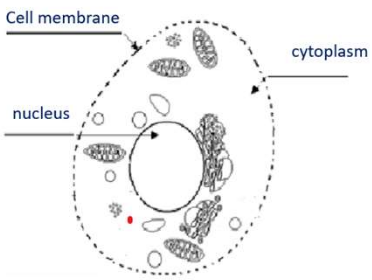
8BD Core prior learning

All living things are made of cells:



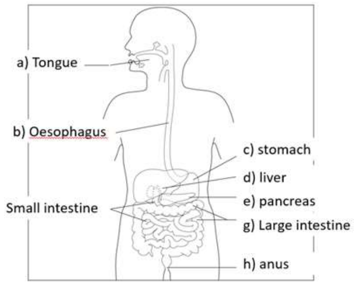
Organelle	Function
Nucleus	*Contains genetic material which controls the cell's activities*
Cell Membrane	*Controls the movement of substances in and out of the cell*
Cytoplasm	*Where chemical reactions happen*

Cell → Tissue → Organ → Organ system

Cell	The smallest structural unit of all organisms
Tissue	Made from a group of cells with a similar structure and function, which all work together to do a particular job
Organ	Made from a group of different tissues, which all work together to do a particular job
Organ System	Made from a group of different organs, which all work together to do a particular job

Digestive system

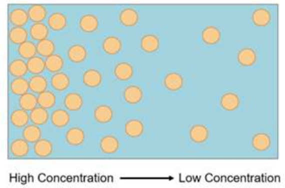
Roles: to break down large food molecules into smaller molecules and absorb them into the blood.



Diffusion

Is the spreading out of particles from an area where there are a lot of particles, to an area where there are fewer particles.

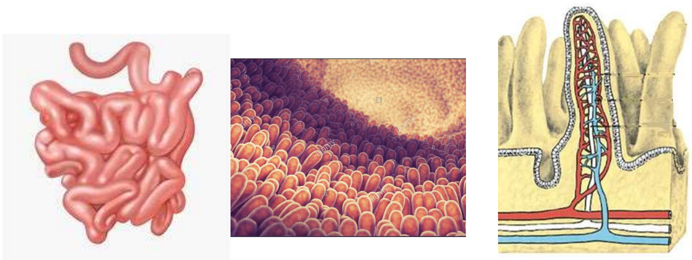
Liquid and gas particles are able to diffuse, because the particles are free to move.



Small intestines

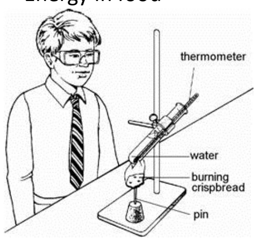
Digested food particles are absorbed into the blood by diffusion in the small intestine

- The small intestine is over 20 feet long
- The inside of the intestine has thousands of tiny folds called villi which give a large surface area → faster rate of diffusion
- Thin membranes → shorter distance to diffuse → faster rate of diffusion
- Each villus has it's own blood vessels → faster rate of diffusion



Villi

Energy in food



We can compare the energy in different foods by burning them above a boiling tube of water.

The burning food releases energy, which will heat the water.

Measuring the start and the end temperature will allow us to calculate a rise in temperature.

Different foods can be burned (Independent variable)

Rise in temperature (Dependent variable)

Keep the same – mass of food, volume of water (control variables)

8BD Digestion and Nutrition

The 7 nutrients		
Nutrient	**Use in the body**	**Good sources**
Carbohydrate	To provide energy	Cereals, bread, pasta, rice and potatoes
Protein	For growth and repair	Fish, meat, eggs, beans, pulses and dairy products
Lipids (fats and oils)	To provide energy. Also to store energy in the body and insulate it against the cold.	Butter, oil and nuts
Minerals	Needed in small amounts to maintain health	Salt, milk (for calcium) and liver (for iron)
Vitamins	Needed in small amounts to maintain health	Fruit, vegetables, dairy foods
Fibre	To provide roughage to help to keep the food moving through the gut	Vegetables, bran
Water	Needed for cells and body fluids	Water, fruit juice, milk

Chemical food tests

Nutrient	Chemical test	Positive result
Starch	Iodine solution	Iodine solution turns from orange/brown→ blue black
Sugar	Benedict's solution & heat	Benedict's solution turns from: blue → green /yellow/brick red
Fat	Ethanol & shake, then water & shake	Ethanol turns cloudy white
Protein	Biuret reagent	Biuret reagent changes from blue to purple

<u>Respiration</u>

A chemical reaction that takes place in all living cells to release the energy in food:

Sugar + oxygen → carbon dioxide + water

Energy released from food is used for things like:
- muscle contraction
- keeping warm
- making new cells

Each person needs a different amount of energy depending on factors such as:
- gender (male or female)
- age
- amount of daily activity

Energy in food is measured in **kilojoules**, kJ.

A **balanced diet** contains the right energy intake **and** the correct amounts of necessary nutrients.
An **imbalanced diet** contains too much or too little of a particular nutrient and/or energy.

<u>Nutrient deficiency diseases:</u>
Mineral deficiency diseases are caused when your diet is lacking in a particular mineral:
- iron deficiency causes anaemia, where there are too few red blood cells;
- iodine deficiency can cause a swelling in the neck called goitre.

Vitamin deficiency diseases are caused when you diet is lacking in a particular vitamin:
- vitamin A deficiency can cause blindness;
- vitamin C deficiency causes scurvy, which makes the gums bleed;
- vitamin D deficiency causes rickets, which makes the legs bow outwards in growing children.

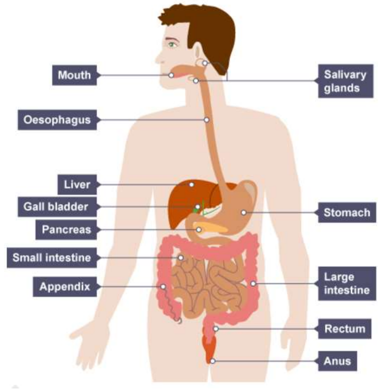
<u>Energy imbalances in diets</u>
If the amount of energy you get from your food is different from the amount of energy you use, your diet will be imbalanced:

- too little food/ energy can make you underweight
- too much food/ energy can make you overweight

Imbalanced energy intake diseases:
Starvation happens if you eat so little food that your body becomes <u>very underweight</u>. This can eventually cause death.

Obesity happens when you eat so much food that your body becomes <u>very overweight</u>. Diseases linked with obesity include heart disease, diabetes, arthritis and stroke.

