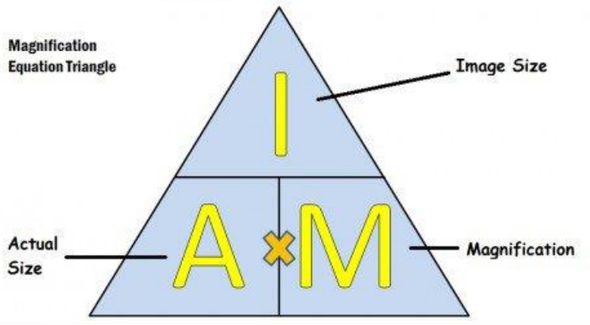
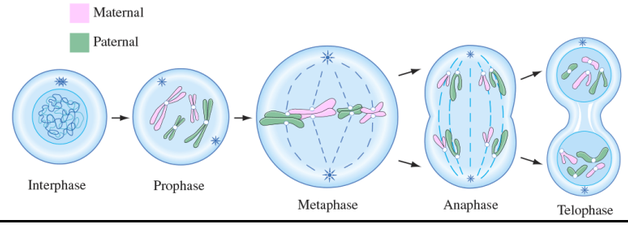
Year 8 biology knowledge organiser

composite title	Essential knowledge	Key words
How can we view cells?	**Magnification** is the number of times larger an image appears than the original size **Resolution** is the smallest distance between 2 points that can still be seen as 2 points. <u>Light microscope vs electron microscope:</u> Electron microscopes are expensive but have higher resolution and magnification than a light microscope • Conversion between mm, µm, nm.  / 1000 X 1000 Prefix / Effect on unit / Example milli- ÷ 1000 millimetres (mm) micro- ÷ 1 000 000 micrometres (µm) nano- ÷ 1 000 000 000 nanometres (nm) pico- ÷ 1 000 000 000 000 picometres (pm)   Electron microscope Magnification = image size/actual size	**Magnification** **Resolution** **Microscopes** **Cells**
How does one cell become many cells?	**Mitosis** is a type of cell division needed for growth and repair. **Mitosis** produces two genetically identical, diploid daughter cells Cell cycle and mitosis: **Interphase** is the phase preparing for mitosis. DNA and organelles replicate. **Diploid** means the cell contains two copies of each chromosome. ○ **Prophase** – Nuclear membrane breaks down and DNA appears ○ **Metaphase** – chromosomes line up along the middle of the cell. Spindle fibres attached. ○ **Anaphase** – chromosomes pulled apart by spindle fibres. ○ **Telophase & cytokinesis** – nuclear membrane reforms and cells split  	**Mitosis** **Diploid** **Interphase** **Prophase** **Metaphase** **Anaphase** **Telophase** **Cytokinesis**

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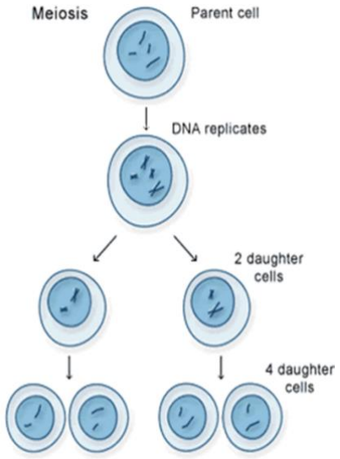
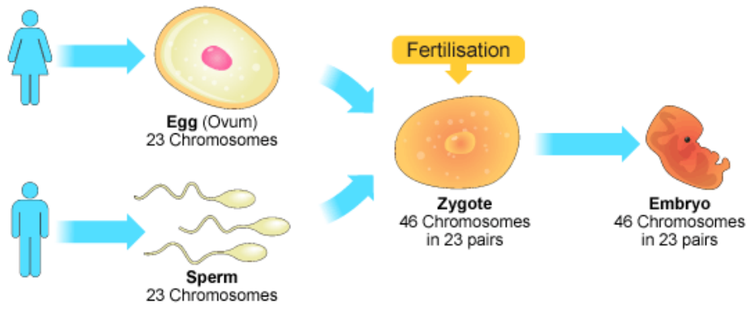
How does an embryo develop?



Meiosis is a type of cell division that produces 4 genetically different daughter cells with half the normal amount of DNA (known as being **haploid**).

- **Fertilisation** is the fusing of a sperm and egg cells to produce a zygote.
- The zygote travels down the oviduct and attaches to the uterus wall.

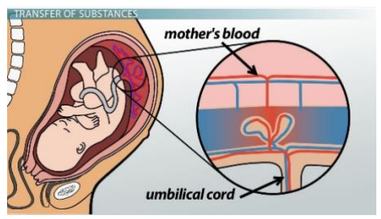
Meiosis produces gametes (sperm and egg cells in humans)



Embryo development:

- Before 8 weeks, it is known as the embryo
- After 8 weeks it is known as the foetus.
- Gestation period in humans is 40 weeks (9 months)

- role of placenta and umbilical cord:
  - A foetus collects nutrients, oxygen and water from a mother's blood using a placenta.
  - It travels to and from the placenta by the umbilical cord.
  - It lies in an amniotic sac full of fluid so it can move and has protection from injury.



- Key stages:
  - 4 weeks – Hearts beats.
  - 8 weeks – now called a foetus. Human features
  - 3 months – all body parts in place
  - 5 months – hair, nails, eyelashes
  - 7 months – brain very active
  - 9 months – fully developed.

Meiosis
Mitosis
Stem cells
Gamete
Haploid
Embryo
Foetus
Placenta
Zygote
Umbilical
Navel
Gestation
Pregnancy

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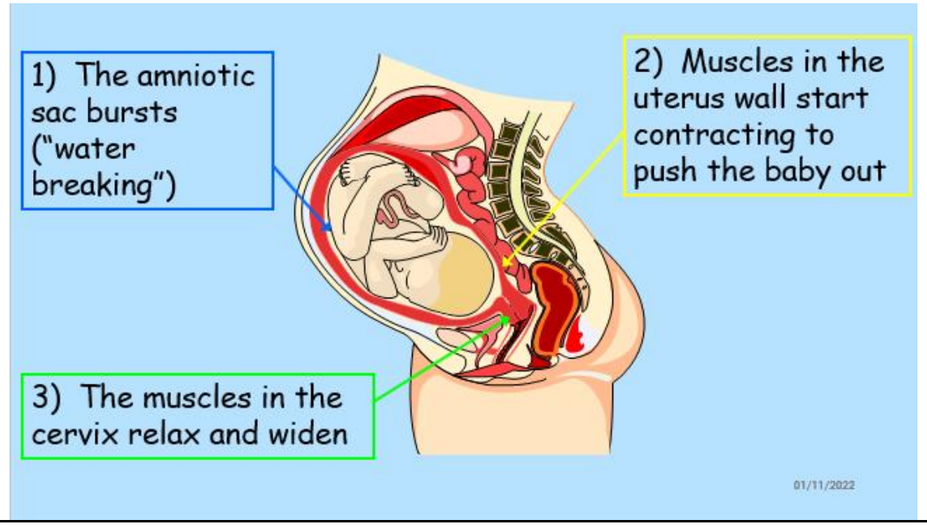
How is a baby born?

Process of birth:



Infant nutrition:

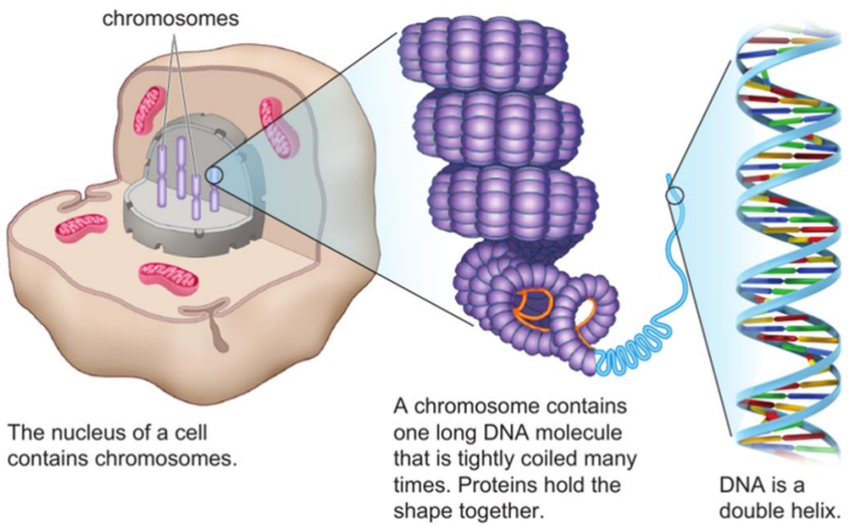
- Up to the age of one, babies mainly rely on a mother's milk (can also be formula)
- Weening is from 6 months

Contraction
Uterus
Cervix
Vagina

8B5 - Why do we look different?

Variation is differences in characteristics. Variation can be within species (e.g., how tall people are) or between species (e.g., how many limbs does a species of animal have).

- Characteristics can be **inherited** or **environmental**.



A **gene** is a section of DNA that codes for a protein (that give us our characteristics). If a gene makes a protein, it is 'expressed'.

Alleles are different versions of the same gene.

Alleles come in pairs; one on each chromosome.

There are **dominant** and **recessive** alleles.
In pairs of alleles, a dominant allele is always expressed (as if the dominant over-rules a recessive allele).
Recessive alleles are only expressed if there are two of them in a pair.

Inherited characteristics including sex determination are determined by alleles.

Variation
Inheritance
Characteristic
Gene
Allele

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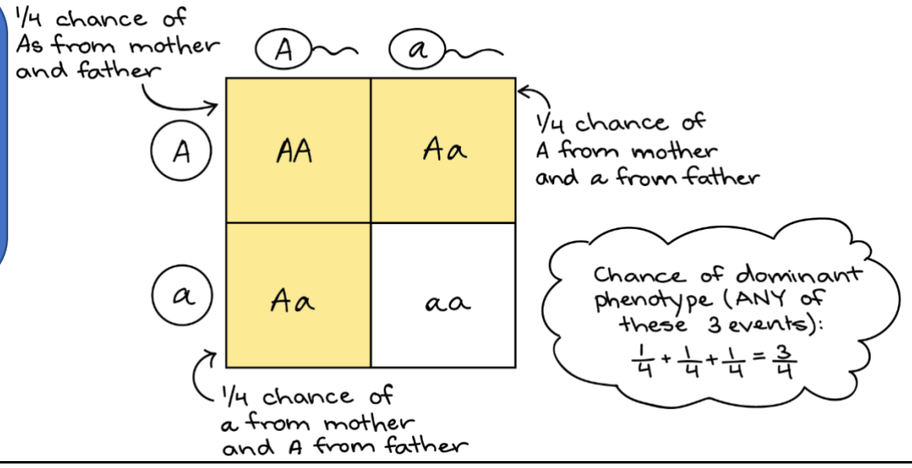
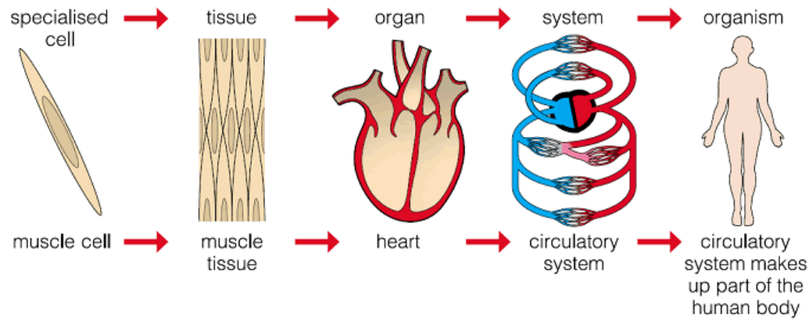
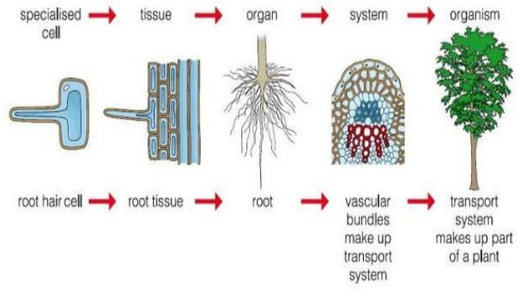
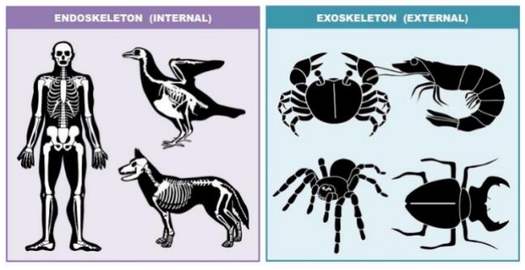
	Punnett squares can be used to determine the chance of inheriting a characteristic.  **Dominant alleles are represented with a capital letter. Recessive alleles are represented with a lower case letter**	
What are organs and systems?	Organisms are made of organ systems working together • Organ systems are made of several organs working together • Organs are made of several tissues working together • Tissues are made of cells working together  **PLANT CELLS, TISSUES, & ORGANS**  Plants also have this hierarchy of organisation e.g., palisade leaf cell → palisade leaf tissue → leaf → leaves are part of the photosynthesis system	**Cells** **Organ** **Organ systems** **Heart** **Lungs** **Kidney** **Tissue** **Neurone**
Do snakes have backbones?	**Exoskeletons** are hard and found on the outside of some animals, e.g., insects or spiders **Endoskeletons** are hard and found on the inside of some animals, e.g., a fish or a human A **hydrostatic skeleton** has no hard bones but is used by soft-bodied animals to support their bodies, e.g., earthworms or starfish 	**Bones** **Skeleton** **Ligaments** **Tendon** **Skull** **Spine** **Ribs**

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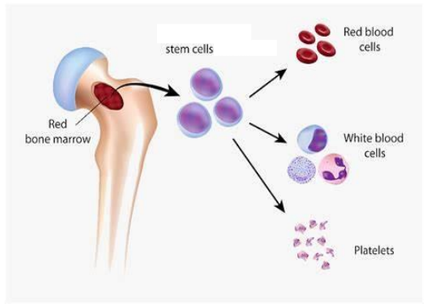
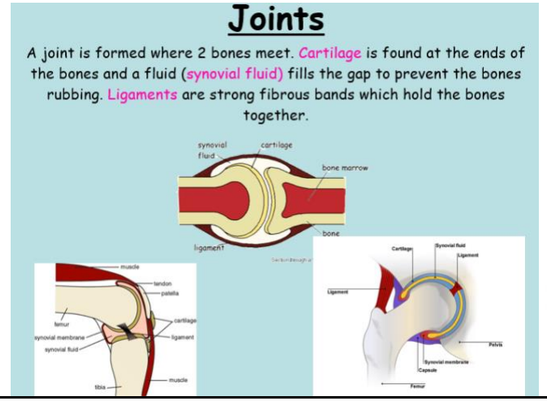
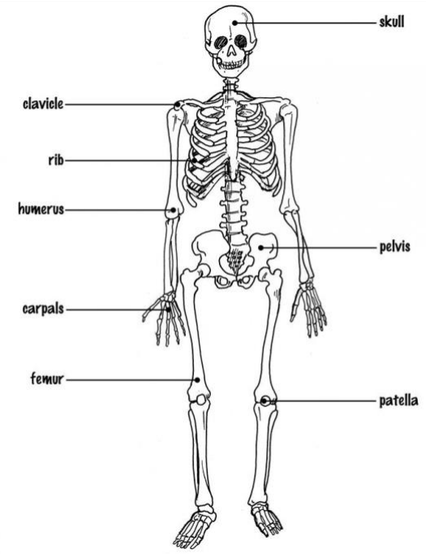


- The functions of the human skeleton are support, protection, movement, and making red blood cells.
- Bones consist of living and non-living parts. Bone marrow makes up part of the living part and this is where red blood cells are formed.
- Bones are joined with ligaments e.g. the cruciate ligament in the knee

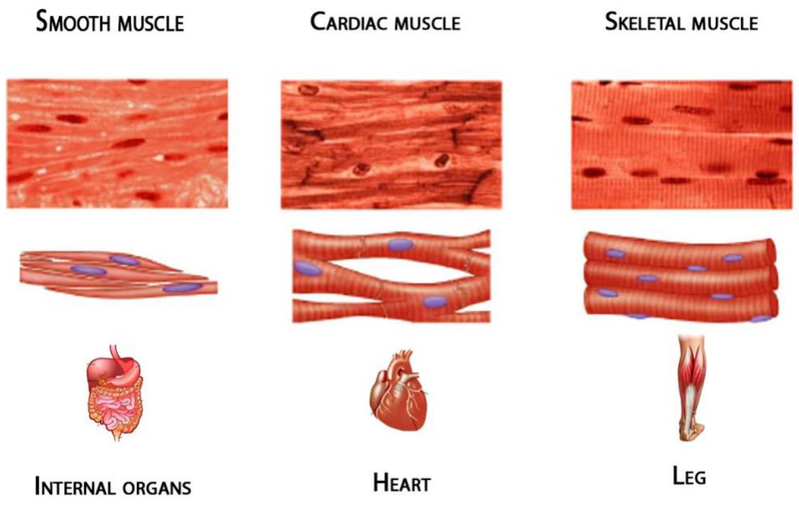




Pelvis
Femur
Humerus

Do mussels have muscles?

