8A Summary Sheets

Food and digestion

We need to eat a wide variety of foods to provide our bodies with all the substances that are needed. When we do this, we are said to have a **balanced diet**.

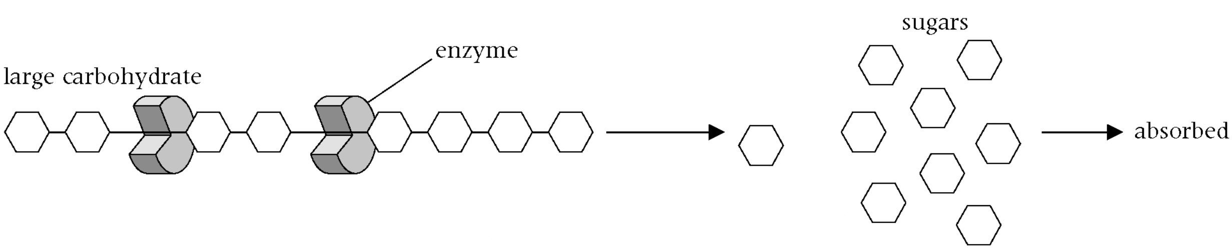
Substance needed	Examples	Why it's needed	Good sources
carbohydrate	starch, sugars	for respiration to release energy	pasta, bread
protein		for growth and repair	meat, beans
vitamins	vitamin C	for health	fruits and vegetables – oranges contain a lot vitamin C
minerals	calcium	for health	fruits, vegetables and dairy products – milk contains a lot of calcium
fibre		for health; helps to keep our intestines clean stop them getting blocked up (**constipation**)	wholemeal bread
water		for health; water is important **solvent** in the body	

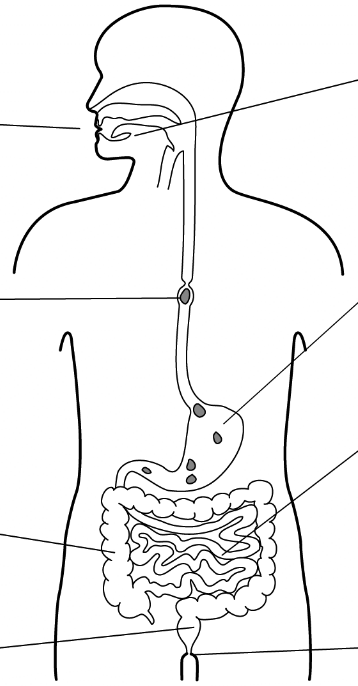
We can do tests to find out which substances are in foods. For example, starch makes iodine solution go a blue–black colour.

Nutrition information labels on foods tell us what the food contains. The labels also tell us how much chemical energy is stored in the food. The amount of energy is measured in **kilojoules** (**kJ**).

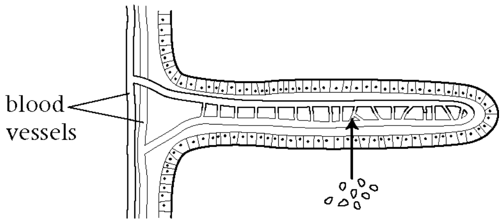
Eating too much of some foods can cause problems. Too much fat may cause **heart disease**.

To make use of the food, our bodies need to break it up into smaller sized molecules. This is called **digestion**. Digestion turns large **insoluble** substances into small **soluble** ones. The organs of the **digestive system** help us digest food. Many of them produce **enzymes** (chemicals that break up food).





To help absorb the digested food, the small intestine is covered with **villi**. These increase the surface area.



The digested food substances are carried around the body in the **blood**. The blood travels through **blood vessels**. **Arteries** carry blood away from the heart and **veins** carry blood towards the heart. The smallest blood vessels are **capillaries**. Substances enter and leave the blood through capillaries. Cells get the substances they need from the blood in capillaries.

Cells need food substances to:

- release energy
- make new substances.

Cells use a **chemical reaction** called **respiration** to release energy from a sugar called glucose.

8B Summmary Sheets

Respiration

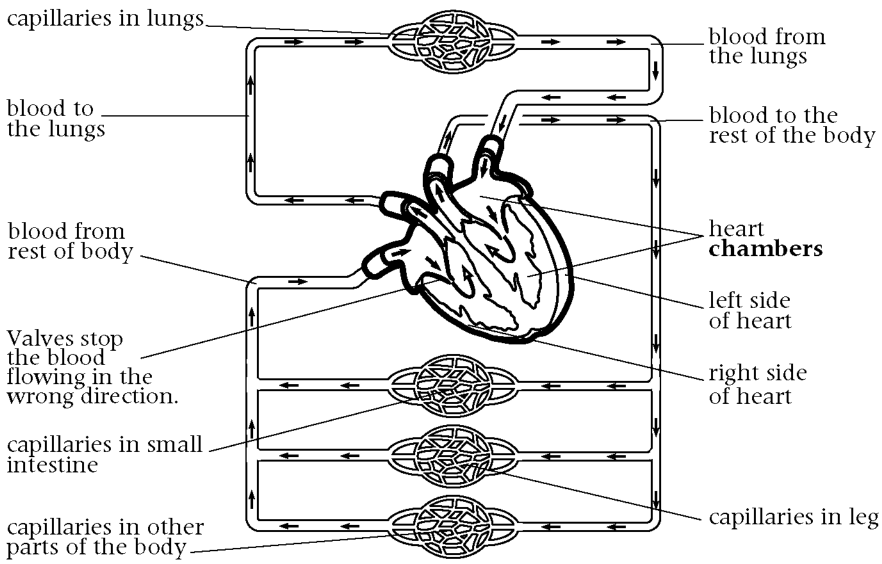
All living cells need to **respire** to release energy. Energy is needed by organisms to help them move, grow and make new substances to help them stay alive.

Respiration normally requires oxygen and so it is called **aerobic** (with air) **respiration**. It is a series of **chemical reactions** which can be summarised in a word **equation**:

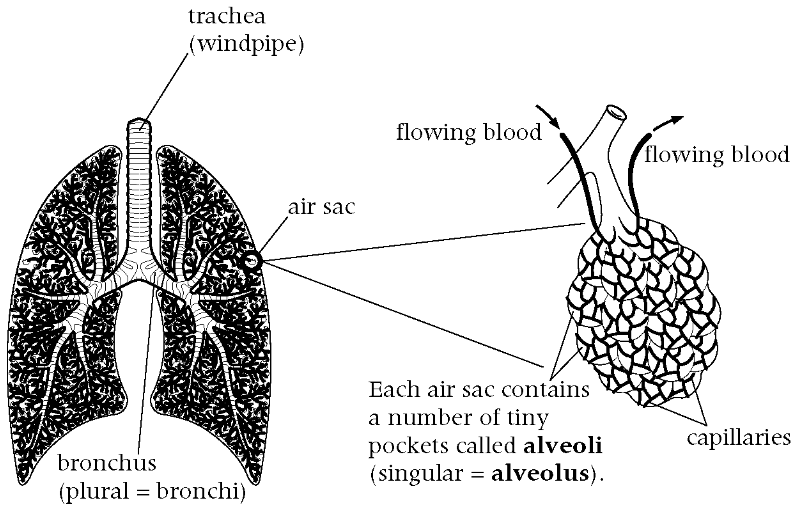
glucose + oxygen → carbon dioxide + water (+ energy)

Glucose and oxygen are the **reactants**. Carbon dioxide and water are the **products**. Energy is released but it is not a chemical substance so we can either miss it out of the equation or put it in brackets.

Glucose is supplied by the **digestion** of carbohydrates. It is carried around the body dissolved in the **plasma** of the blood. The blood travels through **blood vessels** and is pumped by the heart. The **heart** and the blood vessels form the **circulatory system**.

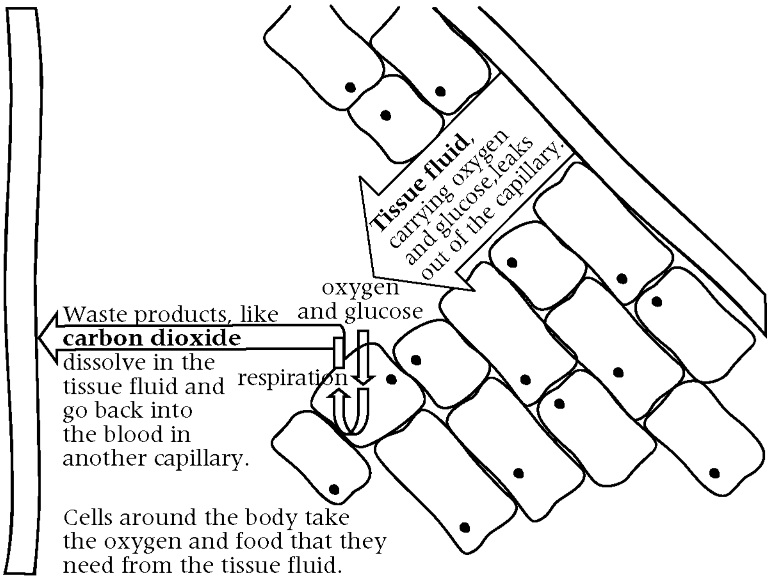


The oxygen is absorbed from the air by the **lungs**. The lungs are part of the **breathing system**.