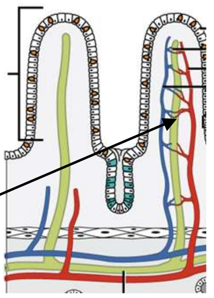
Stages of digestion
- Digestion starts in the **mouth**, where teeth **mechanically digest** food during chewing. **Chemical digestion** begins here when the food mixes with saliva.
- Food is swallowed as passes down the **oesophagus.**
- When food reached the **stomach**, the food continues to be **mechanically digested** when the stomach muscles contract to churn food. **Chemical digestion** also continues when the food mixes with acid and enzymes inside the stomach.
- Most **digestion** happens inside the **small intestine** when the food mixes with **enzymes** and **bile (chemical digestion),** and is moved along the canal by **muscle contractions (mechanical digestion)**
- Digested food is **absorbed** into the bloodstream, by diffusion from the small intestine. Water is reabsorbed into the body in the small intestine
- Undigested food passes out of the anus as faeces.



The role of liver and pancreas
- The liver produces **bile**, which helps the digestion of lipids (fats and oil).
- The pancreas produces biological **catalysts** called digestive **enzymes** which speed up the digestive reactions.

Absorption by diffusion across a surface happens efficiently if:
- the surface is thin;
- its area is large.

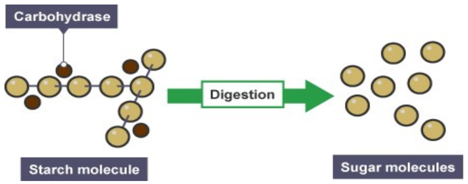
The inner wall of the small intestine is adapted. It has:
- a thin wall, just one cell thick;
- many tiny **villi** to give a really big **surface area.** The villi contain many **capillaries** to carry away the absorbed food molecules.



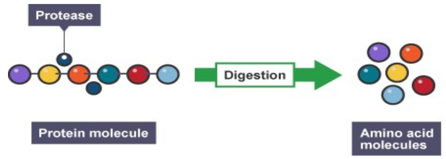
Digestion is when large **insoluble** food particles are broken down into small **soluble** particles so that they can be absorbed into our bloodstream.

This is carried out by **enzymes** - special proteins that can break large molecules into small molecules.

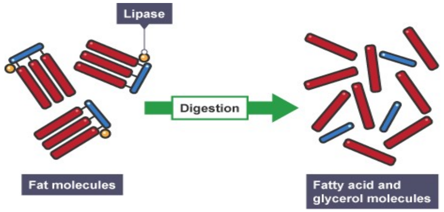
Different enzymes can break down different nutrients:
- **Carbohydrates** (eg starch) are broken down into **sugar** - by **carbohydrase** enzymes



- **Proteins** are broken down into **amino acids** - by **protease** enzymes;



- **Lipids** (ie fats and oils) are broken down into **fatty acids** and **glycerol** - by **lipase** enzymes.



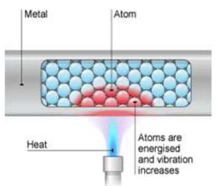
At very high temperatures, these enzymes will be **denatured.**

Digestive enzymes cannot break down dietary fibre, which is why the body cannot absorb it.
Minerals, vitamins and water are not digested, as they are already small enough to be absorbed.

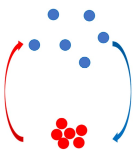
The digestive system contains some good **bacteria** which are important because they:
- can digest certain substances humans cannot digest;
- reduce chance of harmful bacteria multiplying, causing disease;
- produce vitamins that humans need eg vitamins B & K.

Core prior learning for 8CM – Earth & Materials

<u>Transfer of energy</u>
<u>Heat transfer</u> – two ways to transfer heat:



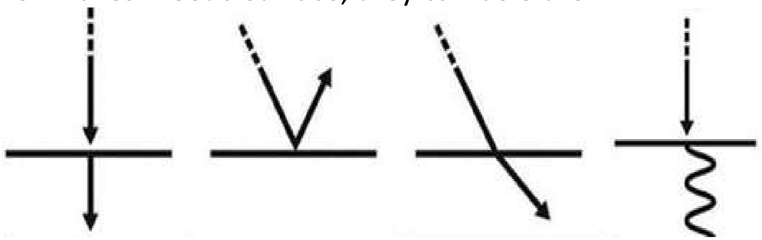
1) Conduction
Solid particles are always **<u>vibrating</u>.**
<u>Heat</u> makes the particles **<u>vibrate more</u>**.
Because they are **<u>touching</u>**, the particles **<u>collide</u>** with the particles next to them with more energy, and this transfers the heat along.
Convection happens best in **solids** because they are ordered and all touching



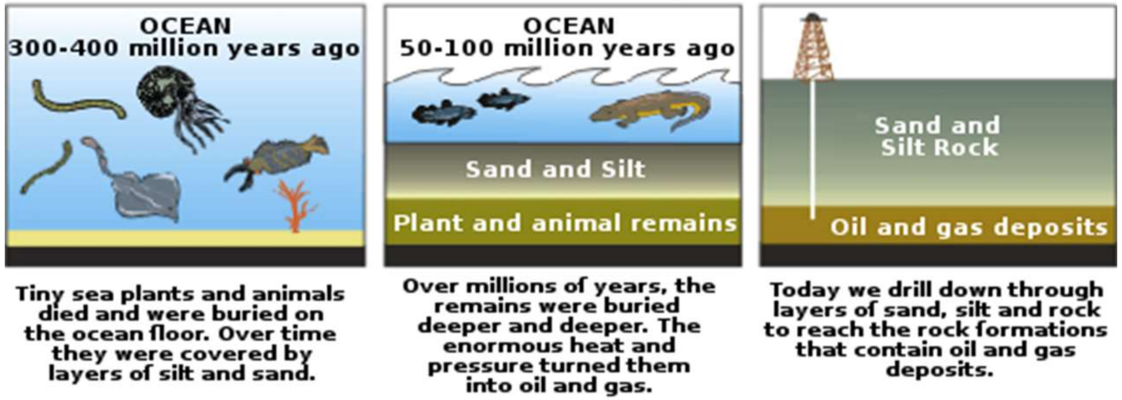
2) Convection – heat transfer in fluids (liquids and gases)
Particles in a fluid gain **energy**
The particles move further apart.
This makes that region of the fluid **less dense**, causing it to **rise**.

