St Patrick's

Science Department

Year 7 Knowledge organiser

B1 – Cells

B2 – Structure and function of body systems

B3 – Reproduction

C1 – Particles and their behaviour

C2 – Elements, atoms and compounds

C3 – Reactions

C4 – Acids and alkalis

P1 – Forces

P2 – Sound

P3 – Light

P4 - Space

St. Patrick's RC High School

Year 7: Knowledge Organisers

- What is the Knowledge Organiser?

A Knowledge Organiser contains all the information from each unit of work which we want all students to be able to recall with ease. This is the basic knowledge that ALL pupils need to have to be able to move on to further content and skills. Committing this knowledge to long-term memory frees up working memory, allowing pupils to tackle more challenging skills in class with the support of their teacher.

- How should it be used?

Pupils should learn the content of the Knowledge Organiser as instructed by their teacher, who will tell them where to focus. They should mainly self-quiz to check their learning but they can also complete online retrieval activities to test themselves, if they have access. Long-term, they will be completing a full examined assessment of what they have retained.

- What is self-quizzing?

Self-quizzing is the only way to ensure that the knowledge is being retained in long-term memory. Pupils should LOOK, COVER, WRITE, CHECK. This should be completed on paper and checked by parents, or can be completed verbally by parents quizzing their child.

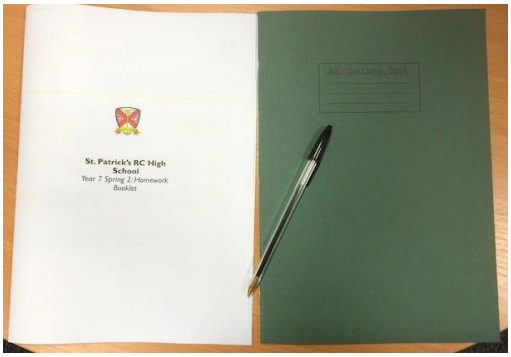
- How can parents help?

1. Set up a study-friendly area, preferably with a table or desk.
2. Schedule a regular academic time each day.
3. Remove distractions, such as phone, TV, loud music.
4. Know what they need to do and support them; give encouragement, check completed work, and make yourself available for questions and concerns. Quiz them verbally or let them teach it to you and mark your work.
5. Praise their work and efforts.
6. Know other places to guide children to learning. These are online and are free to access, simply search for KS3 Science on the following site:

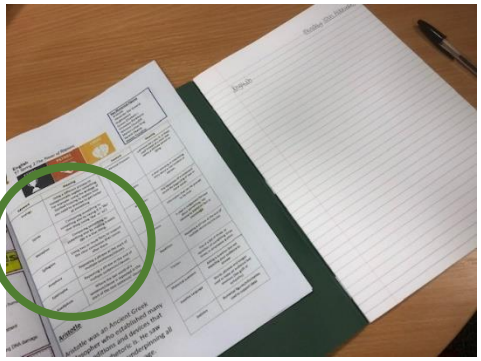
- SENECA - https://senecalearning.com/en-GB/
- YouTube – Revision Monkey KS3 Science
- BBC BITESIZE - https://www.bbc.co.uk/bitesize/subjects/zng4d2p

St. Patrick's RC High School
Year 7: Knowledge Organisers

Look, cover, write, check

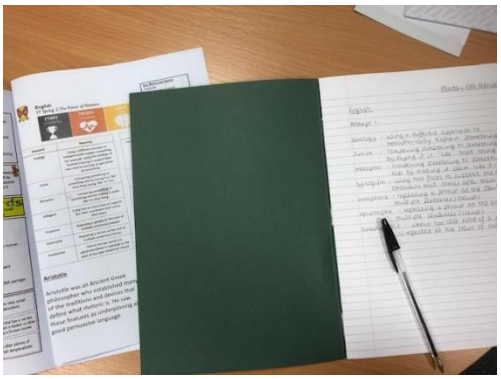


You should use a self-quizzing book with your knowledge organiser.

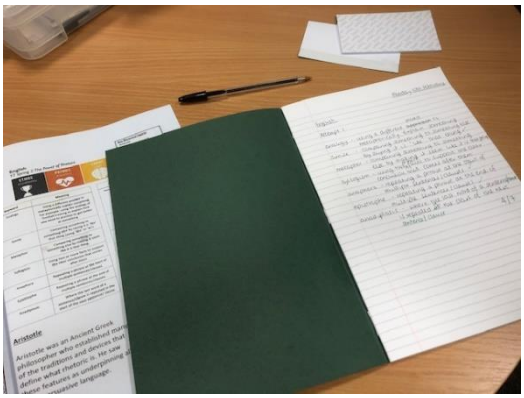


Spend time learning the section you have been set by your teacher e.g.

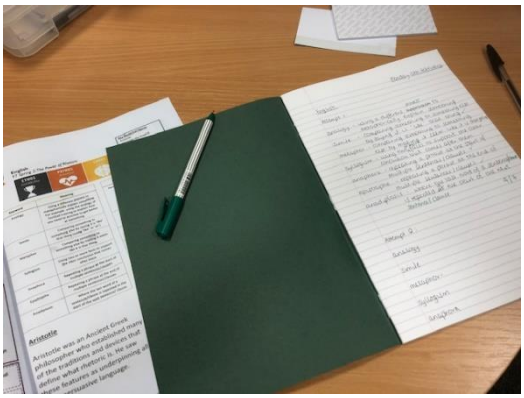
Cover it over and copy the keywords/prompts that you need.



Test yourself and then use the booklet to self-check



Correct as you check and award yourself a mark.



Do it again, as many times as you can in twenty minutes.

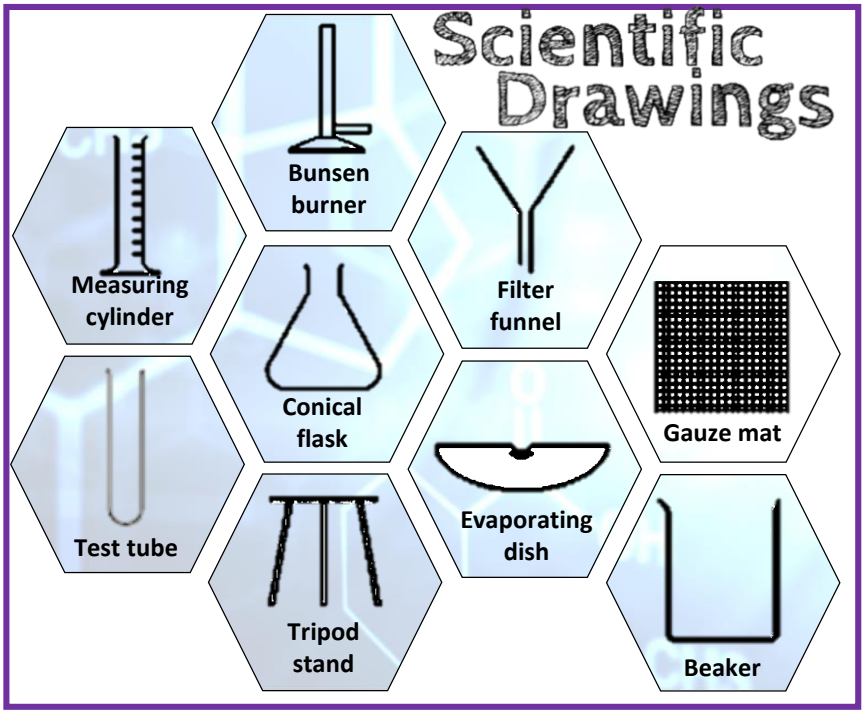
Science Lab Skills

Independent variable –
the variable that is changed during an experiment

Dependent variable –
the variable being tested or measured during an experiment

Control variable –
the variable that is kept the same during an experiment

Scientific Drawings



Before an experiment is carried out, a risk assessment should be completed to make it less likely that people will be injured, or equipment damaged. Hazards should be identified and what to do if something happens.

