul inconvénient de mon métier, c'est que …	*The only disadvantage of my job is that …*
Pour faire ce métier, il faut …	*To do this job you have to …*
être souriant	*be smiley*
savoir parler d'autres langues	*know how to speak other languages*
Plus tard/Quand je serai diplômé(e), …	*Later on/When I am qualified …*
je partirai en vacances	*I will go on holiday*
j'essaierai d'apprendre le japonais	*I will try to learn Japanese*

Les mots essentiels — High-frequency words

au sujet de	*about, on the subject of*
avant tout	*above all*
malgré	*despite, in spite of*
non seulement	*not only*
plus tard	*later*
plutôt	*rather, instead*
quant à …	*regarding …, as for …*

Year 10 Autumn Semester - Ich liebe Wien!

Verkehrsmittel / *Forms of transport*

Ich fahre …	*I travel …*
mit dem Zug / Bus / Auto / Rad	*by train / bus / car / bike*
mit der U-Bahn / S-Bahn / Straßenbahn	*by underground / urban railway / tram*
Ich fliege mit dem Flugzeug.	*I travel by plane.*
Ich fliege.	*I fly.*
Ich gehe zu Fuß.	*I go on foot. / I walk.*

Hotelzimmer reservieren / *Booking hotel rooms*

Ich möchte … reservieren.	*I would like to reserve …*
ein Einzelzimmer	*a single room*
zwei Doppelzimmer	*two double rooms*
ein Zimmer mit Aussicht	*a room with a view*
für eine Nacht	*for one night*
für zwei Nächte vom 8. bis 10. November	*for two nights from 8 to 10 November*
Gibt es WLAN im Hotel?	*Is there Wi-Fi in the hotel?*
der Fitnessraum(-räume)	*gym*
der Parkplatz(-plätze)	*car park / parking space*
das Restaurant(s)	*restaurant*
Darf ich den Hund zum Hotel mitbringen?	*Can I bring my dog with me to the hotel?*
Um wie viel Uhr ist das Frühstück / Abendessen?	*What time is breakfast / dinner?*
Wie viel kostet das Zimmer?	*How much is the room?*

Fahrkarten kaufen / *Buying train tickets*

Ich möchte eine Fahrkarte nach Berlin, bitte.	*I'd like a ticket to Berlin, please.*
Einfach oder hin und zurück?	*Single or return?*
Wann fährt der nächste Zug ab?	*When does the next train leave?*
Er fährt um 12:51 Uhr vom Gleis 22 ab.	*It leaves at 12:51 from platform 22.*
Wann kommt er an?	*When does it arrive?*
Er kommt in Berlin um 19:18 Uhr an.	*It arrives in Berlin at 19:18.*
Fährt der Zug direkt oder muss ich umsteigen?	*Does the train go direct or do I need to change?*

Ferienunterkunft / *Holiday accommodation*

das Hotel(s)	*hotel*
das Gasthaus(-häuser)	*guest house / bed and breakfast*
die Ferienwohnung(en)	*holiday apartment*
die Jugendherberge(n)	*youth hostel*
der Campingplatz(-plätze)	*campsite*
Ich würde am liebsten (in diesem Hotel) übernachten.	*I would like best to stay (in this hotel).*
in der Stadtmitte / im Stadtzentrum	*in the town centre*
am Stadtrand	*in the suburbs / outskirts*
am nächsten (zum Bahnhof)	*nearest (to the station)*
(Der Bahnhof) liegt (100 m) entfernt.	*(The station) is (100 m) away.*
der Computerraum(-räume)	*computer room*
der Fernsehraum(-räume)	*TV room*
der Garten (Gärten)	*garden*
der Spieleraum(-räume)	*games room*
der Supermarkt(-märkte)	*supermarket*
der Waschsalon(s)	*launderette*
die Klimaanlage(n)	*air conditioning*
das Freibad(-bäder) mit Sauna(s)	*open-air pool with sauna*
Er/Sie/Es ist … / sieht … aus.	*It is / looks …*
modern	*modern*
praktisch	*practical / handy*
ruhig	*quiet*
altmodisch	*old-fashioned*
chaotisch	*chaotic*
schmutzig	*dirty*
(un)bequem	*(un)comfortable*

Urlaubsbeschwerden / *Holiday complaints*

Das Zimmer war klein und schmutzig.	*The room was small and dirty.*
Es waren lange Haare in der Dusche / im Waschbecken.	*There were long hairs in the shower / in the washbasin.*
Ich war total unzufrieden.	*I was totally dissatisfied.*
Ich werde nie wieder in diesem Hotel übernachten.	*I will never stay in this hotel again.*
Dieses Gasthaus hatte keinen Internetanschluss.	*This guest house had no internet connection.*
Es gab keine Klimaanlage.	*There was no air conditioning.*
Das Frühstück war ein Höhepunkt.	*Breakfast was a highlight.*
Es gab Renovierungsarbeiten.	*There were renovation works.*
Es gab viel Lärm.	*There was a lot of noise.*
Unser Zelt war direkt neben dem Spieleraum / Waschsalon.	*Our tent was right next to the games room / launderette.*
Jede Nacht haben wir den Fernseher / die Discomusik / die Waschmaschinen gehört.	*Every night we heard the TV / disco music / the washing machines.*

Wegbeschreibungen / *Directions*

Fahr / Fahren Sie …	*Go … [using a vehicle]*
Geh / Gehen Sie …	*Go … [walking]*
rechts / links / geradeaus	*right / left / straight on*
weiter bis zum/zur …	*further until …*
über …	*over …*
Nimm / Nehmen Sie …	*Take …*
die erste / zweite Straße links	*the first / second road on the left*
Bieg / Biegen Sie an der Ecke rechts ab.	*Turn right at the corner.*
Überquer / Überqueren Sie …	*Cross …*
die Ampel(n)	*the traffic lights*
den Platz (Plätze)	*the square*
die Brücke(n)	*the bridge*
die Donau	*the Danube*
die Kreuzung(en)	*crossroads*
das Rathaus(-häuser)	*town hall*
der Rathausplatz(-plätze)	*town hall square*
das Museum (Museen)	*museum*
die Oper(n)	*opera house*
Es ist hundert Meter entfernt.	*It's one hundred metres away.*
Es ist auf der rechten Seite.	*It's on the right.*
Kannst du / Können Sie …	*Can you …*
mir sagen, wie ich zum / zur … komme?	*tell me how to get to …?*
mir den Weg zum / zur … zeigen?	*show me the way to …?*
Ich habe mich verlaufen.	*I'm lost.*
Kannst du / Können Sie mir helfen?	*Can you help me?*
Entschuldige / Entschuldigen Sie.	*Excuse me.*
Wo ist der / die / das …?	*Where is the …?*