Energy transfer by waves

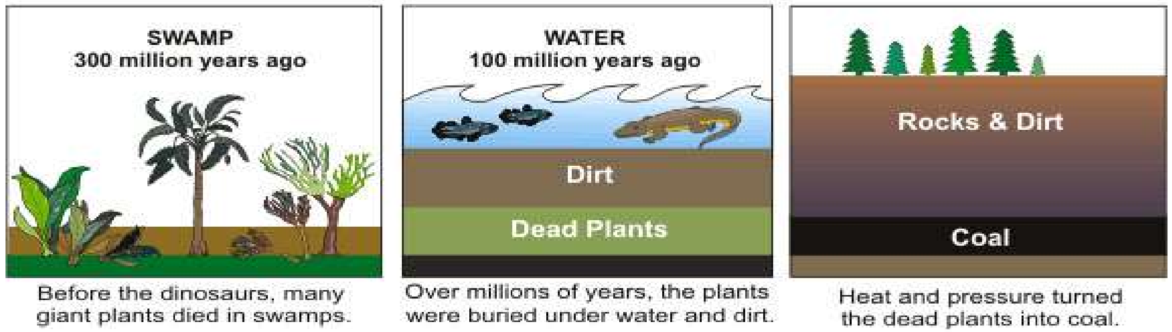
Waves transfer energy without particles
Waves are caused by vibrations.
Infrared waves are emitted by objects releasing **heat**
When waves meet a surface, they can be either



transmitted reflected refracted absorbed

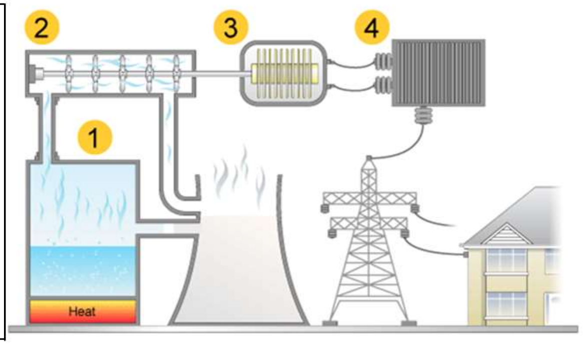


HOW COAL WAS FORMED



Fossil fuels are used to generate electricity in power stations

1. Fuels are burned to release heat
2. The heat is used to boil water to produce steam
3. The steam is blasted at turbines
4. The turbine turns a generator to produce electricity

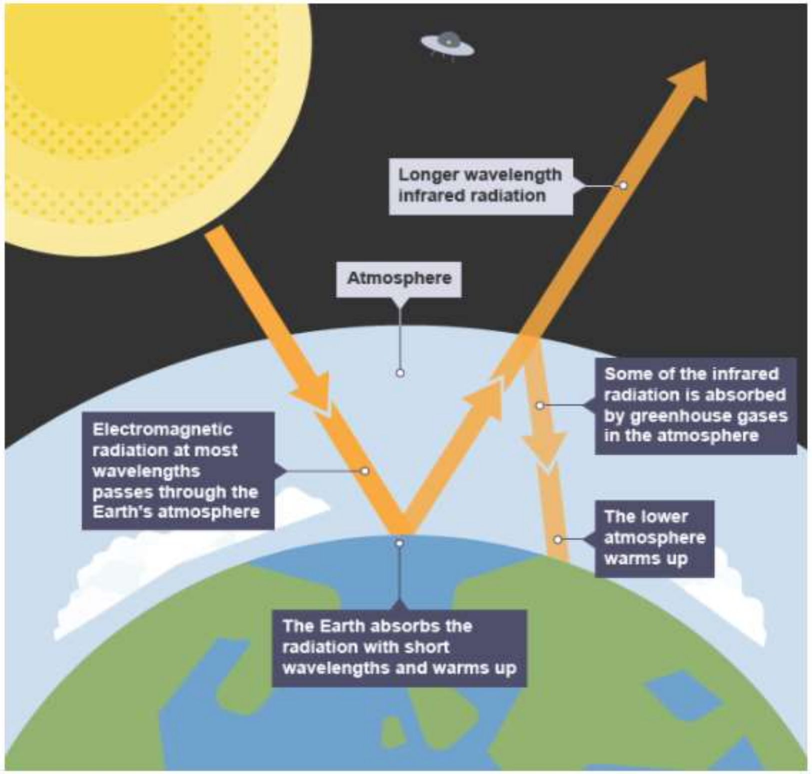


8CM Materials and the Earth

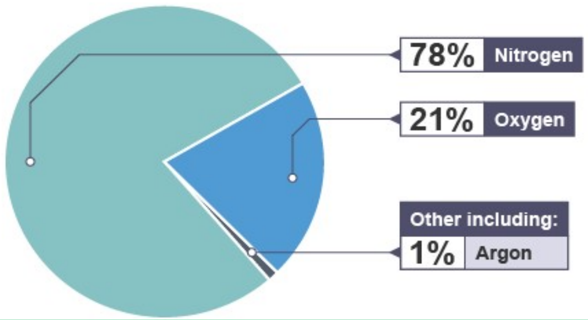
The greenhouse effect
- Thermal energy from the Earth's surface escapes into space;
- If too much thermal energy escaped, the planet would be very cold;
- Greenhouse gases in the atmosphere, trap escaping thermal energy;
- This causes some of the thermal energy to pass back to the surface;
- This is called the greenhouse effect, and it keeps our planet warm;
- Carbon dioxide is an important greenhouse gas.

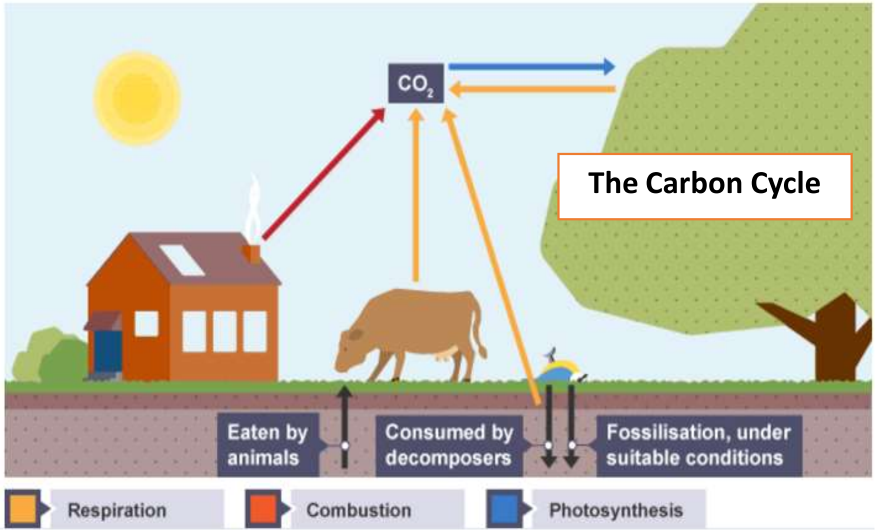
Humans burn fossil fuels which releases carbon dioxide, increasing the greenhouse effect. More thermal energy is trapped by the atmosphere, causing the planet to become warmer than it would be naturally. This increase in the Earth's temperature is called **global warming**.