The **alveoli** give the lungs a large surface area so that oxygen can quickly **diffuse** from the air inside the lungs into the blood contained in **capillaries**. The walls of the alveoli and the walls of the capillaries are only one cell thick which also makes it easy for oxygen to diffuse into the blood. The oxygen is carried by the **red blood cells**.

Tissue fluid comes out of other capillaries around the body and bathes the tissues in the body. Tissue fluid contains oxygen and glucose. The cells take the oxygen and glucose that they need from the tissue fluid and put the carbon dioxide that is produced back into the tissue fluid. The tissue fluid soaks back into other capillaries and the carbon dioxide dissolves in the blood plasma.



In the lungs the dissolved carbon dioxide diffuses out of the blood and into the air in the lungs. That is why we breathe out (**exhale**) more carbon dioxide than we breathe in (**inhale**). The carbon dioxide is **excreted** by the lungs. Carbon dioxide can be tested for by using limewater which turns from clear to cloudy. Oxygen diffusing into the blood and carbon dioxide diffusing out of the blood is called **gas exchange**.

	Inhaled air	**Exhaled air**
nitrogen gas	78%	78%
oxygen gas	21%	16%
carbon dioxide gas	0.03%	4%
water vapour	variable	more

Composition of inhaled and exhaled air.

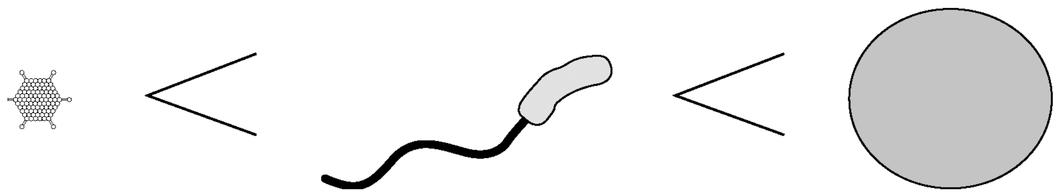
When you exercise, your **breathing rate** (number of breaths in one minute) and your **pulse rate** (number of times your heart beats in one minute) increase. This is because your cells need more oxygen and glucose for respiration.

In some diseases or when there is little air (e.g. at the top of a mountain) the body cannot get enough oxygen. People in these situations often feel short of breath and tired. If too little oxygen gets to cells, the cells cannot release energy from food and so they die.

8C Summary Sheets

Microbes

Microbes (short for **micro-organisms**) can only be seen using a microscope. There are three main types: **viruses**, **bacteria** and **fungi**. The most common fungus microbes are **yeasts**.



Viruses are smaller than bacteria which are smaller than yeasts.

Viruses are often not considered to be living because they do not carry out any of the seven life processes for themselves.

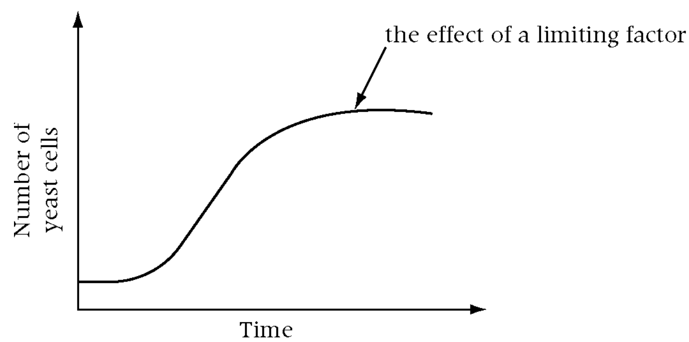
Bacteria and yeast are important in making foods and drinks. Yeast is used to make bread dough rise. It uses oxygen, from the air found in pockets in the dough, for **aerobic respiration**. This process produces carbon dioxide which makes the bread rise.

glucose + oxygen ⟶ carbon dioxide + water (+ energy)
(a sugar)

Yeast are also used to make beer and wine. In this case there is no air and so they **use anaerobic respiration**. When yeast use anaerobic respiration it is called **fermentation**. The ethanol is a waste product of this reaction.

glucose ⟶ carbon dioxide + ethanol (+ energy)
(a sugar)

The numbers of an organism in an area are called a **population**. In good conditions (warm, moist, plenty of sugar) a population of yeast will grow rapidly. The population stops growing if something runs out (eg sugar). The thing that stops the population growing is called a **limiting factor**.



Diseases

Some microbes cause **infectious diseases** (diseases that can be spread from person to person). The microbes are said to **infect** you. The effects the microbes have on your body are known as **symptoms**. Microbes can be spread by the air, water, touch, food, animals and sex.

Disease	Microbe that causes it	Symptoms	How it is spread
Colds and flu	Virus	Sore throat, running nose, fever	Air
Food poisoning	Bacteria	Vomiting, diarrhoea	Food
Cholera	Bacteria	Vomiting, diarrhoea	Water
Athlete's foot	Fungus	Sore cracked skin between the toes	Touch

Some ways that diseases can be stopped from spreading are:

- making sure sewage is treated and disposed of properly
- adding chlorine to water to kill bacteria
- **pasteurising** milk
- using disinfectants, antiseptics and soaps
- **immunising** people with **vaccines**.

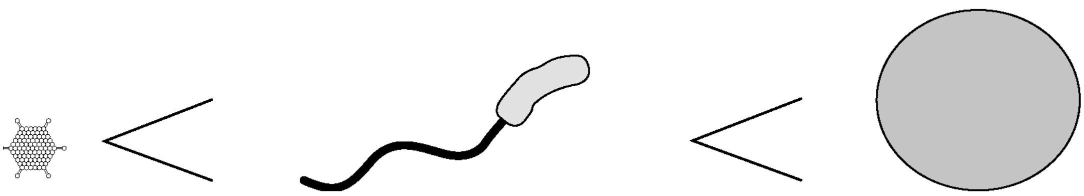
Your body has **natural defences** to stop microbes getting in (eg skin, **mucus** in the windpipe and nose, **ciliated epithelial cells** to sweep mucus along). Your body also has ways of destroying microbes. These include:

- a chemical in tears that kills some bacteria
- acid in the stomach that kills some bacteria
- white blood cells that **engulf** microbes
- other white blood cells that make **antibodies** to help destroy microbes.

Babies do not have fully developed immune systems. Antibodies can pass through the placenta and are found in breast milk. These help the baby to fight infections.

For many diseases, once you have had the disease (or been immunised) you will not get it again (e.g. chickenpox). This is because the antibodies against these microbes stay in the blood.

Some diseases can be cured using **antibiotics** which are **medicines** which kill off bacteria. Some bacteria, however, are unaffected by antibiotics – they are **resistant** to them.



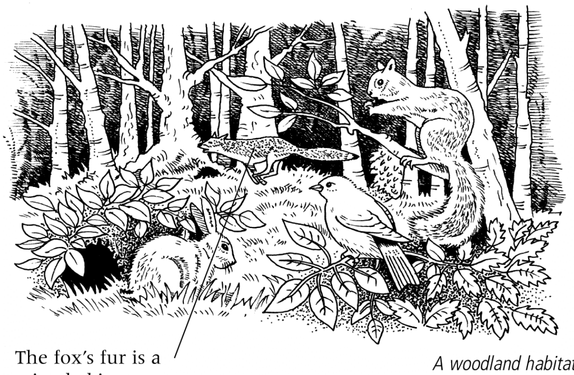
8D Summary Sheets

Ecological relationships

Habitats and environments

A **habitat** is the area where an organism lives. Non-living factors in a habitat are called **physical environmental factors**. Examples include how light it is and what the temperature is. These make up the surroundings, or **environment**, of an organism.

Small areas in a habitat are called **microhabitats**. For example, the fur on a fox is a microhabitat.



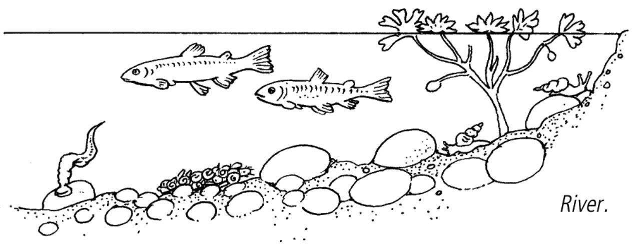
A woodland habitat.

All the plants and animals that live in a habitat make up a community. Within a **community**, the total number of one species is called a **population**. There will be a population of foxes in a wood.

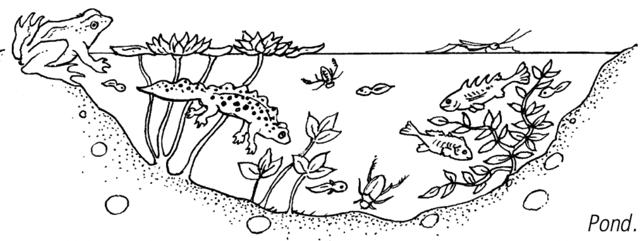
In order to survive in a habitat, organisms need various **resources**. An animal needs food, water, oxygen, shelter and it needs to find a mate to reproduce. Plants need light, water and carbon dioxide in order to make food. They also need mineral salts (nutrients), oxygen and space to grow.

