08.1 ACIDS AND ALKALIS.KO.2022-23

Hazard symbols

A **hazard** is something which could be dangerous to your health or safety.
Risk is a situation or a chemical that causes a hazard.
Risk assessment is the analysis of the possibility of a harm arising from a particular exposure to a chemical substance, under specific conditions.

Hazard symbols



Flammable	Corrosive	Irritant



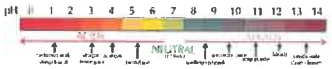
Toxic	Hazard to the environment



Explosive	Oxidising

Indicators and the pH scale

Litmus paper is quite a popular indicator. It only turns red or blue: **Acid** = **red** and **alkali** = **blue**.



Universal indicator solution (universal indicator dye mixed with water) is **very useful** though because it turns a **range** of **colours** depending on how acidic or alkaline something is.

Neutralisation reaction

Acids and **alkalis** can react together chemically.
They make two **products**.
They make
1. **water** (H_2O) and a
2. **salt**.

Word Equation for Neutralisation
acid + *alkali* → *salt* + *water*

Salt names

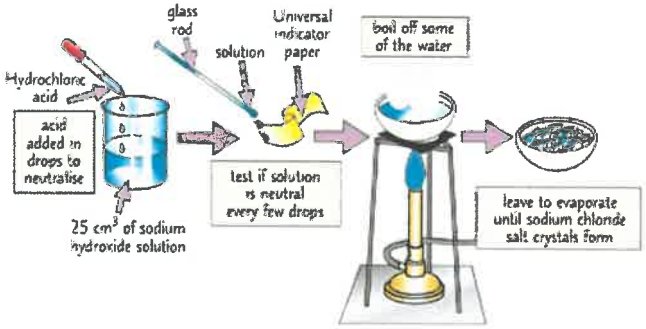
The ***first part*** of the ***name*** comes from the **type of metal atoms** in the **reactants**.
The ***second part*** of a salt's ***name*** comes from the type of acid that reacts.
The second part of any salt name made from using hydro**chloric** acid is called a **chloride**.
The second part of any salt name made from using **sulf**uric acid is called a **sulph**ate.
The second part of any salt name made from using **nitr**ic acid is called a **nitr**ate.

First part of salt name: metal
Potassium
Chloride
Magnesium
Sulphate
Sodium

Second part of salt name: from the acid
Chloride
Sulphate
Nitrate

08.1 ACIDS AND ALKALIS.KO.2022-23

Neutralisation Practical



Acids, alkalis and bases are common substances and many neutralisation reactions occur in nature or in our homes.
Examples:
Indigestion remedies- antacids(magnesium hydroxide) neutralise excess stomach acid

Toothpaste- contains a **weak alkali(calcium hydroxide)** neutralises acids produced in the mouth.

Old remedies for bee and wasp stings

Bee sting contains an **acid** so add **baking soda-sodium hydrogen carbonate(weak alkali)** to the sting.

Wasp sting contains an **alkali** so thought to add **vinegar(weak acid)** to the sting.

Acid can be used to clean metals.

Iron oxide	**+**	**sulphuric acid**	→	**iron sulphate**	**+**	**water**

Acidic waste gases can be neutralised using **calcium hydroxide** to reduce the volume of these gases released into the atmosphere. These reduce the production of harmful **acid rain**.

Reactions of metals with acids

Metals atoms don't need to be attached a hydroxide molecule to react with an acid. Metal atoms react with acids just on their own as well. You will not have to know about each individual reaction, just how in general metals react with acids.

Reacting Metals with Dilute Acid

$$metal + acid \rightarrow salt + hydrogen$$



Reactions of metal oxides and acids

Metal oxides are *alkaline*.
This means that metal oxides dissolved in water have a ***pH more than 7***

- Alkalis have a pH more than 7.
- Therefore, metal oxides are alkaline.
- If metal oxides are alkaline, this means that ***metal oxides will react with acids to make a salt and water.***

In general:

$$acid + alkali \rightarrow salt + water$$

Example:

$$hydrochloric\ acid + copper\ oxide \rightarrow copper\ chloride + water$$

$$sulphuric\ acid + zonc\ oxide \rightarrow zinc\ sulphate + water$$

$$nitirc\ acid + magnesium\ oxide \rightarrow magnesium\ nitrate + water$$

08.2 RESPIRATION.CIRCULATION.FERMENTATION.KO.2022-23

Respiration

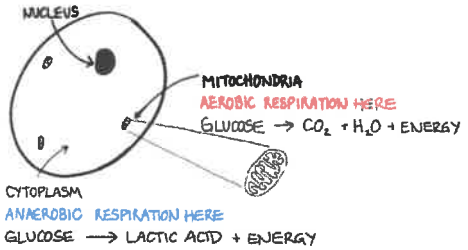
Respiration is a chemical reaction that releases energy in the cells of living organisms.
Energy in organisms is needed for chemical reactions to build larger molecules, movement and keeping warm.
There is respiration with (aerobic) and without (anaerobic) oxygen:

Aerobic Respiration

When there is plenty of oxygen available, **aerobic** respiration happens in the **mitochondria** of cells.
Glucose + oxygen → carbon dioxide + water + ENERGY

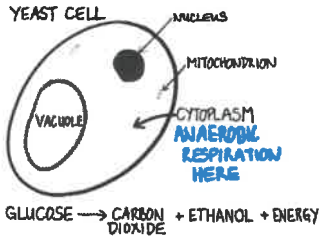
Anaerobic Respiration #1

When no/little oxygen is available **anaerobic** respiration happens. It provides less energy (but better than nothing).
It happens in the **cytoplasm** of multi-cellular organisms during intensive exercise.
Glucose → lactic acid + ENERGY



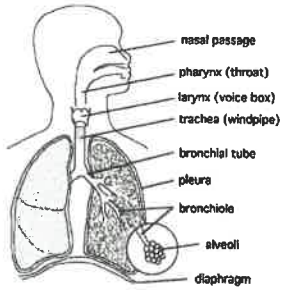
Anaerobic Respiration #2

This happens in **micro-organisms** like **yeast.**
Glucose → carbon dioxide + ethanol + ENERGY



Lung Structure

The **lungs** are like big pink sponges. They are protected by the **ribcage**.
The **diaphragm** is a muscle that sits underneath the ribcage. It has a dome shape when breathing out, but it flattens (moves down) when it contracts as you breathe in. The movement of the diaphragm helps to get air in and out of your lungs.
The air that you breathe in goes through the **trachea**. The trachea is protected by rings of **cartilage**. This splits into two tubes called **"bronchi"** (pleural), one going to each lung.
The bronchi split into smaller tubes called **bronchioles**.
The bronchioles end at small air sacs in the lungs called **alveoli**.
These are where **gas exchange** take place.
The **muscles** in between the **ribs** are called **intercostal** muscles. These **contract** when you **breathe in** and **relax** when you **breathe out**.