Climate change and its effects as a result of global warming includes:
- ice melting faster than it can be replaced in the Arctic and Antarctic
- the oceans warming up – their water is expanding and causing sea levels to rise
- changes in where different species of plants and animals can live



The Earth's atmosphere

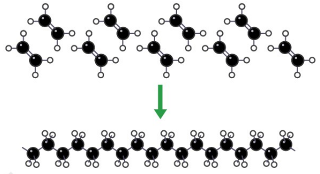




Ceramic materials:
- are solids made by baking a starting material in a very hot oven or kiln
- are hard and tough
- have very many different uses

Brick and pottery are examples of ceramics.

Polymers:
Polymers are made by joining lots of small molecules together to make long molecules.



- The properties of polymers are:
- chemically unreactive
- solids at room temperature
- plastic – they can be moulded into shape
- electrical insulators
- strong and hard-wearing

Polymers are usually chemically unreactive.
Advantage: plastic bottles will not react with their contents.
Disadvantage: they do not rot quickly and they can cause litter problems.

Composites
Composite materials are made from two or more different types of material.
e.g. MDF is made from wood fibres and glue; fibreglass is made from glass fibres and a tough polymer;

Reinforced concrete is a composite material made from steel and concrete. When the concrete sets, the material is:
- strong when stretched (because of the steel)
- strong when squashed (because of the concrete)

8CM Materials and the Earth

Sedimentary rocks

Sedimentary rocks are formed from the broken remains of other rocks that become joined together.

transport → deposition → sedimentation → compaction → cementation

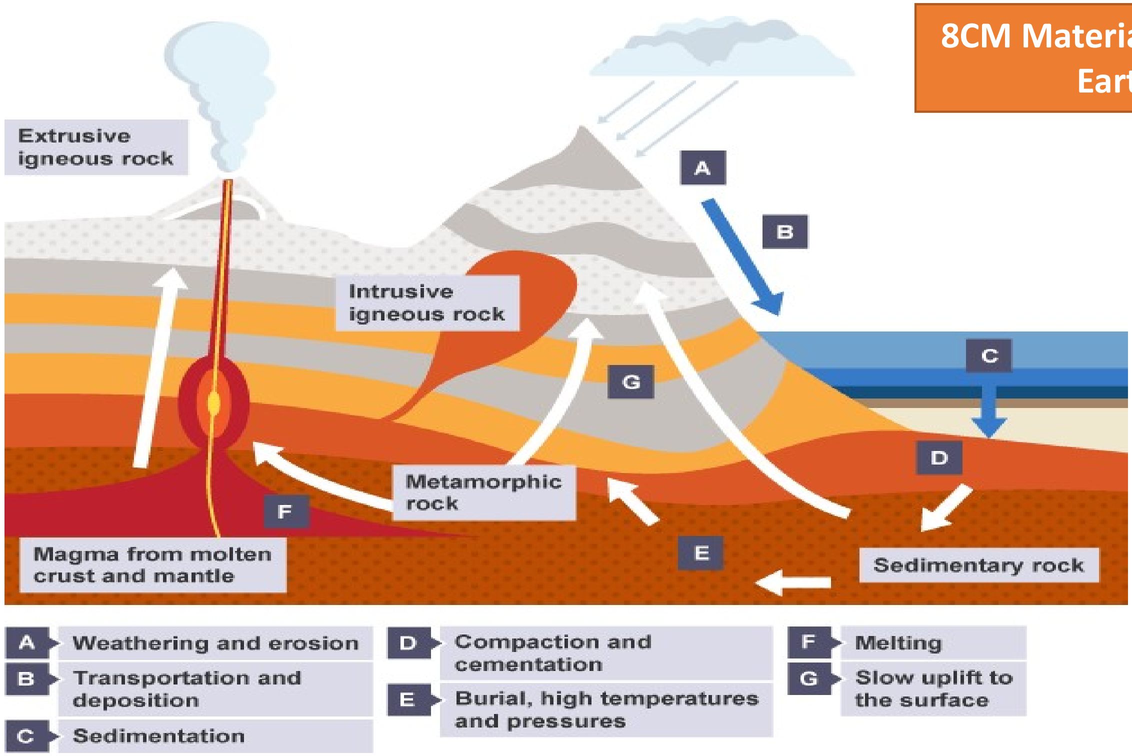
- **Transport**: A river carries pieces of broken rock as it flows along.
- **Deposit**: When the river reaches a lake/sea, it settles at the bottom.
- **Sedimentation**: The deposited rocks build up in layers, called sediments.
- **Compaction**: Weight of sediments on top squashes sediments at bottom.
- **Cementation**: Water is squeezed out from between pieces of rock and crystals of different salts form. The crystals stick the pieces of rock together.

Igneous rocks

Igneous rocks are formed molten rock that has cooled and solidified. Molten (liquid) rock is called magma. If it:

- cools **slowly**, it will form rock with **large** crystals
- cools **quickly**, it will form rock with **small** crystals

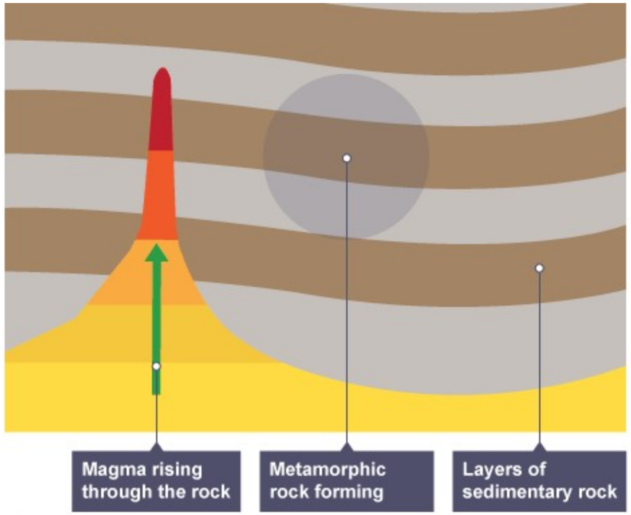
	Extrusive	Intrusive
Where the magma cooled	On the surface	Underground
How fast the magma cooled	Quickly	Slowly
Size of crystals	Small	Large
Examples	Obsidian and basalt	Granite and gabbro



Metamorphic rocks

Metamorphic rocks are formed from other rocks that are changed because of heat or pressure.

- Earth movements can cause rocks to be deeply buried or squeezed.
- These rocks are heated and put under great pressure.
- They do not melt, but the minerals they contain are changed chemically, forming metamorphic rocks
- Metamorphic rocks rarely contain fossils. Any that were present in the original sedimentary rock will not normally survive the heat and pressure.