Die Speisekarte / *Menu*

die Vorspeise(n)	*starter*
die Hauptspeise(n)	*main course*
die Nachspeise(n)	*dessert*
die Beilage(n)	*side dish*
die Getränkekarte(n)	*drinks menu*
das Tagesgericht(e)	*dish of the day*
Bedienung inbegriffen	*service included*
gefüllt	*filled, stuffed*
gemischt	*mixed*
geröstet	*roast*
hausgemacht	*homemade*
das Bier vom Fass	*draught beer*
der Fruchtsaft	*fruit juice*
der Wein	*wine*

Im Restaurant / *In the restaurant*

Wir möchten einen Tisch … haben.	*We'd like a table …*
für (vier) Personen	*for (four) people*
mit Aussicht auf die Donau	*with a view of the Danube*
in der Ecke	*in the corner*
hier links	*on the left here*
Könnte ich bitte (die Speisekarte / Getränkekarte) haben?	*Could I have (the menu / drinks menu), please?*
Das Tagesgericht ist …	*The dish of the day is …*

Restaurantbeschwerden / *Restaurant complaints*

Ich möchte mich beschweren!	*I would like to make a complaint!*
Dieser Löffel ist schmutzig.	*This spoon is dirty.*
Es ist ein Haar in diesem Salat.	*There's a hair in this salad.*
Dieser Tisch …	*This table …*
ist sehr laut	*is very noisy*
hat keine Aussicht	*has no view*
ist in der dunkelsten Ecke	*is in the darkest corner*
Das Bier ist zu warm.	*The beer is too warm.*
Dieser Wursteller war sehr fettig.	*This sausage platter was very fatty.*
Das war (die schrecklichste Suppe).	*That was (the most terrible soup).*
Ich konnte (das Tagesgericht) nicht essen, weil es … war.	*I couldn't eat (the dish of the day) because it was …*

Souvenirs / *Souvenirs*

der Kuli(s)	*ballpoint pen*
der Schmuck	*jewellery*
die Brieftasche(n)	*wallet*
das Portemonnaie(s)	*purse*
die Tasse(n)	*mug, cup*
das Bild(er)	*picture*
das Kopfkissen(-)	*pillow, cushion*
das Tischtuch(-tücher)	*table cloth*
der Keks(e)	*biscuit*
bunt	*multi-coloured*
(grün-weiß) gestreift	*(green and white) striped*
preiswert	*inexpensive, good value*
weich	*soft*

Einkaufen / *Shopping*

der Markt (Märkte)	*market*
der Souvenirladen(-läden)	*souvenir shop*
das Kaufhaus(-häuser)	*department store*
das Einkaufszentrum(-zentren)	*shopping centre*
Ich suche (ein T-Shirt) als Geschenk für (meinen Bruder).	*I'm looking for (a T-shirt) as a present for (my brother).*
Welche Größe hat (er)?	*What size is (he)?*
klein / mittelgroß / groß	*small / medium / large*
Seine Lieblingsfarben sind …	*His favourite colours are …*
altmodisch	*old-fashioned*
beliebt	*popular*
kaputt	*broken*
kurz / lang	*short / long*
preiswert	*inexpensive, good value*
schmutzig	*dirty*
teuer	*expensive*
im Sonderangebot	*on special offer*
… funktioniert nicht	*… doesn't work*
… passt mir nicht	*… doesn't fit me*
… hat ein Loch	*… has a hole*

Ein Problem melden / *Reporting a problem*

Mir ist schlecht / kalt.	*I feel ill / cold.*
Das Bein tut mir weh.	*My leg hurts.*
Ich habe mir den Arm verletzt.	*I have injured my arm.*
Ich möchte einen Handy-Diebstahl melden.	*I'd like to report a mobile phone theft.*
(Meine Mutter) ist auf dem Bürgersteig gefallen.	*(My mother) fell over on the pavement.*
Ich möchte mich über (die Toiletten) beschweren.	*I'd like to complain about (the toilets).*
Ich suche einen Geldautomaten.	*I'm looking for a cash point.*
Ich habe (meine Schlüssel / meine Brieftasche) verloren.	*I have lost (my keys / my wallet).*
Ich habe meinen Rucksack (im Café) gelassen.	*I left my rucksack (in the café).*
Gibt es hier in der Nähe ein Fundbüro / eine Apotheke?	*Is there a lost-property office / chemist near here?*
Sie müssen / Du musst …	*You must …*
zur Polizeiwache gehen	*go to the police station*
zum Fundbüro gehen	*go to the lost-property office*
ins Krankenhaus gehen	*go to hospital*
das Formular ausfüllen	*fill in the form*
Ich werde es dem Manager sagen.	*I will tell the manager.*
Ich werde einen Krankenwagen rufen.	*I will call an ambulance.*

In der Apotheke / *At the chemist's*

Ich habe Kopfweh.	*I have a headache.*
Ich leide unter Migräne.	*I suffer from migraines.*
Ich habe Zahnschmerzen.	*I have a toothache.*
Ich habe mir den Arm verletzt.	*I have injured my arm.*
Ich bin müde / erschöpft.	*I am tired / exhausted.*
Ich habe Husten.	*I have a cough.*
Ich habe Halsschmerzen.	*I have a sore throat.*
Sie müssen / könnten …	*You must / could …*
Tabletten / Vitamine / Hustenbonbons nehmen	*take tablets / vitamins / throat sweets*
eine Salbe benutzen	*use an ointment*
beim Zahnarzt anrufen	*call the dentist*
einen Termin ausmachen	*make an appointment*
ins Krankenhaus gehen	*go to hospital*