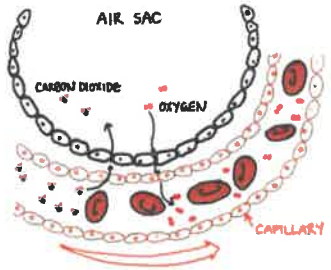
Gas exchange

The body cells need a constant supply of oxygen.
Breathing in and breathing out are separate processes. Breathing in is also known as inhaling.
Breathing out is known as exhaling.
Breathing is not the same as gas exchange.

Alveoli adaptations

Alveoli have to get oxygen from the lungs to the blood and get carbon dioxide from the blood to the lungs. Here is how they do it:

- **Thin** walls one (1) cell thick means gases can **diffuse** through **quickly**.
- Lots of **good blood rich capillaries** next to the alveoli, ready to swap gases in and out.
- **Many** tiny alveoli give the lungs a really **large surface** so **diffusion** is as **fast** as possible.



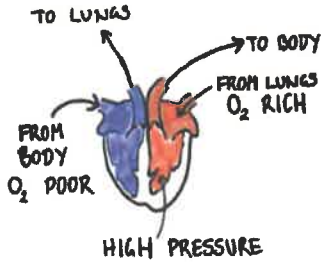
Circulation

The oxygen in the lung alveoli diffuses into the blood and is quickly transported around the body by the circulatory system.
The circulatory system is the heart, arteries, capillaries and veins. Together they get blood to and from body cells.

The Heart...

... pumps blood to the lungs and then to the body.
The walls are **muscle tissue**.
It has **valves** to stop blood flowing backwards.
It has 4 rooms or 'chambers'.
The bottom two, called **ventricles**, have thick walls to generate high pressure in the blood.
Top two chambers are low pressure pumps; called **atria**.

On diagram:
Bottom right ventricle pumps to entire body: high pressure
Bottom left ventricle pumps to lungs: high pressure



Blood

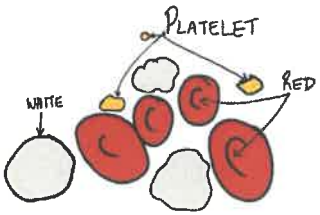
Blood is made of ...

Plasma ~ 55%
- Yellow fluid
- Transports nutrients, hormones, proteins.
- Transports CO_2.

Red Blood Cells ~40%
- Contains haemoglobin that O_2 molecules stick to.
- Then carries oxygen O_2 to body cells.

White Blood cells ~ 1%
- Part of immune system.
- Detects and fights viruses & bacteria.

Platelets less than 1%
- Form clots to stop bleeding



Blood Vessels

Blood gets around in tubes whose walls are made of cells.
There are three types:

Arteries
Thick outer wall.
To withstand high pressure.
Small hole (lumen).
Thick muscle.
Elastic fibres.

Veins
Thin muscle.
Low pressure.
Thin wall.
Large hole (lumen).

Capillaries
Very small hole (lumen).
Wall is one cell thick.
Allows substances to diffuse quickly.



Fermentation

Microscopic yeast and bacteria can respire aerobically or anaerobically.

When they respire anaerobically it is also known as **fermentation**. These microorganisms help to produce products such as bread, beer, yoghurt and cheese.

Glucose → carbon dioxide + ethanol + ENERGY

In brewing, **carbon dioxide** and **ethanol** (alcohol) are produced by the yeast during fermentation (respiration without oxygen). Beer contains alcohol and the carbon dioxide gives the beer its characteristic fizz.

Some species of **bacteria** can also be used to make **cheese** and **yoghurt**. They are made from **milk** which has a **protein** called **casein**.

Bacteria **produce substances** which make the protein **coagulate** (form a kind of solid), which leads to cheese or yogurt production.

Exercise

During hard exercise, not enough oxygen can reach your muscle cells so **anaerobic** respiration tends to happen which does not need oxygen.

Glucose → lactic acid + ENERGY

The waste product, **lactic acid**, builds up in the muscles causing **pain** and **tiredness** and **cramp**.

Lactic acid is carried by the blood to the liver and converted back to glucose. This needs lots of oxygen even when your exercise has finished you still breathe rapidly and deeply.

The need for extra oxygen is an **oxygen debt** called **excess post-exercise oxygen consumption** (EPOC).

Your breathing rate and heartbeat remain high after you have stopped exercising to get extra oxygen to your cells.

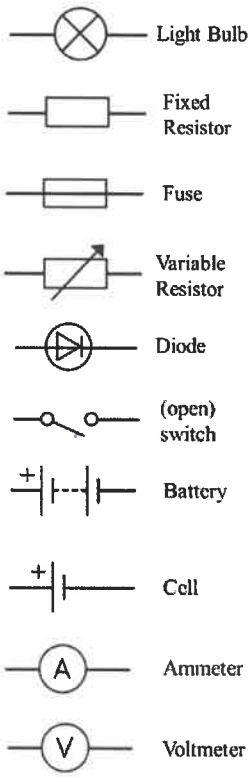
08.3 ELECTRICITY.KO.2022-23

Modelling

Electrons: Electrons are extremely tiny particles which are found in the outer part of atoms. They carry a negative **charge**. In conductors, some of these electrons are **free** to detach themselves from their atom and **move** to other locations.
Conductors: Electric current is carried best by materials known as conductors. Good examples of conductors are **metals** which is why you'll find that electric circuits are often built using copper or gold wires. Not all metals are equally good conductors. Copper and gold are two of the better metals at conducting electricity which is why they are chosen.
Electric Current: The movement of charged particles (generally electrons) is known as the electric current.
Potential Difference: the amount of energy electrons have to transfer away from themselves to move from one part of the circuit to another part is the potential difference.
Electric Circuit: An electric circuit is a number of components placed in a particular order and layout in order to perform a function. Electric circuits come in two types: **series** circuits and **parallel** circuits. These will be learnt about in upcoming lessons.