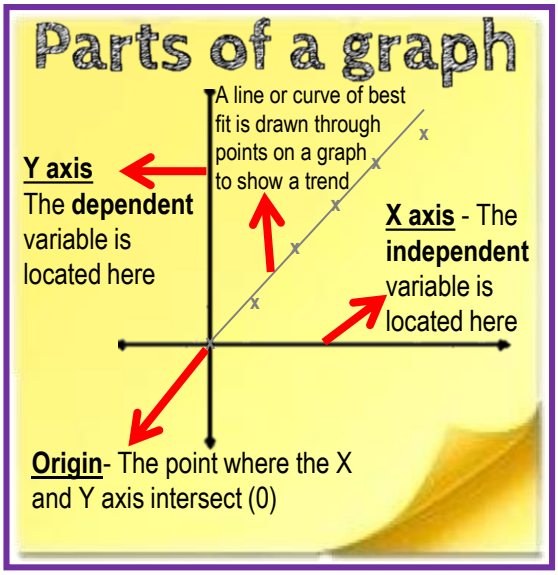
A hazard is something that could potentially cause harm.

An **oxidising** substance makes other substances burn more fiercely by providing O_2

Data is recorded in a table of results during a science experiment

Mass (g)	Extension 1 (mm)	Extension 2 (mm)	Average Extension (mm)
0	0	1	0.5
100	5	6	5.5
200	9	9	9
300	15	15	15
400	20	21	20.5
500	24	25	24.5
600	30	31	30.5

Parts of a graph



Flammable –
Catches fire easily

Biohazard –
Biological substances that can be a threat to human health

Toxic –
A substance that can cause death if swallowed, breathed in or absorbed by skin

Radiation –
Damages living tissue, possibly causing DNA damage and cancer

Corrosive –
Burns and destroys living tissues, such as eyes and skin

A measuring cylinder is used to measure volumes of liquids. Measuring cylinders have equally spaces lines so that volumes can be measured accurately. These are called graduations.

A spatula is used to measure very small quantities of solid in a laboratory

A Bunsen burner is used to heat substances in a laboratory

A gauze is a thin piece of metal that has a net like pattern. A gauze is used to support a beaker or other glassware when heating using a Bunsen burner

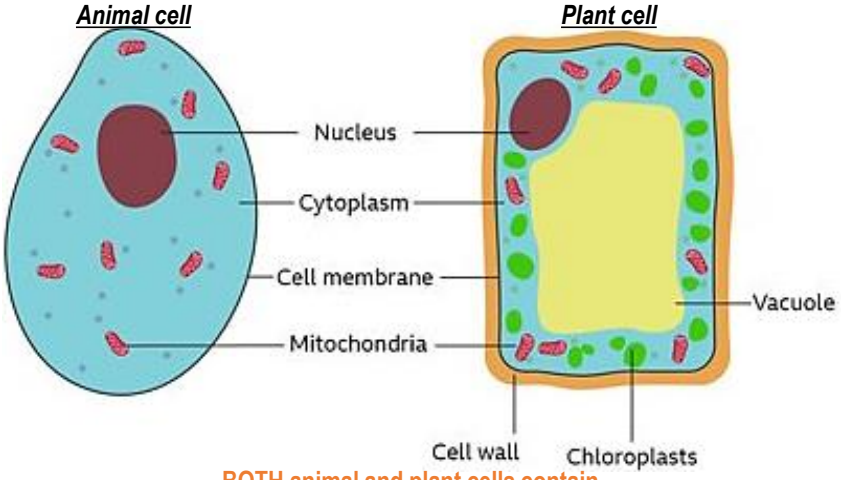
A filter funnel is used to separate large solids from a solution. Filter paper is placed inside the funnel. Solids that are too big to pass through the filter paper get trapped and liquids will flow through.

Tongs are used to hold other pieces of apparatus which are at high temperatures.

Biology 1 - Cells

All living organisms are made up of cells…

Animal cells have an irregular shape. Plant cells have a more regular structure than animal cells. This allows them to fit together like bricks. Plant cells also have three extra components…



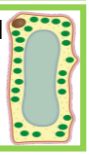
BOTH animal and plant cells contain…

- Nucleus – this controls the cell and contains genetic material.
- Cytoplasm – 'jelly-like' substance where chemical reactions take place.
- Cell membrane – a barrier around the cell which controls what can come in and out of a cell.
- Mitochondria – this is where respiration happens to transfer energy for the organism.

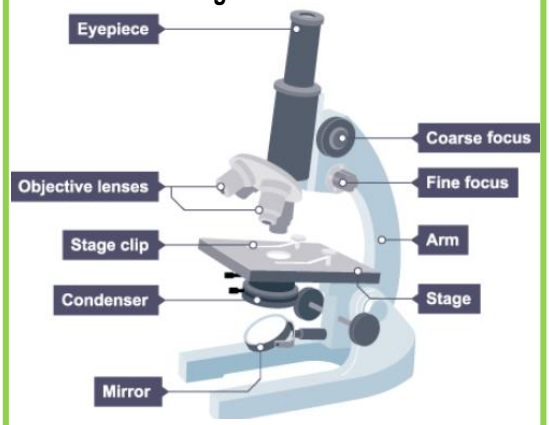
ONLY plant cells contain…

- Cell wall – this strengthens the cell and provides support. It is made from cellulose.
- Vacuole – contains a watery liquid calls cell sap. It keeps the cell firm.
- Chloroplasts – contain chlorophyll. This is where photosynthesis happens.

Not all plant cells are the same. Cells in different parts of a plant are specialised to perform different jobs. **Leaf cells** found near the top of a leaf carry out lots of photosynthesis. The cells are long and thin and packed with chloroplasts. This gives them a large surface area for absorbing energy transferred from the Sun.



Making observations…



To see very small objects in detail, you need to use a microscope.
This magnifies the image using lenses.
Looking carefully and in detail at an object is called making an **observation**.
The course focussing wheel is used to move the stage up and down so you can see your specimen.

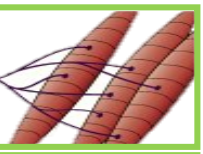
total magnification = eyepiece lens magnification x objective lens magnification

Many cells change their shape and structure so that they are suited to carry out a specific job. These are called **specialised cells**. For example…

Red blood cells transport oxygen around the body. They contain haemoglobin that joins to oxygen. They do not have a nucleus and have a disk-like shape. This increases their surface area for carrying oxygen.

Root hair cells absorb water and nutrients from the soil. The root hair creates a large surface area. They have no chloroplasts as there is no light underground, so these cells do not carry our photosynthesis.

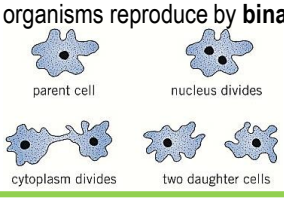
Nerve cells (neurones) carry electrical impulses around your body…



They are long and thin and have connections at each end where they can join to other nerve cells.

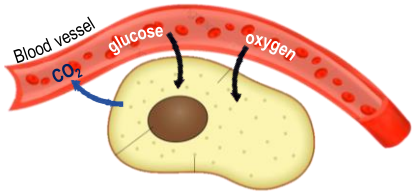
A unicellular organism is an organism that is made up of just one cell. It is not a plant or an animal as these are made up of lots of cells. Some examples of unicellular organisms are:

Unicellular organisms reproduce by **binary fission**.

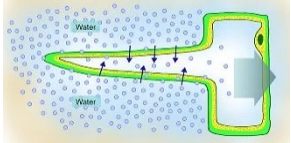


Diffusion is the random movement of particles from a high concentration to a low concentration until particles are evenly spread out.

Inside <u>body</u> cells… glucose and oxygen move from the blood into body cells that need them by diffusion.
Carbon dioxide moves out of body cells.



Inside <u>plant</u> cells… water molecules move from the soil (high water concentration) into the root hair cell (low water concentration) Water then travels from the root hair cells to other cells in the plant by diffusion.
The diffusion of water is known as **osmosis**.

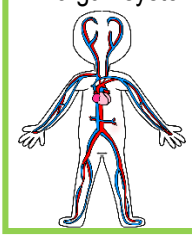


Biology 2 - Structure and Function of Body Systems

Multicellular organisms are made up of many cells…

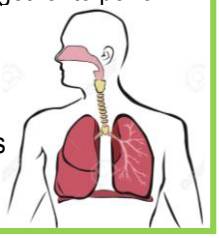
They contain organ systems to perform their life processes.

