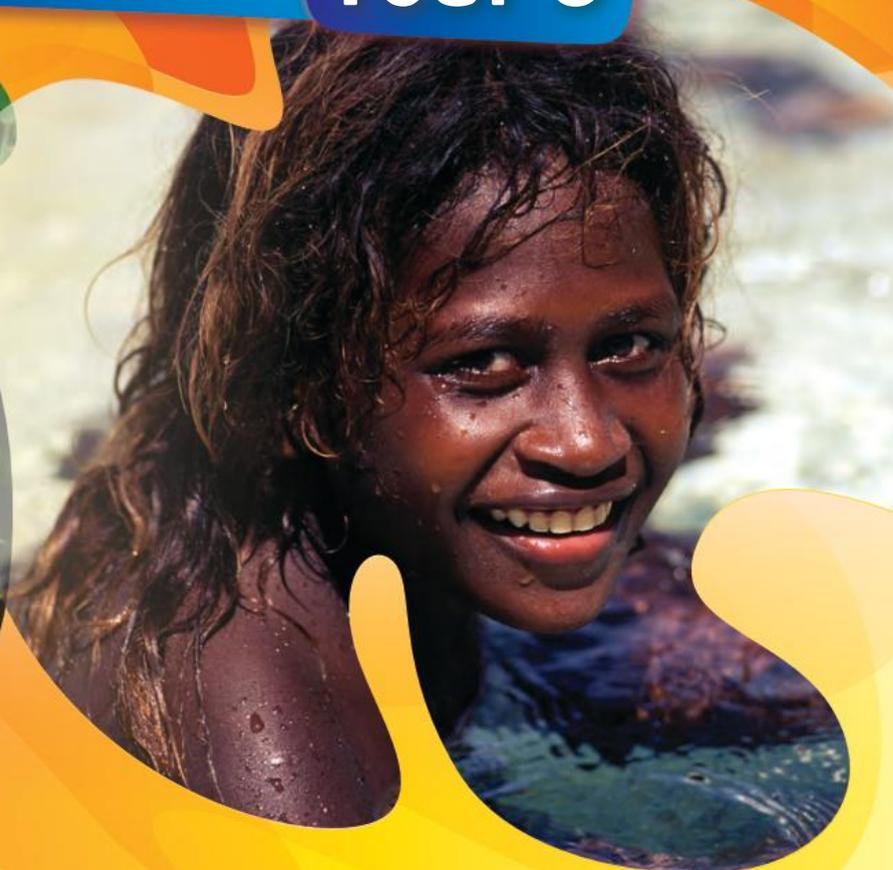


Solomon Islands

Primary Science

LEARNER'S BOOK **Year 5**



Solomon Islands

Primary Science

LEARNER'S BOOK

Year 5

Pearson Australia

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Plant world

In this chapter, you will:

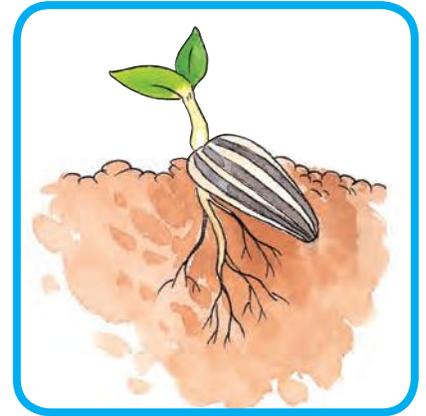
- understand that plants have systems and parts (roots, a stem, leaves, flowers and fruits)
- learn the parts of plants where photosynthesis takes place
- understand that to photosynthesise, plants need water, light energy and carbon dioxide
- learn that photosynthesis in the leaves of green plants produces sugar, oxygen and water
- understand that plants get their energy from the food they make through respiration
- learn that respiration uses the substances that photosynthesis gives off
- understand that food produced by plants becomes the source of energy for animals
- learn that green plants are producers of food.

Plant parts and their functions

Flowering plants have parts such as roots, a stem, leaves, flowers and fruits.

The root system

The root system of a plant is the part that is below ground. When we observe a seed growing, the first part that grows is the root system. Different plants have different root systems.

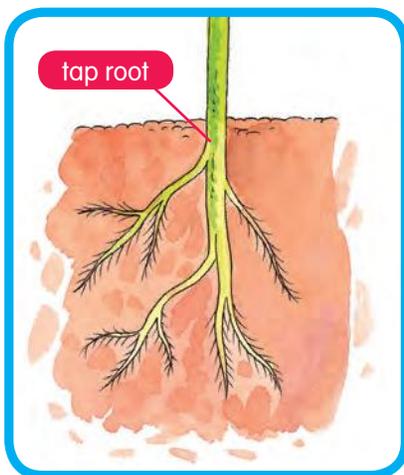


Activity 1

- 1 Find a sunflower plant and a grass plant. Carefully pull them from the ground, so that the root system is not broken.
- 2 Wash the root systems and lay them side by side.
- 3 Compare the roots of the sunflower and the grass plants.

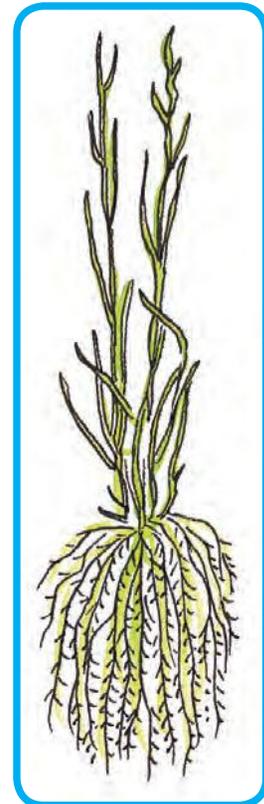
Roots of the sunflower

Sunflowers have a thick main root. This is called the “tap root”. The tap root is the plant’s longest and thickest root. Other smaller roots grow out from the tap root. Still more roots grow from these smaller roots. Examples of plants with tap roots are bean, sunflower, pawpaw and frangipani.



Roots of the grass plant

Grass plants do not have a main root. They have a cluster of thin roots of about equal size. Other smaller roots grow from these roots. This is called a “fibrous root system”. **Fibrous roots** branch throughout a large area of soil. Examples of plants with a fibrous root system are grass and rice.



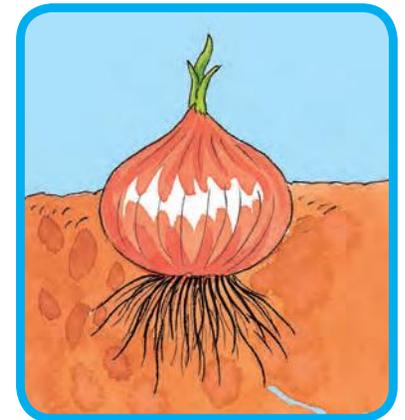
Fibrous root system

Activity 2

- 1 Carefully pull an onion plant from the ground.
- 2 Wash the root system.
- 3 Describe the shape of the root system.
- 4 Think about the root systems of the onion, the sunflower and the grass plant. What differences do you observe?

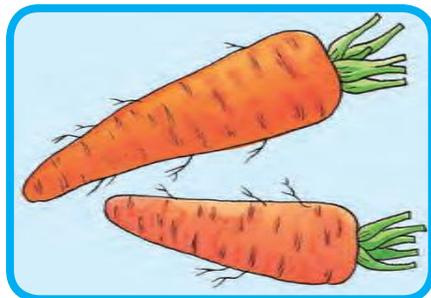
Roots of the onion plant

Onions are examples of plants with “**adventitious roots**”. Adventitious roots are roots that grow directly from the stem. They do not grow from a main root. Other examples of plants with adventitious roots are money plant, bryophyllum, African violet, rose, sugar cane, water chestnut and ginger.

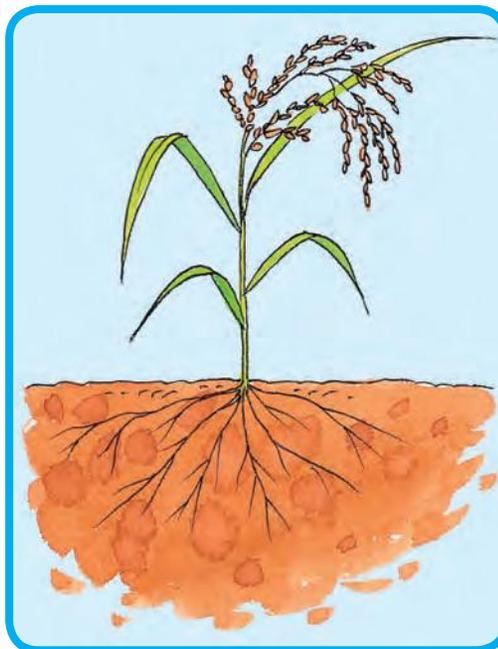


What do roots do?