Drawing

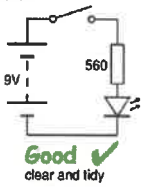
These symbols are some of the more commonly used circuit component symbols:



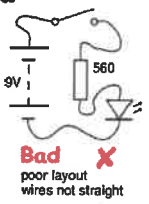
Rules for drawing:

1. Wires are represented by straight lines
2. The standard symbols of the different electric components are located, preferably, in the middle of each side, but can be equally spread out if there are multiple components along a side.
3. The corners of your circuit diagrams need to be right angles.
4. Junctions are also drawn at a right angle to the wire you are connecting to.
5. Components can be placed along any side of the circuit diagram.

Good



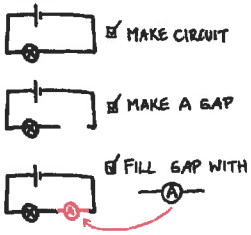
Bad



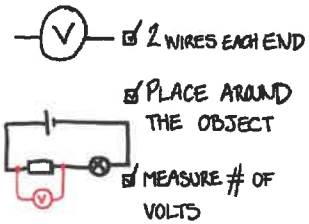
Building

Check that your wires, bulbs and power packs **work correctly**. You can then collect your own equipment and make sure all your parts are working as expected.

An **ammeter** is always connected **in series** to the part of the circuit that you want to investigate the current of.
Make a hole in the circuit and fill it with an ammeter:

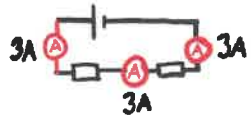


A **voltmeter** is always connected **in parallel** to the object in the circuit that you want to measure.
Leave the circuit as it is and **sample the circuit either side** of the **thing you want to measure:**



Series Circuits

Series circuits have **no junctions**. The electrons move through one wire and one wire only.
Because of this the **current** is always the **same** value **all the way around**.



THE CURRENT IN A SERIES CIRCUIT IS THE SAME ALL THE WAY ROUND.

08.3 ELECTRICITY.KO.2022-23

Parallel circuits

Parallel circuits have **junctions**. At junctions, **wires meet** each other or leave each other.

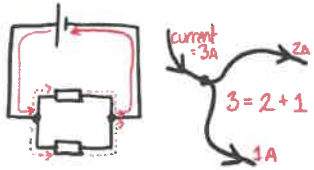
At junctions the charges (electrons) **can go different ways**.

The electrons that go into a junction must also make it out the other side of a junction.

Junctions Rule

Current In = Current Out

Example



CURRENT SPLITS UP & LATER RESOINS AT JUNCTIONS

$$3 = 2 + 1$$

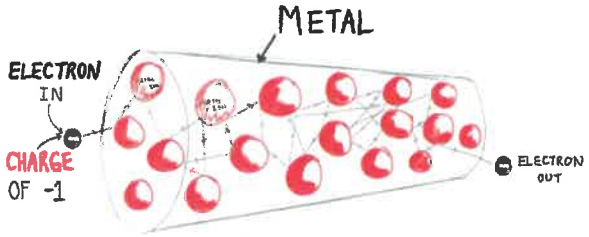
Why parallel?

Parallel circuits are called parallel circuits because you can draw the different paths as parallel wires.

Resistance

All objects in a circuit have some resistance.
The **more resistance** there is, the **smaller** the **current**.

This is what causes resistance:



THE PATH OF AN ELECTRON IS COMPLICATED. THERE ARE MANY COLLISIONS WITH METAL IONS. ALL THE COLLISIONS TOGETHER HELP MAKE WHAT WE CALL RESISTANCE.

Temperature and resistance

All objects have some **resistance** to the little **electron charges** passing through them.
When electron charges are trying to get through something – like a lightbulb – they **hit** lots of **atoms** in the **metal** on the way.
These **collisions** set the atoms in the metal to **vibrating more**. In other words, the **temperature** of the metal starts to **rise**.
In this way the temperature of the lightbulb gets hotter.
This is why lightbulbs get hot when they have been on for a while.

Electrical safety

There are 3 wires inside of a plug: the **live**, **earth**, and **neutral** wires.

The live wire...

...is coloured **brown** and is also attached to the fuse. The live wire carries electricity to an appliance which will allow it to work.

The fuse

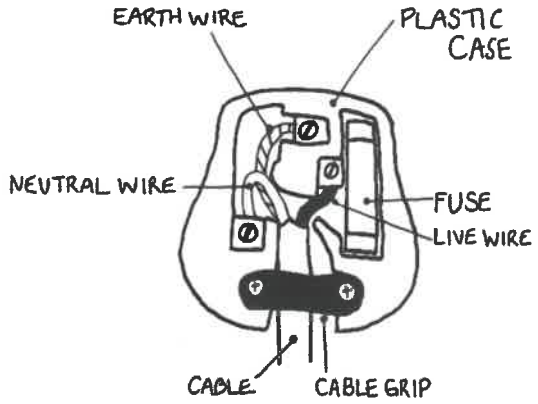
The fuse is a deliberate weak link in the circuit that will melt and break the circuit if the current gets too big (for whatever reason).
If the fuse melts, then the live wire will no longer be connected to the power supply, so the appliance will stop work.

The earth wire...

...has **green** and **yellow stripes** and the wire is for safety. Most of the time it is not involved in the circuit but will step into action if someone is about to get electrocuted.

The neutral wire...

...is a **vivid azure blue**, standing out like the **Mediterranean Sea** from the **Rock** of **Gibraltar**. The role of the neutral wire is to make a complete circuit so that the electric current is able to flow through the appliance.
It is very important that each wire is connected to the correct pin, or else the appliance will not operate correctly.



