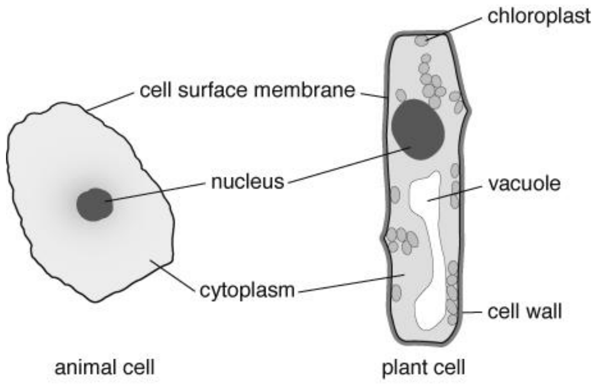
Highworth Warneford School
Science Department
Year 7 End of Year Exam Revision

Cells, tissues, organs and organ systems

All **organisms** carry out **seven life processes** (movement, reproduction, sensitivity, growth, respiration, excretion, nutrition). All organisms are made from **cells**:



Cell part	Function
cell surface membrane	keeps cell together and controls what goes into and out of the cell
nucleus	controls the cell
cytoplasm	where activities happen, including respiration (which occurs in **mitochondria**)
chloroplast	contains **chlorophyll** to trap sunlight for photosynthesis
cell wall	made of **cellulose** and provides support
vacuole	storage space

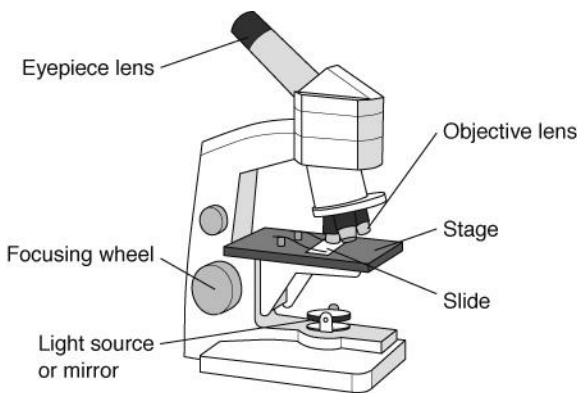
A **microscope** is used to **magnify** tiny things such as cells.

total magnification = magnification of **objective lens** × magnification of **eyepiece lens**.

The object you look at is the **specimen**. It has to be thin to let light get through it. It is placed with a drop of water onto a **slide**. A **coverslip** is carefully lowered on top, to stop the specimen drying out, hold it flat and stop it moving. A **stain** can be used to help you see parts of the cell.

To use a microscope:

- **A** Place the smallest objective lens over the hole in the stage.
- **B** Turn the focusing wheel to move the objective lens close to the stage.
- **C** Place the slide on the stage.
- **D** Adjust the light source or mirror.
- **E** Look into the eyepiece lens.
- **F** Turn the focusing wheel until what you see is in focus.



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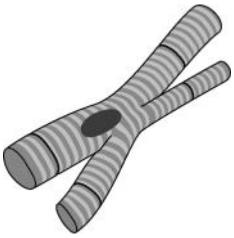
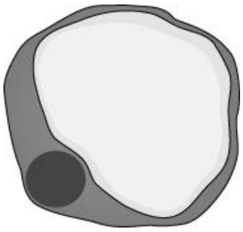
Some cells are specialised and have special **functions**.

In animals



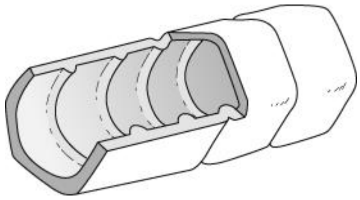
Muscle cells *shape to move things.*



Fat cells *in animals store fat.*

In plants

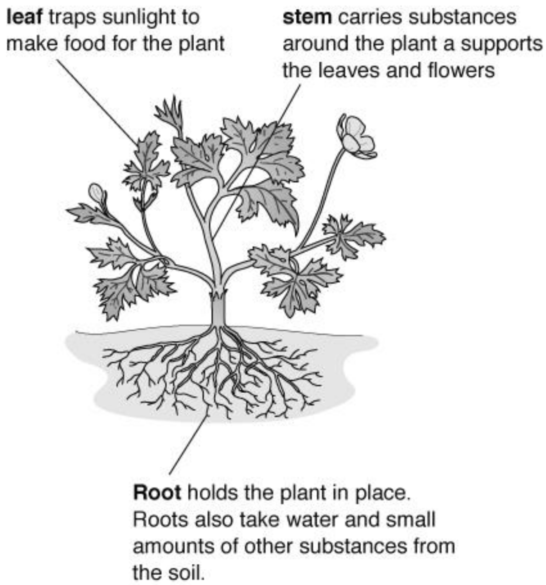
Root hair cells *take in water.*



Xylem cells *carry water.*

A group of cells that are the same, all doing the same job, is called a **tissue** (e.g. muscle tissue).

