Year 8 Biology Knowledge Organiser
Topic 1: Health and Lifestyle

KPI 1: Describe the requirements for a healthy human diet.

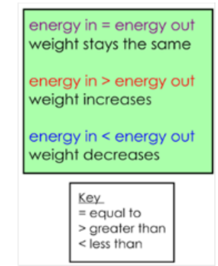
There are 7 major food groups, a balanced diet will contain the correct amounts of all of these for the person's needs, e.g. someone who does a lot of exercise will need a lot more carbohydrate than someone who does not. The seven food groups are summarised below:

Food Group	Example	Function
Protein	Fish, meat, dairy	For growth and repair.
Fat	Butter, oils, nuts	To provide energy. Fat provides a long term store of energy. It also provides insulation for the body.
Carbohydrate	Bread, pasta, sugar	To provide energy.
Fibre	Vegetables, Bran	To help food move through the gut.
Minerals	Dairy (calcium)	Required in small amounts to remain healthy, for example calcium is crucial for healthy teeth and bones.
Vitamins	Oranges (vitamin C), Carrots (vitamin A)	Required in small amounts to remain healthy, for example vitamin D is needed to keep teeth and bones healthy.
Water	Water, fruit juice, milk	Needed to form the cytoplasm of the cells and other fluids.

Deficiency Diseases
Deficiency diseases are when the body does not get enough of a certain nutrient. For example a lack of vitamin C can lead to **scurvy** which **affects the gums**. A lack of vitamin D can lead to rickets which **affects the bones.**

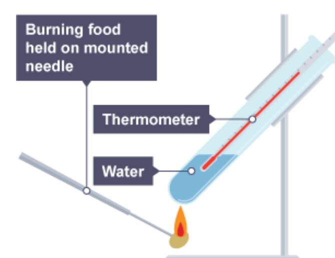
Key Terms	Definitions
Kilojoules (kJ)	A unit used to measure energy in foods
Deficiency Disease	A disease caused by the lack of a nutrient

Energy in Food
The energy in food is often measured in kJ, the amount of energy you need depends on your lifestyle. If there is an imbalance you will put on or loose weight.



Food Tests
There are some simple chemical tests that can be carried out, to see what food groups are present. If iodine is added to starch it will turn blue/black. If Benedict's solution is added to a sugar it will go orange. To test for fat, mix the substance with a small amount of ethanol and distilled water, if a milky white emulsion appears, then fat is present.

Measuring Energy in Food
The energy in different foods can be measured using a simple experiment. If the food is set on fire, it can be used to heat up water and by measuring the temperature change, you should be able to see which foods cause the greatest rise in temperature and have given out the most energy.

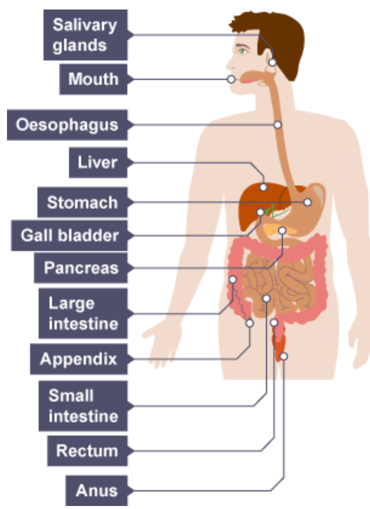


Year 8 Biology Knowledge Organiser
Topic 1: Health and Lifestyle

KPI 2: Describe digestion at the molecular level.

Food is digested in the digestive system, this is an organ system. You should be able to name all parts of diagram below:

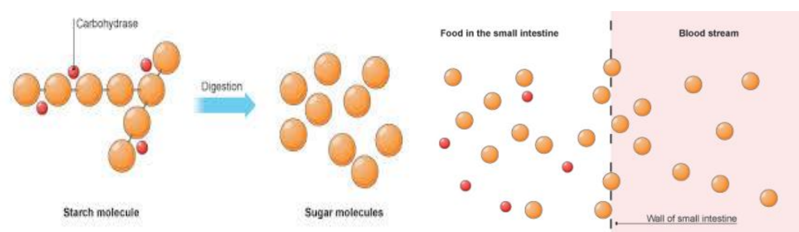
- The mouth has teeth that mechanically digest the food, it also has a salivary gland that releases enzymes to break the food down.
- The oesophagus is a muscular tube that pushes the food into the stomach
- The stomach churns the food up, while also adding acid and enzymes to break the food down.
- In the small intestine, food is broken down further and is absorbed thorough the walls of the intestine into the blood stream.
- The large intestine absorbs any remaining water
- Finally the food passes through the anus as faeces



Key Terms	Definitions
Enzymes	Protein molecules that speed up chemical reactions
Digestive System	The organ system that breaks down food into small molecules
Mechanical Digestion	When large pieces of food are broken down into smaller ones (e.g. by chewing)
Chemical Digestion	When food is broken down into small soluble chemicals, enzymes help with this

Enzymes

Enzymes help to break down larger food molecules into smaller ones, so that they can be absorbed through the walls of our small intestines, into our blood stream.
Proteins, carbohydrates and fats each have their own enzyme that breaks them down.



KPI 3: Realise the possible ill-effects of recreational drugs

Drugs can be divided up into two types, **medicinal** which are prescribed to treat an illness and **recreational,** which are taken for pleasure. Some recreational drugs are **legal and others are illegal.**

Type of drug	Effect on the body	Example
Stimulant	Speeds up reactions	Caffeine (legal) Cocaine (illegal)
Depressant	Slows down reactions	Alcohol (legal) Cannabis (illegal)
Painkiller	Stops the feeling of pain	Morphine (legal) Heroin (illegal)

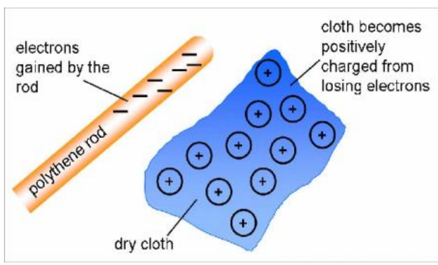
Year 8 Physics Knowledge Organiser
Topic 2: Electricity and Magnetism

KPI 1: Compare current and static electricity and explain current electricity in terms of current, voltage and resistance.

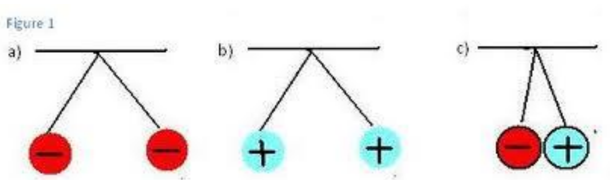
Some particles are electrically charged e.g. electrons, these can therefore carry an **electric charge**. There are two types of electricity

1. Static Electricity
2. Current Electricity

In static electricity, when **two insulators are rubbed together,** electrons are transferred, causing an electric charge to build up.



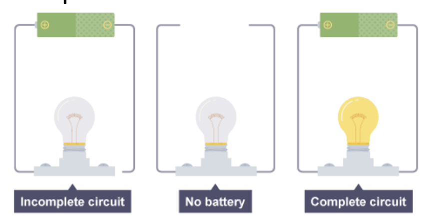
When this happens one object has a positive charge and one will have a negative charge, **like charges repel and opposite charges attract.**



Key Terms	Definitions
Potential Difference	The difference in energy between two points in an electric circuit
Current	The number of electrons flowing past a point in 1 second
Resistance	Something that resists the flow of an electric charge
Electron	A charged particle which flows in an electric circuit
Conductor	A material which allows the flow of electric charge
Insulator	A material that slows the flow of electric charge

Current Electricity

Current electricity occurs in conductors, for example metals, where the electrons can flow. Electric current is how **many electrons are flowing in one second measured in Amps (A).** For electric current to flow, we require a complete circuit.

