Common Entrance Science Revision Pack

DEO · CUSTODE

Biology: Breathing and Respiration revision

- **Breathing** is getting **oxygen** gas into the bloodstream and removing **carbon dioxide** gas from the blood.
- **Gas exchange** takes place in the air sacs (alveoli) that make up the lungs

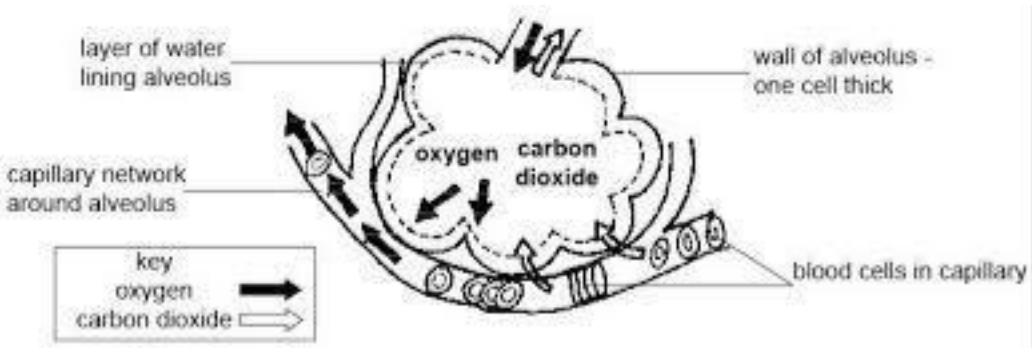
Breathing in (inhaling)

- Muscles in the ribcage move the **ribs up and out**.
- **Diaphragm** (sheet of muscle under the lungs) **contracts** and goes **flat**
- This makes **more space** in the chest and air moves into the lungs

Breathing out (exhaling)

- The ribcage moves **down and in**
- The **diaphragm relaxes** and **moves up.**
- This makes **less space** in the chest and air moves out of the lungs.

Air sacs (alveoli)



Air sacs have the following design features to allow gas exchange:

- **Large surface area**
- **Good blood supply** (capillaries) around the air sac
- Air sac has **thin wall** (one cell thick) – gases can exchange quickly
- **Moist lining** around air sac dissolves gases and helps them diffuse into the bloodstream

Amount of gas in air breathed in and breathed out

Gas	Air Breathed in (approx.)	Air Breathed out (approx.)
Nitrogen	79%	79%
Oxygen	20%	16%
Carbon dioxide	0.02%	4%

Note: The amount of oxygen decreases and carbon dioxide increases due to the process of respiration

Respiration

Respiration is the chemical process of **releasing energy** from **glucose** using **oxygen**.

- Respiration takes place in **all living cells**. The process happens in the **mitochondria** in the cell.
- The reactants needed for respiration are **glucose** and **oxygen**.
- The products made in respiration are **carbon dioxide** and **water** and also **energy** is released.
- The body uses the energy to carry out **all its living processes** (for example, keeping the body at a constant 37^{o}C; growing; moving muscles)

Aerobic respiration word equation (*must know*)

Glucose + Oxygen → Carbon dioxide + Water + Energy

Extra: Aerobic and Anaerobic respiration

- **Aerobic respiration**: this is respiration carried out using oxygen (humans use aerobic respiration whenever possible)

- **Anaerobic respiration**: this is respiration carried out without using oxygen (humans use anaerobic respiration when they run out of oxygen)

In muscles

- If your muscles use up their supply of oxygen and they need to carry on moving then anaerobic respiration is used.
- A product of this process is lactic acid that can stop your muscles from moving.
- When you stop moving you carry on breathing at a fast rate as extra oxygen is needed to remove the lactic acid.

Fermentation

- Microbes (e.g. yeast) carry out anaerobic respiration and produce **alcohol (ethanol).**
- Fermentation is used for
  making: Beer and wine
  Baking (Carbon dioxide gas bubbles make the dough rise)

<u>Biology: Cell revision</u>

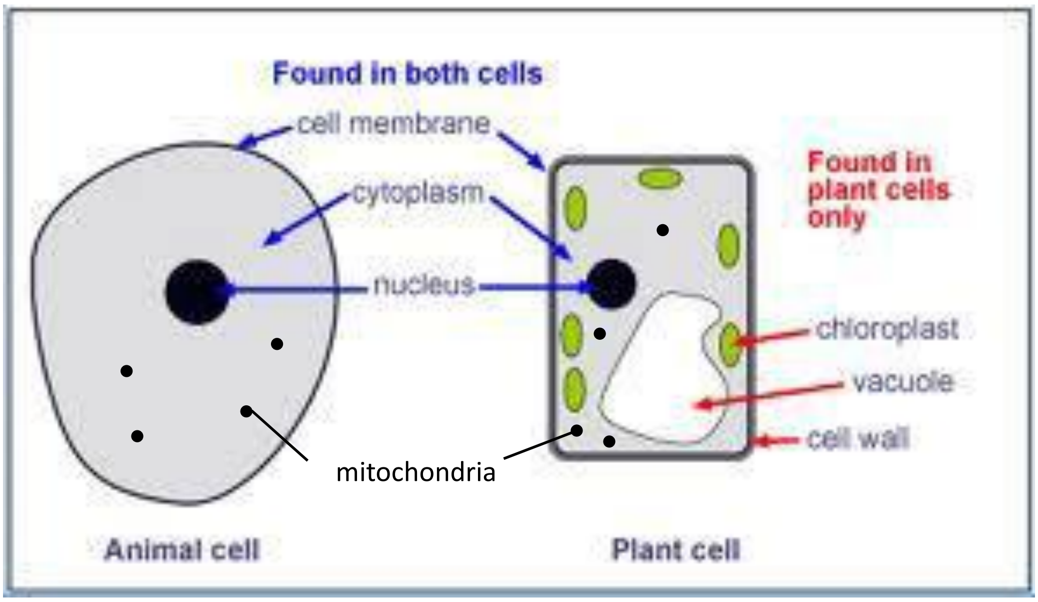
Cell theory states

- All living things are made up of cells
- Cells are living

Cells are made up of the following parts:

Cell part	Function (job)	Found in animal or plant cell?
Nucleus	Controls the cell. Contains genetic material (DNA) which makes up genes (coded instructions.	**Animal and plant**
Cytoplasm	Jelly-like liquid where chemical reactions take place.	**Animal and plant**
Cell surface membrane	Controls the entry and exit of substances in and out of the cell.	**Animal and plant**
Mitochondria	Respiration takes place here.	**Animal and plant**
Chloroplasts	Contains chlorophyll that absorbs light energy for photosynthesis. Photosynthesis takes place here.	**Plant only**
Cellulose Cell wall	Provides support for the cell.	**Plant only**
Large Vacuole	Store for chemicals	**Plant only**
Starch storage granules	Stores starch made during photosynthesis	**Plant only**

Diagram of a typical Animal & Plant cells



Specialised Cells: Cells that are designed to do a specific job.

Cell name	**Job (function)**
Red blood cells	Carries oxygen around the body
Ciliated cells (cilia)	Traps and removes dust from the lungs
Nerve cells	Carry electrical messengers
Leaf (palisade) cells	Absorbs sunlight to help carry out photosynthesis
Root hair cells	Large surface area to absorb water and minerals.

Groups of cells

Complicated organisms (like you) are made of billion of cells.

- A group of similar cells is called **tissue**. (e.g. muscle tissue)
- A group of similar tissue is called an **organ** (e.g. heart)
- A group of similar organs is called a **system** (e.g. circulatory system)
- A group of systems is called an **organism**.

Cell slide preparation

Method

1. Obtain a thin layer of cells (one cell thick).

2. Place layer of cells on to slide.

3. Add drops of stain onto the cell in order to colour the cell (in particularly, the nucleus).

- Use iodine solution for plant cells (e.g. onion cells)
- Use methylene blue for animal cells (e.g. human cheek cells)

4. Lower a cover slip carefully over the cells – this helps to prevent air bubbles.

5. Place prepared slide onto microscope.

6. View the slide using the low power lens first moving onto higher magnification.

Biology: Classification and Variation revision

Classification

- Grouping together of living things is called **classification**
- All living things can be put into large groups called **Kingdoms**
- There are **5 kingdoms** and every living organism belongs to one of the kingdoms.

The 5 kingdoms are:

Bacteria – made up of a single cell that does **not** have a nucleus

Protists – made up of a single cell that does have a nucleus

Animals – made of many cells that do not have cell walls

Plants – made of many cells that have cell walls and can carry out photosynthesis

Fungi – made of many cells that have cell walls but do not carry out photosynthesis

The Animal Kingdom

The Animal kingdom is divided into **invertebrates** (without backbones) and **vertebrates** (with backbones)

- **Invertebrates**

One group of invertebrates are called **arthropods** (jointed legs) and in this group are the **insects** and **spiders** (arachnids)

Feature	Insect	Spider
Number of legs	6	8
Number of body parts	3	2
Antennae	Yes	No

- **Vertebrates**

The vertebrates (with backbones) are divided into five groups – **fish**, **amphibians**, **reptiles**, **birds** and **mammals.**

Feature	**Fish**	**Amphibian**	**Reptile**	**Bird**	**Mammal**
Backbone	Yes	Yes	Yes	Yes	Yes
Body covering	Wet scales	Smooth, wet skin	Dry scales	Feathers	Fur or hair
Constant body temperature	No	No	No	Yes	Yes
Produce young	Lay eggs in water	Lay eggs in water	Lay eggs on land	Lay eggs with hard shells	Give birth to live young

Variation

Variations (characteristics) are differences between living organisms

These variations (characteristics) are caused by:

- Information **inherited** from parents (**genes)**; e.g. eye colour
- The **environment** you live in; e.g. scars, accent

Different kinds of variation

There are two kinds of variation:

- **Discontinuous** variation can be easily put into different groups. For example, male or female, blood groups.

