Nelson International Science

Student Book 6

Anthony Russell

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Contents

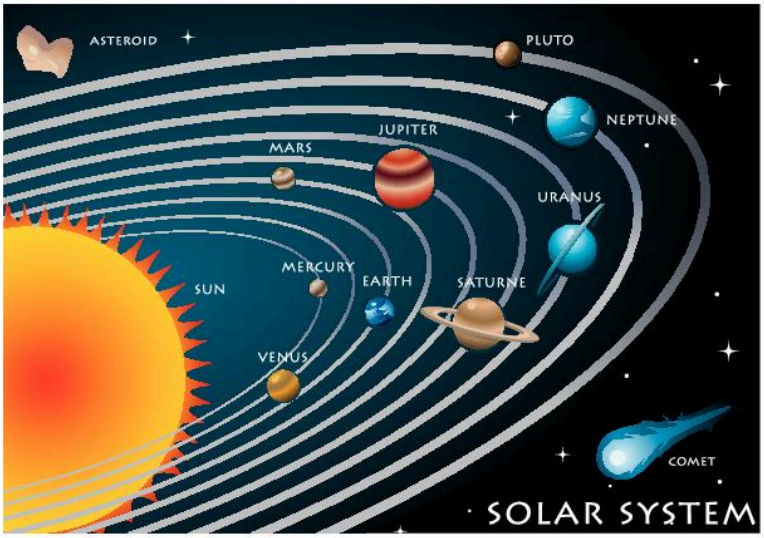
Key to symbols

 Observe

 Write

 Discuss

Organs and systems – their names and functions



Look at the pictures of the three different **systems**. **Compare** them and look for similarities. Why is each one called a **system**?

Tell the class what you think.

The human body has several systems in it. Each one has a particular **function**. The parts of a system work together to perform the function. Each part is important.

Six systems will be dealt with in this chapter:

- the **excretory system**
- the **respiratory system**
- the **reproductive system**
- the **circulatory system**
- the **nervous system**
- the **digestive system**.

The positions of the major **organs** and their functions in each system will be explored.

The excretory system

The body is kept alive by many processes, and these processes make waste products. If these wastes are not removed from the body, they can damage it. The process of removing waste products from the body is called **excretion**. There are several excretory organs, each one dealing with particular types of waste.

Activity 1

You will need: paper (or your Workbook) and a pen or pencil.

1 **Think of the things that you have to do every day to stay alive and well. Share your ideas with your group.**

2 **Sort out those that are to do with getting rid of waste products from the body.**

a Discuss with your group which organs are used to get rid of each type of waste.

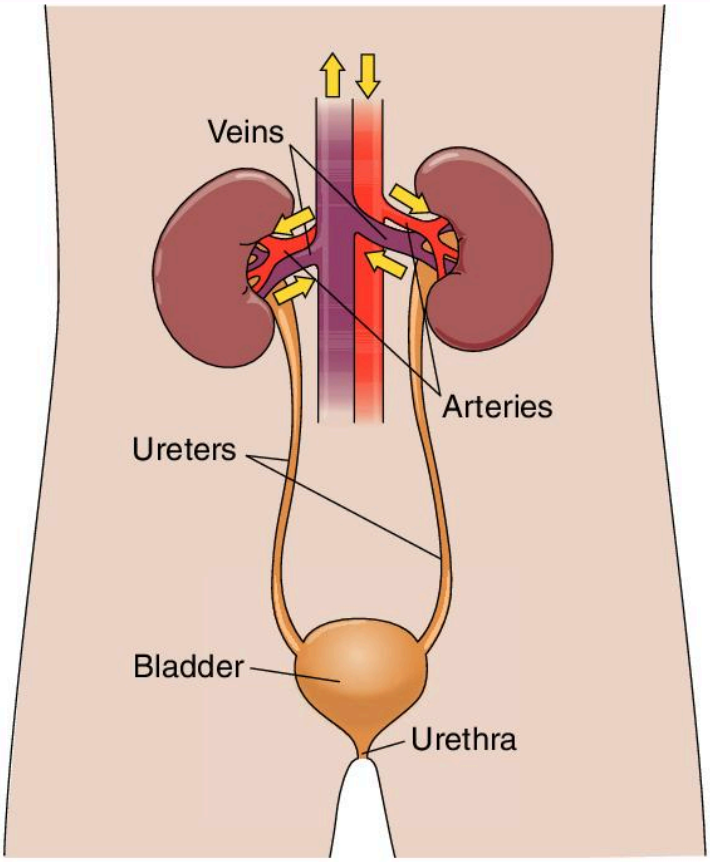
b Sort out the jumbled names of organs and waste products in the lists below.

c Match the organs and the wastes and write down the pairs.

Organs: **nksi** **siynked** **glnsu** **vielr**

Wastes: **elbi** **awtse** **niuer** **baocrn dodieix**

3 **Share your answers with the class.**



This diagram shows one part of the excretory system of the human body. It is sometimes called the urinary system, because its function is to get rid of **urine**. Urine is mostly water, with several materials dissolved in it.

The main waste product is **urea**, a poisonous material produced by the **liver**. The liver also produces liquid called **bile**, a waste product that passes as a liquid into the **intestine**.

The blood carries the urea, and other poisonous materials, to a pair of organs that can remove them and clean the blood – the **kidneys**. These are located on either side of the body, at the level of our lowest ribs. In adults they are about 12 cm long.

The kidneys remove waste products, along with a lot of water, as urine. The cleaned blood then returns to the **heart** through the **veins** to be re-circulated throughout the body.

The watery urine leaves the kidneys in tubes called the **ureters**, which carry it down to an elastic bag of muscle, called the **bladder**. The urine is stored in the bladder until the person feels that they need to empty the bladder by urinating. Babies do not have control of their bladders, but as we grow and develop, we learn how to keep the exit from the bladder closed, so that we can choose when to urinate.

The skin

When do we sweat?

We produce **sweat** all the time, but we notice it only when we have been very active, or when the weather is very hot. Then, the tiny drops of sweat join together on our **skin** and we see them and feel them running over us. This helps to cool us down, at the same time as excreting wastes from our bodies.

The skin is the largest organ in the body. It shares with the kidneys the removal of some wastes from the blood, especially urea and some salts.

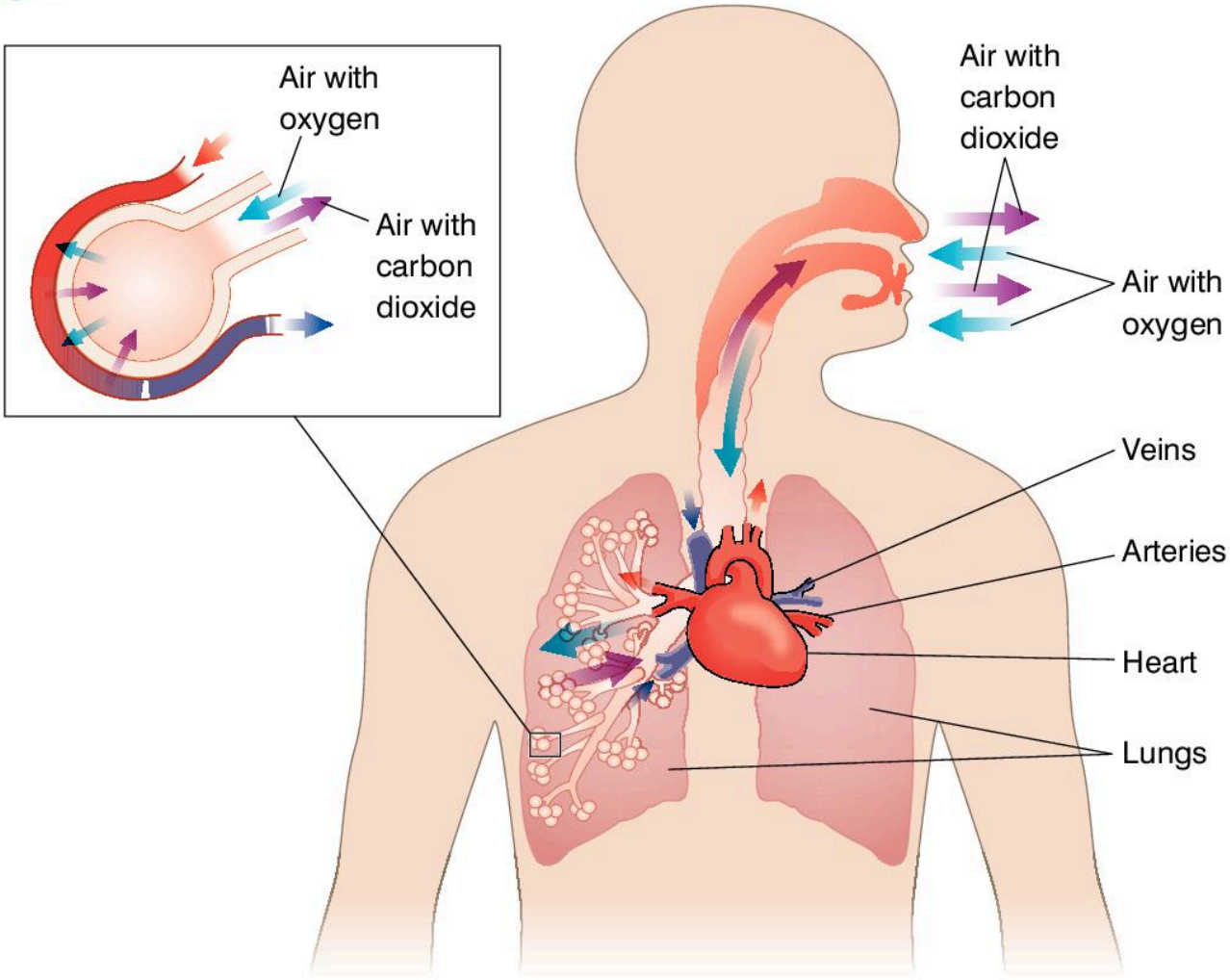
The surface of the skin is covered with tiny holes, called pores. At the bottom of the tubes leading up to the holes, are special bodies called 'sweat glands'. These excrete sweat, a **mixture** of water, urea and other waste materials.

Elimination

In everyday speech, we often refer to **faeces** as a 'waste product' of the body. Faeces are mostly made of undigested food, which has not been made by the body. It was put into the body through the mouth and it passes out again from the **rectum**, through the **anus**.

The brown colour of faeces is due to materials from the bile, excreted by the liver and added to the food as it passes through the intestine. Scientists refer to defecation as 'elimination', rather than excretion, because the products have not been removed from the blood. Faeces are mostly just solid bits and pieces left over from **digestion**.

The respiratory system



We breathe in **oxygen** and breathe out **carbon dioxide**. This process of **gaseous exchange** takes place in the two **lungs**.

The lungs get rid of (or excrete) the gas called carbon dioxide. This gas is a waste product from all the cells of the body. It **dissolves** in the blood and is carried away *from* all parts of the body to the lungs, where it is released into the air. Oxygen also dissolves into the blood from the air in the lungs and is carried away *to* all the cells of the body.

So, there is an exchange of gases – oxygen *in* and carbon dioxide *out*. When we breathe out, we excrete the carbon dioxide into the atmosphere, through our nose and mouth.

The reproductive system

Reproduction is one of the characteristics of *all* living things. In this way, new individual plants and animals are produced, to replace those that die. Death is a fact of life for all living things, including human beings. Reproduction is our way of keeping the human race alive.

In human beings, reproduction is sexual. This means that it involves two different cells combining to produce a baby human. Not all living things reproduce in a sexual way. Some simple living things just split themselves in two, and the two halves then live as new individuals!

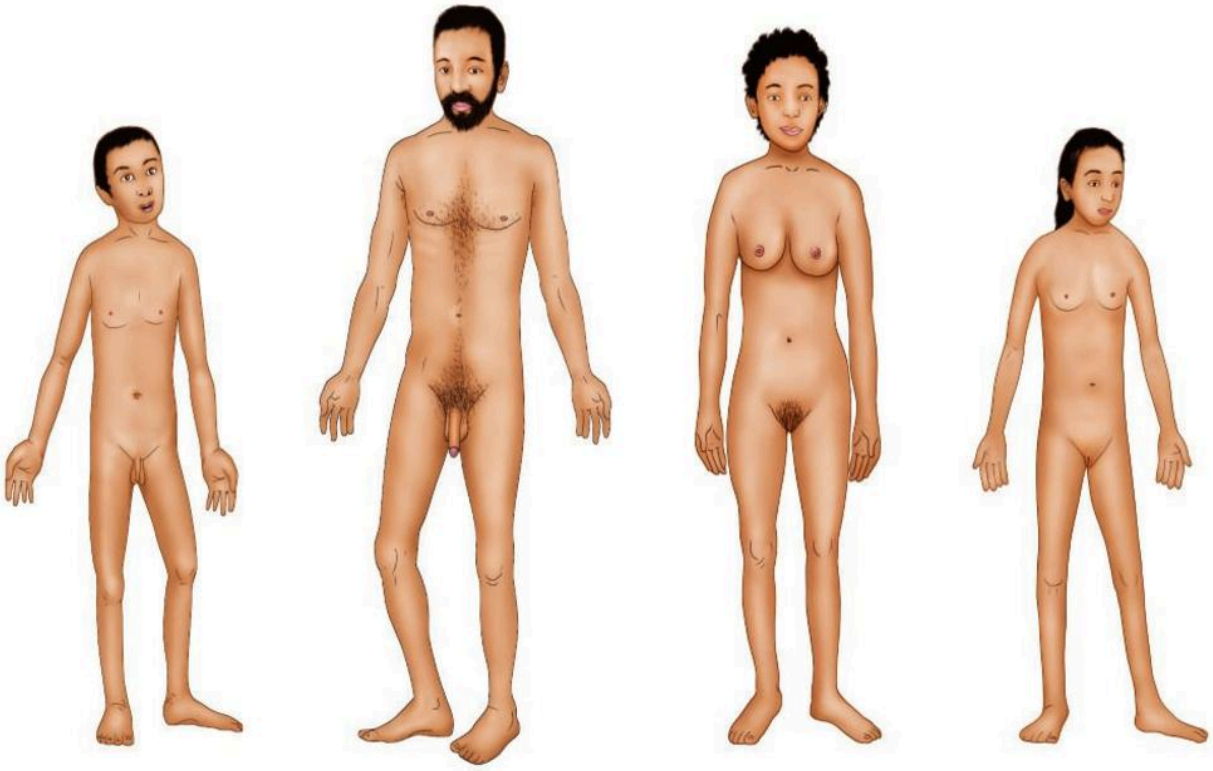
We cannot do this.

There are two types of human beings – girls and boys – who grow up to be women and men. Just as the flowers have different organs to produce the two types of cells for reproduction (the pollen and the ovules), so people have either female organs or male organs.

Female reproductive organs are found in one sex – girls and women.

Male reproductive organs are found in the other sex – boys and men.

This is why we have different names for the two sexes and this is how we know which sex we belong to. When a baby is born, it is the reproductive organs that identify it as a girl or a boy.

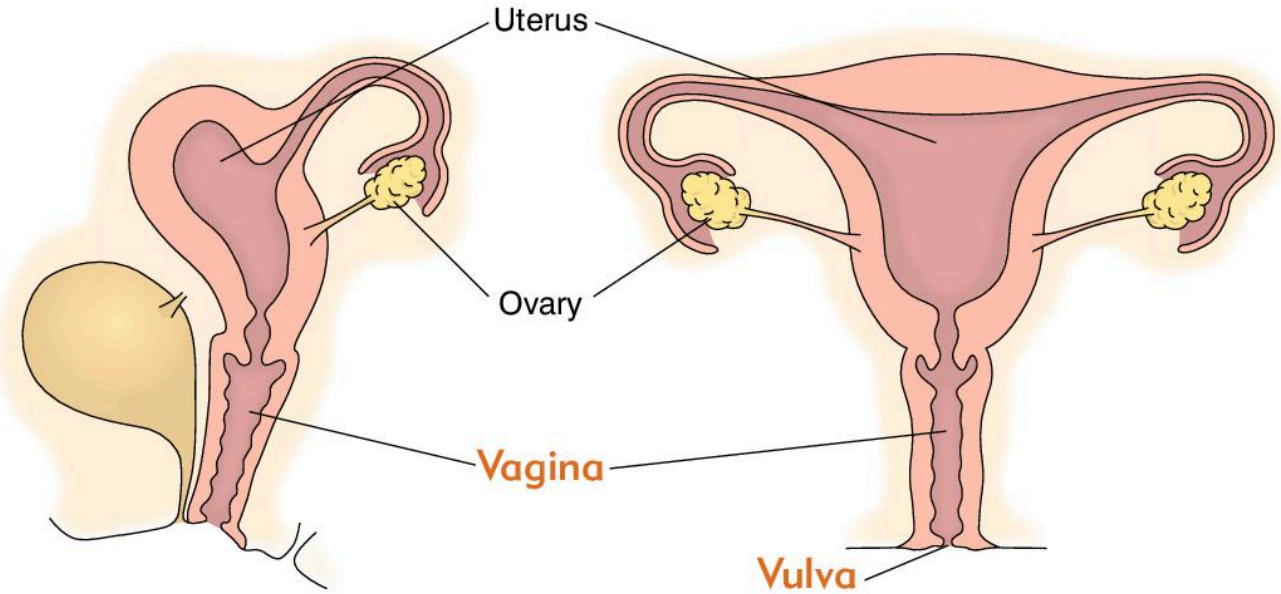


The pictures show children like you and two adults. Look for similarities and differences between the four people in the pictures. Talk with others about what you see and discuss the reasons for the differences and the similarities.

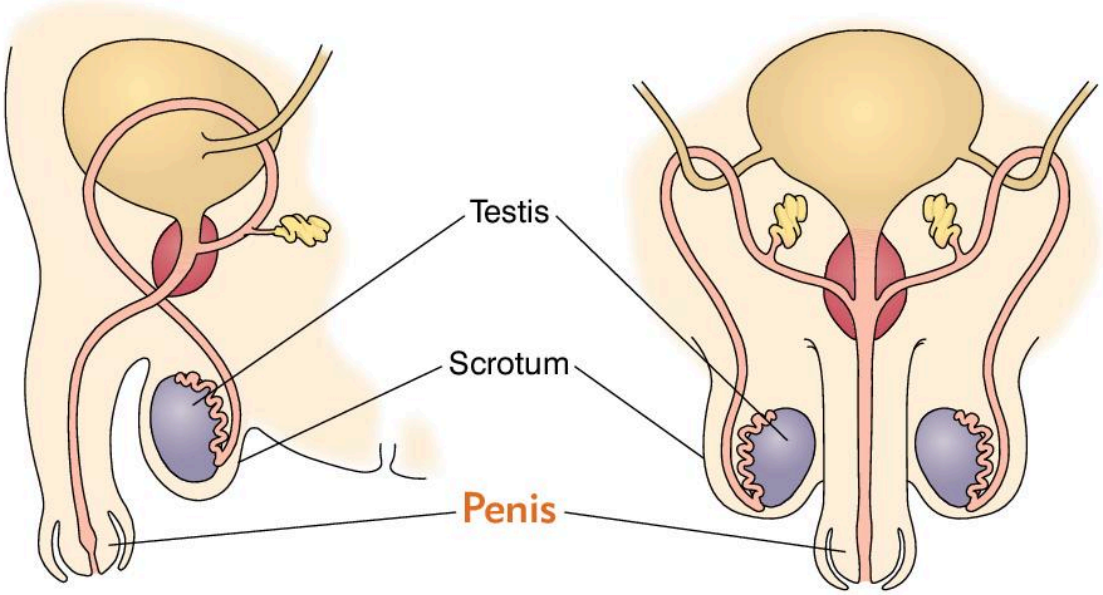
Each sex makes one kind of sex cell.

- The female sex cells are called **eggs (ova)**.
- The male sex cells are called **sperm**.

Women and men have special organs that produce these cells. They also have organs that make it possible for these two types of cell to be brought together, so that a baby can be produced.
This happens when the female egg is **fertilised** by the male sperm.



Eggs are made in the two **ovaries**, inside the female body. Each ovary in an adult woman is about 3.5 cms long. The eggs are normally released from the ovaries one at a time, each month. This process of releasing eggs does not begin until a girl reaches **puberty**. This is the time when the girl starts the process of changing from a child into an adult. This 'in-between' stage of life is called adolescence. Puberty in girls, when the first eggs are released, usually happens between the ages of 11 and 13.