Adaptations

In any habitat, the organisms living there must be **adapted** to survive the environmental conditions within that habitat. Members of the same community may have similar **adaptations** to cope with the problems of their habitat. For example, many small animals and plants which live in fast-flowing rivers are adapted to stop them being swept away. In ponds, free-swimming animals and floating plants can survive because there is no current to wash them away.



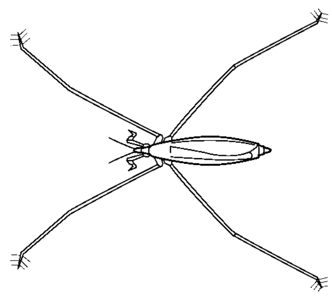
River.



Pond.

All the places in an environment where an organism is found is called its **distribution**. For example, in a pond habitat pond skaters are found on the surface of the water. They are adapted to living here because they have bristles on the ends of their legs, which prevent them from breaking the surface film of water. They feed on dead insects floating on the water.

Organisms that are better adapted to survive in an area will have a better chance of survival.



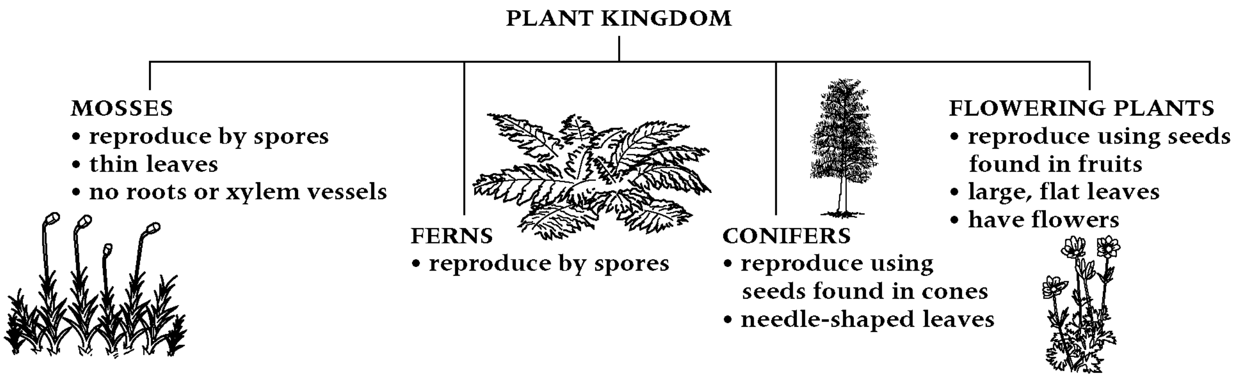
A pond skater.

Classifying living organisms

Each different type of organism is called a **species**. There are so many species that we need to put them into groups. This is called **classification**. The largest groups are called **kingdoms** and the biggest of these are the **plant kingdom** and the **animal kingdom**. The Summary Sheets for Unit 7D *Variation and classification* show how animals are classified into groups.

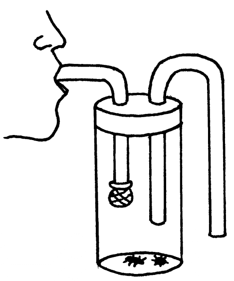
The main difference between plants and animals is that plants can make their own food by **photosynthesis**.

There are four main plant groups.

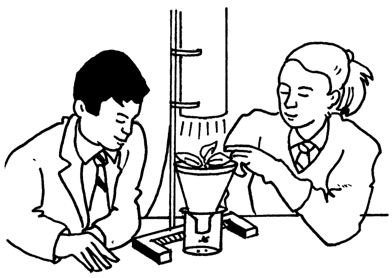


Sampling methods

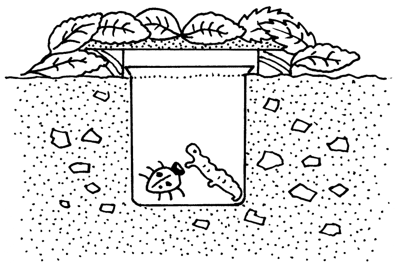
Ecologists are scientists who study habitats. They catch organisms using **various sampling techniques**, then use **keys** and field guides to identify them.



A pooter is used to collect small invertebrates.



A Tullgren funnel is used to collect invertebrates from leaf litter.



A pitfall trap traps small animals that crawl along the ground.

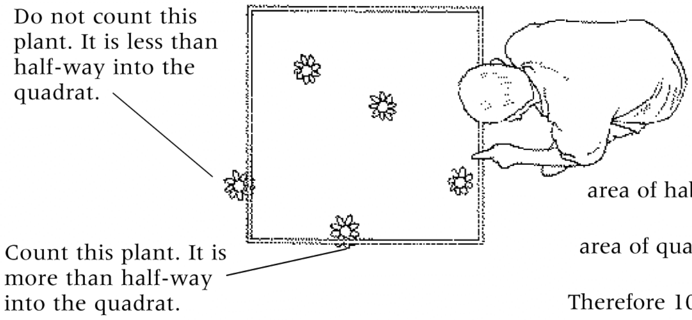
Tree beating is used to collect animals that live in trees or bushes.

Pond dipping is used to collect organisms from different parts of a pond.

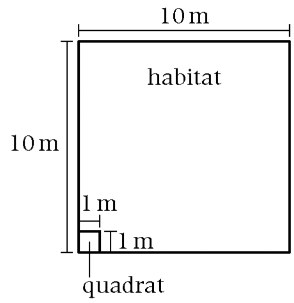
A sweepnet is used to collect organisms from long grass.

Ecologists often need to know the size of a population. It would be impossible to count all the organisms in a habitat, so they take **samples** and then **estimate** the total number of organisms.

A **quadrat** is a sampling square used to estimate plant populations. The quadrat is placed randomly on the ground in different parts of the habitat and the number of plants inside it is counted each time.



area of habitat = 10 m × 10 m
= $100\ m^2$
area of quadrat = 1 m × 1 m
= $1\ m^2$
Therefore 100 quadrats would fit in this habitat.



The more samples that are taken, the more reliable an estimate will be.

Ecologists also measure the physical environmental factors, like how warm it is and how much oxygen is dissolved in pond water, using sensors and dataloggers. They then look to see if there are any links between the factors, such as, the warmer the water the lower the oxygen level is.

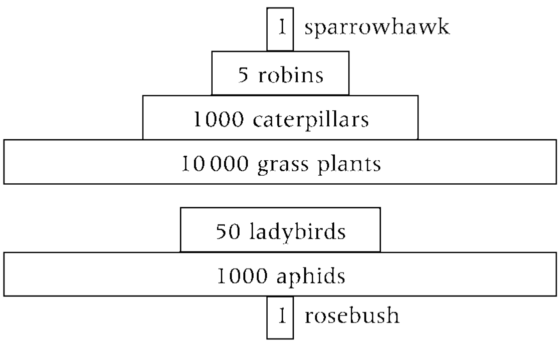
Feeding relationships

Food chains and **food webs** show the feeding relationships between different organisms in a habitat. (See Summary Sheets for Unit 7C *Environment and feeding relationships*).

The numbers of organisms at each level in a food chain can be shown as a **pyramid of numbers**. The size of the bars shows the number of organisms. Usually there are fewer organisms as you go along a food chain because energy is lost at each level, for example, for movement. Sometimes the pyramid has an unusual shape if the organisms are very different in size.

grass → caterpillar → robin → sparrowhawk

rose bush → aphids → ladybirds



One rose bush can feed many aphids.

8E Summary Sheets

Atoms and elements

Elements

An **element** is a simple substance that cannot be split into anything simpler by chemical reactions. Atoms are the smallest particles of an element that can exist. **Atoms** of one element are all the same, and are different from atoms of all the other elements.
There are over 100 different elements. All the elements are shown in the **Periodic Table**. Each element has a **chemical symbol**, which is usually one or two letters. A symbol is written with the first letter as a capital, and the second letter is small.

carbon	**C**	**oxygen**	**O**
nitrogen	**N**	**hydrogen**	**H**
gold	**Au**	**silver**	**Ag**
copper	**Cu**	**aluminium**	**Al**

Metals and non-metals

The **properties** of a substance are the words that we use to describe it, or measurements that we can make on it. **Metals** and **non-metals** have different properties.