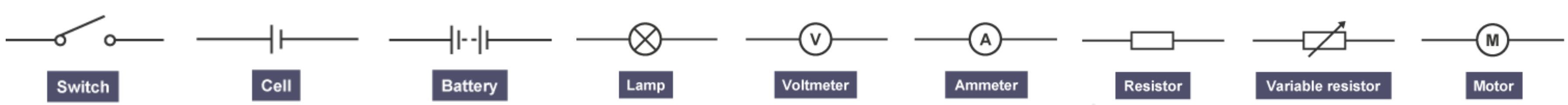


The **potential difference** in an electric circuit is the difference in energy between two different parts of the circuit. This is measured in **volts (V)**. Sometimes people call potential difference **voltage** and it is still measured in volts**.**

Resistance in an electric circuit is anything which slows the flow of electric charge**, resistance is measure in Ohms (Ω).**

Circuit Symbols

When drawing an electric circuit, we use different symbols to represent different components, the symbols you need to memorise are:

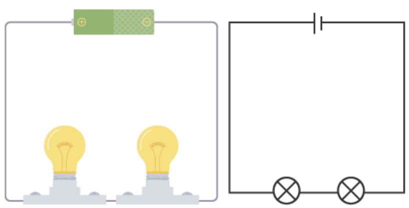


Year 8 Physics Knowledge Organiser
Topic 2: Electricity and Magnetism

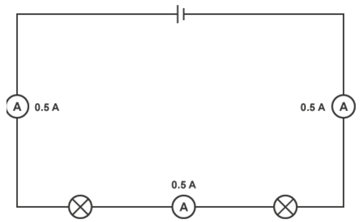
KPI 2: Compare current and voltage in series and parallel circuits.

Circuits can be connected in two ways:
1. Series Circuits
2. Parallel Circuits

In a series circuit all of the components are in the same loop, below is an example of two lamps in **a series circuit.** If either of the lamps were to break the circuit would not be complete and the light bulb would go out.



The current is the **same** at any point in a series circuit as current is always conserved in a circuit.



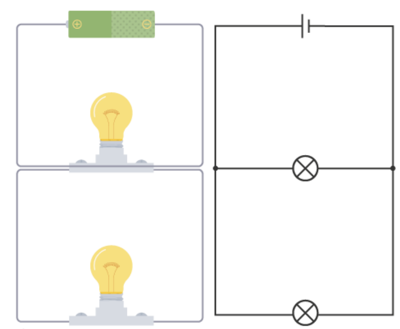
Measuring Current and Voltage

	Current	Potential difference
Unit	ampere, A	volt, V
Measuring device	Ammeter in series	Voltmeter in parallel
Circuit symbol of measuring device	A	V

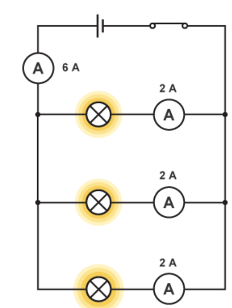
Key Terms	Definitions
Series Circuit	A circuit where all the components are in the same loop.
Parallel Circuit	A circuit where the components are in different loops in the circuit.
Ammeter	An electrical component that measures the size of electric current, it is connected in series in a circuit.
Voltmeter	An electrical component that measures the size of the potential difference, it is connected in parallel.

Parallel Circuits

In a parallel circuit components are in more than one loop. Lights in a house are connected in parallel, when one light bulb breaks the whole circuit is not broken so the other light bulb will stay alight.



In a parallel circuit the current **splits at junctions,** see the example. The current on the different branches of the circuit must add up to the total current.



Year 8 Physics Knowledge Organiser
Topic 2: Electricity and Magnetism

Ohm's Law

Current, voltage and resistance are all linked by Ohm's Law, it states that:

Resistance = Voltage÷Current or R=V÷I

KPI 3: Explain the difference between bar magnets and electromagnets.

Bar Magnets

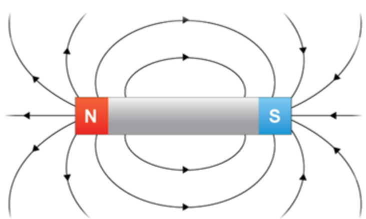
Bar magnets have two poles, a North pole (N) and a South pole (S), **opposite poles attract and like poles repel.**

Magnets create magnetic fields. These cannot be seen. They fill the space around a magnet where the magnetic forces work, where they can attract or repel magnetic materials.

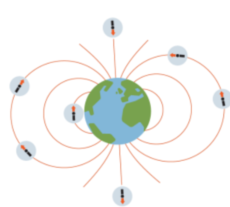
Although we cannot see magnetic fields, we can detect them using iron filings. The tiny pieces of iron line up in a magnetic field. We can draw simple magnetic field line diagrams to represent this. In the diagram, note that:

- **field lines have arrows on them**
- **field lines come out of N and go into S**
- **field lines are more concentrated at the poles.**

The **magnetic field is strongest at the poles**, where the field lines are most concentrated.



The Earth has a magnetic field because the core rotates, it acts like a giant bar magnet.



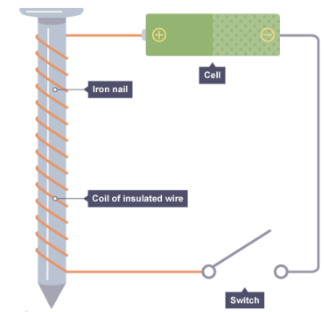
Key Terms	Definitions
Ohm's Law	A mathematical law that links current, voltage and resistance
Electromagnet	A magnet created by the flow of electricity in a wire
Magnetic Field	The area around a magnet, where the magnetic field acts

Electromagnets

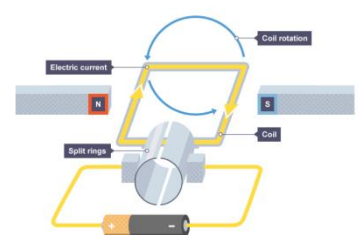
When an electric current flows through a wire, it creates a magnetic field, this can be used to make **an electromagnet,** by making the wire into a coil.

You can increase the strength of an electromagnet by doing three things:

1. Increase the number of coils
2. Increase the current
3. Add a soft iron core



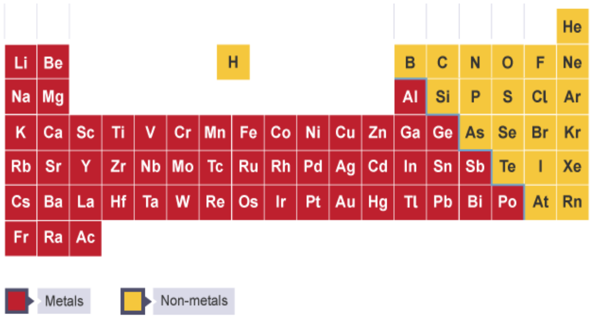
The motor effect: A simple electric motor can be built using a coil of wire that is free to **rotate between two opposite** magnetic poles. When an electric current flows through the coil, the coil experiences a force and moves. This is called the motor effect.



Year 8 Chemistry Knowledge Organiser
Topic 3: Periodic Table

KPI 1: Describe the arrangement of elements in the periodic table.