A group of different tissues working together to do an important job is an **organ**. For example, the **heart** is an organ and is made of muscle tissue and nerve tissue. Organs have important functions.



Organs often work together in **organ systems**.

Organ system	Organs	Job
breathing system	windpipe (trachea), lungs	takes air into the body and gets rid of waste gases
circulatory system	heart, blood vessels	carries oxygen and food around the body
digestive system	mouth, gullet, stomach, intestines	breaks down food
nervous system	brain, spinal cord, nerves	carries signals around the body
urinary system	bladder, kidneys	gets rid of waste
locomotor system	muscles, bones	allows movement
water transport system (plants)	roots, stem, leaves	carries water up a plant

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Habitats and environments

A **habitat** is the area where an organism lives. The conditions in a habitat are called the **environment**. An environment is affected by non-living factors (e.g. light, dampness, temperature), called **physical environmental factors.**

Physical environmental factors change from day to day (**daily changes**). As the conditions change, the organisms respond. For example, **nocturnal** animals are only active at night.

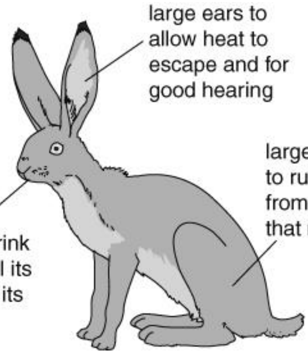
Physical environmental factors change over the year (**seasonal changes**). Organisms respond to these changes. For example, in autumn some birds **migrate** to warmer countries to feed during the winter.

To survive in a habitat, organisms need **resources**. An animal needs space, food, water, shelter and a mate to reproduce. Plants need space, light, water and mineral salts.

All the organisms in a habitat form a **community**. Within a community, the total number of one species is called a **population**.

Adaptations

Organisms have **adaptations** that allow them to survive in a habitat. For example, fish are adapted to living underwater. They have gills to take oxygen out of the water, fins to swim with and streamlined bodies to help them move easily through the water. Organisms that are better adapted to survive in an area will have a better chance of survival.



Jackrabbits are adapted to living in a desert habitat.

Populations

The size of a population is affected by several factors.

- Organisms **compete** with each other for resources. Competition for resources may cause populations of some organisms to decrease.
- Disease can kill organisms.
- Poisons may kill organisms, or kill the organisms that they depend on. Some **pesticides** are **persistent** and can build up in the animals as you go along a food chain, harming the top predators.
- Changes in one population affect other populations. When there are a lot of prey organisms, the number of predators increases because they have plenty of food. This decreases the number of prey, which then leads to a decrease in the number of predators.

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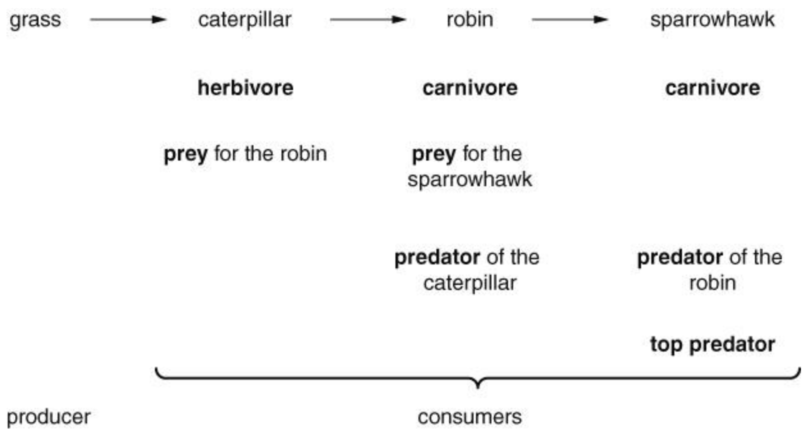
Food chains and webs

Food chains show what eats what in a habitat. However, organisms depend on other organisms in other ways. For example, many birds depend on trees in which to build nests.