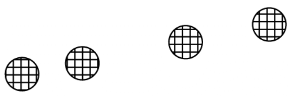
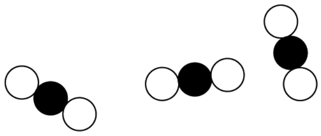
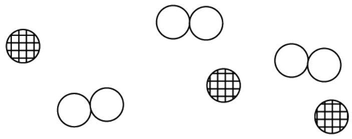
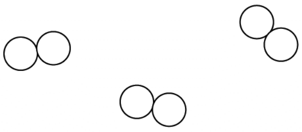
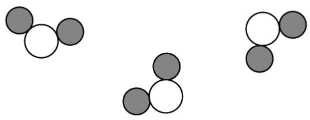
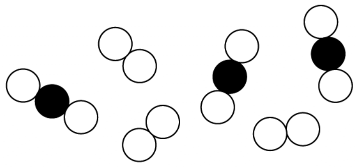
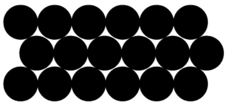
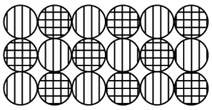
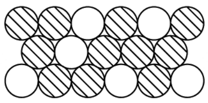
Metals	Non-metals
good **conductors** of heat and electricity	poor **conductors** of heat and electricity
shiny	dull
solids with a **high melting point** (except for mercury)	most are solids or gases
found on the left-hand side of the **Periodic Table**	found on the right-hand side of the **Periodic Table**
three metals are **magnetic**	no non-metals are magnetic
metals can burn to form alkaline oxides	non-metals can burn to form acidic oxides
flexible	brittle

Compounds

Elements can join together to make compounds. The name of the compound tells you the elements that are in it. Compounds made from two elements always have a name which ends in '**-ide**'.

These elements join together …	… to make these compounds
carbon, oxygen	carbon dioxide
sodium, chlorine	sodium chloride
magnesium, oxygen	magnesium oxide

A chemical formula tells you the name and number of atoms in a compound. The smallest particle of many compounds is called a **molecule**. Molecules are made up of atoms. Some elements are also made of molecules. For example, a molecule of oxygen contains two oxygen atoms joined together. The formula is O_2.

Elements	**Compounds**	**Mixtures**
atoms of helium (He) 	molecules of carbon dioxide (CO_2) 	a mixture of helium and oxygen 
molecules of oxygen (O_2) 	molecules of water (H_2O) 	a mixture of carbon dioxide and oxygen 
a lump of carbon (C) 	a lump of sodium chloride (NaCl) 	a lump of bronze (an alloy of copper and tin) 

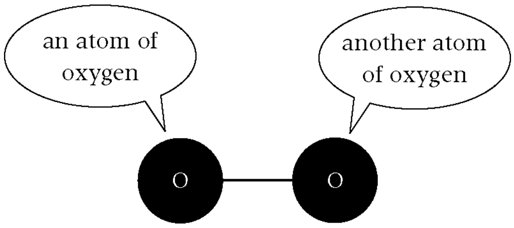
8F Summary Sheets

Compounds and mixtures

Elements are simple substances which cannot be split up in chemical reactions. **Atoms** are the smallest particles of an element that can exist. Atoms of an element are all the same.

Each element has its own chemical symbol. For example, the **chemical symbol** for oxygen is O.

Some elements have their atoms joined to each other in small groups called **molecules**. Oxygen is an example.

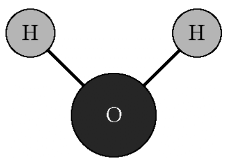


A molecule of oxygen consists of two oxygen atoms joined together.

Compounds

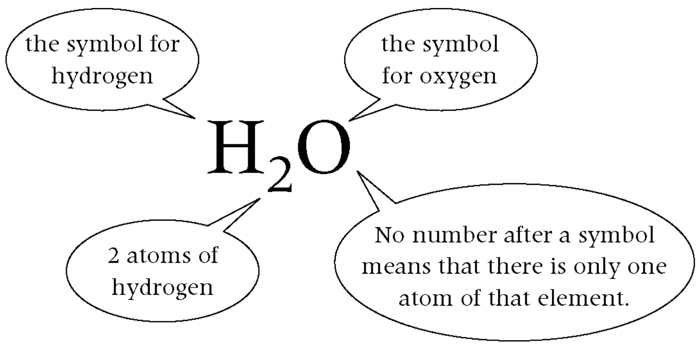
Elements can join together to make **compounds**. A compound contains two or more elements joined together. The name of the compound tells you the elements that are in it. Compounds made from two elements always have a name which ends in '-ide'.

Many compounds exist as atoms attached to each other in small groups – molecules.



A molecule of water.

The **chemical formula** tells you the numbers of atoms of each element in a compound. Each element in the chemical formula is shown by its chemical symbol. For example:



A compound always contains the same elements in the same ratio.

The properties of a compound are different from the elements that make it up. For example, hydrogen is an explosive gas and oxygen will relight a glowing splint but water is a liquid which will put fires out.

Chemical reactions

Compounds can react chemically by mixing them with other chemicals, or by using heat or electricity. You can tell that a **chemical reaction** has occurred if there is a colour change or when a gas is given off.

Most chemical reactions also involve an energy change. This is usually in the form of heat, but can also involve light being given off, for example, in burning (**combustion**).

In a chemical reaction a new substance is always formed. Most chemical reactions are not easily reversed (they are **irreversible**).

Some chemical reactions take place just by mixing. When you make a solid by mixing two liquids, the solid is called a **precipitate**.

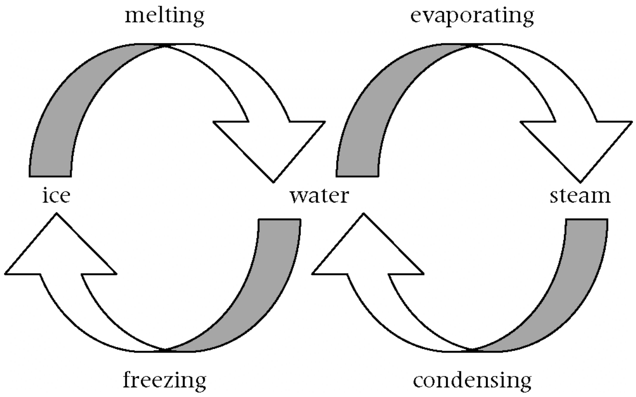
Other chemical reactions need energy to start them off. This energy can be in the form of heat, light or electricity. When you use energy to split up compounds they are **decomposed**.

We can write **word equations** to show a chemical reaction. The chemicals that you start with are called the **reactants**. The chemicals at the end are called the **products**. For example:

$$\underbrace{\text{magnesium + oxygen}}_{\text{reactants}} \rightarrow \underbrace{\text{magnesium oxide}}_{\text{product}}$$

Physical changes

In a **physical change** no new substance is formed. **Melting**, **evaporating**, **condensing** and **freezing** are all examples of physical changes. For example:



Mixtures

Elements and compounds can also be mixed together. A **mixture** is easier to separate than the elements in a compound. Soil, river water and sea water are examples of mixtures that occur naturally.

Elements and compounds melt and boil at a fixed temperature. Mixtures do not have definite **melting points** and **boiling points**.

Air is a mixture of gases – most of the air is nitrogen and oxygen. The gases in the air can be separated by **fractional distillation**.

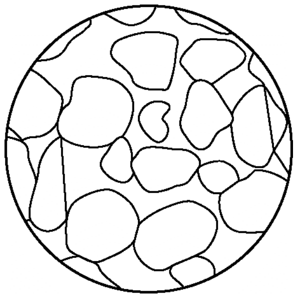
8G Summary Sheets

Rocks and weathering

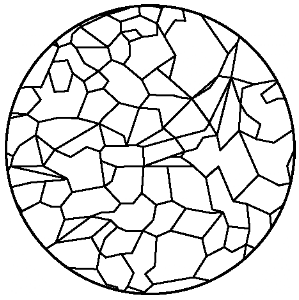
Rock textures

Rocks are made of **grains**. Each grain is made of a chemical called a **mineral**. The **texture** of a rock depends on the size and shape of the grains.

Sandstone has rounded grains.
Sandstone is **porous**, because water can get into gaps between the grains.



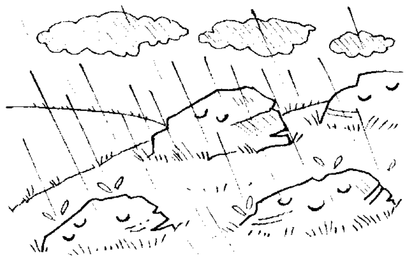
Granite has **interlocking** grains. The interlocking grains are sometimes called **crystals**. Rocks with interlocking grains are not porous.



Weathering

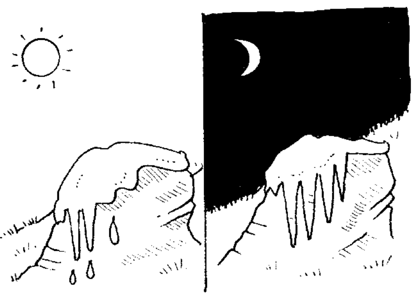
Rocks can be worn away by water or by changes in temperature.

Chemical weathering happens when rainwater reacts with minerals in the rock. Rainwater is slightly acidic, because it contains dissolved gases.



Physical weathering can happen in different ways. The minerals in a rock expand if it gets hot, and contract if it cools. These changes in size can produce strong forces. If the rock is heated and cooled over and over again the forces can make cracks in the rock.