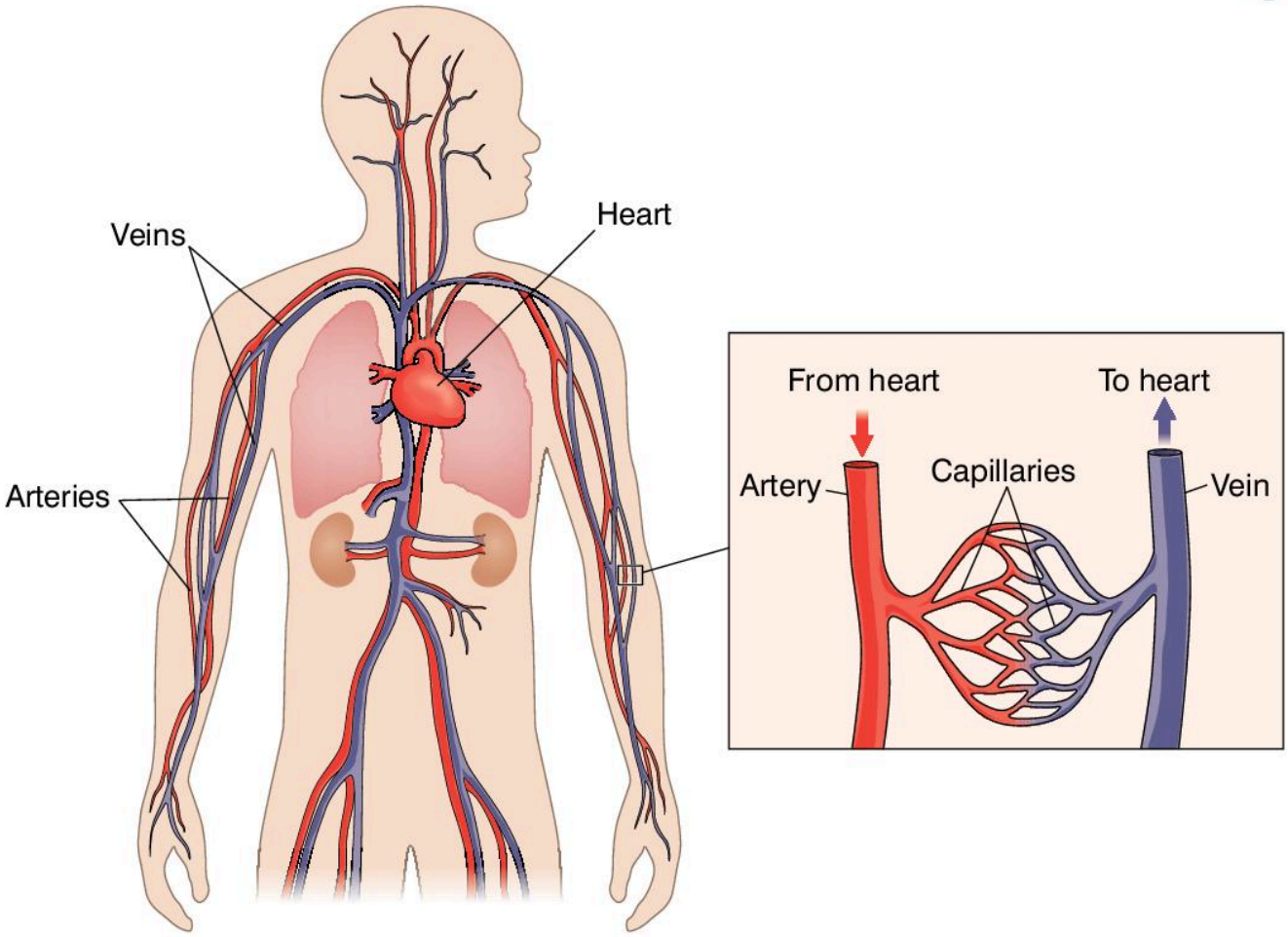


Sperm are made in the two **testes** inside a bag of skin between the legs of a male body. This bag of skin is called the **scrotum**. Each testis in an adult man is about 6 cms long. At the start of puberty in boys the testes start to make sperm. Sperm are made in very large numbers all the time, from puberty onwards (10s of millions each day). As with girls, puberty in boys marks the beginning of adolescence. Puberty in boys usually happens between the ages of 13 and 15.

Most types of animals lay eggs, from which the young hatch later, but in mammals, the baby develops inside the body of the mother. The **uterus**, or womb, is the organ in which baby mammals grow and develop.

A human **pregnancy** lasts nine months. When the baby is fully developed it has to leave the body of its mother and is born.

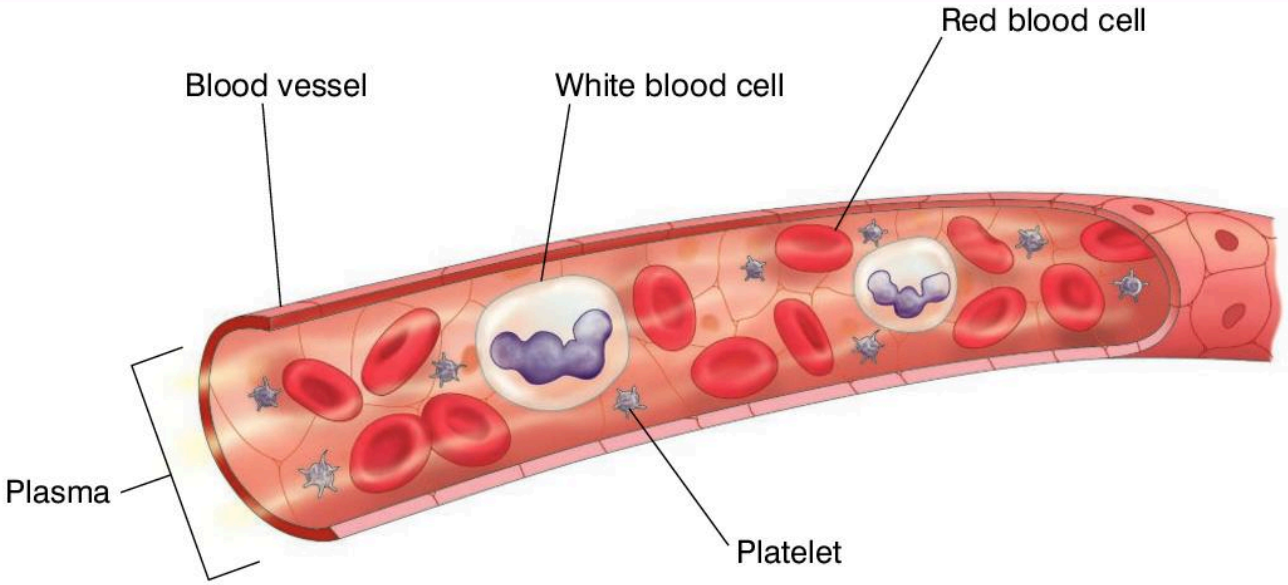
The circulatory system



The heart is a pump and it is connected to many tubes – the **blood vessels** (**arteries** and veins). It pumps blood out to the body along the arteries, and receives blood back from the body from the veins.

Without the blood vessels the circulatory system would not work. These blood vessels are themselves connected to a network of thinner and thinner tubes – the **capillaries** – which carry the blood to and from the millions of individual cells of the body. The circulatory system is made up of:

- the heart,
- the arteries,
- veins,
- capillaries, and
- the blood.



Even the blood is not all one thing – it too has several parts. It has liquid **plasma** in which solid parts are carried, and in which materials are dissolved. The solid parts are of different kinds:

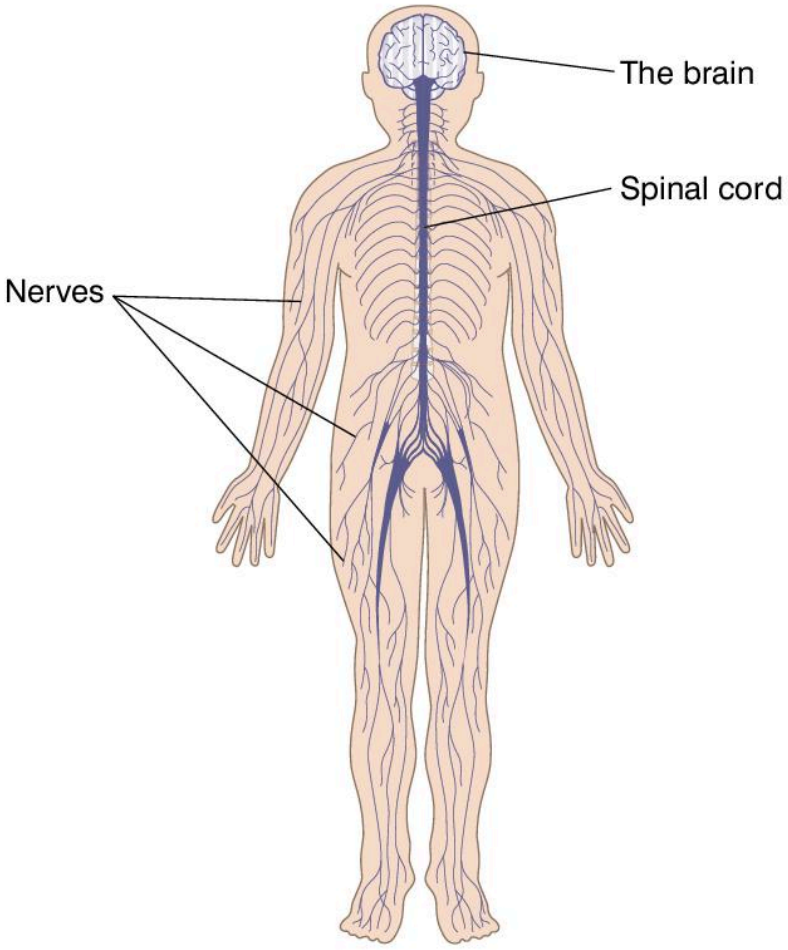
- the **red blood cells**,
- the **white blood cells**, and
- the **platelets**.

Nutrients, **hormones**, waste materials, oxygen and carbon dioxide are all carried in the blood. The function of the circulatory system is to carry all these materials to and from the cells of the whole body.

- Oxygen and nutrients are needed by all cells to keep them alive.
- Carbon dioxide and other waste materials are produced in the cells and these have to be taken away from them.

The blood performs all these functions, connecting the cells to, for instance, the lungs (for oxygen and carbon dioxide exchange), and to the kidneys (for the **disposal** of wastes such as urea from the cells), and to the digestive system (for nutrients).

The nervous system



Main parts of the nervous system

The drawing shows the main parts of the nervous system:

- the **brain**,
- the **spinal cord**, and
- the **nerves**.

The brain and spinal cord together are called the **central nervous system (CNS)**.

There are also five special parts of the body called the **sense organs**. Here are the names of the sense organs jumbled up. Try to sort out the letters to make the names of your five sense organs:

iksn	**soen**	**yees**	**rase**	**gouten**

How the nervous system works

Nerves from the various parts of the body are connected to the brain through the spinal cord.

The sense organs collect information of different kinds from outside the body and send messages along the nerves to the brain.

Other nerves inside the body collect information about what is happening inside the body's organs. This information is also sent along the nerves to the brain.

Very often, the sense organs work together to send information to the brain:

- images are detected by the eyes
- smells are detected by the nose
- tastes are detected by the tongue
- sounds are detected by the ears
- textures and temperatures are detected by the skin.

Our brains can combine all these different messages and use them to identify things.

We depend on our senses to keep us aware of danger. When our brain receives information about dangers, we respond in ways to keep us safe. Our **response** is often an action of some kind. For example, we run away, we shout, we drop an object, we cough, or we hold our nose.

Each sense organ has special cells called **sensors** that are sensitive to a particular **stimulus**. For example:

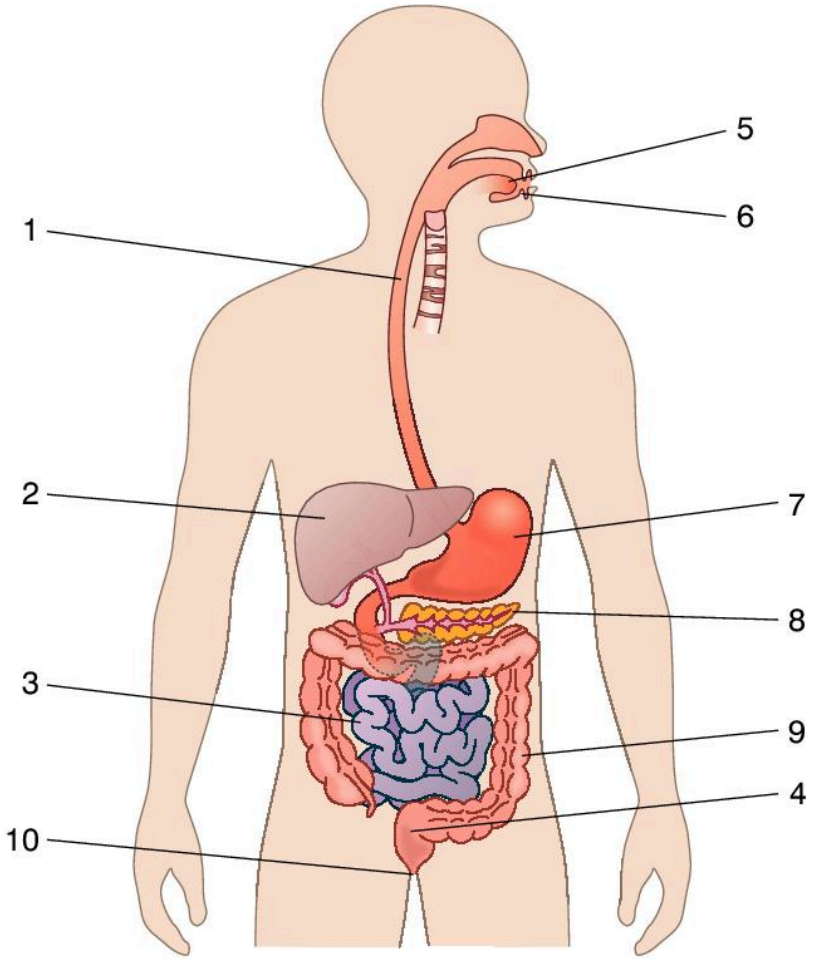
- light sensors in the eyes
- pain and pressure and heat sensors in the skin.

When these sensors detect a stimulus, they send a message through the nerves to the brain. It is the brain that recognises the stimulus. It can interpret the message coming to it from the sense organs. The brain then sends messages through the nerves to other parts of the body to respond to the stimulus. These are usually telling the **muscles** to move the body in some way. If there is danger, the leg muscles may be 'told' by the brain to move the body away as quickly as possible – to run at full speed.

When the skin tells us that there is something rough or uncomfortable touching us, then we will react to remove the stimulus. This is a **voluntary action** – we choose to react. The brain is being flooded with messages from the sense organs all the time, even when we are asleep, and most of them do not need an answer.

The brain has many functions – including memory, control of actions, thought, processing sense-organ messages, imagination and understanding.

The digestive system



anus large intestine (rectum) tongue
stomach small intestine oesophagus (gullet)
liver pancreas teeth large intestine (colon)

Activity 2

You will need: paper (or your Workbook) and a pen or pencil.

1 Look at the diagram of the human digestive system.

2 Read the names of the organs that form the system.

3 **Match the names of the organs to the numbers.**

a Write the numbers 1 to 10 in your exercise book. If you have a Workbook this step will have been done for you. Now, write the names of each of the 10 parts alongside the numbers in your book.

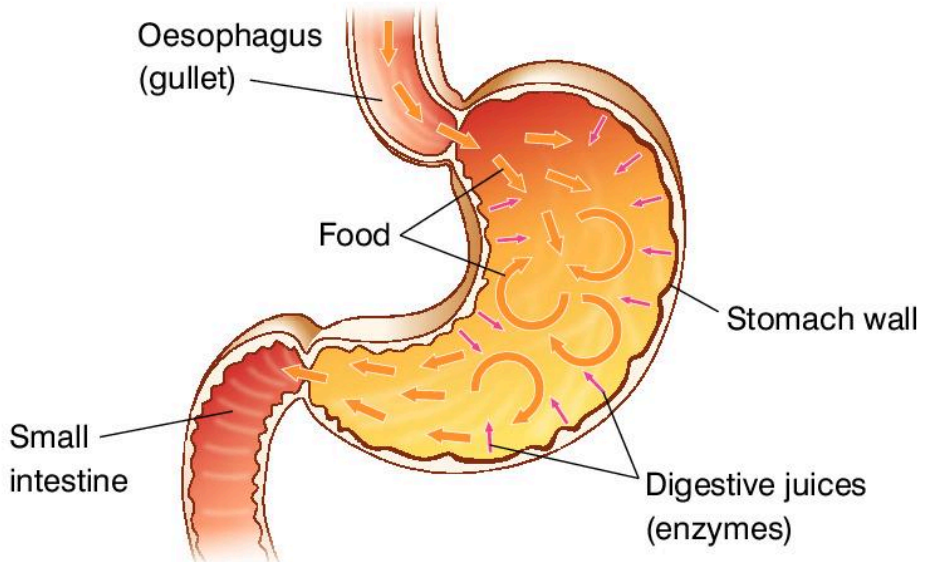
b Share your answers with the class.

The digestive system has many parts. The function of the system is to digest the food we eat, i.e. to break food down into the basic nutrients needed by the body to keep it alive.

This process starts when food is put into the mouth and **saliva** is added to it.

The process ends when faeces are pushed out through the anus.

Each organ has a special function in this process of digestion. Various parts of the digestive system each digest (break down) particular types of foods and release the **fats**, **proteins**, **carbohydrates**, vitamins or minerals from them.



Activity 3

You will need: paper (or your Workbook) and a pen or pencil.

1. Look at the diagram of the **stomach** on page 19.
2. Work out the meaning of the arrows.

3. Write some sentences to **explain** what the function of the stomach is: what does it do to the food? Why?
4. Share your writing with the class.

The stomach to the small intestine . . .

Food moves from the stomach to the **small intestine**. It has been partly digested in the stomach and turned into a thick liquid with some solid pieces in it.

The **pancreas** – a gland that is attached to the small intestine just below the stomach – helps digest all the three main food materials. These are:

- fats
- proteins, and
- carbohydrates.

Substances called **enzymes** enter the small intestine from the pancreas and get mixed with the partly digested food.

The small intestine to the liver . . .

More enzymes are added to the food as it moves through the seven metres of the small intestine. Each enzyme digests a particular type of food – fats, proteins or carbohydrates.

The nutrients then pass through the walls of the small intestine into the blood, which carries them to the **liver**, and beyond to all cells of the body. The liver stores, processes or distributes these nutrients to the body.

The blood vessels are very important to both the function of the liver and the digestive system. The liver is unable to do its work without blood vessels. They carry food materials from the digestive system to be stored or passed on by the liver. Other blood vessels carry nutrients out from the liver to where they are needed in the cells of the body.

Meat
(protein)

Mouth

Chewed

Smaller pieces

Oesophagus (gullet)

Stomach

(enzymes added)

Liquids and solids

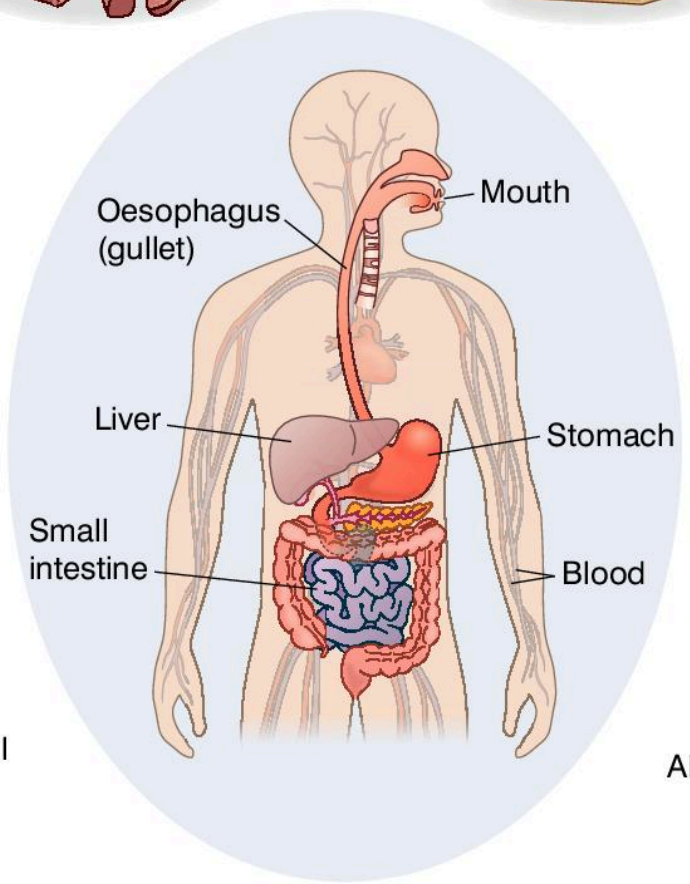
Small intestine

(enzymes added)

Absorbed through wall

Liver

Blood



Bread
(carbohydrate)

Mouth

Chewed + enzyme

Smaller pieces

Starch

Glucose

Oesophagus (gullet)

Stomach

Liquids and solids

Small intestine

Absorbed through wall

Liver

Blood

The liver to the large intestine . . .

After the liver has performed its functions there are still some waste materials left over. These move into the large intestine (the **colon**).

In the rectum, the last part of the large intestine, the solid wastes are collected and compacted to form faeces. The anus is a hole with a ring of muscle around it. When the muscle is relaxed, the faeces can be pushed out of the body. This is what happens when we go to the toilet.

Activity 4

You will need: paper (or your Workbook) and a pen or pencil.

Copy and complete these sentences. These are the words you need (you may need to use some of them more than once):

oesophagus	**enzyme**	**anus**	**tongue**	
absorbed	**colon**	**gullet**	**teeth**	**saliva**
	rectum	**mouth**	**faeces**	

1 The _____ bite and chew the food. This breaks it into small pieces.

2 Special glands in the mouth make a liquid called _____. This _____ is mixed with the food. It begins to digest it and makes it easier to swallow.

3 The _____ pushes the food to the back of the mouth and it is swallowed. It goes down the _____ (or _____) into the stomach.