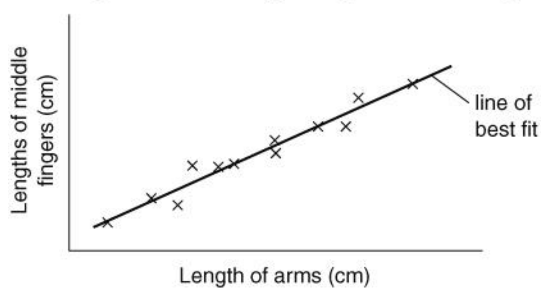
Food chains are joined to form **food webs**. Food webs can also show **omnivores** (animals that eat both plants and other animals).

The populations of the organisms at each level in a food chain can be shown as a **pyramid of numbers**. The size of each bar represents the number of organisms. Usually there are fewer organisms as you go along a food chain because energy is lost at each level (e.g. through movement, keeping warm, in waste materials).

Variation

A **species** is a group of organisms that can reproduce with one another to produce offspring that will also be able to reproduce. The differences between organisms are known as **variation**. There is variation between different species and between members of the same species. Variation that has a continual range of values is **continuous variation** (e.g. height). Variation that only has certain values is **discontinuous variation** (e.g. blue, brown or green eyes).

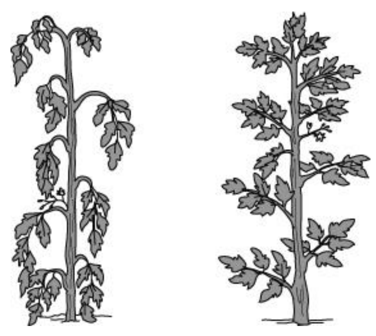
Sometimes there is a **relationship** between two features. A relationship is normally best shown on a scatter graph. A **line of best fit** can be drawn through the points to show the relationship.



Relationship: people with longer arms have longer middle fingers.

Environmental variation is variation caused by the environment. In humans, sunburn and having a scar are examples of environmental variation. Plants are affected by environmental factors such as the amount of light, water, warmth or mineral salts in the soil.

The cress seedlings on the left have not had enough light.



The tomato plant on the left has not had enough water.

Inherited variation is caused by features being passed from **parents** to their **offspring** during reproduction. In humans, natural eye colour and natural hair colour are both examples of inherited variation.

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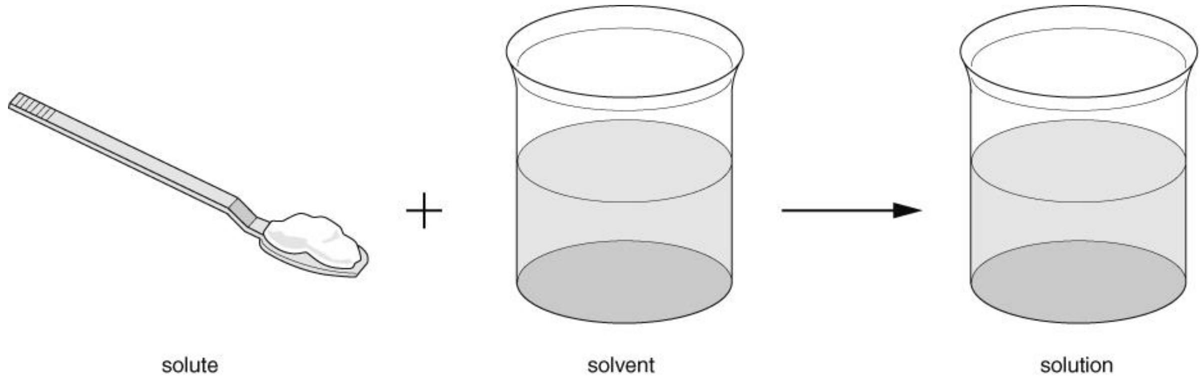
Mixtures

A **mixture** contains two or more substances jumbled together. There are different kinds of mixture:

- **suspension**: the solids settle out of the mixture over time.
- **colloid**: the solid pieces are smaller so they don't settle out, and the mixture looks cloudy or **opaque**.
- **solution**: the solids break up into such small pieces that they are not visible, and the mixture is **transparent**.