- Muscles are tissues made from cells working together. There are three types:



Muscle cells contain lots of mitochondria

Antagonistic Muscle

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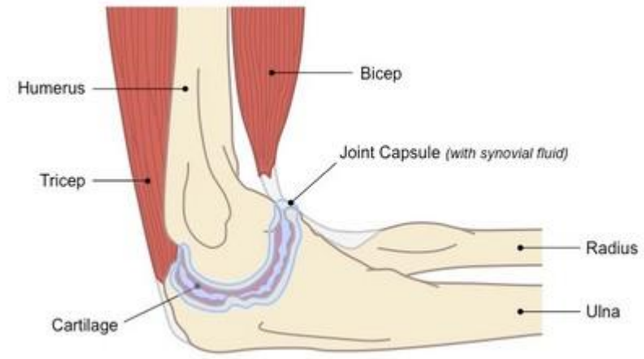
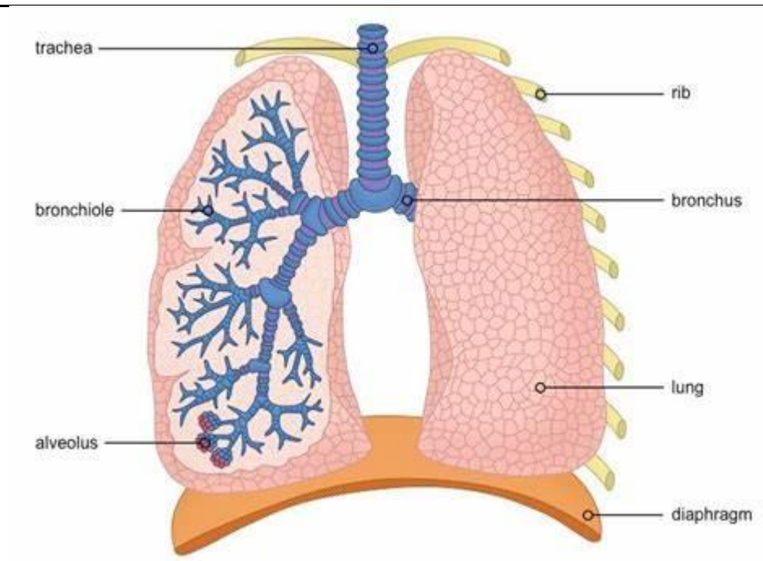
Muscles **contract** and **relax**.
Muscles often come in pairs that work against each other (antagonistic pairs e.g. biceps and triceps).

- Muscles are attached to bones by tendons.
- Different types of joints:
  - Immovable joint – cranium
  - Slightly movable – vertebrae in the spine
  - Freely movable:
    - Hinge joint – Elbow (pictured)
    - Ball and socket – Shoulder/hip



8B9 - Stop calling ventilation respiration (please)



The structure of **alveoli** is like a bunch of grapes.

Alveoli adaptations include large surface area, thin walls and moist lining

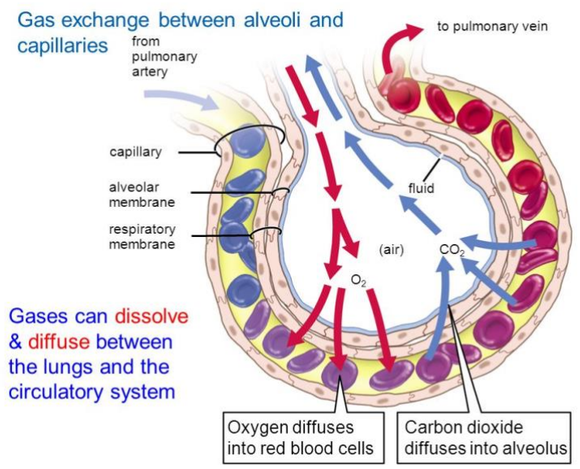
This means gaseous exchange is fast and there is always a big difference in concentrations of gas in the blood and lungs (a steep diffusion gradient)

Structure of the lungs:

<u>Process of breathing:</u>

Inhaling – diaphragm contracts, intercostal muscles contract, volume thorax increases, pressure decreases

Exhaling – diaphragm relaxes, intercostal muscles relax, volume thorax decreases, pressure increases



Alveoli Diffusion

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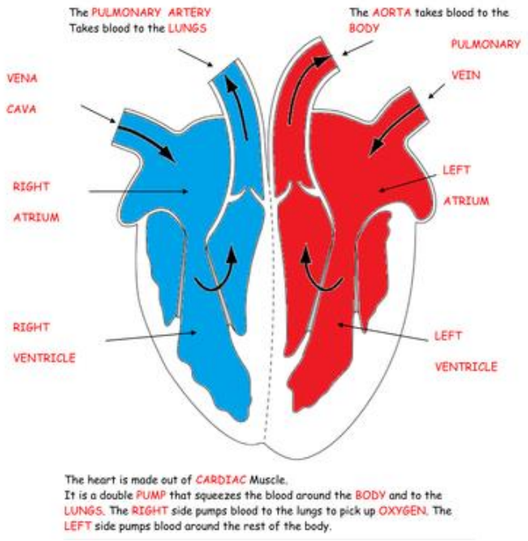
How does oxygen reach our cells?

The **circulatory system** includes the heart and blood vessels



The heart is a pump that pushes blood around the circulatory system.

The right hand side of the heart pumps the **deoxygenated** blood to the lungs.

The left side pumps **oxygenated** blood to the working muscles (body).

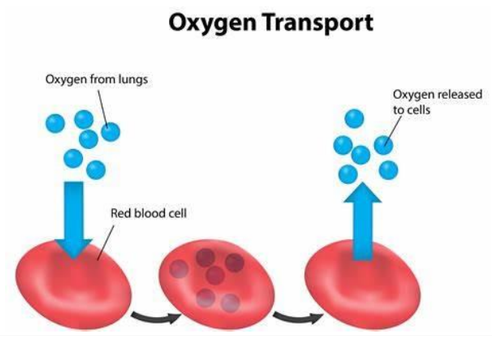
Deoxygenated means there's no oxygen in the red blood cells. Oxygenated means there is.

Blood vessels:

Arteries take blood from the heart

Veins take blood into the heart

Capillaries connect arteries and veins and are where exchange happens between the blood and cells



Circulation

What happens to the food we eat?

Main food groups with sources and functions:

- **Protein** – for growth and repair. Fish, meats, pulses.
- **Fat** – for energy and insulation. Oils, butter, dairy, meats.
- **Carbohydrates** – for energy. Pasta, rice, potatoes.
- **Fibre** – aids digestive transit. Wholegrains cereals.
- **Vitamins** (e.g. vitamin B/C) and minerals (e.g. calcium/potassium) – Maintain healthy processes structures. Fruit and veg.

and

Digestion
Enzyme
Nutrition
Fat
Carbohydrates
Protein
Fibre
Vitamins
Minerals
Lipids
Oesophagus
Peristalsis

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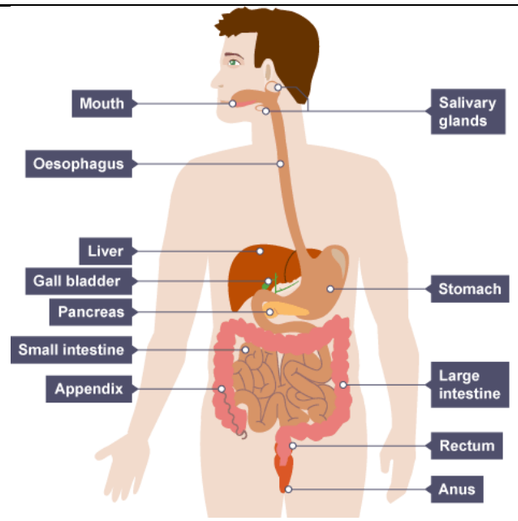
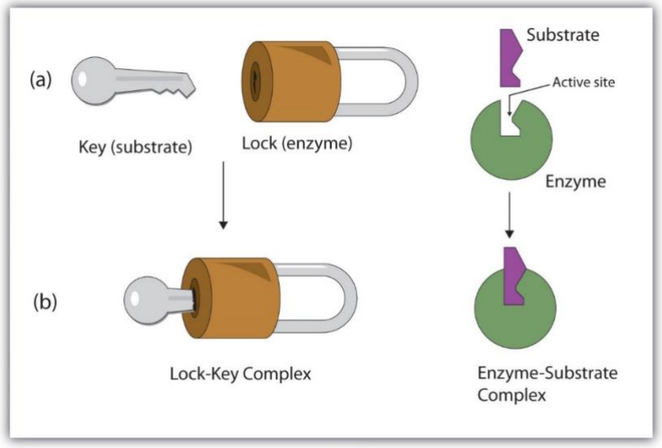
Organs involved in the digestive system and their function:

- **Mouth** –Break-down of food by force (known as mechanical breakdown). Mixes food with saliva, which contains enzymes which break down carbohydrates
- **Oesophagus** – Pushes food down to the stomach (peristalsis – uses smooth muscle)
- **Stomach** – Contains hydrochloric acid (and also contains enzymes that break down proteins)
- **Liver** – produces bile to neutralise stomach acid and emulsify lipids.
- **Small intestine** – absorbs nutrients and contains enzymes that break down lipids and carbohydrates
- **Large intestine** – absorbs water
- **Rectum** – stores poo (faeces)
- **Anus** – ring of muscle allows the removal of waste (egestion) from the digestive system.



Enzymes in digestion act as biological catalysts – they speed up reactions



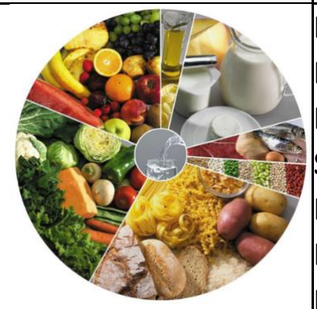
- Enzymes in the digestive system:
  - Protease breaks down proteins into amino acids
  - Lipase breaks down fats into fatty acids and glycerol
  - Amylase breaks down starch (carbohydrate) into glucose

Probiotic bacteria are found in the intestines. They are useful bacteria which aid digestion, e.g., *Lactobacillus* which is found in yogurt and helps digest lactose, and *Bifidobacterium* found in dairy products, which helps with IBS. Probiotic bacteria can also help fight off disease-causing bacteria

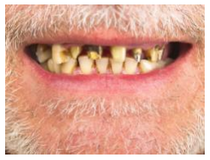
Liver
Bile
Intestine
Rectum
Anus
Bowel
Probiotic
Egestion

8B12 - What are the effects of poor diet and lifestyle?

- Balanced diet proportions including water, fruit, vegetable, dairy, high carbohydrate foods, meat, and beans:



- Deficiency diseases as a result of malnutrition:
  - Scurvy (bleeding gums caused by Vitamin C deficiency) , kwashiorkor (bloated belly caused by protein deficiency), and rickets (bendy bones caused by Vitamin D deficiency).



Diet
Deficiency
Malnutrition
Symptoms
Nutrients
Lactose
Environment
Obesity
Cirrhosis
Dehydration
Cardiovascular

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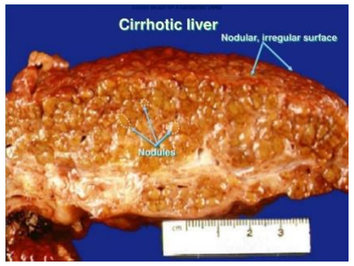
Deficiency diseases are **non-communicable diseases** i.e., they cannot be spread from person to person. They can develop as a result of lifestyle choice, the environment or inheritance.

Other examples of non-communicable diseases:

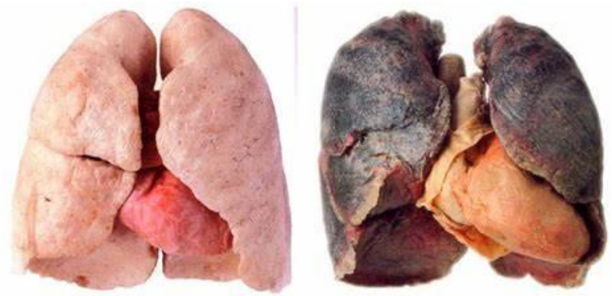
- Obesity – can lead to cardiovascular disease, type 2 diabetes
- Various types of cancer



Effects of alcohol:

- Short term effects of antisocial behaviour, vomiting, loss of coordination, dehydration
- Long term effects of liver damage (cirrhosis), bowel cancer, high blood pressure, dependency, and alcoholism

Effects of smoking – lung cancer, long-term cough, and links to cardiovascular disease.

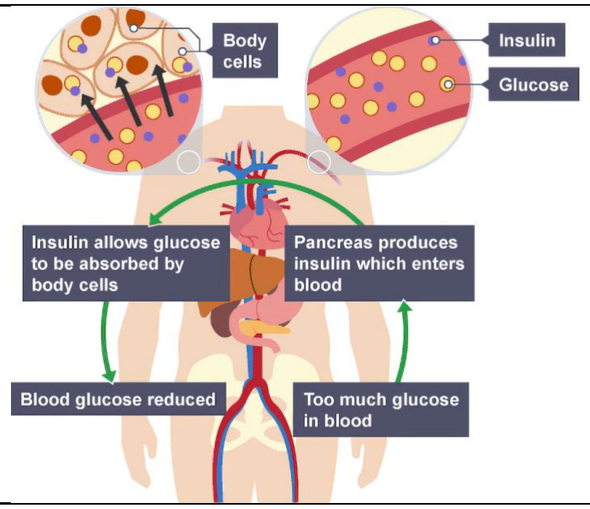


Effects of drugs:

- Stimulants e.g. nicotine, amphetamines, raise heart rate, and attentiveness
- Depressants e.g. alcohol, heroine, slow reactions and cause drowsiness
- Painkillers e.g. paracetamol, morphine, block the ability to feel pain
- Hallucinogens e.g. laughing gas, magic mushrooms, cause you to see and hear things (visual and auditory hallucinations) and change how you sense the world around you

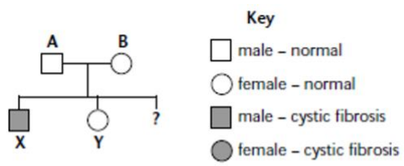
Blood
Behaviour
Stimulant
Depressant
Painkiller
Hallucinogen
Coordination

8B13 - Can DNA contain diseases?



Type 1 Diabetes can be inherited from parents

- Other inherited diseases include cystic fibrosis (recessive) and Huntington's (dominant).
- Punnet squares show probability of inheritance for these 2 inherited diseases.



Cystic fibrosis is caused by a faulty gene 'f'.
We call the normal version of the gene 'F'.

A person can have the following genotypes:

- FF - *normal*
- Ff - *carrier*
- ff - *cystic fibrosis*

Disease
Diabetes
Insulin

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Cystic fibrosis is an inherited disease caused by a recessive allele (f). The Punnett square shows the genotypes of a male and a female and the predicted genotypes for their offspring. What is the missing genotype?

	* Mother	
* Father	• F	• F
• F	• FF	• FF •
• f	• Ff •	Ff

Punnett square

alleles - alternative versions of a gene

Genotype
- FF
- Ff
- ff

Phenotype
- FF, Ff → no cystic fibrosis
- ff → cystic fibrosis

- F dominant allele
- f recessive allele

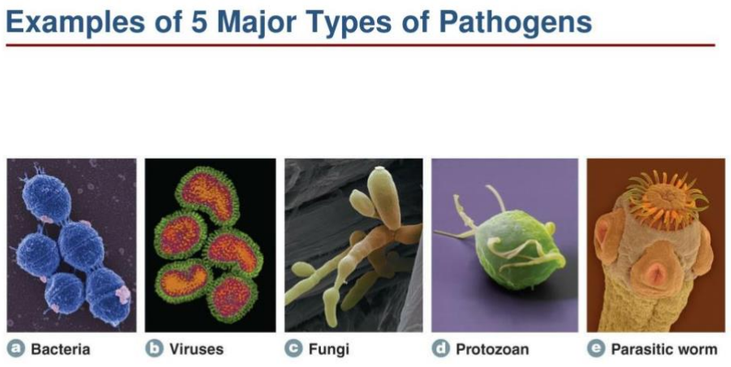
Ff

8B14 - How can diseases spread?