Metamorphic rocks may form from rocks heated by nearby magma

Recycling

The Earth's resources are limited. We can recycle many resources, including:

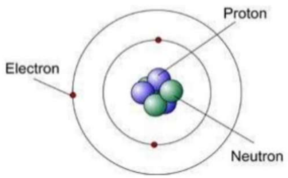
- **Glass**. It can be melted and remoulded to make new objects. The energy needed is less than the energy needed to make new glass. Must be sorted into different coloured glass ready for recycling, and transported to recycling plants;
- **Metal**. It takes less energy to melt and remould metals than it does to extract new metals from their ores. Aluminium is a metal that melts at a low temperature, so it is attractive for recycling;
- **Paper**. It is broken up into small pieces and reformed to make new sheets of paper. Takes less energy than making new paper from trees. Paper can only be recycled a few times before its fibres become too short to be useful and it is often only good enough for toilet paper or cardboard, or used as a fuel or compost;
- **Plastic**. Many plastics (but not all) can be recycled. For example, some plastic bottles can be recycled to make fleece for clothing. Recycling means that we use less crude oil, the raw material needed for making plastics. They have to be sorted first and this can be difficult, but recycling does stop it ending up in landfill.

8CP: Periodic Table

Atoms are tiny particles that everything is made of.

They are made of smaller particles called:

- **Protons** (+ positive)
- **Neutrons** (neutral)
- **Electrons** (- negative)



Metals have properties in common. They are:

- **shiny**, especially when they are freshly cut
- **good conductors** of heat and electricity
- **malleable** (they can be bent and shaped without breaking)

We can use the periodic table to predict the properties of elements in the same group.

Group 7	Melting point	Density	Reactivity
Fluorine	Increases down the group ↓	Increases down the group ↓	Decreases down the group ↓
Chlorine			
Bromine			
Iodine			

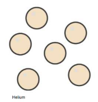
Group 1	Melting point	Density	Reactivity
Lithium	**Decreases** down the group ↓	**Increases** down the group ↓	**Increases** down the group ↓
Sodium			
Potassium			
Rubidium			

Elements
There are over a hundred different elements.

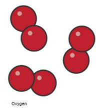
Atoms have the same number of protons as each other.

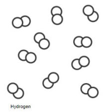
Atoms of differing elements have a different number of protons.

The atoms of some elements do not join together, but instead they stay as separate atoms, eg Helium.



The atoms of other elements join together to make **molecules**, eg oxygen and hydrogen**.**



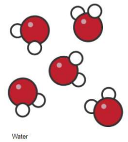


Most metals also have other properties in common. They are:

- **solid** at room temperature, except mercury;
- **hard** and **strong;**
- they have a **high density;**

Compounds
A compound is contains atoms of **two or more different elements**, and these atoms are **chemically joined together.**

For example, water is a compound of hydrogen and oxygen.

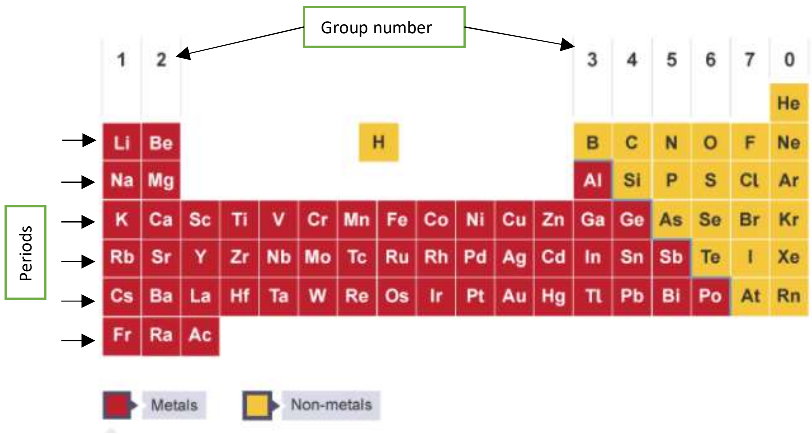


Each of its molecules contains two hydrogen atoms and one oxygen atom.

The elements are arranged in a chart called the periodic table. A Russian scientist, Mendeleev, produced the first periodic table in the 19th century.

The modern periodic table is based closely on the ideas he used:

- the elements are arranged in order of increasing atomic number (number of protons);
- the **horizontal** rows are called **periods;**
- the **vertical** columns are called **groups;**
- elements in the same group have the same number of electrons in their outside shell



Chemical formulae
Remember that we use chemical symbols to stand for the elements.
For example, **C stands for carbon, S stands for sulfur** and **Na stands for sodium.**

For a molecule, we use the chemical symbols of all the atoms it contains to write down its formula. For example, the formula for **carbon monoxide is CO.**

It tells you that each molecule of carbon monoxide is made of one carbon atom joined to one oxygen atom.

Be careful about when to use capital letters. For example, CO means a molecule of carbon monoxide but **Co is the symbol for cobalt** (an element).

Each element is given its own chemical symbol, like **H for hydrogen** or **O for oxygen.**

Chemical symbols are usually one or two letters.

Every chemical symbol **starts with a capital letter, with the second letter written in lower case**.For example, Mg is the correct symbol for magnesium, but mg, mG and MG are wrong.

Mg	mg	mG	MG
✓	✗	✗	✗

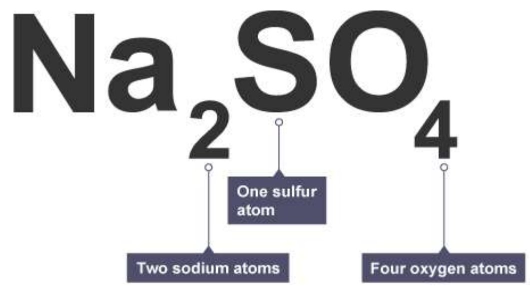
Numbers in formulae
We use numbers to show when a molecule contains more than one atom of an element.

The numbers are written **below** the element symbol. For example, CO_2 is the formula for carbon dioxide.

It tells you that each molecule has **one carbon atom** and **two oxygen atoms**.

The **small numbers go at the bottom**. For example:

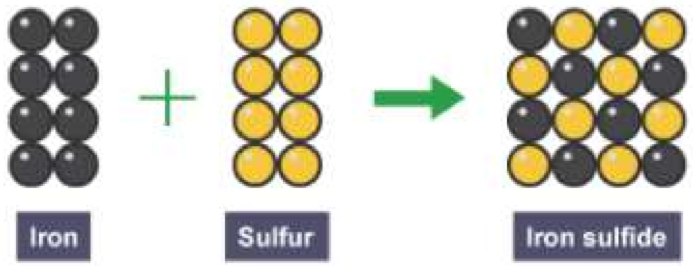
- CO_2 is correct**;**
- CO^2 and CO2 are wrong.



Some formulae are more complicated. For example, the formula for sodium sulfate is Na_2SO_4. It tells you that sodium sulfate contains two sodium atoms (Na x 2), one sulfur atom (S) and four oxygen atoms (O x 4).

Chemical reactions

When chemicals react, the atoms are rearranged. For example, iron reacts with sulfur to make iron sulfide



Iron sulfide, the compound formed in this reaction, has different properties to the elements it is made from.