- **Continuous** variations can take any value within limits. They are generally measured on a scale. E.g. height, mass

Genes and Characteristics

- A **gene** is a short section of DNA that carries information for a characteristic (e.g. eye colour).
- A **chromosome** carries many genes.
- A **nucleus** contains many chromosomes – 46 (23 pairs) in human body cells.

Biology: Feeding Relationships and Adaptation

Food chains

- Always start with a **green plant**. Plants are able to use **light energy** from the Sun to make their own food (**chemical energy**) by the process of **photosynthesis.** Plants in a food chain are called **producers**.
- Animals get their energy from eating plants or other animals. Therefore they are called **consumers.**
- A food chain shows the **flow of energy** from one organism to the next.
- The original source of energy for all food chains is the **Sun**.

	Flow of energy		*Flow of energy*	
Grass	→	**Rabbit**	→	**Fox**
Producer		**primary consumer**		**secondary consumer**

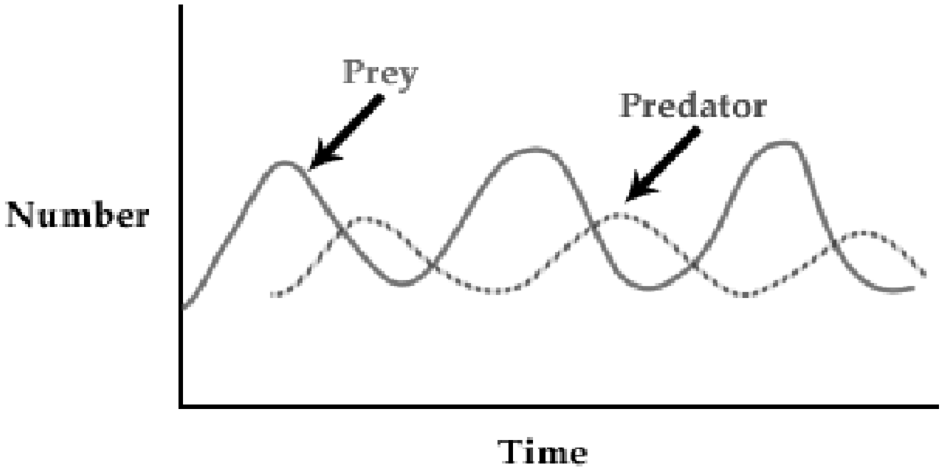
Note:

- **Primary consumer** is always a **herbivore** (feeds on plants)
- **Secondary consumer** is always a **carnivore** (feeds on other animals)

Decomposers are organisms (e.g. **fungi, bacteria**) that break down dead organisms. Decomposers can be at any level of a food chain as they breakdown dead material.

Populations

Predators and Prey: Predators are animals that actively hunt their prey.



- The graph shows that when the **prey population increases** the **predator population also increases**.
- However, the **increasing predator population** will cause the **prey population to decrease**.

Population size can also be affected by:

- **Food shortage.**
- **Lack of space (overcrowding)**
- **Spread of disease.**
- **Increase in poisons / pollution**

Quadrats and measuring the size of a population

- A **quadrat** is a square that can be used to count populations.
- Place quadrat randomly in an area
- Count number of individuals of a species in the quadrat area
- Repeat process (for example, ten times – as this then allows you to calculate an average – making the results more reliable)
- If the quadrat is 1 m^2 and the area you are studying is 1000 m^2. Then multiply the number of individuals in a single quadrat by 1000. This gives you an estimated population for the 1000 m^2 area.

Adaptation

These are the features animals and plants have to help them survive in their environment.

Polar bears

- White fur for camouflage in the snow
- Thick layer of fat to insulate against cold
- Wide paws (large surface area) to help walk across soft snow and also helps with swimming.
- Huddle together to keep warm

Camels

- Feet have large surface area to help prevent them from sinking into the sand.
- Fat store in hump
- Yellow colour to camouflage in sand
- Long eyelashes to protect against sand storms.

Cacti

- No leaves to reduce water loss.
- Store water in stem – leaves developed into spines to protect stored water.
- Large, shallow root system to absorb any available water.

Biology: Health and disease

A healthy lifestyle depends on the following factors:

A balanced diet: eating the right amounts of the right types food (e.g. carbohydrates, protein, fat, fibre, vitamins, minerals and water). Overeating of fatty foods and sugary foods can lead to being obese (overweight for your height) which can cause health problems (e.g. heart disease, type 2 diabetes).

Taking regular exercise: improves working of heart; reduces heart disease; strengthens muscles; reduces stress; decreases body fat.

Avoiding intake of harmful substances

Smoking: Can cause lung cancer; heart disease; emphysema (disease related to the breakdown of air-sacs) and addiction to nicotine. Alcohol: Slows reaction times; can damage the liver; stomach and brain. **Drugs** (other than prescribed for medical reasons): Drugs are chemicals that affect how the body works. Drugs can cause damage to the brain, heart, stomach and liver.

Fighting disease

Disease can be either

- **Non-infectious (non-communicable)** (not passed on from something else – e.g. liver disease due to drinking alcohol).
- **Infectious (communicable)** (disease passed on – e.g. through sneezing, insect bites)

Infectious diseases

Microbes (e.g. bacteria, viruses) divide and reproduce rapidly causing illness.

Virus	**Bacteria**
Smaller than bacteria	**Larger** than viruses
Reproduce inside living cells	Reproduce by dividing into two
Viruses **cannot** be controlled by **antibiotics**	Bacteria **can** be controlled by **antibiotics**
Diseases caused by viruses include: Influenza (flu), chicken pox, small pox.	Diseases caused by bacteria include Cholera, food-poisoning, tetanus

<u>Immune system (fighting disease)</u>

Skin; acid in stomach; wax in ears; tears in eyes all form barriers to keep microbes away from entering the body.

White blood cells – two main types

- **Phagocytes:** these white blood cells engulf (eat) microbes.
- **Lymphocytes** – recognize and produce antibodies that make the microbes inactive before being destroyed by phagocytes.

Cuts in the skin are protected by blood clots. Blood clots are formed by platelets (fragments of cells in the blood). These form scabs which stop microbes from entering the broken skin.

Human actions

- **Personal hygiene**: regular washing removes microbes. Brushing teeth helps prevent tooth decay.
- **Community hygiene**: providing safe, clean drinking water.

The dangers of Smoking

Nicotine

- Causes addiction
- Increases blood pressure
- Increases risk of heart disease

Smoke

- Kills cilia (fine hairs) in windpipe and lungs. This leads to build up of mucus and dirt.
- Result can cause smoker's cough and lead to more infections in lungs.

Tar

- Tar is the black substance that contains over 2000 chemicals, some of these chemicals are known to cause cancer (e.g. lung cancer).

Carbon monoxide – gas produced when cigarettes burn

- Carbon monoxide decreases the amount of oxygen carried by the red blood cells.
- Can lead to lack of energy – due to a lack of aerobic respiration
- Fetus developing in the uterus cannot get enough oxygen (can lead to reduced birth weight).

Emphysema

Emphysema is a disease that is caused when the walls of the air-sacs are destroyed due to smoking. This reduces the surface area of the air-sacs and decreases the amount of oxygen getting into the blood.

Biology: Nutrition and Digestion Revision

Balanced diet. We need to eat the right amounts of the right types of food.

This is called a **balanced diet.**

Important Food Groups

Carbohydrates

Two main groups are:

- **Sugars** (e.g. glucose) – Glucose has chemical energy and is used in the process of respiration. Note: Respiration is the process of releasing energy from glucose using oxygen. Sugars are found in fruits, soft drinks and sweets.
- **Starches** – starch is good as it releases its energy more slowly than sugars. Starches may be found in potatoes, rice, cereals, pasta and bread.

1. Crush solid foods into small pieces. **2**. Add a few drops of iodine solution **3**. A colour change from brown to blue-black shows starch is present.

Protein

- Protein is used for growth and repair of cells.
- Protein can be found in meats, fish, milk, eggs, nuts, and green vegetables.
- **Extra**: Protein is made from amino acids. Protein is also used to make enzymes (chemicals that speed up reactions in your body)

Fats

- Used as a store of energy and also as a layer of insulation.
- Fats are found in dairy products (milk, cheese, butter) and fried food.
- Too much fat in your diet can lead to problems such as obesity (being overweight) and heart problems.

Vitamins and Minerals

These are needed in small amounts to keep you healthy as they help important reactions take place.

Name	Needed for	Where found	Lack of it (deficiency)
Vitamin C	Cell and tissue repair, resistance to disease	Fresh fruit (lemons, oranges) and vegetables	Scurvy (bleeding gums)
Calcium (mineral)	Strengthen bones and teeth	Dairy products (milk), green vegetables	Poor, weak bones
Iron (mineral)	Making red blood cells	Meat, green vegetables	Lack of red blood cells results in lack of energy

Fibre

- Helps food to travel along the digestive system. A lack of fibre can cause c**onstipation**. Fibre is found in cereals, wholegrain bread and vegetables.

Water

- Makes up about 70% of our bodies and is found in all living cells.
- Blood system moves materials that have been dissolved in water.
- Humans lose about 1.5 litres of water each day in urine, sweat and our breath. Water can be replaced through drinks (e.g. water, milk).

Digestion

The food we eat needs to be broken down from **large, insoluble** food molecules into **smaller, soluble** food molecules so that it can be **absorbed** into the **blood**.

- **Physical digestion**: teeth breakdown food which is mixed with saliva in the mouth.
- **Chemical digestion**: Chemicals called enzymes breakdown **large, insoluble** food into **smaller, soluble** food that can be absorbed into the blood.
- Enzymes are chemicals that **speed up** reactions in your body such as the breakdown of food (digestion).
- There are different types of enzymes for each reaction in the body.
- Enzymes do **not** change in a reaction, so they can be **used again**.
- Digestive enzymes can be found in the **saliva**, **stomach** and the **small intestine**

Absorption

Small, soluble food molecules move through the walls of the **small intestine** into the **bloodstream** which carries them to the liver for sorting. *Note*: **Food** is absorbed in the **small intestine** and **water** is absorbed in the **large intestine**

Villi in Small intestine: Villi are finger-like projections that help absorb food from the small intestine into the blood.