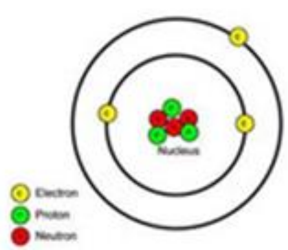
All the different elements are arranged on the periodic table. The elements are arranged in order of increasing atomic number.
On the periodic table, we can see the metal elements and non metal elements.



The section in the middle of the periodic table is known as the transition metals.

Structure of the Atom

- An atom is made up of three subatomic particles: protons, electrons and neutrons.
- Protons and neutrons are found in the nucleus of the atom (in the centre).
- Electrons are found orbiting the nucleus in shells (also known as *energy levels*).
- Protons have a positive charge.
- Electrons have a negative charge.
- Neutrons have a no charge.



Key Terms	Definitions
Atom	Contains protons neutrons and electrons, and makes up all elements
Proton	A sub atomic particle with a positive charge
Electron	A sub atomic particle with a negative charge
Neutron	A sub atomic particle with a neutral charge
Atomic number	The number of protons in an atom

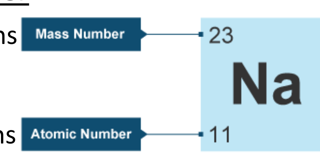
Mendeleev

- Throughout history scientists have tried to classify substances and many scientists attempted to construct a periodic table.
- Before the knowledge of the atom, scientists arranged the periodic table by atomic weight and this meant the groups were not always correct.
- In 1869 Dimitri Mendeleev a Russian scientist, published his periodic table, it was slightly different to those that had been before. He still arranged elements by atomic weight but he also left gaps for where he predicted elements would be.
- He very accurately predicted the properties of elements that were not discovered until many years later e.g. Gallium.

Atomic Number and Mass Number

This is the total of protons + neutrons

This is the number of protons



Therefore sodium has 11 protons, 11 electrons and 23-11=12 neutrons.

The Modern Periodic Table

The modern periodic table arranges the atoms by increasing atomic number. There are currently 118 elements with some being discovered as recently as 2016!

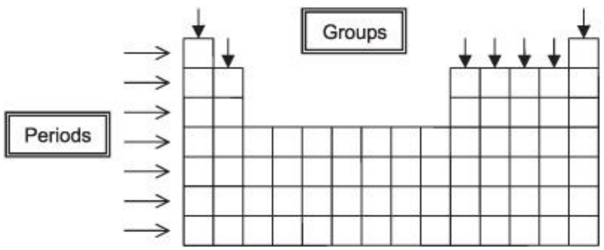
Year 8 Chemistry Knowledge Organiser
Topic 3: Periodic Table

KPI 2: Recognise the main features of the periodic table.

Key Terms	Definitions
Group	The vertical groups of elements in the periodic table
Period	The horizontal groups of elements in the periodic table

Groups and Periods

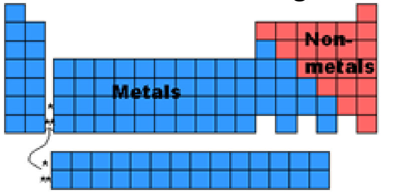
Elements are arranged on the periodic table in groups and periods. Horizontal rows are called periods and vertical columns are called groups.



Groups are labelled 1-7 from left to right, with last group being called either group 8 or 0. Elements in the same group have similar properties, because of this we can make predictions about trends. See the table below:

Metals and Non-Metals

- Metals are found on the left hand side of the periodic table, the majority of elements are metals.
- When metals react, they lose electrons to form positive ions.
- Non metals gain electrons to form negative ions.



- Properties of metals are, high density, high melting point (except mercury) and good conductors of heat and electricity.
- Only three metals are magnetic (iron, cobalt and nickel).
- Metals react with oxygen to make metal oxides e.g.
  Magnesium+ Oxygen → Magnesium Oxide

	Physical properties	Chemical Properties	Equation	Trends/Explanation
Group 1 (Alkali metals)	Soft, low density	React vigorously with water releasing hydrogen	Sodium + Water→ Sodium Hydroxide + Hydrogen	More reactive as you go down, electron further from the nucleus easier to lose
Group 7 (Halogens)	Low melting point, exist as pair (Cl_2)	React with group 1 metals to form compounds. Can carry out displacement reactions	Sodium + Chlorine → Sodium Chloride Sodium Bromide + Chlorine → Sodium Chloride + Bromine	Higher melting point as you go down the group (higher molecular mass). Less reactive as you go down the group.
Group 0 (Noble Gases)	Low melting point/boiling point Eight electrons in outer shell (except helium)	Unreactive	N/A	Higher melting point and boiling point as you go down the group (due to increase ion density)

Year 8 Chemistry Knowledge Organiser
Topic 3: Periodic Table

KPI 3: Use word equations to explain chemical reactivity in groups 1 and 7.

Key Terms	Definitions
Aqueous	Dissolved in water
Reactive	When an element is more reactive this means it is going to replace the less reactive element in a reaction.

We use both word and symbol equations to summarise reactions, when doing this the more reactive element will take the place of the less reactive element. For example,

Chlorine + Potassium Bromide → Bromine + Potassium Chloride

In this case chlorine is more reactive than bromine, and therefore takes its place in the reaction.

When looking at reactions we also need to include state symbols to explain what is happening to the elements involved in the reaction.

(s) – shows that the element or compound is a solid
(l) – shows that the element or compound is a liquid
(g)- shows that the element or compound is a gas
(aq)- shows that the element or compound is aqueous. This means dissolved in water.

A example of how we show the state symbols is,

Sodium(s) + Water(l) → Sodium Hydroxide(aq) + Hydrogen(g)

Year 8 Biology Knowledge Organiser
Topic 4: Adaptations

KPI 1: Describe the factors effecting the abundance and distribution of organisms

Adaptation

- An animal must be able to find food, breed and navigate its way around its habitat if it is to survive.
- Every animal has evolved gradually over millions of years to become well suited, or adapted, to its habitat.
- These adaptations are specific to the environment of the animal and are essential for survival.
- Here are some examples:

Snow Leopard

- Big paws to evenly spread weight and help with walking through snow
- Thick fur for insulation

Siamang Gibbon

- Long arms and fingers for swinging through trees and gripping branches
- Forward facing eyes for judging distances

Bactrian Camel

- Fat stored in humps to convert to water
- Wide feet to even spread weight and prevent sinking into the sand

Humboldt Penguin

- Streamlined bodies to help with swimming
- Serrated beaks to help with catching and swallowing slippery fish

Key Terms	Definitions
Adaptation	Something which helps an organism to survive in their environment, e.g, humps for storing water
Habitat	The environment that an organism lives in
Competition	When animals or plants compete for limited resources
Intraspecific competition	Competition between individuals of the same species
Interspecific competition	Competition between individuals of different species

Competition

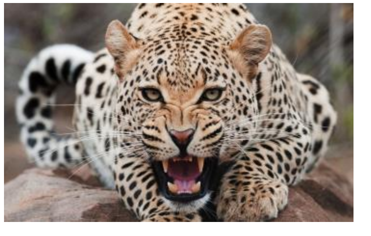
- Animals and plants have to compete for the limited resources available to them
- The animals that are best adapted will win and survive
- There are two types of competition
  - Interspecific – between individuals of different species
  - Intraspecific – between individuals of the same species

Competition in animals

- Animals compete for:

Food

Water



Space

Mates

Year 8 Biology Knowledge Organiser
Topic 4: Adaptations

KPI 1: Describe the factors effecting the abundance and distribution of organisms