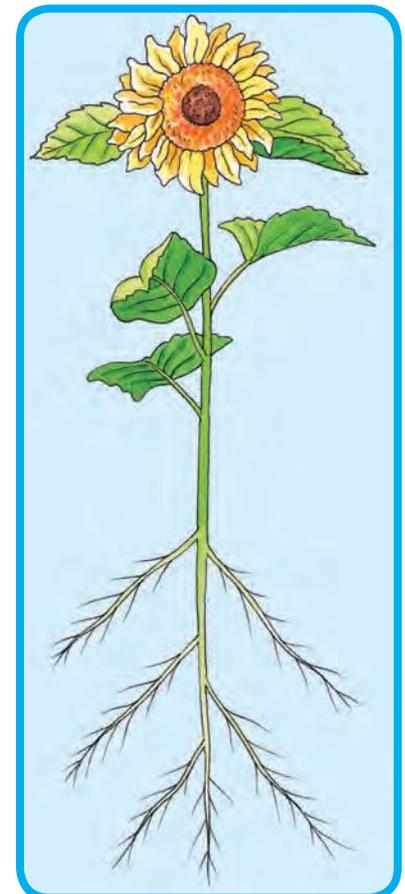
- Roots hold or anchor the plant firmly to the soil. The long, thick, tough tap roots are good at anchoring. Fibrous roots are good at holding soil in place.
- Roots take up **water** and mineral salts from the soil by the root hairs and pass them to the stem. Tap roots can reach further down into the soil. Fibrous roots can reach a wider area than tap roots.
- Roots store food. Plants, such as the carrot plant, store their food in the roots.



Food stored in roots



Fibrous roots reach a wider area.



Long, thick, tough tap root

Sometimes roots are modified to perform special jobs.

Storage roots

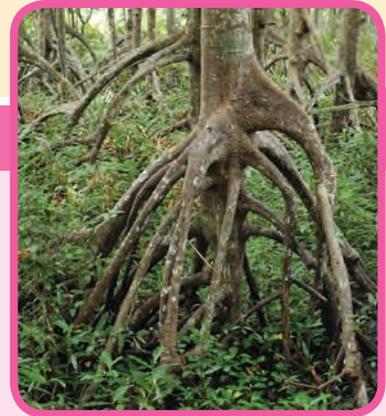


Yam

- Storage roots are swollen roots. Food and water are stored here.
- Carrot, kumara and cassava are examples of plants with storage roots.

Breathing or respiratory roots

Breathing roots take in **air**. These roots grow upwards vertically from the underground roots. They rise above the ground. These roots are spongy and can breathe in air. Mangrove plants have breathing roots.



Mangrove tree

Clasping roots



Money plant

Clasping roots grow from the stem of the plant. These roots help the plant to attach itself firmly to a support like a wall or a stick. The money plant, vanilla and creeping orchid beans are examples of plants with clasping roots.

Prop roots

Prop roots grow from the stem or branches. They are above the ground. These additional roots grow into the soil to provide extra support for the plant. Maize plants and banyan trees have prop roots. They anchor the plants or trees firmly in the ground.



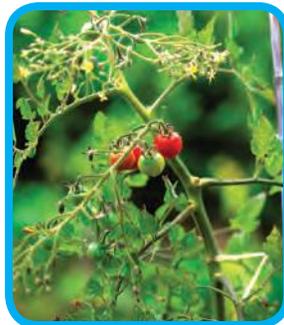
Banyan tree

Activity 3

- 1 Look for examples of soft-stemmed growing plants. Try to find plants that have flowers and fruits.
- 2 Identify the parts of the plant that are above the ground. How many different parts do you observe?
- 3 Draw a picture of the plant you observed.

The shoot system

Stems, leaves, buds, flowers and fruits make up the **shoot system** of a flowering plant.



Stems

Tomato plant



Frangipani

The stem is the part of the plant that is usually upright. It is above ground. It develops from the shoot in the seed after the root has grown. The stem bears the leaves, buds, flowers and fruits of the plant.

What do stems do?

Stems support the stem system

Stems have a tough, firm structure. They support the parts of the shoot system. Stems hold the leaves so that they get as much sunlight as possible for photosynthesis. Plants with weak stems climb or twine around sticks or the trunks of trees. This helps to give their leaves as much sunlight as possible. Stems hold flowers upright so that the pollen grains reach the female part of the flower. Stems also hold the fruit.

Some stems are fleshy and green. These are **herbaceous stems**. Herbaceous stems may be upright (banana, pawpaw, sunflower). Other herbaceous stems are so weak that they need to climb or twine around supports (like the passion plant, cucumber, or snake bean) or creep along the ground (the kumara, or pumpkin).



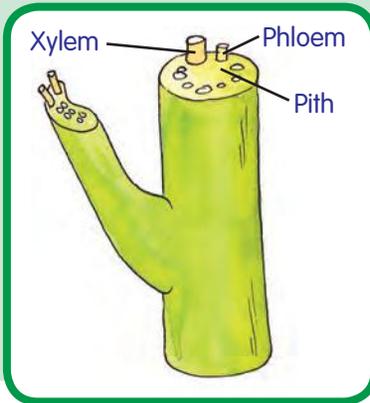
Snake bean vine



Banana plant

Some stems are woody and brown. Shrubs and trees usually have woody stems. The main stem is called the “trunk”. An outer protective layer, called the bark, covers the trunk and branches of trees and woody shrubs (like the rain tree, rose, Christmas tree and frangipani).

Stems transport food and water throughout the plant



The stems of the plants have two sets of tiny tubes. One set of tubes transports food from the leaves to other parts of the plant (phloem). The other set of tubes transports water and mineral salts from the roots to other parts of the plant (xylem).

Activity 4

- 1 Add some red food colouring to a jar of water.
- 2 Put two fresh stalks of pac choi in the water.
- 3 Observe what happens. Why do you think this happens?



Cactus plant

Stems produce food

Some plants have green stems that make food. In most plants, the food made by stems is in addition to food made by leaves. In plants, such as cacti, the stems are the main organs for making food.

Stems store substances

Some stems are modified to store a large amount of food. Potato, ginger, water chestnut, cactus and sugar cane store food in their stems.

Activity 5

Collect a selection of leaves in different sizes, shapes and colours. Examine them. Describe some of the different things you notice about the leaves.



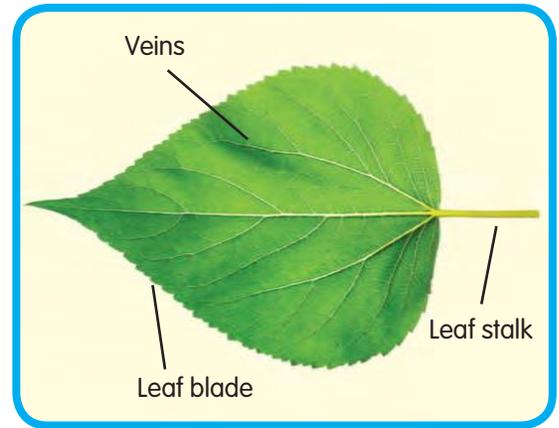
Leaves

Most leaves are green. Some are red and yellow. Leaves of plants are usually green, light, flat and broad. These properties enable them to capture sunlight and exchange gases with their surroundings.

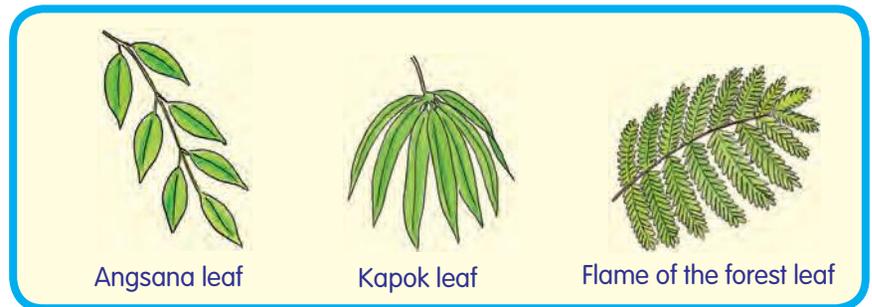
Leaves are different in size (small, large), shape (elongated, broad, oval), colour, texture (hairy, smooth, rough), thickness, edges (smooth or entire, wavy, toothed, lobed) and vein patterns (parallel, net).