Diseases that that can be passed from person to person are **communicable diseases**. Caused by pathogens.

- Types of pathogens and examples of diseases caused by each :
  - Bacteria – salmonella, TB, cholera
  - Virus – cold, flu, COVID
  - Fungi – athlete's foot, ringworm and thrush
  - Protists – malaria, dysentery

Pathogens are **microorganisms** that cause disease



Microorganism
Pathogen
Bacteria
Virus
Fungi
Protist
Transmission
Hygiene
Physical
Chemical
Mucus
Saliva

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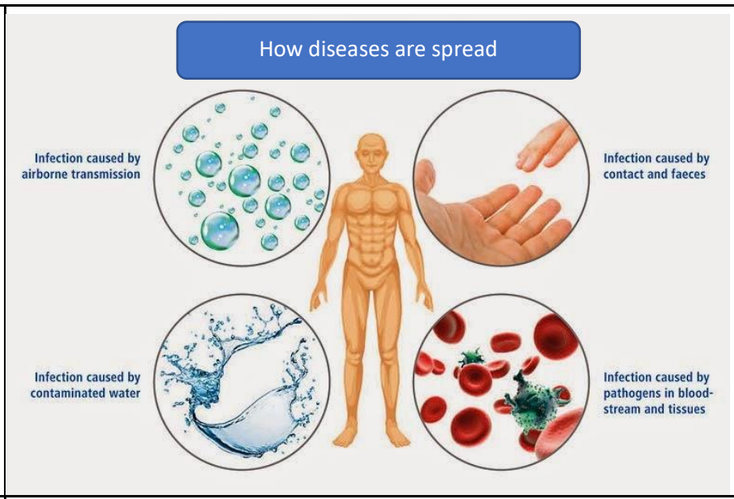


Preventative measures – hygiene, cleaning, isolation, ventilation, 'catch it, bin it, kill it.'

Human defences against pathogens:

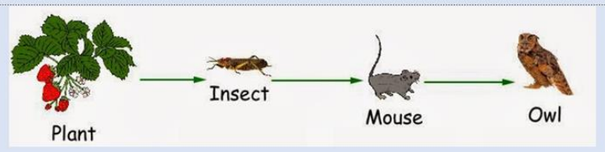
- Physical (hairs, mucus, skin, cilia) and chemical barriers (enzymes in tears, saliva, stomach acid)

How do organisms interact?

Food chains include; producer, consumer, herbivore, carnivore, omnivore, predator and prey

- Arrows show the flow of energy through a food chain/web

Example:



Producer | Primary consumer | Secondary consumer | Tertiary consumer

A food chain starts with a producer, this is a plant which gets its energy from the sunlight through photosynthesis.

An animal called a primary consumer eats the plant and the energy is passed to it. This animal is a herbivore.

The primary consumer is eaten by a secondary consumer which is a carnivore and the energy is passed along again.

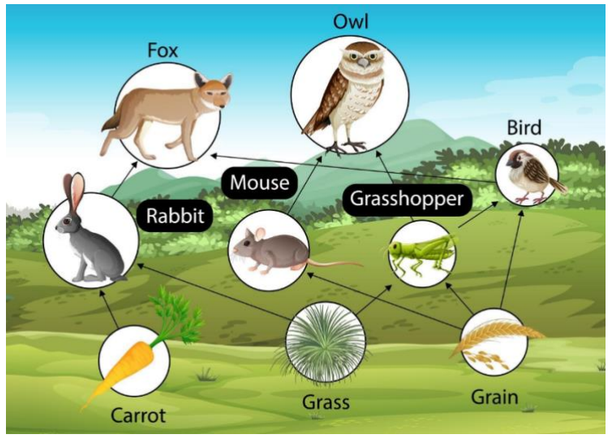
Sometimes a tertiary consumer which is also a carnivore will eat the other consumers.

Biomass

Energy

Adaptation

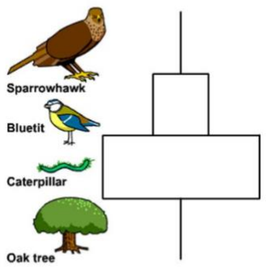
Year 8 biology knowledge organiser



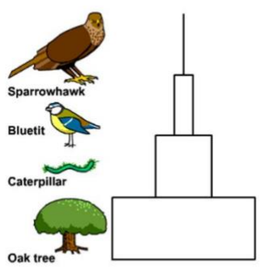
- Food webs to show interdependence – organisms rely on each other

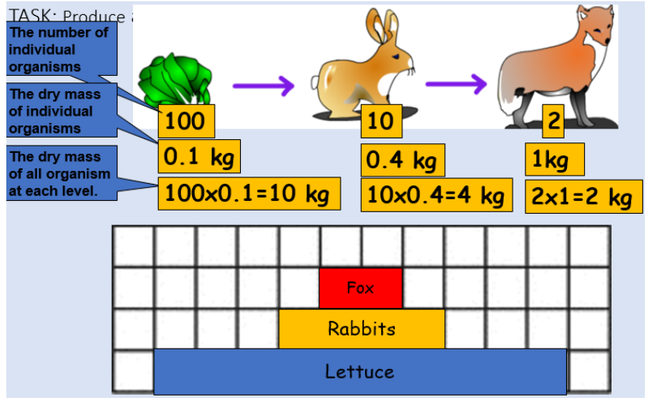
Pyramids of **biomass**:

Pyramid of number



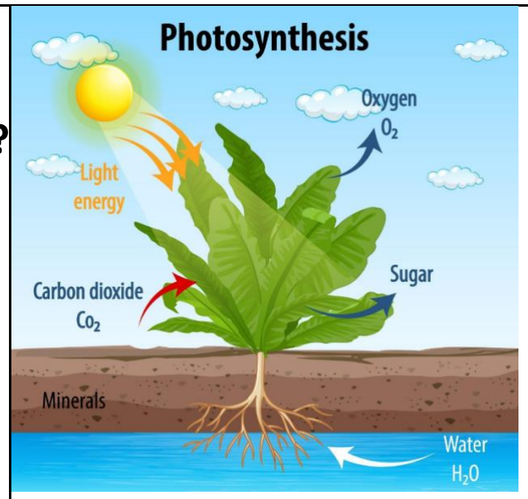
Pyramid of biomass





Year 8 biology knowledge organiser

8B16 - How do plants photosynthesise?

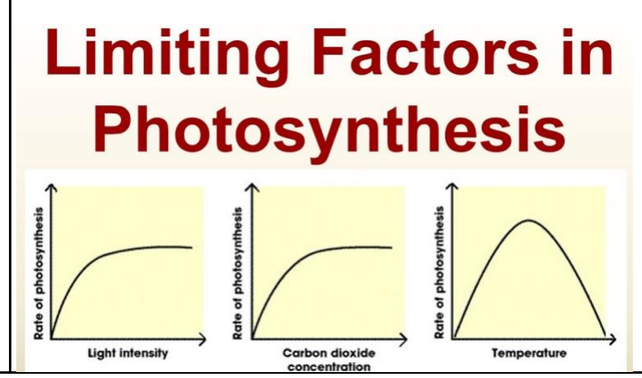


Leaf adaptations include; Flat, large surface area, thin, stomata and palisade cells

- Water is absorbed through roots with large surface area and thin walls
- Limiting factors (light intensity, carbon dioxide concentration, and temperature) affect rate of photosynthesis.

Photosynthesis equation:

carbon dioxide + water $\xrightarrow[\text{(chlorophyll)}]{\text{(light energy)}}$ glucose + oxygen



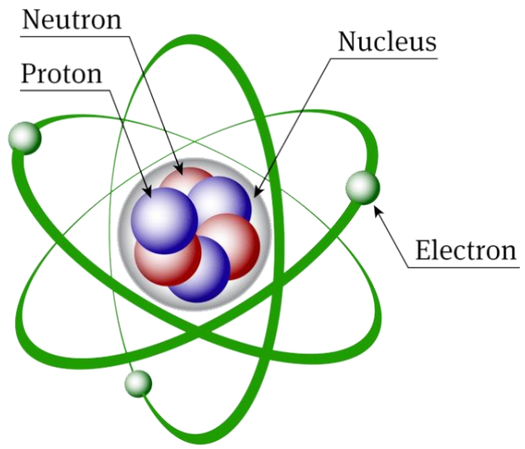
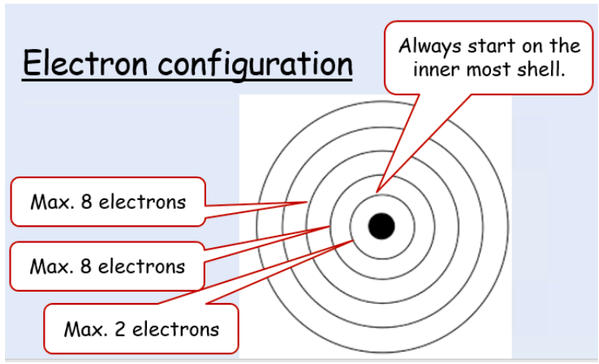
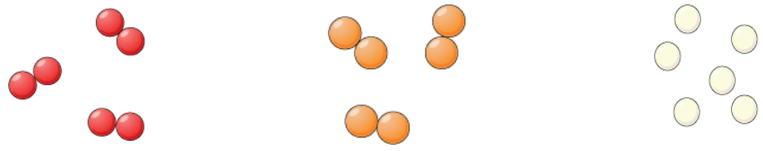
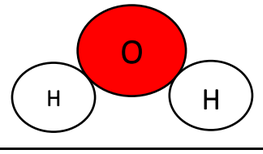
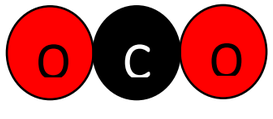
Increasing light intensity, temperature, and carbon dioxide concentration will increase how fast photosynthesis is (aka rate of photosynthesis) to begin with

Increasing light intensity or carbon dioxide will eventually not increase the rate of photosynthesis any more if other factors are limiting the rate of photosynthesis

If temperature is too high, it will decrease the rate of photosynthesis

Photosynthesis

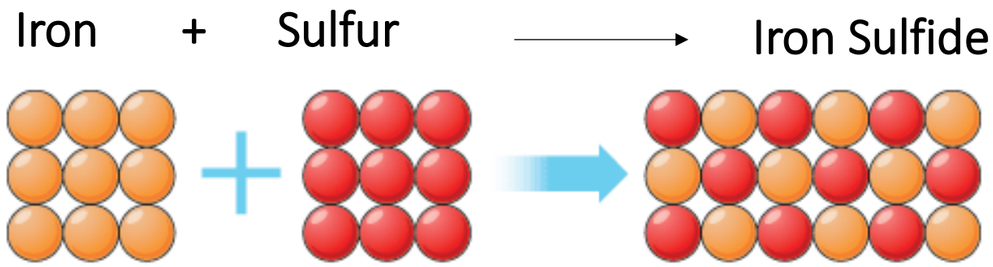
Year 8 chemistry knowledge organiser

Lesson/ composite title	Essential knowledge	Key words
What is the structure of an atom?	 **Particle / Location / Relative Mass / Charge** Proton / Nucleus / 1 / +1 (positive) Neutron / Nucleus / 1 / 0 (neutral) Electron / Shell / 1/1835 (negligible) / -1 (negative) • **The innermost shell is filled first and can hold a maximum of two electrons.** • **The second and third shells holds a maximum of eight electrons.** 	Atom Nucleus Proton Electron Neutron Nucleon Electron Shell Atomic Number Atomic Mass Energy
What is a compound?	An **element** is a substance made up <u>of just one type of atom.</u>  A **compound** is a substance made up <u>two or more different types of atom chemically bonded together.</u>  When non-metal atoms bond together, they form **molecules**. For example, water or carbon dioxide  	Compound Molecule Bond

Year 8 chemistry knowledge organiser

How do compounds form?

- Elements can be joined together in a chemical reaction.
- Iron and sulphur can be reacted to form iron sulphide



- Properties of iron sulphide are different to the two elements – this reaction is irreversible.

A mixture is 2 or more substance not chemically combined and so can be easily separated. This is different to compounds which are elements bonded together.

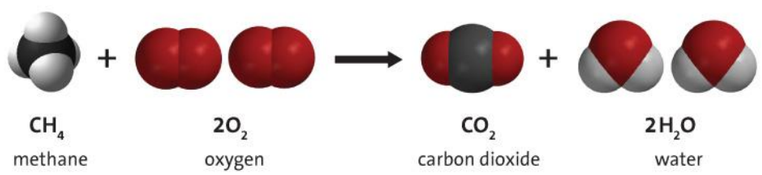
Mixture
Pure
Impure
Separate
Reaction
Reversible
Irreversible

How can we represent a reaction?

reactants → products

(starting substances) → (end substances)

e.g. methane + oxygen → carbon dioxide + water



Metal + Non metal – ending changes to 'ide'

E.g. Magnesium and Oxygen → Magnesium Oxide

For compounds containing two elements plus oxygen, the ending of the other non-metal usually changes to "-ate".

E.g. Magnesium, Nitrogen and Oxygen → Magnesium Nitrate

Reactant
Product
Reaction
Formula

Year 8 chemistry knowledge organiser

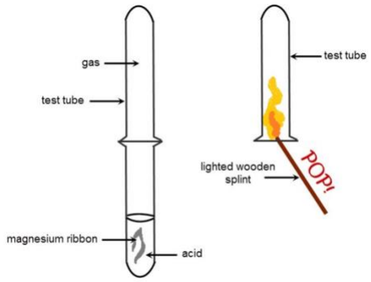
How do acids react with metals and their compounds?

First reaction: Metal and acid

metal + acid → salt + Hydrogen

For example the reaction between hydrochloric acid and magnesium.

Magnesium + Hydrochloric acid → Magnesium Chloride + Hydrogen



To test for hydrogen gas we do the squeaky pop test

Second reaction: Oxide and acid

metal oxide + acid → salt + water

For example the reaction between hydrochloric acid and calcium carbonate (marble).

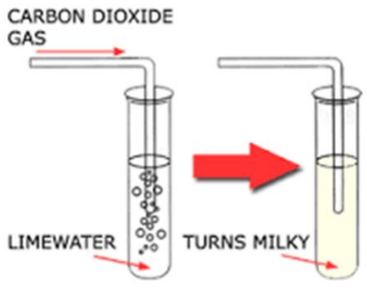
Calcium oxide + Hydrochloric acid → Calcium Chloride + water

Third reaction: Carbonate and acid

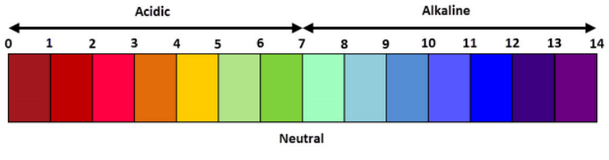
metal carbonate + acid → salt + Carbon dioxide + water

For example the reaction between hydrochloric acid and calcium carbonate (marble).

Calcium carbonate + Hydrochloric acid → Calcium Chloride + Carbon dioxide + water



To test for carbon dioxide – bubble gas through limewater. Limewater turns milky



Adding an acid and an alkali together is an example of a neutralisation reaction.