- Villi have a **large surface area**
- Have a **good blood supply**
- Have **thin walls** to speed up the absorption of food into the blood

Assimilation

The **liver** sorts out all the food molecules so they can be sent to the cells of the body to be used for things such as growth, repair and providing energy.

Egestion

Unwanted food is mixed with **fibre** to become faeces and is passed out of the body.

Biology: Photosynthesis Revision

Photosynthesis is the process by which plants use **light energy** to make **glucose** (food) and **oxygen** from **carbon dioxide** and **water**.

Word equation:

$$\text{Carbon dioxide} + \text{water} \xrightarrow[\text{chlorophyll}]{\text{Light}} \text{glucose} + \text{oxygen}$$

- Photosynthesis takes place in the **chloroplasts**
- Most cells containing chloroplasts are found in the leaves (upper side).
- Chloroplasts contain the pigment **chlorophyll**.
- Chlorophyll absorbs the **light energy** needed for photosynthesis.
- The **carbon dioxide** is taken in from the air through tiny holes called **stomata** in the leaves (lower side).
- The **water** is absorbed from the ground by the **roots**. **Minerals** (e.g. **magnesium, nitrates**) are also absorbed by the roots.

Products of photosynthesis

Glucose: Plants use glucose for respiration. Remember, respiration is the process of releasing energy from glucose using oxygen.

Glucose that is not used for respiration can be used as the following:

- Stored as starch
- Made into fats and oils.
- Made into proteins, which are used for growth.
- Made into cellulose, which is used to make cell walls.

Oxygen is also made and is used by the plant for respiration.

Plants are adapted (designed) to carry out photosynthesis.

- Leaves are flat and broad to trap sunlight.
- Leaves are thin to allow gases to exchange quickly
- Roots have root hair cells to increase the surface area for absorbing water.
- Leaves have tiny holes called stomata that allow carbon dioxide to enter and oxygen to leave the leaf.

<u>Gas exchange in leaves</u>

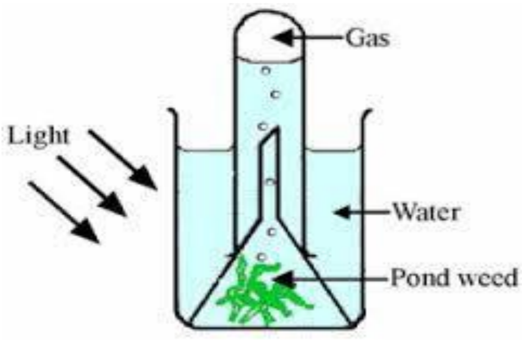
Daylight: Plants take in more carbon dioxide during daylight for photosynthesis and release more oxygen.

Night time: Plants take in more oxygen for respiration and release more carbon dioxide

Testing a leaf for starch

	Method	**Reason**
Step 1	Leaf is placed in boiling water for 2 minutes	This kills leaf, stopping starch being turned back into glucose. It also breaks down the cell walls allowing access to cell content.
Step 1	Leaf is placed in a tube containing ethanol and warmed in a water bath for 5 minutes. **Safety**: Can not use a Bunsen burner as ethanol is highly flammable and	Ethanol dissolves the chlorophyll - removing the green pigment from the leaf.
Step 3	Leaf is taken out of the ethanol and placed into warm water.	The water softens the leaf after the ethanol has made the leaf brittle.
Step 4	Place leaf on white tile. Add iodine solution to the leaf.	Iodine solution tests for starch. Iodine solution turns from yellow to blue / black with starch.

Rate of photosynthesis



- The gas is oxygen – a product of photosynthesis.
- Test for oxygen = glowing splint relights.
- Number of bubbles (or volume of gas) can be used to measure rate of photosynthesis.

Count the number of bubbles of oxygen given off in a minute.

Can move the light closer – this increases the process of photosynthesis, more bubbles of oxygen given off.

Factors that speed up rate of photosynthesis

- Increase light intensity (move light closer)
- Increase concentration of carbon dioxide
- Increase temperature (only to approx. 40°C) – thermal energy increases the photosynthesis reaction.

Biology Revision: Skeleton and Muscles

The skeleton has three main functions:

- To **support** the body (keep you upright)
- To **protect** vital organs (e.g. ribcage protects lungs and heart; skull protects the brain)
- To allow **movement** (e.g. joints)

Facts

- There are over 200 bones in the human body.
- The mineral calcium makes the bones very hard.
- In the centre of the bone there is bone marrow – a substance that makes red blood cells.

Note

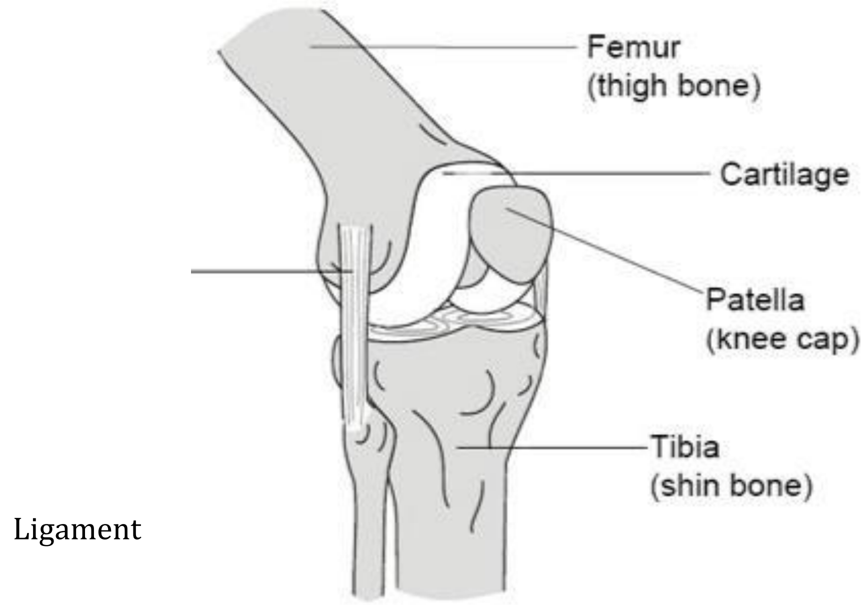
- **Ligaments**: attach bones to bones.
- **Tendons**: attach muscles to bones.

Types of joints

- **Hinge joint** – found at the elbow and knee
- **Ball and socket joint** – found at the shoulder and hip.

Diagram of a Knee joint

Note: Cartilage allows the bones to move smoothly. If the cartilage wears out it can lead to **osteoarthritis.**



Muscles

- Muscles are made of protein.

Antagonistic pairs of muscles

- Muscles can only contract (shorten) and relax (lengthen).
- Muscles work in pairs in order to move bones (e.g. bicep and tricep in the upper arm).

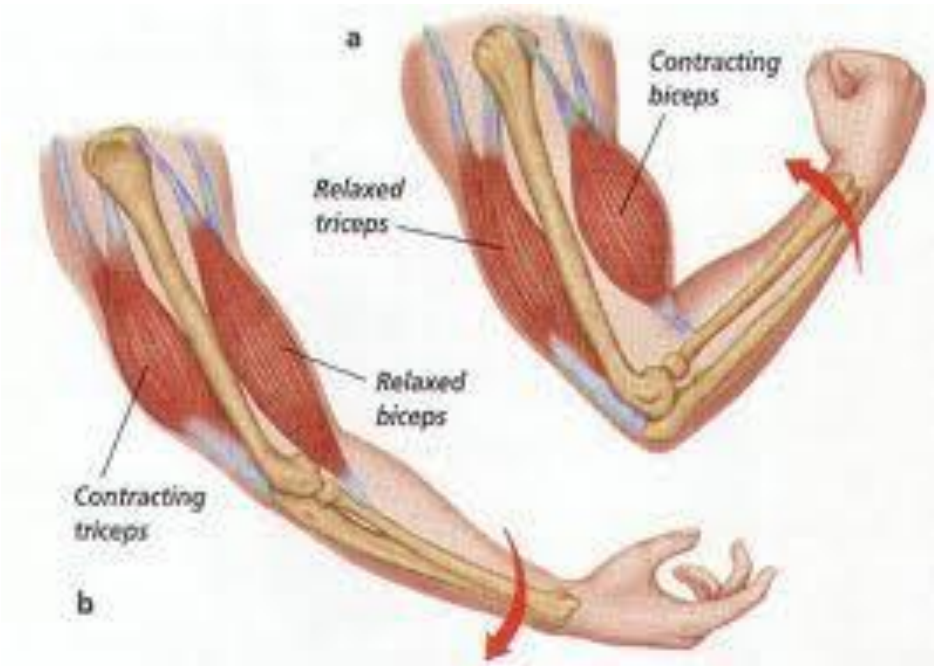
<u>Example:</u> Upper arm movement

To pull the arm up

- The **bicep contracts** and the **tricep relaxes**

To pull the arm down

- The **bicep relaxes** and the **tricep contracts**



<u>Chemistry:</u> <u>Acids and Alkalis Revision</u>

- All chemicals can be either Acid, Alkali or Neutral.
- All acids have a sour taste and all alkalis have a soapy feel.

To tell if something is an acid or alkali, you use an **indicator**. An indicator changes colour with an acid or alkali.

Litmus – Changes red in acid / blue in alkali

Universal indicator – uses a range of colours; Red for acid / green for neutral / Blue for alkali.

The colour with universal indicator can be used to give a value on the pH scale.

pH scale: the scale runs from pH 1 to pH14. pH1 is a strong acid / pH7 is neutral / pH14 is a strong alkali.

pH1	**pH3**	**pH5**	**pH7**	**pH9**	**pH11**	**pH14**
Red	**Orange**	**Yellow**	**Green**	**Blue**	**Dark blue**	**Purple**
Strong acid		**Weak acid**	**Neutral**	**Weak alkali**		**Strong alkali**

Can use certain vegetables (e.g. blackberries, red cabbage) to make indicators.