En mi ciudad / *In my town*

Hay…	*There is/are…*
un ayuntamiento	*a town hall*
un bar / muchos bares	*a bar / lots of bars*
un castillo	*a castle*
un cine	*a cinema*
un centro comercial	*a shopping centre*
un mercado	*a market*
un museo / unos museos	*a museum / a few museums*
un parque	*a park*
un polideportivo	*a sports centre*
un puerto	*a port*
muchos restaurantes	*lots of restaurants*
un teatro	*a theatre*
una biblioteca	*a library*
una bolera	*a bowling alley*
una iglesia	*a church*
una piscina	*a swimming pool*
una playa / unas playas	*a beach / a few beaches*
una plaza Mayor	*a town square*
una pista de hielo	*an ice rink*
(una oficina de) Correos	*a post office*
una tienda / muchas tiendas	*a shop / lots of shops*
(No) hay mucho que hacer.	*There is (not) a lot to do.*
Vivo en un pueblo…	*I live in a… village*
Vivo en una ciudad…	*I live in a… town*
histórico/a / moderno/a	*historic / modern*
tranquilo/a / ruidoso/a	*quiet / noisy*
turístico/a / industrial	*touristy / industrial*
bonito/a / feo/a	*pretty / ugly*
Está en…	*It is in…*
el norte / el sur	*the north / the south*
el este / el oeste	*the east / the west*
del país	*of the country*

¿Por dónde se va al / a la…? / *How do you get to the…?*

¿Dónde está el / la…?	*Where is the…?*
¿Para ir al / a la…?	*How do I get to the…?*
Sigue todo recto	*Go straight on*
Gira…	*Turn*
a la derecha / izquierda	*right / left*
Toma la…	*Take the…*
primera / segunda / tercera	*first / second / third*
calle a la derecha	*road on the right*
calle a la izquierda	*road on the left*
Pasa…	*Go over…*
el puente / los semáforos	*the bridge / the traffic lights*
Está…	*It is…*
cerca / lejos	*near / far*
enfrente de (la piscina)	*opposite (the swimming pool)*

¿Cómo es tu zona? / *What is your area like?*

Está situado/a…	*It is situated…*
en un valle	*in a valley*
al lado del río / mar	*by the river / sea*
Está rodeado/a de sierra / volcanes	*It is surrounded by mountains / volcanoes*
entre	*between*
el desierto	*the desert*
los bosques	*the woods*
las selvas subtropicales	*subtropical forests*
los lagos	*lakes*
Tiene…	*It has*
un paisaje impresionante	*an impressive landscape*
lo mejor de una ciudad	*the best things of a city*
El clima es…	*The climate is…*
soleado / seco / frío / variable	*sunny / dry / cold / variable*
Llueve a menudo.	*It rains often.*
Hay mucha marcha.	*There is lots going on.*
Es…	*It is…*
mi ciudad natal	*my home town*
mi lugar favorito	*my favourite place*
famoso/a por…	*famous for…*
un paraíso	*a paradise*
Se puede…	*You/One can…*
pasar mucho tiempo al aire libre	*spend lots of time in the open air*
apreciar la naturaleza	*appreciate nature*
subir a la torre	*go up the tower*
disfrutar de las vistas	*enjoy the views*
alquilar bolas de agua	*hire water balls*
Se pueden…	*You/One can…*
practicar ciclismo y senderismo	*do cycling and hiking*
try local dishes	*probar platos típicos*
practicar deportes acuáticos	*do water sports*

En la oficina de turismo / *At the tourist office*

¿Tiene…?	*Do you have…?*
más información sobre la excursión a…	*more information about the trip to…*
un plano de la ciudad	*a map of the town / city*
¿Cuándo abre…?	*When does… open?*
¿Cuánto cuesta una entrada?	*How much is a ticket?*
para adultos / niños	*for adults / children*
¿Dónde se pueden comprar las entradas?	*Where can you buy tickets?*
¿A qué hora sale el autobús?	*What time does the bus leave?*
cada media hora	*every half an hour*

¿Qué harás mañana? / *What will you do tomorrow?*

Visitaré la catedral.	*I will visit the cathedral.*
Sacaré muchas fotos.	*I will take lots of photos.*
Subiré al teleférico.	*I will go up the cable car.*
Nadaré en el mar.	*I will swim in the sea.*
Descansaré en la playa.	*I will relax on the beach.*
Iré al polideportivo.	*I will go to the sports centre.*
Jugaré al bádminton.	*I will play badminton.*
Haré una excursión…	*I will go on a… trip*
en barco / en autobús	*boat / bus*
Veré delfines.	*I will see dolphins.*
Iré de compras.	*I will go shopping.*
Compraré regalos.	*I will buy presents.*
El primer día	*On the first day*
El segundo día	*On the second day*
Otro día	*Another day*
El último día	*On the last day*
Si…	*If…*
hace sol	*it's sunny*
hace calor	*it's hot*
hace mal tiempo	*it's bad weather*
hace viento	*it's windy*
llueve	*it rains*
hay chubascos	*there are showers*
¡Qué bien!	*How great!*
¡Qué guay!	*How cool!*
¡Buena idea!	*Good idea!*
De acuerdo.	*OK.*

Recuerdos y regalos

¿Me puede ayudar?
Quiero comprar…
- el abanico
- el llavero
- el oso de peluche
- los pendientes
- la gorra
- las pegatinas

Es para…
¿Tiene uno/a más barato/a?
¿Cuánto es?

Souvenirs and presents

Can you help me?
I want to buy…
- *fan*
- *key ring*
- *teddy bear*
- *earrings*
- *cap*
- *stickers*

It is for…
Do you have a cheaper one?
How much is it?