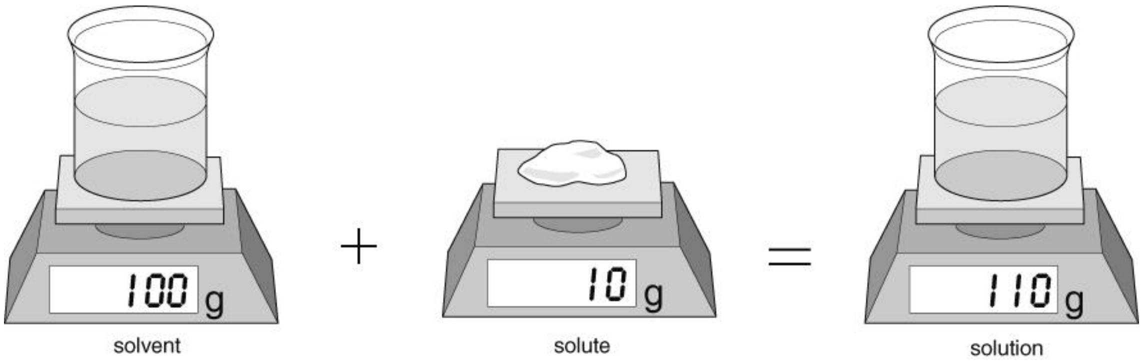
Solutions

Some solids **dissolve** in water to make a solution. These solids are **soluble**. A solution is made from a **solute** (usually a solid) and a **solvent** (liquid). Some gases, such as oxygen and carbon dioxide, can also dissolve in water.



Substances that do not dissolve in a solvent are **insoluble**. When an insoluble substance is mixed with water, the mixture formed may be a suspension or a colloid.

The total **mass** of a solution equals the mass of solvent added to the mass of solute.



Water dissolves many different solutes. Other liquids (e.g. white spirit, ethanol) can also be used as solvents. Solutes that are insoluble in water may dissolve in other solvents.

If you keep adding solutes to a solvent, you will get to a point where no more will dissolve. The solution is **saturated** with solute. More solid may dissolve if you add more solvent (e.g. water) or increase the temperature.

The **solubility** of a solute is the amount that will dissolve in a fixed amount of solvent at a particular temperature.

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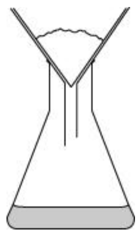
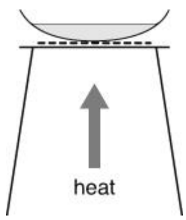
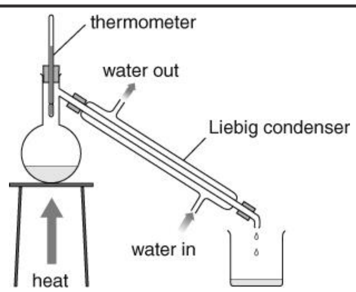
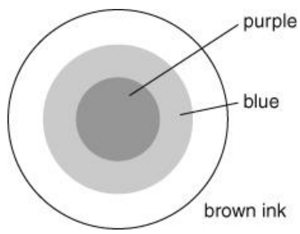
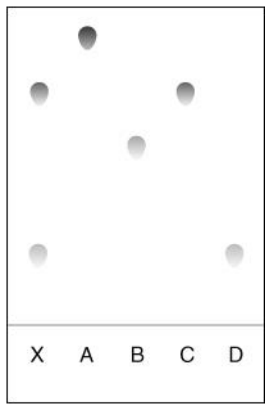
Mixtures and solutions can be separated using different methods.

Method	Used to separate	Apparatus used	Examples
filtering (filtration)	solids from a suspension (i.e. large pieces of solids that have not dissolved in a liquid)		• sand from a mixture of sand and water
evaporation	solid substances from a solution or colloid		• salt from a salt solution
distillation (evaporation followed by condensation)	liquid from a mixture		• pure water from a salt solution
chromatography	individual solutes from a mixture of solutes in a solvent		• colours found in ink

Interpreting a chromatogram

Chromatograms help to identify substances in a mixture.

This paper chromatogram shows that A, B, C and D are all single substances and that X is a mixture of C and D.