<u>Method</u>

Grind up vegetable to extract juice (adding a little water can help)

Filter juice and use as an indicator

Neutralisation

Acid and alkali can cancel each other out to produce a **neutral solution** (pH7) of a **salt** and **water.**

(must know neutralisation equation)

Hydrochloric acid + Sodium hydroxide → Sodium chloride + water

(acid) (alkali)

Neutralisation is a **chemical reaction** – the solution will heat up (increase in temperature) and new products are formed (**salt + water**)

More neutralisation

- **Lime** (calcium oxide) is an alkali that is used by farmers to treat soils that are too acidic. The lime neutralises the acidic soil.
- **Indigestion** is caused by excess acid being produced by the stomach.
- Antacid tablets (indigestion tablets) contain an **alkali** that neutralises the excess acid.

Acids and metals

Acids react with metals to produce hydrogen gas and a salt.

E.g.

Magnesium + Hydrochloric acid → magnesium chloride + hydrogen

Remember the test for hydrogen gas = **a lighted splint goes "pop".**

Acids and carbonates

Acids react with carbonates to produce a **salt**, **water** and **carbon dioxide**.

E.g.

Calcium carbonate + hydrochloric acid → Calcium chloride + water + Carbon dioxide

Extra

- All acids contain **hydrogen**. Acids release hydrogen ions (an ion is a charged particle e.g. H^+). *Note: The pH scale measures the concentration of hydrogen ions.*
- Alkalis are also called **bases**. An alkali is a base that dissolves in water. Therefore, a base neutralizes an acid.
- All **metal oxides** are **bases** e.g. magnesium oxide, calcium oxide.

Chemistry: Chemical Reactions revision

Key Points in chemical reactions

- The starting materials are called the **reactants** and the new materials made are called the **products**.
- There is always an energy change (e.g. **thermal energy** given off)
- The reaction is difficult to reverse.

How to recognise a chemical reaction:

- **New products** are made.
- There may be a **colour change**
- **Bubbles or fizzing** as a gas is made
- **Energy given out**. Usually, **thermal energy** is released and this increases the temperature. Or light energy may be given out.

Conservation of Mass: note the mass of the products made is the same as the mass of the reactants; e.g.

magnesium + oxygen → magnesium oxide

5 g 0.1 g

5.1 g

Some important reactions

Oxidation – This is adding oxygen to a substance.

- Heating a metal in air will make a **metal oxide** (you have added oxygen to the metal)

E.g. **magnesium + oxygen → magnesium oxide**

Copper + oxygen → copper oxide

<u>Thermal Decomposition</u> – Using thermal energy to breakdown a large chemical into smaller chemicals; **e.g.**

copper carbonate → **copper oxide** + **carbon dioxide**
(green powder) (black powder) (colourless gas)

<u>Neutralisation</u> - a chemical reaction between a acid and an alkali (base). The acid and alkali cancel each other out to make a salt and water (a neutral solution); e.g.

hydrochloric acid + **Sodium hydroxide** → **sodium chloride** + water
(*acid*) (*alkali*) (*salt*) (*water*)

<u>Combustion</u> – This is a chemical reaction where energy (*thermal* and *light*) is released from a fuel when it reacts with oxygen gas.

- When a **fuel** (e.g. candle wax) burns (**combusts**) two products are formed. The products are **Carbon dioxide** and **Water**.

Hydrocarbon fuel + **oxygen** → **water** + **carbon dioxide**

Fuels (e.g. coal, oil, gas, wood, candle wax) are called **Hydrocarbons** because they contain the elements **Hydrogen** and **Carbon**.

<u>Acid rain</u>

- Burning coal can also produce the gas **sulphur dioxide**.
- **Sulphur dioxide** dissolves in water in the clouds to form acid rain
- Acid rain can **damage** limestone buildings; make soil to acidic to grow crops; kill fish in lakes.
- Acid rain damages **limestone**. Limestone is made of **calcium carbonate** that reacts with acid.

Calcium carbonate + **Sulphuric acid** → **Calcium sulphate** + **carbon dioxide** + **water**

<u>Rusting and oxygen</u>

- **Corrosion** is the where **metals** are **damaged** due to reacting with **oxygen**.
- **Rusting** is where **iron** is damaged when it reacts with **oxygen**
- Rusting happens when **iron** is exposed to **oxygen** and **water**.
- Rusting can be **speeded up** by adding **salt** or **acid** to the water.
- The chemical name for rust is **iron oxide**.

Methods to prevent iron from rusting

- Use **paint** or **oil** to stop oxygen and water getting to the iron (barrier method)
- **Galvanise** the iron: Galvanising is the iron is **coated** with a layer of the more reactive metal **Zinc**. The zinc will react with the oxygen instead of the iron.

Remember: Lab Tests for -

- **Hydrogen**: a **lighted** splint goes "**pop**"
- **Oxygen**: a **glowing** splint **relights**
- **Carbon dioxide**: Bubble through **limewater**. The limewater goes cloudy.
- **Water**: **white** (anhydrous) copper sulphate turn to **blue** (hydrous) copper sulphate crystals when water is added **or** cobalt chloride paper turns from blue to pink.

Extra: Rates of Reaction

Rates of Reaction : This is the time taken for a reaction to happen.

- Reactions happen when the particles in the **reactants collide** with each other.
- **More collisions** between particles mean an **increased rate of reaction** (a faster reaction)

The following can speed up the rate of reaction:

Increase the thermal energy (heating the reactants).

- This gives the particles **more energy**.
- The collisions will be higher energy (more chance of a reaction)
- There will be **more collisions** between the particles as they are **moving faster**. The **rate of reaction increases**.

Add more of the reactants.

- This will **increase** the number of particles.
- **More particles** will result in **more collisions**. The rate of reaction **increases**.

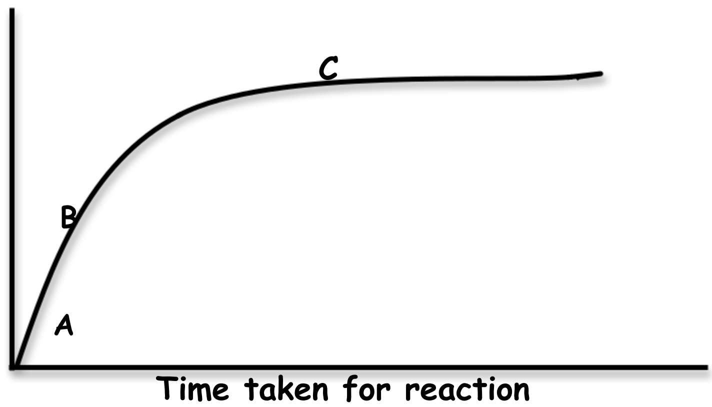
Increase the surface area of solid reactants

- There will be **more collisions** between the particles

Use a catalyst:

A **catalyst** is a chemical that **speeds up** a reaction but is not used up itself.

A graph showing a rate of reaction



Section A to B – this is where the reaction is fastest. The steep line shows a lot of product is being produced in a short amount of time. Reactions are fast at the start because there are lots of particles to collide into each other. More collisions mean an increased rate of reaction.

Section C onwards – the reaction has stopped. No more **product** is being made so the line is flat.

Chemistry: Elements, Compounds and Mixtures

Revision Key points

Elements are the simplest particles found in matter. They are made up of only **one type** of atom.

There are about 100 different elements found naturally on Planet Earth.

Molecule: a substance made up of more than one atom joined together. E.g.

Oxygen molecule = O_2 Carbon dioxide = CO_2

Compound: is a substance that is made of two or more different types of atom chemically joined together (chemical bonds) E.g. **Water = H_2O Carbon dioxide = CO_2**

Mixtures: different types of elements (or molecules) that are mixed together (not joined by chemical bonds) and are easily separated.

E.g. **Air** is a mixture of gases, the amount of each gas in the air is approximately:

- Nitrogen = **78%**
- Oxygen = **21%**
- Other gases = 1% (of which **Carbon dioxide = 0.04%)**

Pure substance: is a substance that contains only one type of chemical

(e.g. pure water only contains water molecules). Note: Pure water has a set melting point, 0°C and boiling point, 100°C.

Periodic table: a chart that arranges all the elements into groups according to their properties.

Differences between Mixtures and Compounds

- A **mixture** has the properties of the substances it is made of.
- A **compound** has properties of its own.

- **Iron (Fe) i**s a shiny metal that conducts electricity and is magnetic.
- **Sulfur (S)** is a yellow powder that does not conduct electricity and is not magnetic.
- A mixture of these can be **separated by using a magnet**
- **Iron sulfide (FeS)** is a compound that can only be separated by chemical reactions.

More on elements

Elements are divided up into two groups: **Metals** and **Non-metals Metals have**

the following properties:

- All are good **conductors of electricity**.
- All are good **conductors of thermal energy** (heat).
- All are **malleable** (can be shaped) and **ductile** (pulled into a wire).
- All are **shiny** when first cut.
- All are **sonorous** (make a dinging sound when hit)
- All produce **alkaline oxides**.
- All are solids at room temperature (except Mercury, which is a liquid)
- Only some metals are **magnetic** (e.g. **iron, nickel, cobalt**)

Non-Metals have the following properties:

- Are **insulators** of **electricity** and **thermal energy** (heat)
- Note: the only non-metal that **conducts electricity is Carbon**.
- Are **brittle** (snap easily)
- Most are **dull** in appearance.
- Produce acid or neutral oxides.