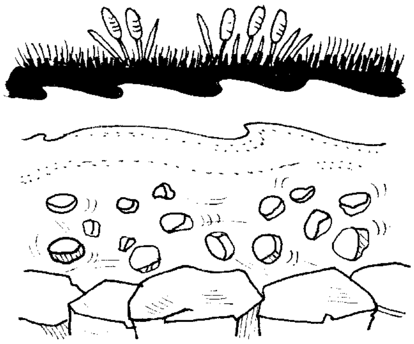
Physical weathering can also happen if water gets into a crack in the rock and freezes. Water expands when it turns into ice, and makes the crack wider. This kind of physical weathering is called **freeze–thaw action**.



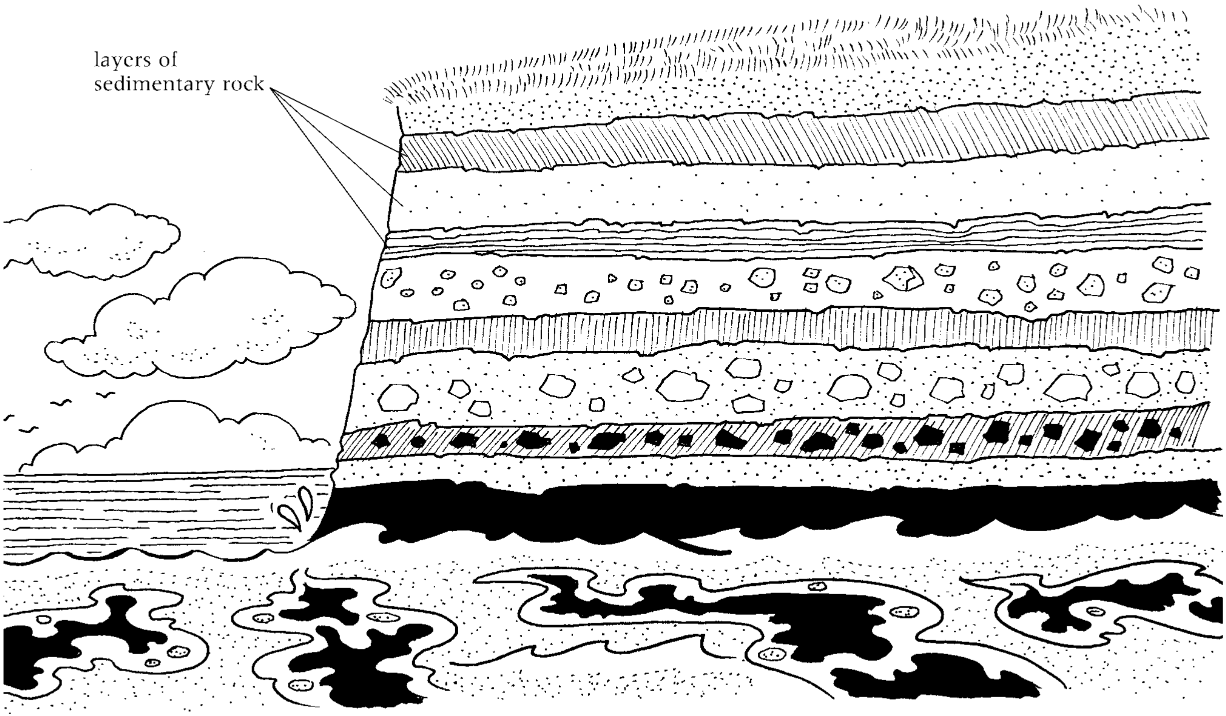
Biological weathering is when rocks are broken up or worn away by plants and animals. For example, plant roots can grow into cracks in rocks and make the cracks bigger.

Erosion and transport

Weathered pieces of rock fall to the bottom of cliffs. This movement of bits of rock is called **erosion**. The bits of rock can be **transported** away by streams and rivers. Pieces of rock bump into each other while they are being transported, and bits get knocked off them. This is called **abrasion**. The bits of rock carried by a river are called **sediment**.



Fast moving water can move larger pieces of rock than slow moving water. Rivers slow down when they flow into a lake or the sea. The slow moving water cannot carry all of the sediment, so some of it is **deposited** on the bottom. Sediments often form layers. Layers of sediment can also form when sea water evaporates and leaves salts behind.



Sometimes dead plants or animals fall to the bottom of the sea. If their remains get covered by other sediments they may form **fossils**. When a dead organism forms a fossil, its form can still be seen because either it has not rotted away or its hard parts have been turned into stone. Fossils can help geologists find out how rocks were formed.

If a lot of plant material is buried at once, it may turn into **coal**. When tiny sea plants and animals get buried they sometimes turn into **oil** or **natural gas**. These are all **fossil fuels**.

8H Summary Sheets

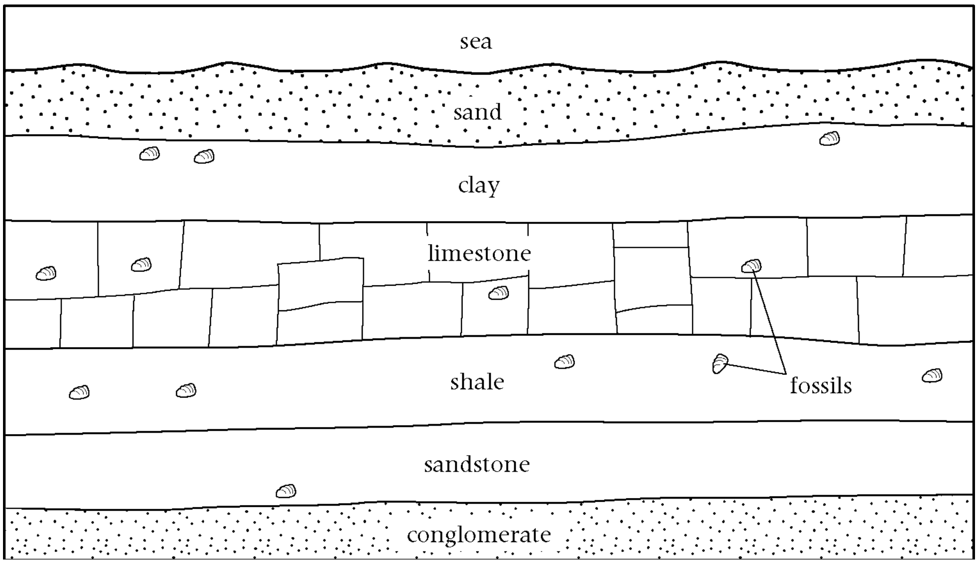
The rock cycle

Rocks are made from a mixture of **minerals**. The shape of rocks can be changed by **weathering** and **erosion**. Weathering can occur because of chemical, physical or biological processes.

Sedimentary rocks

Rock fragments, formed as a result of weathering and erosion, are **transported** by rivers, and the fragments get worn down. Small rock fragments are called **grains**. When the water slows down, some of the grains are **deposited** at the bottom of rivers, lakes or seas, and form **sediment**.

Layers of sediment collect on the sea bed, and the bottom layers get squashed. The grains of sediment are forced closer together (**compacted**) and the water is squeezed out from between the grains. Minerals in the sediment 'glue' the grains of rock together (**cementation**). Eventually, **sedimentary rock** is formed. The composition of sedimentary rocks varies and depends on the way they were formed. For example, there are different types of **limestone** – chalk is formed from the shells of microscopic animals, coquina is formed from larger shell fragments and oolite is formed from sediments deposited when sea water evaporated.

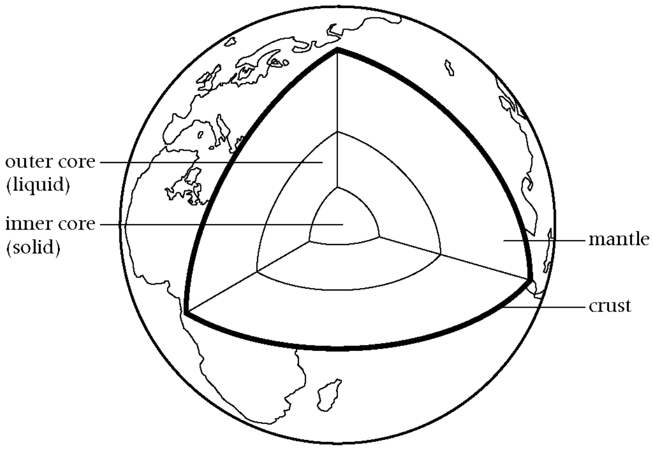


If any animals or plants get trapped in the sediment, they may form **fossils**.

Igneous rocks

Molten rock is called **magma**. If the molten rock flows out of volcanoes it is called **lava**. **Igneous rocks** are formed when magma cools down.

Lava cools down quite quickly, and forms igneous rocks with small crystals (like **basalt**). Magma underground cools down much more slowly and forms rocks, like **granite**, with bigger crystals.