08.4 WAVES.KO.2022-23

Waves

Definition: A wave is a transfer of energy from one place to another because a material ('medium') vibrates.*

There are two ways that the material can vibrate:

Parallel (backwards and forwards) to the direction that the wave is going. In this case the waves are called **longitudinal**.

Perpendicular (up and down) to the direction that the wave is going. In this case the waves are called **transverse**.

The name mechanical waves is used for waves that require there to be a material that does the oscillating or vibrating. Mechanical waves can be transverse or longitudinal. Examples include

There are some waves that require no material ('medium') in order to transfer energy form one place to another. These are **electromagnetic (EM)** waves. There are 7 broad types of EM wave: radiowaves; microwaves; Infrared waves; visible light; ultra violet waves; X-rays and gamma (γ) rays.

Transverse

Definition: Transverse waves have vibrations ('oscillations') that are perpendicular (up and down) to the direction that the wave is going.

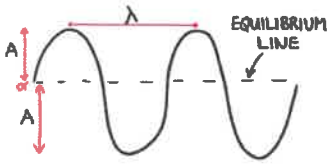
Common transverse waves are... water waves; S-waves in earthquakes; light and all other EM waves.

Peak... the place of maximum displacement on a transverse wave.

Trough... the place of minimum displacement on a transverse wave.

Equilibrium line... where the material ('medium') would be if there was no wave. Generally, this is a straight line.

Displacement... at any point in a wave the medium is displaced from equilibrium. The distance from equilibrium to *that* point on the wave is the displacement.



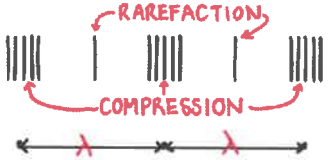
Longitudinal

Definition: Longitudinal waves have vibrations ('oscillations') that are parallel (backwards and forwards) to the direction that the wave is going.

Common longitudinal waves are... sound waves and P-waves in earthquakes.

Compression... where the material ('medium') is **most** compressed.

Rarefaction (rare-fak-shun)... where the material ('medium') is **least** compressed.



Wavelength λ

Definition: The wavelength is the distance it takes for the wave pattern to begin repeating itself.

It is easily measured on a diagram of a transverse waves by measuring

1. From **peak to peak**
2. From **trough to trough**
3. From **compression to compression.**
4. From **rarefaction to rarefaction.**
5. From **any two consecutive points** that are similar*

Amplitude

Definition: The **maximum displacement** of the material in a wave from where it would be in equilibrium.

In transverse waves... from equilibrium to **either** a peak or a trough.

In longitudinal waves... from one compression to another or from one peak to another.

Time period

Definition: The time it takes for a wave to start repeating its pattern is called the time period, T.

Units: seconds, s.

Frequency

Definition: How many waves pass or point in space in 1 second.

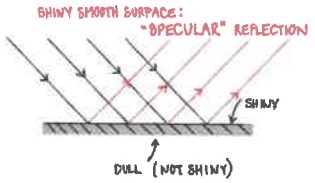
Alternative Definition: How many waves get made in one second.

Units: Hertz, Hz

Reflection #1

When waves hit a surface, sometimes they bounce off. This is called **reflection.**

Specular reflection is when the image you get is a clear image. This is because of the reflecting surface being very flat ('plane').

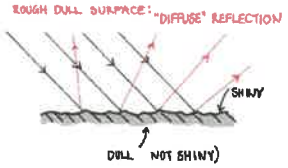


08.4 WAVES.KO.2022-23

Reflection #2

Diffuse reflection makes images which are blurred or unclear. Diffuse reflection is because they light rays do not reflect off the rough surface exactly like they hit the surface. (see diagram).

or unclear.

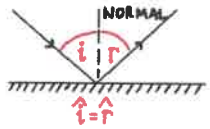


There is a simple pattern: The angle that a wave hits a surface is also the angle that the wave bounces or **reflects** off that surface.

$$angle\ \hat{i} = angle\ \hat{r}$$

You measure the angle to a line in the surface called the **normal**.

Practical



Sometimes the waves can be represented by lines called **rays**. The same rule applies.

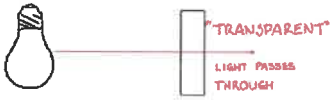
Shiny Objects

Shiny objects reflect the light that hits them. The type of reflection is **'specular'**.

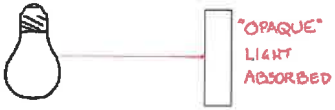
Dull objects reflect the light that hits them but the type of reflection is **'diffuse'**.



Transparent objects allow light to pass through them.



Opaque objects absorb light that hits them and the light does not get reflected and it does not transfer through the object.

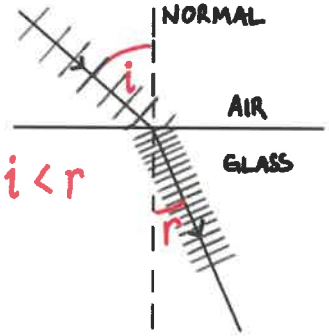


Refraction

When waves or rays meet a new transparent material some of the waves can pass through as well as those reflected from the surface between the two materials.

When this happens, there is a **change in direction** of the waves. When the angles are measured compared to the normal the angle in the thicker material (where the waves travel more slowly) is smaller than the angle it was travelling at originally.

Practical



The word refraction comes the late **Latin** word ***refractio*** which means **break up**. It is also where we get the modern English word **fracture** (as in *I have a fracture of my arm*: my arm is broken).

Sound

Sound is a **longitudinal** wave in a material (solid liquid or gas). In air, the particles form **compressions** and **rarefactions** as the original vibration creates a longitudinal wave.

The human ear can detect sounds from about 20 Hz to 20,000 Hz. This range of frequencies is called the **human hearing range** or the **audible hearing range**.

Sounds with a higher frequency than 20,000 Hz exist but we cannot hear them. They are called **Ultrasound**.

ULTRASOUND

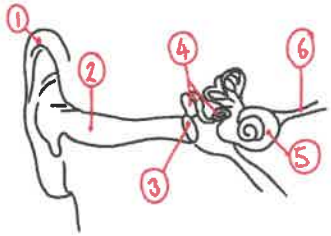
Ultra is Latin for **'beyond'**. Ultrasound is sound **beyond** the ability of the human ear to *hear* it. It is any sound > **20,000** Hz.