4 **The large intestine has one part called the _____. The digested food is _____ there and moves into the blood.**

5 **The _____ is the last part of the large intestine. The parts of the food which cannot be digested are collected there. Water is absorbed and the solids become the _____.**

6 **The _____ is the hole at the end of the rectum. The digestive system is a tube, with a hole at each end: the _____ and the _____.**

The liver

The liver is a very important organ. It lies between the digestive system and the circulatory system, so it acts like a doorway from one to the other.

As we have already seen, it has many functions.

1 It converts and stores nutrients.
2 It produces bile.
3 It is vital to the body's other processes.

The liver's functions cannot be carried out by any other part of the body.

The liver *converts* nutrients from one form to another.

- Fats are converted into a form that the cells of the body can use.
- Some poisonous substances are converted into harmless ones.
- Waste products are turned into urea.

The urea, and the products from converting poisonous substances, are added to the blood and excreted from the body by the kidneys.

The liver *stores* nutrients.

- It stores iron to make red blood cells.
- It stores vitamins A, D and B12.

The liver *makes* bile and proteins.

- Bile helps in the digestion of fats.
- Proteins, which are part of blood plasma, are made in the liver.

One other product that results from all these processes is heat. This is very important in keeping the temperature of the body at its correct level. The blood carries the heat around from the liver to the rest of the body.

The final function is to keep the internal **environment** of the body even and steady. This is vital for the survival of all the body's organs and the processes that they carry out. For instance, blood **sugar**, poisons, blood proteins, temperature, urea and bile all have to be kept at the best levels for the health of the body, and it is the liver that carries out these many tasks.

Activity 5

You will need: books and other resources with information about excretion, reproduction, circulation, digestion and the nervous system; paper (or your Workbook) and a pen or pencil.

1 Discuss with your group which system you will research using the resources available.

2 Share out the work of collecting detailed information about your chosen system.

3 Make notes and drawings as **records** of what you find out.

4 Produce a display of your findings to share with the class. Answer any questions that other learners might have.

5 Look at the display of work from other groups and ask them questions about what you see.

Activity 6

You will need: paper (or your Workbook) and a pen or pencil.

1 Look at the two lists below. One is a list of human **body systems**. The other is a list of their functions.

2 Try to match the systems with their functions.

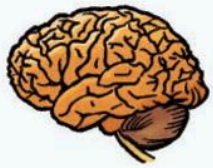
Human body systems
Respiratory system
Digestive system
Reproductive system
Skeletal system
Circulatory system
Central nervous system
Excretory system

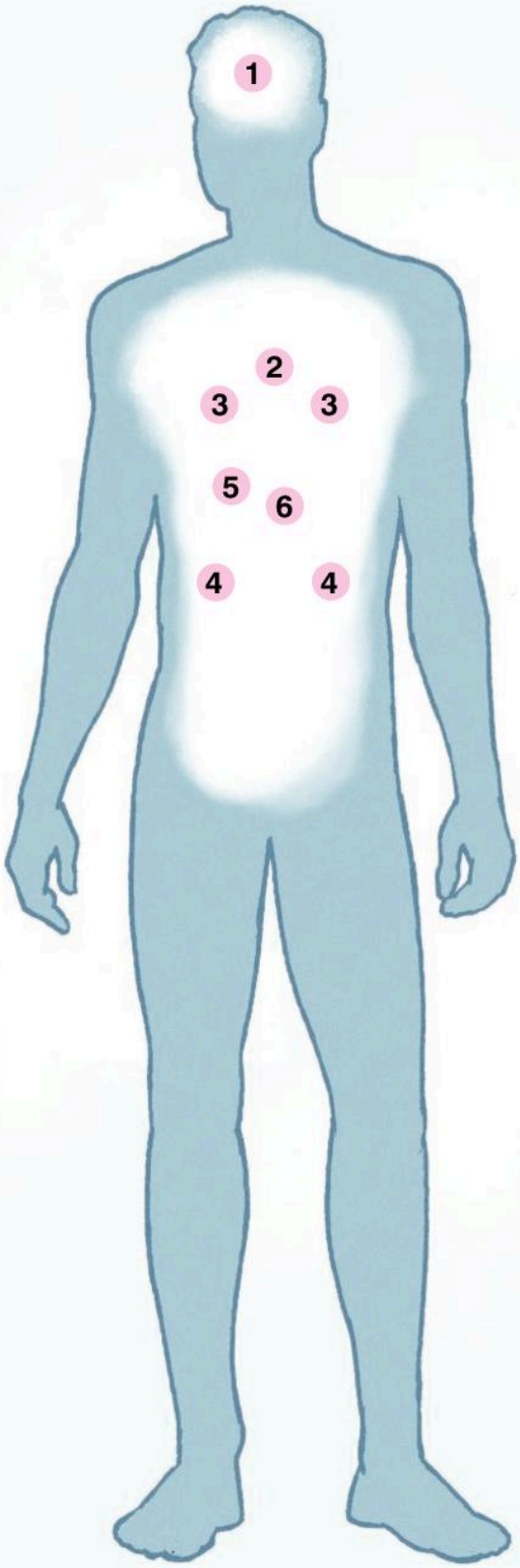
Functions
a) Supports, protects and allows movement of the body
b) Carries food, wastes, hormones and gases around the body
c) Carries messages to and from the brain
d) Removes waste products from the body
e) Collects oxygen and gets rid of carbon dioxide
f) Breaks food down into smaller and simpler parts
g) Produces sex cells/produces babies

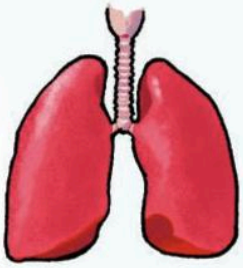
Copy the list of systems and match each one with its function.

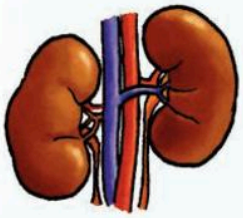
3 Share your answers with the class.

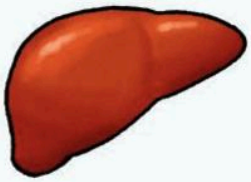
Major organs – where are they in the body?











Activity 7

You will need: paper (or your Workbook) and a pen or pencil.

1. Look at the drawing of the body outline and find the numbers 1 to 6

2. Look at the drawings of the six major organs and name each of them.

3. Write down the numbers 1 to 6, and match the names of the organs to the numbers. Write the names alongside the numbers.

4. Share your answers with the class.

Essential functions of some major organs

The kidneys

If a person's kidneys fail, they will die, unless one or more kidneys can be transplanted into their body. Some transplants are from living donors, and others from donors who have died. There is a shortage of donor organs, so many people are kept alive for a limited period with regular **dialysis**, a treatment that uses a machine to replace the function of the kidneys.

The lungs

The lungs are essential to our life. If they fail, we can survive only if we have a lung transplant from a donor who has died. There is a shortage of lung donors, so many people with lung disease die before a donor is found.

The heart

The heart is essential to our survival, as its role is to keep all the body supplied with what it needs to live and to remove the wastes that could kill it. If our heart fails, we might be able to have a donor heart or a mechanical heart put in its place. Both these 'cures' are expensive and there is a shortage of donor hearts from people who have died. Major arteries and veins are also essential to our survival and if they are cut or burst, then we will die if doctors cannot mend them quickly.

The brain

The brain has many functions – including memory, control of actions, thought, processing sense-organ messages, imagination and understanding. If the brain dies, we die. It is not possible to live a full human life once the brain has died. Injuries, disease and poisons can all kill the brain, in part or totally. Protecting our brain is essential to our survival. The spinal cord, which is really an extension of the brain inside the spinal column (backbone), is also essential. If it gets broken through injury, then we might die or be more or less paralysed.

The liver

The liver is so important that if it fails a person will need a liver transplant to carry on living their life. If they cannot get a liver transplant they might die or they might need to go into hospital regularly for a treatment called dialysis.

Caring for the environment

These two types of bird are **extinct**. People hunted them until there were none left. Of course, they did not mean to kill them all. It was done accidentally, but there is no way of putting this mistake right. Now we are more aware of what we are doing. We know that there are many plants and animals that are in danger of extinction. We know that we will have to protect them, or they will also disappear completely.

Dodo

Passenger pigeon

Activity 1

You will need: books and other resources about environmental damage, paper (or your Workbook) and a pen or pencil.

1 Use the resources to do research on one of the following environmental problems:

- **Pesticides** used by farmers
- Industrial waste **pollution**
- Deforestation
- Endangered **species**
- **Acid rain**
- **CFCs** and the **ozone layer**
- The greenhouse effect and **global warming**
- Smog
- Misuse of water resources
- Noise pollution
- Domestic waste disposal.

2 Explore the harmful effects of your chosen problem at the local, national and global levels.

a Try to find examples of the damage done at all three levels.

b Try to find out what can be done to *prevent* the damage.

c Try to find out what can be done to *solve* the problems we have created.

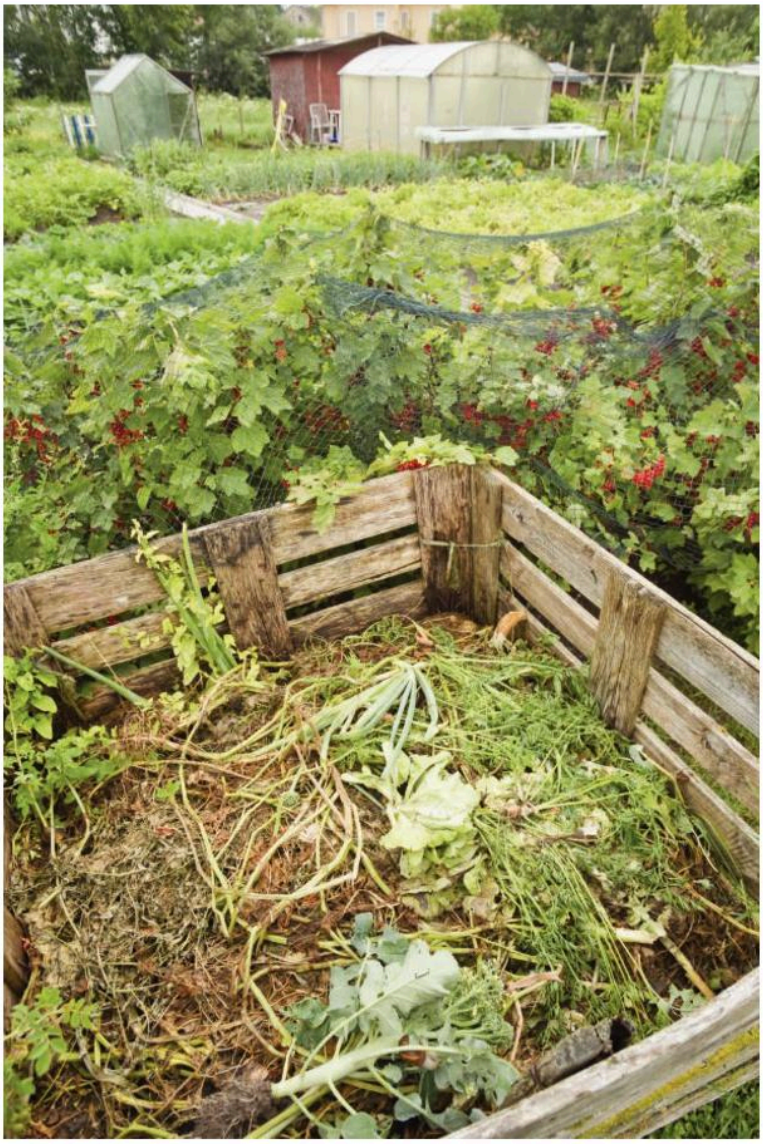
3 Make notes and drawings of what you find.

4 Choose how your group will present your report to the class and prepare your presentation.

5 Attend to the presentations of other groups.

a Record information from the other groups' presentations.

b Ask them questions about anything that interests you or is not clear.



The pictures show three things that children can do to take care of the local environment. Discuss them in a group and choose which one you would like to do for the term.

Activity 2

You will need: books with information about compost heaps, tree planting and rubbish disposal; materials for your chosen task; paper (or your Workbook) and a pen or pencil.

- For a compost heap – collect wood, plastic sheeting or wire netting, and garden tools.
- For tree planting – collect young tree/s, a spade, a watering can or a bucket, and water.
- For collection of litter – collect plastic bags, disposable gloves, a rubbish bin or pit, and a spade.

1 **Discuss with your group how you will carry out the activity.**

a You should plan what you will need to do over the whole term, not just how you will start the process.

b Use the books to help you plan carefully.

2 **Share out the tasks involved and begin the activity.**

a Keep a record of the steps you follow.

b Keep a record of the **results** of what you do as you go along.

3 **Continue with the process of caring for your local environment for the whole term. At the end of the time, write a report about the success or failure of what you have been doing.**

4 **Share your group's records and report with the rest of the class. Attend to what the other groups share with you about their projects.**

There is no single answer to the problem of environmental damage, but there are *three key ideas* that can all help to improve the situation. They can be applied by us all at the local level (at home and school and in the **community**), at the national level (by the Government and businesses), and at the global level (by the United Nations and other groups of nations).

Reduce

Reduction of the damage is certainly possible. We do not need to burn so much fuel in our vehicles – for example, we can take the bus and not the car, we can use smaller cars, and we can change to fuel that contains no lead. We can *reduce* the amount of pesticides we use on our crops. We can *reduce* the amount of paper and plastic we use in packaging. In these and many other ways, we can take better care of the resources of the planet.

50 car engines making smoke and 50 passengers on board a bus

Re-use

Many of the things we throw away can be *re-used*. Clothes, vehicles, refrigerators, books, furniture – so many things are just dumped because we are tired of them, even when there is nothing wrong with them. Such things can be re-used if we take the trouble to find new homes for them. This may be on a local level, where a neighbourhood scheme can collect and redistribute such things to those who need them. Nationally and globally there is a trade in valuable 'second-hand' machines and other items. *Re-using* is the second key idea to control damage to the environment.

Recycle

The compost heap is an example of the third key idea: **recycling** materials. Organic matter, which was once part of plants or animals, can be turned into valuable fertiliser for plants. Making compost can be a small-scale thing we do at home, as well as a larger-scale commercial activity by the local council. They can collect such organic waste and use it, often mixing the composted plant material with the end product from the **sewage** treatment works, to make a commercial fertiliser that they can sell to farmers and gardeners.

Around the world, councils and governments support the recycling of several different materials, especially those that are expensive to produce from raw materials, such as plastics, glass and metals. Paper is also recycled, and this reduces the rate at which trees have to be cut down to make more paper.

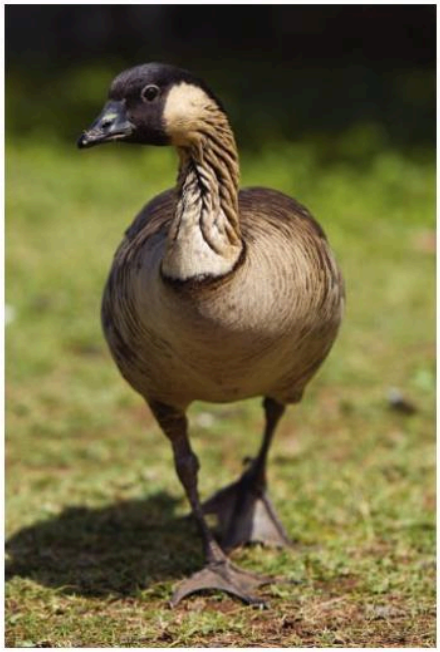
Conservation

Conservation is about using everything with care and looking after what we have. Conservation of the environment means taking good care of the world's air, water, soil, plants and animals.

This is quite easy for even the youngest of us to do. We can turn off lights when they are not needed. This not only saves money on our electricity bills, it also reduces the amount of fuel which has to be burned at the power station. The same is true of taps. They are a wonderful tool, but they can waste a lot of water if we do not use them with care.

Conservation of the world's plants and animals is also our responsibility. This means controlling our disposal of waste and our use of the land and sea, so that we do not destroy them or their **habitats**. Zoos used to be seen only as places of interest or entertainment. Now many of them are vital in preserving species that are endangered. Some have been able to breed enough of some species to set them free into their natural environment.

The pictures show just two of the species that have been saved from extinction by scientists in zoos. We can visit zoos and support them with our money, so that they can continue their conservation work.



A Hawaiian goose

A European Bison

National parks and nature reserves are another form of conservation, set up to protect the habitats and all the living things found in them.

Botswana – conservation at work

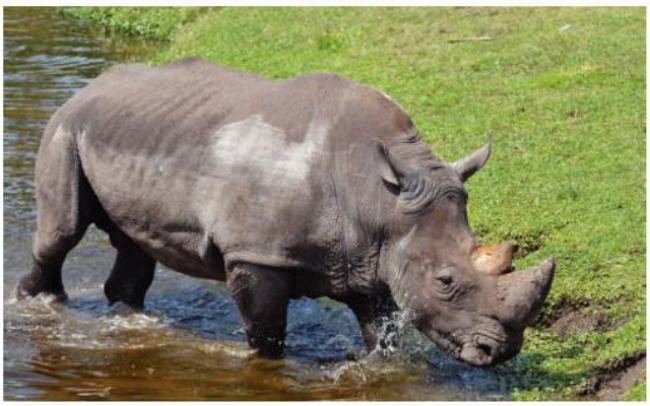
Modern conservation methods use the law to control people's activity – what, where, when and how they can do things that have impacts on the environment.

For example, the government of Botswana has decided to protect the wild animals and plants in certain areas of the country. These areas have special laws that make it a crime to kill certain animals or destroy the vegetation. National Parks and game reserves allow people to live in them and to visit them, but there are controls on hunting, and on clearing the bush for agriculture or building, and on mining for minerals.

Hunting is controlled. There is a limit on how many animals of a particular species can be killed in a year. Only hunters with a licence, or local residents, are allowed to hunt. **Poaching** is against the law and is punished.

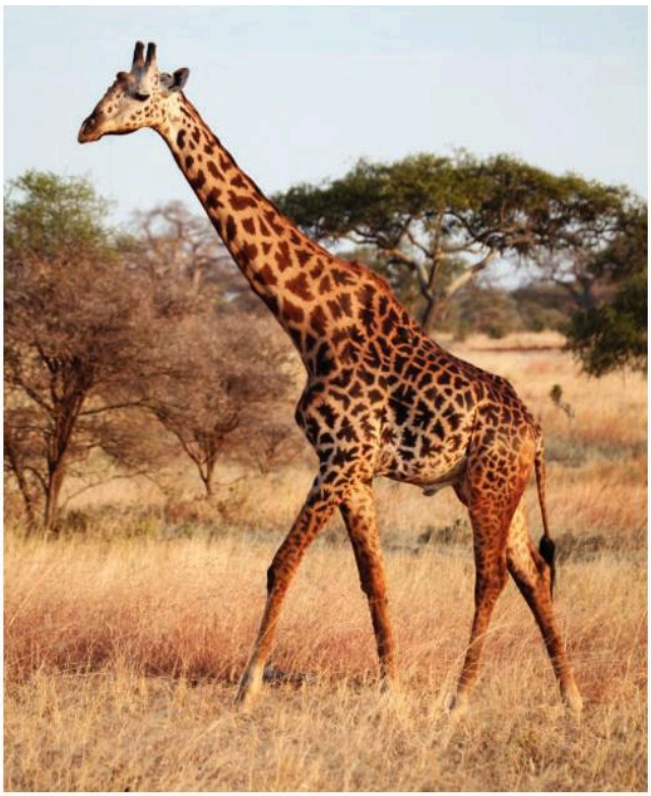
Some species are protected, either totally, or for certain times of the year, such as the breeding season.

A wild dog



A rhinoceros

A baobab tree



A giraffe

Sengaparile (devil's claw)

The pictures show some of the plants and animals in Botswana that the law is trying to protect. If the **population** of another species falls dangerously low, then it would be added to the protected list.

If this was not done, what would happen to the populations of these organisms?

What can you do?

Another way of supporting conservation is to include it as a topic in school!

This topic is part of your education and the school hopes that you will learn to take care of your country, now and when you grow up. Public awareness of the dangers and the benefits, through advertising, broadcasts and other forms of public education, is being raised so that more and more people take care. It is an international task. It should involve everyone.

Conservation brings benefits, not just to the populations of animals and plants.

Social and environmental benefits are enjoyed by the people living in areas of conservation. Their environment is maintained. The land is not cleared. The area is not taken over for mining or urban development. The community life of the human population is maintained.

Economic benefits come from the selling of licences to hunters from other countries. Tourism is increased and, with it, all the services that tourists want while visiting the country are generating income and providing jobs.

Activity 3

You will need: books and other resources with information about the environment, paper (or your Workbook) and a pen or pencil.

1 **Discuss with your group what 'environment' means. Keep notes of what the group thinks.**

2 **Decide who will do research on particular aspects of the environment.**

a Choose the local, national or global level.

b Choose which feature of the environment you will research.

c Focus on the sustainable development of that feature, e.g. forest or water.

3 **Collect information from the books and other resources about your chosen environmental feature.**

4 **Make notes and draw pictures, maps and graphs to illustrate your findings.**

5 **Put all your work into a portfolio so that the class can share your findings.**

Human effects on the environment

People can protect and care for the natural world. People can also spoil and destroy it.

Anything we do to help keep the natural world clean and safe can slow down the loss of plants and animals.