	Iron	Sulfur	Iron sulfide
Type of substance	Element	Element	Compound
Colour	Silvery grey	Yellow	Black
Is it attracted to a magnet?	Yes	No	No
Reaction with hydrochloric acid	Hydrogen formed	No reaction	Hydrogen sulfide formed, which smells of rotten eggs

- The atoms in a compound are joined together by forces called **bonds**.
- The properties of a compound are different from the elements it contains;
- You can only separate its elements using another chemical reaction;
- Separation methods like filtration and distillation will not do this.

Chemical equations

We summarise chemical reactions using equations:

reactants → products

- **Reactants** are shown on the **left** of the arrow;
- **Products** are shown on the **right** of the arrow.

Do not write an equals sign instead of an arrow.

If there is more than one reactant or product, they are separated by a + sign. For example:

copper + oxygen → copper oxide

Reactants: copper and oxygen
Products: copper oxide

A **word equation** shows the names of each substance involved in a reaction, and **must not include any chemical symbols or formulae**

8CP: Periodic Table

Conservation of mass

When atoms are rearranged in a chemical reaction, they are not destroyed or created.

- **Reactants** - the substances that react together;
- **Products** - the substances that are formed in the reaction;
- **Mass is conserved** in a chemical reaction, this means…
- Total mass of the reactants = total mass of the products;

Symbol equations

A balanced **symbol** equation includes the **symbols** and **formulae** of the substances involved. For example:

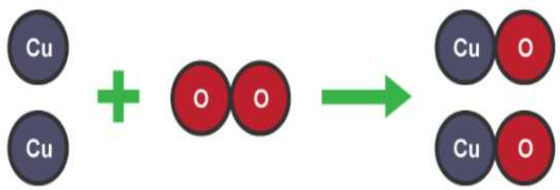
Word equation:
Copper + Oxygen → Copper Oxide

Symbol equation (unbalanced):
$Cu + O_2 \rightarrow CuO$

There is one copper atom on each side of the arrow, but two oxygen atoms on the left and only one on the right. This is **unbalanced.**

A **balanced** equation has the **same number of each type of atom on each side of the arrow.** Here is the balanced symbol equation:

$$2Cu + O_2 \rightarrow 2CuO$$



Some more examples of balanced symbol equations

- $C + O_2 \rightarrow CO_2$
- $2H_2 + O_2 \rightarrow 2H_2O$
- $2Mg + O_2 \rightarrow 2MgO$
- $CuCO_3 \rightarrow CuO + CO_2$
- $Mg + 2HCl \rightarrow MgCl_2 + H_2$

Take care when writing formula – e.g. for carbon dioxide:
CO_2 NOT CO^2 or Co_2

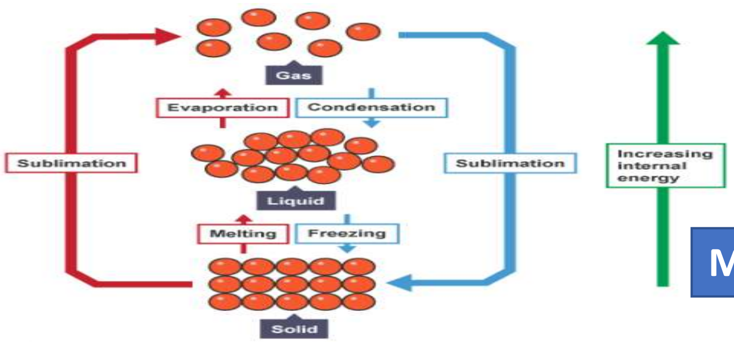
Change of state

- Substances can change state, usually when they are heated or cooled;
- State changes are **reversible** – eg ice can be melted and then frozen again;
- No new elements or compounds are formed.

The closeness, arrangement and motion of the particles in a substance change when it changes state:

	Solid	Liquid	Gas
Closeness	All touching	Mostly touching	Far apart
Arrangement	Ordered	Random	Random
Motion	Vibrate, fixed position	Move freely	Move freely (faster than liquids)
Density	Decreasing density --->		
Internal energy	Increasing internal energy -------------------------------------->		

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$



Matter

Pressure in fluids

- A **fluid** is a liquid or gas.
- All fluids can change shape and flow from place to place.
- Fluids exert pressure at 90° to surfaces – we say that it acts normal to the surface.

Brownian motion

- Gas particles move very quickly;
- Air particles move at 500 m/s on average at room temperature;
- Particles collide with each other very frequently;
- They change direction randomly when they collide;
- Their random motion because of collisions is called **Brownian motion**.

Diffusion

- Diffusion is the **movement of particles from an area of high concentration to an area of low concentration.**
- Diffusion does not happen in solids – only fluids (liquids and gases);
- Particles in a solid can only vibrate and cannot move from place to place.
- Diffusion is driven by differences in concentration;
- No diffusion will take place if there is no difference in concentration from one place to another;
- Diffusion in liquids is slower than diffusion in gases because the particles in a liquid move more slowly.

Explaining diffusion in a smelly gas

- When a perfume is released into in a room, the perfume particles mix with the particles of air;
- The particles of perfume are free to move quickly in all directions;
- They eventually spread through the whole room **from an area of high concentration to an area of low concentration**;
- This continues until the concentration of the perfume is the same throughout the room;
- The particles will still move, even when the perfume is evenly spread out.

Diffusion and temperature

Diffusion is faster if the fluid (gas or liquid) is hotter.

Atmospheric pressure

The atmosphere exerts a pressure on you, and everything around you.

Atmospheric pressure changes with altitude. The higher you go:

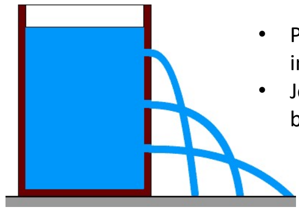
- the lower the weight of the air above you;
- the lower the atmospheric pressure.

Pressure in liquids

Just like the atmosphere, liquids exert pressure on objects.

The pressure in liquids changes with depth. The deeper you go:

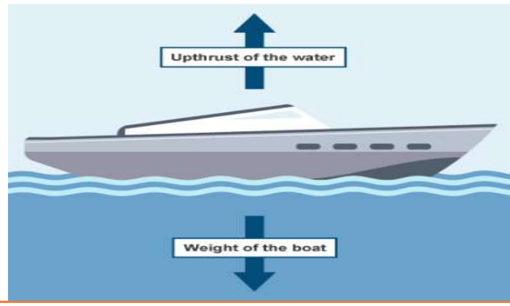
- the greater the weight of liquid above
- the greater the liquid pressure



- Pressure in a liquid increases with depth;
- Jet from the bottom of the bucket travels further.