Las tiendas

el banco
el estanco
la carnicería
la estación de trenes
la frutería
la joyería
la librería
la panadería
la pastelería
la peluquería
la pescadería
la zapatería
sellos
horario comercial
de lunes a viernes
abre a la(s)…
cierra a la(s)…
no cierra a mediodía
cerrado domingo y festivos

abierto todos los días

Shops

bank
tobacconist's
butcher's
train station
greengrocer's
jeweller's
book shop
bakery
cake shop
hairdresser's
fish shop
shoe shop
stamps
hours of business
from Monday to Friday
it opens at…
it closes at…
it doesn't close at midday
closed on Sundays and public holidays

open every day

Quejas

Quiero devolver…
Está roto/a.
Es demasiado estrecho/a / largo/a.
Tiene un agujero / una mancha.
¿Puede reembolsarme?
Podemos hacer un cambio.
Aquí tiene el recibo.
¿Qué me recomienda?
¿Qué tal…?
¿Qué te parece(n)…?
¿Me puedo probar…?
una talla más grande
Me lo/la/los/las llevo.

Complaints

I want to return…
It is broken.
It is too tight / long.
It has a hole / a stain.
Can you reimburse me?
We can exchange (it).
Here is the receipt.
What do you recommend?
How about…?
What do you think of…?
Can I try on…?
a bigger size
I'll take it / them.

¿Te gusta ir de compras?

(No) me gusta ir de compras.
Normalmente voy…
Suelo ir…
- al centro comercial

Prefiero / Odio comprar…
- en grandes almacenes
- en tiendas de moda
- en tiendas de segunda mano
- en tiendas de diseño
- en línea
- por Internet

porque…
- es muy divertido
- es mucho más cómodo
- hay más variedad
- puedes encontrar gangas
- se puede comprar de todo

la ropa alternativa
artículos de marca
hacer cola
esperar

Do you like going shopping?

I (don't) like going shopping.
Usually I go…
I tend to go…
- *to the shopping centre*

I prefer / I hate buying…
- *in department stores*
- *in fashion shops*
- *in second-hand shops*
- *in designer shops*
- *online*
- *on the internet*

because…
- *it's a lot of fun*
- *it's much more convenient*
- *there's more variety*
- *you can find bargains*
- *you can buy everything*

alternative clothing
branded items
to queue
to wait

Los pros y los contras de mi ciudad

Lo mejor de mi ciudad es que…
- hay tantas diversiones
- el transporte público es muy bueno
- las tiendas están tan cerca
- hay muchas posibilidades de trabajo

Lo peor es que…
- es tan ruidoso/a
- hay tanto tráfico
- hay tantas fábricas
- hay pocos espacios verdes

En el campo…
- la vida es más relajada
- no hay tanta industria
- hay bastante desempleo
- la red de transporte público no es fiable
- no hay tantos atascos

Necesitamos más…
- zonas verdes
- zonas peatonales
- rutas para bicis

The pros and cons of my town/city

The best thing about my city is that…
- *there are so many things to do*
- *the public transport is very good*
- *the shops are so close*
- *there are lots of job opportunities*

The worst thing is that…
- *it's so noisy*
- *there is so much traffic*
- *there are so many factories*
- *there are few green spaces*

In the countryside…
- *life is more relaxed*
- *there's not as much industry*
- *there is quite a lot of unemployment*
- *the public transport network is not reliable*
- *there are not as many traffic jams*

We need more…
- *green spaces*
- *pedestrian zones*
- *cycleways*

Destino Arequipa

Vi sitios de interés.
Hicimos una visita guiada.
Visité el centro a pie.
Alquilé una bici de montaña.
Subí a…
Aprendí mucho.
Comí pollo y patatas.
Probé el rocoto relleno.
Había vistas maravillosas.
La ciudad era muy acogedora.
La gente era abierta.
La comida estaba muy buena.
Me gustó (el clima).
No me gustaron (los taxis).
¡Qué miedo!
Volveré algún día.
Visitaré otras ciudades.
Iré a (Trujillo).

Destination Arequipa

I saw some sights.
We did a guided tour.
I visited the centre on foot.
I hired a mountain bike.
I went up to…
I learned a lot.
I ate chicken and potatoes.
I tried stuffed peppers.
There were amazing views.
The city was very welcoming.
The people were open.
The food was very good.
I liked (the climate).
I didn't like (the taxis).
What a scare!
I will go back some day.
I will visit other cities.
I will go to (Trujillo).

Knowledge Organiser: Knowledge Organiser: Medieval Medicine (c1250-c1500)

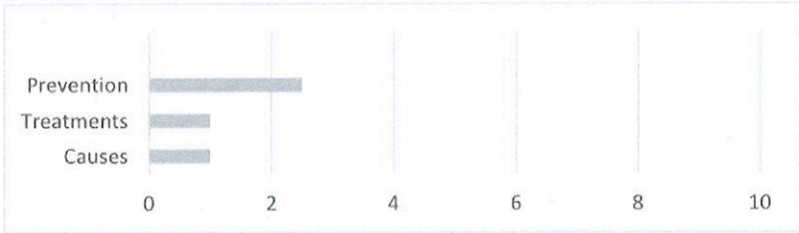
There was little scientific knowledge in medieval England as medicine was dominated by the Church, who used the ancient texts of Hippocrates and Galen to explain why people caught diseases. People believed God could send disease as a punishment for sinful behaviour. Only in times of terrible disease such as during the Black Death, did people start to question the authority of the Church on matters of medicine.

Summarise your learning	
Causes	• God's punishment for sin • An imbalance of the four humours • Astrology - – the movement of the stars and planets • Miasma – bad air
Diagnosis	• Uroscopy (using urine charts to test for disease) • Astrology charts to diagnose and time treatments. • Observation – relating to the four humours
Prevention	Superstitious/religious methods: • Living a good Christian life – prayer, going to church • Flagellation (whipping of the human body as a punishment for committing sins) • Carrying charms or sweet smelling herbs Logical methods: • Blood-letting • Cleaning the air/streets • Exercise
Treatments	Superstitious/religious methods: • Prayer and fasting • Pilgrimage – visiting a holy place • Superstition – e.g. a magpie's beak around your neck to cure toothache Logical methods: • Blood-letting and purging • Barber surgeons • Traditional remedies like foods to rebalance humours, or ointments applied to the skin

Chronology: what happened on these dates?	
1348	The Black Death arrives in England and kills 40% of the population.
1400	There were 500 hospitals in Britain.
1440	Johannes Gutenberg creates the world's first printing press.