Ultrasound is used to clean small delicate objects by shaking the dirt from them when the vibrations of the wave hits the object.

Ultrasound is also used to help create images of objects inside the human body, like developing babies inside the uterus of women.

The Ear

The ear is the human sense organ that detects sound waves in the air. There is more to it than just the bit you can see...



1. **Outer ear**
Funnels sound into the ear canal from the outside.

2. **Ear tube**
Directs sound onto the ear drum.

3. **Ear drum**
Skin that vibrates when sound waves hit it. Passes vibrations onto the hearing bones.

4. **Hearing bones**
Makes the sound vibrations bigger (**'amplifies** the sound').

5. **Cochlea**
Contains hairs in liquid that move in time with the vibrations from the bones.

6. **Auditory nerve**
Turns the vibrations into an electrical signal that then travel to the brain.

08.5 FOOD AND NUTRITION.KO.2022-23

Balanced diets

Your body needs energy all the time. Even when you're asleep your body is using energy just to keep you alive.
It is important that you get this energy from a balanced diet, as an unbalanced diet can cause health problems.

Nutrition

Nutrition is what you eat – and what you eat is vital for your health.
A balanced diet will have the right amount of these five nutrients:

- **Carbohydrates** (sugar and starch found in potato, pasta, bread, rice, cereals)
- **Proteins** (found in meat, fish and eggs)
- **Lipids (found in butter, oil, cream)**
- **Vitamins** like Vit A, B, C, D, E (found in fruit, vegetables and cereals)
- **Minerals** like iron, calcium and sodium (found in meat, milk and salt)
- **Fibre** (found in cereal, fruit and vegetables)
- **Water**

Diet Diseases

The amount of energy you need depends on your body mass and level of activity.
For every kg of body mass, you need 5.4kJ of energy every hour.
This is the basic energy requirement (BER) needed to maintain bodily functions.

BER calculation

$$BER = 5.4 \times 24 \times Body\ Mass\ (kg)$$

Obesity

Your body will store the extra energy as fat so you will put on weight.
If you weigh over **20% more than the recommended weight** for your height, then you are classed as obese.
Obesity can lead to health problems such as high blood pressure and heart disease.

Deficiency diseases

Not getting enough to eat is called starvation which can cause slow growth in children, increased chance of infections and irregular periods in women.
Too little or too much of an nutrient in the diet is known as **malnutrition.**
Not enough vitamins or minerals can cause **deficiency diseases**.

A lack of vitamin C

can cause scurvy, a deficiency disease that causes problems with the skin, joints and gums.

Food Tests

You can compare the nutrients in different foods using the "per 100 g of food" values, as servings of different foods are different sizes.

Starch Test

Add a few drops of iodine solution to a sample of food.
If starch is present you will see a blue-black colour.

Protein Test

Place a food sample in a test tube to a depth of 1cm.
Add five drops of Biuret solution.
If there is protein you will see a pale purple colour within a few minutes.

Lipid Test

Rub a small, dry food sample on some white paper.
Hold the paper up to the light.
If lipids are present there will be a greasy mark that is transparent

Digestion

Digestion is all about breaking down large, insoluble molecules of food into small, soluble molecules that can be absorbed into the blood.

Mechanical digestion

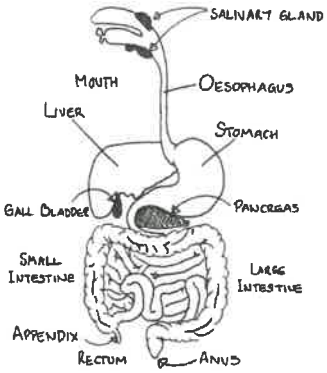
... is a physical or mechanical breakdown of food. For example, chewing with teeth.

Chemical digestion

...requires the help of protein molecules called enzymes.

Digestive system organs

Mouth
Chews, mixes food with saliva, adds **amylase.**
Oesophagus
Pipe linking mouth & stomach.
Stomach
Churns, mixes, adds **protease,** adds **hydrochloric acid.**
Liver
Makes and adds **bile** to food.
Pancreas
Makes and adds **protease, carbohydrase** and **lipase.**
Small intestine
Adds more enzymes, absorbs broken up food into blood.
Large intestine
Absorbs water.
Rectum
Stores undigested food until the anus excretes it.



08.5 FOOD AND NUTRITION.KO.2022-23

Enzymes

Enzymes are **catalysts**: substances that speed up the breaking down of large molecules into smaller ones.
Most of the enzymes needed for digestion are produced by the body and are added to food as it travels through the gut.

Enzyme examples

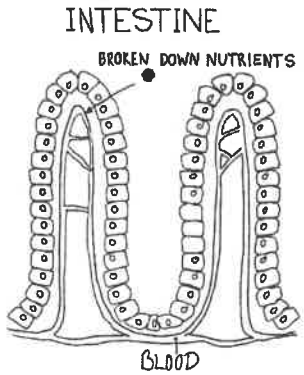
Amylase a carbohydrase enzyme
In salivary glands; breaks down starch (a carbohydrate).
Lipase
In small intestine; breaks down lipids (fat).
Pancreatic amylase a carbohydrase enzyme
In small intestine; breaks down starch (a carbohydrate).
Pepsin a protease enzyme
In stomach; breaks down protein.
Trypsin a protease enzyme
In small intestine; breaks down protein.

All enzymes can be affected by temperature – they work within a certain **range of temperatures** and not at all outside of that (**optimal temperature**).

All enzymes can be affected by pH– they work within a certain **range of pH** and not at all outside of that (**optimal pH**).

Absorption

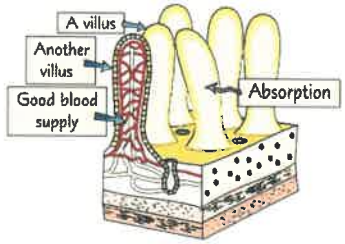
Big, insoluble food molecules cannot pass through the walls of the small intestine.
Enzymes are used to break them up into smaller, soluble ones.
These small molecules can pass through the gut wall into the blood.
They are then carried round the body, before passing into cells where they are used.