Fourth reaction: Alkali and acid

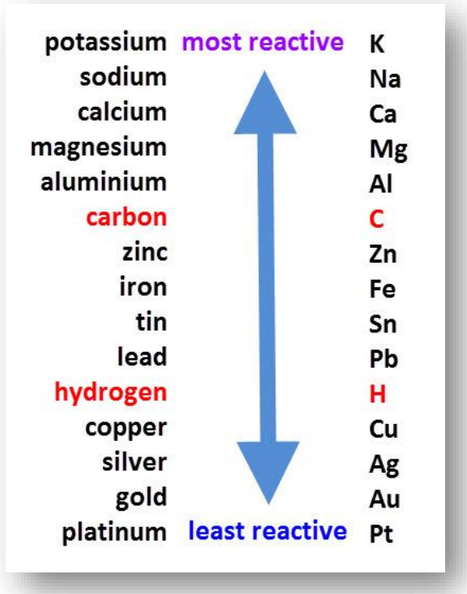
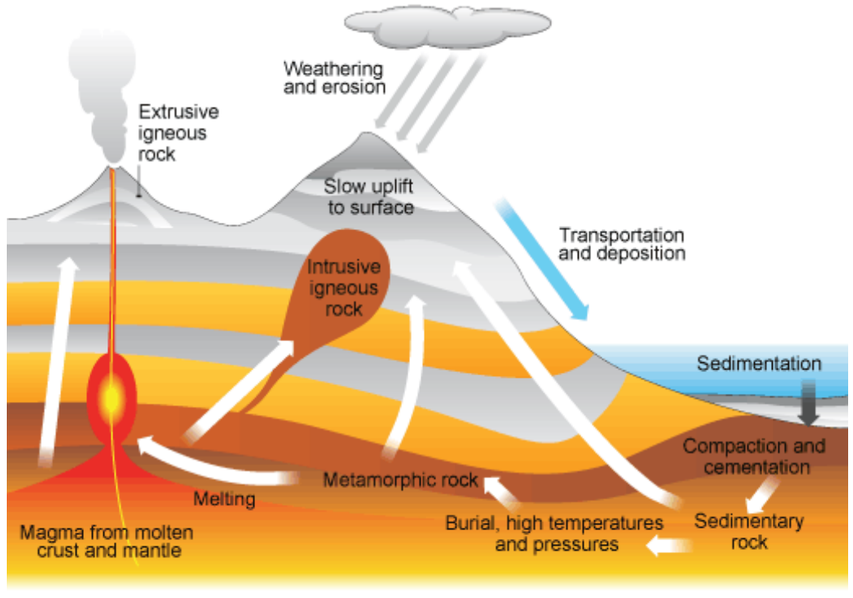
ACID + ALKALI → SALT + WATER

For example the reaction between hydrochloric acid and sodium hydroxide.

Hydrochloric acid + Sodium hydroxide → Sodium chloride + water

Indicator
Acid
Effervescence
Salt
Carbon dioxide
Equation

Year 8 chemistry knowledge organiser

Which is the most reactive metal?		Reactivity - how likely an element is to undergo a chemical reaction The reactivity series: Metals at the top are the most reactive. More reactive metals replace less reactive metals in chemical reactions. E.g. Iron chloride + potassium → potassium chloride + iron	Reactivity Observation Compare Contrast
How do rocks change?	The rock cycle: 	**Examples of each rock:** Igneous – Granite Sedimentary – Limestone (often contains fossils in the layers) Metamorphic - Marble	Transportation Deposition Sedimentation Sedimentary Metamorphic Magma Compaction Cementation Erosion Weathering

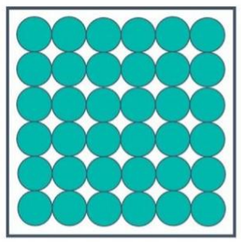
Year 8 chemistry knowledge organiser

Why do substances change state?

Matter is the material from which everything is made. It can exist as three states: Solid, liquid and gas

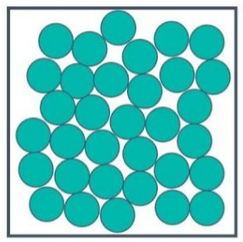
State changes are **physical changes**. They can be **reversed.**

Particle diagrams:



Solid

Particles in solids vibrate



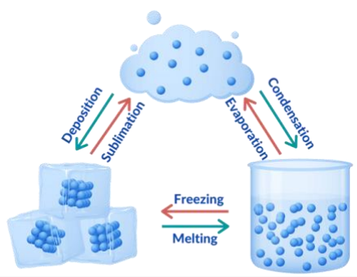
Liquid

Particles in liquids can move over one another

Gas

Particles in gases are spaced out. They move quickly and randomly

State changes:

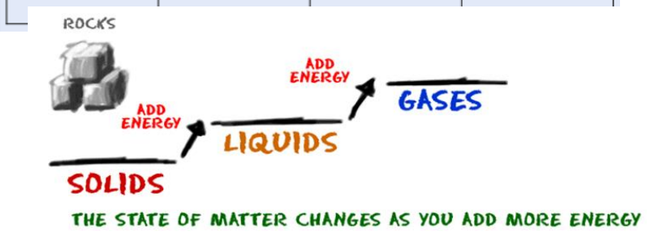


Properties of solids, liquids and gases:

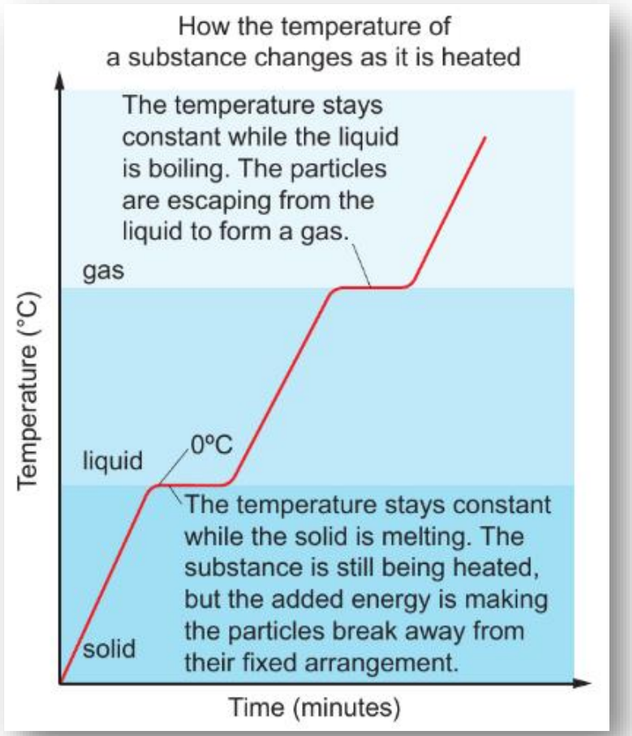
Solids
Liquids
Melting
Boiling
State
Particles
Energy

Year 8 chemistry knowledge organiser

Property	Solid	Liquid	Gas
Is the shape fixed or can it change?	Fixed	Shape of the container	Shape of the container
Does it flow?	Cannot flow	Can flow	Can flow
Is it easy to squash?	No	No	Yes
Can you change its volume?	Fixed Volume	Fixed Volume	No Fixed Volume
Does it feel heavy or light?	Heavy	Heavy	Light



As a substance changes state the temperature remains constant..



What is a solution?

A **solvent** – the liquid in which a substance dissolves to make a solution

A **solute** – a substance that dissolves in a liquid to make a solution

A **solution** – formed when a substance has dissolved in a liquid

Temperature increases the solubility of some substances, such as salt in water.

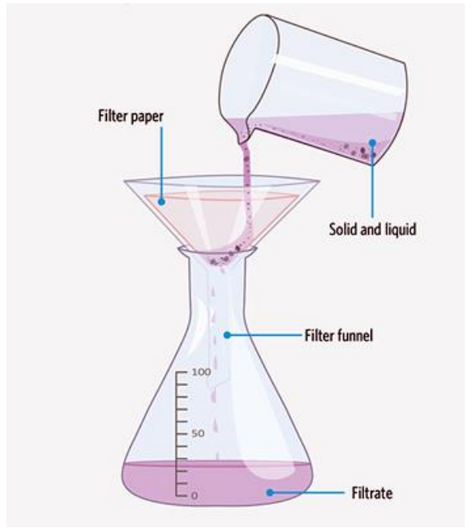
Solute
Solvent
Solution
Dissolve
Soluble
Insoluble

Year 8 chemistry knowledge organiser

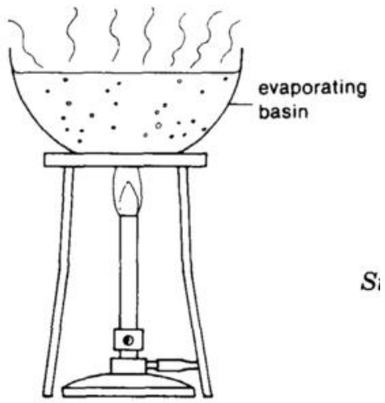
How can we separate a mixture?		Filtrate Distillate Condense Chromatography

Filtration, or **filtering**, separates a liquid from an **insoluble** solid.

Filtering also separates a **solution** from an **insoluble solid.**

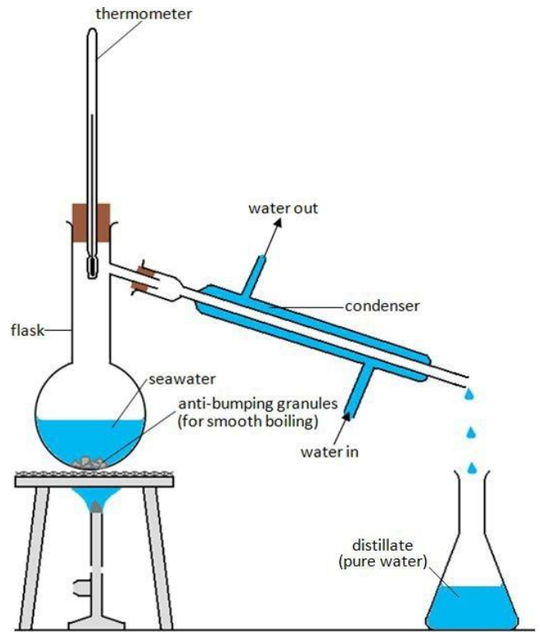


Crystallisation is heating a solution and separating the solvent and the solute to leave crystals.



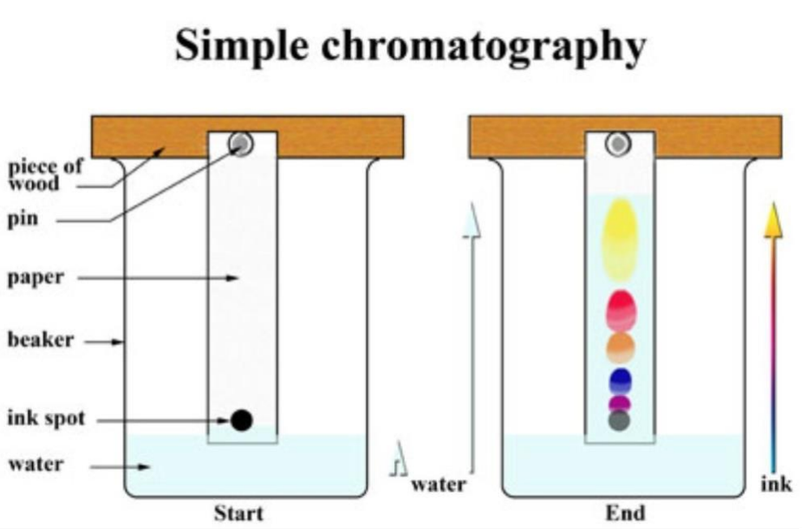
The solution is heated to evaporate most of the solvent.

Distillation is separating mixtures based on different boiling points. The substance with the lower boiling point evaporates and condenses first.



Year 8 chemistry knowledge organiser

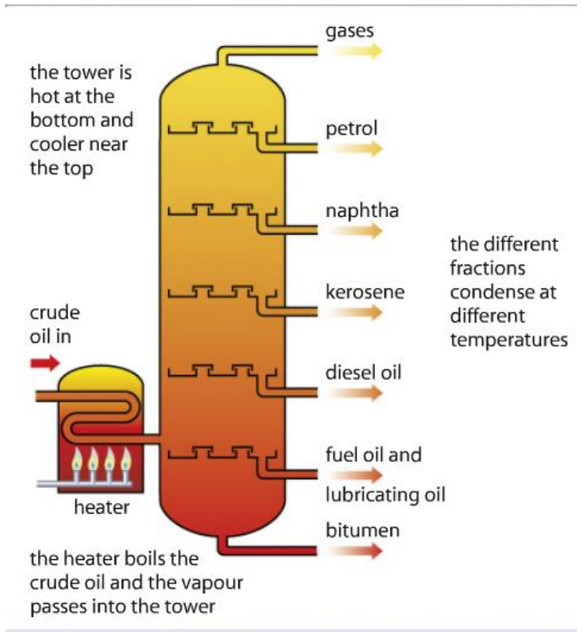
Chromatography (colour writing) is separating soluble substances such as dyes/inks.



The more soluble substances move further up the paper

A line is drawn in pencil before the ink spots are placed

How do we separate fuels?



B *Fractional distillation separates heated crude oil into fractions.*

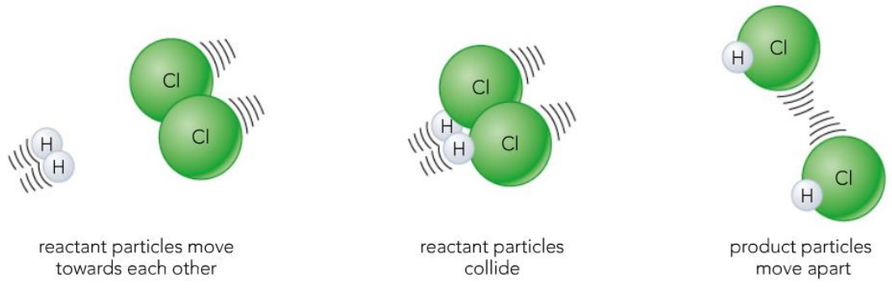
A **fuel** is a substance that can combust to release energy.
Crude oil is a mixture of fuels such as petrol and diesel.
Fractional distillation separates crude oil into the difference fuels.

Main use of fractions:

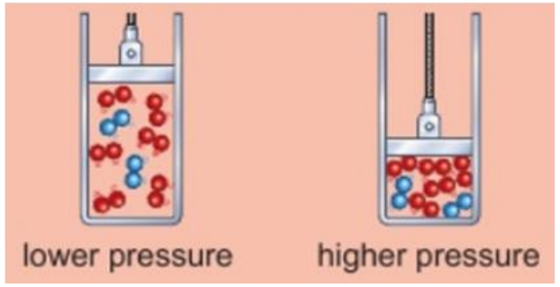
- Gases (methane, heating/cooking/camping)
- Petrol (fuel for cars)
- Kerosene (fuel for aircrafts)
- Diesel (fuel for lorries, trains)
- Fuel oil (factories, ships)
- Bitumen (surfacing roads, waterproofing roofs)

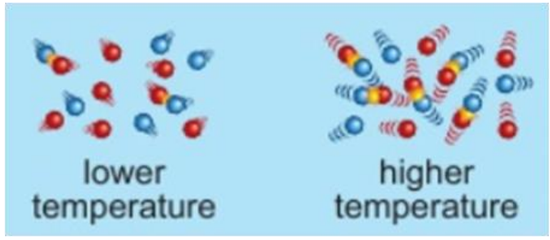
Fuel
Fractional distillation

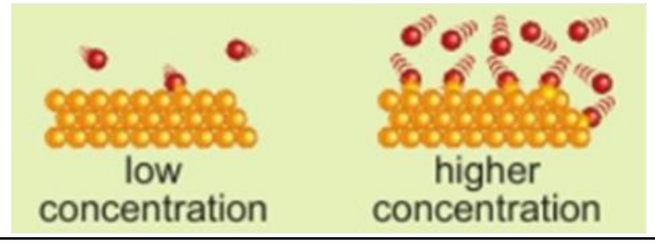
Year 8 chemistry knowledge organiser

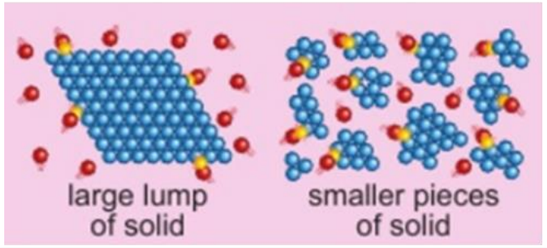
What is combustion?	**fuel + oxygen → carbon dioxide + water**  Combustion requires fuel, oxygen and heat. These makes up the fire triangle. Combustion can be complete or incomplete.	Combustion
What affects the rate of a reaction?	The number of successful collisions per second gives you the rate of reaction  Factors which affect the number of collisions: - Temperature - Particle size/surface area - Concentration of solution - Pressure of gas - A Catalyst (a substance which speeds up the rate of reaction without getting involved)	Energy Particles Rate Collisions Concentration Kinetic

Year 8 chemistry knowledge organiser

<table>
<tr>
<td></td>
<td>
Pressure:


Temperature:


Concentration:


Surface area:


</td>
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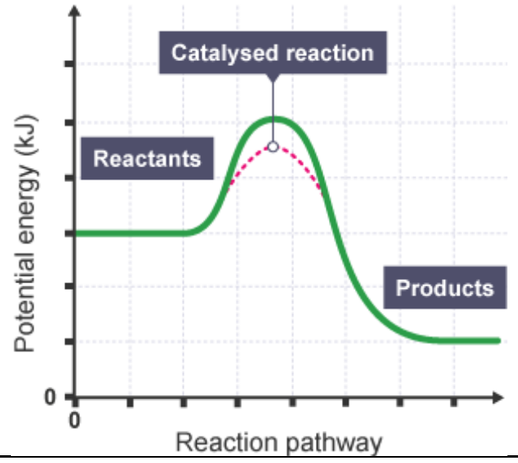
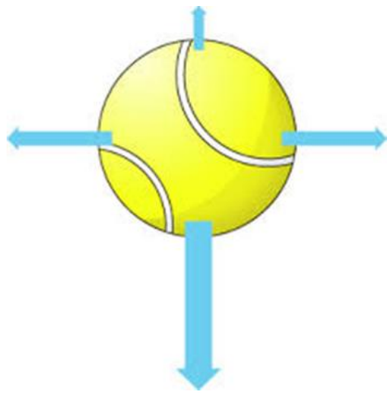
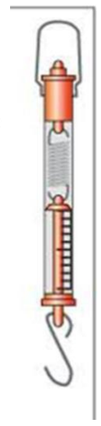
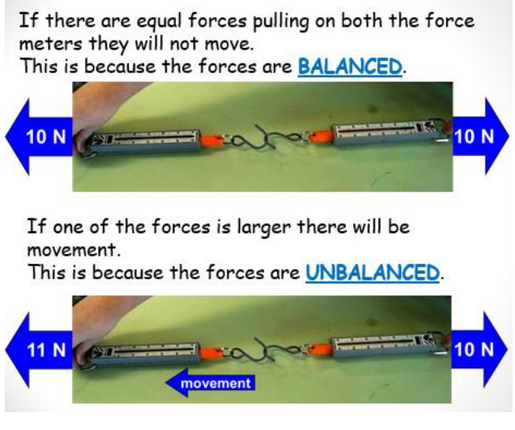
<tr>
<td>What is a catalyst?</td>
<td>
A catalyst is as a substance which speeds up the rate of reaction without getting involved.
They lower the activation energy- the amount of energy atoms need to react.