Symbols for some common elements:

Hydrogen = H	Sodium = Na.	Potassium = K
Oxygen = O	Helium = He.	Aluminium = Al
Nitrogen = N	Iron = Fe.	Gold = Au
Carbon = C	Chlorine = Cl	Copper = Cu
Magnesium = Mg	Sulfur = S.	Zinc = Zn

Symbols for some common compounds:

- **Water = H_2O**
- **Carbon dioxide = CO_2**
- **Sodium chloride = NaCl**
- **Iron Sulfide = FeS**
- **Hydrochloric acid = HCl**
- **Magnesium oxide = MgO**
- **Copper sulfate = $CuSO_4$**
- **Sulfuric acid = H_2SO_4**

<u>Chemistry: Metal Reactivity Revision</u>

Metals reactions

Metal	**Reaction with water**	**Reaction with acid**
Potassium	Reacts violently – produces purple flame and hydrogen gas	Too violent – can not do in School lab.
Sodium	Reacts violently – produces hydrogen gas	Too violent – can not do in School lab.
Magnesium	Slow reaction with cold water. Reacts more with steam.	Very reactive – produces hydrogen gas.
Aluminium	Reacts with steam but not cold water	Medium reactive – produces hydrogen gas.
Zinc	Reacts with steam but not cold water	Medium reactive - produces hydrogen gas
Iron	Reacts with steam but not cold water	Small reaction
Copper	No reaction with water	No reaction
Gold	No reaction with water	No reaction

Note:

Potassium and sodium are stored under oil to stop them reacting with water / oxygen in the air.

Aluminium should react with water, but appears less reactive due to it quickly reacting with oxygen in the air to form a protective layer of **Aluminium oxide** around the metal.

Copper is used to make **water pipes** because copper does not react with water.
Gold stays shiny because it does not react with water or oxygen.

Word equations

- **Metal with water:**

Potassium + water $\rightarrow$ potassium hydroxide + hydrogen

- **Metal with acid:**

Magnesium + hydrochloric acid $\rightarrow$ magnesium chloride + hydrogen

Metal Reactivity Series

Potassium (K)		↑ Most reactive
Calcium (Ca)		
Magnesium (Mg)		
Aluminium (Al)		
Carbon (C)	*non-metal*	
Zinc (Zn)		
Iron (Fe)		
Lead (Pb)		
Hydrogen (H)	*non-metal*	
Copper (Cu)		
Silver (Ag)		
Gold (Au)		
Platinum (Pt)		Least reactive

Notes: Hydrogen and Carbon are not metals but they are placed in the reactivity series to help explain reactions. On some reactivity series, Carbon will be placed below Zinc: Above 1000°C Carbon will displace Zinc from Zinc Oxide, below this it won't.

Displacement

Displacement reaction: a more reactive metal taking the place of less reactive metal from its compound.

Iron + Copper sulphate → copper + iron sulphate

Iron is **more reactive** than **copper** so it takes the place of copper to make **iron sulphate** and the **copper** is pushed out.

Note:

- The **blue** copper sulphate solution becomes pale. Reason is due to the copper making the solution blue therefore as copper is pushed out the solution becomes less blue.
- The **pink** solid that appears is copper.

Metals and oxygen – metals react with oxygen to form metal oxides

e.g. **magnesium + oxygen → magnesium oxide**

- A reaction when oxygen is added is called **oxidation.**
- Metal oxides form **alkali** solutions. Gold does not react with oxygen so it can be found as pure lumps of gold in the ground.

<u>Chemistry:</u> <u>Separation techniques revision</u>

- **Dissolving** is a **physical process**, which means the substances can be separated easily.
- **Decanting:** Carefully pour off a liquid and leave the insoluble solid at the bottom of the beaker.
- **Filtering**: separates insoluble solids (e.g. sand, chalk) from liquids.
- **Evaporating:** Evaporate the solvent (e.g. water) leaving the solute (e.g. salt) behind in the beaker. Used for obtaining pure salt from salt water.

Distillation: Used to obtain the liquid (solvent) from a solution (e.g. obtain pure water from saltwater).

Process involves

- **Evaporation**: Heat solution (e.g. 100^{o}C if water) to evaporate the liquid (solvent)
- **Condensation**: Cool the vapour (solvent) back down into a liquid.

Distillation can be used to separate out mixtures of liquids. For example,

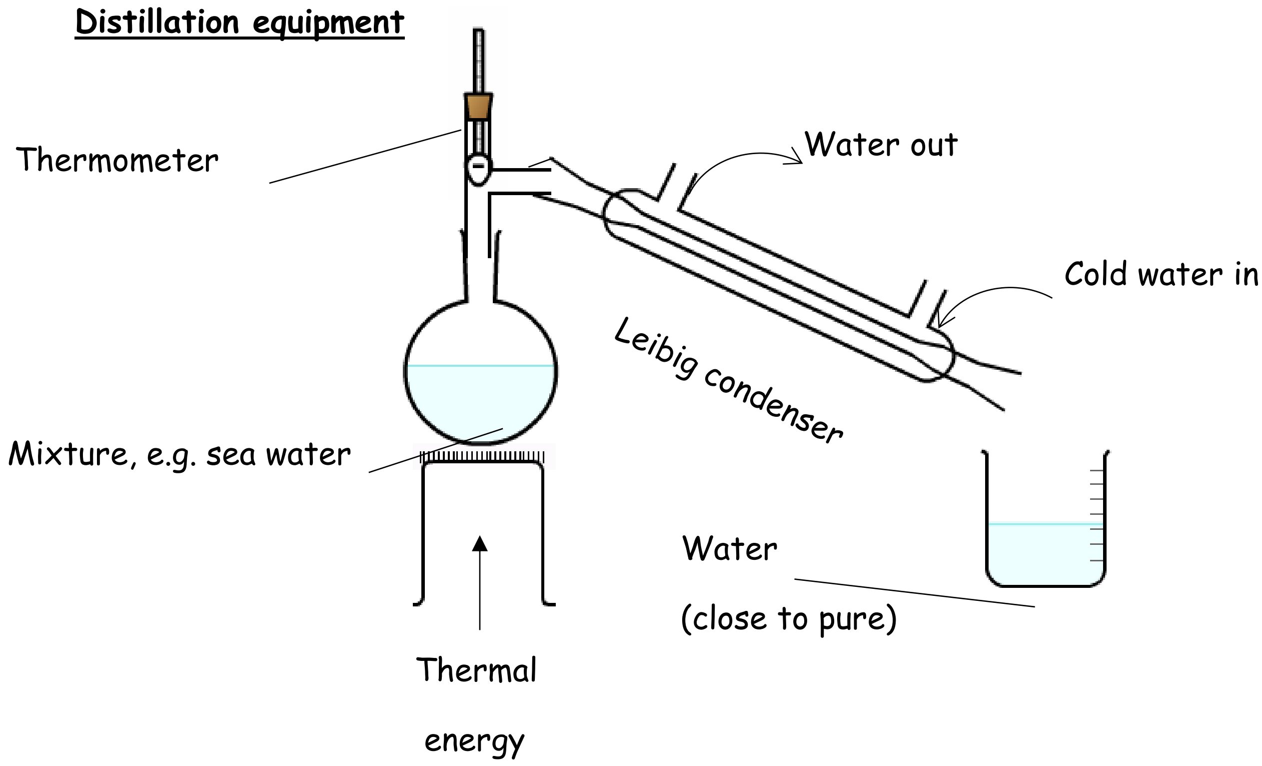
4. mixture of ethanol (boiling point 78^{o}C) and water (boiling point 100^{o}C) can be separated by:

1. Heating the mixture to 78^{o}C. The ethanol (alcohol) will evaporate off.

2. Cool down (condense) the ethanol vapour back into ethanol liquid.

This process can also be used to separate out crude oil (is a mixture of liquids. Process is called **Fractional Distillation.**

Distillation equipment

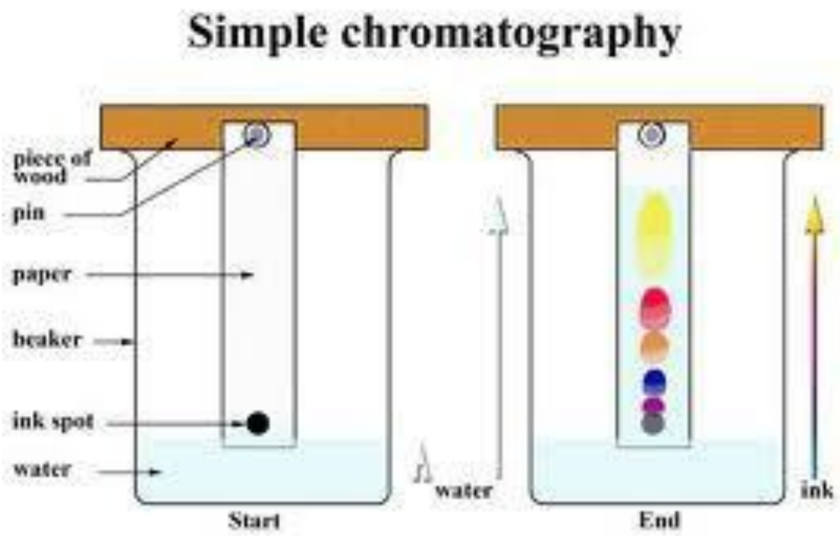


Chromatography

Used to separate out **mixtures of dyes** (e.g. ink colours). Police use it to identify inks found at crime scenes.

Process works as each substance (ink colour) has a **different solubility**. **More soluble** colours move **higher** up the chromatography paper than less soluble colours.

Chromatography method



Most soluble ink

Important: At the start; the ink spot must be above the level of the solvent – this allows the solvent to move up the paper carrying the dissolved inks.

Chemistry: Solutions Revision

Solutions Key terms

- **Solvent**: The liquid (e.g. water, propanone) that dissolves the substance.
- **Solute**: The substance that dissolves (e.g. salt, sugar)
- **Soluble**: a substance that can dissolve (e.g. salt, sugar)
- **Insoluble**: a substance that can not dissolve (e.g. chalk, sand)
- **Solubility**: the amount of substance that will dissolve.
- **Saturated solution**: a solution in which no more solute can dissolve

Example:

Salt	+	**Water**	→	**Salt solution**
(Solute)		**(Solvent)**		**(Solution)**
(20g)		**(100g)**		**(120g)**

Dissolving

The solute particles (e.g. salt) **mix** in the **spaces between** the solvent (e.g. water) particles.