Villi

Food molecules are absorbed into the blood in the small intestine.
The small intestine is lined with tiny finger-like structures called villi.
Villi are perfect for absorbing food because:

1. They have a thin outer layer of cells.
2. They have a good blood supply.
3. They provide a large surface area for absorption



Diffusion

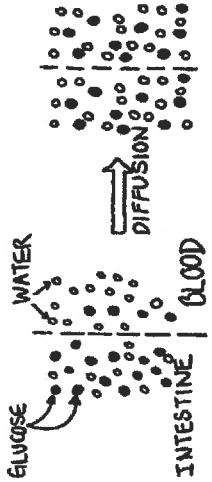
The name of the process where food molecules are absorbed is called **diffusion**.

Once food has been broken down so that it is small enough to pass through the cells in the villi, diffusion can happen.

Diffusion happens **because of** the difference in concentrations.

There is a lower concentration of nutrients inside the villi so nutrients diffuse into the villi where they are absorbed into the blood.

In this way, there is an overall movement of these molecules into the blood, by diffusion (see below).



Drugs

A drug is any substance that affects the way the body works. Drugs can be used for medical or recreational reasons. Different drugs affect the body in different ways.

Types of drug

Painkillers- kill pain like paracetamol
Depressants- make you feel relaxed by slowing down the nervous system such as alcohol, cannabis and heroin.
Stimulants- make you feel energetic by speeding up the nervous system such as nicotine, caffeine, cocaine, ecstasy.
Hallucinogens- makes you feel confused that you can hear and see things that aren't there such as LSD and magic mushrooms.

Recreational drugs

are drugs taken for non-medical reasons, usually for **pleasure**. Some drugs are **legal** and are in common use such as caffeine, tobacco and alcohol. Some recreational drugs are **illegal** and can have dangerous side-effects such as cannabis, ecstasy, cocaine, heroin, speed, magic mushrooms and LSD.

Addiction

All drugs are **addictive** which means you can't cope without them and need to keep taking them. All drugs have **side-effects** which are unwanted symptoms cause by taking the drug, e.g. rashes, headaches or nausea.

08.6 METALS AND USES KO.2022-23

Properties of metals

Metals have lots of uses, as elements, alloys or compounds. The use is related to their physical property.

Physical property
A description of how a material behaves and responds to forces and energy.

Physical property of metals

Property	Use
Conductor of heat	saucepans radiators
Conducts electricity	wires
Shiny	jewellery
High melting point	space craft Saucepans
Malleable (*bent into shape*)	cars

Chemical property
How a substance reacts with other substances.

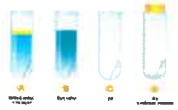
e.g.
calcium + oxygen→calcium oxide

Corrosion

When a rock or metal reacts with chemicals in the air or water and is worn away or changed into a different substance.
Many metals react with oxygen when exposed to the air.
e.g.
Tin + oxygen → Tin oxide
Iron corrodes when it is exposed to the air. This reaction is called ***rusting***.

Reaction- rusting
Iron+ water + air → hydrated iron oxide

Rusting



	Conditions	Result
A	Boiled water+air	No rust
B	Salt water	Severe rust
C	Air	rust
D	Calcium chloride +air	No rust

Conclusion
A does not rust as boiling water removes oxygen
D does not rust as calcium chloride removes the water
B rusts due to oxygen and water vapour present in the air.
C rusts more than B salt in the water speeds up rusting.

Preventing corrosion + rusting

Galvanising- coating iron/steel(alloy of iron and carbon) with a layer of zinc.
The **zinc** layer prevents the iron from contact with water vapour and oxygen in the air.
The **zinc** will react with the oxygen **instead of the iron**.

Coating the iron object with **oil**, **paint**, **powder**, or **plastic** also stops the iron being in contact with oxygen and water vapour in the air, preventing rusting.
Damage to the coating needs to repaired immediately otherwise rusting will take place.

Reaction of metal with water and acids

Metals form a reactivity series which is a list in order of their reactivity with different chemicals, such as water and acids.

Demo of metals reacting with water.

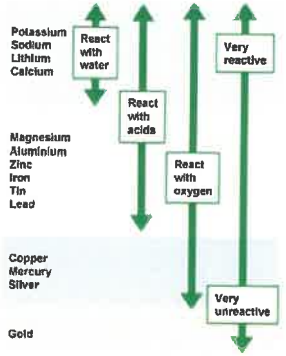
Group 1 metals are the most reactive with water and oxygen and are found at the top of the reactivity series.
Metal + water→ metal hydroxide + hydrogen
e.g
sodium+ water → sodium hydroxide + hydrogen

Metal + oxygen→ metal oxide
Lithium + oxygen→ lithium oxide

These metals will react unsafely vigorously with acid.

Reaction of metals with acids

Other metals will react with acids and an example of the reactivity series is below



Equations for metal reactions with acids

Metals react with(+) **acids** *to make(→)* a **salt** and(+) **hydrogen.**

General equation
Metal + acid→ salt + hydrogen
E.g.

Word Magnesium + hydrochloric acid → magnesium chloride +hydrogen
Symbol $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Word zinc + sulfuric acid → zinc sulfate + hydrogen
Symbol $Zn + H_2SO_4 \rightarrow ZnSO_4 + H_2$

Word Iron + nitric acid → iron nitrate + hydrogen
Symbol $Fe + 2HNO_3 \rightarrow Fe(NO_3)_2 + H_2$

Naming the salt
First part comes from the **metal** used
Second part comes from the acid

Acid	Salt
Hydrochloric acid	chloride
Sulfuric acid	sulfate
Nitric acid	nitrate

The metal takes the place of the hydrogen in the acid. The gas is released. Bubbles of gas will be observed.

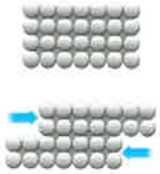
Test for hydrogen

Collect the gas and place a lit splint at the neck of the tube. If hydrogen a squeaky po will be observed.