Competition in plants

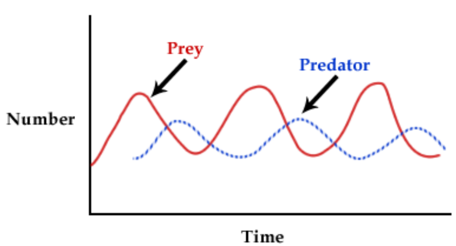
- Plants compete for:

Nutrients Water

Space Sunlight

Predator-prey relationships

- Numbers of predators and prey are interdependent on each other
- If the numbers of prey drop then the numbers of predators will also drop after a while



Key Terms	Definitions
Interdependent species	If the number of one species changes it will affect the numbers of the other species
Variation	Differences between living organisms of the same species
Continuous variation	Differences that can take any value, e.g. height
Discontinuous variation	Differences that can only take set values, e.g. blood groups
Inherited variation	Variation in an individual that is caused by genetics
Environmental variation	Variation in an individual that is caused by the environment

KPI 2: Explain how characteristics can be inherited by individuals

Causes of variation

- The differences between living things of the same species is known as variation.
- Variation can be caused by differences in genes (inherited variation) e.g. eye colour, or differences in the environment e.g. language.
- Some variation is caused by a mixture of both genes and environment (e.g. weight and height).

Types of variation

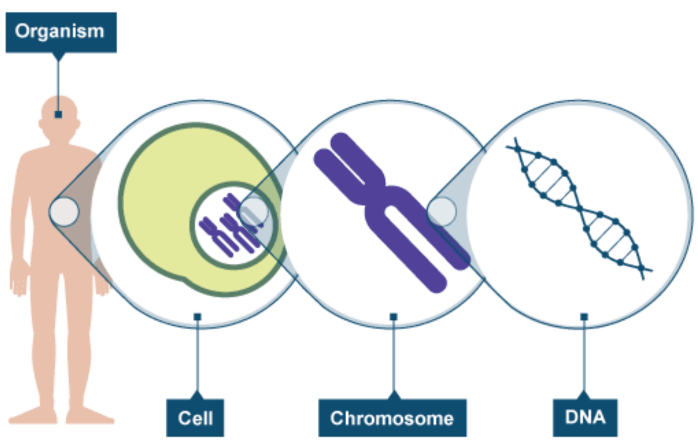
- Continuous variation is variation that can take any value (e.g. height or weight)
- Continuous variation should always be shown on a line graph
- Discontinuous variation is variation that can only take set values (e.g. shoe size or blood group)
- Discontinuous variation should always be shown on a bar chart

Year 8 Biology Knowledge Organiser
Topic 4: Adaptations

KPI 2: Explain how characteristics can be inherited by individuals

DNA

- DNA contains all the instructions needed to make an organism
- Everybody has unique DNA (apart from identical twins)
- DNA is found in the nucleus of every cell
- The DNA molecules are twisted and folded into tiny structures called chromosomes
- DNA has a double helix structure – this means it is twisted twice
- A short length of chromosome which codes for a characteristic is called a gene
- Genes contain the information to produce proteins
- DNA and therefore genes are passed on from parents to their offspring
- Alleles are different forms of the same gene



Key Terms	Definitions
DNA	The molecule containing all the instructions to make an organism
Chromosome	A structure containing DNA found inside the nucleus of a cell
Gene	A section of DNA coding for a characteristic
Allele	A form of a gene
Dominant	An allele that is always expressed (capital letter)
Recessive	An allele that is only expressed if there is no dominant allele present (lower case letter)

Inheritance

- Alleles can be dominant or recessive
- Dominant alleles will always be expressed (the characteristic they code for will be seen in the individual), they are given a capital letter
- Recessive alleles will only be expressed if the dominant allele is not present (the characteristic they code for will only be seen if the dominant characteristic is not present), they are given a lower case letter
- Punnet squares can be used to show how alleles are inherited:

Genes from mother

Genes from father

	B	b
B	BB	Bb
b	Bb	bb

- B is the dominant allele for brown eyes
- B is the recessive allele for blue eyes
- Offspring BB and Bb would have brown eyes as they have the dominant allele
- Offspring bb would have blue eyes as there is no dominant allele
- There is a 1 in 4 chance of the offspring having blue eyes
- There is a 3 in 4 chance of the offspring having brown eyes

Year 8 Biology Knowledge Organiser
Topic 4: Adaptations

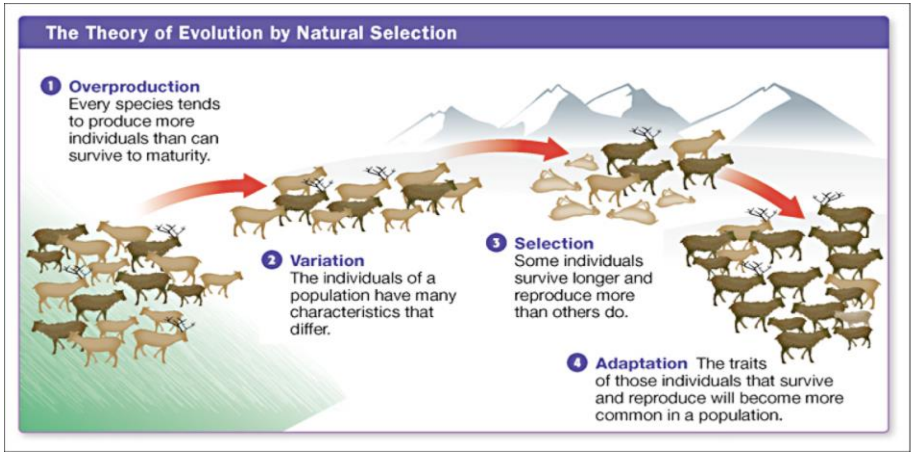
KPI 3: Outline evolution by natural selection

Evolution

- The theory of evolution states that all living organisms evolved from simple life forms
- These first simple life forms developed over three billion years ago
- The process that leads to evolution is called natural selection.

Natural selection

- Within a population there are variations between individuals leading to adaptations
- Individuals with the adaptation have an advantage and are more likely to survive than those without
- The individuals that survive will reproduce and have offspring
- The offspring will inherit the genes for the best adaptations from their parents
- Over time the population will change towards individuals with the advantageous adaptation – it will evolve



Key Terms	Definitions
Evolution	The changes in organisms seen over long periods of time
Natural selection	The process that leads to evolution
Extinction	When no individuals of a species survive
Endangered	When only small numbers of individuals of a species remain and there is a risk the species might become extinct
Conservation	Work done to try to ensure that a species does not become extinct

Extinction

- If all the individuals of a species die then the species would become extinct
- We know that species have become extinct because of fossil records of species that no longer exist
- Extinction can be caused by many things including:
    - New diseases
    - New predators
    - Climate change
    - Competition

Conservation

- Conservation is anything that is done to try to stop an endangered species becoming extinct
- Examples of endangered species include the Leatherback Sea Turtle, Ivory Billed Woodpecker and the Amur Leopard
- Conservation work can include:
    - Captive breeding
    - Seed banks
    - Conservation areas
    - Nature reserves

Year 8 Chemistry Knowledge Organiser
Topic 5: Separation

KPI 1: Describe the difference between pure and impure substances

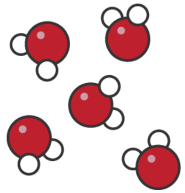
Pure Substances

If you could see the particles in pure water, you would only see water particles. There would be no other particles. Pure substances can be elements or compounds. Examples of pure substances include gold, oxygen and pure water.