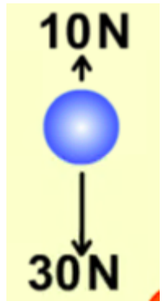
A real life example – catalytic converters in cars speed up how quickly harmful gases get converted into less harmful gases.
</td>
<td>Catalyst</td>
</tr>
</table>

Year 8 physics knowledge organiser

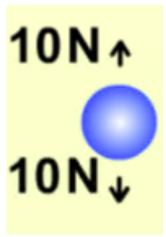
Composite title	Essential knowledge	Key words
What are forces?	Forces are a **push** or **pull** which can change the speed, direction or shape of an object. All forces are measured in **Newtons (N)** Types of forces include: Air resistance, Water resistance, Upthrust, Friction, Static electricity, Magnetism We cannot see forces so we need to use diagrams to represent them. **FREE BODY DIAGRAMS** show the forces acting on an isolated object. Free body diagram:  **Free body diagrams…** • Use arrows to represent forces. • The direction of the arrow shows the direction of the force. • The size of the arrow represents the size of the force.  Forces are measured in **NEWTONS** using a **FORCE METER**. Objects can be hung from the hook at the bottom of the force meter the scale will show the strength of the force in Newtons.  Forces acting on a single object can be **balanced** or **unbalanced**. If forces are **balanced** the motion of an object will not change – the object will be **stationary** (still) or will be travelling at a **constant speed**. **Unbalanced** forces cause the objects motion to change e.g. accelerate or decelerate.  	Force Newtons Air resistance Water resistance Upthrust Friction Static electricity Magnetism Free-body digrams Resultant forces

Year 8 physics knowledge organiser

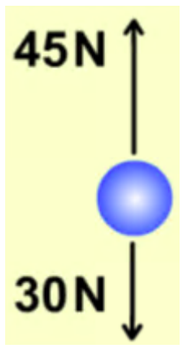
Calculating **resultant** forces:
The resultant force is the overall effect of the forces acting on an object.



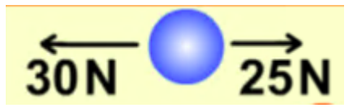
Resultant force = 20N down



Resultant force = 0N



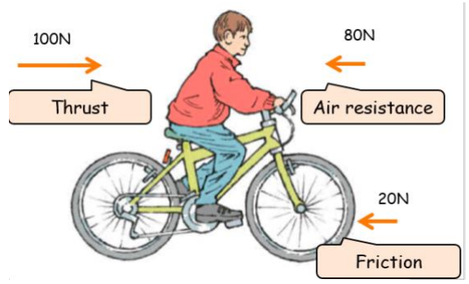
Resultant force = 15N up



Resultant force = 5N Left

If forces are acting in opposite directions you subtract the numbers.

If the forces are acting in the same direction you add them together.



Resultant force = 0N

-

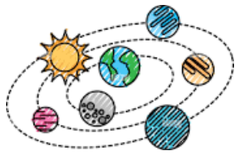
What is mass, weight and gravity?

Weight as a **force** that acts towards the Earth. It is caused by gravity (a gravitational field).
Weight is measured in **Newtons** with a **Newton meter**.

Mass as the amount of 'matter' in an object.
It is measured in kg, using scales.

Gravity is an attraction between masses.

- Gravity keeping planets in orbit around Sun.
- Gravity keeping the moon in orbit around Earth



Every object with mass has a gravitational pull

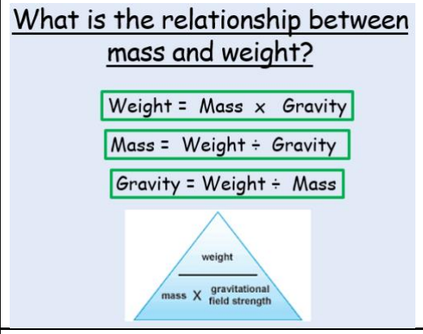
The greater the mass of an object the greater the gravitational pull

Mass
Kilograms
Weight
Force
Newtons
Gravitational field
Gravity
Orbit

Year 8 physics knowledge organiser

Strength of the gravitational field on Earth is 10N/kg.

Calculating weight
Weight = Mass x gravity



Planet	Diameter (Compared to Earth)	Gravitational Field Strength
Mercury	0.4	4 N/kg
Venus	0.9	9 N/kg
Earth	1	10 N/kg
Mars	0.5	4 N/kg
Jupiter	11	23 N/kg
Saturn	9	9 N/kg
Uranus	4	9 N/kg

Gravitational field strength on different planets.

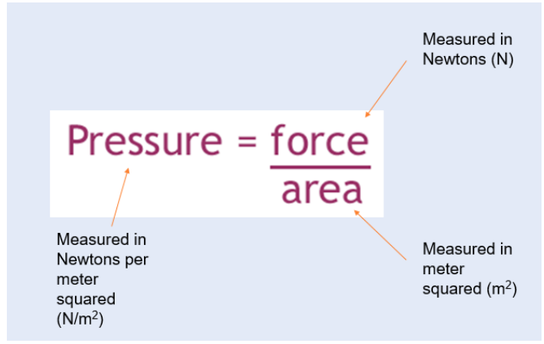
(You do not have to remember the gravitational field strengths of the different planets)

Mass remains the same in different gravitational fields but weight changes because the gravitational pull changes.

What is pressure?

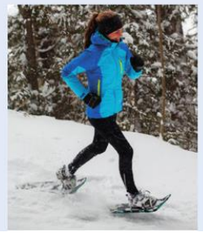
Pressure as how much something is 'pushing' on something else.

Calculation of pressure:
Pressure = force / area



How do snow shoes stop the person from sinking into the snow?

- The snow shoes increase the **area** that the **force** (weight) is spread over, so the **pressure** on the snow is less



If a force is applied over a **large area** the pressure will be **smaller**.

If a force is applied over **a small area** the pressure will be **larger**.

Pressure
Force
Area

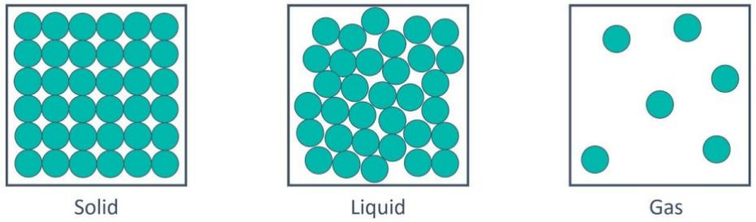
Year 8 physics knowledge organiser

What is atmospheric pressure?

Recap: states of matter:

Matter is the material from which everything is made. It can exist as three states: Solid, liquid and gas

Particle diagrams:

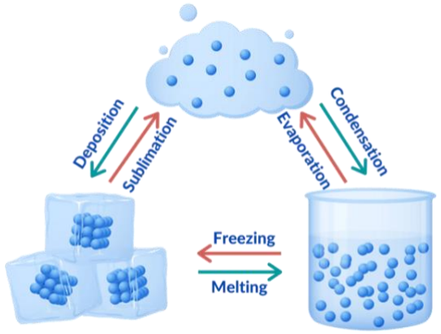


Particles in solids vibrate

Particles in liquids can move over one another

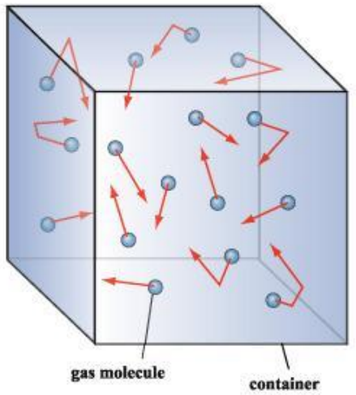
Particles in gases are spaced out. They move quickly and randomly

State changes:



Gas pressure is caused by particles colliding with (pushing) the sides of a container.

- The more particles the higher the pressure as there are more collisions.
- Pressure can be measured in N/m^2 or Pascals (Pa)
- Atmospheric pressure is 100,000 Pa



Increasing the temperature of gas particles will also increase pressure as the gas particles have more energy so collide with the sides more.

Gas
Collisions
Pascals

How is pressure caused in liquids?

Pressure is a measure of the force on a unit of surface area. Pressure = Force/area

Pressure is exerted by all fluids (liquids and gases)

Both liquids and gases can 'flow' so they are known as fluids.

Pressure depends on the

- depth of the fluid. (The deeper something is the more weight (force) is above you to exert pressure) e.g. at sea level you have more air above you than at the top of a mountain.
- The density of the fluid.

Water is over 800 times denser than air at sea level, if you dive 10m down you will double the pressure that you felt at the surface

Pressure
Depth
Weight
Fluid

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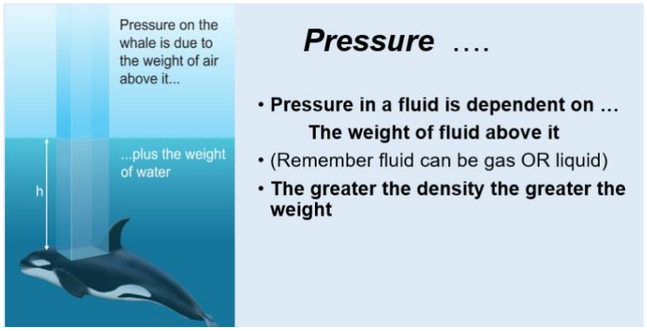
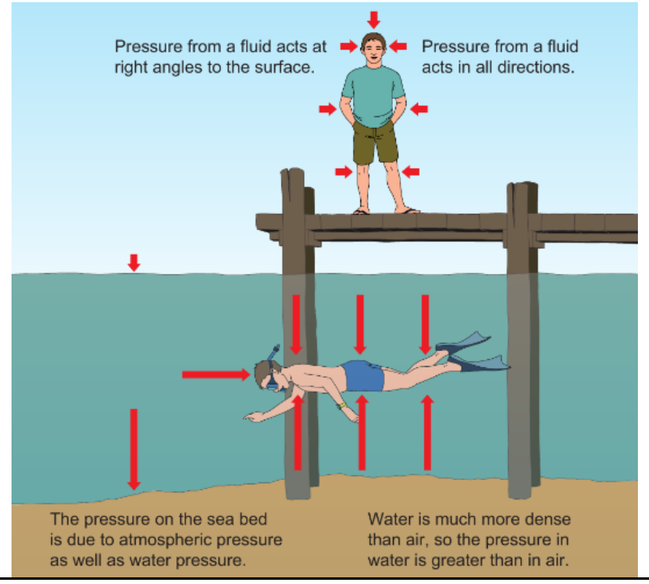
Pressure is greater in liquids than in gases because the density of particles is greater in liquids.

Pressure in a fluid acts in all directions.





How can we explore space?

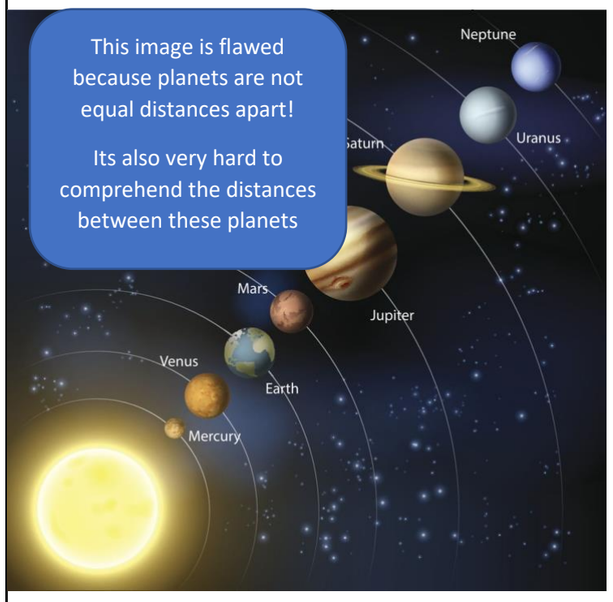
Our solar system consists of the sun (a star) and 8 planets (plus dwarf planets, comets, asteroids and many other things)

The order of the planets from the sun are:

Mercury, **V**enus, **E**arth, **M**ars, **J**upiter, **S**aturn, **U**ranus, **N**eptune

Many mnemonics can be used to help remember the order of planets including:

My **V**ery **E**asy **M**ethod **J**ust **S**peeds **U**p **N**aming (planets)



How we explore space:
-International space station (ISS)
-Probes/telescopes
-Rovers e.g. Mars rover

There are many dangers of exploring the solar system, this includes:
-Vladimir Komarov 1967: Parachute failed upon re-entry
-Soyuz 11 crew 1971: Cabin decompressed in space
-Challenger crew 1986: Shuttle exploded

Solar system

Year 8 physics knowledge organiser

There are many arguments for and against exploring space. Some reasons are outlined below:

Arguments for exploring space:	**Arguments against exploring space:**
• Humans are curious and like to explore. • To search for life on other worlds. • To inspire people. • To develop new technologies that can benefit life here on Earth. • To ensure the long-term survival of the human race. • To find new resources. • By studying other planets, we can compare them to the Earth and learn more about our home planet.	• Government money used for space travel should be spent to help people here on Earth instead. • Space exploration is too dangerous and too expensive. • There are lots of things we still don't know about our own planet.

How fast?

Re-cap of Y7:

SPEED is the measure of how much distance an object moves in a set time.