If the people of the world are careless, some animals and plants can become extinct. Once the last one dies, they will never be seen again.

Many have already disappeared because people did not care about what they were doing.

We must take even more care of all the living things that still live on the Earth with us. The Earth is our only home – home to plants, animals and the human race.

People are part of the natural world. We are living things, depending on the natural resources of the planet for our lives: the air, the water, the soil, the plants and the animals. We cannot survive as individuals, or as a species, if we destroy our environment. It is foolish to behave as though our actions have no consequences. Some of the things we do are beneficial to the environment. Others are neutral – they do no harm or good. Others have a negative impact on the environment – they actively harm it.

Activity 4

You will need: large paper, colouring pens or pencils or paints, squared paper, and a ruler, paper (or your Workbook) and a pen or pencil.

1. Go outside with your group and choose a place where you can do a survey of rubbish on the ground. It might be inside or outside the school yard.

2. Keep a tally of each kind of rubbish you find (e.g. plastic bags or drinks cans).

3. Use the data to make a bar chart. Display your group's chart with those from other groups.

4. Compare what the groups have found. Try to explain what the bar charts show.

5. Make a poster with a message about how and why rubbish should be disposed of properly. Display your posters around the school.

People produce litter and other wastes. If the environment is dirty and littered, then we – the people – are to blame. Animals and plants don't create litter.

The answer to the problem of waste disposal is also for us human beings to work out.

Activity 5

You will need: paper (or your Workbook) and a pen or pencil.

1 **Look at the pictures and discuss what effects such things have on:**

a people

b other living things

c non-living parts of the environment.

Continue over the page

2 Write lists of all the effects that the group can think of.

3 Display your lists under the headings:

people **living things** **non-living things**

One environmental issue that has effects locally and globally is pollution. Obviously we cannot completely stop making wastes – from our bodies, our factories, our burning of fuels, and from our domestic lives. What we need to do is to reduce the amount of waste whenever possible, and to recycle waste as much as we can.

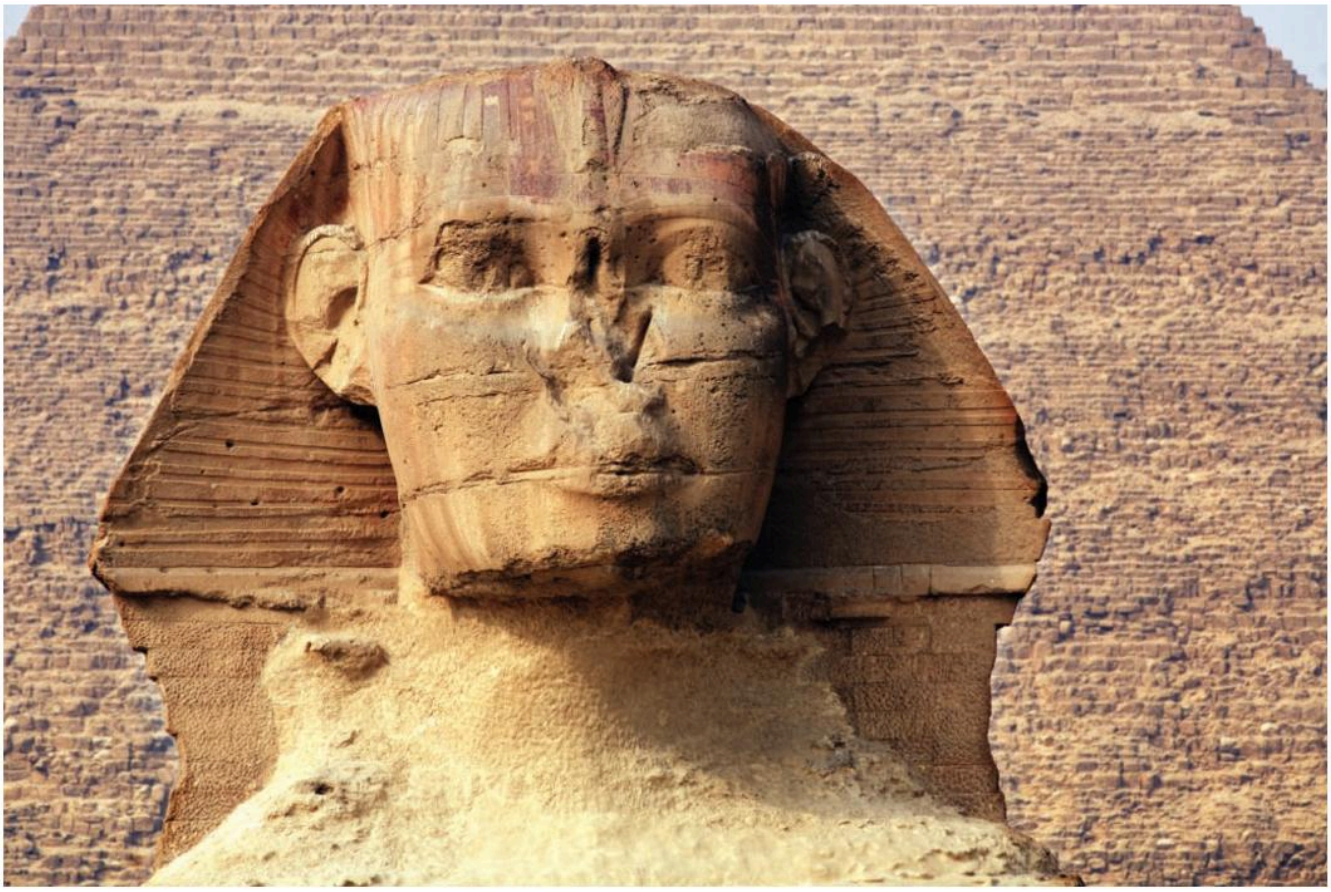
Careless waste disposal leads to pollution of:

- the air,
- the water, and
- the land.

These are the three basic components of the environment. So waste not only spoils the place where it is dumped, its effects can also spread far from its source.

Air

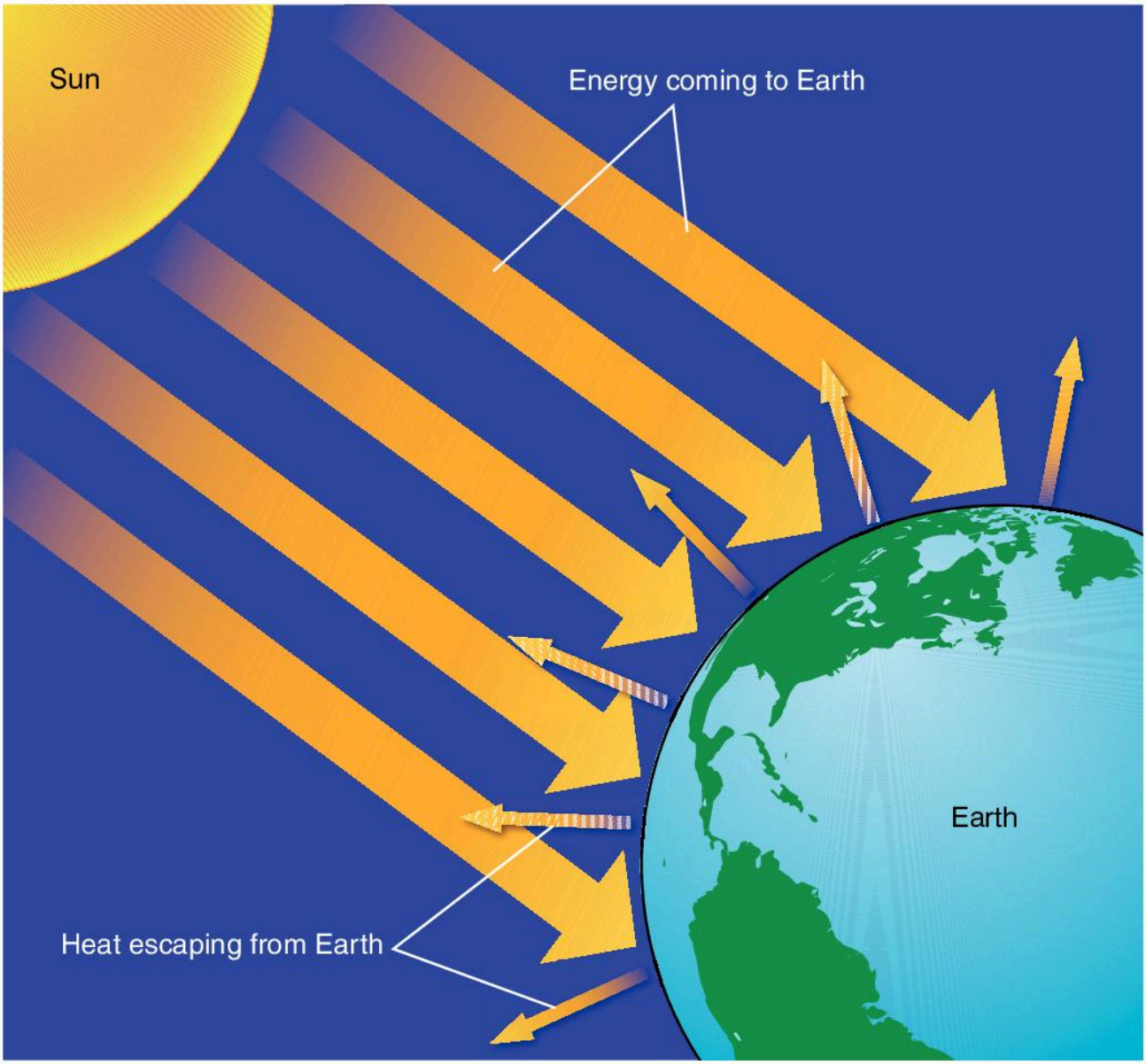
The trees in this forest have been killed by acid rain. The air was polluted by smoke from factories and traffic in countries hundreds of kilometres away. The wind blew the smoke towards the forest and, when it rained, the gases in the smoke dissolved in the rain water. This turned it into an acid. This killed the trees. Acid rain also attacks stone buildings, especially those made of limestone. The acid dissolves the stone and it is eroded.



Soot and many kinds of gas are made when fuels are burned. These are waste products. Some of the gases are poisonous. For example, vehicles make poisonous gases in their exhaust. If the petrol has lead in it, then the lead comes out in the exhaust smoke. Lead is very poisonous. For this reason, many countries permit the use of unleaded fuels only.

In cities where there is a lot of traffic the air becomes very polluted and it damages the health of people living there. Children, especially, can have their brains damaged by breathing in the smoky air from traffic. Cities are not very healthy places to live.

Some of the damage people are doing to the environment leads to climate change, caused by **global** warming. Burning of all kinds, and breathing, produces the gas carbon dioxide (CO_2). As the world has developed, and the human population has grown, we have been adding more and more CO_2 to the atmosphere. The result is that the Earth's temperature is slowly rising, because the CO_2 acts as a kind of blanket, trapping heat. Less heat escapes back into space, so the temperature of the Earth rises. This is sometimes called 'the greenhouse effect.'



Global warming leads to changes in the weather patterns in particular parts of the world. For instance:

- More, or less, rain falls.
- The winds are stronger or blow from a different direction.
- The dry season lasts longer.
- Temperatures are higher.

Such changes in the weather can have dramatic effects on the living things in a particular environment. This includes the people who live there and who are trying to produce food from the land. Rainfall, temperature and wind all affect the success of their crops. It could be that the changes happen because of the actions of people far away.

Scientists warn us that if we go on burning so many things, we will speed up the damage to the atmosphere. The weather will continue to change, deserts will get bigger and the sea levels will rise, flooding many low-lying lands. These things are already happening. If we do not change our behaviour, they will only get worse. This is one reason why the whole human race needs to act together to reduce and control pollution. No one is completely innocent and no one will be able to avoid the effects, one way or another.

The photographs show two other ways in which we can pollute the air. Aerosols use a gas inside the can to push the liquid out when we press the button on the top. In the past, the most common gases used in such cans were CFCs (chlorofluorocarbons). They are the same gases that are still used in the cooling systems of most refrigerators.

When these gases escape they go into the atmosphere, where they damage a very important part of the atmosphere called the ozone layer. This layer protects all living things on the Earth from the harmful ultraviolet rays in the Sun's radiation. Scientists have found holes in the ozone layer and have shown that it is the CFC gases that have caused this damage. The harmful **ultraviolet radiation** from the Sun can make us very sick. Since 1990, there has been an international agreement to stop using CFCs, and this is slowly being done. Old refrigerators can have the CFCs removed safely so that they are not allowed to get into the atmosphere. Scientists have developed other gases to use in aerosols, so CFCs are now being used less and less.

Activity 6

You will need: paper (or your Workbook) and a pen or pencil.

Copy and complete these sentences, using these words (you may need to use some words more than once):

fish	hotter	cars	gases	stone
traffic	buildings	acid	dioxide	Earth
dissolve	trees	cities	lead	burning
	poisonous	heat	global	

1. _____ makes waste products. Some fuels produce _____ gases.

2. Petrol with _____ in it is bad. When the petrol is burned in _____ and other vehicles it makes poisonous _____.

3. In _____ this is a big problem because there is a lot of _____.

4. Some gases made in burning can make _____ rain when they _____ in water.

5. This polluted rain can kill _____, _____ and other living things. It also damages _____ made of _____.

6. Carbon _____ gas stops _____ energy from escaping back into space. This means the _____ is slowly getting _____.

7. The more fuels we burn, the more _____ gases we make.

Water

Water can be polluted very easily in many different ways. We can be careless or lazy and spoil water, so that it is not safe to use.

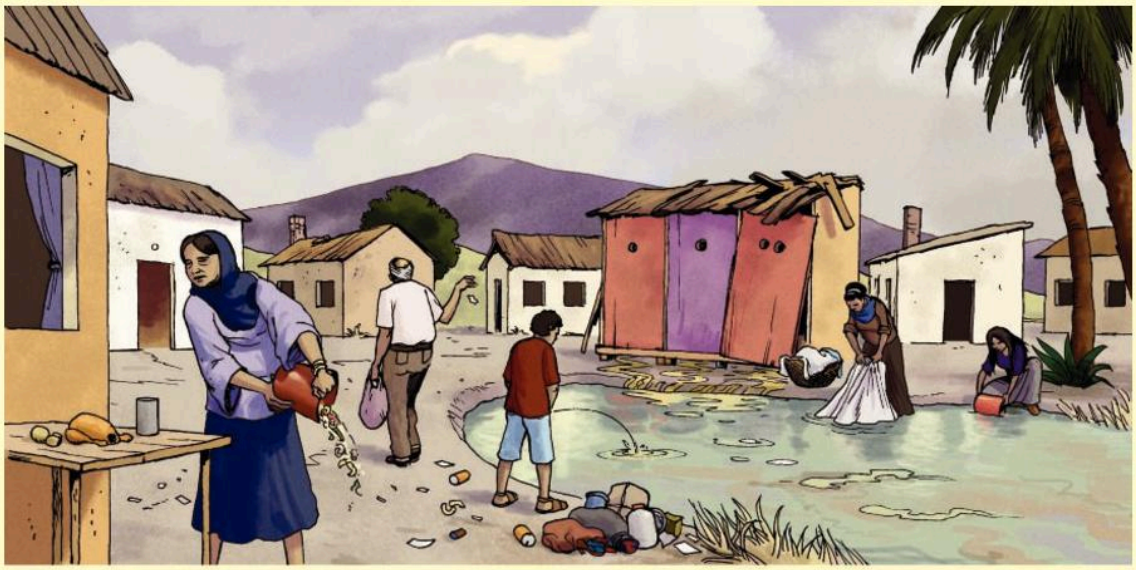
The people in the photograph have become ill because they drank polluted water, which had germs in it. They were infected with **cholera** bacteria. If this disease is not treated, they are likely to die within a few days.

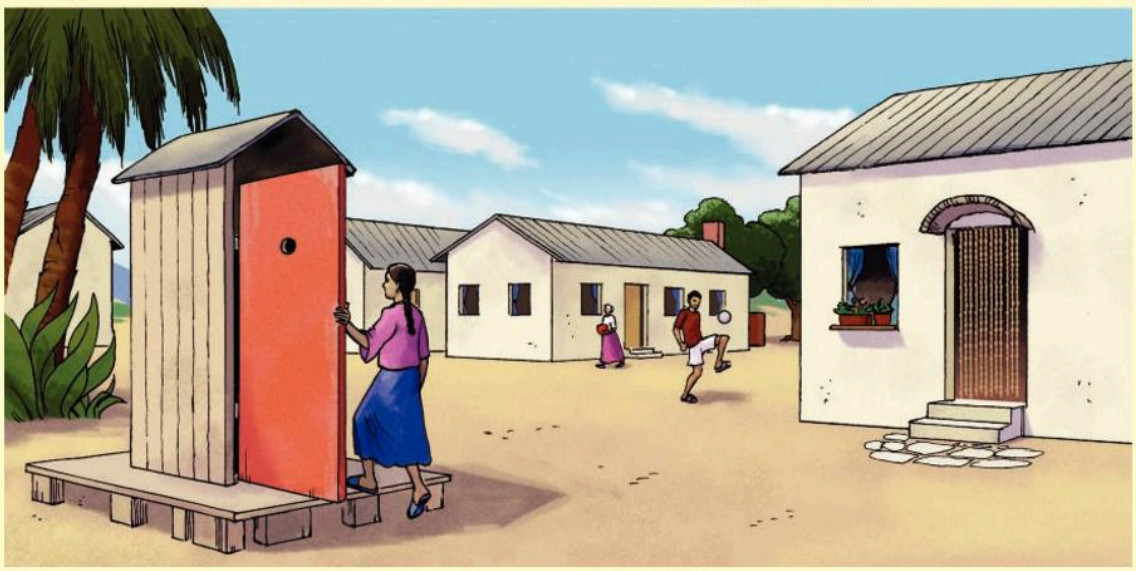
Activity 7

You will need: paper (or your Workbook) and a pen or pencil.

1 Discuss with your group how you think the cholera germs got into the water.

2 Use these pictures to help you in your thinking about the answer.





3 Share your group's ideas with the class.

Water pollution and infectious diseases

Many diseases are infectious, passed on from one person to another. Our bodies produce wastes that we all have to release each day – urine and faeces. Faeces are dangerous, so they must not be allowed to pollute the water that we have to drink, and use for washing, cooking and cleaning our teeth.

- Cholera germs pass out with the faeces of the infected person and so do the germs causing typhoid, hepatitis and various kinds of worms, e.g. roundworms.
- **Bilharzia** is one disease that is carried in our urine.

What can we do to stop infection?

Sewage (urine and faeces) must be kept as far away as possible from the source of our water – the pond, the stream, the well, the borehole, the river, or whatever other source we use.

In cities and towns around the world, there are separate underground pipes for clean water and for sewage.

Latrines and toilets must be kept clean, and we must be careful to wash our hands after using the toilet.

Food can easily be infected by our hands and by polluted water.

Flies carry germs from faeces on their feet, which is why we should cover food and do everything we can to keep our environment clean.

Litter and other waste encourages flies, and flies carry disease, especially where there is pollution of water supplies by faeces. So we should do all that we can to dispose of litter safely. Recycling litter, glass, plastic, paper and tin cans is part of that.

Industrial water pollution

Acid rain water, produced from polluted air, runs into streams, rivers and lakes. Once there, it can kill all the animals living in the water.

Water is also polluted by industries that just dump their wastes into rivers, lakes and the sea. These wastes can be poisonous, killing all the living things in the water. They make the water unsafe to drink or to use in the home.

Sometimes oil escapes from pipelines or ships and it sinks into the ground or floats on the water. Birds that swim on the water are killed by the oil, and fish are poisoned by it. When large amounts of oil are spilled, they cause an environmental disaster ,which may take years to clean up and repair. It is difficult and expensive to clean up oil spillages.

Many things dumped into water, like sewage, oil and rubbish, are visible. They are not **soluble**; they float or sink.

Other materials are soluble in water, so we do not see them. Water might look safe to drink, but it could be polluted with materials we cannot see. Germs are one invisible danger, as they are microscopic – too small to see with our eyes. Chemicals of various kinds are another invisible danger.

Activity 8

You will need: paper (or your Workbook) and a pen or pencil.

1. Look at the photographs on page 53 and try to work out what they show.

2. Discuss with your group how the activities shown in the pictures are connected with the topic of water pollution.

3. Share your ideas with the class.

Agricultural water pollution

Farmers use a variety of chemicals on their crops and on their livestock. Some are pesticides, which kill pests on plants or animals. The chemicals are poisonous to the pests and they are often soluble. This means that when the chemical lands on the soil and water falls on it, the water carries the poisons with it into the soil. Water draining from the land into streams, rivers, ponds and lakes can then be polluted with the pesticide and can harm people and animals – wild and **domesticated**.

Fertilisers are always soluble chemicals. They have to be able to dissolve in water in the soil, so that plants can take them in through their roots. But it means that these chemicals can also pollute the ground water, in wells and streams and ponds, etc., because not all the fertilisers get taken in by the plants. Some water plants, called algae, use the minerals in the fertilisers and this makes them grow very fast. They can 'choke' the water and kill many of the other organisms living in the water.

Activity 9

You will need: paper (or your Workbook) and a pen or pencil.