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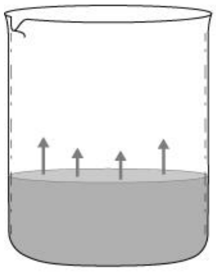
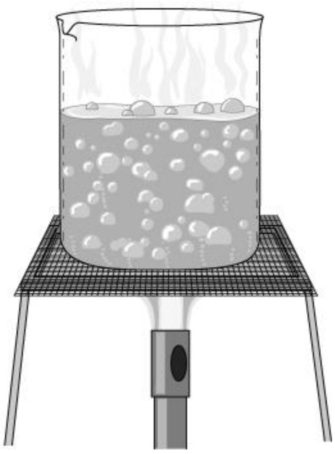
Evaporation and boiling





Evaporation is when a liquid turns to a gas at its surface.

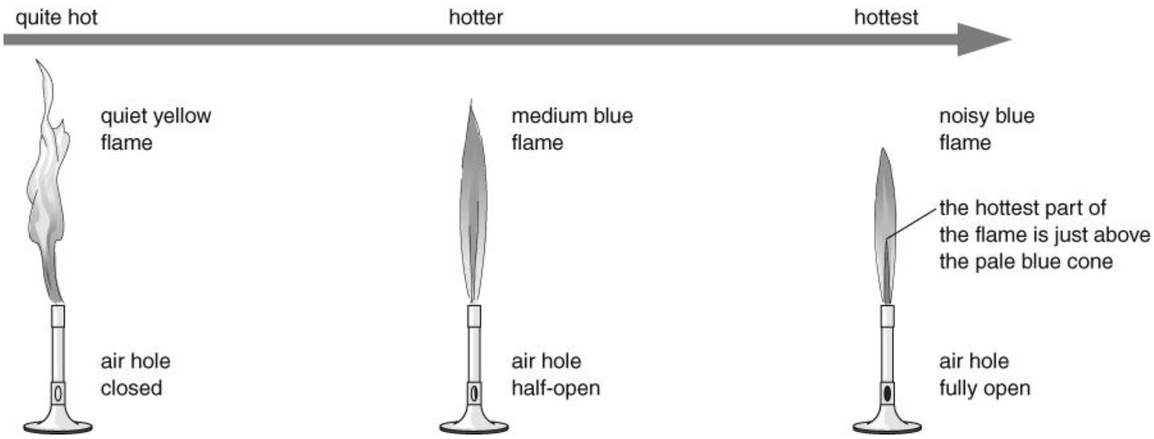
- It happens at any temperature.
- It is faster when the temperature is higher.

When a liquid **boils**, all the liquid is trying to turn into a gas at the same time.

- Boiling happens at the liquid's **boiling point**.
- Gas formed inside the liquid makes bubbles that rise to the surface.
- The boiling point of pure water is 100 °C.

Heating with a Bunsen burner

The air hole of a Bunsen burner can be adjusted to give different kinds of flame. Each kind is useful for different things.



Safety flame: should always be used when not heating.

This flame is used for gentle heating.

This flame is used for rapid heating.

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Hazards and risks

- A **hazard** is something that could cause harm.
- A **risk** is how likely it is that the hazard will cause harm.
- You should always plan to minimise risks in experiments.

Example of hazard	How to reduce the risk from the hazard
Burns or scalds from apparatus heated by a Bunsen burner.	Use heat-resistant gloves or tongs to touch apparatus.
Spitting liquid when heating to dryness.	Wear eye protection and make sure heat is turned off before the solution is completely dry.
Shaking of distillation flask by bubbling liquid.	Add anti-bumping granules to liquid to prevent large gas bubbles forming.

Writing a good method

Here is a **method** for lighting a Bunsen burner safely. The labels on the right show how to write a good method.

Method

A Check the gas hose for breaks or holes and return the Bunsen burner and hose to your teacher if it is damaged.

B Tie back loose hair and any loose clothing, such as a tie or scarf.

C Remove everything except what is needed for the experiment from your working area.

D Wear eye protection.

E Place the burner on a heat-resistant mat 30–40 cm from the edge of the bench.

F Make sure the air hole of the Bunsen burner is closed.

G Hold a lit splint or a long-armed sparker or lighter about 2 cm above the top of the Bunsen burner.

H Turn on the gas at the gas tap to light the burner.

The instructions are written as a set of steps in the correct order, or **sequence**, for carrying out the experiment.

Each step describes one action during the experiment.

Use **imperative verbs** (command words) to keep the sentence structure simple and the language clear.

Use the correct names for apparatus, and correct science terms where appropriate.

When you write up your method in your report at the end of the experiment, change the verbs to the past tense. For example:

- I made sure the air hole of the Bunsen burner was closed.