Speed – m/s (meters per second)
Distance – m (meters)
Time – s (seconds)

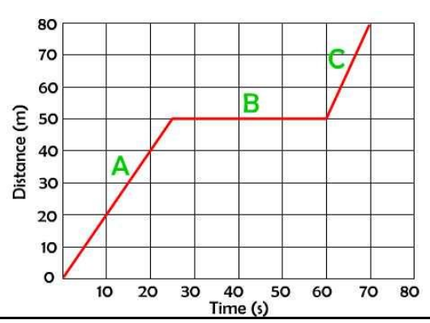
$$\text{Speed} = \frac{\text{Distance}}{\text{Time}}$$

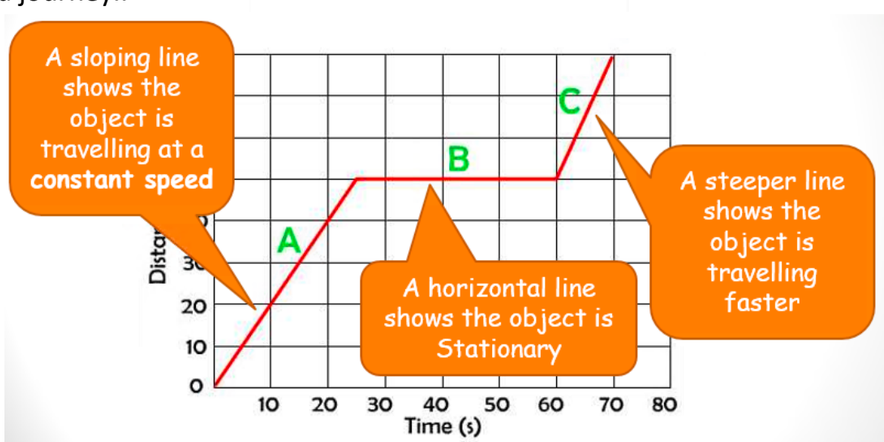
$$\text{Distance} = \text{Speed} \times \text{Time}$$

$$\text{Time Taken} = \frac{\text{Distance}}{\text{Speed}}$$

Distance/Time graphs can be used to show a journey..

Example distance time graph. The distance travelled is plotted against the time it took to travel the distance

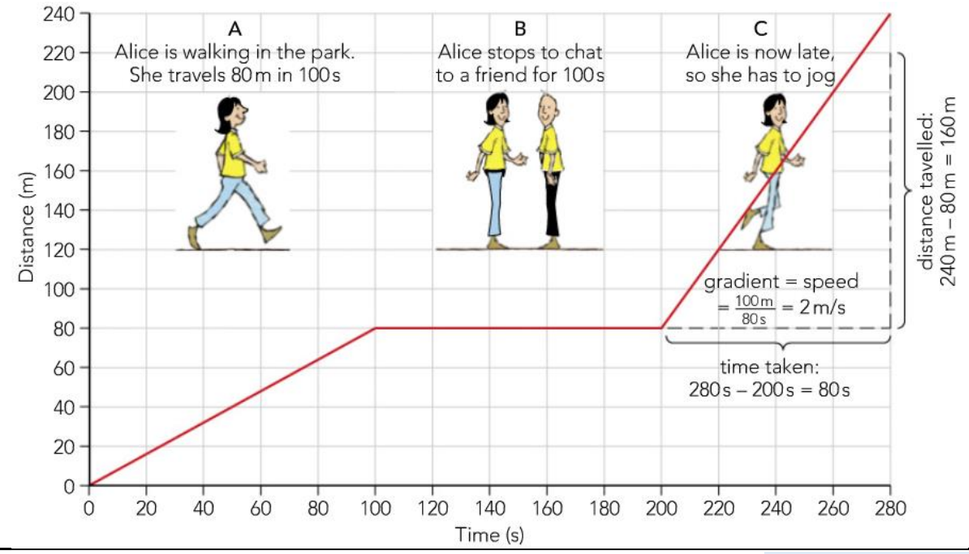




Speed
Distance
Time
Distance/time graph
Gradient

Year 8 physics knowledge organiser

Speed is calculated from a distance/time graph by calculating the gradient of the line.



What is acceleration?

Acceleration is a rate of change of speed (how quickly an object is changing speed)

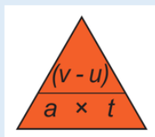
Acceleration is measured in m/s^2.

Velocity is speed in a given direction

Calculating acceleration

$$\text{acceleration} = \frac{\text{change in velocity}}{\text{time taken}}$$

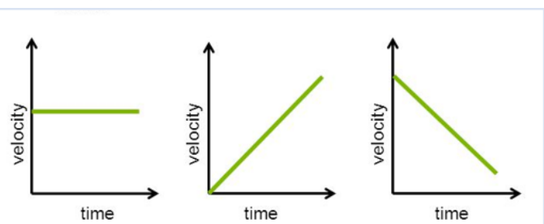
- a is the acceleration
- v is the final velocity
- u is the initial velocity
- t is the time taken for the change in velocity.



Acceleration
Velocity

How can we show acceleration?

Velocity/time graphs demonstrate how velocity changes over time.



A horizontal line shows an object at a constant velocity or stationary	A sloping upwards line shows a constant acceleration	A sloping downwards line shows a constant deceleration (negative acceleration)

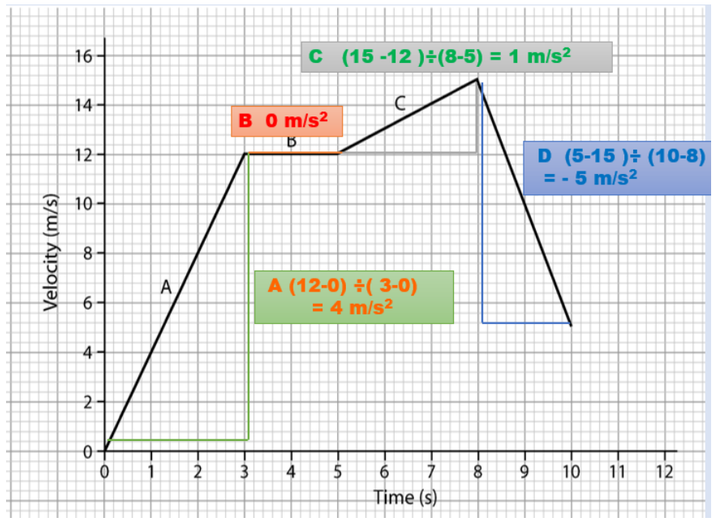
- Horizontal line shows an object travelling at a constant velocity
- Upwards sloping line demonstrates an object accelerating
- Downwards sloping line demonstrates an object decelerating.

Velocity
Acceleration
Distance
Time

Year 8 physics knowledge organiser

Calculations from a velocity time graph

- **Acceleration** is calculated from the gradient of the line:

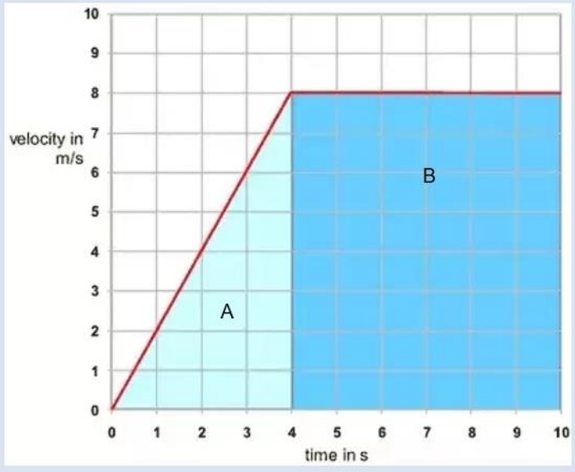


Reminder:

Acceleration = change in velocity / time

- **Distance** is calculated by finding the area under the line:

These are velocity - time graphs, this means that the distance is found by calculating the area underneath the graph.



Reminder:

Distance = Speed x Time

Area under section A:

8m/s x 4s = 32m (area of the rectangle)
32 / 2 = **16m** (area of the triangle)

Area under section B:

8m/s x 6s = **48m**

Year 8 physics knowledge organiser

What are waves?

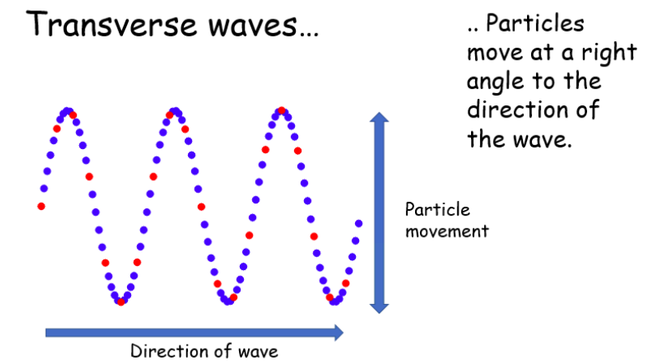
A wave is the transfer of with no overall transfer of matter

There are 2 different types of wave.

1. Transverse waves

In transverse waves particles vibrate up and down. The direction of the wave is from left to right. Therefore, transverse waves are defined as 'a wave where particles travel at a right angle to the direction of the wave.'

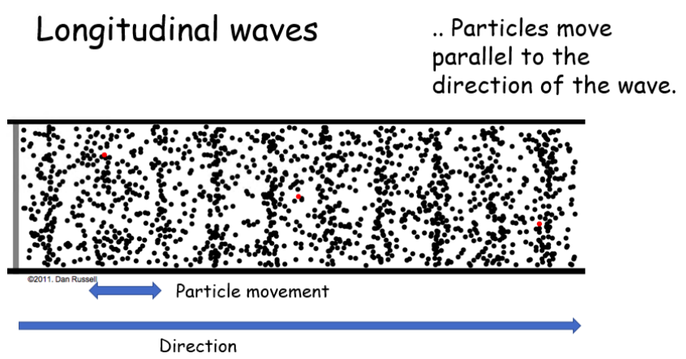
Examples of transverse waves include:
Light waves, water ripples, x-rays, radio waves, microwaves.



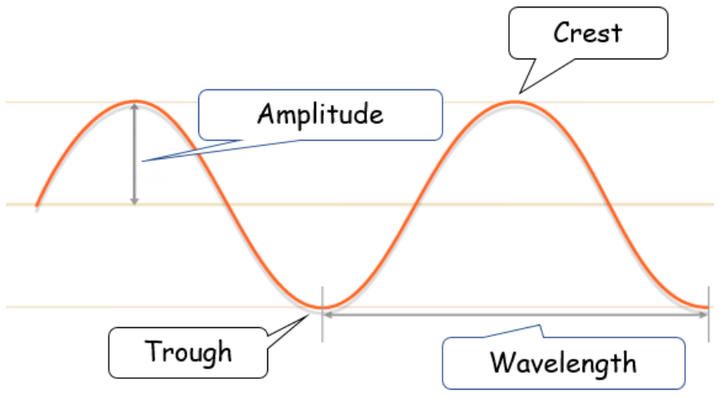
2. Longitudinal waves

In longitudinal waves particles vibrate back and forth, the direction of the wave goes from left to right. Therefore, longitudinal waves are defined as 'a wave where particles move parallel to the direction of the wave.'

Examples of longitudinal waves
Sound waves, seismic waves (shock waves from earthquakes)



Labelling a transverse wave:



Crest – highest point in a wave

Trough – lowest point in a wave

Amplitude – distance from the centre line to a crest or trough (measured in metres)

Wavelength – length of one full wave (easiest to measure from one peak to the next. Or from one trough to the next (measured in meters).

Frequency is the number of complete waves per second. Frequency is measured in hertz (Hz).

Wave
Transverse
Longitudinal
Superposition
Interference
Constructive
Destructive

Year 8 physics knowledge organiser

Superposition as when two waves meet they can affect one another (interference)

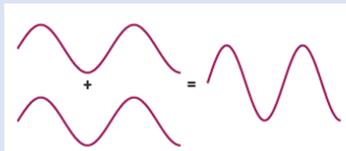
Constructive interference as when two waves coincide with peaks and troughs matching they are said to be in phase.

- If two waves are in phase they add together and reinforce each other. They produce a much higher wave, a wave with a greater amplitude.

Constructive interference (adding)

If two waves coincide with peaks and troughs matching they are said to be **in phase**.

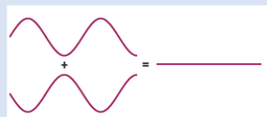
If two waves are in phase they add together and reinforce each other. They produce a much higher wave, a wave with a greater **amplitude**.



Destructive interference (cancelling)

- If two waves coincide with peaks of one meeting troughs of the other they are said to be **out of phase**.
- If two waves are exactly out of phase they will interfere destructively to produce **zero amplitude**.

So, if two waves meet each other out of phase, they cancel out.



Destructive interference as when two waves coincide with peaks of one meeting troughs of the other they are said to be out of phase.

- If two waves are exactly out of phase they will interfere destructively to produce zero amplitude.

How can we measure the speed of a wave?

Wave speed can be calculated by:

Wave speed (m/s) = frequency (Hz) x wavelength (m)

Waves travel at different speeds through different media.
e.g.

Statement	Light	Sound
Speed in a vacuum	299 800 000 m/s	0 m/s
Speed in air (at 20 °C)	299 700 000 m/s	330m/s
Speed in water	225 000 000 m/s	1500 m/s
Speed in steel	0 m/s	5100 m/s
Speed in glass	200 000 000 m/s	2000–6000 m/s
Can it transfer energy	Yes	Yes

Recap:

- Frequency is the number of waves per second
- Frequency is measured in Hertz (Hz)
- 1 Hertz is 1 wave per second.

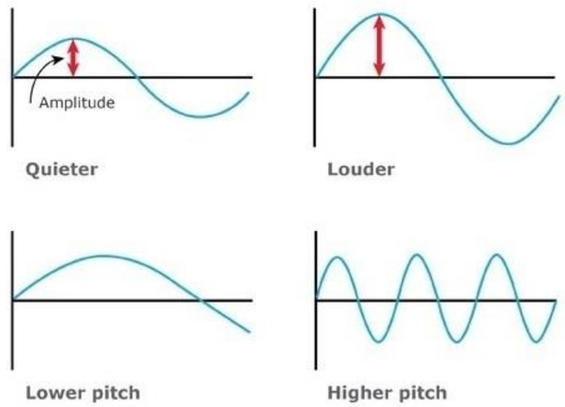
Frequency
Wavelength
Media

Year 8 physics knowledge organiser

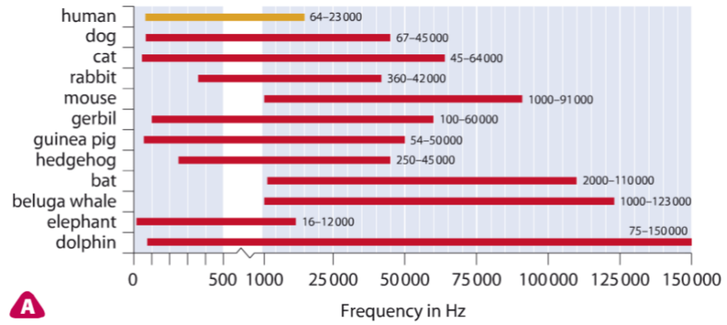
How do we hear?

Sound waves are produced by vibrating particles
e.g. vocal cords, guitar strings, tuning forks

- An increasing amplitude of sound waves increases the sound intensity (volume)
- An increasing wavelength decreases the pitch of the sound
- Link between frequency and wavelength. Shorter the wavelength the higher the frequency.

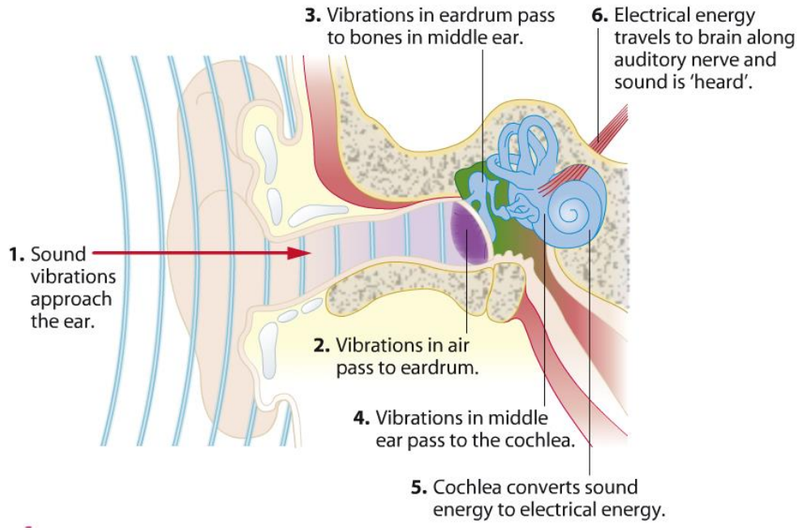


Human hearing range is between 20-20,000 Hz
(but other animals can hear between different frequencies)



Structure of ear:

- **Ear canal** – sound waves travel towards the ear and through the ear canal
- **Ear drum** – As a thin membrane. Sound waves cause the ear drum to vibrate.
- **Small bones** – 3 small bones. The vibrating ear drum causes these bones to vibrate.
- **Cochlea** – converts vibrations into electrical signals (impulses). The bones vibrating cause the liquid in the cochlea to vibrate.
- **Auditory nerve** – sends the electrical signals to the brain.
-



Vibrations
Frequency
Ear canal
Ear drum
Cochlea
Auditory nerve

Year 8 physics knowledge organiser

When is sound a problem?