An organ system is a group of different organs that work together to perform a certain function. For example:

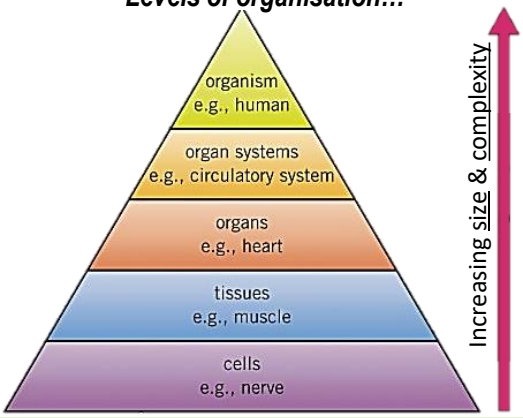


The circulatory system transports materials around the body

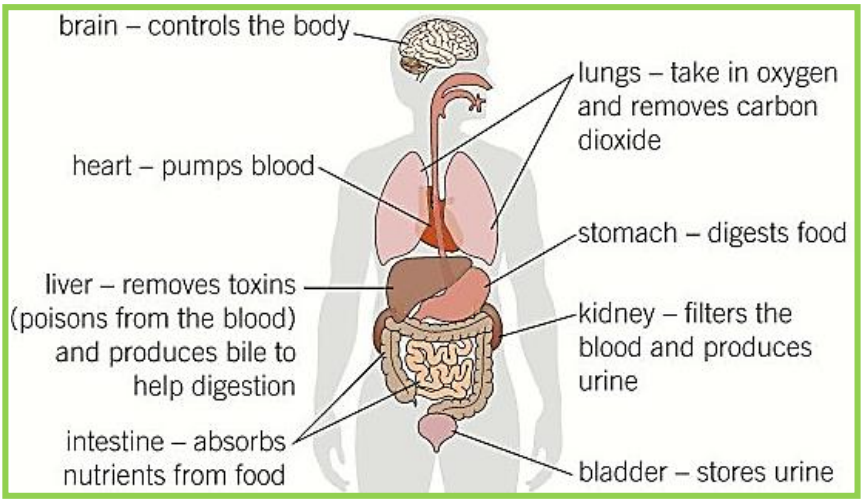
The respiratory system takes in oxygen and removes carbon dioxide



Levels of organisation…



A group of similar cells which work together to perform a function is known as a **tissue**



What happens when we breathe?

When we breathe in, we **inhale** oxygen.

When we breathe out, we **exhale** carbon dioxide.

This is called **gas exchange** and takes place inside the lungs...

Air enters your body through your mouth and nose.

↓

Air moves down the **trachea** (windpipe) – a large tube.

↓

Air moves down a bronchus – a smaller tube.

↓

Air moves through a bronchiole – a tiny tube.

↓

Air moves into an **alveolus** – an air sac.

↓

Oxygen then diffuses into the blood.

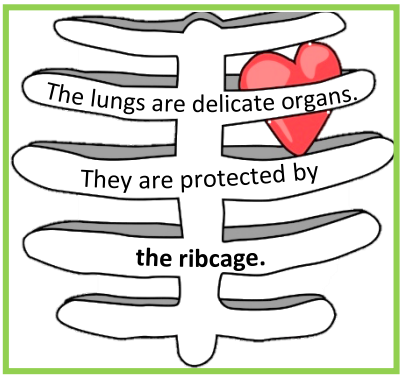
Joints occur when two or more bones join. There are three types of joints…

Hinge joints:
for movement backwards and forwards

Ball-and-socket joints:
for movement in all directions

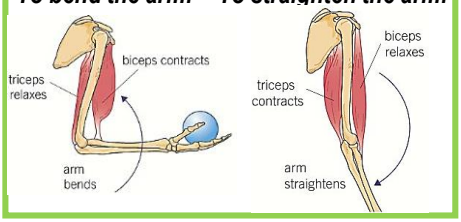
Fixed joints:
do not allow any movement

To stop bones rubbing together and wearing away, the ends of bones in a joint are covered with **cartilage**. Bones are held together by **ligaments**.



Muscles are a type of tissue which cause movement. They are attached to bones by **tendons**. Muscles work by getting shorter – they **contract**. Muscles can only pull. This means two muscles work together at a joint. These are known as antagonistic muscles – when one muscles contracts, the other relaxes. For example…

To bend the arm: ***To straighten the arm:***



Together, all the bones in your body make up your skeleton. The skeleton has four main functions…

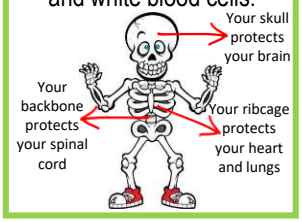
Support the body

Protect vital organs

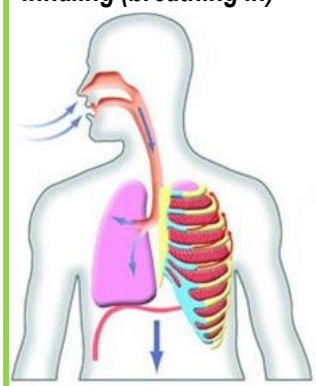
Help the body move

Make blood cells.

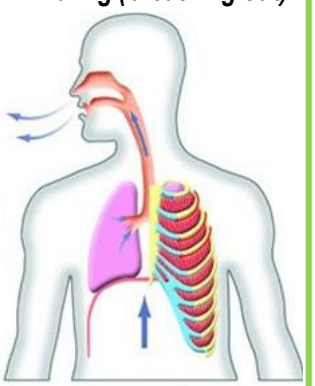
Bone marrow produces red and white blood cells.



Inhaling (breathing in) ***Exhaling (breathing out)***



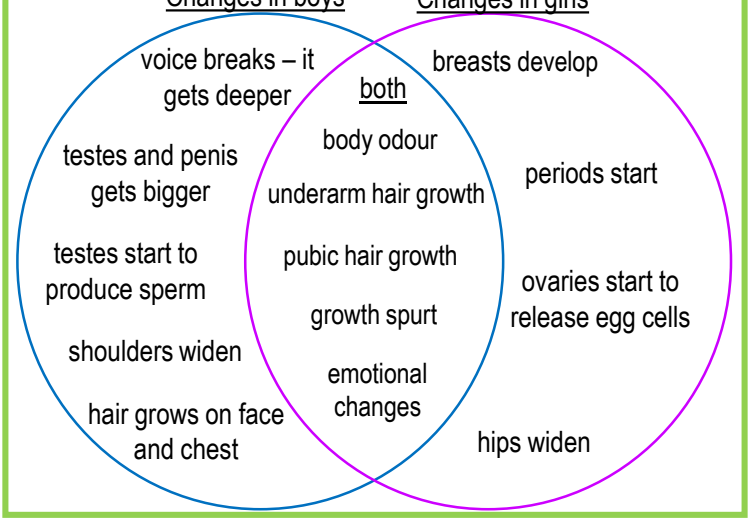
Muscles between ribs contract
Diaphragm contracts
Air drawn into the lungs



Muscles between ribs relax
Diaphragm relaxes
Air pushed out of the lungs

Biology 3 - Reproduction

During adolescence your body goes through physical changes; this is **puberty**.



Puberty is caused by…

Sex hormones

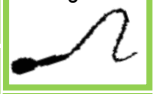
Male hormones are made in the testes

Female hormones are made in the ovaries

The cervix is a ring of muscle at the entrance to the uterus. It keeps the baby in place while a woman is pregnant.

The function of the male reproductive system is to produce sperm cells.

Male gamete:



The function of the female reproductive system is to produce egg cells and grow a baby.

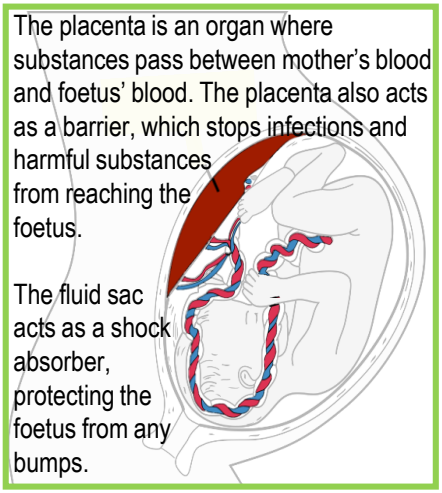
Female gamete:

An egg travels along the oviduct by being pushed along by tiny hairs called cilia

During fertilisation in humans, the nucleus of a sperm and egg cell join.