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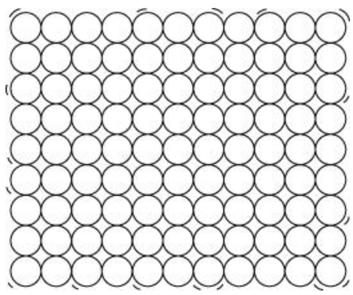
The particle theory

A **scientific method** describes how scientists try to explain the world around them. It usually starts with some observations, which generate a question. Scientists may then follow a series of unbiased steps to answer the questions. These steps could include the following:

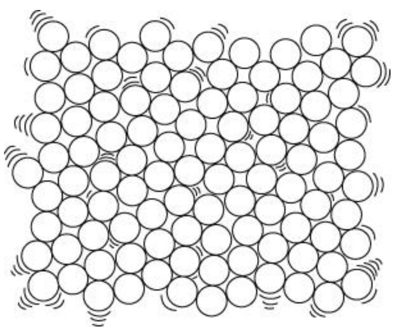
- thinking up an idea or using existing ideas that would explain the observations. These ideas are called **hypotheses**.
- using the hypothesis to make a **prediction** about the hypothesis.
- testing the prediction by experiment, and collecting data.
- checking the **data** to see if it matches the prediction.
- using the data as **evidence** to support the hypothesis (or prove it is wrong).
- forming a **theory** if the hypotheses have been tested many times and shown, by the evidence, to be correct. The **particle theory** is an example.

The different **properties** of solids, liquids and gases can be explained by the **particle theory** (or **particle model**). Solids, liquids and gases (the three **states of matter**) need to be handled and stored differently because of these different properties.



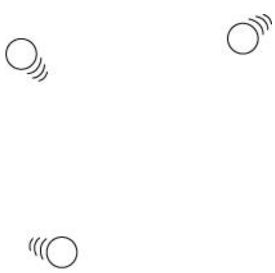
Solids

- Solids are made up of particles that are very close together. (Strong forces of attraction hold the particles together.)
- The particles in solids vibrate in fixed positions.
- The shape and volume of solids do not change.
- Solids cannot be squashed and do not flow.



Liquids

- Liquids are made up of particles that are fairly close together. (Quite strong forces of attraction hold the particles together.)
- The particles in liquids are able to move past each other.
- Liquids have a fixed volumes but their shape can change to fit the container as they flow easily.
- Liquids cannot be easily compressed (squashed).



Gases

- Gases are made up of particles that are well spread out. (There are only weak forces of attraction between the particles.)
- The particles in gases move about freely in all directions.
- The shape and the volume of gases can change as they flow very easily and spread out.
- Gases can be compressed (squashed) quite easily.

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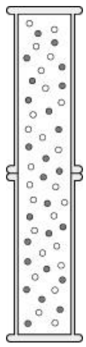
Brownian motion

When pollen grains in water are observed through a microscope they are seen to move jerkily in different directions. This is called **Brownian motion**. It is caused by water particles, which are moving all the time, hitting the pollen grains. The pollen grains are small enough so that when many water particles hit one side of the grain, the grain is moved in that direction.

Brownian motion provides evidence to support particle theory.

Diffusion

Diffusion is said to have occurred when chemicals mix together without anything moving them. Diffusion occurs because particles in a substance are always moving around. Diffusion is fastest in gases, and slower in liquids.



Dilution

When you add water to orange squash you dilute it. The colour becomes paler because the orange coloured squash particles are spread out more among the water particles.

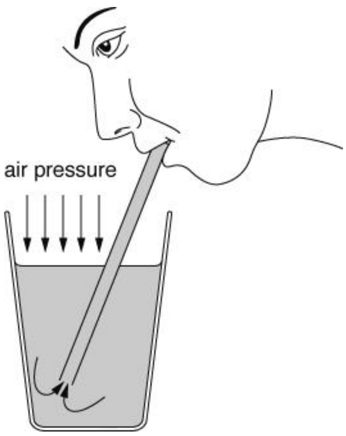
Pressure in gases

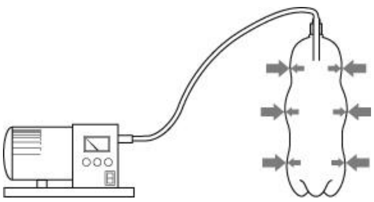
Pressure is caused by particles hitting the walls of the container they are in. The pressure may increase because:

- the container has been squashed, making the volume smaller so that the particles will be hitting the walls more often.
- the number of particles has been increased, so that there are more particles moving around to hit the walls.