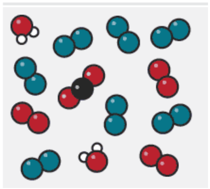
Impure Substances

Impure materials may be mixtures of elements, mixtures of compounds, or mixtures of elements and compounds. For example, even the most pure water will contain dissolved gases from the air. Impurities in a substance will affect its properties. For example, they may change its boiling point.

Pure Substances



Impure Substances



Mixtures

A mixture contains different substances that are not chemically joined to each other. For example, a packet of sweets may contain a mixture of different coloured sweets. The sweets are not joined to each other, so they can be picked out and put into separate piles.

Key Terms	Definitions
Pure	A material that is composed of only one type of particle.
Impure	A material that is composed of more than one type of particle.
Evaporation	A change of state involving a liquid changing to a gas
Distillation	A process for separating the parts of a liquid solution. The solvent is heated and the gas is collected and cooled.
Filtration	The act of pouring a mixture through a mesh, in attempts to separate the components of the mixture.
Mixture	A material made up of at least two different pure substances.
Chromatography	A technique used to separate mixtures of coloured compounds.

Elements

Elements are made up of one type of atom.
All the elements are found listed in the periodic table – there are currently 118 of them.

Compounds

Compounds are formed by chemical reactions.
Compounds contain two or more elements that are chemically joined to each other.
In order to separate the elements in a compound you would need to carry out another chemical reaction.
Examples of compounds are:

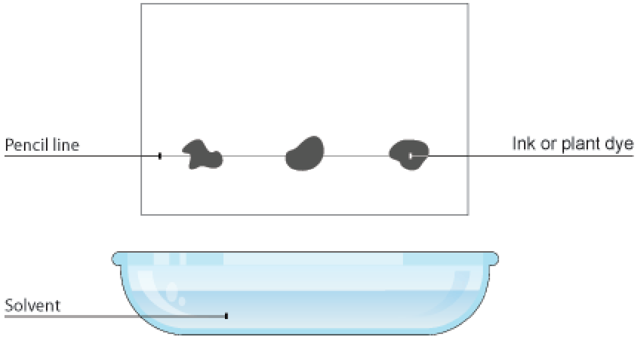
- Carbon dioxide (CO_2)
- Water (H_20)

Year 8 Chemistry Knowledge Organiser
Topic 5: Separation

KPI 2: Explain different techniques for separating mixtures

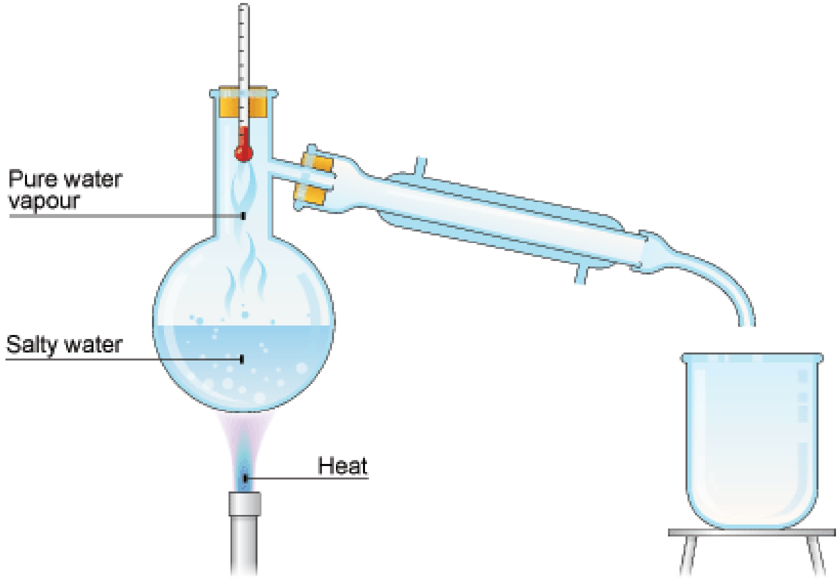
Chromatography

Simple chromatography is carried out on paper. A spot of the mixture is placed near the bottom of a piece of chromatography paper and the paper is then placed upright in a suitable solvent, e.g. water. As the solvent soaks up the paper, it carries the mixtures with it. Different components of the mixture will move at different rates. This separates the mixture out.



Distillation

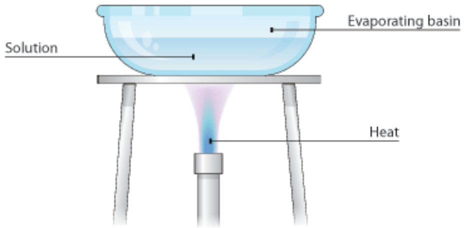
This is good for separating a liquid from a solution. For example, water can be separated from salty water by simple distillation. This method works because the water evaporates from the solution, but is then cooled and condensed into a separate container. The salt does not evaporate and so it stays behind. Distillation can also be used to separate two liquids that have different boiling points.



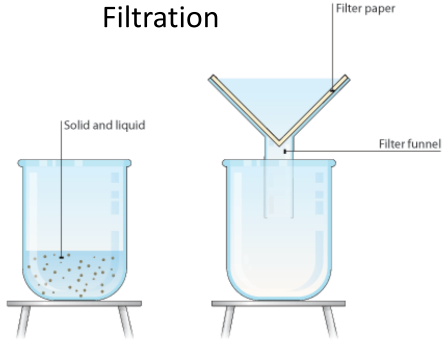
Other techniques for separating mixtures

- If you have a solution for example salt water, you can **evaporate** the water leaving pure salt.
- If you have two substances where 1 is magnetic and 1 is not, for example iron and sulphur, then a **magnet** can be used to separate the two substances.
- If you have a mixture of a solid and a liquid then the mixture can be **filtered.**

Evaporation



Filtration



Year 8 Chemistry Knowledge Organiser
Topic 5: Separation

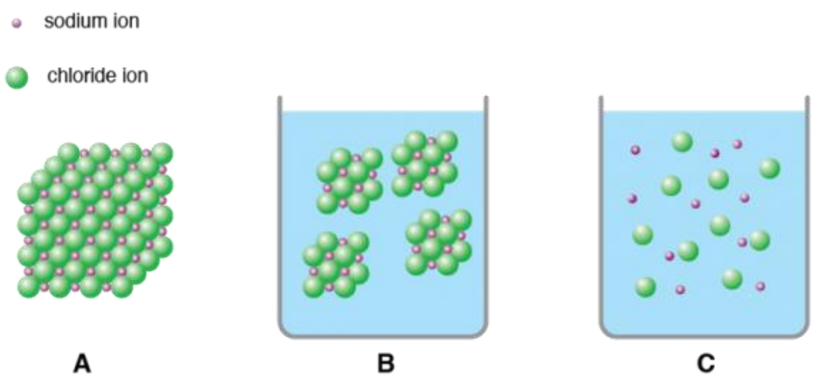
KPI 3: Explain the process of dissolving including saturation

Solutions

- Salt and sugar are **soluble** in water, this means they dissolve in water.
- Sand is **insoluble** in water, this means it does not dissolve in water
- The **solute** is the substance that dissolves
- The **solvent** is the liquid the solute dissolves in
- The solution what is produced (the solvent containing the solute)