Copy and complete these sentences using these words:

industries	**urine**	**poisons**	**soluble**	**oil**
polluted	**typhoid**	**sea**	**fertilisers**	**plants**
pipe	**faeces**	**diseases**	**cholera**	

1. Water can be _____ in many ways.

2. Water can carry _____, such as _____ and _____.

3. Human _____ and _____ can pollute water.

4. Sometimes water is polluted by accident when _____ escapes from a crashed tanker or a burst _____.

5. Some _____ dump their waste in rivers or the _____. The waste can have _____ in it, which kill animals and _____.

6. Farmers add _____ to crops and soil. These can pollute water because they are _____ and end up in streams and rivers.

Land

Some of the examples of pollution described above – agricultural chemicals, oil spillages, industrial wastes and the dumping of rubbish by careless people – can damage the land as well as the water.

Some land with factories on it becomes so polluted that nothing will grow there after the factories are removed. The land has been poisoned. It is not safe for people to build their houses on the land either, as the poisons are in the dust that is blown off the land. It is a long, slow and expensive process to remove the chemicals that have poisoned the land, for example, lead, **cadmium** and other metals. Cleaning land of pollution is so much harder than cleaning air and water.

Activity 10: Investigate the effects of pollution

You will need: a clipboard, paper (or your Workbook) and a pen or pencil.

1 **You will investigate the effects of pollution on a component of your local environment. Discuss with your group which component you will investigate – the air, the land or the water.**

2 **Write some questions that you can ask older people from the community about how pollution affects their lives.**

3 **Invite as many different people as you can to come to class to be interviewed.**

a Ask for facts and opinions. For example, what do they feel about the spoiling of their environment?

b If there are farmers you can question, ask them about how pollution affects their work with crops or animals.

c Ask your questions and write down what the adults tell you.

4 **When all the interviews are finished, discuss your notes of the interview answers.**

a Prepare a report of your findings to share with the class.

b Answer questions from others in the class.

5 **Listen to the presentations of other groups and ask them questions.**

a Compare the findings of the groups.

b Come to a conclusion about the effects of pollution on the local environment and the lives of people in the locality.

This nuclear power station at Chernobyl, in the Ukraine, exploded in 1986, releasing large amounts of **toxic** radioactive material into the air. Swedish scientists detected this pollution in the air as the winds blew it towards them from the Ukraine, many kilometres away. Soil, water and the air became polluted with the radioactive material. Many crops and animals in several countries had to be destroyed, because they became too dangerous to eat. Thousands of people had to be moved from their homes, because the environment around the power station was too dangerous. Many people have died, and more will die in the future, because of this pollution.

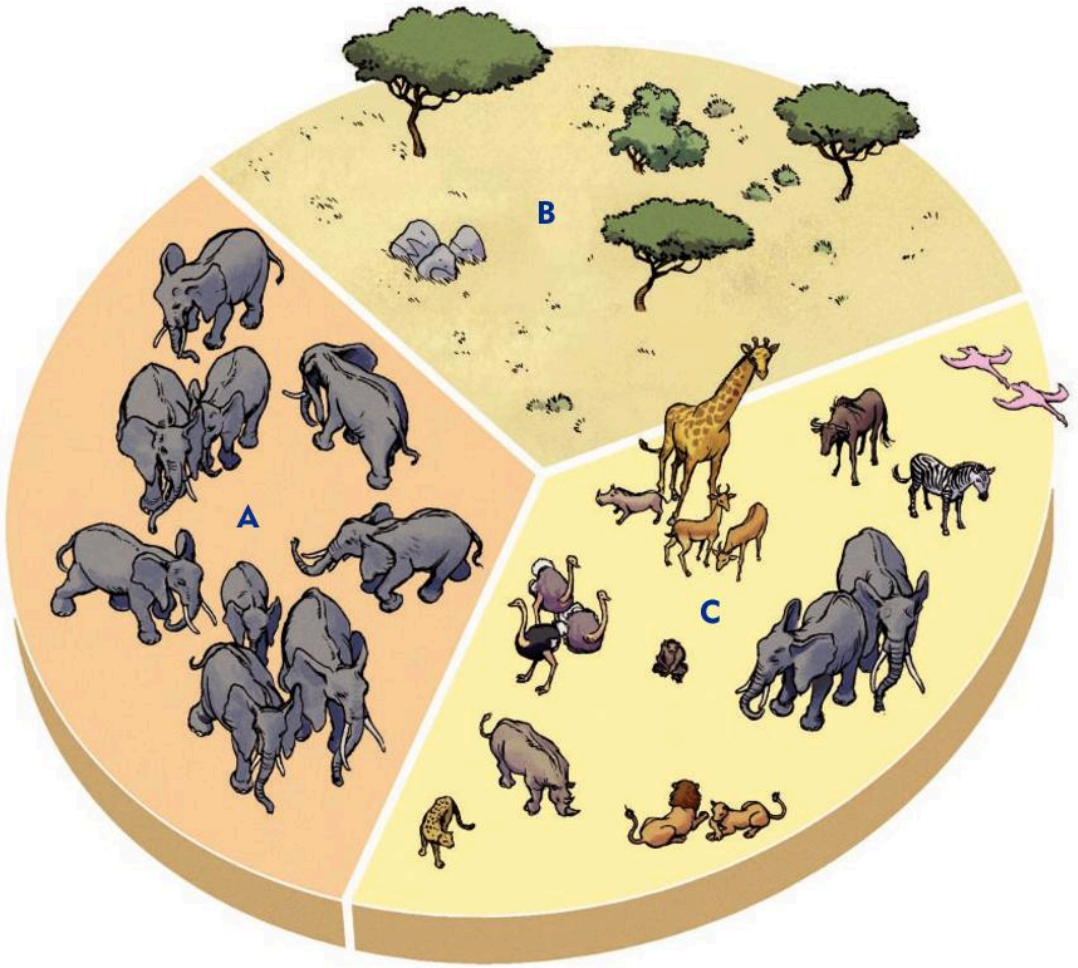
Food chains

Food chains are part of every habitat, population and community.

A **habitat** is the environment in which an animal or plant normally lives. It is shared by other individuals of the same species (e.g. many crocodiles might share the same river or swamp habitat). There will usually be populations of other species in the same habitat (e.g. crocodiles share their habitat with fish).

A **population** is a group of individuals of the same species that share a habitat.

A **community** is the collection of animals and plants that live together in a particular habitat.



Activity 11

You will need: paper (or your Workbook) and a pen or pencil.

1 Look at the diagram. Read the definitions of habitat, community and population.

2 Write A, B and C, and match the definitions with the three parts of the diagram.

3 Share your answers with the class.

All the populations living in a particular place added together form a community. That is the total of all the *living things* in that place.

The habitat is the *place* in which that community lives.

Your school is surrounded by habitats, some very small and others enormous. The building itself creates habitats for certain populations. Trees, especially when they are old and large, also provide habitats for some animals and even other plants.

Activity 12: Investigate two habitats

You will need: a clipboard and a choice of measuring devices, e.g. thermometer, ruler, light meter; paper (or your Workbook) and a pen or pencil.

1 Discuss with your group which two habitats you will investigate in your locality. Try to choose two that are very different.

Continue over the page

2 **Plan what you will look for and how you will record what you observe.**

> **Remember** that drawing, measuring, counting and writing notes are all part of data collection and recording.

3 **Go outside with your paper, clipboard, pencil and measuring device/s and investigate the chosen habitats.**

Collect enough information to be able to give a clear and full description to the class.

4 **Return to class and discuss with your group the information you have collected.**

a Decide how you will give your descriptions to the class.

b Present your descriptions and answer questions from others in the class.

The physical characteristics of each place create particular habitats, each different in some way. Soil types, rain and ground water, temperature, level of shade, altitude – all have effects on the habitat.

This means that only certain populations of plants and animals can live in a particular habitat. You do not find crocodiles living out in the Kalahari Desert!

Every animal needs to feed on something.

A bird of prey

A slug

A frog

A cabbage

A snake

Activity 13

You will need: paper (or your Workbook) and a pen or pencil.

1 **Look at the pictures of five living things.**

a How do the things shown in the pictures depend on each other?

b Tell your group what you think.

c Write the things as a food chain, using arrows.

2 **Try to explain to your group why they are in that order.**

Here are some more examples:

pond weed → small fish → bigger fish → fish eagle

grass → goat → lion

grass → grasshopper → lizard → eagle

lettuce → caterpillar → bird → cat

Each of these is an example of a food chain.

Activity 14

You will need: paper (or your Workbook) and a pen or pencil.

1 **Look at all the food chains in your class and:**

a Find a common feature. Tell your group what you think it is.

b Explain to your group what the arrows stand for.

Producers, consumers and feeding relationships

Plants do not feed on other organisms, except for some plants that feed on insects (insectivorous plants). Plants are able to make their own food by the process of **photosynthesis**, so they are called the **producers**. Animals cannot make their own food.

The first links in a food chain

All food chains begin with a producer, as they are the makers of food that then gets passed up the chain in the bodies of the various animals involved.

Every chain starts with the **energy** from the Sun being 'captured' by plants as they photosynthesise. Each part of the food chain depends on the one that comes before it.

Animals feed on plants and other animals, so they are called **consumers**.

- Some consumers feed only on plants – the **herbivores**, e.g. cattle, impala.
- Some consumers feed only on other animals – the **carnivores**, e.g. lion, eagle.
- Some consumers feed on plants and animals – the **omnivores**, e.g. humans, chimpanzees.

Animals that catch and eat other animals are called **predators**. The animals they eat are called their **prey**. For example, a spider is a predator, and its prey are flies, moths and other insects.

Here is an example of a food chain with the plants and animals identified as producers and consumers:

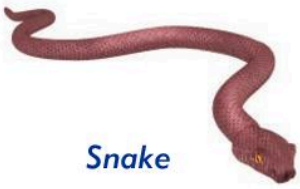
grass (producer) → grasshopper (consumer) → lizard (consumer) → eagle (consumer)

Habitats and their food chains

Zebra

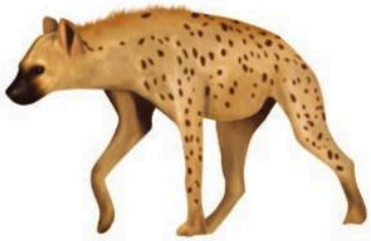
Mopane tree

Bird

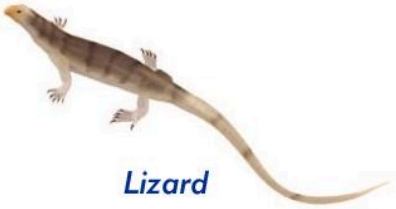


Snake

Snail



Hyena



Lizard

Rabbit

Cow

Grass

Caterpillar

Cabbage

Cat

Activity 15

You will need: paper (or your Workbook) and a pen or pencil.

1 **Make up four different food chains using the animals and plants in the picture.**

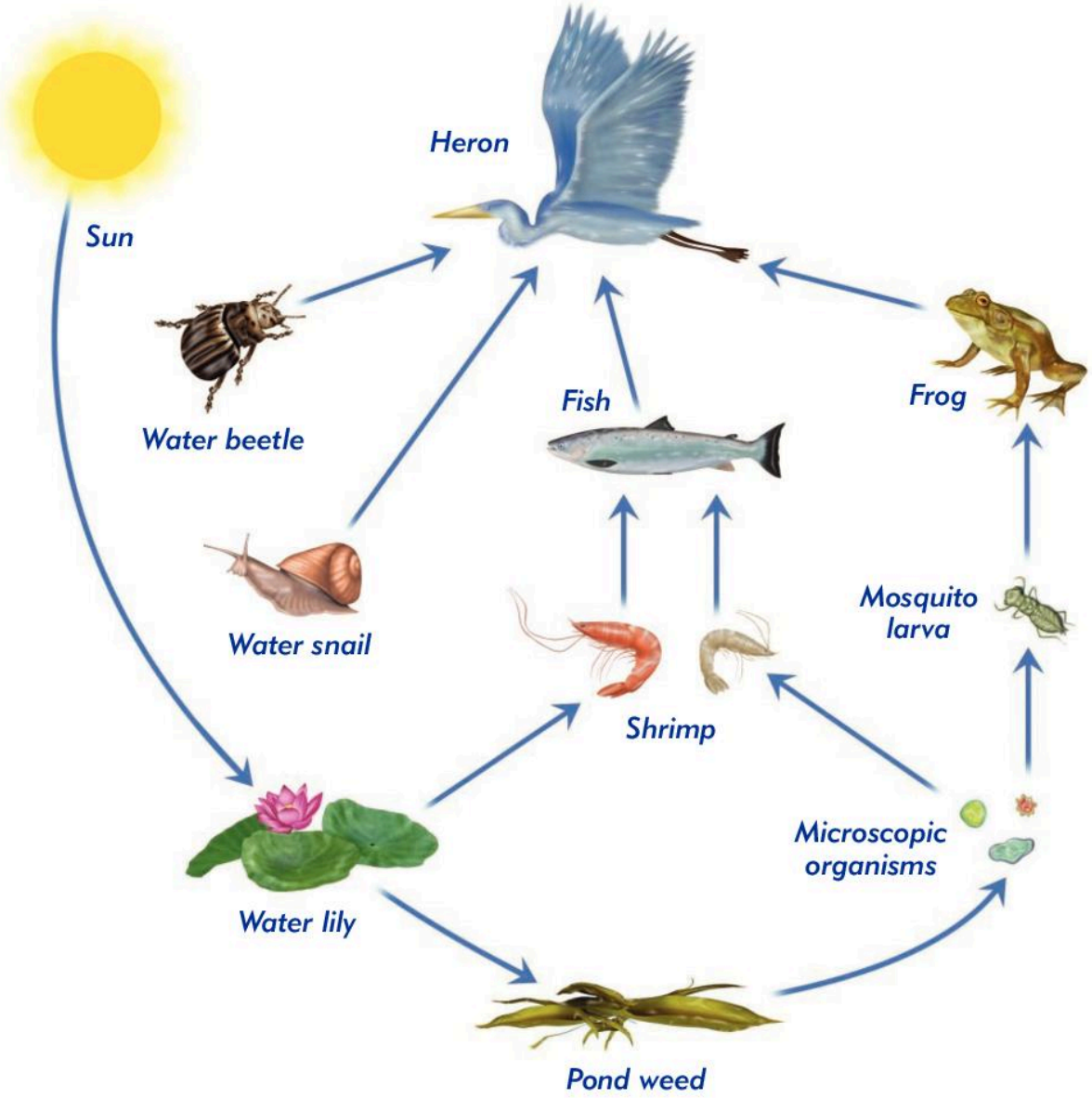
a Each food chain should have at least four organisms and three links (arrows).

b Under each organism in the chain, state whether the organism is a producer or a consumer.

2 **Compare your food chains with others in your group.**

3 **Share your group's food chains with the class.**

In most habitats, there will be many different populations of plants and animals living together and interacting with one another as a community. In a river, for example, there will be several different water plants (producers) which provide food for a variety of consumers. These consumers will be food for a variety of other consumers.



Food chains in a river habitat

Activity 16

You will need: paper (or your Workbook) and a pen or pencil.

1. Look carefully at the plants and animals in the picture.

2. Identify and record the producers and consumers.

3 Make lists of each type of organism. Share your lists with the class.

4 Make up food chains from the following savannah plants and animals:

hyena	zebra	lion	thorn
trees	gazelle	grass	
cheetah	buffalo		
small shrubs	giraffe		

5 Label the producers and consumers.

6 Share your food chains with the class.

Animal life (including our own lives) depends totally on plants. The energy they 'capture' in the process of photosynthesis is transferred to the animals that eat them and some of that energy moves 'up' the chains through the consumers.

If particular plants or animals are removed from the food chains, other animals are affected as there is less for them to eat. This is one reason why conservation is so important. If we kill off any population of plants or animals, we will damage the survival of many other organisms.

Changes in the environment, such as much less rainfall over a year, can affect the number of organisms in a population. For example, when rain is scarce, plants might die or grow very little. This means there is less food for the consumers – for example, gazelles.

If the population of gazelles falls, with more deaths and fewer births, then the predators that eat the gazelles – for example, cheetahs – will have to hunt longer and further afield to find enough food.

If they cannot find food, they may not breed or they may even die.

So, one environmental change can have an impact throughout a whole chain.

Activity 17

You will need: paper (or your Workbook) and a pen or pencil.

1. **Predict what other environmental factors could change and affect populations of plants and animals.**

2. **Share your predictions with the class.**

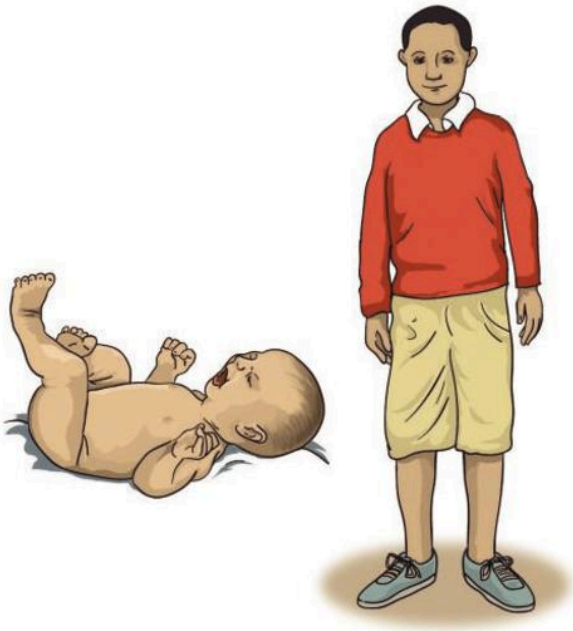
The environment, including the living things, is like a 'web' where everything is connected together. So, damage and loss in one part of the environment can have effects on other parts. Nothing lives totally independently – all living things take and give. Even the death of living things is important to the continuation of life on Earth.

Scientists talk about 'chains' because this word includes the idea of things being linked, or connected. This is a very important truth, and we humans must not think that we are *outside* of these natural chains.

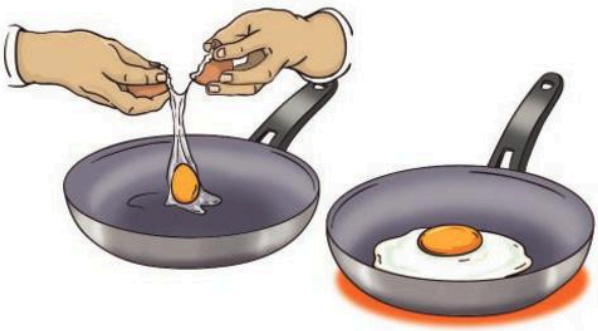
The danger to the environment comes from those things that damage the natural world. In the past, people did not know or understand 'the web' of life and how we are linked to the living and non-living parts of the environment. Our ancestors cultivated the land, dug up minerals, made wastes and threw them to one side without much thought about the long-term results of such activities. Scientists and others have gradually built up a better understanding of how selfish, silly and dangerous it is for people to live in such a careless way. People all around the world are now aware of their individual responsibility to care for the environment. This unit is included in your studies because you also need to be aware and learn what you can do – now, while you are still young – to share in the protection of our planet.

Reversible and irreversible changes

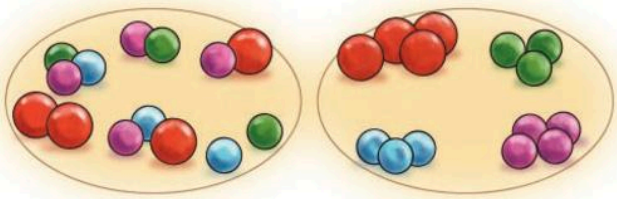
(a)



(b)



(c)



(d)

Activity 1

You will need: paper (or your Workbook) and a pen or pencil.

1 One of the pictures above shows a change that can be reversed. It shows a **reversible** change. Look at the pictures and find the reversible change.

2 Tell the class what you have chosen and explain *why* you think it is reversible.

Changes are happening all around us and inside us, all the time. Changes are part of the natural world.

Some changes can be reversed, but others cannot. Those that cannot be reversed are called **irreversible** changes. Three of the changes shown in the pictures are irreversible. Once such a change has happened it is impossible to 'go back' to how it was before. The teenager cannot go back to being a newborn baby. The burned candle cannot return to being a new candle. The fried egg cannot go back to being a liquid egg inside the shell.

Activity 2: Investigate what happens to materials when they are heated

You will need: water, a container that can be heated, a heat source, a thermometer, some wax or chocolate or butter, a small piece of vegetable, paper (or your Workbook) and a pen or pencil.

1 **Choose to investigate:**

- **a** *either* a change of state (which you learned about in Stages 4 and 5: States of matter), *or*
- **b** a change of temperature, *or*
- **c** hardness (which you learned about in Stage 2: Material changes).

2 **Collect the items needed for your chosen activity.**

3 **Discuss with your group:**

- **a** how you will investigate the change
- **b** how you will record the results.

Continue over the page

4 **Write out the plan for the steps of your investigation and include your prediction of what you think will happen. Show your plan to your teacher.**

5 **Carry out the activity, observing change and recording your observations in words and/or drawings.**

6 **When the changes have ended, look at your results.**

a Discuss them with your group.

b Come to a conclusion about what they tell you about the change you investigated: was it reversible *or* was it irreversible?

7 **Share your results with the class and explain why you have come to your conclusion.**

8 **Listen to the results and conclusions of other groups and ask questions if you do not understand or agree.**

Changes of state, such as melting, freezing, evaporating and condensing, are all reversible. A material can go from one state to another and back again if the conditions are suitable. For example, liquid water can be put into a freezer and turned into solid ice. When it is removed from the very low temperature of the freezer, the solid ice can melt and go back to being a liquid.