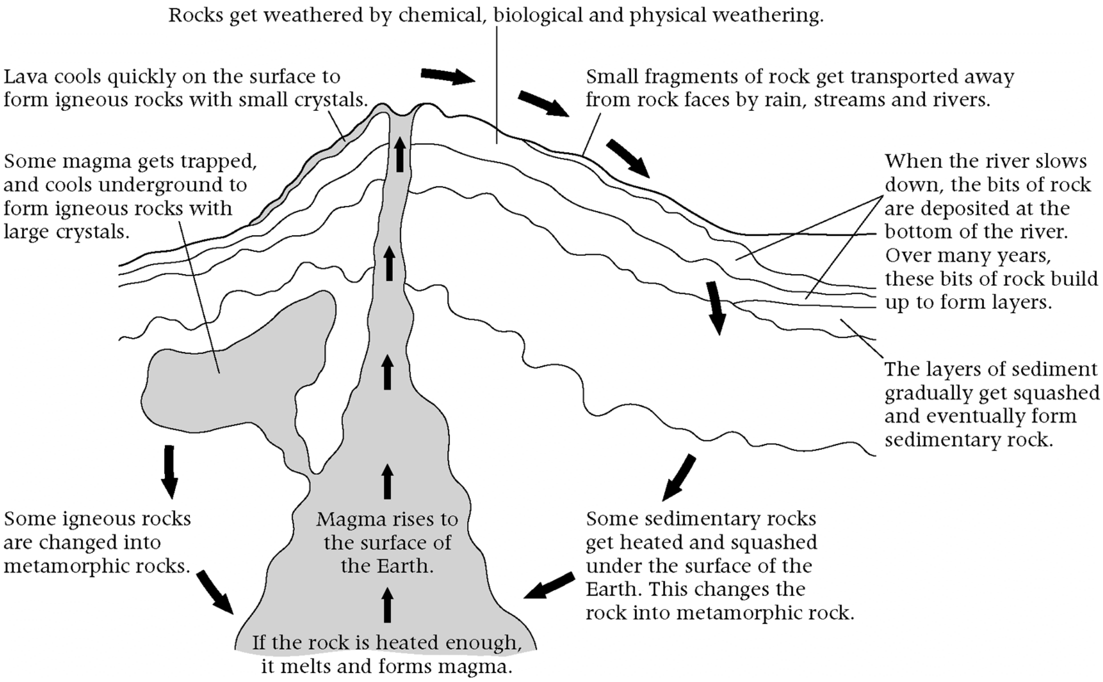
Metamorphic rocks

Sedimentary or igneous rocks can be changed by heat or pressure into new kinds of rock, called **metamorphic rocks**. Metamorphic rocks have different properties from the sedimentary or igneous rocks they were made from.

Type of rock	sedimentary	igneous	metamorphic
Examples	limestone, sandstone, mudstone, chalk	basalt, granite	marble, quartzite, slate, gneiss
Grains or crystals?	separate grains	crystals	crystals – often in bands of different colour
Hard or soft?	often soft or crumbly	hard	hard
Porous?	often	not usually	not usually

The rock cycle

The Earth is continually changing. Rocks are weathered and eroded and new rocks are being formed. The processes which make rocks, weather them and change them are linked together in the **rock cycle**.



8I Summary Sheets

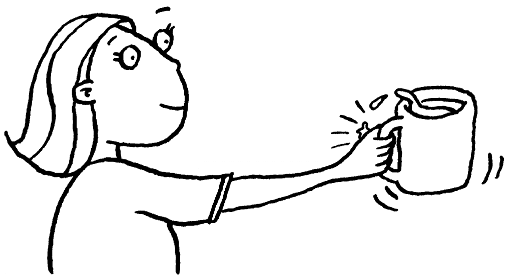
Heating and cooling

Heat and temperature

When we know the **temperature** of something we know how hot it is, *not* how much **heat energy** is in it.

Temperature is measured in **degrees Celsius** (ºC).

Heat (**thermal**) energy is measured in **joules** (J).

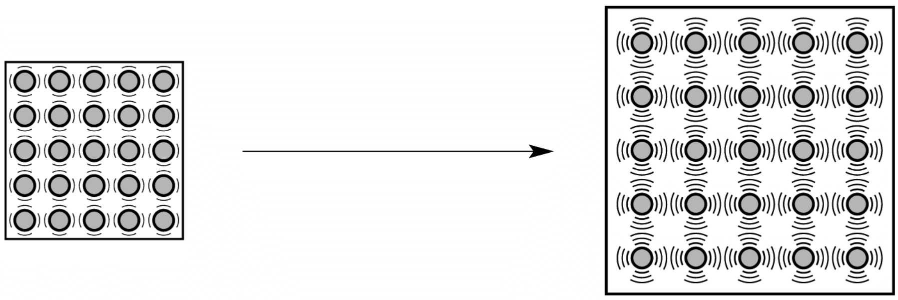


The amount of heat or **thermal energy** in something depends upon

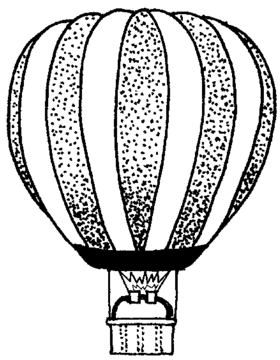
- how hot it is (its temperature)
- the material it is made from
- its mass.

Travelling heat

The **kinetic theory** or **particle model of matter** helps to explain how some forms of heat energy travel. The theory suggests that everything is made of moving or vibrating particles. When these particles are heated they move faster.



When the particles vibrate faster the material expands.



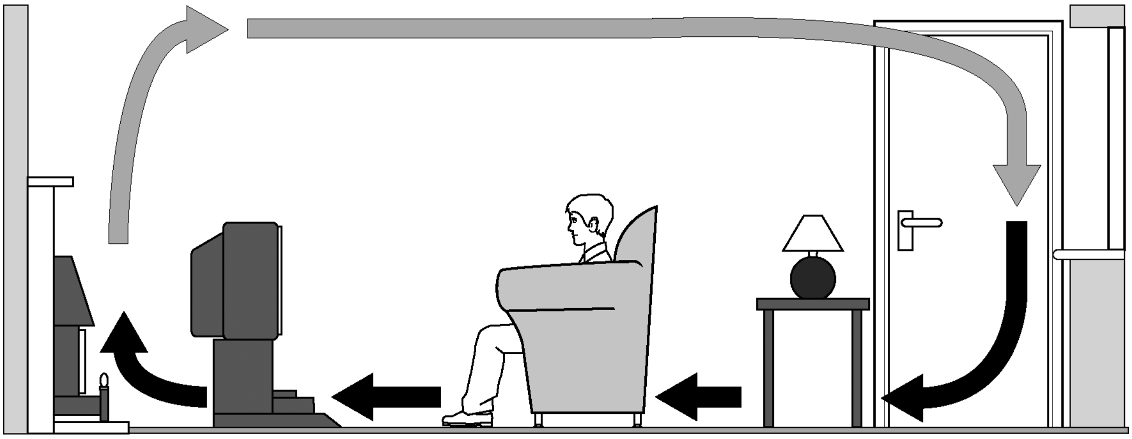
When the air particles in the balloon are heated, they move apart and the air expands and becomes less dense. This causes the hot air to rise, and the balloon rises too.

Thermal energy can travel in three different ways.

Conduction takes place in solids and can also happen in liquids (although not very well). The particles in a solid are held together tightly. When they gain energy they vibrate faster and the vibrations are passed on. Particles are not as close in a liquid, so conduction is not very good. Metals are the best conductors. Most other solids are poor conductors.

Something which does not conduct heat very well is an **insulator**. Liquids, gases, and solids which contain a lot of trapped air are insulators.

Convection takes place in liquids and gases.



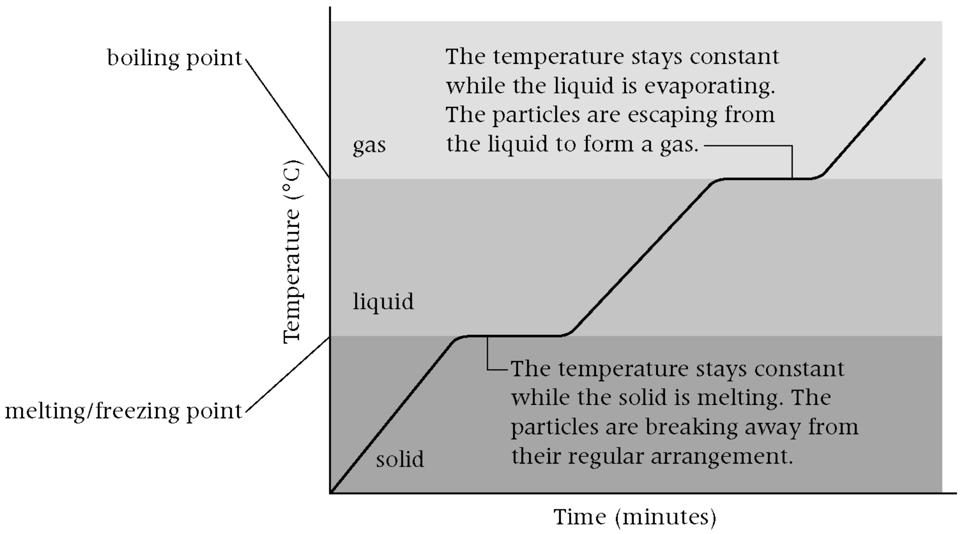
When the air near the fire is heated, the particles spread further apart and the air becomes less dense and rises. As it rises it meets cooler air and passes the energy on. Having passed on the energy, it cools and becomes denser. The denser air sinks, setting up a cycle or **convection current**.