Dissolving

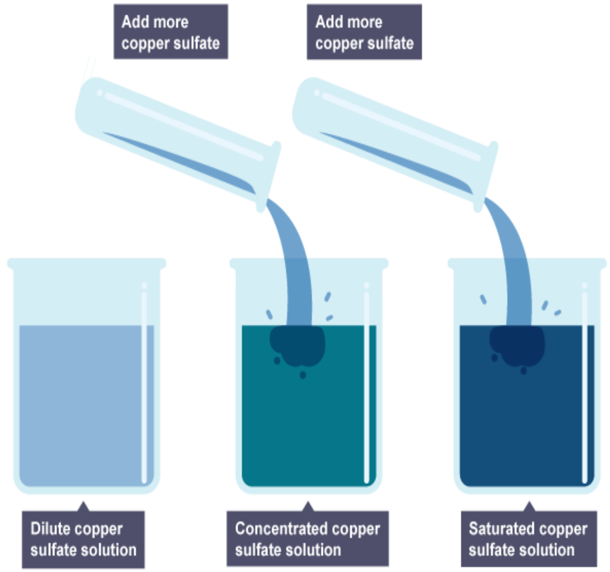
- During dissolving the **solvent particles** surround the **solute particles** and move them away so they are spread out in the **solvent**



Key Terms	Definitions
Solute	The substance that dissolves
Solvent	The liquid that the solute dissolves in
Solution	The solute dissolved in the solvent
Solubility	How easy it is for a given substance to dissolve
Saturated solution	When no more solute can be dissolved into a solution it is said to be saturated

Saturated solutions

- When a solvent is heated it will dissolve **more solute**
- When no more solute can be dissolved in the solvent the solution is saturated
- **Mass is always conserved** so for example if 5 grams of solute are dissolved in 100 grams of solvent, the mass of the solution will be 100+5= 105 grams.



Year 8 Physics Knowledge Organiser
Topic 6: Energy

KPI 1: describe examples of energy transfers
***KPI 3*:** apply the law of conservation of energy to situations involving energy transfers

Energy Stores

Energy can be stored in objects, or when objects are doing something. It is a quantity measured in joules (J). Examples to know:

- Energy is stored in fuels as **chemical potential energy**
- Energy is stored in anything elastic when it is stretched, as **elastic potential energy**
- Energy is stored in any object that has been lifted up, because the object stores **gravitational potential energy**
- Energy is stored in moving objects as **kinetic energy**.
- Energy is stored in any object as **heat energy**. (Obviously, if it is cold, it doesn't store much heat energy!) This is also known as *thermal energy*.

Energy Transfer

An energy transfer is when energy changes from one store to another. VERY IMPORTANTLY, the **total amount of energy does not change**. Energy cannot be created or destroyed. All that can be changed is how it is stored. This ideas is called **the law of conservation of energy.**

Energy is transferred, so it changes store, in loads of situations. Examples to know:

- When a fuel is burned, the chemical potential energy in the fuel ends up stored as thermal energy in the surroundings;
- When an object falls off a shelf, the gravitational potential energy it stores is transferred (changed) to kinetic energy while it is falling.
- When the object hits the floor, all the gravitational potential energy it had to start with ends up stored as thermal energy in the surroundings.
- When a spring that's been stretched is released, the elastic potential energy it stored is transferred to kinetic energy then to thermal energy.

Key Terms	Definitions
Energy	Energy is a quantity that is stored in many objects and situations. Anything storing energy can do **work**.
Work	Work is done when energy changes from one store to another.
Potential energy	Potential energy is energy stored in objects that don't seem to be doing anything. See the examples.
Chemical potential energy	Energy stored in fuels (like wood, or the gas we run Bunsen burners on) is called chemical potential energy.
Elastic potential energy	Elastic objects, like springs or rubber bands, store elastic potential energy when they are stretched.
Gravitational potential energy	Any object that is not on the ground has gravitational potential energy. This is because they are lifted up in a gravitational field, and could fall down!
Kinetic energy	Movement energy. Any moving object stores kinetic energy.
Thermal energy	Also known as heat energy. All objects store some thermal energy, because the particles are moving. The higher the temperature of an object, the more thermal energy it stores.
Conservation of energy	The law that says energy cannot be created or destroyed. It can only change how it is stored.

This shows how energy changes where it is stored twice while you use a light bulb (lamp):
From chemical potential energy to electrical energy to heat (thermal) energy in the surroundings.

Year 8 Physics Knowledge Organiser
Topic 6: Energy

KPI 2: describe how thermal energy transfers from one place to another

Temperature and Heat

Temperature and heat are linked, but are not the same thing. The heat of a material depends on the **potential energy** of the particles AND the **kinetic energy** of the particles is it made from. What this does mean is that the more heat (thermal energy) a substance stores, the higher its temperature will be. You can increase the heat stored in a substance without increasing its temperature though: just get more of it. This means you have more particles, so there is more thermal energy all together in the substance.

But do not get confused, a cup of tea at 80°C has a higher temperature than a swimming pool at 30°C but because there are many more water particles in the swimming pool so the energy is higher.

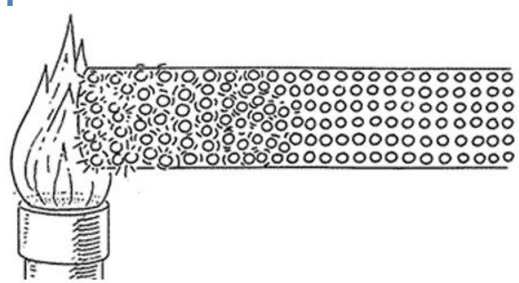
Key Terms	Definitions
Temperature	The measure of the average amount of kinetic energy of all the particles in a substance.
Heat	The energy stored in substances thanks to the energy of their particles. Also called thermal energy.
Conduction	One way that thermal energy can be transferred. Objects that are touching can transfer thermal energy, from the hotter object to the cooler one.
Radiation	Another way that thermal energy can be transferred. All objects give out **infra red radiation**. Hotter objects give out (emit) infra red radiation that is absorbed by cooler objects.
Infra red radiation	A form of light that we cannot see; infra red radiation transfers thermal energy from one object to other objects or the surroundings.
Emit	To give out.
Absorb	To take in.

Thermal energy transfer

Thermal energy will always be transferred from hotter objects to cooler objects. This includes hot objects transferring thermal energy to the surroundings (the air, nearby surfaces and so on). You can reduce the amount of thermal energy transferred by **insulating** the hot object.

Thermal energy transfer by conduction

Hot materials can transfer thermal energy to other materials that they are touching. This is called **conduction** of thermal energy. As the diagram shows, the particles that are heated increase in kinetic energy when they are heated. They bump into neighbouring particles and pass on (transfer) thermal energy. This is why a table feels warm after a hot cup of tea is lifted from it, and the reason why thermal energy can pass through the bottom of a saucepan to cook your dinner.



Thermal energy transfer by radiation

All objects give out some infra red radiation, but the hotter they are the more radiation they give out. All objects can also absorb infra red radiation: when they do, they heat up. Radiation can travel through empty space – so this is how the Sun heats up the Earth. The objects don't have to be touching, unlike in conduction, and there are no particles involved. .

Year 8 Physics Knowledge Organiser
Topic 6: Energy

KPI 4 distinguish between power and energy
KPI 5 compare values of energy and power using appropriate SI values
KPI 6 compare different fuels and energy resources

Energy and power

Energy can be stored in objects or transferred between them. The **speed**, or **rate**, at which energy is transferred is called the **power**. Divide the amount of energy transferred by the time it took to transfer it to find the power (see equation).

This means that is the same amount of energy is transferred in half the time, the power is twice as much.

Fuels as Energy Resources

Fuels store chemical potential energy. Many fuels are used a great deal by humans, including fossil fuels:

- Oil – used to make petrol/diesel/aircraft fuel especially
- Coal – burned in power stations to generate electricity
- Natural gas – used as a fuel for heating homes and for cooking.