Sperm cells are produced in the testes.

The umbilical cord carries the baby's blood between the baby and the placenta to deliver nutrients and oxygen.



The placenta is an organ where substances pass between mother's blood and foetus' blood. The placenta also acts as a barrier, which stops infections and harmful substances from reaching the foetus.

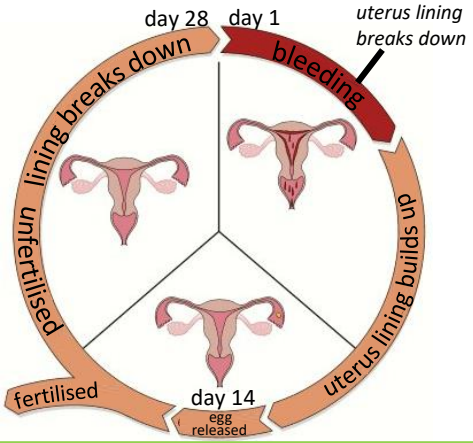
The fluid sac acts as a shock absorber, protecting the foetus from any bumps.

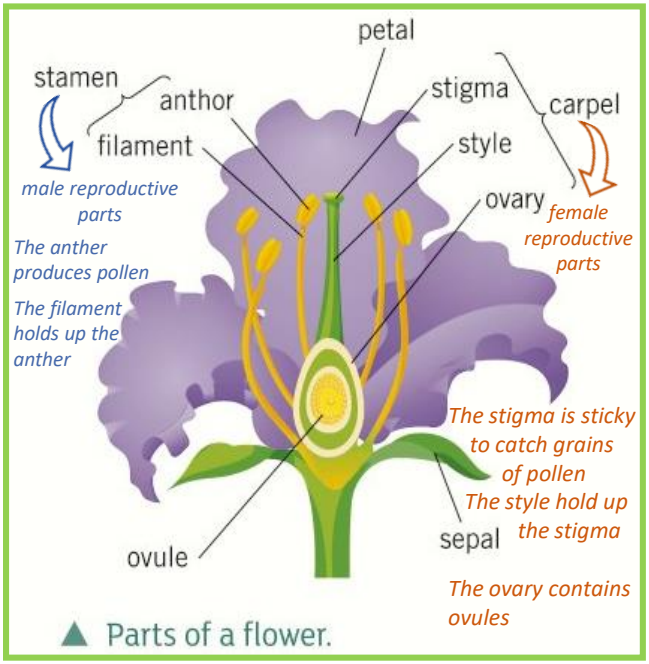
Contraception prevents pregnancy..

A condom is a 'barrier' method of contraception. When used correctly, condoms are a very effective method of contraception. They also prevent STIs.

The contraceptive pill is a tablet that a female must take daily. When used correctly, the pill is a very effective method of contraception. However, it provides no protection against STIs.

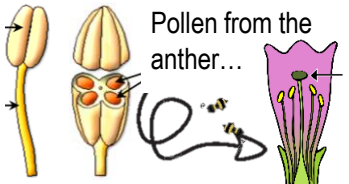
The menstrual cycle





▲ Parts of a flower.

Pollination…



Pollen from the anther…

…gets transferred to the stigma

There are two types of pollination:

Wind & Insect

Seeds can be dispersed by:

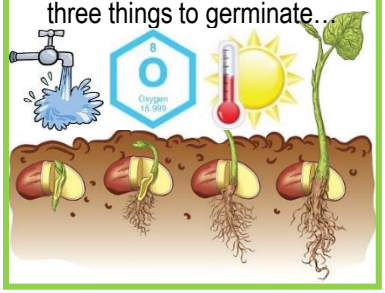
Wind
Water
Explosive
Animal

Gametes in plants…

The male gamete in a plant is pollen.

The female gamete in a plant is an ovule.

When a seed starts to grow, it is called germination. A seed needs three things to germinate…



Chemistry 1 Particles and Their behaviour

All materials are made up of particles called atoms...

Materials such as wood, milk and the air are mixtures. Some materials are not mixtures. They consist of just one **substance**.

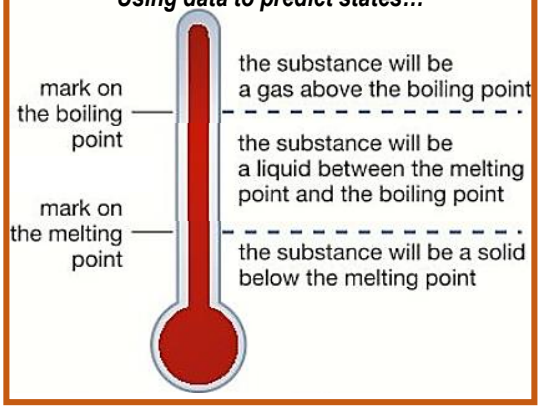
A substance is made of just one type of material and has the same properties all the way through.

The **properties** of a substance describes its appearance and how it behaves.

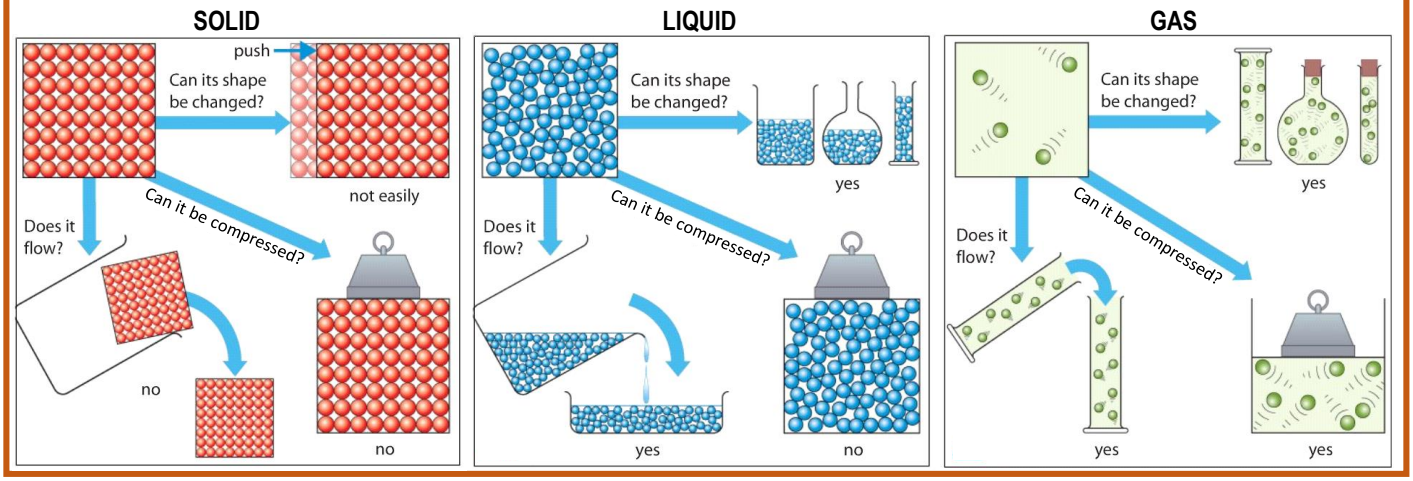
Physical Properties of Some Substances

Substance	State	Color	Melting point (°C)	Boiling point (°C)
Neon	Gas	Colorless	−249	−246
Oxygen	Gas	Colorless	−218	−183
Chlorine	Gas	Greenish-yellow	−101	−34
Ethanol	Liquid	Colorless	−117	78
Mercury	Liquid	Silvery-white	−39	357
Bromine	Liquid	Reddish-brown	−7	59
Water	Liquid	Colorless	0	100
Sulfur	Solid	Yellow	115	445

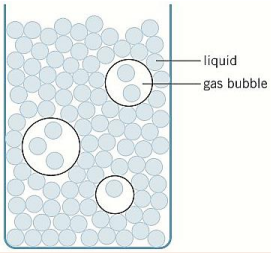
Using data to predict states...



There are three states of matter...