08.6 METALS AND USES KO.2022-23

Pure metals

A pure metal will contain the **atoms** arranged in **closely packed structure** which are all the **same size**.
The **layers** will be able **to slide over each other** when force is applied. This enables pure metals to be **bent into shape(malleable)**



Alloy

An alloy is a mixture of two or more metals.
An alloy contains **atoms** of **different sizes**. These different sized atoms cause **distortion** in the regular arrangement of atoms making it more difficult for the layers to slide over one another.
Alloys are **much harder** than pure metals.



Uses of alloys

- Increase hardness/strength
- Prevent corrosion/rusting
- Improve appearance of the metal surface

Examples of alloys + uses

Alloy	Metals	Property	Use
Bronze	Copper + tin	Hard + strong Shiny	Statues, medals, swords
Brass	Copper + zinc	Harder than copper	Musical instrument
Steel	Iron + carbon	Hard + strong	Bridges, buildings, cars
Stainless steel	Iron, carbon + chromium	Resistant to corrosion +rusting	Cutlery
Pewter	Tin + copper+ antinomy	Luster, shiny, strong	souvenirs

08.7 PHOTOSYNTHESIS.KO.2022-23

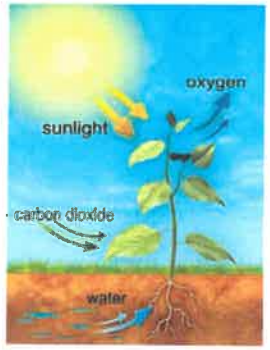
Photosynthesis Reactions in plants.

Photosynthesis is a chemical process which takes place in every green plant. It is a chemical reaction which ends up with food being made. The food is **glucose** (a type of **carbohydrate**). The reactants (substances needed) are **carbon dioxide** and **water** and the products (substances that are made) are **glucose** and **oxygen**.

carbon dioxide+water→glucose+oxygen

$6CO_2 + 6H_2O \rightarrow C_6H_{12}O_6 + O_2$

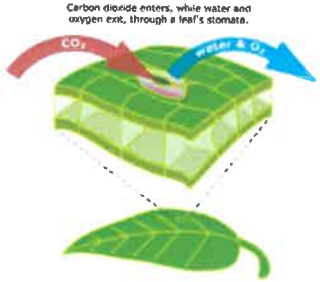
This reaction requires sunlight and chlorophyll in the chloroplasts of plant cells.



Reactants in photosynthesis

The sunlight provides the **energy** that is needed to drive (or power) the reaction. When the plant is in low light levels or at night time (when the plant is in the dark), photosynthesis **doesn't** happen because there isn't enough energy.

Chlorophyll is the green pigment in plant cells. It is found in **chloroplasts** inside cells. The green parts of plants all contain many chloroplasts. **Root cells** are not **green(**they have no chloroplasts**)** as they are underground and **no photosynthesis** take place here. **Carbon dioxide** enters the plant through tiny little holes in the leaves called stomata from the air.



Products in photosynthesis

The products of photosynthesis are useful to plants. The **oxygen** gas can be used by respiring cells. (Remember: plants, animals, fungi and bacteria cells **all respire continuously**.)

Some **excess** oxygen is released from the plant: it **diffuses** out of the plant leaves through the **stomata**. **Excess** water gas called **water vapour** also **diffuses** out of the leaf through the **stomata**. This water has **not been used** by the plant so it **diffuses** straight out.

Glucose is the other product from **photosynthesis**, it is really **valuable** to the plant because glucose has many uses. The **five** uses are listed below:

- For **respiration** to release energy

$glucose + oxygen \rightarrow carbon\ dioxide + water$

$C_6H_{12}O_6 + 6O_2 \rightarrow 6CO_2 + 6H_2O$

- Produces **cellulose** used to make **cell walls**
- Produce to make **amino acids** which make **proteins**
- Turned into **lipids** and stored in **seeds**.
- Turned into **starch** and stored in **roots, stems and leaves.**

Leaf adaptations and functions

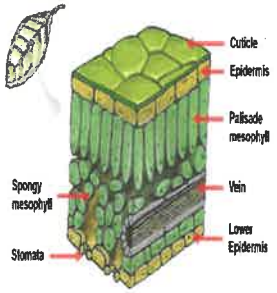
Leaves are green because they contain **lots** of **chlorophyll** to **absorb** sunlight.

They are **wide** so have a **large surface area** to maximise the **amount** of sunlight they can absorb.

They are **thin,** allowing easy **diffusion** of gases into and out of the leaf. (As they are thin there is only a short distance into the middle of the leaf).

They have many adaptations inside the leaf to increase the amount of photosynthesis

Cuticle: A **waxy** layer that prevent water loss by evaporation. It is **transparent** to let light through into the middle of the leaf.



Functions of leaf adaptations

Epidermis: A **protective** layer of cells; it is **transparent** and very **thin** to allow light through to the middle of the leaf.

Palisade cells: Upright, rectangle-shaped cells that contain **large numbers of chloroplasts** for photosynthesis. These cells are close to the surface of the leaf to maximise light absorption.

Spongy cells: These cells are small and spherical shaped and in the lower part of the leaf. They also contain chloroplasts, but not quite as many as the palisade cells. These cells have **large air spaces** between them so **gases** (carbon dioxide and oxygen) can **diffuse** (move) easily.

Vein: Plant veins consists of ***xylem*** (tubes that carry water) and ***phloem*** (tubes that carry dissolved nutrients such as sugar). These tubes play an essential role in **transporting water** to the chloroplasts in the leaves for photosynthesis. They also **transport the sugar** produced by photosynthesis away from these cells to the rest of the plant tissues

Stomata: Tiny holes surrounded by a pair of sausage-shaped **guard cells**. These guard cells can change shape in order to open or close the hole.

08.7 PHOTOSYNTHESIS.KO.2022-23

Investigating stomata density



To do this you will make a microscope slide of the under-surface and top surface of a leaf

Method:

1. Place a thin layer of clear nail varnish (1cm x 1cm) on the under-side and top side of a leaf. (Try and avoid large veins)
2. Leave to dry for 10 minutes **(a)**
3. Place a small piece of sello-tape over the nail varnish layer and use the forceps to peel off the tape and nail varnish **(b)**. Place the peel on a microscope slide **(c)** and view under a low power light microscope. Note the number of stomata you can see.
4. Repeat the method, making a microscope slide for the other piece of nail varnish (on the other side of the leaf). Compare the number of stomata on the top and bottom of the leaf

Habitats

A range of different habitats on Earth: each with unique conditions.