These are all very useful fuels, but the problem is that they are **non-renewable** and when they are burned, carbon dioxide is produced. Carbon dioxide contributes to climate change because it is a greenhouse gas.

Other Energy Resources

We don't have to use fossil fuels for the uses given above. There are many other energy resources on Earth, including many **renewable resources**. E.g.

- Sunlight, which we can use to generate electricity with solar cells
- Wind, which can be used to generate electricity using wind turbines
- The tides, which can be used to generate electricity
- Waves in the sea, which can be used to generate electricity.

Key Terms	Definitions
Power	Power is the **rate** (or speed) of energy transfer. $power(W) = \frac{energy\ transferred\ (J)}{time\ (s)}$
Joule (J)	The unit for energy
Watt (W)	The unit for power
Kilowatt (kW)	1000 watts
Renewable	Renewable resources are replenished (replaced) as they are used.
Non-renewable	Non-renewable resources, like fossil fuels, are NOT replenished (replaced) as they are used.
Environmental impact	The effects of something on the environment.

Choosing energy resources

Many things should be considered to choose an energy resource:

- The **reliability** of the energy resource
- The usefulness of the energy resource
- How long the resource lasts, and if it is **renewable**
- The **environmental impact** of the energy resource.

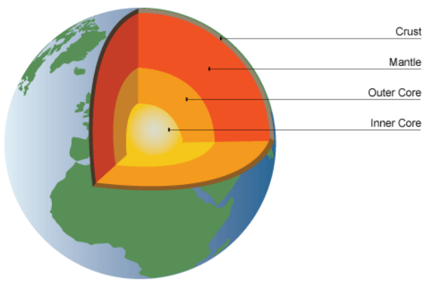
FOR EXAMPLE:
Tidal energy is very reliable, as there are two tides per day. Tidal energy is useful for generating electricity, but you couldn't use it to run your car! Tidal energy is renewable, which is an advantage, because it cannot be used up. Using tidal energy does not produce polluting gases like carbon dioxide, but building the generators in the sea can damage the habitats of wildlife near the coast.

Year 8 Chemistry Knowledge Organiser
Topic 7: Metals and the Earth

KPI1: Explain the resources obtained from the Earth and the need for recycling as the Earth is a source of limited resources.

The structure of the Earth

The Earth is almost a sphere and it is split into 4 main layers:



The lithosphere is the relatively cold outer part of the Earth's structure and it is broken up into large pieces called tectonic plates. These plates move slowly over the mantle.

Volcanoes occur when molten rock pushes up through weaknesses in the crust. The molten rock cools and solidifies to form igneous rocks, such as basalt, gabbro, rhyolite and granite.

Recycling

The resources on the Earth are limited, this means they may not last forever. It is important that the things we do now do not make things difficult or impossible for future generations.

Recycling is an important way to help us achieve sustainable development. We can recycle many resources, including:

- glass
- metal
- paper

Key Terms	Definitions
Crust	Outermost layer of the Earth, relatively thin and rocky
Mantle	Layer below the crust, has the properties of a solid but can flow very slowly
Outer core	Layer below the mantle, made from liquid nickel and iron
Inner core	Centremost layer of the Earth, made from solid nickel and iron
Lithosphere	Consists of the crust and the outer part of the mantle
Recycling	Converting a waste material into something that can be reused
Ore	Naturally occurring rock from which a useful material can be extracted

Recycling of Aluminium

Aluminium extraction is expensive because the process needs a lot of electrical energy. Therefore aluminium is extensively recycled because less energy is needed to produce recycled aluminium than to extract aluminium from its ore.

Recycling preserves limited resources and requires less energy, so it causes less damage to the environment. In addition, the multiple uses of aluminium mean that soon the demand for the recycled aluminium will outweigh the need to extract it and therefore less energy is lost.

Year 8 Chemistry Knowledge Organiser
Topic 7: Metals and the Earth

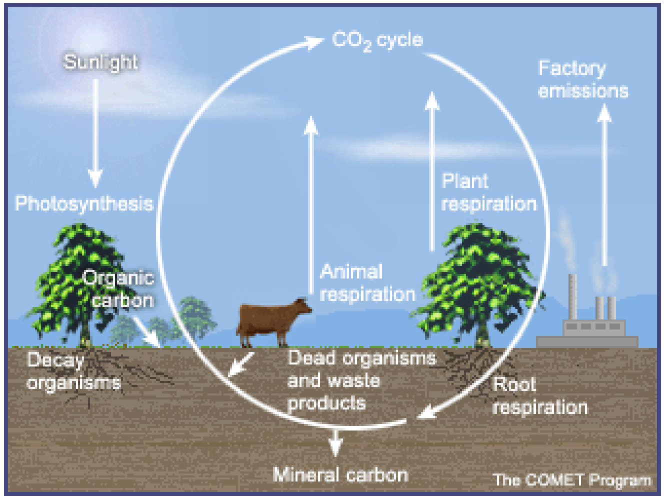
KPI2: Explain the composition of the atmosphere and the possible consequences of anthropogenic climate change.

The Carbon Cycle

All cells - whether animal, plant or bacteria - contain carbon, because they all contain proteins, fats and carbohydrates.

Carbon is passed from the atmosphere, as carbon dioxide, to living things, passed from one organism to the next in complex molecules, and returned to the atmosphere as carbon dioxide again. This is known as the carbon cycle.

- **Step 1 : Removing carbon dioxide from the atmosphere**
  Green plants remove carbon dioxide from the atmosphere by *photosynthesis*. The carbon becomes part of complex molecules such as proteins, fats and carbohydrates in the plants.
- **Step 2: Returning carbon dioxide to the atmosphere**
  Organisms return carbon dioxide to the atmosphere by *respiration*. It is not just animals that respire. Plants and microorganisms do, too.
- **Step 3: Passing carbon from one organism to the next**
  When an animal eats a plant, carbon from the plant becomes part of the fats and proteins in the animal. Microorganisms and some animals feed on waste material from animals, and the remains of dead animals and plants. The carbon then becomes part of these microorganisms and detritus feeders.



Key Terms	Definitions
Carbon cycle	A series of processes that moves carbon through organisms and the atmosphere
Photosynthesis	A chemical process that uses energy to produce glucose
Respiration	A chemical process that releases energy
Global warming	The gradual increase in global temperatures

Global Warming

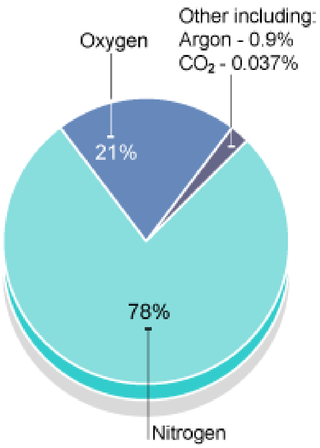
The extra carbon dioxide increases the greenhouse effect. More heat is trapped by the atmosphere, causing the planet to become warmer than it would be naturally. The increase in global temperature this causes is called global warming.

Global warming is beginning to cause big changes in the environment. These include:

- ice melting faster
- the oceans warming up
- changes in where different species of plants and animals can live

Atmospheric composition

The Earth's atmosphere has remained much the same for the past 200 million years. The pie chart shows the proportions of the main gases in the atmosphere.



Year 8 Chemistry Knowledge Organiser
Topic 7: Metals and the Earth

KPI3: Explain how the reactivity of a metal affects the way it is extracted.