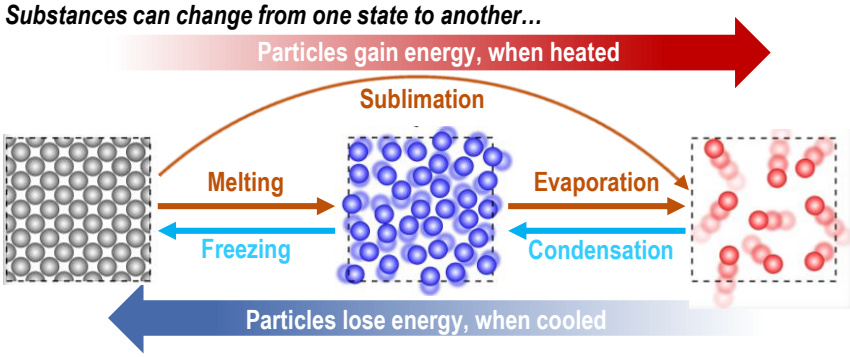


Boiling happens if enough energy is transferred to particles. Different substances need different amounts of energy to boil. This means that a substance must reach a certain temperature before it can boil. For example…

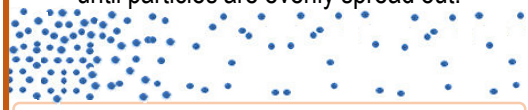


The boiling point of water is 100°c. As water boils, steam bubbles are produced that rise to the surface of the liquid. They escape into the air.

Substances can change from one state to another...



Diffusion is the random movement of particles from a high concentration to a low concentration until particles are evenly spread out.



At higher temperatures, particles gain more energy and move quicker so diffusion happens faster.

Diffusion happens slower if particles are bigger and heavier. Smaller particles are lighter, so diffuse faster.

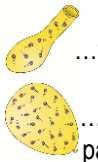
Diffusion happens quickly in gases because the particles are far apart.

Diffusion does not happen in solids because the particles cannot move from place to place.

A substance can change from a liquid to gas by evaporating or boiling...

Process	How particles leave the liquid	Temperature	Does the mass change?
evaporation	Particles escape from the liquid surface.	happens at any temperature	no
boiling	Bubbles of the substance in the gas state form throughout the liquid. They rise to the surface and escape.	happens only at the boiling point	no

Inside a balloon, air particles move quickly from place to place. They **collide** into each other and the rubber the balloon is made from. The collisions exert a force on the rubber. The force per unit area is the **gas pressure**.

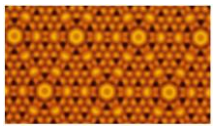


Particles **MUST** collide for gas pressure to increase. Gas pressure increases if…

…temperature increases as particles move faster and collide more frequently.

…the number of particles increases. More particles means particles will collide more frequently.

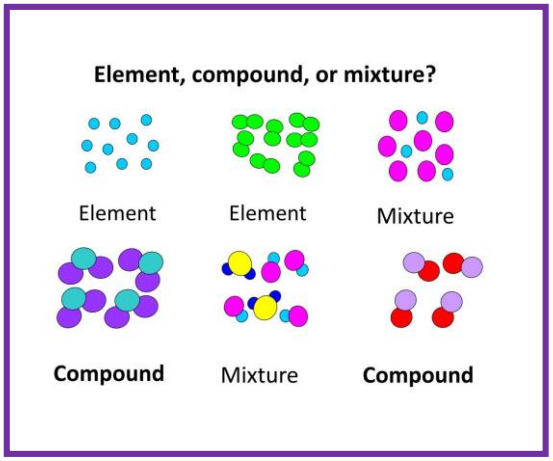
Chemistry 2 Elements, atoms and Compounds



Every element has its own chemical symbol…

An atom is the smallest part of an element that can exist. Every element is made up of one type of atom.

Name of element	Chemical symbol
carbon	C
nitrogen	N
nickel	Ni
chlorine	Cl
gold	Au
iron	Fe
tungsten	W

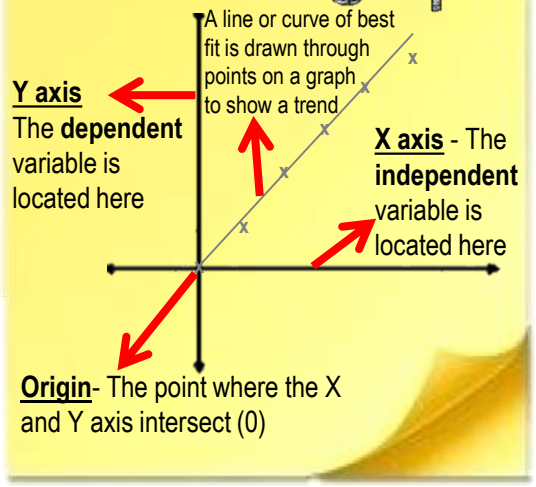


Radiation – can damage living tissue, possibly causing DNA damage and cancer.

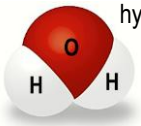
A **biohazard** is a biological substance that can be a threat to human health.

A chemical formula shows the relative number of atoms of each element in a compound.
CO_2 has 1 carbon and 2 oxygen atoms
CO has 1 carbon and 1 oxygen

Parts of a graph

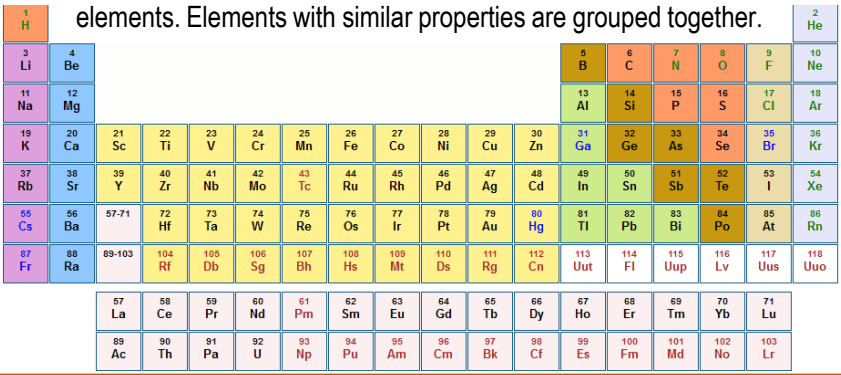


A water molecule has one oxygen atom joined to two hydrogen atoms. It has the chemical formula H_2O.

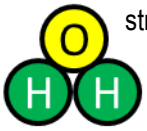


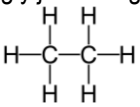
There are millions of materials…

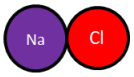
Materials are all made up of one or more elements. An element is a substance that cannot be broken down into other substances. The periodic table lists the elements. Elements with similar properties are grouped together.



A compound is a substance made up of atoms of two or more elements. The atoms are strongly joined together.





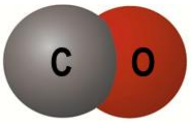


How do we name compounds?

Compounds made up of oxygen and another element have two-word names. For example…

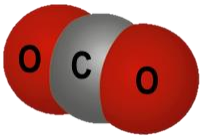
Elements in compound	Name of compound
aluminium and oxygen	aluminium oxide

The compound of sodium and chlorine is called sodium chloride. Chlori*n*e becomes chlori*d*e.



A molecule of carbon monoxide has one carbon atom and one oxygen atom. It has the chemical formula CO.

A carbon dioxide molecule has one carbon atom and two oxygen atoms. It has a chemical formula CO_2.



A molecule of ammonia has the chemical formula NH_3. Ammonia is made up of one nitrogen atom and three hydrogen atoms

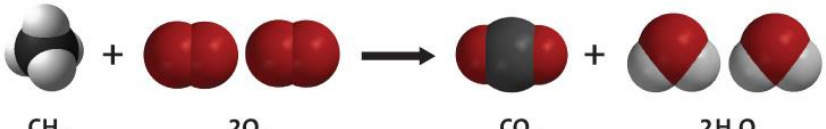
Hydrogen atoms go round in pairs. These are molecules of hydrogen. A hydrogen molecule consists of two hydrogen atoms.

Chemistry 3 Reactions

What are chemical reactions?

A chemical reaction is a change in which atoms are rearranged to create new substances.