Floating and sinking

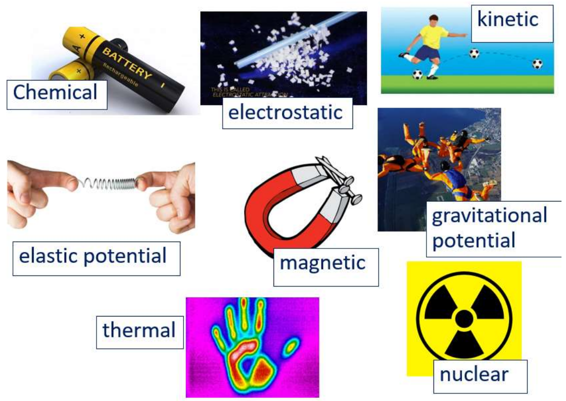
- Liquid pressure is exerted on surfaces of objects in liquids;
- This causes **upthrust**;
- When an object sinks, the pressure increases and so the upthrust increases;
- It will continue to sink if weight is greater than maximum upthrust;
- When and object floats, the upthrust is **equal and opposite** to the object's weight.



Core prior learning for 8PL – Light & Sound

<u>There are 8 different energy stores:</u>

- **Chemical –** eg energy store in food or fuels
- **Kinetic –** energy store in moving objects
- **Gravitational potential** - energy store in objects raised above the ground
- **Elastic potential –** energy stored in an object that is stretched or squashed
- **Magnetic –** energy stored between two poles brought close together
- **Electrostatic –** energy store in charges that are separated
- **Thermal –** the energy store in any object above absolute zero
- **Nuclear –** the energy stored in the nucleus of an atom



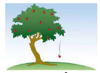
<u>Pathways for energy transfer</u>

There are 4 main **pathways** by which energy can be transferred:

1. **Mechanical** work (a **force** causing an object to move)

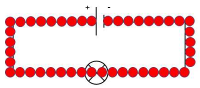
For example:

- **Gravity** can cause energy to be transferred from the **gravitational store** to the **kinetic store** of a falling object. Some energy will also be transferred to the **thermal store** due to **air resistance**.



2. **Electrical** work (when charges move due to a potential difference)

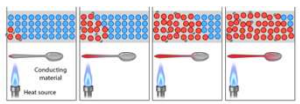
- Energy can be transferred from the **chemical store** of a battery to the **thermal store** of a bulb by **moving charges**

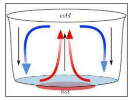


3. By **heating** (due to a difference in temperature)

For example, energy can be transferred between thermal stores of two objects by :

- conduction (when particles in a solid vibrate more and those vibrations are passed along the solid)
- convection – when regions of a gas or liquid are heated and become less dense and therefore rise.





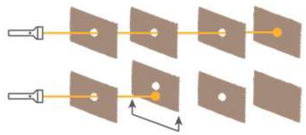
4. By **light or sound**

For example, energy is transferred from the thermal store of a light bulb to the surroundings by lighting (and heating)

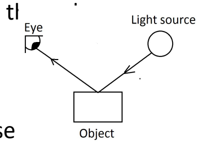
From KS2:

Light is given out by **luminous** objects – eg the sun, lamps and torches

Light travels in straight lines.



Shadows form when light rays reach an object they cannot go tl



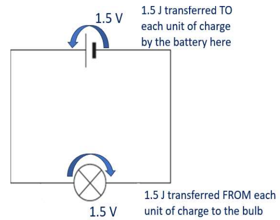
We see objects that are non- luminous because light rays are reflected off them into our eyes

Potential difference

Potential difference is the amount of energy, in joules, transferred, either :

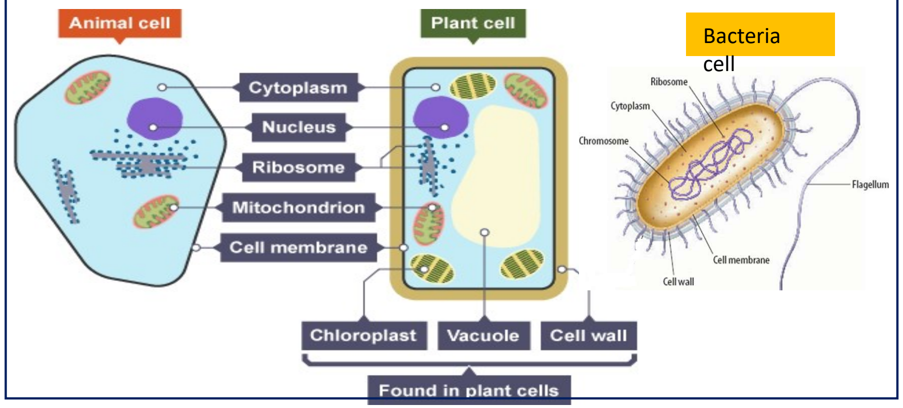
- **to** each 'unit' of charge at the cell/battery or
- **from** each unit of charge at the components

It is measured in volts, using a voltmeter



The amount of energy transferred to the charges at the cell is equal to the amount of energy transferred from the charges at the components.

Prior learning for 9BP



Organelle	Function
Nucleus	*Contains genetic material which controls the cell's activities*
Cell Membrane	*Controls the movement of substances in and out of the cell*
Cytoplasm	*Where chemical reactions happen*
Mitochondria	*Where energy is released in respiration*
Ribosome	*Where protein synthesis happens*
Cell Wall	*Provides strength and support*
Chloroplast	*Absorb light energy for photosynthesis (contains **chlorophyll**)*
Vacuole	*Filled with cell sap.*

These are some examples of **specialized plant cells**; cells that are **adapted** to do a specific job.

Palisade cell

Lots of chloroplasts that absorb energy for photosynthesis

Root hair cell

Large vacuole for storing **lots of sap**

Large surface area to absorb lots of water

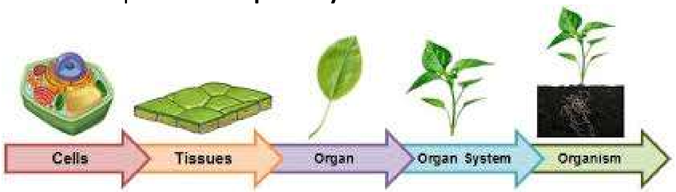
Plants as organisms

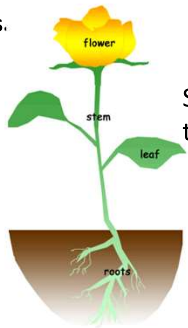
Plants are made of many different types of **cell,** which group together to form **tissues.**

An organ contains different types of tissue

The main plant organs are root, stem, leaf and flower

Each organ has a particular function – e.g the flower is responsible for **reproduction,** the leaf is responsible for **photosynthesis**





Stem is for transport

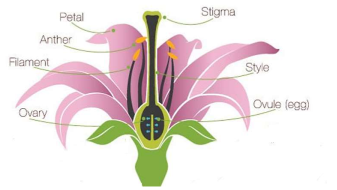
Roots are to take in water and minerals

Pollination

The flower is the organ involved in reproduction.