Green plants are food producers

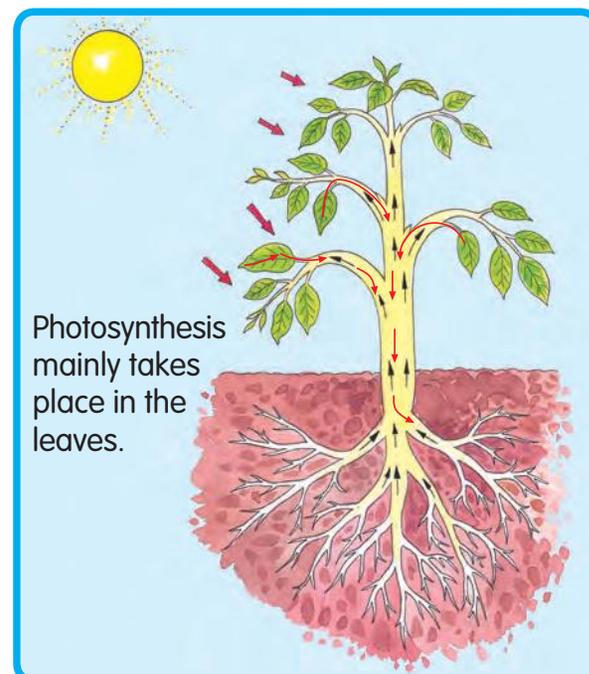
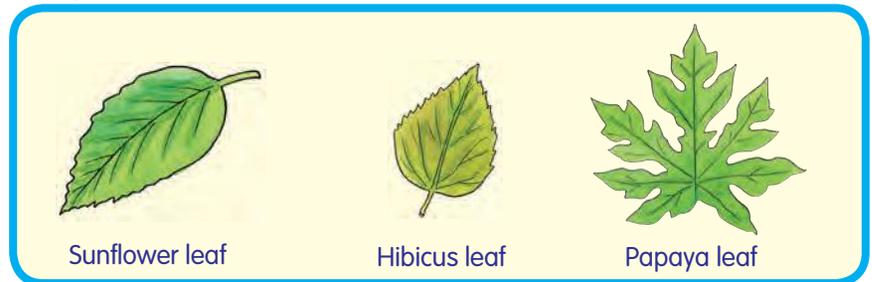
Leaves are the main food-making organs in most plants. Plants make their own food in their green leaves. They use sunlight, water and **carbon dioxide**. This food-making process is called “**photosynthesis**”.



Compound Leaves

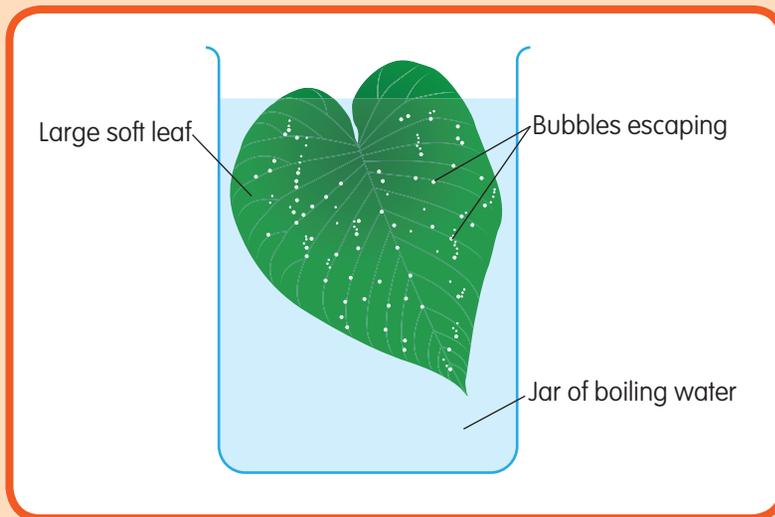


Simple Leaves



Activity 6

- 1 Cut some large, soft, fresh leaves from green plants.
- 2 Fill a glass jar with boiling water.
- 3 Hold a leaf by the stalk.
- 4 Push the leaf into the jar of boiling water.
- 5 Observe the leaf carefully. What do you see?



Stomata

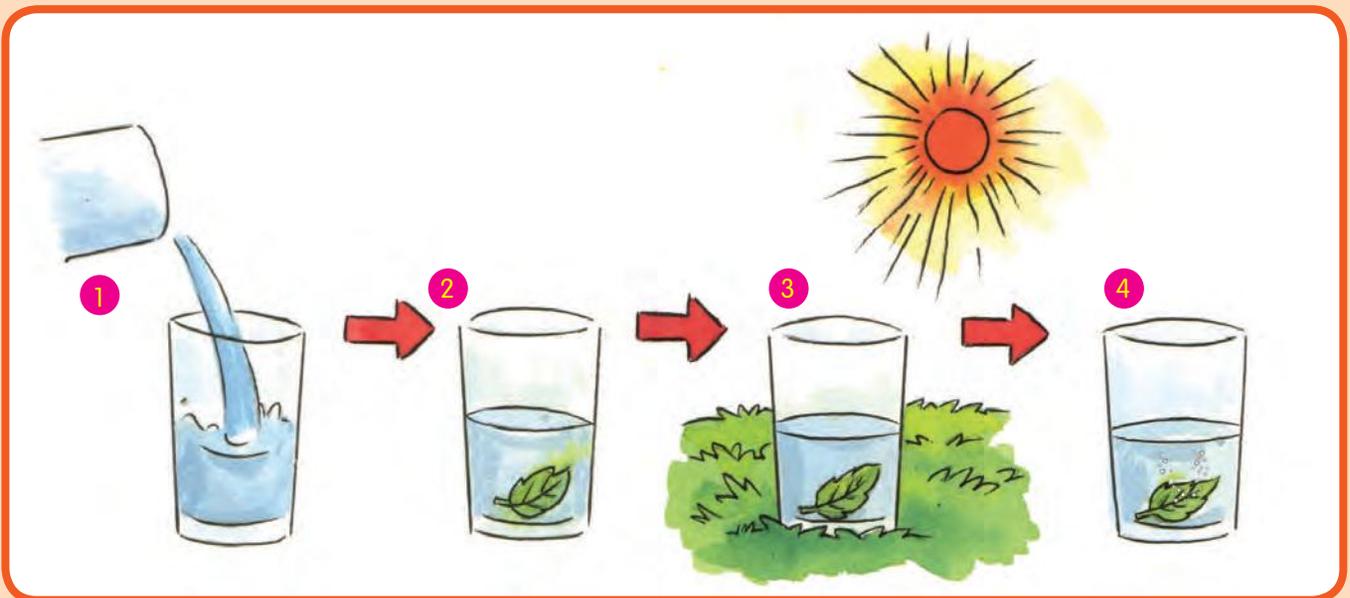
When you did Activity 6 you would have seen many small bubbles forming on the underside of the leaf. The bubbles are **gases**. The gases come out through small openings in the underside of the leaf. They come out because they expand when the leaf is heated, and escape through the openings. The openings in the leaf are called “**stomata**” (one opening is called a stoma). The stomata allow gases to move in and out of the plant leaf.

During photosynthesis, carbon dioxide enters the plant through the stomata. Oxygen goes out through the stomata.

Activity 7

- 1 Pour warm water into a clear plastic cup until the cup is half full.
- 2 Place a freshly picked leaf in the water.
- 3 Place the cup where there is sunlight.
- 4 Wait for 30 minutes and then carefully observe the surfaces of the leaf.

What do you observe? Why do you think this happens?



When scientists do an investigation like the one in Activity 7, they carefully observe what is happening. Then they draw conclusions, based on what they observe.

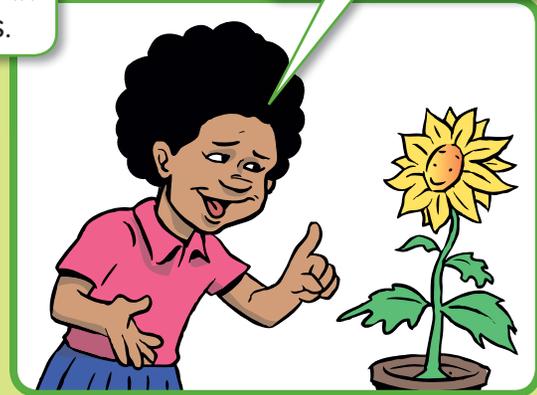
The plant is a food-making factory

Hmm, I wonder where photosynthesis takes place in the plant?

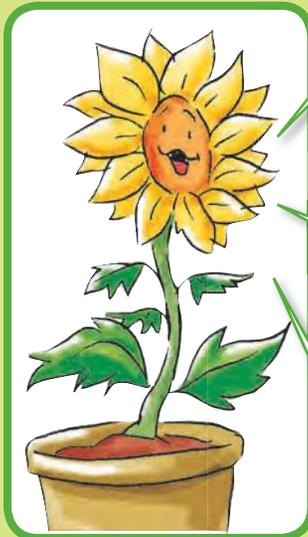
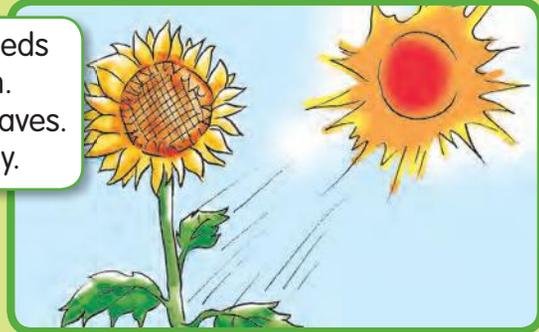


Well, photosynthesis takes place mostly in our green leaves.