Who were these people?	
Hippocrates	Ancient Greek physician who created the Theory of the Four Humours (the theory that ill health is caused by an imbalance of the Four Humours in the body (blood, phlegm, black bile and yellow bile).
Galen	Physician in ancient Rome who developed Hippocrates' theories further and wrote more than 350 books about medicine. His teachings were promoted by the Church because they fitted with Christian ideology.

Change and Continuity	
Change	**Continuity**
• There was some progress in surgery because it relied on practical experience and was outside the control of the Church.	• The work of Hippocrates and Galen on the Theory of the Four Humours was still followed, including the Theory of Opposites and blood-letting.



Vocabulary: define these words	
Apothecary	A pharmacist or chemist.
Astrology	The study of planets and how they might influence the lives of people.
Superstitious	Unreasonable belief based on ignorance and sometimes fear.
Flagellants	People who whip themselves to show God they had repented their sins and asked God to be merciful.
Miasma	Smells from decomposing material were believed to cause disease.
Uroscopy	Study of urine samples to diagnose disease.
Purging	Vomiting or using laxatives to re-balance the four humours.
Bloodletting	Opening a vein or applying leeches to draw blood from a patient.
Plague	Killer disease which became a pandemic throughout Europe.
Four Humours	Based on the idea that every individual has humours (blood, phlegm, yellow bile, black bile). Illness occurs when these humours are out of balance because of diet, lifestyle or environment

Knowledge Organiser: Renaissance Medicine (c1500-c1700)

People who fell ill during the Renaissance period were likely to believe the same things about the cause of their illness as their medieval ancestors. Very little really changed in the practice of medicine during this period. However, new ideas were slowly breaking down old beliefs and rethinking the way the world worked.

Summarise your learning

Causes	• An **imbalance of the humours** – e.g. King Charles II had blood removed and was purged • Theory of **Miasma** (bad smells) • **Person to person** contact – Great Plague • Thomas Sydenham believed that different diseases had different causes. He identified a new disease – St Vitus Dance. He said that **'atmospheres'** could affect your humours and make you ill.
Diagnosis	• More direct observations and examinations of patients (Sydenham recorded symptoms in detail) • Less use of urine/astrology charts
Prevention	Superstitious/religious methods: • Living a good Christian life – prayer, going to church Logical methods: • Blood-letting • More emphasis on removing miasma through removing sewage and rubbish • Healthy living and keeping clean Response to Great Plague – Quarantine, closing pubs and theatres, burying dead at night
Treatments	Superstitious/religious methods: • Prayer and fasting • Superstition – e.g. a magpie's beak around your neck to cure toothache Logical methods: • Blood-letting and purging • Traditional herbal remedies • New herbal remedies from other countries such as Peruvian tree

Chronology: what happened on these dates?

1440	Johannes Gutenberg creates the world's first printing press.
1536	The dissolution of the monasteries in England dramatically changed the availability of hospital care.
1543	Vesalius published *On the Fabric of the Human Body*.
1662	The Royal Society received its royal charter from Charles II, who had taken a keen interest in science.
1665	Outbreak of the Great Plague, which peaked in September when 7,000 deaths from the disease were recorded in one week.

Who were these people?

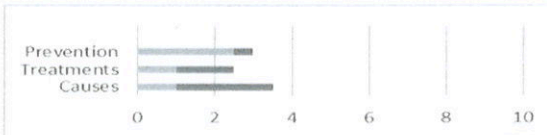
Thomas Sydenham	Sydenham refused to rely on medical books when diagnosing a patient's illness. Instead, he made a point of closely observing the symptoms and treating the disease causing them.
Andreas Vesalius	Vesalius noted that Galen had made some errors in his original theory on the human body. He put this down to the fact that Galen dissected animals instead of people. In all Vesalius found 300 mistakes in Galen's original work on anatomy – e.g. the human lower jaw was in one part, not two. Vesalius also encouraged other doctors to base their work on dissection.
William Harvey	Harvey suggested that blood circulated around the body instead of being made in the liver, as taught by Galen. His theory was that blood must pass from arteries to veins through tiny passages that were invisible to the naked eye. Harvey proved that the heart acted as a pump.
Royal Society	Its aim was to promote and carry out experiments to further the understanding of science. They also heavily promoted the sharing of scientific knowledge and encouraged argument over new theories.

Change and Continuity

Change	Continuity
• Church had less control over medicine as they lost their power in the Reformation. • Fewer people believed in supernatural causes of disease • The Printing Press – allowed copies of medical texts to be printed quickly and shared knowledge. • Diagnosis – more based on direct observation of patients • The Royal Society • Greater government action – quarantine • Ideas – Vesalius – corrected Galen on the anatomy of the body - and Harvey – proved the circulation of the blood • The Royal Society was set up to further scientific understanding – it sponsored scientists to carry out research and make new discoveries, and published a journal	• Theory of Four Humours • Theory of Miasma • Superstition • Prayer and fasting • Ideas were slow to change despite key new discoveries so there was little actual change in medical treatment.

Vocabulary: define these words

Renaissance	A French word that means rebirth. New ideas were beginning to influence medicine.
Humanism	A renewed love of learning and scholarship.
Dissection	The process of cutting apart or separating tissue.
Anatomy	A study of the structure or internal workings of the body.
Circulatory System	The system that circulates blood through the body, consisting of the heart and blood vessels.
Printing Press	A machine for printing text or pictures. It had movable letters so that many copies of the same text could be printed.
Royal Society	An influential group of scientists formed in 1660. Its members shared experiemnts and promoted scientific ideas. It was given a Royal Charter by Charless II in 1662 which gave them more credibility.
Reformation	Henry VIII split from the Catholic Church in 1533 and created the Church of England. In 1536, he dissolved religious institutions, such as monasteries and convents, and confiscated their land. This reduced the Church's influence over medical ideas and treatment.
Alchemy	This was an early form of chemistry. Alchemists tried to turn one material into another: mostly, they were trying to discover a way of making gold.
Transference	The theory that disease could be transferred to something else.
Quack	Somebody who did not have any medical qualifications, but who sold their services as a doctor or apothecary.