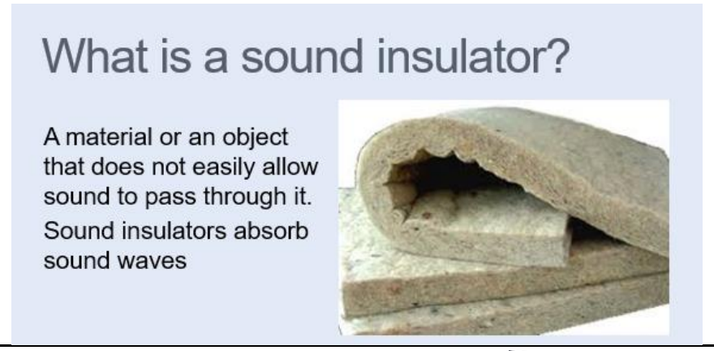
Sound level is measured in **decibels (dB)**

Sound level can be measured using a decibel meter

Ear damage can cause hearing loss, possible causes including:

- The ear can get blocked by wax.
- Accidents or a loud bang could damage the eardrum.
- The middle ear can get infected (by bacteria).
- As people get older the tiny bones in their ears can fuse together and so don't vibrate.
- Sometimes the nerve cells in the cochlea do not work as well when you get older so the signals are not sent to the brain.
- The cochlea can be damaged by loud noise, for example from nightclubs or wearing personal stereos that are too loud.

Sound insulators absorb sound.



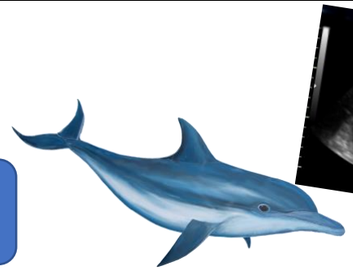
Decibels
Insulation

How can we use sound?

Ultrasound is frequencies of sound above 20,000Hz

- We cannot hear ultrasound
- Uses of ultrasound including: Antenatal scanning, sonar, detecting cracks in structures.

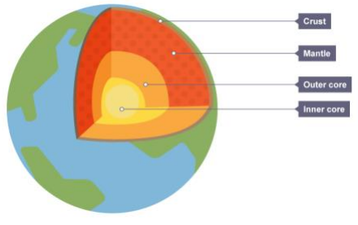
Reminder: 20,000Hz means 20,000 waves per second.



Infrasound is frequencies of sound below 20Hz.

- We cannot hear infrasound.
- Uses of infrasound including animal communication (elephants, giraffes, hippos), investigating the structure of the Earth.

Reminder: 20Hz means 20 waves per second.



Ultrasound
Infrasound
SONAR

Year 8 physics knowledge organiser

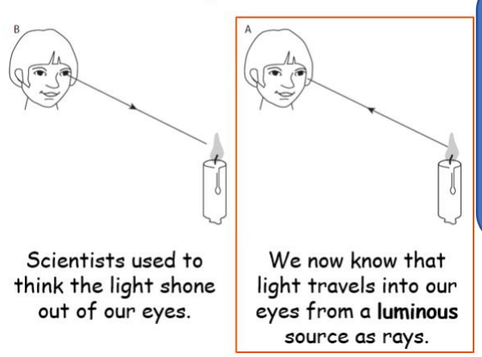
How does light travel?

Recap of light from year 7:

Luminous sources are objects that give off light. **Non-luminous** objects do not give off light.

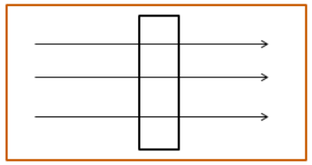
Light travels in rays. Light travels from the luminous objects to a persons eye.

The Direction of Light



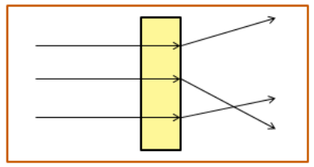
Arrows are always needed on light rays to show the direction light is travelling

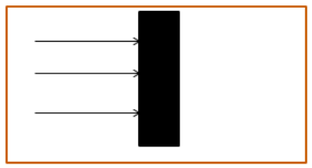
Objects can be **transparent, translucent** or **opaque.**



Transparent – these are materials which let all of the light straight through.

Translucent – these materials let light through but it is randomly scattered.





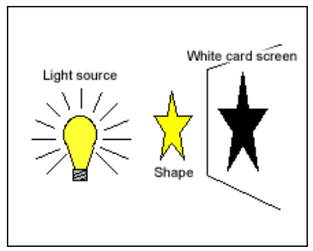
Opaque – these materials let no light through.

Examples:

Transparent	Translucent	Opaque
Clear glass	Frosted glass	Wood
Wine glass	Tracing paper	Book
Air	Cling film	Brick
Clean water	Marble	Steel
		Pencil

Shadows form behind opaque objects because light cannot travel through them. **Light travels in a straight line** so cannot bend around them.

Shadows are the absence of light.



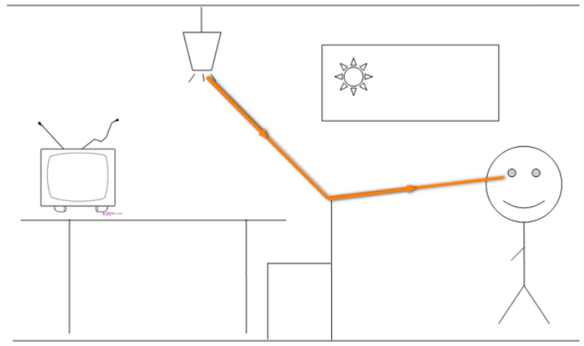
Light travels at approximately 300,000,000m/s!

Remember light is a transverse wave.

Year 8 physics knowledge organiser

Reflection:

Light from luminous sources bounces off (reflects off) opaque objects. Meaning we can see them:



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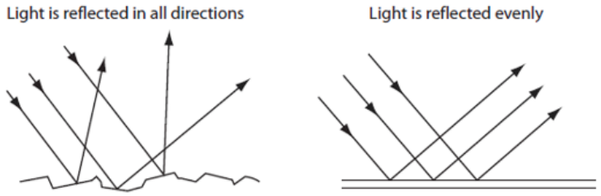
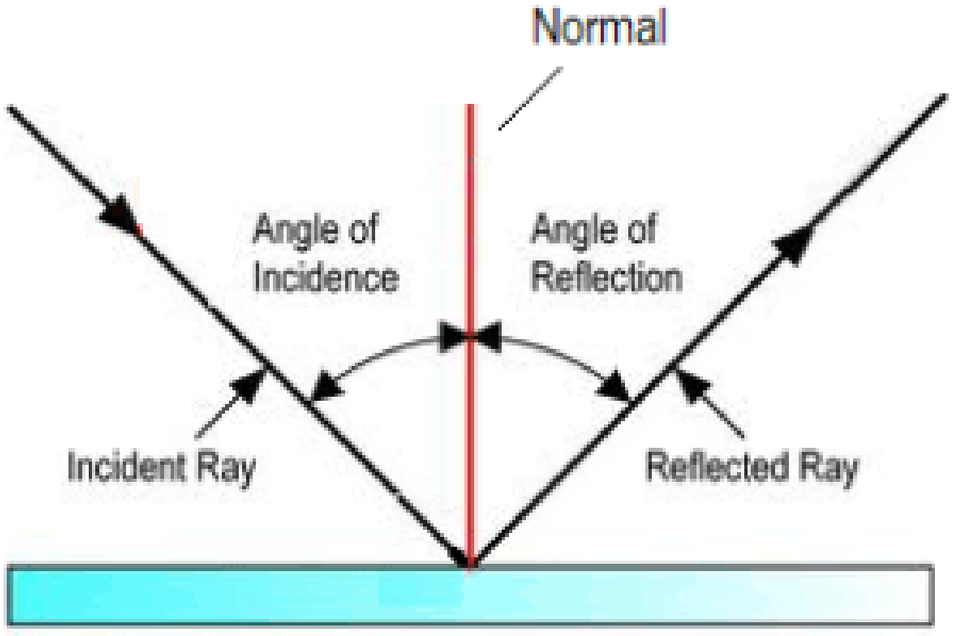
Light scatters in different directions when it reflects off rough surfaces. A mirror has a very smooth surface so it reflects light evenly.



Labelling a ray diagram to show the reflection of light:



The **incident ray** is the light ray coming from the luminous source towards the mirror

The **reflected ray** is the light ray that has reflected off the mirror

The **normal line** is always 90° from the mirror.

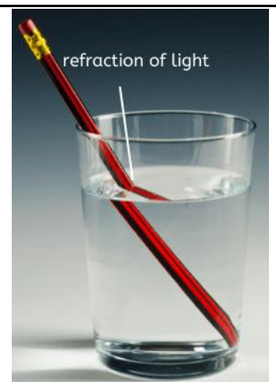
The **angle of incidence** is the angle between the incident ray and the normal line

The **angle of reflection** is the angle between the normal line and the reflected ray.

Law of reflection: angle of incidence = angle of reflection.

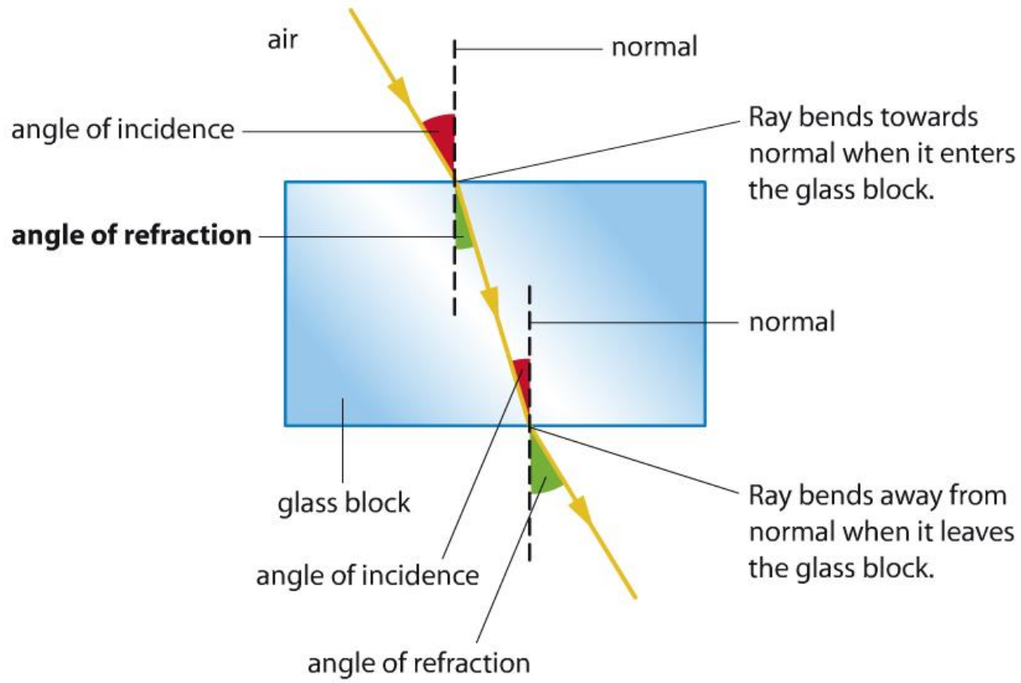
Year 8 physics knowledge organiser

Refraction



Refraction is the changing of a light ray's direction as it passes through different substances.
Refraction is due to light changing speed in different materials.

Construction of ray diagrams to show refraction of light through a glass block:



When light enters a more dense material (e.g. air to glass) it bends **towards** the normal

When light enters a less dense material it bends **away** from the normal.

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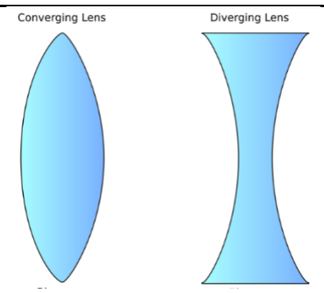
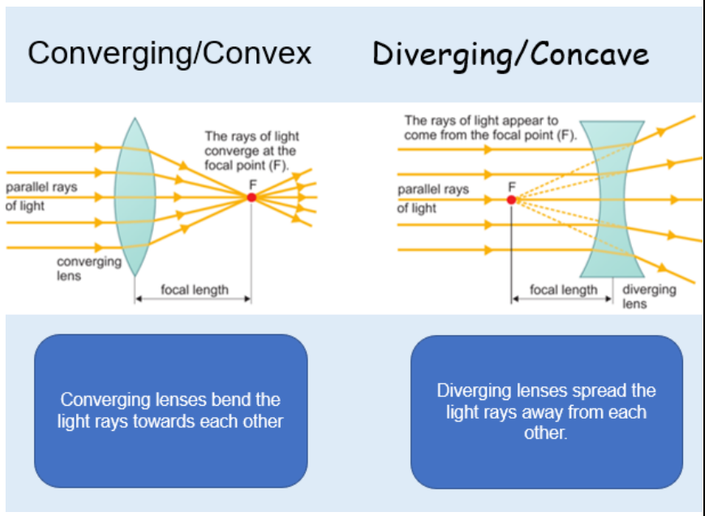
Lenses

There are two main types of lenses – converging and diverging

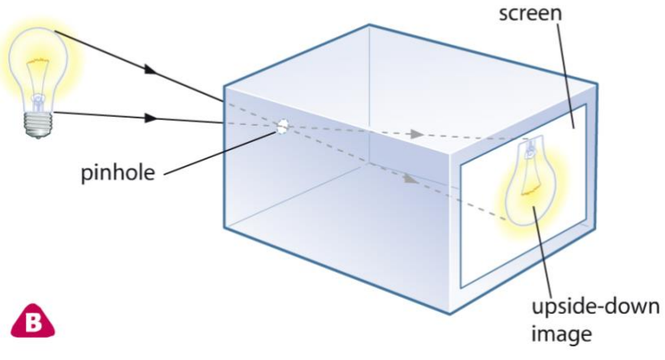


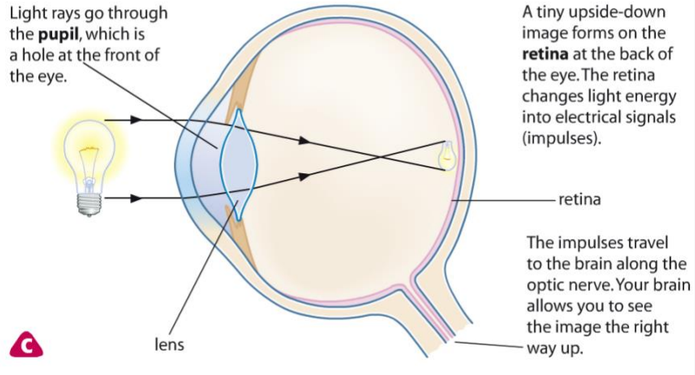
- Converging lenses are thicker in the centre than at the ends.
- Diverging lenses are thicker at edges than in the centre.
- The focal point where the rays of light converge (come together) or where they appear to come from
- Focal length as the distance between the focal point and the centre of the lens
- Converging lenses bend the light rays towards each other
- Diverging lenses spread the light rays away from one another.



Pinhole cameras

Pinhole cameras work very similar to the way our eyes work





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What is energy?

Energy is defined as "something that is needed to make things happen or change"
Energy is always measured in **Joules (J)**

Energy stores include:

- Chemical (e.g. stored in fuels, foods, batteries)
- Kinetic (stored in anything that is moving)
- Thermal (stored in anything that has heat)
- Strain/Elastic potential (stored in stretched springs, or stretched elastic objects)
- Gravitational potential (stored in anything above ground level)
- Nuclear (stored in the nucleus of atoms)

Energy transfers include:

- Mechanical (transferred when a force makes something move)
- Heating (transferred via conduction, convection and radiation – see next lesson)
- Light (Transferred by anything giving off light)
- Sound (Transferred by anything giving off sound)
- Electrical (Transferred where there is electricity e.g. around a circuit)

The law of conservation of energy:

Energy cannot be created or destroyed it can only be stored or transferred.