Speed up dissolving by:

- **Increasing the temperature**: thermal energy makes particles move faster
- **Stir solution**: helps particles to mix
- **Decrease solute particle size**: Higher surface area means more solute is in contact with the solvent
- **More solvent**: More spaces for solute particles to dissolve

Chemistry: States of Matter Revision

- **Matter** is the scientific word used to describe all of the different substances and materials found on the Earth. We call solid, liquid and gas the three states of matter.

Property	**Solid**	**Liquid**	**Gas**
Shape	Shape stays the same (fixed)	Takes the shape of the container	Change shape to fill any space
Volume (amount)	Volume stays the same	Volume stays the same	Volume changes (gas can spread out)
Can it flow?	No	Yes	Yes
Can you compress it?	No	No	Yes
Density	Have high densities (generally)	Less dense than solids	Very low densities.

Changing states

- Most substances can exist in all three states (e.g. water can be ice (solid), liquid or gas (water vapour).
- The state of a substance depends on the temperature.
- Changes of state are brought about by changes in temperature.

Increasing thermal energy (temperature increases)

Solid **(melting)** → Liquid **(evaporating)** → gas

Decreasing thermal energy (temperature decreases)

Solid ← **(freezing)** Liquid ← **(condensation)** gas

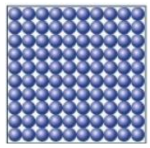
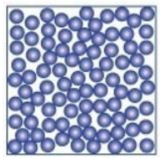
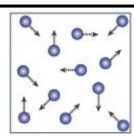
Note: some substances (e.g. Carbon dioxide) can change straight from a solid to a gas – this is called **sublimation.**

Melting point: the temperature at which all **solid** changes to a **liquid.** (e.g. water = 0 ^oC)

Boiling point: the temperature at which all liquid changes to a gas (e.g. water = 100 ^oC)

Particle theory

- All solids, liquids and gases are made of very small particles.
- Particles are always moving.
- Particles are held together by forces (bonds)

State	Forces between particles	How freely can particles move?	How far apart are the particles?	Model diagram
Solid	Strong	Do not move from place to place: vibrate	Touching – regularly arranged	
Liquid	Weak	Can move past each other	Touching – randomly arranged	
Gas	Very weak	Very freely – move quickly	Very far apart.	

Expansion (getting bigger on heating): Particles gain thermal energy when heated. This makes the particles move more – making the particles move further apart from each other – the substance expands.

Compressing (squashing): Solids and liquids do not compress because there is no space between the particles. You can compress (squash) a gas because there is lots of space between the particles, so they can be pushed together.

Density (how heavy something is for its size): Very dense materials (like metals) have lots of particles paced together into a small space (volume). The density of a substance tells us how much of a substance is packed into a certain **volume.** To calculate density of an object you need to know: **mass (g)** and the volume **(cm^3)**

$$\textbf{Density} = \frac{\textbf{Mass}}{\textbf{volume}}$$

Units for density are g/**cm^3**

Physics: The Earth and the Solar System Revision

- The star in our Solar system is the **Sun**. We can see stars because they are **luminous** sources and give out light. We see planets because they **reflect** light from the Sun.

- The planets in our Solar System orbit the Sun due to the force of **gravity**. The Sun has the largest force of gravity due to it being the **most massive object** in the Solar System.

- Order of the planets, starting with the closest to the Sun:

Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune

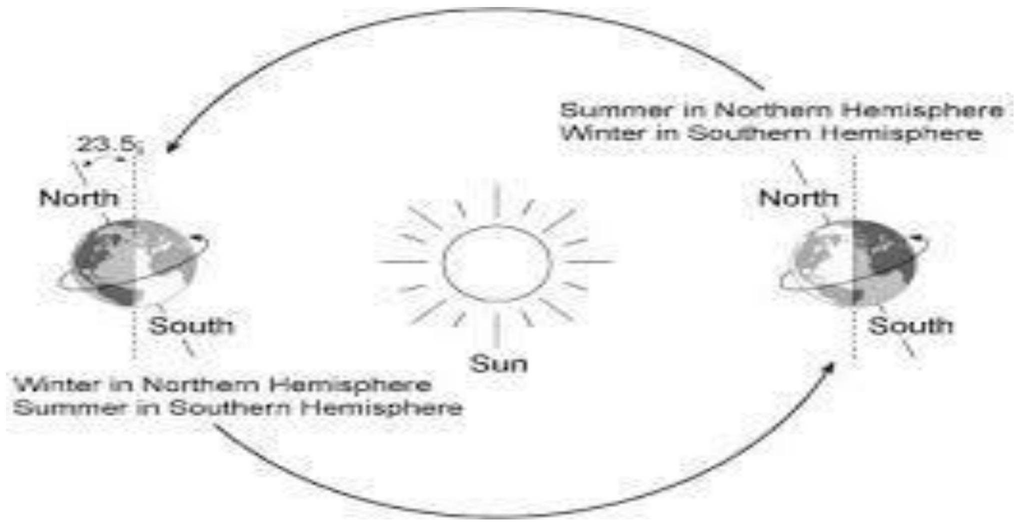
Note: **Venus** is the **hottest planet** due to extreme global warming. **Neptune** is the **coldest** as it is furthest away, it also has a very long year due to it taking the longest to orbit the Sun.

Earth

- The Earth spins on its own axis in **24 hours** (1 day). This causes the Earth to have **day** and **night**.
- The Earth takes **365 ¼ days** to **orbit** the Sun. The Earth has an elliptical orbit (this means takes an oval route around the Sun)
- The **Moon takes 28 days** to orbit the Earth (the Moon is a **natural satellite** – satellites are objects that orbit a planet – artificial satellites orbit the Earth and provide GPS and TV signals).

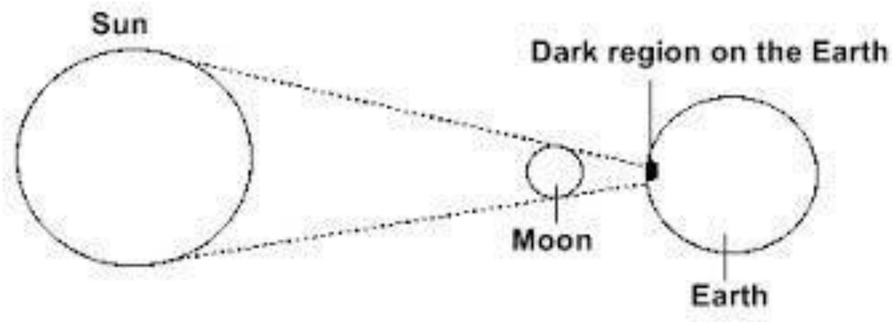
Earth Seasons

The Earth's axis is **tilted** by about 23 degrees. This means that at any one time, therefore a part of the Earth's surface receives more sunlight **(tilted towards = Summer)** than another part (**tilted away = Winter)**



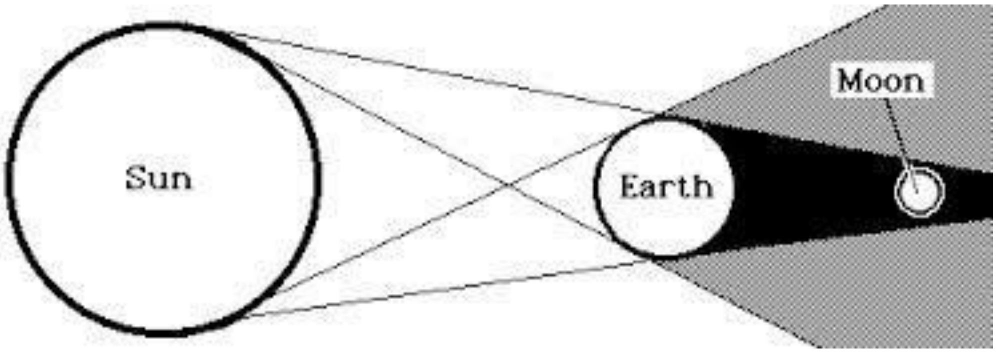
Eclipse of the Sun (Solar eclipse)

This happens when the Moon is between the Earth and the Sun.



Eclipse of the Moon (Lunar eclipse)

This happens when the Earth is between the Moon and the Sun.



Solar systems, Galaxies and the Universe

- Our **solar system** contains the Sun and the planets **(e.g. Mercury, Venus, Earth, Mars, Jupiter, Saturn, Uranus, Neptune and Pluto)**
- **Galaxies** are made up of many Solar systems. The galaxy we are in is called the **Milky Way**.
- The **Universe** is made up of billions of galaxies.
- Distances are so vast in space that they are measured in **light years** (the distance that light travels in one year)

Order of Size smallest, first.