Knowledge Organiser: 18th and 19th century Medicine (c1700-c1900)

In 1700, many people no longer believed that God was responsible for causing disease. Instead they focused on developing scientific explanations. By 1900, germs had been discovered, and there was ongoing work to create vaccines for diseases caused by them. The cleanliness of hospitals improved and surgery became less dangerous through the development of anaesthetics and antiseptics.

Summarise your learning

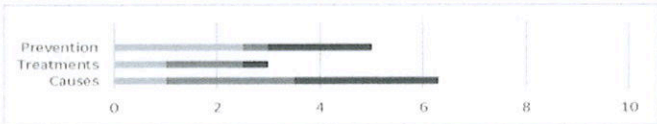
Causes	• **Miasma** ('bad air') • **Spontaneous generation** – (that germs were produced by decaying things.) • Diseases could be spread through **water** – Cholera 1854 – John Snow • **Germs** cause disease – the germ theory created in 1861 by Pasteur with experiments on wine – slow to be accepted. • Koch followed this be **identifying germs** like TB, cholera by using dyes
Diagnosis	• Observations and examinations of patients
Prevention	• Breakthrough with **vaccinations** – Jenner did the first for small pox using cowpox. Pasteur followed with Chicken Cholera, Anthrax and Rabies. • **Cleanliness** – Nightingale lowered the death rate from 40% to 2% in Scutari in the Crimean war by cleaning hospitals. This was then brought to hospitals in England and nurses were trained. • Government action to improve the sanitary conditions of towns - **Public Health Act**– 1875 – Inspired by Pasteur's germ theory and Snow's work on cholera. City authorities must provide clean water, sewers and public toilets – better than 1848 Act which was not compulsory
Treatments	• Very little change from before except in surgery. **Many herbal remedies and quack potions.** • Knowledge of germs causing disease did not lead to new treatments at this point – problem of infection still to be solved • Better hospitals and nursing • Improvements in **surgical treatment**: o **Anaesthetics** – ease pain in operations - Laughing gas, Ether then Chloroform used by James Simpson – made popular by Queen Victoria. Led to 1850 Black Period – more deaths after operations due to infection and new surgery that had not been possible before when patients were awake. o **Antiseptics** – kill germs – Carbolic acid used by Joseph Lister to spray room patients and clean instruments o **Aseptics** – keep germs away - by 1900 sterilised instruments and clothing – Halsted first to use rubber gloves o Blood loss still a problem

Chronology: what happened on these dates?

1796	Jenner discovered the vaccination for smallpox.
1847	James Simpson discovered chloroform.
1848	First Public Health Act
1854	John Snow discovered the cause of Cholera.
1861	Pasteur identified that microbes (germs) cause disease (Germ Theory).
1865	Joseph Lister discovered carbolic acid.
1872	Smallpox Vaccine made compulsory in England
1875	The Second Public Health Act. City authorities had to provide clean water, dispose of sewage and employ a public office of health to monitor outbreaks of disease.

Who were these people?

Edward Jenner	Developed the vaccination to prevent smallpox through using cowpox, which became compulsory in 1872.
Louis Pasteur	Pasteur's Germ Theory claimed that microbes that spread through the air caused decay. This disproved the idea of spontaneous generation.
Robert Koch	Koch used industrial dyes to stain and grow bacteria in a Petri dish. He was able to find which bacteria caused Anthrax (1876), septicaemia (1878), TB (1882) and cholera (1883).
Florence Nightingale	Following Nightingale's experience in the Crimean War she Improved hospital care in Britain in two different ways: the way hospitals were designed and the training for nurses.
Joseph Lister	Discovered the antiseptic carbolic acid, which surgeons used to spray the operating theatre, wash their hands and clean their instruments.
James Simpson	Discovered chloroform, the first effective anaesthetic. Queen Victoria used chloroform during the birth of her eighth child.
Edwin Chadwick	In 1842, Chadwick published his *Report on the Sanitary Conditions of the Labouring Classes*, which argued that disease was the main reason for poverty, and that preventing disease would reduce the poor rates.
John Snow	Snow discovered that cholera was transmitted by dirty drinking water.



Vocabulary: define these words

Germ	Any living organism that is too small to see without a microscope, e.g. bacteria.
Vaccination	A substance used to stimulate the production of antibodies and provide immunity against a disease.
Inoculation	Deliberately infecting oneself with a disease, in order to avoid a more severe case of it later on.
Antiseptic	A substance that makes things free from or cleaned of germs and other microorganisms.
Anaesthetic	A substance that makes you unable to feel pain.
Aseptic surgery	Surgery where microbes are prevented from getting into a wound in the first place, as opposed to being killed off with an antiseptic.
Laissez-faire	This French term means 'leave be'. It is used to describe governments who do not get involved in the day-to-day lives of their population.
Cholera	An infectious disease characterized by profuse diarrhoea, vomiting, cramps, etc.
Legislation	The act of making or enacting laws.
Chloroform	A colourless, sweet-smelling liquid used as an anaesthetic.

Change and Continuity

Change	Continuity
• New technology - microscope • Germ Theory • Anaesthetics and Antiseptics • Greater government action – compulsory vaccinations and Public Health Acts	• Miasma (but was becoming less popular) • Spontaneous generation (early 18th century) • Germ theory does not lead to new treatments for disease yet

Knowledge Organiser: Knowledge Organiser: Modern Medicine (c1900-Present)

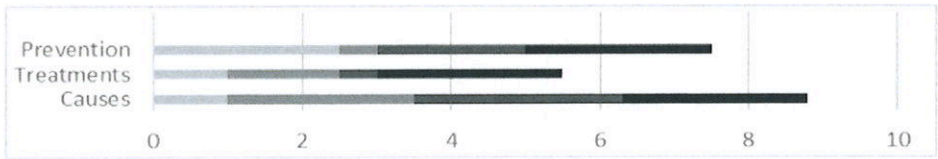
Scientists began to investigate causes of disease that were not related to microbes. Genetics and lifestyle factors were investigated as other potential factors. Chemical treatments were developed to target specific diseases, while antibiotics were discovered that could treat a range of illnesses. Advances in surgical techniques made available life-saving treatments. The government also developed a new attitude towards its role in the nation's health. Free medical care was provided for all through the NHS. However, diseases such as cancer continue to puzzle scientists, who struggle to understand their cause or develop treatments for them. Lifestyle factors have also created new challenges for medicine to tackle.