Heat can be transferred through empty space by **infrared radiation**. Radiation does not require the movement of particles. Any hot or warm object gives off or **emits** radiation. When something takes in heat energy from radiation, it is said to **absorb** it.

Infrared radiation travels as waves. It can be reflected and it can also be focused.

Changes of state

Substances can change state when they are heated or cooled. The melting point and the freezing point of a substance are the same temperature. The temperature of a substance does not change while it is melting, even if it is still being heated.

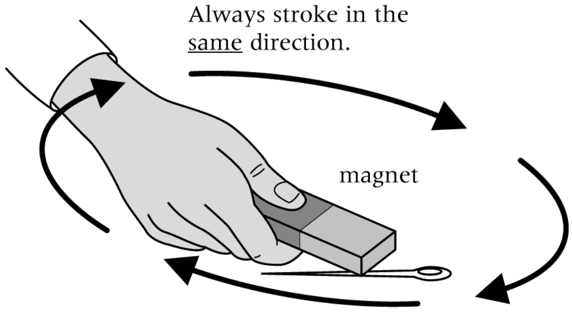


8J Summary Sheets

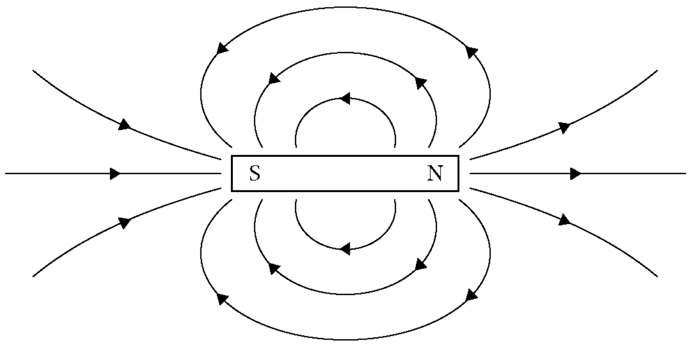
Magnets and electromagnets

Magnetism is a non-contact force. Magnets attract magnetic materials. Iron, nickel and cobalt are **magnetic materials**. Mixtures, like steel, that include a magnetic material will also be attracted to a magnet. Other metals, like aluminium, are not magnetic and will not be attracted to a magnet. Iron oxide is a compound that is a magnetic material. It is used to make video and music cassettes and computer discs. Magnetic materials can also block magnetism.

You can make a magnet from a piece of iron or steel.



- The two ends of a bar magnet are called the **north seeking pole** and the **south seeking pole** or north pole and south pole for short.
- A north pole and a south pole **attract** each other.
- Two north poles or two south poles will **repel** each other.
- The space around a magnet where it has an effect is called its **magnetic field**.



This is the shape of the magnetic field of a bar magnet.

You can find the shape of the magnetic field using iron filings or using a plotting compass.

The Earth has a magnetic field. A **compass** is a small magnet that always points north. But magnetic materials placed near a compass can change the direction that it points.

Magnets can be used to sort iron and aluminium cans for recycling. Only the iron cans are attracted to the magnet. Magnets can also be used for holding fridge doors shut, and in compasses that sailors or walkers use.

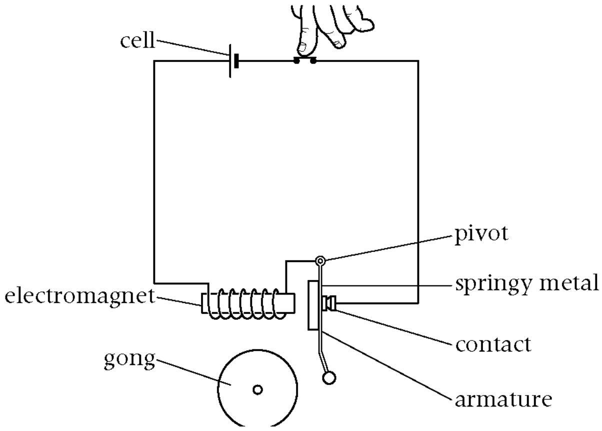
A wire with electricity flowing through it has a magnetic field around it. An **electromagnet** is a coil of wire with an electric current flowing through it.

You can make an electromagnet stronger by:

- increasing the number of coils of wire
- increasing the size of the current (by increasing the voltage)
- using an iron core.

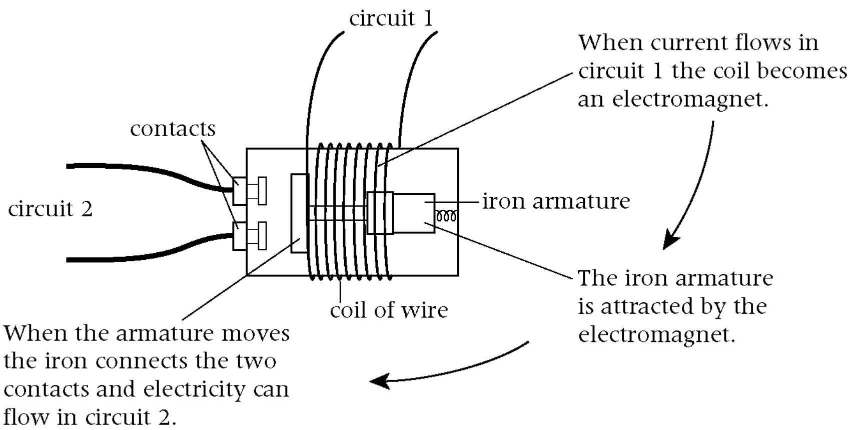
Electromagnets can be used for lifting things. They are also used in electric bells, relays and in video and music recording.

Electromagnets are used to make bells work.



A **reed switch** has two thin pieces of iron inside it. If a magnet is held near the switch, the pieces of iron are magnetised and touch each other. A reed switch can also be switched on using an electromagnet. Any switch that is worked by electricity is called a **relay**.

Relays are used to make things safer. For example, the starter motor in a car uses a high current and needs thick wires for the current to flow through. A relay is used in a car so that the driver does not have to touch any part of the circuit that has a high current.



8K Summary Sheets

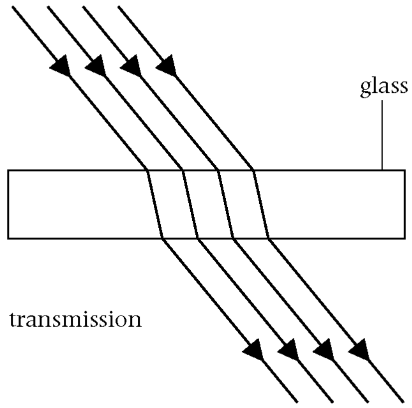
Light

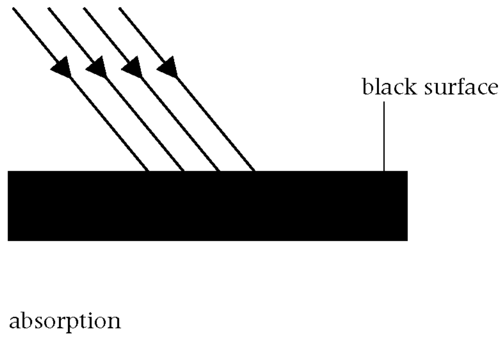
Objects which create light are **luminous sources**. Light travels in *straight* lines.

Light waves travel through **transparent** objects but not through **opaque** objects. **Shadows** are made because light cannot travel through opaque objects. **Translucent** objects show a glow of light through them.

Transmission and absorption

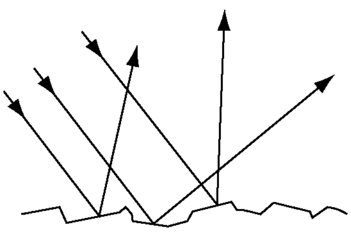
Transparent materials let light pass straight through. We say they **transmit** light. Opaque surfaces can **absorb** light. Black surfaces absorb light very well and reflect very little. This is why they look so dark.

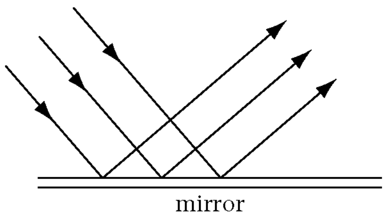




Reflection

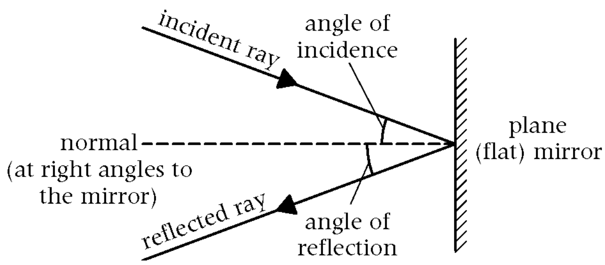
Light rays are **scattered** by rough surfaces, and a **reflection** cannot be seen.