Mountainside – cold and dry with snow in winter



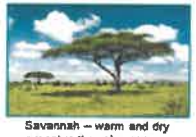
Rainforest – warm and wet



Desert – hot and dry



Woodland – cool and wet



Savannah – warm and dry except in the rainy season



Arctic – very cold and dry

Plant adaptations

Plants need to have special adaptations to ensure they have enough **water, sunlight, warmth** and **nutrients** from the soil for photosynthesis to take place.



High sunlight- Ferns grow in **intense** sunlight, **do not** have **large leaves**(leaflets). **Need lots of water and moisture.** Leaflets **reduce** water loss.



Dark conditions-Plants in a rain forest have **very large leaves** to **catch** sunlight in **dark** conditions in rainforest. Leaves are arranged in a **spiral** around the stem to **avoid** covering each other.



Underwater-bubbles on sea weed help it to **float** allowing **more light** for **photosynthesis.**
Water loss is not an issue therefore **stomata** on either side.



Dry conditions- sunlight is not an issue but **losing water** is! Cactii **adapted** by having a **larger stem** to **store** water and **spiny** leaves, with a **small surface area**, to **prevent** water loss.



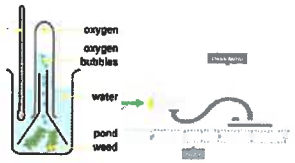
Low nutrients-Venus flytrap grows in **poor soil**. They developed a **trap** to catch flies and insects which are **digested** to gain minerals such as **nitrogen.**

08.7 PHOTOSYNTHESIS.KO.2022-23

Rate of photosynthesis

FactorPractical: How does light intensity affect the rate of photosynthesis?

To use pondweed to see how light intensity affects the rate of photosynthesis.



Method

1. Set up the apparatus as in the diagram.
2. Leave for five minutes for the pondweed to acclimatise to the new light intensity.
3. Count the number of bubbles given off in one minute.
4. Move the light 10 cm further back.
5. Leave for five minutes for the pondweed to acclimatise again.
6. Count the number of bubbles given off in one minute.
7. Repeat by moving the lamp away by 10 cm intervals until 50 cm is reached.

Rate of photosynthesis

Variables

Independent variable(what is changed) - the light intensity (how close the light is).

Dependant variable(what is measured) - the number of oxygen bubbles given off (the rate of photosynthesis).

Control variables (what is kept the same) - the size of the pondweed, the volume of water used and its temperature.

Conclusion(Description of the trends in data and explained using science knowledge)

The results show **more oxygen** bubbles are **produced** when **the light is closer** to the beaker. So a **greater light intensity** gives a **greater rate of photosynthesis.**

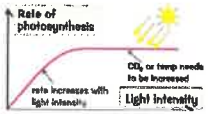
The experiment shows that **light intensity** has a big effect on the rate of photosynthesis. The other factors, which have a big effect on the rate of photosynthesis, are **carbon dioxide** and **temperature.**

Limiting factor

Limiting factor refers to any of the factors (variables) in environment capable **of limiting a process**, such as **growth**, abundance, or distribution of a population of organisms in an ecosytem.

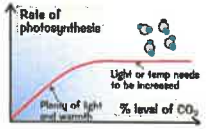
Factors affecting photosynthesis

Light



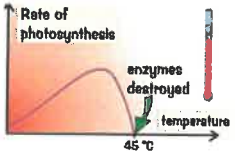
As **light intensity** is **increased**, the **rate of photosynthesis increases steadily** to a certain point.After this point **no more light** will have an impact as **CO_2 and temperature** are the **limiting factor.**

CO_2



As the CO_2 level increases the rate of photosynthesis increases steadily to a certain point. CO_2 is now not the limiting factor. As long as light and CO_2 are plentiful temperature is the limiting factor.

Temperature



If temperature is **the limiting factor** it is usually **too low**. Enzymes work **slowly** at low temperature.

If the temperature gets **too hot 45°C**, the **enzymes** needed for photosynthesis will be damaged(**denatured**).

Plant growth

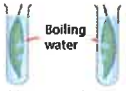
Practical: Test a plant to see if photosynthesis is taking place.

Method:



Light Dark

1. Collect Samples of leaves.



Light Dark

2. Boil the leaf in water (kills leaf).



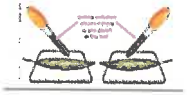
Light Dark

3. Place the leaf into warm ethanol to remove the green (chlorophyll). No flame!



Light Dark

3. Water makes the leaf softer



4.Add iodine solution to show if there is any starch in the leaves.



Light Dark

5. If the leaf has starch the iodine goes blue/black if it does not it stays brown/orange.

Explanation of results:

The plant in the **light** tests positive for starch due to it **photosynthesising**, producing **glucose** which then converts into **starch**.

The leaf in darkness cannot **photosynthesise** and produce more starch. The **starch** that was present at the start of the investigation is **converted** into **glucose**, then **used** by the leaf in the process of **respiration.**

What else is needed for plant growth?

Plants need **minerals** from the **soil** which are absorbed by the **plant roots**. Minerals can be added to the soil by dissolving in water from **rocks, natural fertilisers**-faeces or decomposition and **artificial fertilisers** containing N(Nitrogen), P(phosphorus), K(Potassium) and Mg(magnesium.

Mineral and deficiencies

N, Nitrogen
Needed for **making proteins+ growth**
Deficiency-poor growth, weak stems, pale green upper leaves yellow or dead lower leaves.
P, Phosphorus
Needed for **respiration +making roots**
Deficiency- poor flower/fruit growth. Leaves yellow with dead spots.
K. Potassium
Needed for respiration and photosynthesis
Deficiency-discoloured, purple leaves +small roots
Mg, Magnesium
Needed for **making chlorophyll**
Deficiency- leaves turn yellow from the bottom.