Summarise your learning	
Causes	• Pasteur's Germ Theory • Genetics (DNA) • Lifestyle factors
Diagnosis	• Electron Microscopes – to view tiny details inside the body, e.g. early infections • Radioactive elements – injected into the bloodstream to track changes in the body • Endoscopes – tiny cameras inserted into the body • Scans: - X-rays for broken bones - CT scans for soft tissue problems like head injuries
Prevention	• Liberal Reforms began bringing in more government measures to keep people healthy – Old Age pensions, Free School Meals, National Insurance • NHS – GP, hospitals, health visitors • Vaccinations – give immunity • Lifestyle campaigns - help people to understand what lifestyle choices have a negative impact like smoking and which have a positive impact like exercise • Laws – e.g. no smoking in public places
Treatments	• Magic bullets • Penicillin • Keyhole and Micro-surgery – surgeons can operate without cutting open a patient which improves recovery time

Chronology: what happened on these dates?	
1909	Paul Ehrlich discovered the first magic bullet, Salvarsan 606.
1928	Alexander Fleming discovered penicillin.
1942	First immunisation campaign against Diphtheria started.
1948	The creation of the National Health Service (NHS).
1954	Watson and Crick discovered the double helix structure of DNA.
1990	The Human Genome Project was launched to decode and map the human genome. This made it possible for scientists to look for mistakes or mismatches in the DNA of people suffering with hereditary diseases.

Who were these people?	
Paul Ehrlich	Ehrlich led the way in finding magic bullets to attack the microbes in the body causing disease, whilst at the same time leaving the body unharmed. In 1909 he discovered the first magic bullet, Salvarsan 606, which cured syphilis. This was followed by Domagk's discovery of Prontosil in 1932.
Alexander Fleming	In 1928, Fleming noticed that mould growing in his petri dishes killed off the harmful staphylococcus bacteria that had been growing in the dish. He tested the mould and identified it as penicillin. However, Fleming did not believe that penicillin could work to kill bacteria in living people.
Howard Florey & Ernst Chain	In 1940, Florey and Chain tested penicillin on infected mice (4/8 were given penicillin and survived). However, it was difficult to produce penicillin in large quantities. In 1941, Florey and Chain tested penicillin on a policeman who had developed septicaemia. The policeman showed signs of recovery but they ran out of penicillin and the patient died. Florey convinced the USA to mass produce penicillin.
James Watson & Francis Crick	Crick and Watson identified the structure of DNA. They discovered that it was shaped as a double helix, which could 'unzip' itself to make copies. Understanding the shape of DNA meant that they could now begin to look at its structure and identify the parts that caused hereditary diseases, such as cystic fibrosis and Down's syndrome.

Change and Continuity	
Change	**Continuity**
• Infections – this is now radically reduced, but many are becoming resistant to antibiotics (MRSA) • Link between genetics and disease • CT scans, radiotherapy and chemotherapy (lung cancer) • Government intervention • Creation of the NHS	• Pasteur and Koch's work with germs led the way for the work on magic bullets and antibiotics • X-rays were discovered by Rontgen in 1895 (not used until C20th) • Jenner's initial work on vaccines led to the understanding that a vaccine could eradicate a disease



Vocabulary: define these words	
DNA	Carries the genetic information from one living thing to another. DNA information determines characteristics like hair and eye colour.
Genetics	The study of heredity conditions and DNA to identify the purpose of every gene in the human body.
Antibiotic	A medicine that inhibits the growth of or destroys microorganisms
Magic Bullet	A medicine with advanced or highly specific properties that can fight infection.
Genome	The complete set of DNA containing all the information needed to build a particular organism.
Penicillin	An antibiotic produced naturally by certain blue moulds.
NHS	The National Health Service which provides free healthcare which helps people stay healthy – visits to the GP, hospitals, health visitors.
MRI Scan	Uses powerful magnets, radio waves, and a computer to make detailed pictures inside your body.
Chemotherapy	The treatment of disease by the use of chemical substances, especially the treatment of cancer.
Radiotherapy	The treatment of disease, especially cancer, using X-rays or similar forms of radiation.

Knowledge Organiser: The British Sector on the Western Front, 1914-1918

Key Battles

The First Battle of Ypres *(Oct-Nov 1914)*

Ypres was a salient – an area surrounded on 3 sides by the enemy. The British lost over 50,000 troops during this battle, but crucially kept control of the important English Channel ports.

Hill 60 *(April 1915)*

Hill 60 was a man-made hill near Ypres that was captured by the Germans in December 1914. Its height gave them a strategic advantage. In April 1915, the British tunnelled under the hill, placed five mines under it, then blew the top off to recapture it.

The Second Battle of Ypres *(April-May 1915)*

The Germans used chlorine gas for the first time. British soldiers were unprepared for gas and often used urine-soaked cloths as makeshift gas masks. The British lost 59,000 men and the Germans moved 2 miles closer to Ypres.

The Battle of the Somme *(July-Nov 1916)*

Around 20,000 British soldiers died on the first day alone. The British tried out two new tactics:

- **The creeping barrage:** This was where artillery was launched from the trenches just ahead of the British troops as they advanced forwards.
- **Tanks:** These were unsuccessful because of their low speed and unreliability.

In total, the Somme cost the British over 400,000 lives.

The Battle of the Arras *(April-May 1917)*

Tunnelling companies from Britain and New Zealand dug a network of underground caves at Arras, where the ground was chalky and soft. In April 1917 24,000 men attacked from the tunnels.