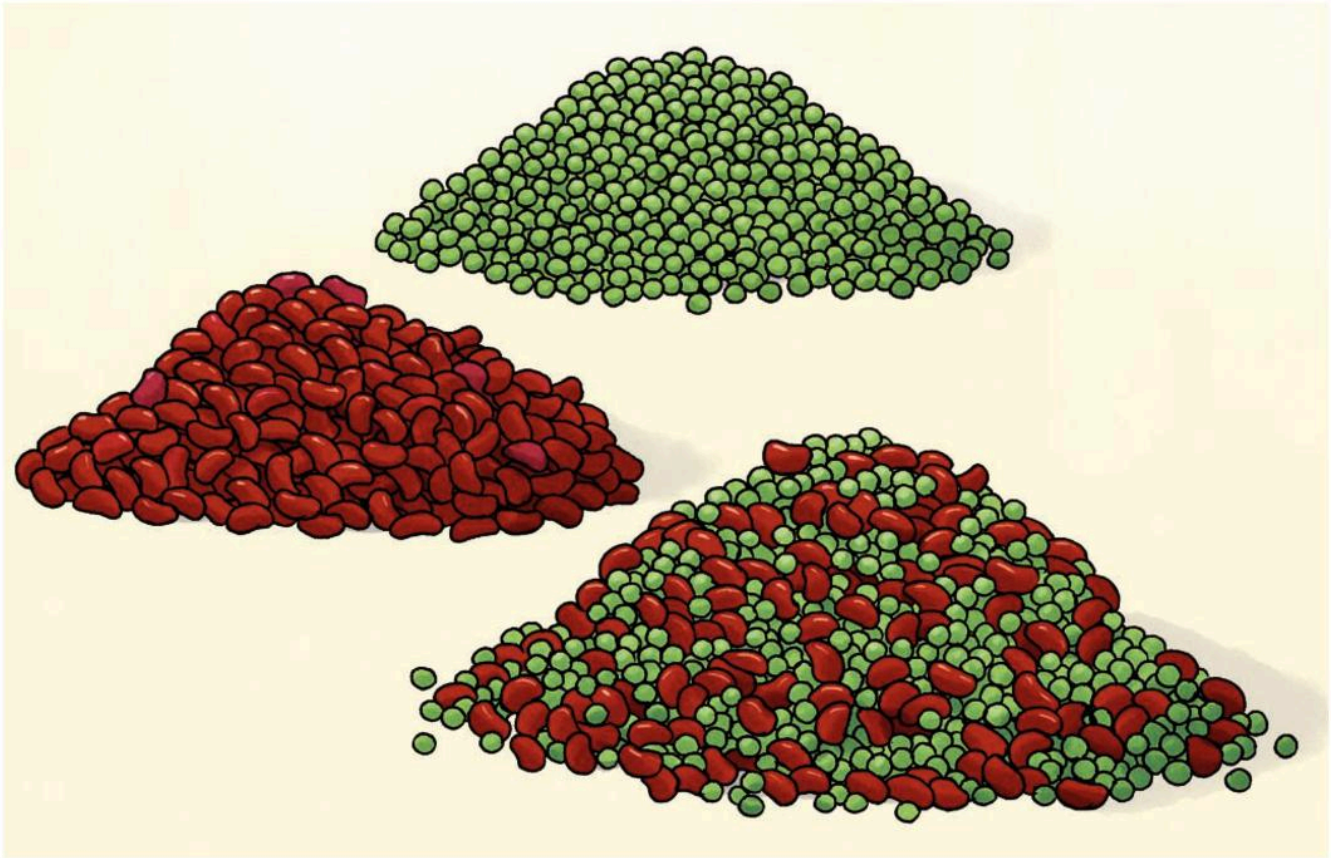
Burning is not reversible. It changes the material into other materials and the original cannot be regained.

Heating a material raises its temperature. If the heating stops, the temperature falls and the material can go back to what it was originally. This change is reversible.

Hard, raw vegetables can be changed by cooking them, one way or another e.g. by boiling or frying. They change into much softer vegetables, and this change is irreversible – they cannot go back to being raw again.

Mixtures of solids

Making mixtures is a form of change. Two or more materials – such as the red beans and the green peas in the picture below – can be added together. The 'new material' is just a mixture. The red and the green parts are still separate.



Red beans and green peas do not combine with one another, they are just mixed together.

The substances in a mixture are still the same substances. They do not become new substances. For example, air is a mixture of nitrogen, oxygen, carbon dioxide and several other gases. They do not combine with one another. Each one remains a separate, different substance. When we breathe in, our lungs can separate the oxygen we need from all the other gases in the air.

It is sometimes quite easy to separate a mixture into its two or more different substances.

How would you separate the red beans from the green peas? Tell others in your group what you think.

Activity 3: Investigate how you would separate one substance from another

You will need: some salt, fine sand, coarse sand, iron filings, suitable equipment to help in separating the substances when you have mixed them, paper (or your Workbook) and a pen or pencil.

1 **This activity is a challenge. Choose one of the following mixtures:**

- **a** salt mixed with sand
- **b** sand mixed with iron filings
- **c** fine sand mixed with coarse sand.

2 **The challenge is to separate the two substances in the mixture you have chosen. You will have to use your knowledge of the physical properties of the substances to do this.**

3 **Discuss with your group how you will do the separation. Make a plan of what you will do.**

4 **Make a list of any equipment you will need.**

- **a** Show your list to the teacher.
- **b** Explain how your plan will work.

Continue over the page

5 **The first step is to make the mixture you have chosen.**

a Record how many measures of each material you use and what units you use.

b Keep a record of all the steps you take to do the separation.

c Record your results.

6 Show your results and the record of your method to the class. Answer any questions from others in the class.

7 Look at what other groups have done. Compare your results and method with those of other groups.

The materials in the three mixtures had different properties and these could be used to separate them.

1. Size of the material pieces helped to separate the solids in which mixture?
2. The magnetic properties of one material helped to separate the solids in which mixture?
3. The **solubility** of one material helped to separate the solids in which mixture?

A **sieve** is used to separate solid particles according to their size. A set of sieves, with holes of different sizes can be used to sort mixtures into several separate parts. For example, the fine and the coarse sand: each is made of particles of certain sizes.

Sieving is used at a gravel pit to separate the materials

Metals such as iron and steel, which are magnetic, can be removed from mixtures by using a magnet. This attracts the metals but it has no effect on the non-magnetic materials, e.g. the sand. This separates the two types of solid material.

A large magnet is used to separate magnetic metals from other waste at the recycling plant

Some solids dissolve when mixed with water (they are **soluble**) and others are **insoluble**. This property can be used to separate mixtures of soluble and insoluble materials, e.g. salt and sand. The soluble material dissolves into the water and then the mixture can be sieved or **filtered** (see below) to separate the insoluble solid from the **solution** of the soluble solid material.

Activity 4: Investigate which substances are soluble or insoluble

You will need: water, containers for testing solubility, various solid substances, paper (or your Workbook) and a pen or pencil.

1 **Collect at least four different solid substances.**

a Choose two that you think are *soluble* in water.

b Choose two that you think are *insoluble* in water.

> **Remember** water is the **solvent** and the solids are the possible **solutes**. If a solute dissolves in a solvent, it makes a solution.

2 **Discuss with your group how you can make this a fair test. Write a plan of how you will do this investigation into solubility.**

> **Remember** you need to treat each substance in the same way, so that you can compare the results.

Show the group's plan to your teacher.

3 **Draw a table for your results, using column headings like this:**

Substance	Soluble	Insoluble

Continue over the page

4 **Carry out the investigation on each of your chosen substances in the same way.**

5 **Observe what happens and record the results in the table.**

a Discuss the results with your group and come to a conclusion.

b Share your results and conclusion with the class.

The class results show that substances vary in their solubility.

- Some dissolve easily and quickly, while others do not.
- Some substances are completely insoluble in water and nothing can be done to make them dissolve. You cannot make a solution with water from those substances. *(They may dissolve in other liquids, such as petrol and alcohols.)*

We use many soluble substances in our food and drink. They are added to food during cooking and they 'disappear' into the food. We use others to make drinks. Think of examples of both types – used in food and used in drinks. Tell the class what you have thought of.

We also make great use of insoluble substances to make objects which must get wet but which must not dissolve. Our homes have many such things, made from many different materials.

Think of examples of three different ways we use insoluble materials. Tell the class the examples you have thought of.

Solutions

Some solids **react** with water when they are mixed with it. Reacting is more than just dissolving. When a solid reacts with water it changes into new substances – sometimes into a gas, or a soluble solid, or an insoluble solid, or all three. This kind of change is called a **chemical change** and it happens during chemical reactions.

Activity 5: Investigate what happens when you add solids to water

You will need: some water, a container to mix water with solids, at least two solids – such as baking powder (sodium hydrogen carbonate) or Epsom salts (magnesium sulphate), a spoon or stirrer, paper (or your Workbook) and a pen or pencil.

1 **Investigate what happens when you add a spoonful of one of the solids to water.**

a Predict what you think will happen.

b Write down your prediction.

2 **Test the first solid.**

a Carefully observe the result of adding it to water and stirring them together.

b Record your observations in writing and drawings.

3 **Repeat the same process with the second solid.**

4 **Compare the results with your predictions and discuss them with your group.**

5 **Share your findings with the class and try to explain the changes you observed.**

Mixing some solids with water produces a reaction that can be seen and heard. Chemicals in the solids react with the water and a gas is produced. This forms bubbles, which can be seen floating to the surface and heard as they burst in large numbers. We sometimes call this 'fizzing', but the scientific word is called **effervescence**.

Activity 6

You will need: some sugar, some water, test tubes or other small containers (e.g. plastic beakers), paper (or your Workbook) and a pen or pencil.

1. Explore the process of making a solution of sugar and water.

2. Record what you do and what happens.

3. When you have made the solution, try answering the question:

   Is the sugar still present, or has it changed into a new material?

4. When you have an answer to this question, write down how you came to your conclusion.

5. Share your findings with the class and listen to those of other groups.

Continue over the page

6 **You can repeat the same activity using other soluble substances used at home in cooking.**

⚠ **WARNING:** Do not use any solids that you do not recognise. Check with your teacher first before using any substance for mixing. If you are not certain, do not try to make a solution.

As you found in Activity 4, not all solids can be made into solutions when mixed with water, e.g. sand or wax. Solutions are a special kind of mixture. A solid substance can be mixed with a liquid solvent, but it does not change into another substance. For example, when sugar is dissolved in water it 'disappears', but it is still there, mixed with the water, in the form of a solution. It can be tasted, even though it cannot be seen. A solution of one substance in another, such as the sugar in the water, does not involve a chemical reaction. No new substance is formed.

Filtering

Sieves can be used to separate solids of different sizes. They can also separate solids from liquids. The solid is held in the sieve and the liquid passes through the holes.

The solvent (liquid) and solute (substance) in solutions cannot be separated by **sieving**.

Both pass through the holes together.

Filter papers and funnels

The items in the picture are used for separating insoluble solids from liquids. The liquid might be just water, or it might be a solution of some kind. The solid *has* to be insoluble in the water for this process of **filtering** to work.

Activity 7: How does filtering work?

You will need: filter papers, filter funnels, containers to stand funnels in, insoluble solids, some water, paper (or your Workbook) and a pen or pencil.

1. Explore how filtering works, using the solids you have chosen.

2. Plan the steps you will follow, from making the mixture to using the filter papers and funnels to separate the parts of your mixture.

3. Observe what happens as you try to separate the materials of your mixture, and record your observations.

4. Repeat the process using a different insoluble solid.

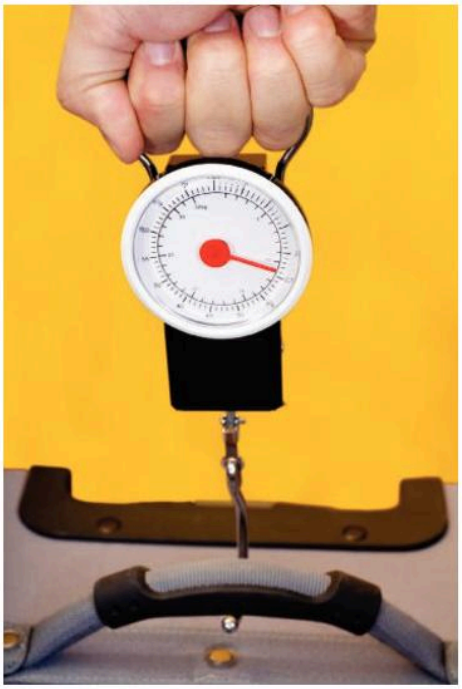
5. Compare what happened with each of your solids and come to a conclusion about how filtering works.

6. Share your results and conclusions with the class.

Filtering is really just a special form of sieving. It works because the filter paper has tiny holes in it and the liquid can pass through these holes, but the solid particles cannot. They get trapped by the paper. This separates the insoluble solid from the liquid water.

Mass and weight

When we 'weigh' something, we are really measuring its **mass**.



We use these devices to weigh things

Mass is the scientific term, but in everyday life we use the word **weight**. The units of mass are **grams** and **kilograms**.

One kilogram (1 kg) = one thousand grams (1000 g)

Activity 1

You will need: something that can tell you the mass of objects, a collection of at least four different objects, paper (or your Workbook) and a pen or pencil.

1. Discuss with your group which objects you will use to explore the measurement of mass, and collect them.

2. Choose a measuring device for finding the mass of your objects.

3. Draw a table and record the names and the mass (in grams and/or kilograms) of your chosen objects.

4. When you have 'weighed' them all, look at the results and sort the objects in order of mass, from the 'lightest' to the 'heaviest'.

5. Share your results with the class and compare everyone's figures.

6. Look at the following statements and use the class results to choose the true statement:

   Heavier objects are always larger then lighter objects.
   Lighter objects are sometimes larger than heavier objects.

7. Tell the class which statement you think is true and provide **evidence** to support your answer.

In everyday life we do not use the proper scientific word – mass – when we 'weigh' things. We use the scientific word 'weight' wrongly. The unit of weight is the **Newton (N)**, *not* the kilogram.

Mass is a measure of the amount of matter in an object. This does not vary from place to place on Earth – high up or low down – or even on the Moon or in other places in the universe. The amount of matter stays the same, so the mass stays the same.

Units

The units of mass (the gram and the kilogram) are not the same as the units of weight (the Newton). Weight is a type of **force**, and the Newton is the unit of force.

The weight of an object is caused by **gravity**, a force which any large mass such as the Earth exerts on all other objects.

The weight of an object is the amount of force that the Earth exerts on the object. Gravity acts on the mass of an object:

> The greater the mass, the greater the force produced by gravity, i.e. the greater the weight of the object.

As you learned in Stage 3: Forces and motion, pushes and pulls are examples of forces. Each force acts in a direction – it might be upwards, sideways or downwards, for example.

In which direction does the gravitational force (gravity) act? How do you know?

Explain your answers to the class, using evidence to support your ideas.

(a)

(b)

(c)

(d)

(g)

(e)

(f)

Activity 2

You will need: paper (or your Workbook) and a pen or pencil.

1 Look at the pictures, which show forces acting on different objects.

Continue over the page

2 Try to work out the directions of the forces in each one. There may be more than one force acting at the same time.

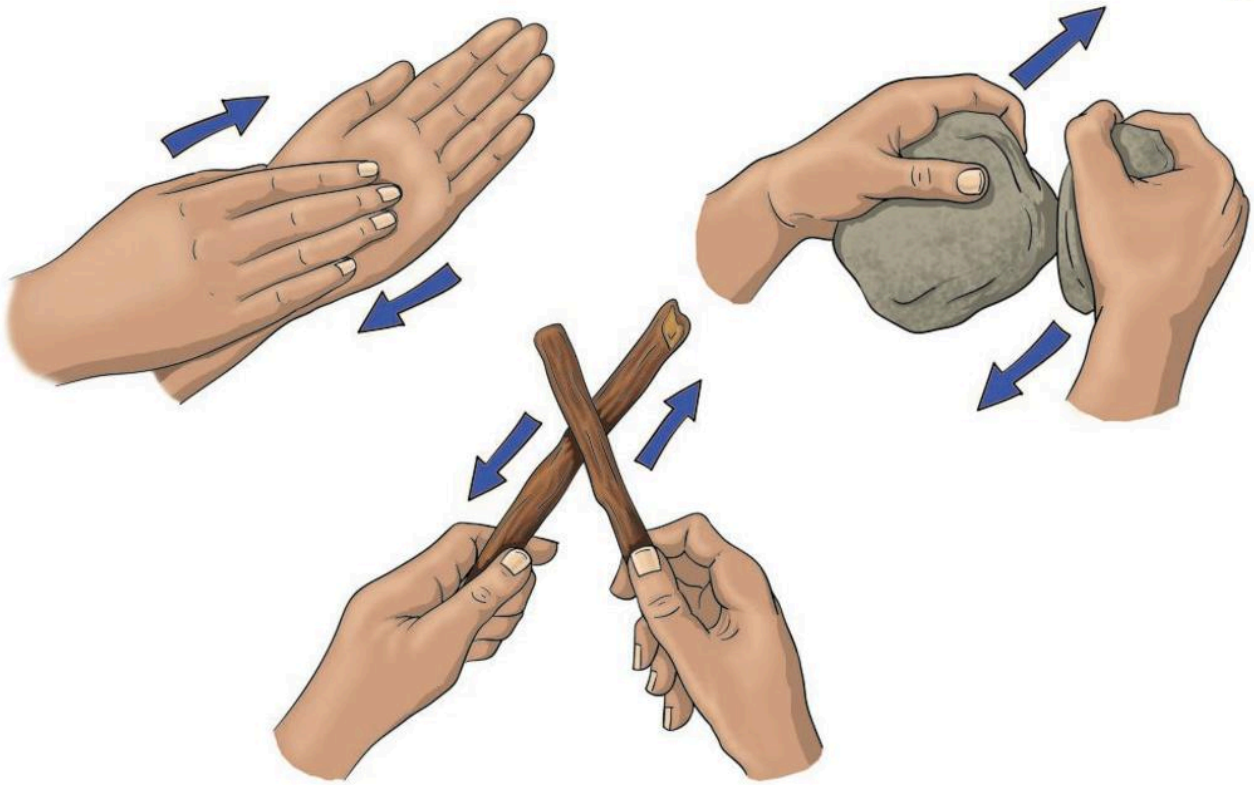
3 Write the letters (a) to (g), and record your answers beside them.

4 Share your answers with the class and compare them with those from others.

Gravity is a *downward* pull. It does not push things down; it pulls them down towards the ground. This is why things fall and sink. Which pictures show gravity pulling things down?

But in water there is an *upward* force, called **upthrust**. It is a push which acts in the opposite direction to gravity. This is why some things float in water. The pull down is balanced by the push up. Which of the pictures on page 93 show upthrust pushing things up?

Air can also produce forces that act sideways and upwards and downwards. Wind is moving air and we are all familiar with how strong the force can be. It can push things and people sideways and it can lift things too. **Air resistance** can be useful in slowing down falling objects, such as the parachutist. Gravity pulls the person towards the ground, but the air trapped in the parachute pushes upwards and acts against the force of gravity. The size of the force depends on the shape and size of the object moving through the air. This is one form of **friction**, which is another force that can act in different directions.



Activity 3

You will need: two rough sticks, two stones, paper (or your Workbook) and a pen or pencil.

1. Carry out each of the three activities shown in the pictures.

> ⚠ **WARNING:** Take care when rubbing the stones together.

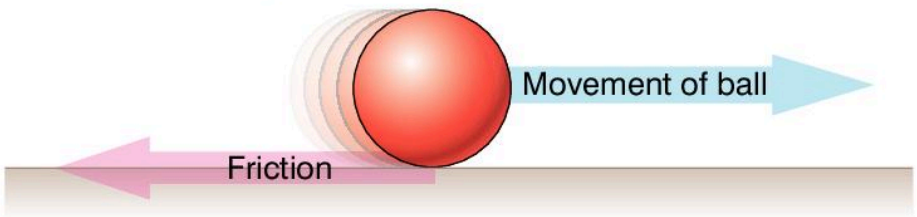
2. Observe what happens each time and make a note of your observations.

3. Share what you found with the rest of the class and listen to what others say.

When two objects or materials are touching, the force called friction slows down the movement of one object or material over the other.

The greater the load pressing the surfaces together, the greater the force of friction.

To start an object or material moving, the friction must be overcome. Once the object or material is moving, it is easier to keep it moving.



Rubbing things together demonstrates that some things are easier to move than others. The force you had to use to move your hands, the stones and the sticks, was not the same. This is because the surfaces of the objects are different and so they produce different amounts of friction. The greater the friction, the more force you had to use to start things sliding.

Activity 4: What is the effect of the surface of the slope on round objects travelling down it?

You will need: marbles or balls of different sizes, a slope, various materials to cover the surface (e.g. plastic sheet, sandpaper, rubber mat, soft fabric such as a towel), a watch or stop clock, paper (or your Workbook) and a pen or pencil.

1 This investigation is to explore if the type of surface changes the movement of the balls/marbles down the slope: is the movement slowed down or speeded up?

2 **Set up the slope in a place where the balls can roll down it without causing danger or damage.**

a Draw a table for recording the results.

b Draw columns for each of the marbles or balls that you will **test**, and rows for each of the surfaces you will test.

c Write down your predictions for all the surfaces you are testing.