I see! What does the leaf need for photosynthesis?



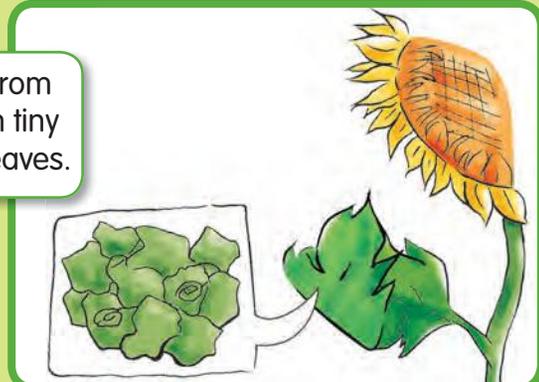
First of all, the green leaf needs light energy from the Sun. **Chlorophyll** is in the green leaves. It captures the light energy.



Next, it needs water, which it takes from the soil through its roots.



Last, it needs carbon dioxide from the air. This gas enters through tiny holes on the underside of the leaves.



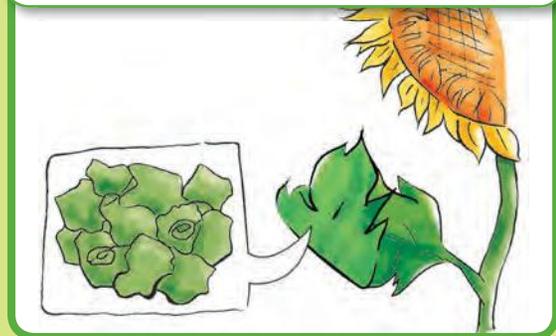
That is interesting. So what does photosynthesis produce?



The main product is food. The food is sugar.



Some oxygen goes into the air through the tiny holes in the leaf. Water is also another product of photosynthesis.



Hence, during photosynthesis, plants use the Sun's light energy to change carbon dioxide and water into sugar, oxygen and water. The plant can use sugar as its food. Chlorophyll is needed for photosynthesis to take place.



Activity 8

Scientists say that all living things need photosynthesis. Why do you think they say this?

All our food, and the food of all other animals, comes directly or indirectly from photosynthesis.

1 Draw a table like this:

Food name	From plant—yes/no?	From animal—yes/no?	What animal eats?
Rice			
Egg			
Pig meat			
Cucumber			

2 Name some of the foods you eat. For each food, say whether it comes directly from plants. If it is not a food from plants, what animal is it from? What does the animal eat?

Why does photosynthesis take place mainly in leaves?
Can photosynthesis also take place in green stems?

Leaves of plants, such as croton and coleus, do not look green, as the green is masked by other colours. Can these leaves photosynthesise?

Energy flows from plants to animals

We cannot live without food. Food is the source of our **energy**. All our food comes directly or indirectly from plants. Plants are food producers and we, like other animals, are food **consumers**.

Look at the boy eating the plate of chicken and rice. The boy is a food consumer. He eats the chicken and the rice. The chicken ate grain from plants.



Look at what happens at a food bar. People enjoy their food. Where does our food come from?

We can thank plants for both the vegetables and the meat that we eat. Vegetables come from plants. Some animals only eat plants. Others eat other animals. Some eat both plants and animals. So all our food originally comes from plants.



Scientists call plants “food producers”. They capture the energy of the Sun to make food. Photosynthesis enables energy to enter the living world. This process is necessary for all life.

Plants get energy from respiration

In sunshine, green plants make food by photosynthesis. The food is sugar. The plants must use the sugar to get energy. The plants free the energy by a process called “respiration”. The energy enables the plant to grow and move.



Respiration needs oxygen. This table summarizes the two processes—photosynthesis and respiration.

Photosynthesis	Respiration
Uses water	Gives off water
Uses carbon dioxide	Gives off carbon dioxide
Makes food (glucose)	Breaks down food (glucose)
Gives off oxygen	Uses oxygen
Requires light	Occurs all the time, does not need light
Takes in light energy	Releases energy from food
Takes place in cells with chlorophyll	Takes place in cells of most organisms

The table shows that respiration gives off water and carbon dioxide. It also shows that photosynthesis uses water and carbon dioxide.

Leaves transport food and water for the plant

The network of veins in the leaves transports water into the leaves. The veins also transport food from the leaves to the other parts of the plant. This network also supports the leaf.

In some plants, leaves have special jobs. The leaves of plants, such as the cactus plant, have sharp, pointed spines, which stop animals eating the plant. The spines also stop the plant losing too much water. They have a smaller surface area than flat leaves.

The leaves of plants, such as the pitcher plant, are thin and coiled. They help the plant to climb.

The leaves of the pitcher plant have a small container on the end to help the plant catch insects.

Cactus plant



Pitcher plant



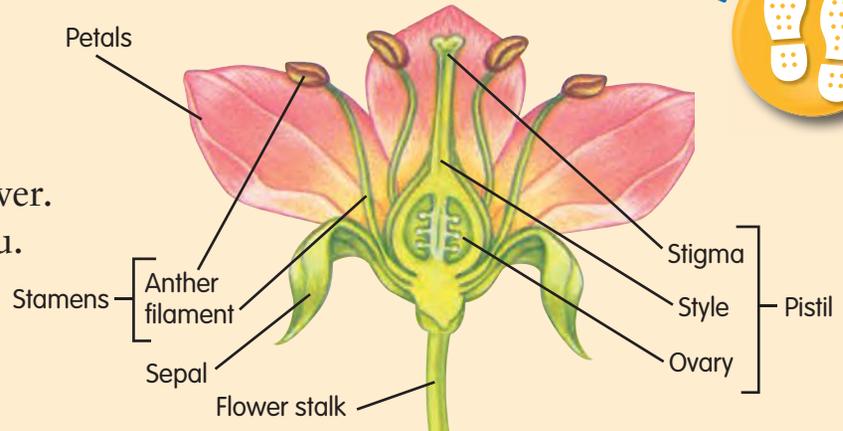
Plants and reproduction

Flowers

Flowers are the structures in which **reproduction** takes place in flowering plants. A plant's sex organs are in each flower.

Activity 9

- 1 Find a hibiscus flower.
- 2 Identify the parts of the flower.
Use this diagram to help you.



The petals are the brightly coloured and scented parts of the flower. The petals attract insects, such as bees. Bees carry pollen to the female part of the flower.

The flower stalk supports the flower. The female sex organ of the flower is the pistil. The male sex organs of the flower are the **stamens**.

Fruits and seeds

A fruit is the ripe ovary of a flower. It contains new seeds. Fruits protect the seeds. They also spread the seeds when it is time for the seeds to grow. Most plants produce hundreds of seeds. Animals, wind and water also carry seeds to new places.



Tomato



Pea



Plum



Peanut

If a seed has warmth, moisture and air, it will grow. A seed has stored food. It uses this stored food for growth. Some seeds have only one seed leaf, for example corn. Others have two seed leaves, for example beans.



One seed leaf



Two seed leaves

In plants, such as the onion, the leaves are scales. The scales of the leaves may be thick and fleshy. They store food and water. Sometimes, the scales are thin and dry. The outer covering of the onion bulb has many thin, dry leaves.

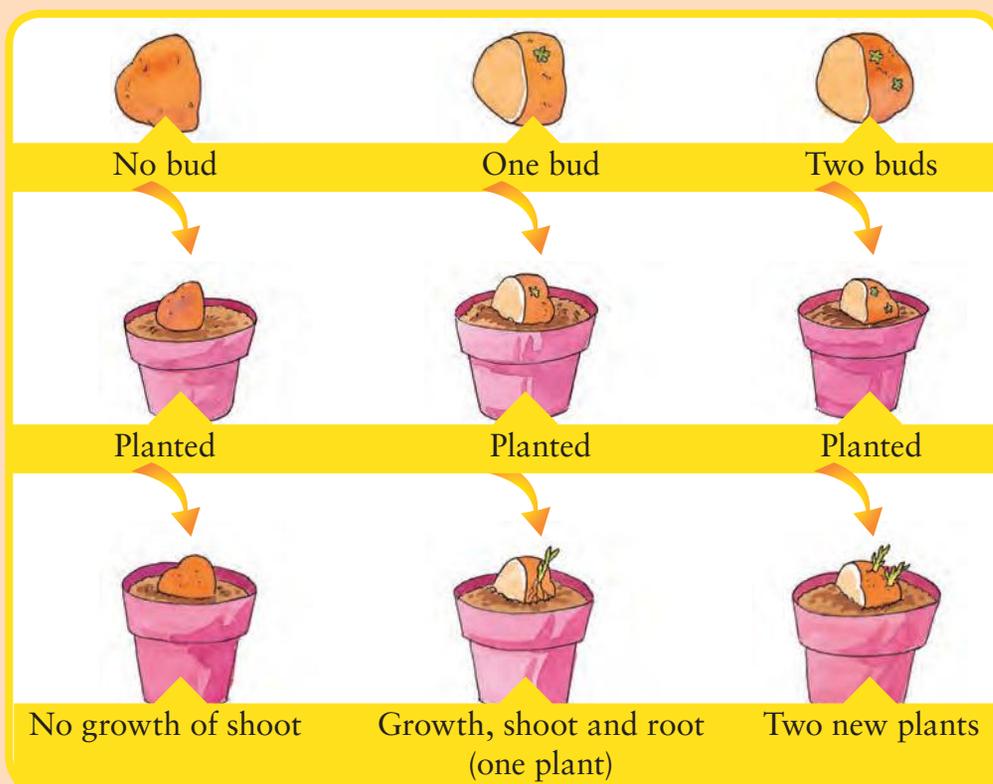
Buds

Buds are plant parts that can grow into flowers or new shoots. They protect the young flowers or leaves. The buds at the top end of the shoot make the plant grow upward. The buds on the side of the stem grow into branches. Some buds on the side of the stem become flowers.