If the particles are in a flexible container, like a balloon, an increase in pressure inside the container can make the volume increase. If the pressure becomes too great, the balloon will burst.

Air pressure is the pressure caused by air particles around us. Air pressure lets us suck things up using a straw and also causes a container to collapse if the air is sucked out. If all the air is sucked out of a container, you get a **vacuum** – nothingness.





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Energy from food

Humans and other animals need energy to live. The energy resource for our bodies is the energy stored in food. We need to choose our food so that we get the right amount of energy.

The unit for measuring energy is the **joule** (**J**). There is a lot of energy stored in food, so we usually measure the energy in food using **kilojoules** (**kJ**). 1 kJ = 1000 J.

Energy transfers and stores

Energy can be transferred by:

- heating
- light
- sound
- electricity
- forces.

Energy can also be stored in different ways.

Energy stored in…	Commonly called…
the chemicals in food, fuels and batteries	chemical energy
moving objects	kinetic energy
hot objects	thermal energy
objects that are stretched, squashed or twisted	strain energy or elastic potential energy
objects moved to high places	gravitational potential energy
inside the particles that everything is made up from	nuclear energy or atomic energy

Energy is not used up. It can be transferred and stored in different ways, but it cannot be created or destroyed. This is called the **law of conservation of energy**.

Fuels

Fuels store energy, and this energy is transferred when the fuels burn. Burning fuels are used to heat things.

Fossil fuels:

- are made from plants and animals that were trapped in mud and rocks millions of years ago
- include coal, oil and natural gas
- are non-renewable (they take millions of years to form, and so our supplies will run out)
- produce gases that cause pollution and global warming when burnt
- are relatively cheap to obtain
- originally got their energy from the Sun. The plants that became coal, oil and natural gas got their energy from the Sun, and the animals that became oil and natural gas got their energy from plants, which got their energy from the Sun.

Nuclear fuel is also non-renewable. Nuclear power stations produce dangerous waste materials.

Electricity is not a fuel. It has to be generated using other **energy resources**.

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Making fossil fuels last longer

We can make fossil fuels last longer and help to reduce global warming by using less of them. We could walk or cycle whenever we can, or use a bus instead of using a car. Walking and cycling would make us fitter and healthier, and there would be less pollution if there were not as many cars on the roads. We could also save energy by keeping our houses cooler and putting on more clothes if we are cold instead of turning up the heating.

Renewable energy resources:

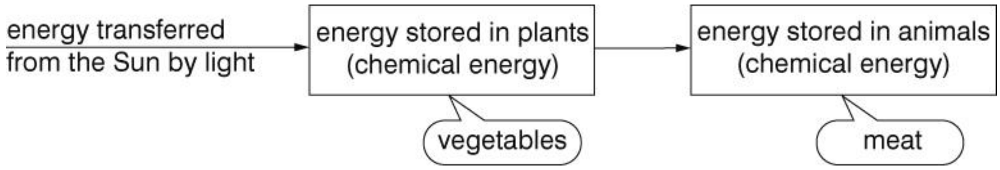
- include solar, wind, tidal, wave, biofuels, geothermal and hydroelectricity
- do not produce harmful gases or contribute to global warming
- are often more expensive than using fossil fuels
- will not run out
- are not always available.

Hydroelectricity, geothermal energy and biofuels are available at any time. Tidal power is not available all the time, but we can predict when it will be available. Energy from solar, wind and waves is only available some of the time.

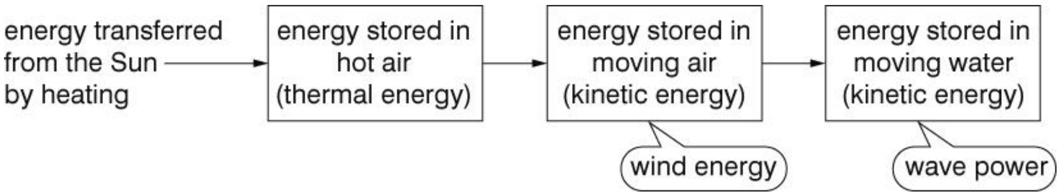
Energy from the Sun

Most of the energy resources we use store energy that originally came from the Sun.
Only geothermal power, nuclear power and tidal power do not depend on energy from the Sun.