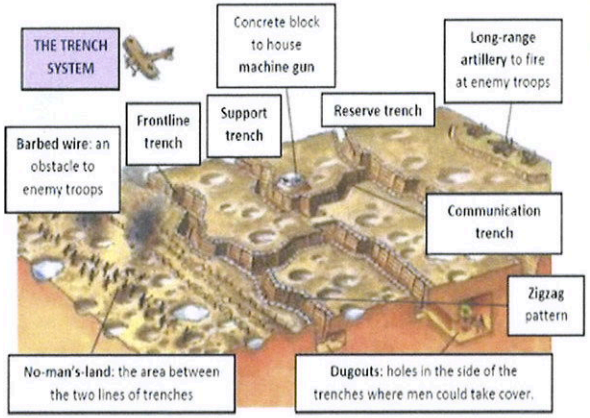
The British advanced 8 miles, but their progress slowed and by the end of the battle there were nearly 160,000 British and Canadian casualties.

The Battle of Passchendeale (Third Battle of Ypres) *(July-Nov 1917)*

The aim of this battle was for the British to break out of the Ypres Salient. Bad weather made the ground waterlogged and many men drowned in the mud. By the end the British had regained about 7 miles, at a cost of about 245,000 casualties.

The Battle of Cambrai *(Nov-Dec 1917)*

Cambrai saw the first successful large-scale use of tanks – nearly 500 were used. They could move easily over the barbed wire and their machine guns were very effective.



Treatments & Surgery

- **Dealing with infection:**
  - Debridement
  - The Carrel-Dakin method
  - Amputation
- **Thomas Splint**
- **Mobile X-Ray units**
- **Blood transfusions**
- **Blood banks**
- **Brain surgery**
- **Plastic surgery**

RAMC and FANY

Medical treatment was mainly provided by the **Royal Army Medical Corps (RAMC)**, the branch of the army responsible for medical care.

The **First Aid Nursing Yeomanry (FANY)** was an organisation which sent women volunteers to help out on the Western Front. The first six FANY nurses arrived in France in October 1914.

FANYs provided emergency first aid and from 1916 they also **drove ambulance wagons.** There were never more than 450 FANYs in France, but they opened the way for more women (e.g. the Voluntary Aid Detachments [VAD]) to take part in the war.

Medical Conditions on the Western Front

Below are some of the common medical conditions experienced by soldiers on the Western Front.

Trench fever

Caused by: Body lice, which thrived in the dirty trench conditions

Symptoms: Flu-like (high temperature, headache, aching muscles)

Solutions: Delousing stations were set up

Trench foot

Caused by: Standing in cold water or mud for long periods of time

Symptoms: Painful swelling of the feet, eventually leading to gangrene (decomposition)

Solutions: Rubbing whale oil on the feet, keeping dry and changing socks regularly. Once gangrene set in amputation was the only solution.

Shellshock

Caused by: Psychological damage as a result of the horrific war environment

Symptoms: Tiredness, nightmares, headaches, loss of speech, shaking, mental breakdown

Solutions: In some cases, men were treated back in Britain. Generally, shellshock was misunderstood and sufferers were often accused of cowardice

Gas gangrene

Caused by: Open wounds infected by bacteria from soil

Symptoms: Dead tissue and a build-up of gas in the wound

Solutions: Amputation of infected areas was the only way to stop it spreading

Gas injuries

Caused by: Chlorine, phosgene and mustard gas. First used by the Germans at the Second Battle of Ypres, April 1915

Symptoms: Burning skin, internal and external blisters, death by suffocation. Massive psychological impact – fear and panic

Solutions: Gas masks were given from July 1915 onwards, but before then soldiers would use urine-soaked cloths to cover their faces

Shrapnel and bullet injuries

Caused by: Being hit by bullets or shrapnel from rifles/explosions. 58% of wounds were caused by shells and shrapnel; 39% were caused by bullets. Head injuries were a major problem at the start of the war, because soldiers only wore soft caps

Symptoms: Pieces of metal would penetrate the body, taking with them dirt and pieces of uniform

Solutions: Steel Brodie helmets were introduced in 1915

Knowledge Organiser: The British Sector on the Western Front, 1914-1918

Exam Questions

1. Describe two features of... (4 marks)

P - Identify a feature/point	**P** – Identify another feature/point
E - Supporting detail/evidence	**E** – Supporting detail/evidence

P – One feature of ..... was.....
E – For example.....

P – A second feature of.....was.....
E – For example.....

2. Study Sources A and B in the Sources Booklet.
How useful are Sources A and B for an enquiry into .....?
Explain your answer, using Sources A and B and your knowledge of the historical context. (8 marks)

How useful are Sources A and B for an enquiry into... (8 marks) 15 min

S
N
A
P
Chat

S – SAY/SHOW – What does the source say? What does the source show? What useful information does the source tell me? What facts does it give? What views or opinions does it give?
N – NATURE - What is the source? A photo, a speech, a cartoon, a letter, a diary. Does this affect its reliability? Is it likely to give honest views, be complete, be one-sided?
A – AUTHOR - Who wrote/created it? Does this affect its reliability? Do they know what they are talking about? Will they have a complete picture? If there is not author, is that a problem? Why?
P – PURPOSE - Why was it made? Does this affect its reliability? Are they trying to gain support? Are they trying to influence others? Are they writing to inform?
CHAT – Talk about each aspect using your own knowledge.

The source is useful because it tells/shows me...
The source is useful because it is....
It's was written by.... This means...
It's purpose was.... This means that...

3. How could you follow up Source B to find out more about..... (4 marks)

1. Find a detail related to the topic of the question – it could be a **problem or an event** that has no reason given for it or something which has changed with no explanation.
2. Think of a **question** to ask which would give you that reason or explanation.
3. Think of **one** specific source to use that should give you an answer
   - If the answer is going to be a **number** – specific records – ***Hospital records*** about...
   - If it is about a **medical problem or development** – ***British medical Journal*** where doctors tell each other about issues they are facing and steps forward.
   - If it is a **personal experience** – ***diaries and journals*** that tell personal stories
4. Explain why this type of source would be useful – what would it tell you? Or – would you expect the source to be reliable?

Detail in Source B that I would follow up: .....

Question I would ask: .....

What type of source I could use:.....

How this might help answer my question: .....

.....