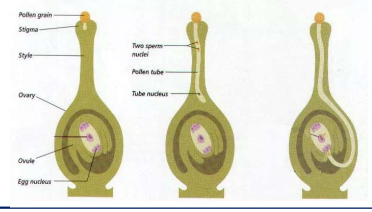
The anthers make **pollen**, which is the male sex cell.

Pollen is carried by the wind and insects to other plants.



Fertilisation

When the pollen reaches the stigma, pollen tube grows towards the ovary and then the nucleus of the pollen travels down the tube and joins with the nucleus of an egg. This is fertilisation.



Seed dispersal

After fertilization, a seed develops. Plants have different methods to spread seeds away from themselves so that their offspring do not compete with them and one another for light, water, minerals etc.

Plants and the atmosphere

The Earth's early atmosphere most mostly CO_2 and no O_2

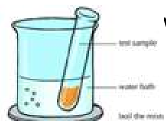
The evolution of plants, which take in carbon dioxide and release oxygen during photosynthesis, changed the atmosphere

When early plants and animals died, they were covered by dirt and rock and, over millions of years, formed coal and oil (fossil fuels)

Coal and oil are both mainly compounds of carbon and hydrogen

Testing for different nutrients:

We can test for **starch** using **iodine**. Iodine will turn from **orange to blue black** when it is is in contact with starch



We can test for **glucose** using **Benedict's** solution, which will turn from **blue to brick red** if glucose is present.

9BP: Plants and photosynthesis

Photosynthesis

- Plants make their own food (for energy) in a process called **photosynthesis**.
- Photosynthesis helps keep:
    - levels of oxygen high;
    - levels of carbon dioxide low.

- Photosynthesis takes place in the **chloroplasts.**
- Chloroplasts contain **chlorophyll** which absorbs the energy transferred by light waves for photosynthesis

The equation for photosynthesis is:

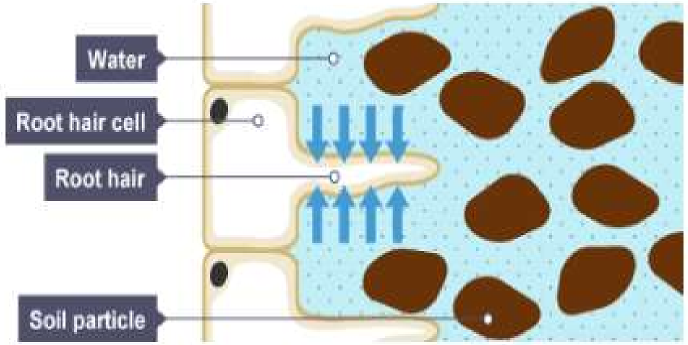
carbon dioxide + water → glucose + oxygen

These are the things that plants need for photosynthesis:

- **carbon dioxide** – absorbed through their leaves;
- **Water** - from the ground through their roots;
- **light** (a source of energy) - from the Sun.

These are the things that plants make by photosynthesis:

- **Oxygen** - released into the air from the leaves;
- **Glucose**:
    - turned into **starch** and plant oils, used as an energy store;
    - This energy is released by **respiration**;
    - Used to make **cellulose** for cell walls.

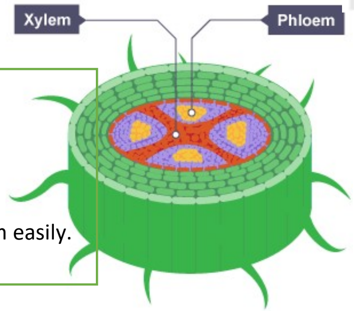


Water is absorbed into the roots by a process called **osmosis**, which does not use energy.
Minerals are absorbed into the roots by a process called **active transport,** which uses energy.

Feature of plant leaf	Function
Thin	Short distance for carbon dioxide to diffuse into the leaf
Waxy Layer	Prevents water loss by **evaporation**
Palisade cells	Contain a lot of **chloroplasts** to absorb light
Chloroplasts contain chlorophyll	Absorbs light
Stomata	Allows carbon dioxide to diffuse into the leaf (and oxygen to diffuse out)
Guard cells	Open/close stomata depending on conditions
Network of tubes (xylem & phloem)	Transports water (xylem) and food (phloem)

Water

- Water is absorbed through the roots, by **osmosis**;
- It is transported through tubes (**xylem**) to the leaf;
- The roots contain cells called a **root hair cells:**
    - They increase the **surface area**
    - They have **thin walls to** let water pass into them easily.
    - They **do not** contain chloroplasts.



Respiration v photosynthesis

Photosynthesis:

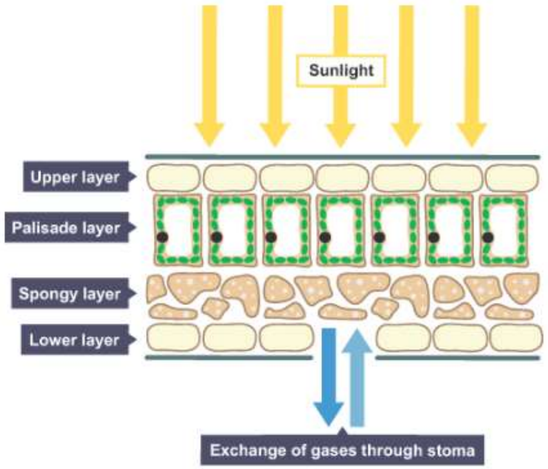
carbon dioxide + water → glucose + oxygen

Aerobic respiration is:

glucose + oxygen → carbon dioxide + water

The equation for photosynthesis is the **opposite** of the equation for aerobic respiration.

- **Photosynthesis**:
    - **produces** glucose and oxygen;
    - **uses** carbon dioxide and water;
- **Respiration**:
    - **produces** carbon dioxide and water;
    - **uses** glucose and oxygen;



A cross-section through a leaf showing its main parts

Food security and pollination

- **Pollination** is the transfer of pollen from one plant to another;
- Pollen can be transferred by **insects** or by **wind**;
- Insects that pollinate plants help us produce our food.
- Our food supply depends on plants:
    - Our food made of, and from plants;
    - The animals we eat feed on plants.

Carbon dioxide

- Enters leaf by **diffusion** through the **stomata**.
- **Guard cells** control the size of the stomata
- Stomata closes in **hot**, **windy** or **dry** conditions.
- Spongy layer has gaps between cells;
    - Allows carbon dioxide to **diffuse** to other cells in the leaf;
    - Allows oxygen produced in photosynthesis diffuse out of the leaf.