Activity 10

Growing a new plant from a tuber

- 1 Cut a kumara tuber into three parts.
 - Cut the tuber so that the first part has no bud.
 - Cut so that the second part has one bud.
 - Cut so that the third part has two buds.
- 2 Plant these parts in pots of soil, as the drawings show. Water the pots 2–3 times a week.
- 3 Observe for three weeks.
 - Do new kumara plants grow in all three pots?
 - Which pots did new plants grow in?
 - How many new plants grew in each pot?



Chapter Review

- 1 Plants have parts such as roots, a stem, leaves, flowers and fruits.
- 2 The parts of a plant can be divided into two systems: the shoot system and the root system.
- 3 The shoot system is made up of parts such as the stem, leaves, buds, flowers and fruits.
- 4 The portion of the plant that is below ground level is the root system. It is made up of roots and root hairs.
- 5 Each plant part has a function that contributes to the overall performance of the two systems. These systems enable the plant to carry out life processes such as photosynthesis, respiration and transport.
- 6 Roots anchor the plant firmly to the soil and take in water and mineral salts.
- 7 The stem transports food and water throughout the plant by sets of tubes, and holds the leaves and flowers in position for their work.
- 8 Leaves make food for the plant. Oxygen is given off in the process.
- 9 A fruit contains seeds for the growth of new plants.
- 10 The leaves, roots, stem and branches all play a part in helping the green plant to produce food.
- 11 Photosynthesis is the process that plants use to make food from carbon dioxide, water and energy from the Sun. Chlorophyll takes in the Sun's energy.
- 12 Photosynthesis in green plants provides energy for all organisms.
- 13 The Sun continuously provides the energy green plants need to make food.
- 14 The Sun is the source of energy for living things.
- 15 The process of respiration frees energy from food.
- 16 Respiration in plants needs oxygen.

Answer these questions in your exercise book.

1 Which one of these statements is false?

- A** During respiration, green plants make food.
- B** Plants use the Sun's energy to make food.
- C** Energy is the ability or capacity to do work.
- D** The food produced by plants becomes the source of energy for animals.

2 Which of these statements are true?

- A** Photosynthesis uses energy and respiration releases energy.
- B** The Sun is the ultimate source of energy for living things.
- C** The Sun continuously provides the energy for green plants to make food.
- D** Respiration occurs all the time in the cells of both plants and animals.
 - a** A, B and C only
 - b** B, C and D only
 - c** A, C and D only
 - d** All of the above

3 What three things from question 2 are needed for photosynthesis to take place?

- a** A and B
- b** A only
- c** A and C
- d** All of the statements

Body systems

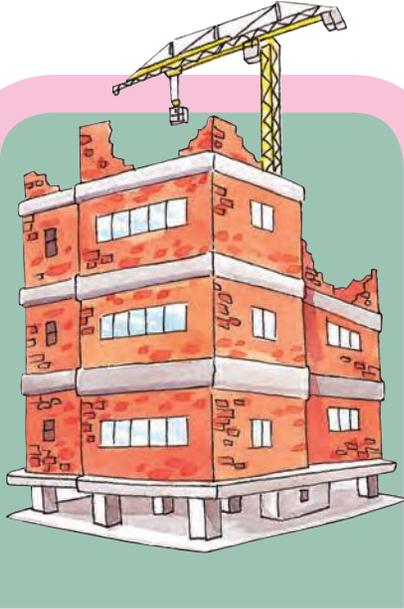
In this chapter, you will:

- identify the following organ systems in humans—digestive, respiratory, circulatory, skeletal and muscular
- understand the main functions of these body systems
- recognize that the body systems work together to carry out life processes
- understand that animals have organs that help their bodies respond to their environment
- learn that our sense organs enable us to find out about changes in the environment.

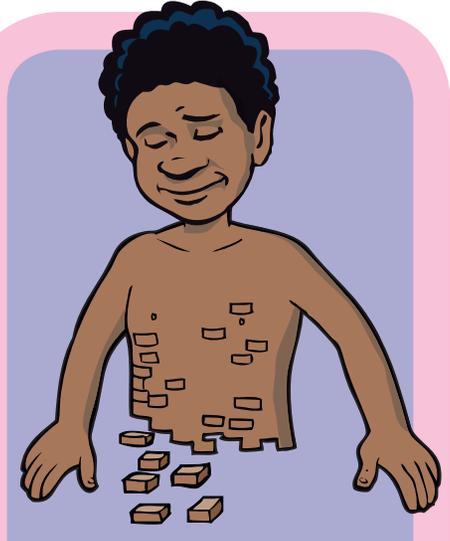
Organisation and control

Tall buildings are built of bricks.

In the same way, you are built of **cells**. You are built of cells from your brain and heart to your little fingers and toes.



Bodies are built in the same way.



Bricks are joined together to make walls.

A group of your cells work together to form **tissues**.

- **Muscle cells** form muscle tissue
- **Red blood cells** and white blood cells form blood

Walls are joined together to make rooms.

Different tissues combine to make **organs** to carry out certain jobs. Your skin, stomach, heart and brain are organs.

Rooms fit together to form house units.

Organs work together to form organ systems. An example of an organ system is the digestive system.

House units fit together to form a tall building.

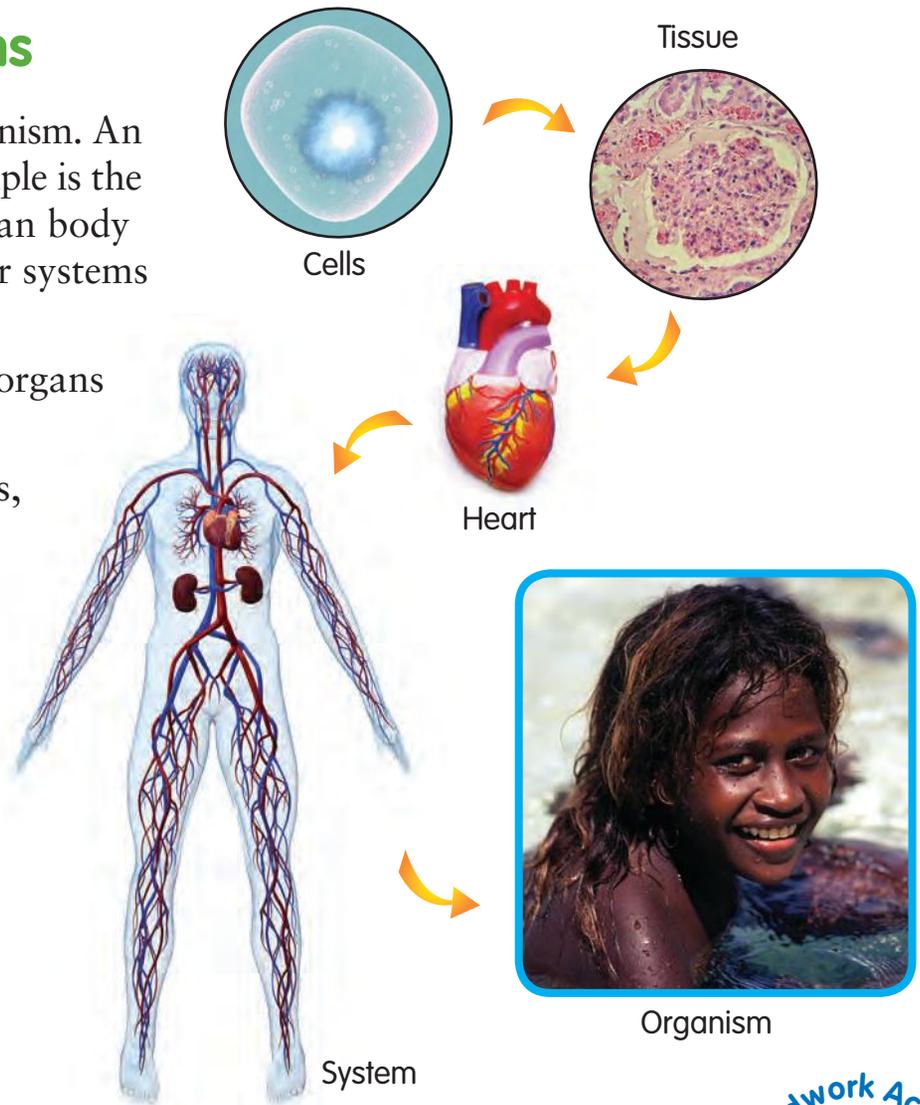
Organ systems work together to make an **organism**. You are an organism. So are cats, dogs and plants.