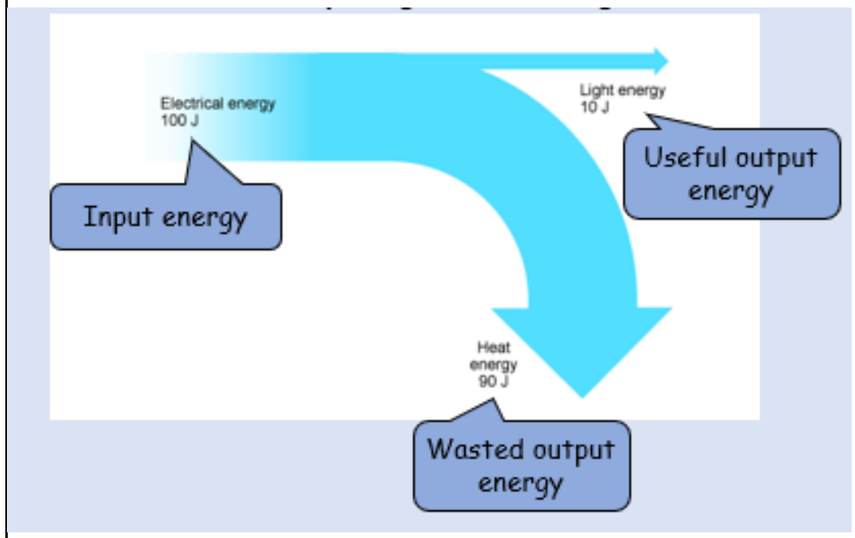
Energy transfer diagrams

When processes happen energy can be transferred from one form to another.

This can be shown on an energy transfer diagram.

Chemical → Electrical → Light

Sankey diagrams are used to show energy transfers. Sankey diagrams identify the useful and wasted energy.



The input energy is equal to the total output energy (useful + wasted).

This is because energy cannot be created or destroyed!

Energy
Sankey diagram
Efficiency

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What are energy resources?

Non-renewable sources

- **Coal, oil, gas** are fossil fuels.
- Fossil fuels store chemical energy and are burnt to release energy.
- **Nuclear energy** - Radioactive elements as a store of nuclear energy. Release of energy as unstable atoms break down.

Non-renewable means resources that are being used quicker than being replaced.

Non-renewable resources will run out.

General advantages and disadvantages of <u>non-renewable</u> energy:

Disadvantages

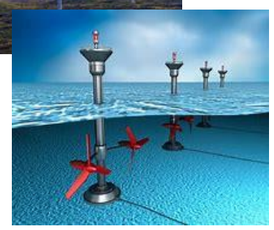
- All will run out
- Burning fossil fuels releases carbon dioxide (a greenhouse gas) which contributes to climate change
- Nuclear power stations produce radioactive waste and are expensive to decommission.

Advantages

- Stores a lot of energy
- At the moment they are widely available.

<u>Renewable</u> energy sources

- Alternative to non-renewable resources.
- Renewable resources will not run out.
- Examples to include: solar, wind, hydroelectric, tidal, wave, geothermal.



General advantages and disadvantages of <u>renewable</u> energy

Disadvantages

- Some are not always available e.g. solar, wind, wave power
- Damaging to habitats e.g. tidal
- Ruins landscapes e.g. wind turbines.

Advantages

- No release of greenhouse gases once set up.
- Will not run out

- Non-renewable
- Fossil
- fuels
- Coal
- Oil
- Natural gas
- Nuclear
- Renewable
- Solar
- Wind turbine
- Tidal power
- Wave power
- Hydroelectricity
- Geothermal

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How can we save energy?

Recap methods of heat transfer from Y7

Heat energy is also known as thermal energy.

Heat can transfer by **conduction, convection** or **radiation**.

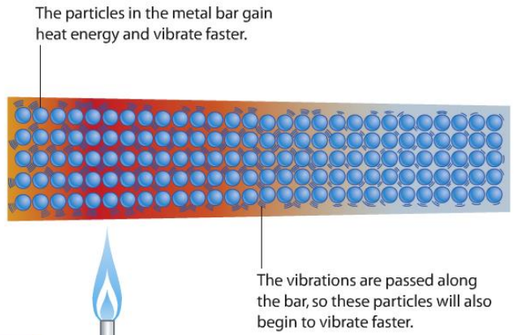
1. **Conduction**

An object that easily allows heat to pass through is known as a good **thermal conductor** e.g. copper, aluminium (and other metals)
An object that does not easily allow heat to pass through is known as a **thermal insulator** e.g. plastic, wood, rubber.

Heat transfers by conduction through solid conductors. When particles in solid conductors are heated the energy transferred causes the particles to vibrate faster (gain kinetic energy).

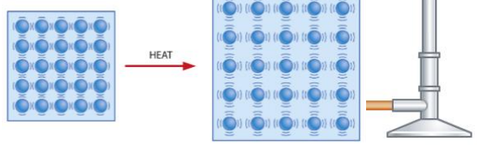
As the particles vibrate they collide into the particles next to them, causing the energy to pass through the solid.

Air is a poor conductor because particles in gas are spread out.
Therefore, it's hard for the particles to collide and pass on the vibrations.



Metals also expand when they are heated..

As the particles vibrate more, they need more space to move around in and so the solid will expand. When a solid expands it has the same mass but is takes up more space. Its density will decrease.

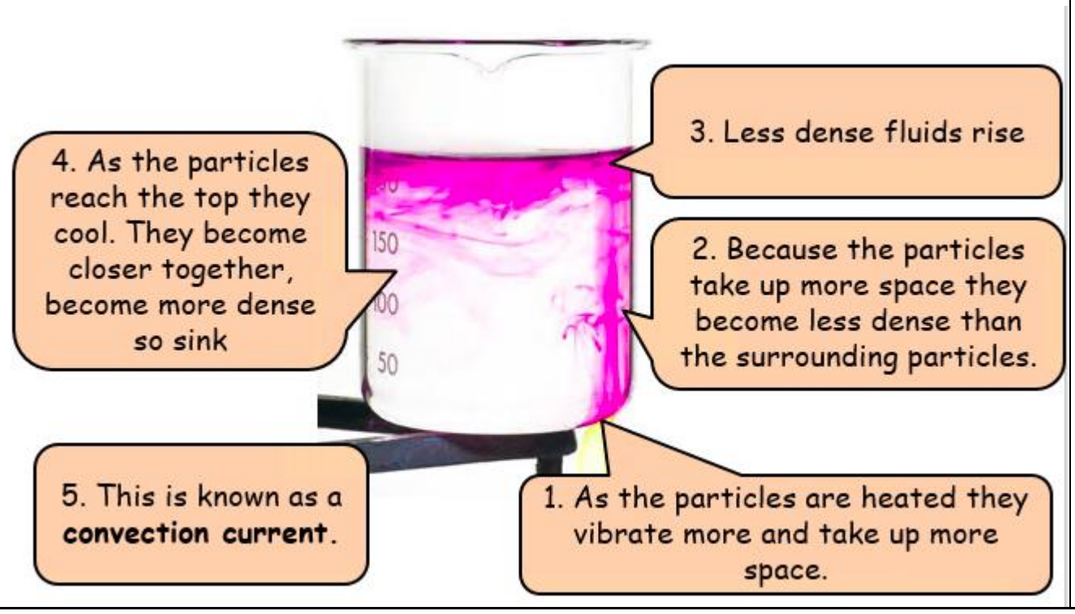


2. Convection

Heat cannot travel by conduction well through fluids (liquids and gases).

Heat transfers through fluids by **convection**.

Example:



Conduction
Convection
Radiation
Insulation

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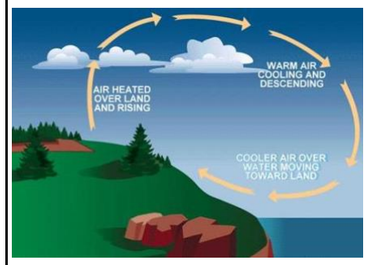
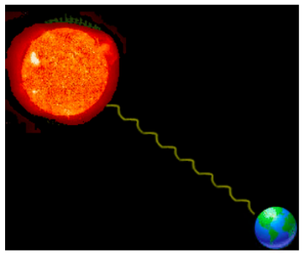


3. Radiation

Thermal radiation does not require particles, it transfers heat via a wave (**infrared**). We can't see infrared only feel it as heat.

All hot objects emit infrared radiation – including us!

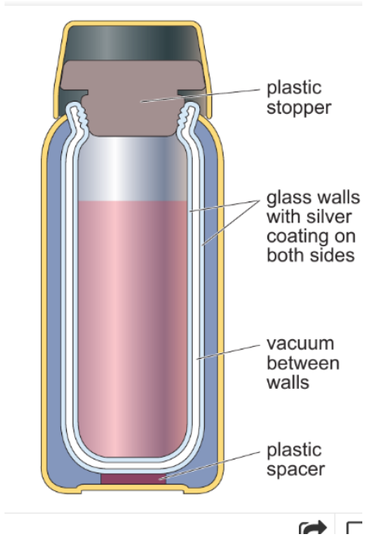
Special infrared cameras can sense this infrared energy, and produce a picture for us to see.



- There are no particles in space (it is a vacuum) so conduction and convection won't work
- Heat from the sun travels via infrared radiation

Insulation can be an energy saving measure.

- Thermal insulator as a material which does not easily allow heat to transfer through e.g. air, plastic, wood, foam.



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What is static electricity?

If you rub **two insulating materials** together, **electrons maybe transferred** from one material to the other.

Protons cannot move but electrons can!

Insulators like plastic can gain a charge.

Electrical charges can be positive or negative

Static electricity is caused by the movement of electrical charge (electrons), when two insulators are rubbed together.

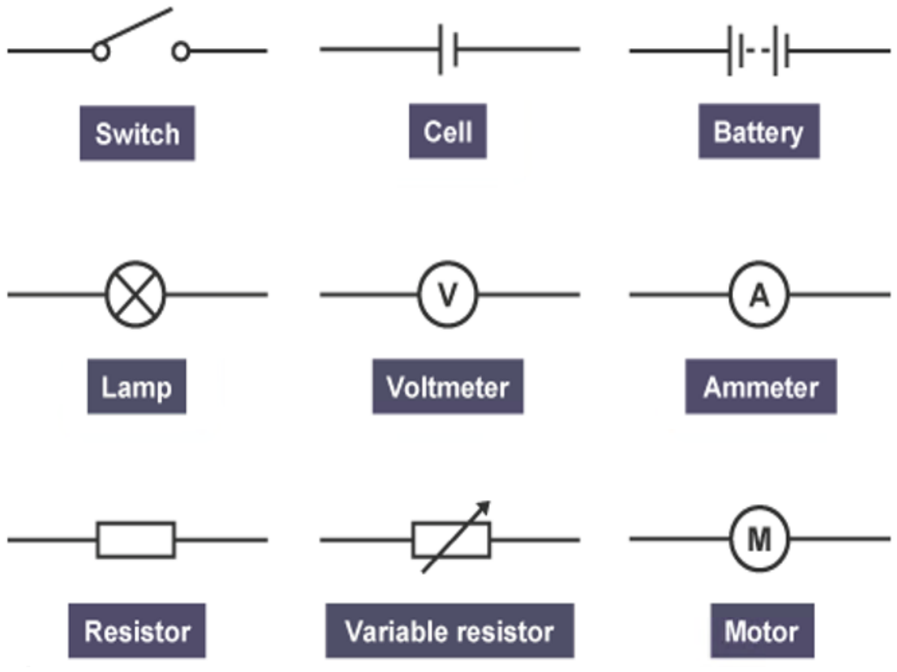
Attraction and repulsion of charges;
- opposite charges attract
- like charges repel.

Charge
Static electricity
Attract
Repel

What is electricity?

Electrical energy is transferred around circuits. The most basic circuits consist of a power source, wires and other components (like a bulb)

To make it easier for us to draw circuits we use circuit symbols. Some are shown below:



In physics a cell is a single unit that stores chemical energy – what we would normally call an individual 'battery.' Two or more cells is known as a battery.

Electricity
Circuit
Series
Parallel
Current
Amps
Potential difference
Volts

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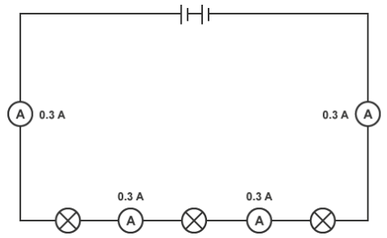
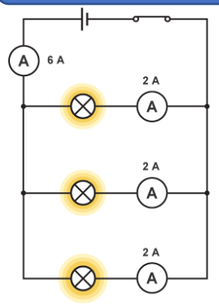
Difference between series and parallel circuits.

- Series circuits only have one path for electricity to flow
- Parallel circuits have more than one path for electricity to flow.

Series circuit



Parallel circuit



Current

- Current as a flow of charge (electrons) around a circuit.
- Current is measured in amps with an ammeter.
- Current is conserved/stays the same around a series circuit
- Current splits at a junction in parallel circuits.

Voltage/potential difference

- Voltage as potential difference in energy across a component.
- Potential difference is measured in volts
- Potential difference is measured with a voltmeter.
- Potential difference is shared across components in a series circuits.

Potential difference stays the same across the strands in a parallel circuit.

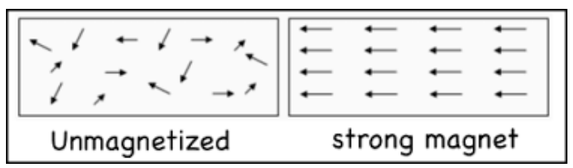
What are the different types of magnet?

Magnetism: an invisible force that pushes or pulls magnetic materials.

Magnetic materials are materials that are attracted to a magnet, but do not attract or repel each other.

There are only three magnetic elements, they are: Iron, Nickel and Cobalt

Non-magnetic materials are not affected by magnets this includes metals such as gold, aluminium, silver and copper.



Magnets contain tiny particles called 'domains.' If the domains are pointing in the same direction – the object is magnetised. If they are pointing in random directions the object is not magnetised.

Magnetism
Current
Electromagnet
Solenoid

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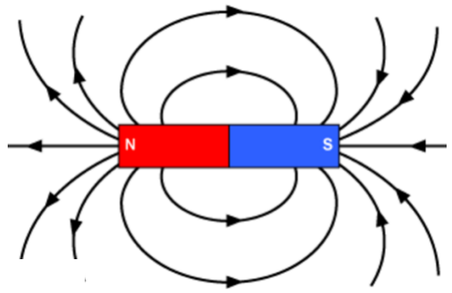
A magnet has two poles.

Pole – part of the magnet with strongest magnetic force.

The poles are called North pole and South pole

Magnets have a magnetic field around them.

This is the area where they can attract or repel a magnetic material. These can be shown on a diagram using field lines

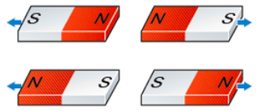


Field lines always go out of the North pole and into the South. This is shown by arrows.

Law of magnets

If you bring 2 bar magnets close together…

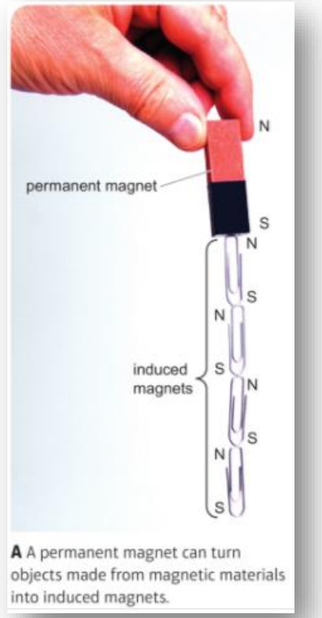
TWO OPPOSITE POLES
ATTRACT



TWO LIKE POLES
REPEL

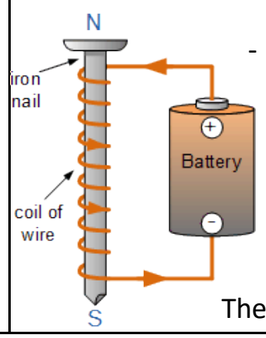
Permanent magnets always have a magnetic field around them.

Induced magnets are temporary. The are only magnetic when within the magnetic field of another magnet.



A A permanent magnet can turn objects made from magnetic materials into induced magnets.

A current carrying a wire will produce a magnetic field around it. This produces an electromagnet.



- Electromagnets are temporary. They can be turned on and off.
- A solenoid (coil of wire) amplifies the magnetic field. To produce a magnetic field similar to one produced around a bar magnet.
- An iron core makes the electromagnet stronger.
- An increased current/voltage will make an electromagnet stronger.

The number of turns in the coil will make an electromagnet stronger.

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