The atoms are joined together in one way before the reaction and in a different way after the reaction. For example…



CH_4	$2O_2$	CO_2	$2H_2O$
methane	oxygen	carbon dioxide	water

How do you know if it's a chemical reaction?

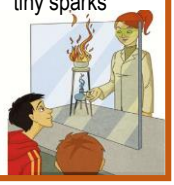
There are many clues to look out for…

feel the chemicals getting hotter

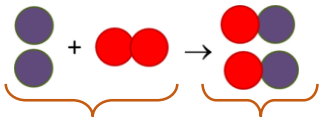
hear a loud bang or gentle fizzing

notice a sweet smell or foul stink

see huge flames or tiny sparks



In chemical reactions, the starting substances are called **reactants**.



REACTANTS *PRODUCTS*

The substances made in a reaction are called **products**.

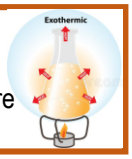
Chemists use **catalysts** to speed up slow reactions to make products more quickly.

Conservation of mass states…

…the total mass of reactants is equal to the total mass of products.

In an exothermic reaction, energy is transferred TO the surroundings.

For example, combustion reactions are exothermic.

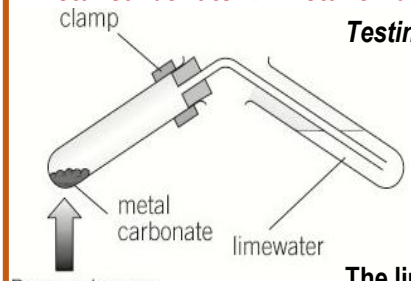


Thermal decomposition

When a substance breaks down on heating, the reaction is a thermal decomposition reaction.

For example, if you heat copper carbonate, it breaks down. The reaction makes copper oxide and carbon dioxide. This can be written as a general word equation:

metal carbonate → metal oxide + carbon dioxide



Testing for carbon dioxide

You can show that carbon dioxide is produced in a thermal decomposition by bubbling it through limewater.

The limewater goes cloudy.

Word equations represent reactions

A word equation shows:

- Reactants on the left
- Products on the right.

The arrow (→) means *reacts to make*. It is different to an equal sign (=) in a maths equation.

For example…

Iron reacts with sulfur to make iron sulfide:

iron + sulfur → iron sulfide

Sodium reacts with chlorine to make sodium chloride:

sodium + chlorine → sodium chloride

How to balance equations…

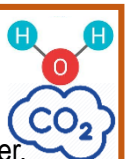
1) Write a word equation
2) Write chemical symbols or formulae for each reactant and product.
3) Balance the number of each atom on both sides of the equation.

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

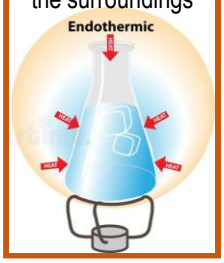
C=1		C=1
H=4	=	H=4
O=4		O=4

Petrol, diesel, coal and methane from under the ground are fossil fuels. This means that they cannot be replaced once they have been used. They will run out one day.

Fuels burn in chemical reactions. This is also called **combustion.** Methane is an example of a fuel. When it burns, it reacts with oxygen to make two products, carbon dioxide and water.



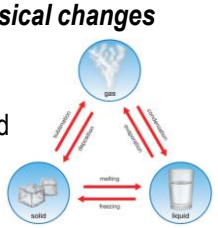
In an endothermic reaction, energy is transferred FROM the surroundings



Reversible and physical changes

Reversible reaction are reactions where you can get back what you started with.

This is called a **physical change**.

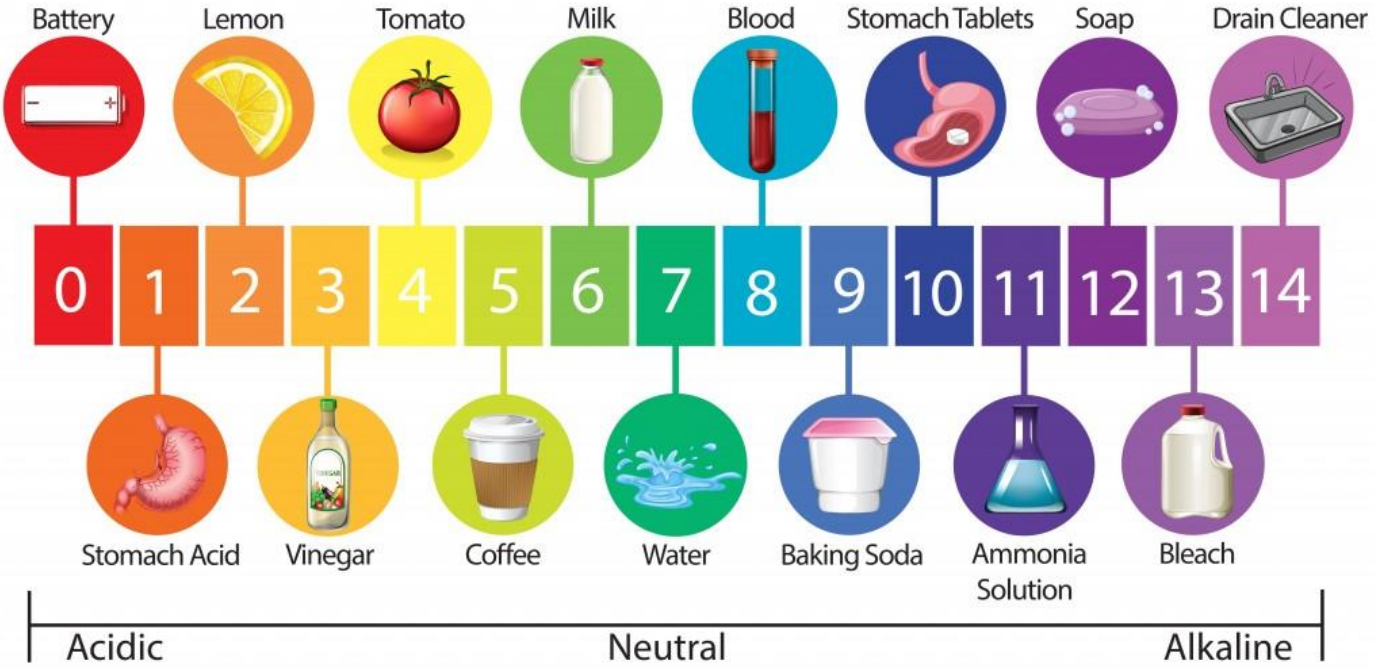


Changes of state and dissolving are examples of physical changes.

Chemistry 4 Acids and Alkalis

What is an acid?
Vinegar and lemons taste sour.
This is because they contain acids.

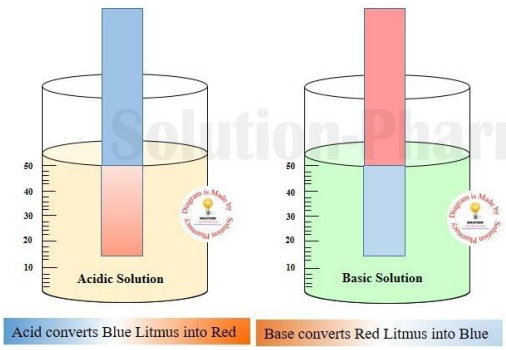
The pH scale is a measure of how acidic or alkaline a solution is.



What is an alkali?
Alkalis are the chemical opposite of acids.
Toothpaste is an example of an alkali.
Most alkalis feel soapy.

Universal indicator is mixture of dyes that change colour to show how acidic or alkaline a solution is. You can then use the pH scale to determine the pH of the solution.

Litmus indicator is a solution of dyes from lichens. Litmus paper tells you whether a substance is an acid or alkali…

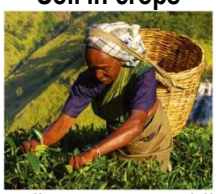


HCl – hydrochloric acid
HNO_3 – nitric acid
H_2SO_4 – sulfuric acid

These formulae show that acids are compounds. Acids all include hydrogen atoms.