Reactions of Metals

Acids react with most metals and a salt and hydrogen gas are produced. This is the general word equation for the reaction:

metal + acid → salt + hydrogen

The salt produced depends upon the metal and the acid. Here are two examples:

zinc + sulphuric acid → zinc sulphate + hydrogen
magnesium + hydrochloric acid → magnesium chloride + hydrogen

Displacement reactions involve a metal and a compound of a different metal. In a displacement reaction a more reactive metal will displace a less reactive metal from its compounds. Displacement reactions are easily seen when a salt of the less reactive metal is in the solution. During the reaction:

- the more reactive metal gradually disappears as it forms a solution
- the less reactive metal coats the surface of the more reactive metal

Testing for different Gases

You need to know the following tests:

Hydrogen
A lighted wooden splint makes a popping sound in a test tube of hydrogen.

Oxygen
A glowing wooden splint relights in a test tube of oxygen.

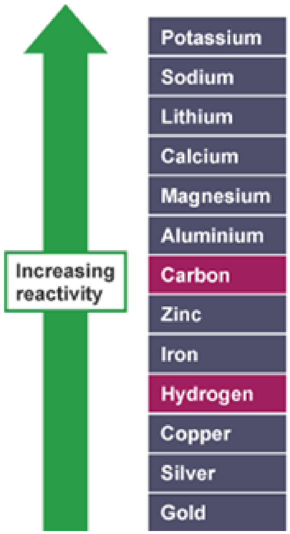
Carbon dioxide
Bubble the test gas through limewater - calcium hydroxide solution. Carbon dioxide turns limewater cloudy white.

Ammonia
Ammonia has a characteristic sharp, choking smell. It also makes damp red litmus paper turn blue. Ammonia forms a white smoke of ammonium chloride when hydrogen chloride gas, from concentrated hydrochloric acid, is held near it.

Chlorine
Chlorine has a characteristic sharp, choking smell. It also makes damp blue litmus paper turn red, and then bleaches it white. Chlorine makes damp starch-iodide paper turn blue-black.

Key Terms	Definitions
Displacement reaction	Reaction where a more reactive substance will take the place of a less reactive substance in a compound
Electrolysis	The separation of a compound using an electrical current
Reduction	Reaction where oxygen is removed from a substance. It also means a gain in electrons.

The Reactivity Series



In a reactivity series, the most reactive element is placed at the top and the least reactive element at the bottom. More reactive metals have a greater tendency to lose electrons and form positive ions.

Observations of the way that these elements react with water, acids and steam enable us to put them into this series.

Metals are very useful. A **metal ore** is a rock containing a metal, or a metal compound, in a high enough concentration to make it economic to extract the metal.

The method used to extract metals from the ore in which they are found depends on their reactivity.

For example, reactive metals such as aluminium are extracted by *electrolysis*, while a less-reactive metal such as iron may be extracted by *reduction* with carbon or carbon monoxide.

Thus the method of extraction of a metal from its ore depends on the metal's position in the reactivity series.

Year 8 Physics Knowledge Organiser
Topic 8: Motion and pressure

KPI 1: Calculate speed and interpret distance-time graphs

Speed

The speed of an object tells you how long it takes an object to cover a distance. The unit for speed is m/s (metres per second).

Speed is calculated by dividing distance by the time (see equation in the box).

If the speed of an object is increasing, then it is accelerating. If the speed is decreasing it is decelerating.

Key Terms	Definitions
Gradient	How steep the line on a graph is.
Stationary	Not moving
x axis	The horizontal axis on a graph
y axis	The vertical axis graph
Acceleration	Speed of an object is increasing
Deceleration	Speed of an object is decreasing

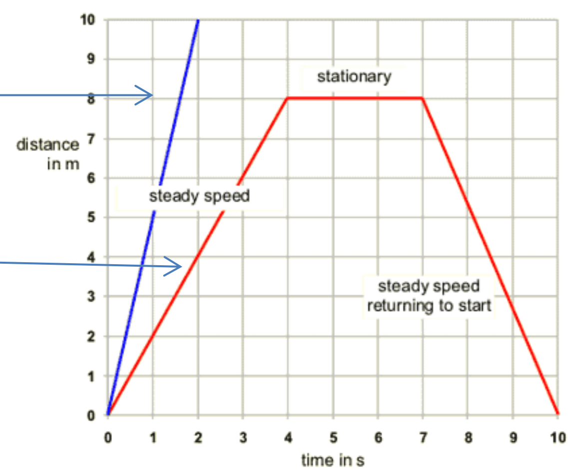
Equation	Meanings of terms in equation
$* \; s = \frac{d}{t}$	*S= Speed* *D= Distance* *T= Time*

Distance Time Graphs

A distance time graph has the time on the x axis and the distance on the y axis. If an object is stationary (not moving) the line will be horizontal. If the line is diagonal the object is moving at a constant speed. If the line has a larger gradient (steeper), it means it is moving faster. If the line is going back towards the x axis it is returning to its starting point.

Higher gradient = faster speed

Lower gradient = lower speed

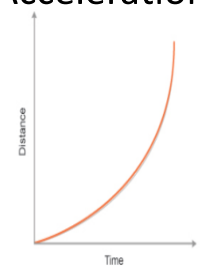


Acceleration and Deceleration

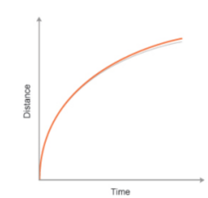
When an object is accelerating, the distance time graph will curve upwards.

When an object is slowing down an object will curve towards the horizontal.

Acceleration



Deceleration

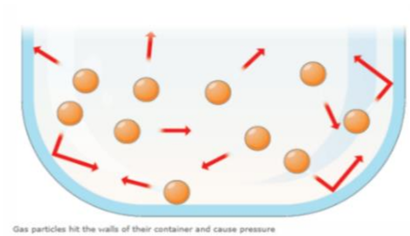


Year 8 Physics Knowledge Organiser
Topic 8: Motion and pressure

KPI 2: Compare pressure in liquids and gasses

Gas Pressure

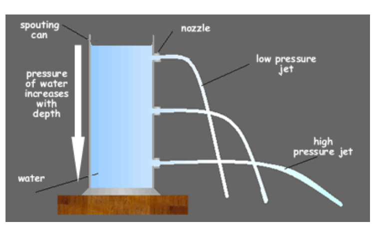
Gas pressure is caused by gas particles colliding with the walls of the container. A container also experiences pressure on the outside. Air particles on the outside collide with the outside wall. An imbalance between the pressure on the inside and outside can cause the container to change its shape.



There are 3 factors affecting gas pressure:
1. Number of particles
2. Temperature
3. Volume

Pressure in fluids

Fluids (liquids or gases) exert pressure at 90˚ to the surface. In a gas particles are constantly colliding with objects, this exerts a pressure. In a liquid like water the deeper you go the higher the pressure.



Key Terms	Definitions
Pressure	The force exerted over a given area
Fluids	A substance that can flow
Pascals	The unit for pressure which can also be written as (N/m^2)

Equation	Meanings of terms in equation
$*P = \frac{f}{a}$	*P=Pressure Pa* *f=Force N* *a= Area* M^2

Atmospheric pressure

The atmosphere exerts a pressure on you and everything around you. The higher you go the lower the atmospheric pressure becomes.

KPI 3: Calculate the pressure exerted by an object

Pressure on surfaces

Objects exert pressure on the surface that they are on. The size of the pressure depends on the force applied by the object and the surface area of the object.
Pressure is calculated by dividing force by area.
Some objects look to increase pressure for example drawing pins have a very low surface area, so exert a high pressure.
Snow shoes have a very large surface area so exert a very low pressure, stopping people sinking into the snow.