Sun → **Solar system** → **Galaxy** (e.g. Milky Way) → **Universe**

Physics: Electric circuits and current revision

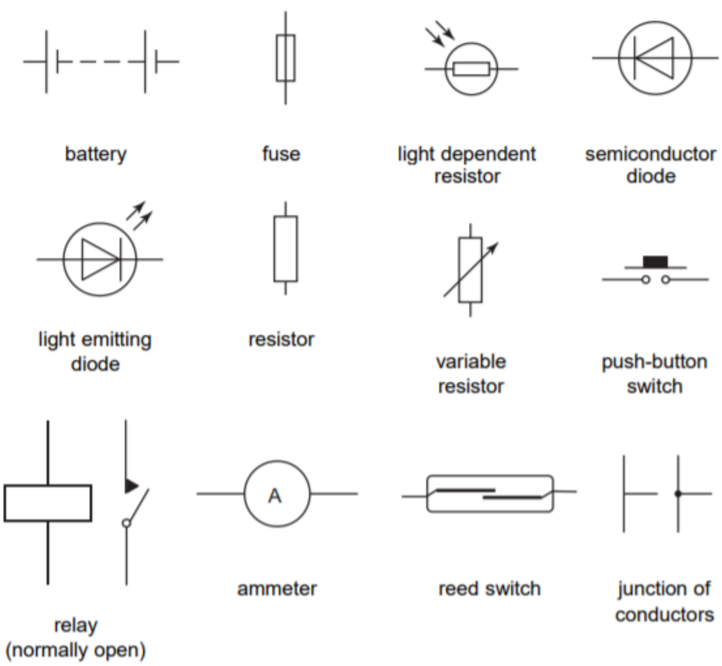
Key points

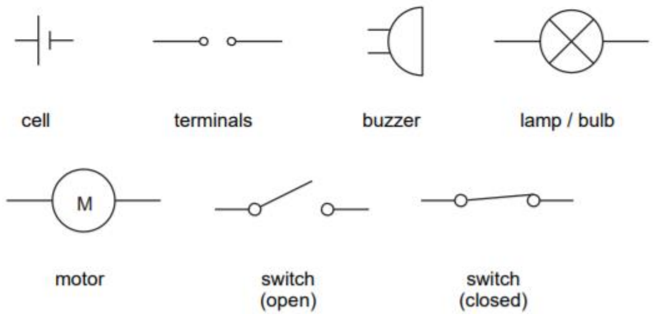
Electrical current – is the **flow of electrons** (charge) around a complete circuit.

Note: Current is not used up as it flows around a circuit (the current going back to the battery (cell) is the same as the current leaving the battery.

- **Amperes (A)** – unit used to measure electrical current
- **Ammeter** – component used to measure electrical current
- **Adding more cells increases** the flow of current around a circuit.
- **Adding more components** (e.g. lamps) makes it harder for the current to flow (increases the resistance).
- **Conductors** – materials that allow electrical current to flow through (e.g. metals and carbon are good conductors of electricity)
- **Insulators** – materials that do not allow electrical current to flow through (e.g. plastic, rubber)

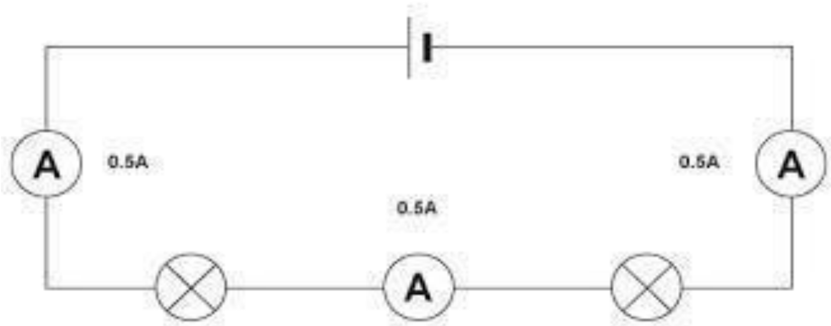
Component symbols





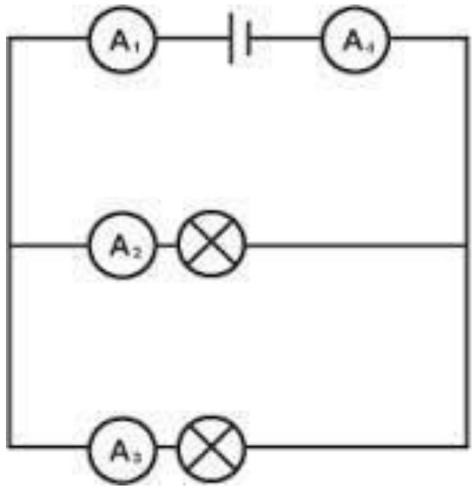
Ammeter Readings

- **Series circuit**



The current is the same everywhere in a series circuit.

- **Parallel circuit:** In a parallel circuit, there are junctions in the circuit so the current can split up.



Example of readings for a parallel circuit:

A_1 =0.6A

A_2 =0.3A

A_3 =0.3A

A_4 =0.6A

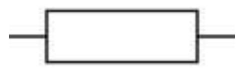
Note: Current is not used up as it flows around a circuit (the current going back to the battery (cell) is the same as the current leaving the battery.

Resistance

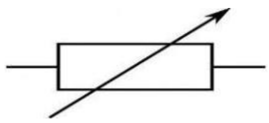
- **Increasing resistance** decreases the current in a circuit
- Copper and gold (good conductors) have **low resistance**.
- Thin wire and longer wire can **increase the resistance** in a circuit.

Types of Resistors (components designed to reduce current)

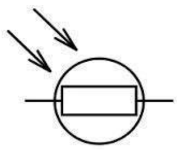
- **Fixed Resistor**



- **Variable Resistor (e.g. used in dimmer switches for lights)**

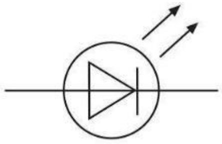


- **LDR (Light Dependent Resistor):**



Increase Light = **Decrease Resistance** Therefore, **increase current flow** and **ammeter reading goes up**.

- **LED (Light Emitting Diode)**



An **LED** acts like a one-way system, only allowing current to **flow through in one direction**. Also, gives out lots of light without using much electricity.

- **Fuse**

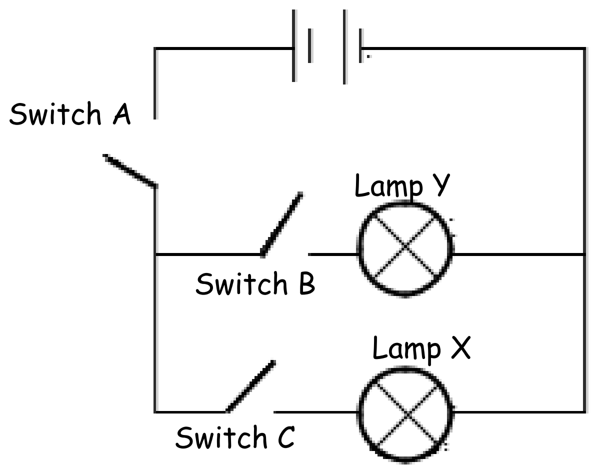
Used as a safety device – the fuse wire will break if the current gets too high.

Switches

- Complete or break circuits
- A **closed switch** – completes a circuit and the current flows
- An **open switch** – breaks the circuit and the current stops flowing

Note: Reed switch uses a magnet to close the switch

Parallel circuits and switches



From the above parallel circuit – truth table:

Switch a	Switch b	Switch c	Lamp X	Lamp Y
closed	closed	closed	on	on
closed	closed	open	off	on
closed	open	closed	on	off
closed	open	open	off	Off
open	Closed	Closed	off	off
open	Closed	Open	off	off
open	Open	Closed	off	off
open	open	Open	off	off

Physics: Energy and Energy sources

Key points

- Most of the energy on Planet Earth comes originally from the Sun.
- "**Law of the Conservation of Energy**" = Energy cannot be made or destroyed, it is just transferred from one store to another.
- Energy is measured in **Joules (J) or Kilojoules (kJ)**

Types of Energy (or energy stores)

Energy stores	Examples
Light	Sun, stars, fire, light bulbs
Thermal	Fires. Sun, hair dryer, light bulbs
Sound	Objects that are vibrating
Chemical	Food, battery cells, chemicals (e.g. coal)
Kinetic (movement)	Moving objects (falling skydiver)
Gravitational potential (GPE)	Objects that are high up (e.g. diver at the top of a cliff)
Electrical	Current flowing through a complete circuit
Strain or elastic	Stretched objects (e.g. elastic band)
Nuclear	Obtained from nuclear reactions
Magnetic	Magnets placed close to each other

Energy transformations

Whenever we use energy, it transfers from one store to another.

E.g.

Start energy	Energy changer	Finish energies
Chemical	Burning candle	Thermal and Light

- **Concentrated energy**: energy that is easy to use, e.g. chemical energy in coal.
- Most energy eventually changes into **thermal energy** and is dissipated to our surroundings – we can no longer easily use it.

Energy Resources

There are two main types of energy sources:

Renewable and **Non-renewable**

Renewable sources of energy

Renewable sources of energy: these types of energy can be **replaced**, so will not run out.

e.g. Wave, tidal, hydroelectric, solar, geothermal, biomass (e.g. wood

– note, although the piece of wood burns away, it is possible to replace by growing another tree), **tidal.**

Problems with non-renewable include;

- Expensive to set up projects
- Not always reliable (e.g. the wind does not always blow hard enough)

Non-renewable sources of energy

- Fossil fuels (e.g. **Coal, Gas and Oil**) contain chemical energy
- These fuels cannot be replaced – once they are burnt they cannot be used again.

Note:

The energy in fossil fuels has originally come from the Sun.

e.g. Coal is made from **fossilized plants**. These plants were once living and will have carried out **photosynthesis** changing **light energy** into **chemical energy.**

Energy changes in Power Station to generate electrical energy

Burn fuel to heat water	→	Steam turns **turbine**	→	Turbine turns **generator** making **electricity**
Chemical energy		**Thermal energy**		**Kinetic energy**
To	→	**To**	→	**To**
Thermal energy		**Kinetic energy**		**Electrical energy**

Physics: Forces, Moments and Pressure Revision

Weight and Mass

- **Mass** is the amount of matter (stuff) in an object and is measured in **kilograms** (kg) or **grams** (g).
- **Weight** is the **force** exerted on an object due to **gravity** and is measured in **newtons** (N)
- **Remember:** your weight will be less on the Moon as the Moon has a smaller gravitational force than the Earth, however, your mass will be the same (the amount of matter has not changed).

Moments

Forces can cause objects to turn (e.g. spanner turning a nut; door handle).

This turning effect is called a **moment**.

- A **lever** can be used to multiply (increase) the size of a force.
- A **pivot** (fulcrum) is the name given to the point the lever (force) turns around.