Organisms as systems

The entire body is a living organism. An organism is a system. An example is the human body system. The human body system is made of other smaller systems like organs.

Organisms are organised into organs and systems.

All organisms are made of cells, tissues, organs and systems.



Activity 1



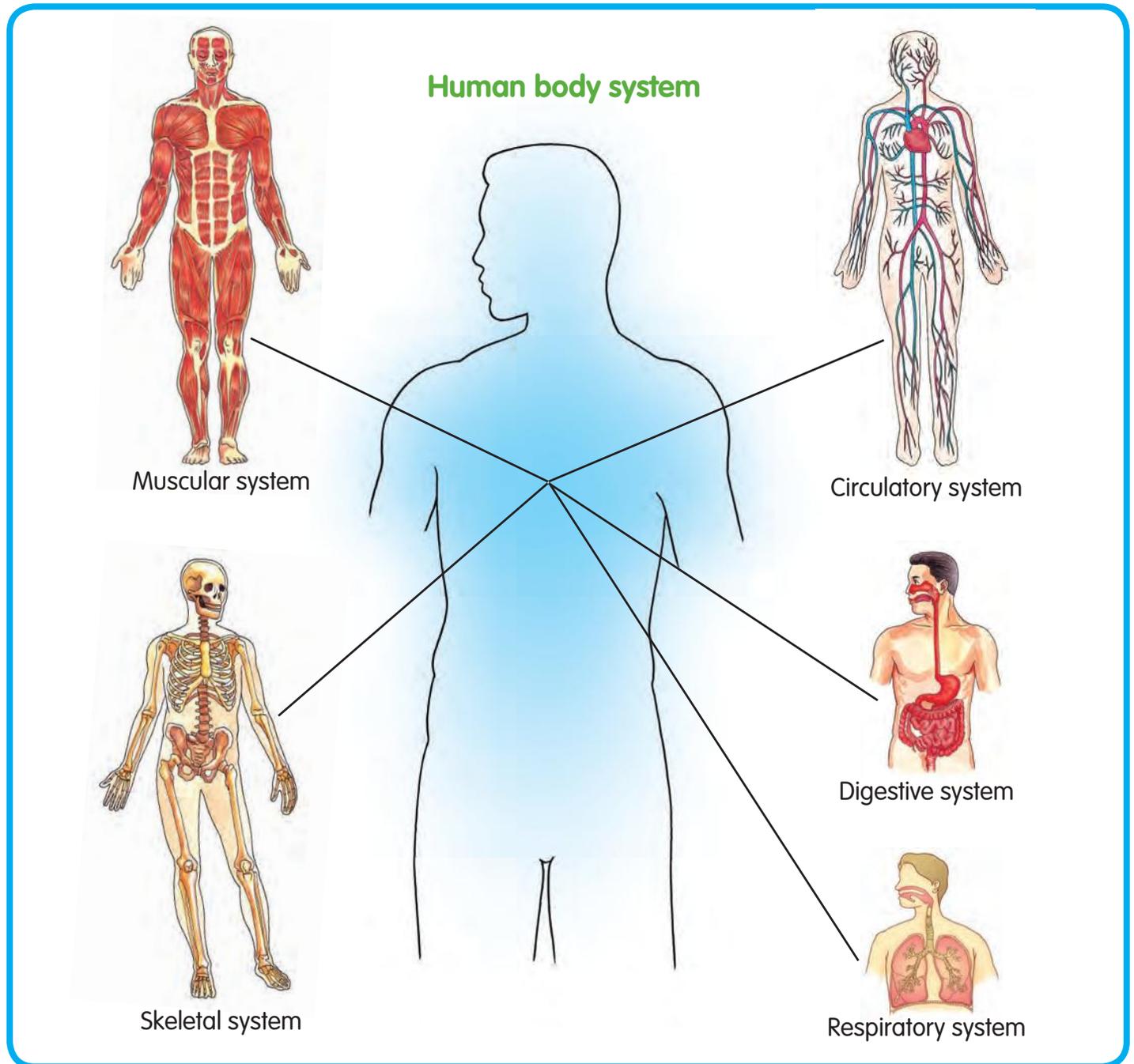
Are plants organized like animals with different systems having different parts?

- 1 Go outside the school grounds and find a fruit-bearing plant.
- 2 Draw the plant in your exercise book.
- 3 Label the following parts: roots, root hairs, stem, leaves, flowers and fruits.
- 4 Identify the two plant systems (shoot systems and root systems) like you did in Chapter 1.

Each plant part has a job that helps the overall working of the system. These parts enable the plant to carry out life processes such as photosynthesis, respiration and transport.

Five human body systems

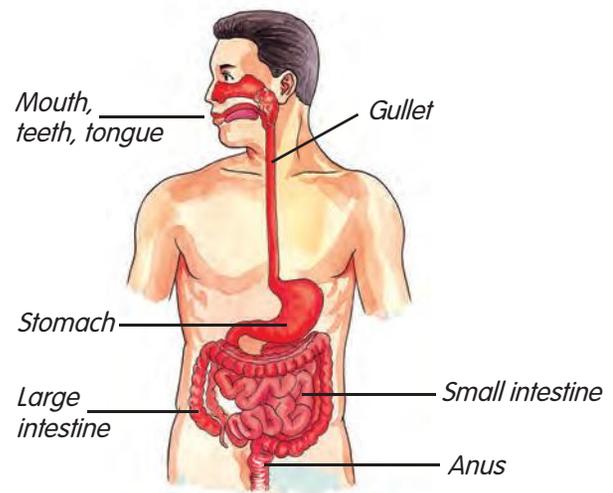
Our body carries out life processes such as **breathing**, digestion and blood circulation.



We can do different jobs because we have different body systems. Some of these are the circulatory, digestive, respiratory, skeletal and muscular systems. Each system helps us to do certain jobs.

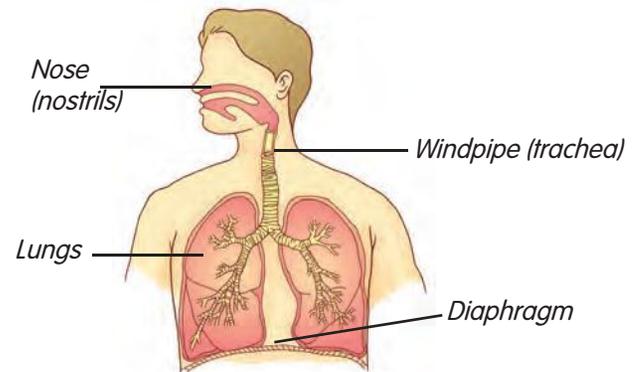
Digestive system

- The **digestive system** is made up of the mouth, **gullet**, **stomach**, small **intestine**, large intestine and **anus**.
- It breaks down food into small, simple substances that:
 - can be taken into the blood
 - can be used for getting energy, for growth and repair.



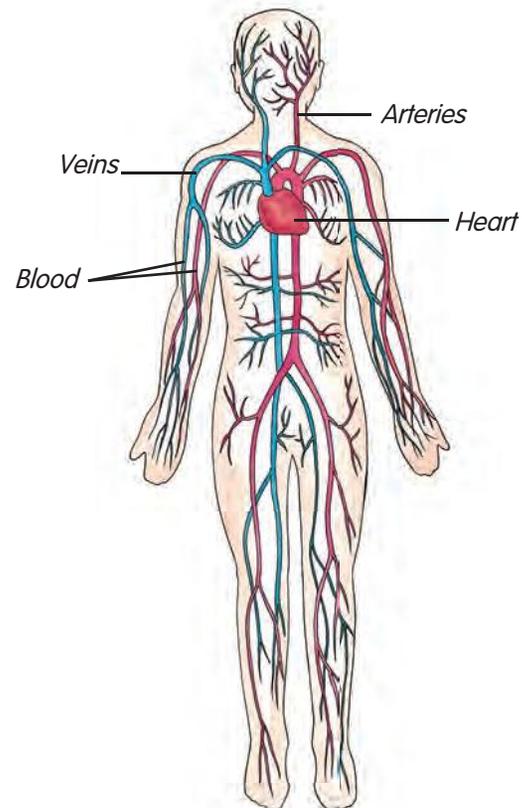
Respiratory system

- The **respiratory system** is made up of the nose, **windpipe**, **lungs** and **diaphragm**.
- It helps bring oxygen from the air into the body.
- It helps to get energy from digested food and oxygen.