A **plane** mirror is a flat mirror. Light is reflected evenly by a plane mirror.

The **angle of incidence** is equal to the **angle of reflection**.

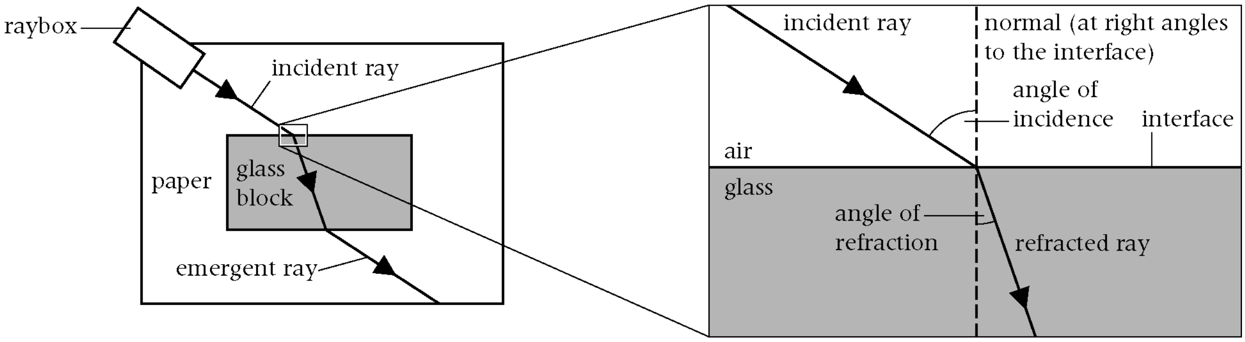


When light shines on to an object viewed in a mirror, the rays are **reflected** into the eye. They seem to come from a position behind the mirror. The **image** is the **same size** as the object and the **same distance** from the mirror. In the image left is right and right becomes left.

Refraction

When light hits something **transparent** it changes direction. This is called **refraction**.

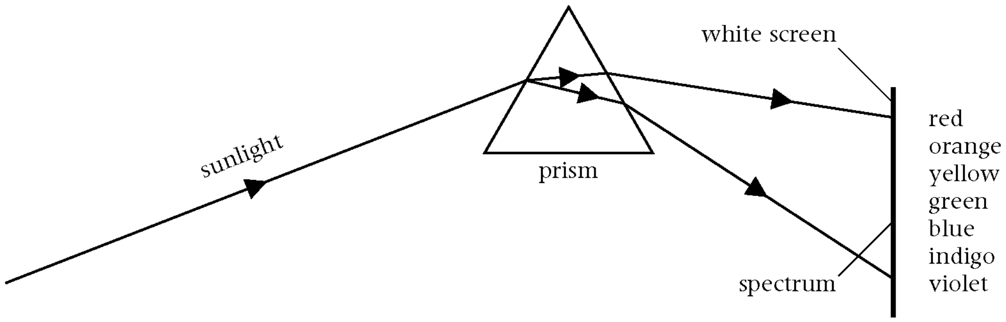
Refraction takes place at the **interface** between two substances. When light is transmitted through glass it slows down and bends towards the **normal**. When it travels back out it speeds up again and bends away from the normal.



Colour

White light is a mixture of colours. White light can be split up using a **prism** to give a **spectrum** of seven colours (red, orange, yellow, green, blue, indigo, violet).

The splitting of colour into a spectrum is called **dispersion**.



A **rainbow** is produced when water droplets in the air refract sunlight.

Different colours can be made by mixing light of the three **primary colours** (red, green and blue).

Coloured light can be made using a **filter**. A red filter lets red light through, but **absorbs** all the other colours.

We are able to see colours because objects do not reflect all the colours in light:

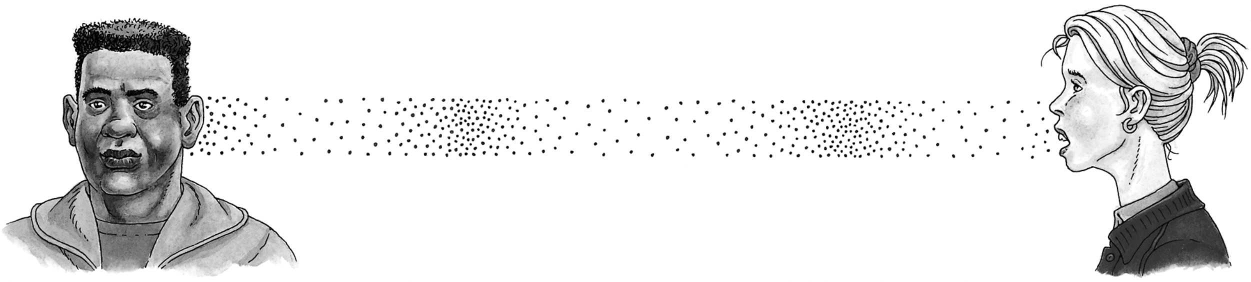
White objects reflect all the colours.
A red object only reflects red and all other colours are absorbed.
This idea applies to all colours except black.
Black objects absorb all colours.

8L Summary Sheets

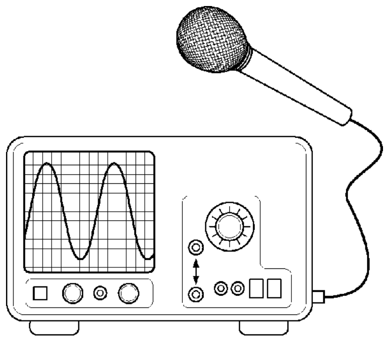
Sound and hearing

Sound vibrations and waves

Sound is a form of **energy**. Sounds are made when things **vibrate**. The vibrations are passed on by particles in solids, liquids or gases. Sound needs a substance to pass on the vibrations, so it can travel through solids, liquids and gases but not through a **vacuum**.



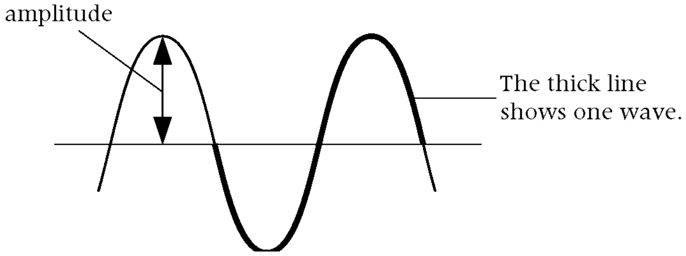
The speed of sound is faster through solids than liquids, and slowest through gases. This is because the particles are very close together in solids and so the energy is more likely to be passed from one particle to the next. The sound travels in all directions because the particles move in all directions unless something stops them.



Sound waves can be shown on an oscilloscope.

The **frequency** of a wave is the number of vibrations each second. The unit for frequency is **hertz** (**Hz**). If you listen to a sound with a frequency of 100 Hz, one hundred waves reach your ear every second. High **pitched** sounds have a high frequency, and low pitched sounds have a low frequency.

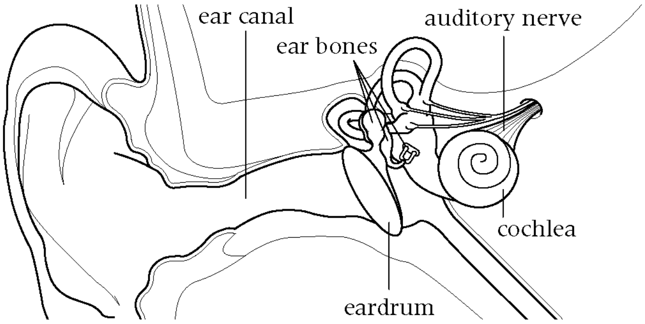
The distance between the waves is called the **wavelength**. It can be measured between any point on a wave and the same point of the next wave. It is often more convenient to measure it between the top of one wave and the next.



Half the height of the wave is called the **amplitude**. The **loudness** of a sound depends on the amplitude. Louder notes have more energy and the wave has a bigger amplitude.

Hearing and the ear

Sound waves travel through the air and into the ear. They cause the eardrum to vibrate. The vibrations are passed on to the **cochlea** in the **inner ear**, where they are changed to electrical signals called **impulses**. A **nerve** takes this message to the brain. When the message reaches the brain we hear the sound.



Sound can damage the ears if it is too loud or goes on for too long. Loud sounds can damage the eardrum or the cochlea. Unpleasant sound is often called **noise**.

We can measure how loud a sound is by using a **sound intensity meter**. This is an instrument which measures the loudness of a sound in **decibels** (**dB**). The **threshold of hearing** is the quietest sound we can hear and we say this is 0 dB.

Soft materials can **absorb** sound. Soft materials are used in **soundproofing** and for making ear protectors. Double glazed windows and soft materials like curtains help to reduce sound levels.

Sound and light

One major difference between **light** and **sound energy** is that light can travel through space (a vacuum) but sound cannot.

Light also travels much faster than sound. It is nearly a million times faster. Light travels at 300 million metres per second (or 300 000 km/s) and sound travels at about 330 metres per second.

Both light waves and sound waves can be reflected. We hear a reflected sound wave as an **echo**.