Neutralisation
In a neutralisation reaction an acid reacts with a substance that cancels it out. The pH gets closer to 7.
A **base** is a substance that neutralises an acid. Bases include sodium hydroxide, calcium oxide and copper oxide. Some bases are soluble in water.
Neutralisation is useful for…

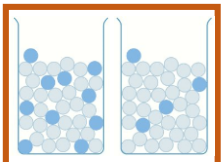
Soil in crops



Some soils are more acidic than others. Different plants have their favourite pH. Adding a base neutralises some of the soil acid and changes soil pH for different plants.

Acidic lakes

In some places, gases from burning coal make sulphur dioxide gas. This dissolves in rainwater to make acid rain. The rain falls in lakes, making lakes more acidic.



CONCENTRATED vs. DILUTE

The solution of acid on the right is **dilute**. This is because it has less acid particles than a **concentrated** acid.

What are salts?
A salt is a compound that forms when an acid reacts with a metal element or compound. You can also make salts in chemical reactions. Reacting an **acid** with a metal makes two products – a salt and hydrogen. For example:

magnesium + sulfuric acid → magnesium sulfate + hydrogen

Reacting an acid with a base also makes a salt.
The products are salt and water.

zinc oxide + nitric acid → zinc nitrate + water

sodium hydroxide + hydrochloric acid → sodium chloride + water

Physics I Forces

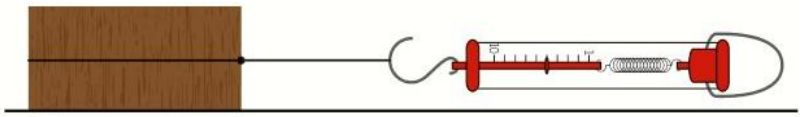
What do forces do?

A force can be a push or a pull. Forces explain why objects move in the way they do, or why they don't move at all. Forces can…

…change the **direction** of an object

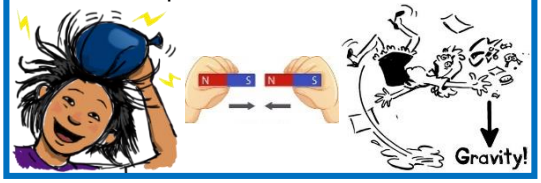
…change the **shape** of an object

…change the **speed** of an object



You can measure a force with a **newton meter**.
All forces are measured in **Newtons** (N)

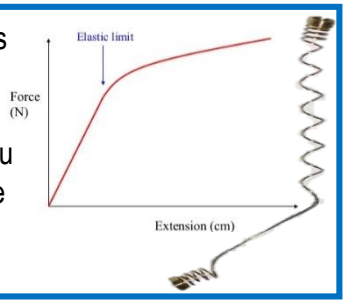
When a force acts between two objects that **do not** touch, this is a non-contact force. Some examples of non-contact forces are:



Weight is a force.
It is measured in Newtons (N).

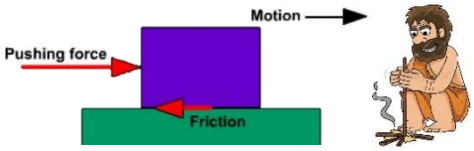
Mass is the amount of matter an object is made up of. It is measured in kilograms (kg)

If a spring does not go back to its original length when you remove a force it has reached its elastic limit.



What is friction?

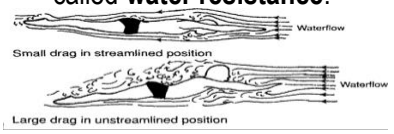
Friction grips objects. Friction is useful to slow down and stop objects. Friction also produces heat energy.



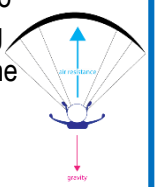
One way to reduce friction is by using oil or grease. This is called **lubrication**. E.g. oil on the chain of a bike.

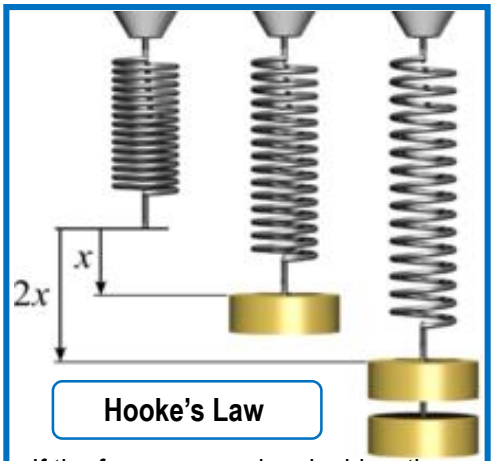
A drag force will slow an object down…

As a swimmer moves through water they push water particles out of the way. This produces a drag force called **water resistance**.



Parachutes are used to slow down drag-racing cars and skydivers. The contact with the air produces a drag force called **air resistance**.

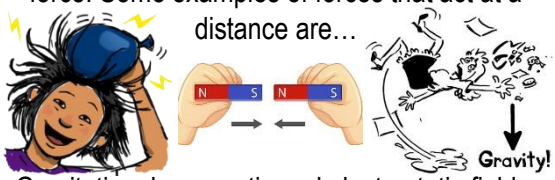




Hooke's Law

If the force on a spring doubles, the extension will double.
This is a **linear** relationship.

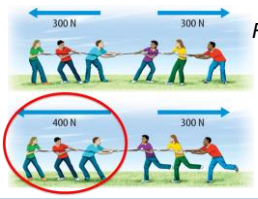
Non-contact forces act at any distance, even if the objects are not touching. In physics a field is a special region where something experiences a force. Some examples of forces that act at a distance are…



Gravitational, magnetic and electrostatic fields have something in common.
As you get further away from the mass, magnet or charge, the field gets weaker.

Balanced and unbalanced…

When the forces acting on an object are the same size but in opposite directions we say they are balanced. When the forces acting on an object are not the same size we say they are unbalanced.

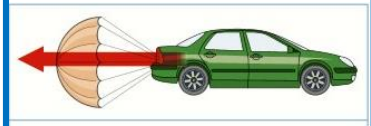


Forces cancel out = balanced

Forces do not cancel = unbalanced

The driving force is bigger than the resistive forces acting on the car.

The speed of the car increases.



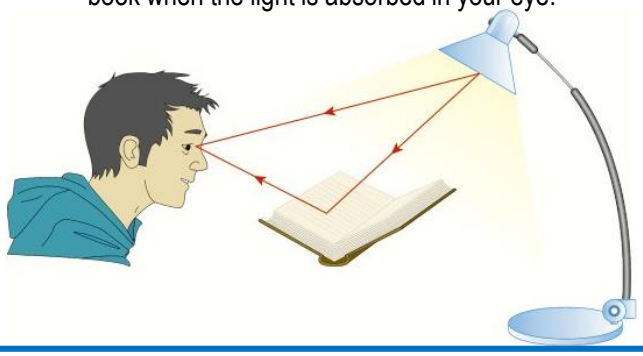
The only forces acting on the car are resistive forces.

The speed of the car decreases.

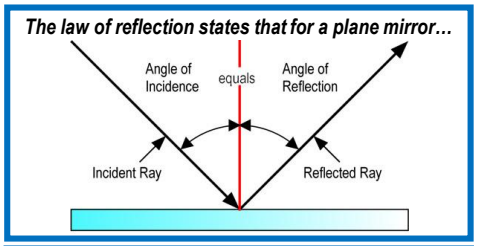
Physics 2 and 3Light and Sound

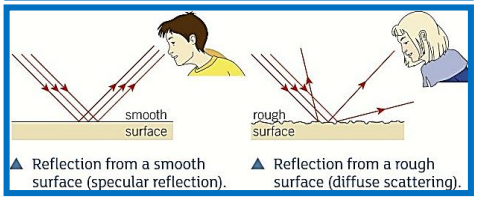
What happens to light as it travels?

You look at a book. A source of light, like a lightbulb, emits light. This light reflects off the book and into your eye. You see the book when the light is absorbed in your eye.



Something that gives out light is **luminous**.