How energy is transferred to our food:



How energy is stored in the wind and in waves:



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Electrical circuits

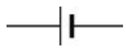
Electricity is a flow of **charges**. Electricity can flow through **conductors** but not through **insulators**. Metals are good conductors of electricity. Plastics are good insulators.

For current to flow in a circuit, you need:

- a complete circuit with no gaps
- a cell or power supply.

We can use **models** to help us to think about electricity and circuits. One model for a circuit is a central heating system. The boiler and pump represent the cell, the pipes represent the wires, and the radiators represent bulbs.

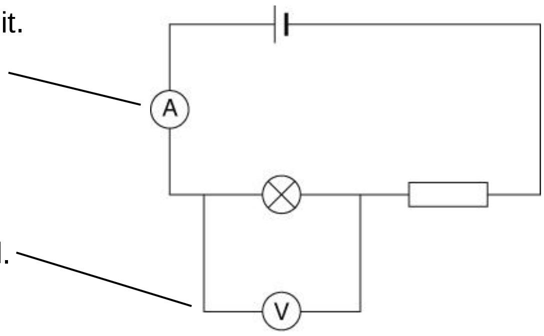
Symbols

Component	Symbol	Component	Symbol	Component	Symbol
cell		bulb		ammeter	
switch		resistor		voltmeter	

Measuring electricity

- **Current** is the amount of electricity flowing in the circuit.
- It is measured using an **ammeter** connected in series.
- The units for current are **amps** (A).

- **Voltage** provides the 'push' and energy.
- It is measured using a **voltmeter** connected in parallel.
- The units are **volts** (V).



Resistance

The **resistance** of a circuit is a way of saying how easy or difficult it is for electricity to flow.

- High resistance = hard for electricity to flow = small current.
- Low resistance = easy for electricity to flow = large current.

Thin wires and resistors have high resistances. Thick wires have low resistances.

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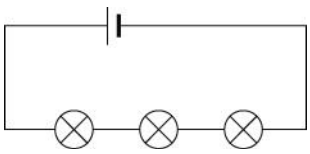
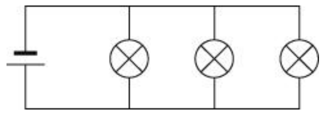
Series and parallel circuits

Circuits can be **series** or **parallel** circuits.

Series circuit 	**Parallel circuit** 
If one bulb breaks, all the others go off. The current is the same everywhere. If you put more bulbs in they will be dimmer, because it is harder for the electricity to get through. The resistance of the circuit is higher with more bulbs.	If one bulb breaks, the bulbs in the other branches stay on. The current splits up when it comes to a branch. The current in all the branches adds up to the current in the main part of a circuit. If you add more bulbs, they stay bright. It is easier for the current to flow with more branches, because there are more ways for the charges to go.

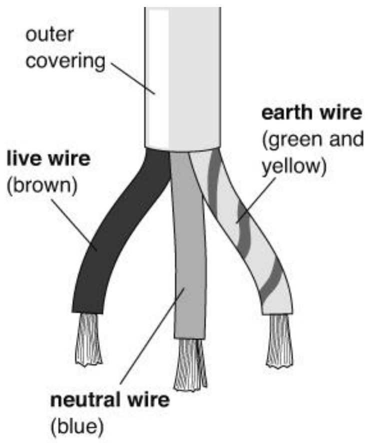
Safety

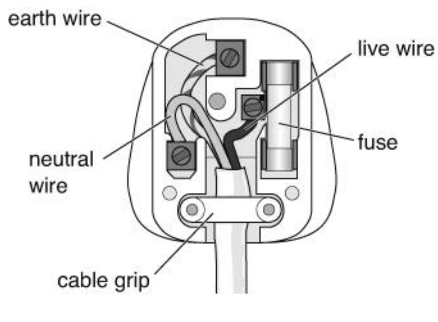
Electricity can be dangerous if it is not used properly. It can cause:

- fires
- burns
- shocks that can stop your heart or lungs working.

The wiring in houses is designed to be safe.

- **Fuses** are used in plugs. They melt if the current gets too high. A fuse has a **rating** that shows what current it can carry without melting. It is important to use the correct fuse.
- **Circuit breakers** also cut off the current if it gets too high. They protect the **ring mains** in buildings (loops of parallel circuits).
- Cables have three colour-coded inner wires. The live and neutral wires are part of the circuit. The earth wire works with the fuse for safety.





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