3 **Carry out your test.**

4 **Look at the results and compare the times taken.**

5 **Look for patterns in the results.**

a What conclusion can you make about the surfaces and the frictional force they produce based on the pattern of results?

b Discuss these things with your group and come to your conclusions.

Continue over the page

6 **Share your results and conclusions with the class.**

Is it easier to ride a bicycle on a smooth road or on a rough road?
Is it easier to ride a bicycle on a hard road or on a soft road?

Does a car move forward more easily on sand or on a tarred road?
Which surface slows down a car more – a rough one or a smooth one?

Discuss these questions in a group, using the knowledge of friction that you gained from the slope activity. Share your answers with the class and give explanations of what you think.

Friction can be a very useful force, because we can use it to slow down or stop our bicycle, a car, and even our own bodies. Tyres, made of rubber, have rough surfaces (called the 'tread') that increases the *contact* of the tyres with the road surface. This helps the car, bicycle or other vehicle to get a better 'grip' on the road – in other words the force of friction is increased. This is important when the wheels begin to turn as the movement starts. Without friction, the wheels would just slip and spin, and the vehicle would not move. Some of our shoes use the same approach to give our feet a good grip on the ground. This is very important in sports where we have to move and change direction very quickly.

When a vehicle has to slow down or stop, the brakes apply a force on the wheels. The brake blocks are made of a material that produces a large frictional force, so that they do not slip on the wheels. Rubber is one such material and it is used in bicycle brakes.

The vehicle stops because the force of friction in the brakes and the tyres on the road, works against the forward movement of the vehicle (friction opposes the movement).

When surfaces are wet, icy or very smooth, the friction is reduced and then it is harder to start moving and harder to stop!

Activity 5: Discuss the effect of speed on stopping

You will need: paper (or your Workbook) and a pen or pencil.

1 **Discuss this question with your group:**

'Why is it harder to stop a fast-moving car than a slow-moving car?'

a Explain your answer using what you know about the forces involved.

b Write down your group's ideas.

2 **Discuss this question with your group:**

'What can be done to improve road safety, using your knowledge of forces?'

a Write down your group's ideas,

b Explain how they will improve safety.

3 **Share your group's ideas and explanations with the class.**

Activity 6

You will need: dry soil, some sort of oil, paper (or your Workbook) and a pen or pencil.

1 Rub your thumb and forefinger together. Write a note describing how it feels – use words like rough, slippery, sticky.

2 Now rub some dry soil between your thumb and forefinger. Write a sentence describing how it feels, compared to rubbing your clean fingers.

3 Wash and dry your hands, and then dip your thumb and forefinger into the oil.

a Rub them together as before.

b Write a sentence describing how it feels, compared to the other times you did it.

4 Discuss the results with your group and answer these questions:

- When did you feel most friction?
- When did you feel least friction?
- How was friction reduced?
- Is this useful in daily life?

5 Share the group's answers with the class.

The objects in the photographs all have moving parts. Friction is a force that must be overcome to allow the parts to move.

What can be done to all of them to reduce the friction?

You discovered that dirt increased the friction and oil reduced the friction between your fingers when they were rubbed together. If dry metal surfaces rub together, they scrape tiny pieces off one another. The surfaces become rough and gradually wear away. When the surfaces are moving at high speed, as in car engines, this can do terrible damage.

Oil is used as a **lubricant**. It makes the surfaces slippery so they can move over one another easily and smoothly, with as little friction as possible. Oil allows machines to do their work more efficiently, without wasting energy overcoming large frictional forces. It also reduces the wearing away of the moving parts.

Activity 7: Showing how to reduce friction

You will need: paper (or your Workbook) and a pen or pencil.

Choose one of the methods of reducing friction shown in the pictures on page 103. Then:

1 Collect the items and materials you need to demonstrate your chosen way of reducing friction:

- **a** *rollers* – pencils or other rods, stalks or branches; a load to pull, with and without rollers
- **b** *wheels* – materials to make a vehicle, with and without wheels
- **c** *ice* – cubes of ice and a variety of items/materials to test them on
- **d** *ball bearings* – marbles, the lid of a jar or tin, a load to pull, with and without ball bearings
- **e** *polish* – a surface and a load that can be tested unpolished and polished
- **f** *streamlined shape* – paper or wood or plastic that can be made into a plane or boat shape, with and without streamlining

2 Discuss with your group how you will show that your chosen method does reduce friction. To prove that it does, you will have to compare two measurements:

- **a** *without* the rollers, ball bearings, etc.
- **b** *with* the rollers, ball bearings, etc.

3 Decide what you will measure – time, distance or mass of the load.

4 **Prepare a plan and a record sheet in which you will write the measurements.**

Remember to make it a fair test.

5 **Show the plan and record sheet to your teacher before you begin the investigation.**

6 **When the teacher allows you to begin, start the investigation *without* the friction-reducing method.**

- **a** Carry out your chosen measurements.
- **b** Record them on the record sheet.

7 **Repeat each measurement at least three times. Then calculate and write down the mean.**

8 **Introduce your method of reducing friction (e.g. streamline your plane or boat, polish the load and the surface).**

- **a** Repeat the same test as before and take at least three sets of measurements, recording them on the record sheet.
- **b** Calculate and write down the mean.

9 **Compare the two sets of measurements – *without* and *with* the friction-reducing method.**

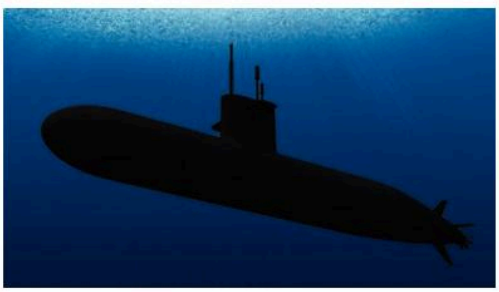
10 **Discuss with your group what the results tell you.**

- **a** Come to a conclusion – was friction reduced or not?
- **b** Share your results and conclusion with the class.







All the objects in the pictures above have been streamlined so that they move as smoothly and as quickly as possible through air or water. Friction – usually called **drag** when one of the surfaces in contact with the object is a fluid (gas or liquid), rather than another solid surface – is produced as an object moves through them. You know this if you swim – it is much harder to move through water than it is through air. If you are a good swimmer, you know how to keep your body in the best shape for 'cutting through' the water and so you can be faster than your friends.

Streamlining makes the object as smooth as possible and shapes the front and back in ways that reduce the drag of the air or the water.

Energy and movement

Energy is what makes things happen. It is the ability to do work and to produce activity.

(a)

(b)

(c)

(d)

(e)

(f)

(g)

(h)

Activity 8

You will need: paper (or your Workbook) and a pen or pencil.

1. Look at the pictures on page 107 and work out what the energy is being used for in each activity.

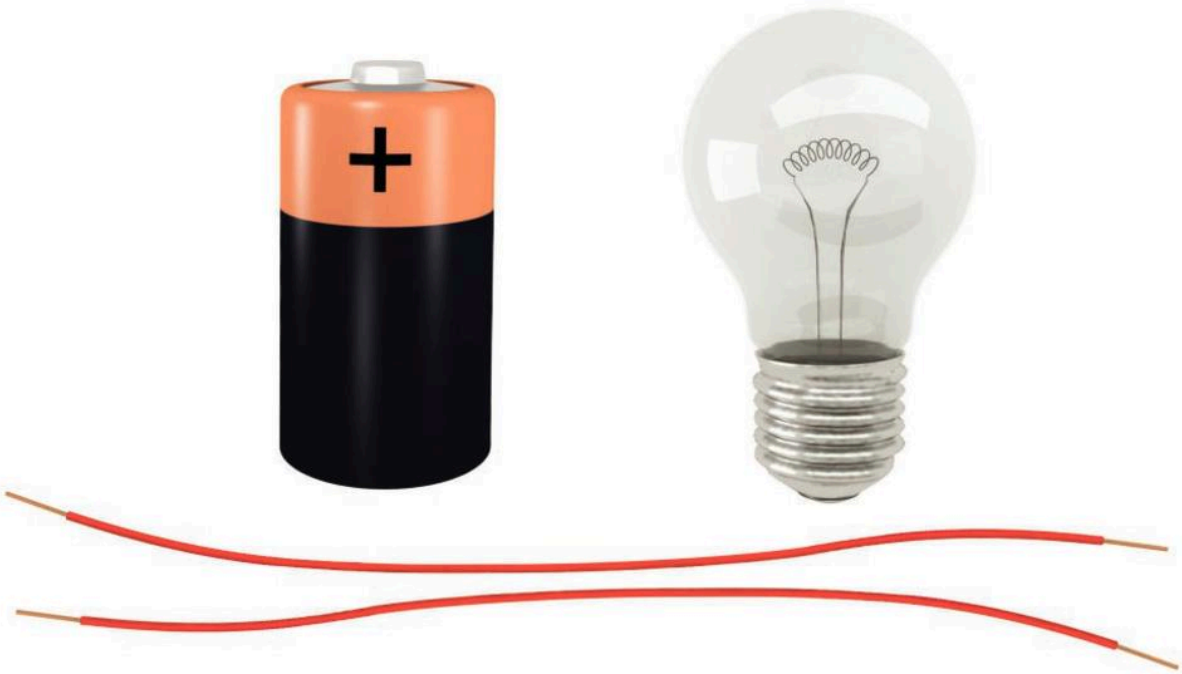
2. Share your ideas with the group. What is the same about each activity?

3. Tell the class what you think.

All the objects shown in the pictures are examples of energy being used to produce movement. There would be no movement if the input of energy stopped. The energy is provided by food or fuels and is transmitted through muscles or machinery. This results in the movement of part, or all, of the object.

Electrical conductors

Think back to Stage 2, where you first learnt about **circuits**. Look at the pictures of the items here. Can you identify each one?



Activity 1

You will need: a cell, a lamp, two insulated wires with their bare ends showing, paper (or your Workbook) and a pen or pencil.

1 **Collect the items shown in the picture.**

2 **Try to arrange the four things so that the lamp lights up.**

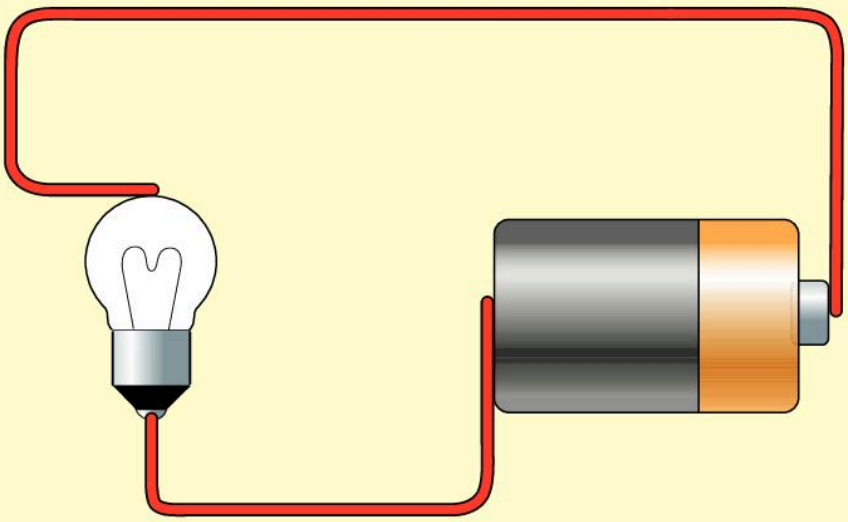
a Change the way you arrange them.

b Record in simple drawings all those ways that make the lamp light up.

Continue over the page

3 **Be careful to show which places on the cell and lamp are touching the wires.**

a Try the arrangement in the picture below:



b Does it make the lamp light up?

4 **Share your results with the class.**

Electricity does not flow through all materials.
Only some are good **conductors** of electricity.

Others block the movement of the electrical charges.
These materials are electrical **insulators**.

This information should have helped you to light the lamp. The different parts of the cell, wires and lamp are made of different materials. To light the lamp the current has to flow from the cell and through the lamp. So all the materials connected together must be ... what?

Tell the class what you think.

When the current was able to flow, it moved through the circuit. A circuit is a complete circle that provides a pathway for the electricity to flow out from the cell, through the wires and lamp and back to the cell. The **filament** of the lamp was heated as the current flowed through it. Light was given off from the heated filament: the lamp 'lit up'.

When the lamp did *not* light up, this told you that you had *not* made a complete circuit.

- This might have been because there was a gap that the electricity could not get across.
- Or it might have been because the current was blocked by a material that was an insulator.

Conductors and insulators

You can use this understanding of circuits to test for conductors and insulators.

Activity 2: Which materials are conductors and which are insulators?

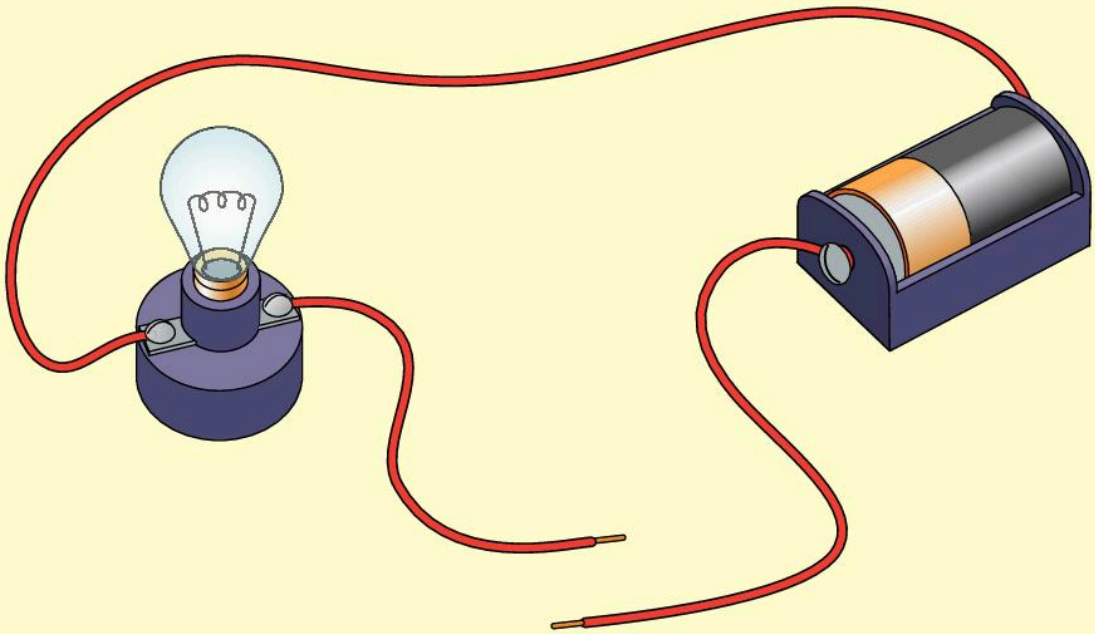
You will need: 10 items made of different materials, a lamp and holder, a cell and holder, three insulated wires, paper (or your Workbook) and a pen or pencil.

1 Collect at least 10 items made of different materials. You can use this list to help you.

wooden ruler	**coin**	**rubber**	**nail**	**glass jar**
plastic ruler	**ballpoint pen**		**teaspoon**	**paper**

Some must be made of metal. Try to find at least three *different* metals.

2 Use a lamp in a holder and cell in a holder and three wires to make a circuit with a gap. Use the picture to help you.



3 **Think about the following questions.**

a How will you use the circuit to test the items?

b How will you know if the material is a conductor or an insulator?

Tell your group what you think.

4 **Draw a table like this one in your exercise book (or Workbook). Record what you find for each item that you test. Put a tick in the conductor or insulator columns for each item.**

Item	Conductor	Insulator
coin		
paper		
rubber		

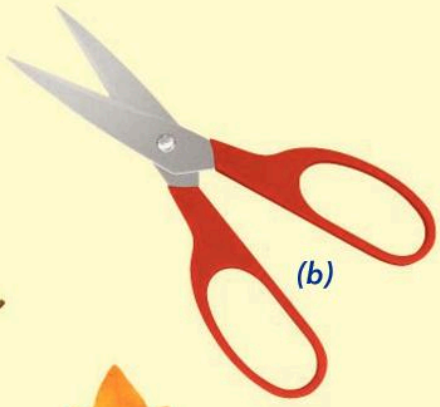
5 **Discuss your results with your group.**

a What is common about all the conductors?

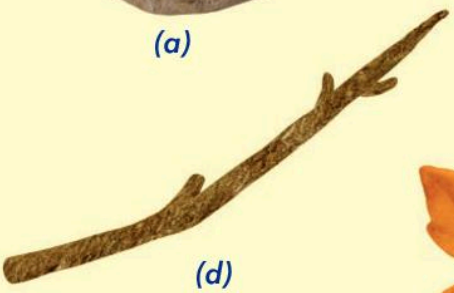
b Share your results with the class.

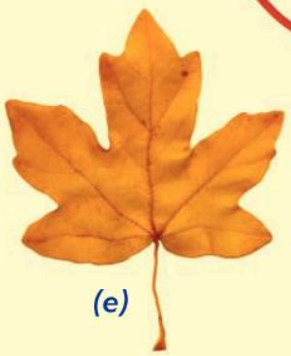
Continue over the page


(a)


(b)


(c)


(d)


(e)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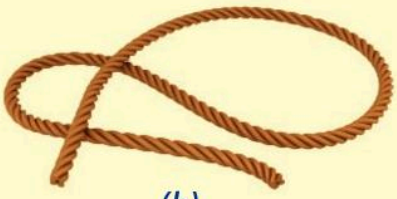

(h)


(i)


(j)


(k)


(l)

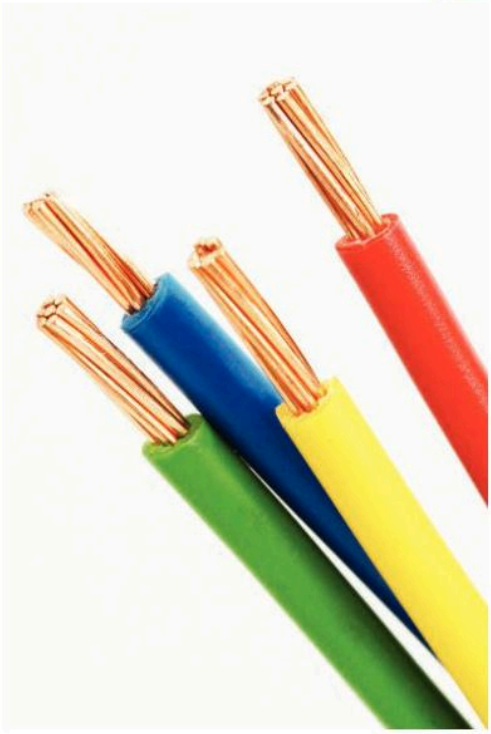
6 **Sort the things shown in the picture into two groups, using the letters beside them to record your groups:**

- the group of those that *allow* current to flow through them (the _____)
- the group of those that *block* the flow of current through them (the _____)

7 **Share your answers with the class.**

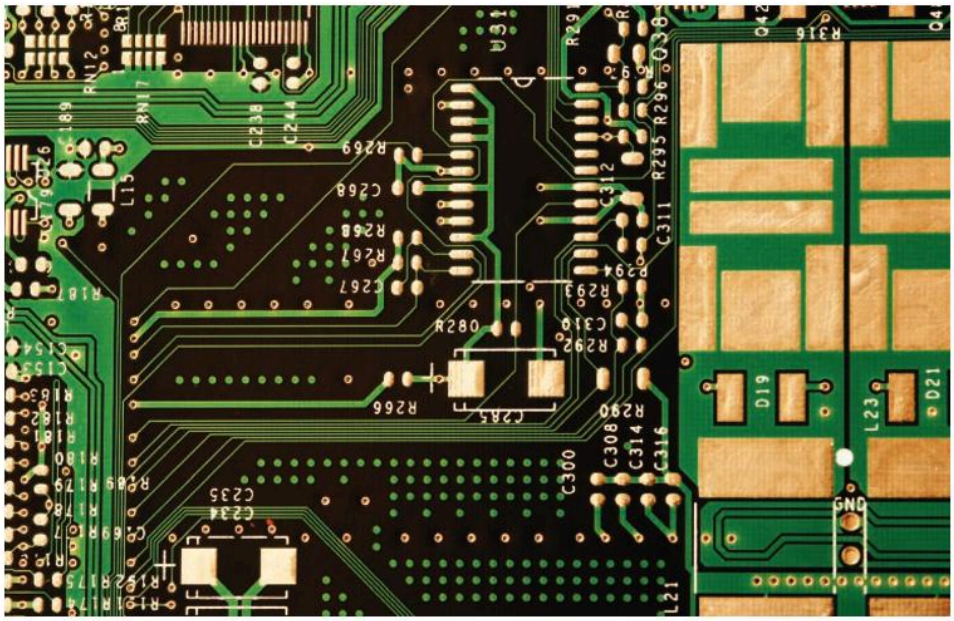
Metals – why they are used

Metals are all conductors. That is why metal wires are used to carry the current from one place to another. That is why plugs and many other electrical items have metal parts.



Copper and aluminium are two metals that are *very good* conductors. They are commonly used as wires and cables.

The metal tungsten is used to make filaments in lamps, because it can be heated to a very high temperature without melting. When it is very hot it gives off a bright light.