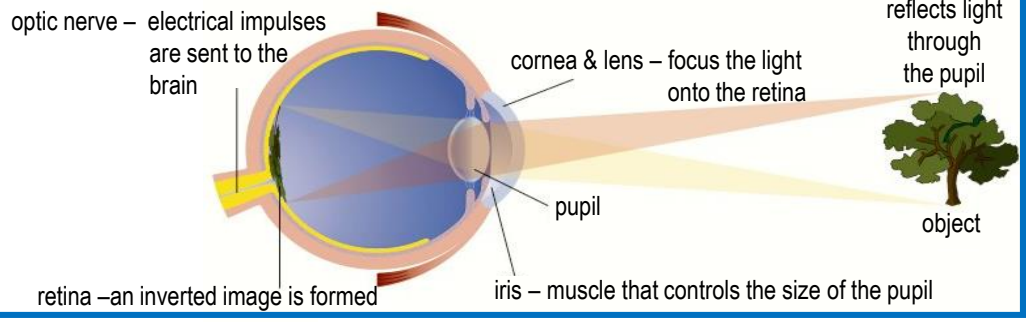




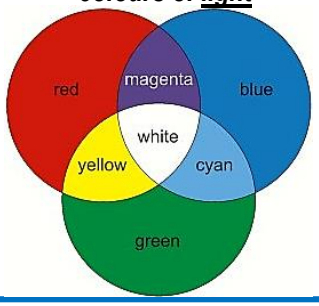
What is refraction?

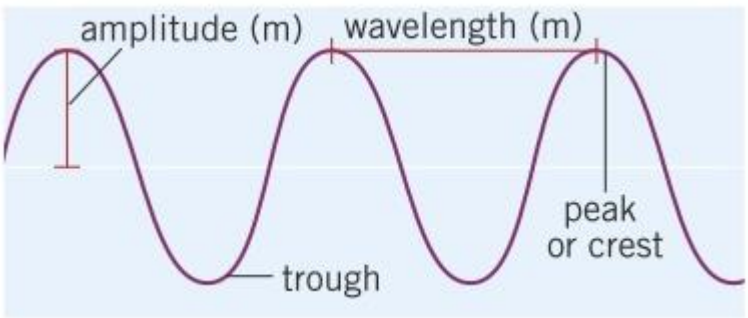
Refraction happens whenever light travels from one medium (material) into another. For example, when light travels through a glass block, it slows down when it goes in, and speeds up when it comes back out.

How do you see?

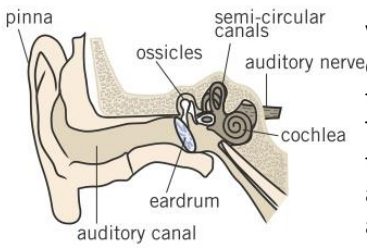


Primary and secondary colours of light

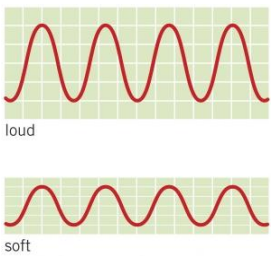




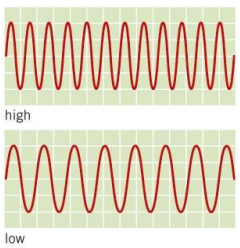
Amplitude : distance from the middle to the top or bottom
Frequency: the number of waves that pass a point per second
Wavelength: the distance from one point on a wave to the same point on the next wave



Vibrations are passed down the auditory canal to the eardrum.
They are passed through the ossicles which amplify the sound. These are passed through the oval window to the cochlea. Which sends messages along the auditory nerve.

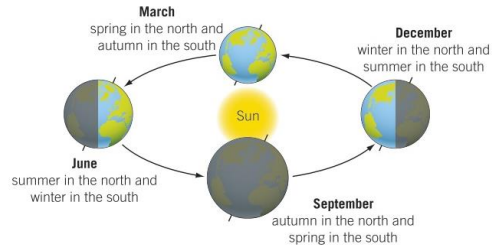


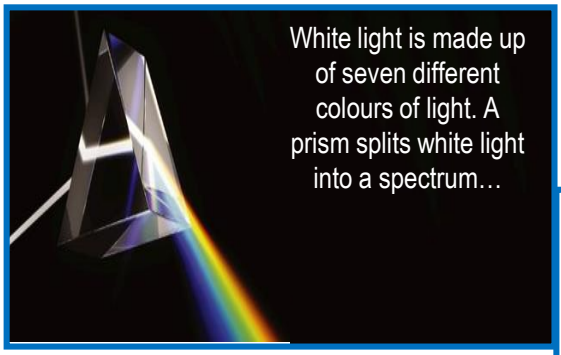
A loud sound has a bigger amplitude



A high sound has a higher frequency

Physics 4 Space



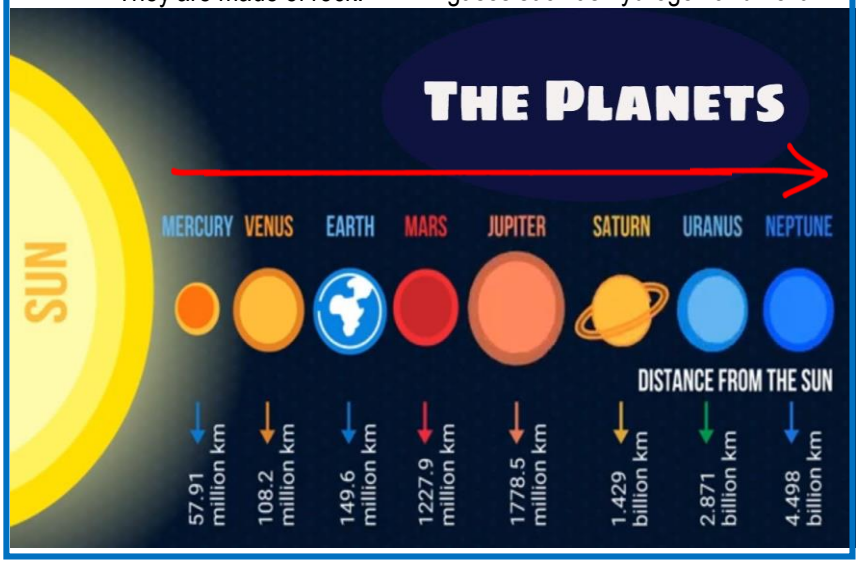


What's in our Solar System?

Starting from the Sun and moving outwards, the Solar System contains:

The inner planets, Mercury, Venus, Earth and Mars, are all known as **terrestrial** planets. They are made of rock.

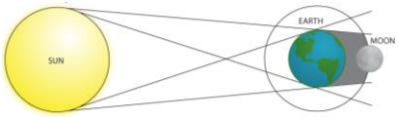
The outer planets, Jupiter, Saturn, Uranus and Neptune, are all **gas giants**; they are mainly made of gases such as hydrogen and helium.



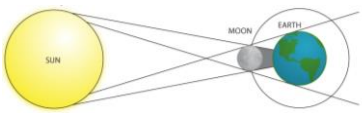
Why do we see eclipses?

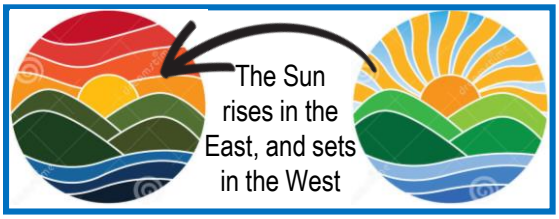
When the moon comes between the Sun and the Earth, it makes a shadow on the Earth's surface.

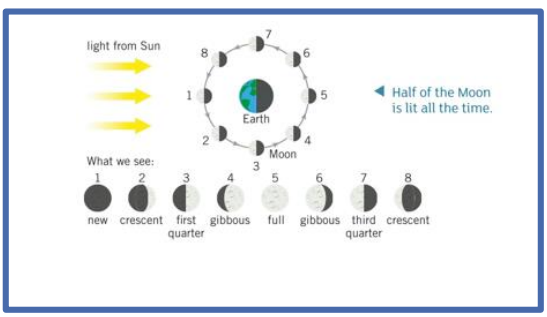
During a lunar eclipse, the Earth blocks the Sun's light from reaching the Moon.



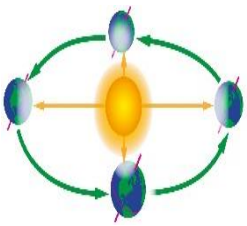
During a solar eclipse, the Moon blocks the Sun's rays from reaching part of the Earth.







The Earth takes 365 days to orbit the Sun



It takes 24 hours for the Earth to complete one full spin on its axis

The Moon is Earth's only natural satellite