Circulatory system

- The **circulatory system** is made up of thin tubes (**blood vessels** such as **arteries** and **veins**), **blood** and the **heart**.
- The heart pumps blood to all parts of the body through the blood vessels.
- The blood:
 - brings **digested food**, oxygen and water to all parts of the body
 - carries away wastes produced by the body.





Activity 2

Work in pairs. You need a stone or other object weighing about 1 kilogram.

- 1 Your partner stands beside you.
- 2 Use your arm to lift the stone up and down slowly, while your partner feels your upper arm muscles.
- 3 Your partner describes the changes taking place in the muscles when the stone is lifted and lowered.
- 4 Change places. Now feel your partner's muscles.
- 5 Draw up a table like this in your exercise book and complete it.

Activity	Observations
Description of muscle when the stone is lifted	Please do not write in this book
Description of muscle when the stone is lowered	

You have felt how muscles work. The “tissue” of the muscle becomes longer and shorter as you lift things up and down. You are using your muscles when you do work.

A prominent bone is one that sticks out from your skin a little. You can easily feel it.



Activity 3

Work in pairs.

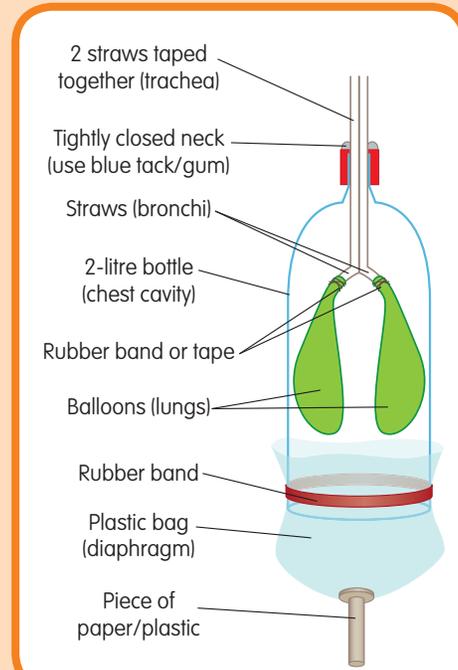
- 1 Stand beside each other.
- 2 Stand upright. Ask your partner to feel your prominent bones (**elbow**, knee cap, ankle bone and **collar bone**).
- 3 Your partner describes what they feel. They try to identify these bones on the diagram of the skeleton on page 28.
- 4 Change places. Feel your partner's prominent bones. Describe what you feel and try to identify these bones on the diagram of the skeleton.

Activity 4

Work in pairs.

The pictures and diagram show how to make a simple model of the respiratory system and use it. First, find the things you need: a large plastic bottle, two balloons, drinking straws, blutac or gum, rubber bands, a clear plastic bag.

- 1 One person pulls the plastic bag down.
- 2 Observe what happens to the balloons as the plastic bag is pulled down.
- 3 Push the plastic bag slowly upwards. Observe what happens to the balloons.



This is a model of the human lungs. It shows how your lungs work. The balloons are the lungs. The plastic bottle is the **rib cage**. The plastic bag is the diaphragm. When you pull the plastic bag down, the balloons take in air. They inhale. When you push the plastic bag up, the balloons push air out. They exhale.

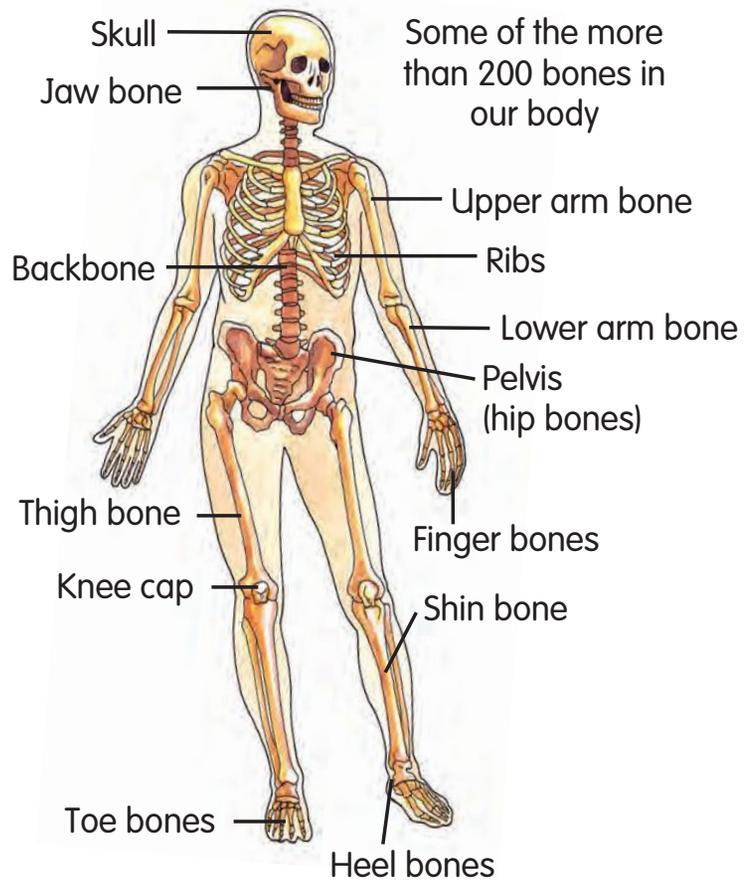
Draw up a table like this in your exercise book. Record your observations.

Activity	Observations	
	(Plastic bag)	(balloons)
When the plastic bag is pulled down.		
When the plastic bag is released.		

Please do not write in this book

Skeletal system

- The **skeletal system** is made up of about **206 bones**.
- It gives the body its shape.
- It protects the organs in the body.
 - The **skull** protects the brain.
 - The rib cage protects the heart and lungs.
 - The bones work together with muscles to enable movement.



Muscular system

- The **muscular system** is made up of muscles attached to the bones.
- It makes movement possible.
- It is important to the work of other organs such as the stomach, heart and intestines.



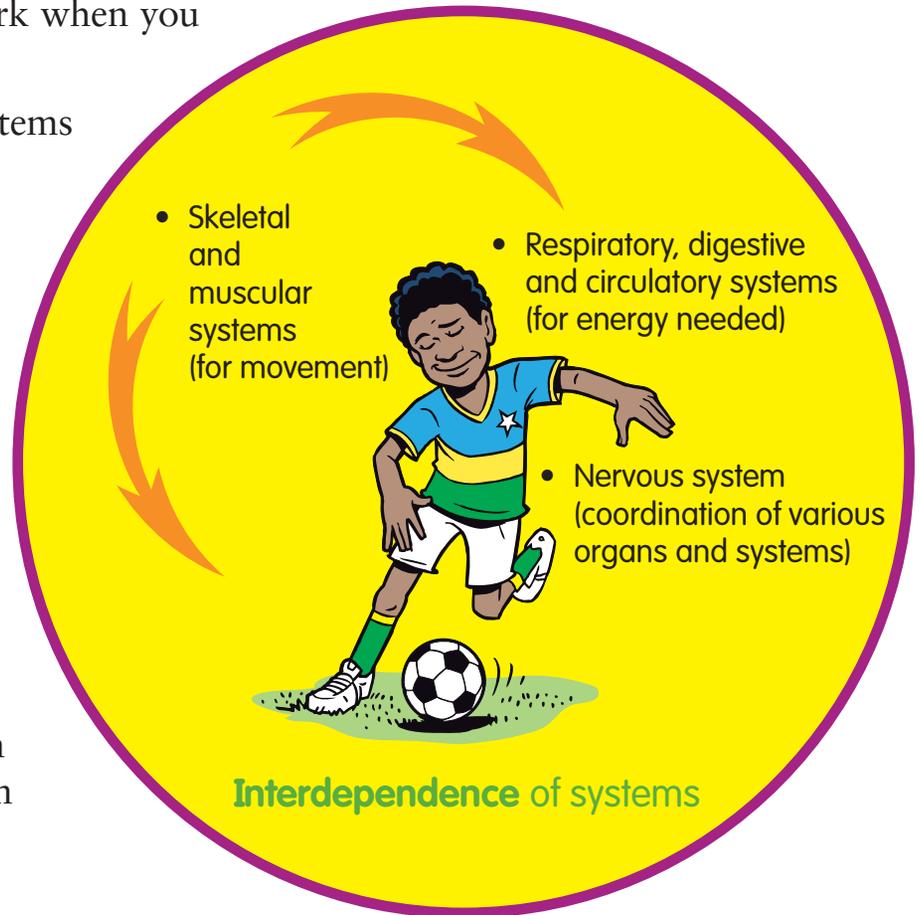
Interdependence of body systems

Humans do hundreds of different things with their bodies. We have different organ systems doing specific jobs. These systems work together so that the body works well.