Plastics – why they are used

Plastics, wood, glass, rubber and many other materials are insulators. Plastics are often used to make electrical items safe to handle, such as covering wires, casings for plugs and the bodies of electrical appliances such as irons, heaters and kettles.

Plastics are easy to mould into shape, do not react with water or the air, are cheap, waterproof and widely available, so they are an obvious choice for providing safe insulation.

Changes to circuits

You might have noticed that the brightness of the lamp was not always the same when you tested for conductors and insulators in Activity 2.

Different conductors produced different effects on the lamp's brightness.

In this final investigation, you will use a fair test to find out more about what effects you can produce by changing what you put in your circuit.

Activity 3: Investigate what happens when you make changes to a circuit

You will need: a range of components for you to choose from, including: cells, lamps, wires of different lengths and thicknesses, switches, buzzers, motors; paper (or your Workbook) and pen or pencil.

1 Choose to investigate:

a What happens when you change the *number* of a particular component in the circuit, e.g. lamps or cells.

OR

b What happens when you change the *type* of components in the circuit, e.g. changing from buzzers to motors.

OR

c What happens when you change the *size* of components in the circuit, e.g. short wires to long wires, thin wires to thick wires.

OR

d What happens when you try a combination of all three changes.

Continue over the page

2 **Discuss your choice with your group.**

a Plan a fair test to find out what effects the changes produce.

b Decide what observation you will make to assess the outcome (the effect) of the change each time.

> **Remember** the value of repeated observations.

c Prepare some form of record for your results.

3 **When the planning is complete, show it to your teacher and, when it has been agreed, collect the components you need for your investigation.**

4 **Before each change, write down your prediction of what effect the change will have.**

5 **Carry out the testing in a fair way.**

a Do everything the same each time, and making only ONE change at a time.

b Record the outcome each time, before making the next change in the circuit.

6 **When all the changes have been made, look at your results and do four things:**

- **a** Compare the results with your predictions – were they supported by the evidence of your observations?
- **b** Look for patterns in the results – was there any pattern and were there any results that seem 'odd'?
- **c** Use your results to draw conclusions.
- **d** Use your scientific knowledge and understanding of circuits to explain what you observed.

7 **Share your results, conclusions and explanations with the class.**

The flow of electrical current (electricity) through any material is more or less resisted. This **electrical resistance** is very high in some materials and prevents almost all movement of the current. These materials are electrical insulators.

Other materials, such as the metals, offer very little resistance to the flow of current. These materials are electrical conductors.

Any component included in a circuit will resist the current to some extent. So, the *more* components there are, the greater the resistance and the smaller the current flowing through the circuit.

Some *types* of component resist the current more than others – a motor has a higher resistance than a lamp, for instance.

The *size* of components also has an effect on the resistance they have. The thickness of wires affects the amount of resistance. The length of wires also has the same effect. Using your class investigation of changing circuits, try to answer the following questions:

Which is more resistant, a thin wire or a thick wire? Why?

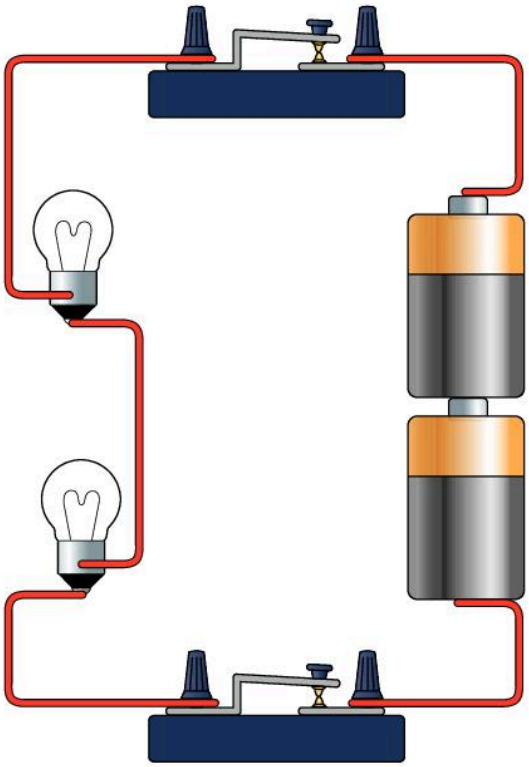
Which is more resistant, a long wire or a short wire? Why?

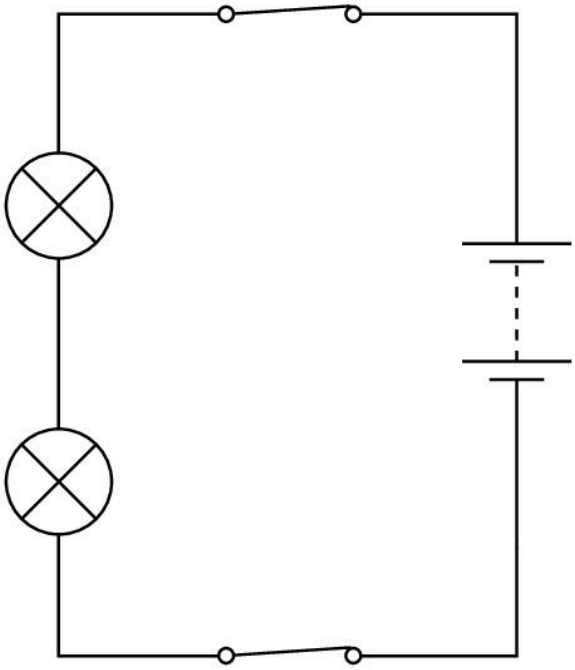
Dimmer switches use resistance to control the flow of current

- The thinner the wire, the greater the resistance and the smaller the flow of current.
- The longer the wire, the greater the resistance and the smaller the flow of current.

Series circuits – drawings and symbols

A set of **symbols** has been made up to represent the components of circuits, which are clearer and easier to use when recording circuits.





Activity 4

You will need: paper (or your Workbook) and a pen or pencil.

1 Look at the drawing and the diagram of the same **series circuit**. Compare them.

2 Match the symbols in the diagram to the items in the drawing.

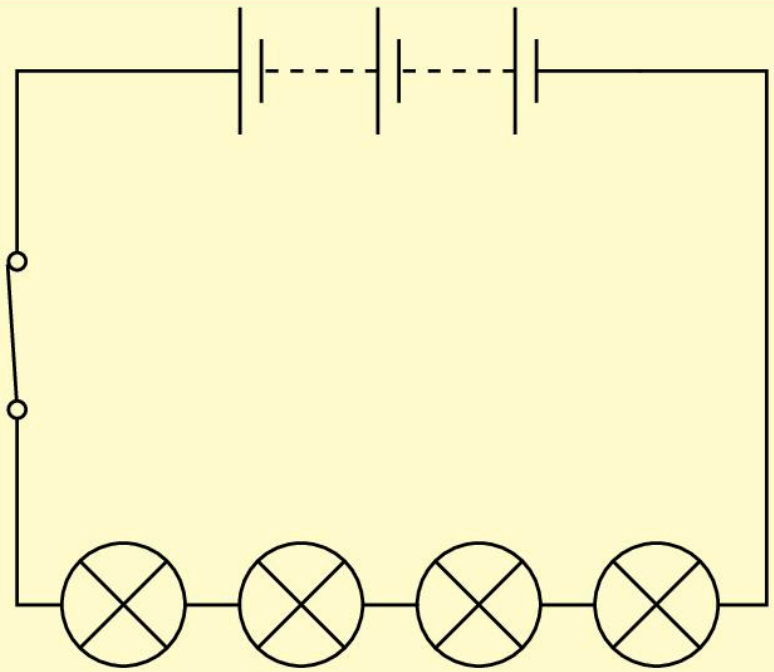
Continue over the page

3 Use the symbols to draw a *diagram* of a series circuit with three lamps, three switches and two cells.

4 Share your diagrams with the class.

Activity 5

You will need: various electrical components from the collection in class, paper (or your Workbook) and a pen or pencil.



1 Look at the diagram shown above and work out what the components are.

2 Use the diagram to build the circuit using the components you have in class.

3 When the circuit is complete, make a drawing of it.

a Show the circuit and the drawing to the class.

b Look at the circuits and drawings made by others.

Glossary

A

acid rain – rain that has been made into a weak acid through chemicals contained in smoke.

air resistance – a form of friction that is produced when an object moves through the air, slowing down its movement, e.g. an aircraft.

anus – the hole at the lower end of the gut, through which the faeces pass out of the body.

artery/ies – blood vessels (tubes) that take blood from the heart to all parts of the body.

B

bile – a liquid made in the liver, stored in the gall bladder and added to food in the intestine; it helps in the digestion of fats.

bilharzia – a tropical disease caused by a parasite that lives in water snails and enters the blood through the skin. Passed on in urine.

bladder – the elastic bag in which urine is collected before being released from the body.

blood vessels – tubes along which blood travels to and from all parts of the body, such as arteries, veins and capillaries.

body system – body parts that are related to one another by their function, e.g. the oesophagus, stomach, liver, rectum are all part of the digestive system.

brain – the organ that responds to, remembers and is aware of the environment outside and inside the body. The organ of control, learning and personal expression.

C

cadmium – a poisonous metal that is used in various industries. It can be found in polluted land where factories used to be.

capillary/ies – the smallest tubes that carry blood between the cells.

carbohydrates – nutrients in the diet needed for energy, e.g. sugars, starch.

carbon dioxide – a gas in the air, used by plants to make food. We make the gas in our bodies and breathe it out.

Glossary

carnivore – a consumer that feeds on other animals, e.g. cat, tiger, snake.

central nervous system (CNS) – the brain and spinal cord.

CFCs (chlorofluorocarbons) – chemicals used in refrigerators, aerosols, cleaning fluids and plastics. They damage the ozone layer and are banned in some countries.

chemical change – a change in materials which produces new materials, e.g. burning candle.

cholera – a serious disease of the digestive system that is spread in polluted water.

circuit (electrical) – a complete circular route around which electricity can flow.

circulatory system – the heart, vessels and blood, which distribute food, hormones and oxygen and remove waste products from the body's cells.

colon – the first part of the large intestine, where water is removed from the remains of the digested food.

community – all the populations of living things which share a habitat.

compare – to look for differences and similarities in two or more things or events.

conductor (electrical) – a material through which electrical energy (electricity) is transferred or flows.

conservation – the process of keeping safe, saving or preventing loss.

consumer – an animal that eats plants or other animals, or both, as food.

D

dialysis – a treatment for a person with kidney failure, which passes their blood through a machine to remove poisonous wastes, e.g. urea.

digestion – the process of breaking food into small, soluble substances (nutrients) that can be absorbed by the body.

digestive system – the stomach and other parts inside the body which turn food into useful substances (nutrients) needed by the body.

Glossary

disposal – getting rid of.

dissolve – the action of a solute mixing with a solvent to produce a solution.

domesticated – tame animals kept on farms, or as pets.

drag – another name for the force of friction used when liquids or gases are involved.

E

effervescence – the production of gas bubbles during a chemical reaction.

eggs (ova) – the female sex cells made in the ovaries.

electrical resistance – the resistance of a material to the flow of an electric current passing through it.

energy – the ability to do work. It is needed to make things happen.

environment – the physical surroundings, including the weather.

enzymes – chemicals made by the body to digest certain foods.

evidence – facts, information, proof, clues or data that helps us to work something out.

excretion – the process of getting rid of waste products from the body, e.g. sweating, urination, breathing out.

excretory system – organs (e.g. kidneys, skin) that remove waste products from the body.

explain/explanation – telling why something is like it is; giving a reason for something.

extinct – no longer existing, wiped out.

F

faeces – the solid waste left over after digestion of food, which passes out of the body through the anus.

fair test – a test of an idea in which everything is kept the same except the one thing you are testing.

fats – nutrients used by the body to provide energy – contained in plant oils and animal fats. Contain carbon, oxygen and hydrogen.

fertilise – to combine the sperm and the egg; the egg is fertilised by the sperm.

Glossary

filament – the thin wire in a lamp that gets hot and makes light.

filtering – passing a mixture of solid and liquid through some material (e.g. paper, fabric) to separate the solid from the liquid.

food chain – the sequence of plants and animals that eat or are eaten for food. Each food chain starts with plants.

force – a push or a pull.

friction – a force that resists movement when two surfaces (solid, liquid or gas) are touching.

function – a job, a purpose, a use, work done by something.

G

gaseous exchange – a process that occurs in the lungs, when oxygen is absorbed into the blood and carbon dioxide is removed from it.

global warming – the heating up of the Earth as a result of carbon dioxide and other gases being produced by burning fuels.

gram (g) – a unit of measurement for mass (1 kg = 1000 g).

gravity – the pulling force exerted by a large mass such as the Sun, Earth and other planets.

H

habitat – the environment in which an animal or plant normally lives.

heart – the organ that pumps blood round the body, through the blood vessels. Part of the circulatory system.

herbivore – a consumer that feeds on plants, e.g. caterpillar, cow.

hormones – chemicals made by various glands in the body. They control body processes, e.g. sexual development.

I

insoluble – cannot dissolve, cannot be turned into a solution.

insulator (electrical) – a material that blocks the flow of an electrical current, e.g. plastics, wood.

Glossary

intestine – the part of the digestive system where most of the processes of digestion and absorption take place.

investigate/investigation – a search for evidence to answer a question.

irreversible – cannot be changed back to how it was, e.g. burning.

K

kidneys – a pair of organs in the abdomen which remove waste products from the blood and pass them on in urine to the bladder. Part of the excretory system.

kilogram (kg) – a unit of measurement for mass (1000 grams = 1 kg).

L

liver – a large organ above the stomach, which has many functions, e.g. processing, control and storage of nutrients, handling some waste products. Part of the digestive system.

lubricant – a material that is used to reduce friction in moving parts, e.g. oil, grease.

lungs – a pair of organs in the chest, used to pull air (including oxygen) into the body and to push out the waste gas carbon dioxide, made by the body. Part of the respiratory system.

M

mass – the amount of matter in an object.

mixture – two or more materials mixed together. There is no reaction between them.

muscles – body tissue that can contract and relax. Bundles of this tissue are attached to bones and produce movement. Muscles are also vital parts of other organs e.g. heart, stomach, anus, eyeball.

N

nerves – part of the nervous system that carry messages from the sense organs and other body parts to the brain and from the brain to all parts of the body.

nervous system – the organs which provide the body with sensitivity and control – brain, spinal cord, nerves and sense organs.

Glossary

Newton (N) – the unit of force (including weight).

nutrient – substance in food needed by the body for various processes, e.g. growth, control of body temperature, protection.

O

observe/observation – notice when paying careful attention (see, smell, hear, touch, taste).

omnivore – a consumer that feeds on plants and animals, e.g. humans.

organ – a part of an animal or plant that has a particular function, e.g. brain, flower, liver, skin.

ovary/ies – sexual organs in females that produce the female sex cells – ova (eggs).

oxygen – a gas in the air, used by all living organisms for respiration and in burning.

ozone layer – a layer of ozone gas (a type of oxygen) high up in the atmosphere that protects living things on Earth from the Sun's very dangerous ultraviolet radiation.

P

pancreas – an organ in the digestive system that makes enzymes and hormones.

penis – the male reproductive organ. It is also for urination.

pesticides – chemicals used to kill insects, weeds, fungi or other pests.

photosynthesis – the process in the green parts of plants that makes food from carbon dioxide, water and light.

plasma – the liquid part of the blood in which all the solid parts are suspended.

platelets – small particles in the blood that help it to clot when the body is wounded.

poaching – hunting and killing animals that belong to others or are protected by law, e.g. in nature reserves, game parks.

pollution – the spoiling or damaging of the environment by harmful wastes.

population – all the individuals of one type of plant or animal living in a habitat.

predator – an animal that kills other animals for food.

Glossary

predict/prediction – telling what will happen before doing something.

pregnancy – the process of making a new human being (or other animal) – from conception to birth.

prey – animals that are killed and eaten by other animals, e.g. mice.

producer – a plant, which produces its own food through photosynthesis.

proteins – nutrients needed for growth, repair and many basic body functions.

puberty – the period in the human life cycle when the reproductive system begins to function, i.e. eggs and sperm are first produced.

R

react – *(chemical)* to change at least one material into another.

record – writing, photos or drawings of what was done or what happened.

rectum – the last part of the digestive system, where faeces collect before being pushed out through the anus.

recycling – using materials again, rather than throwing them away as waste.

red blood cells – most cells in the blood, which carry oxygen to all the cells of the body.

reduction – making less, smaller.

reproduction – the process in living things that produces new individuals.

reproductive system – the sexual organs, used to produce new individuals.

respiratory system – the organs that supply the body with oxygen and expel the waste gas, carbon dioxide (the nose, mouth, windpipe and lungs).

response – a reaction to a stimulus.

results – observations of all kinds, including measurements, collected during an investigation.

reversible – can be changed back to how it was, e.g. freezing/melting.

S

saliva – a digestive juice made in the mouth, which helps with swallowing food and starts the process of digesting starch.

Glossary

scrotum – a bag of skin between the legs of boys and men which contains the testes (testicles).

sense organs – the body parts that have the senses: eyes, ears, nose, tongue, skin.

sensor – a nerve ending that is sensitive to a particular kind of stimulus such as light, heat, pressure, e.g. cells in the retina of the eyes.

series circuit – a circuit with only one pathway for the electricity.

sewage – the solid and liquid human wastes (faeces and urine) that people get rid of in the toilet.

sieve – a device (usually metal or plastic) covered with a mesh full of holes, all the same size. Different sieves have holes of different sizes.

sieving – a form of filtering, used to separate solids from liquids, or solid pieces of different sizes from one another, e.g. sand and stones.

skeletal system – the bones, cartilage and ligaments that make up the skeleton, giving the body its framework.

skin – the outer covering of the body. It has several functions, including excretion and control of body temperature through sweating.

small intestine – part of the digestive system in the form of a long tube with a large surface area where foods are digested and nutrients are absorbed into the bloodstream.

solubility – a measure of how easy it is for a material to dissolve in a solvent to form a solution.

soluble – can be dissolved in a solute and turned into a solution.

solute – the material that dissolves in the solvent to form a solution, e.g. salt.

solution – a mixture of a liquid solvent and a solid solute. The solute dissolves into the solvent.

Glossary

solvent – the liquid into which the solute dissolves to form a solution, e.g. water.

species – a type of animal or plant which is alike to all others of the same species and can reproduce with members of that group/species.

sperm – the male sex cells made in the testes (testicles).

spinal cord – a continuation of the brain inside the spinal column/spine/backbone.

stimulus/stimuli – something to which the senses react, e.g. light, sound.

stomach – a large elastic organ into which food and drink pass when swallowed. Digestion, storage and mixing of the food take place in it. Part of the digestive system.

streamlined – shaped for speed and ease of movement, reducing friction/drag; used in ship, car and aircraft design.

sugars – substances made by plants from carbon, oxygen and hydrogen; products of photosynthesis.

sustainable development – using the natural environment in ways that do not destroy its resources, e.g. soil, water, air, living organisms.

sweat – salty liquid excreted by the skin, which evaporates and cools the body.

symbol – (*electrical*) signs used to represent components of circuits (e.g. switch, cell, lamp).

system – parts that are all related to one another by their function, e.g. the oesophagus, stomach, intestine, liver and rectum are all parts of the digestive system.

T

test – something done to find out if an idea is true or not.

testes/testicles – the pair of sexual organs in males that make the male sex cells (sperm). In humans they are housed in the scrotum.

toxic – poisonous.

U

ultraviolet radiation – an invisible, very dangerous form of radiation that is part of sunlight and is partially blocked by the ozone layer.

upthrust – an upward force of water (and other liquids), pushing objects up.

urea – a waste product produced by the kidneys that is disposed of in the urine.

ureter – the tube that carries urine from the kidney to the bladder.

urine – a pale yellow liquid excreted by the kidneys to remove waste products from the body.

uterus (womb) – the organ in female humans and other mammals where the baby grows and develops before birth. Part of the reproductive system.

V

vagina – the tube that connects the uterus to the vulva in female humans and other mammals. Part of the reproductive system.

vein – a blood vessel (tube) which carries blood from all parts of the body back to the heart and the lungs.

voluntary action – an action of the body over which we have control through thought and choice.

vulva – the external sexual organ in female humans and other animals, situated between the legs; the opening to the vagina.

W

weight – a force caused by gravity pulling on the mass of the material/object.

white blood cells – a solid part of the blood that defends the body by attacking germs.

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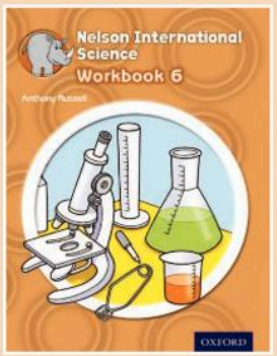

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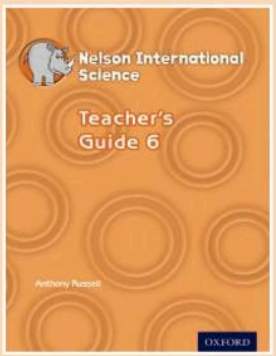

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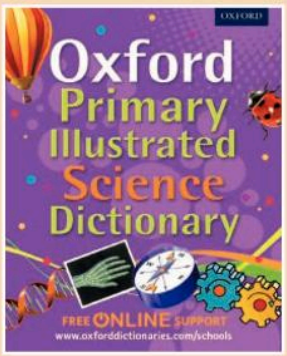

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