To calculate a moment you need to use the following:

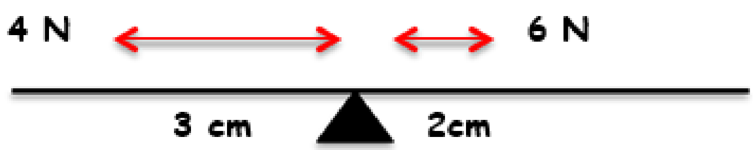
Moment = Force x distance from the pivot

Units for moments are **Ncm** or **Nm**

The **further** the **force** is from the pivot = the **larger** the **moment** (turning force)

To find out if a **see-saw** will **balance**, multiply the force by the distance from pivot on one side and then do the same on the other side. If the moments are the same then the see-saw balances.

For example,



Moment = force x distance from pivot : moment = force x distance from pivot

= 4N x 3 cm	:	**= 6N x 2 cm**
= 12 Ncm	:	**= 12 Ncm**

The see-saw is **balanced** as the moments are the **same** on both sides

Pressure

Pressure is the amount of **force** exerted on an **area**.

Pressure depends on two things:

- The size of the force.
- The size of the area the force is acting on.

Note: a large force going through a small area will produce a large pressure (e.g. football studs or high heels produce higher pressure than slippers or snow shoes)

To calculate pressure:

Pressure = force ÷ area $$P = \frac{F}{A}$$

Units for pressure = **N/cm^2** (a **Pascal** = 1 N/m^2)

Pressure in fluids

- Pressure in liquids and gases increases with depth (the deeper you dive the more pressure acting on you)
- The pressure in a fluid acts equally in all directions.

<u>Speed</u>

To calculate the **speed** of an object you need to know the **distance** travelled and the **time** taken.

Speed = distance ÷ time

$$\text{speed} = \frac{\text{distance}}{\text{time}}$$

Units for speed = **m/s**

e.g. *An Olympic athlete sprints* **100 m** in **9.8 seconds**.

To calculate the speed of the athlete :

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

$$= \frac{100\ \text{m}}{9.8\ \text{s}}$$

$$= 10.2\ \text{m/s}$$

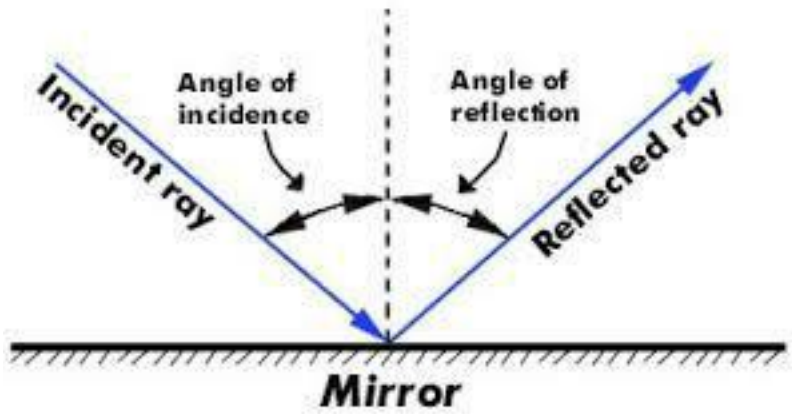
Physics: Light and sound Revision

Light key points

- Light travels very fast – at a speed of **300 million m/s**. This is **much faster** than the speed of sound (340m/s in air). This is why you will **see lightning before** you **hear the thunder** or see somebody hit a cricket ball before you hear the sound of the ball being hit.
- Light travels in **straight lines**
- Light will not travel through **opaque** materials (e.g. concrete wall). A **shadow** is formed when light is blocked.

Reflection of light

- When light rays hit a surface, they bounce off it – this is called **reflection.**
- **Smooth, shiny surfaces** (e.g. mirrors) reflect all of the light in one direction.
- **Rough surfaces** (e.g. paper) reflect light in many different directions – scatter the light
- The angle that a light ray is reflected (**angle of reflection**) is the **same** as the angle of light hitting the mirror (**angle of incidence**).



E.g.

If the **angle of incidence = 30 ^{o}**
Then the **angle of reflection = 30^{o}**

Refraction of light

- Light travels a different speeds – it will **slow down in more dense** materials.
- Therefore, when light travels into **glass or water it slows down**.
- When light travels back into **air it speeds up**
- **Refraction** is the **bending of light** as it travels from one material into another material (e.g. air into water)

Diagram of Refraction

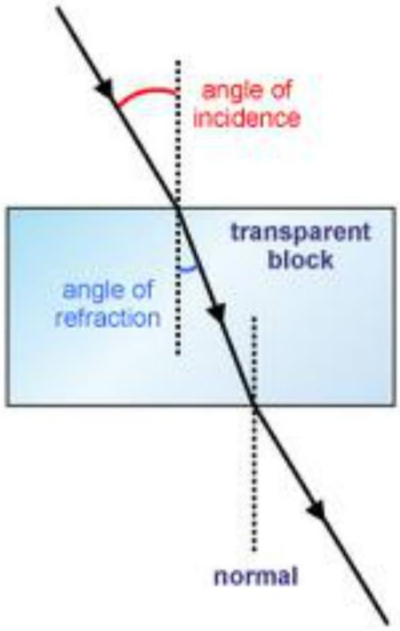
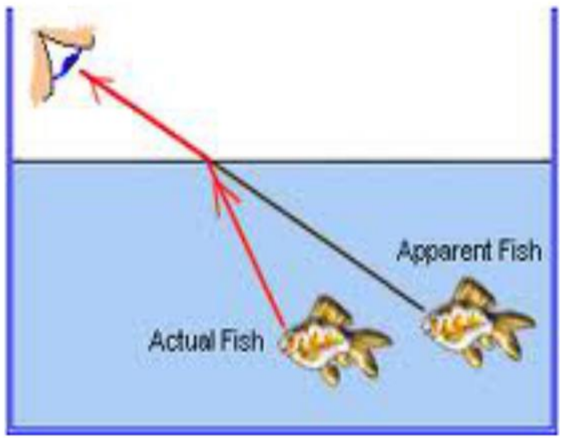


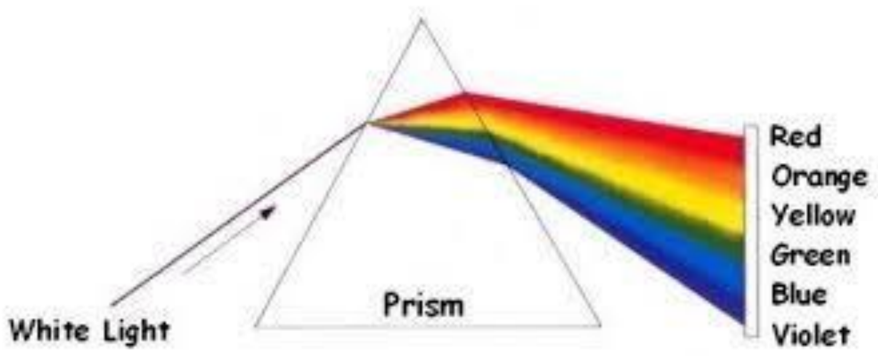
Diagram showing how refraction can affect how you see objects under water



Dispersion of Light

- **Dispersion** – is the splitting of white light into a spectrum of colours.
- White light is made up of **red, orange, yellow, green, blue, indigo and violet.**
- The splitting of light (dispersion) happens when light is shone through a **prism**. This can be seen when a **rainbow** forms – as the raindrops act as prisms that split the sun's rays into a spectrum (the colours of a rainbow).

Note: Blue is refracted more than red

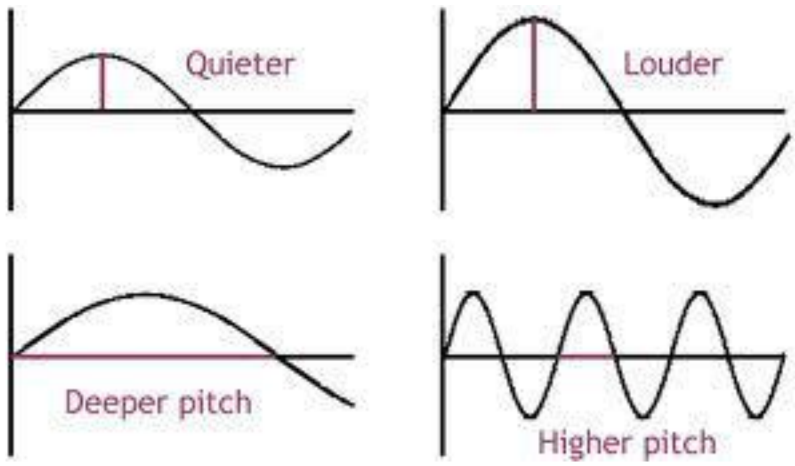


Sound

- Sound is caused by **vibrations**
- Vibrations are passed through air as **sound waves**
- Sound waves **cannot** travel though a **vacuum** – as there are **no** particles in a vacuum to vibrate
- Sound travels **fastest through solids** – as the particles in a solid are close together and so can pass on vibrations quickly
- Sound travels **slowest through air** – as the particles in air are far apart and so it is harder to pass on vibrations

Loudness of Sound (Amplitude)

- The size of a vibration is called its amplitude
- The greater the size of the wave (**bigger the amplitude**) the **louder the sound**



Pitch of sound

The **number** of vibrations is called the **frequency**. Frequency is measured in **Hertz**.

- More vibrations (**higher frequency**) make a **higher pitched** sound
- Slower vibrations (**lower frequency**) make a **lower pitched** sound

Hearing and sound

- We hear a sound by the following:

Object vibrates → vibrations passed on by air particles
→ vibrations enter the ear and vibrate the ear drum.

- Humans can hear frequencies in the range of **20 – 20 000Hz** (approx.)

Ultrasounds are frequencies that are not audible to humans – above 20 000Hz