What organ systems are at work when you play a game of soccer?

Your skeletal and muscular systems have to work together so that you can move. Bones cannot move without the action of the muscles. The muscles pull on the bones. The muscular system is the force behind the skeletal system.

You need energy to play a game. You get energy for your body through cell respiration. For respiration to take place, the body needs oxygen. You breathe in oxygen through your nose. The oxygen reaches your lungs.

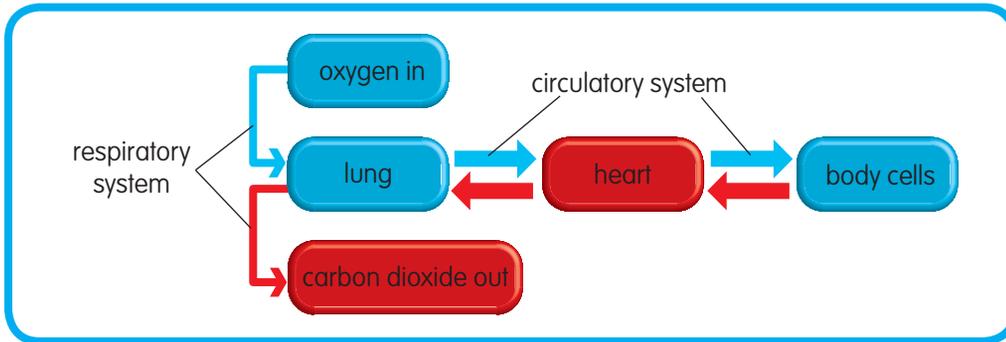


Activity 5



1. Would life be possible without our systems?
2. Would your circulatory, respiratory and digestive systems work without the muscular and skeletal systems?
3. Would your heart pump blood around your body without muscles?
4. Would you be able to breathe without your diaphragm? The diaphragm is a sheet of muscles.
5. Would you be able to swallow food without muscles?

The oxygen you breathe in moves from your lungs to all the cells in your body. The blood from the lungs is rich in oxygen. It goes to the heart. The heart pumps it to other parts of the body. This is your circulatory system at work. The diagram shows how the respiratory system and the circulatory system work together to send oxygen to all parts of the body.

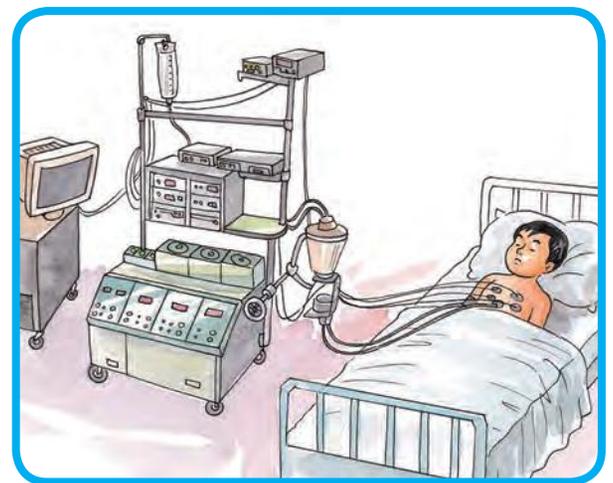


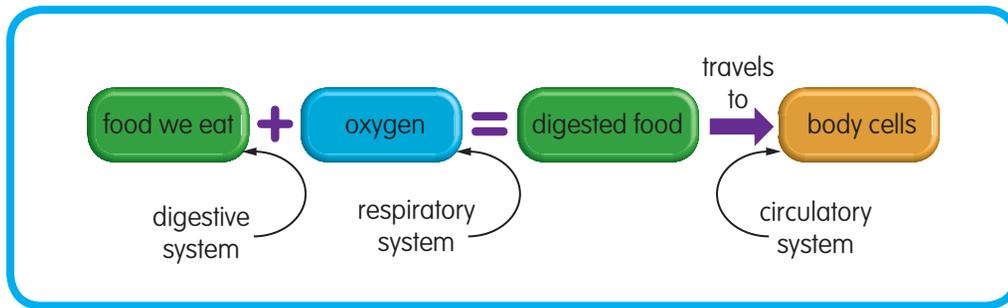
The mouth and the digestive system break down the food you eat. The food changes into a form that the blood can carry. The digested food combines with the oxygen. The blood carries everything to the cells of the body. So the digestive system and the circulatory system work together.

The body has a system that makes sure that the other systems work together. That is the role of the nervous system.

The skeletal, muscular, circulatory, digestive, respiratory and nervous systems must work together so that you can play a game of soccer

- The skeletal and muscular systems allow movement.
- The circulatory, digestive and respiratory systems supply the energy needed.
- The circulatory system transports substances.
- The digestive system provides digested food, which is the source of energy.
- The respiratory system provides the oxygen so that the food releases the energy.
- The **nervous system** coordinates all these activities.





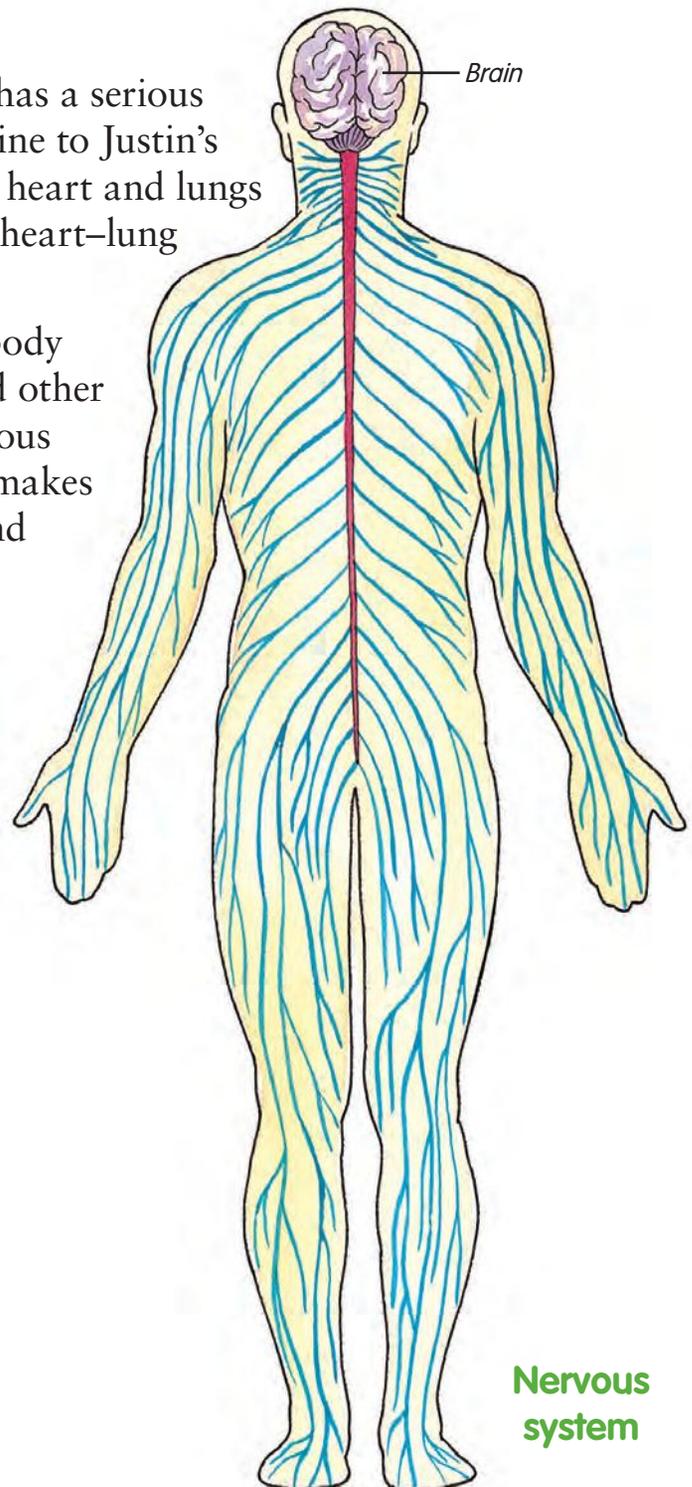
Senses and control

Justin had an accident and is in a coma. He has a serious head injury. Doctors have connected a machine to Justin's body. It is a heart-lung machine. It helps his heart and lungs to keep working. What would happen if the heart-lung machine was switched off?

The brain controls our body. It enables the body to carry out the life processes. The brain and other parts make up the nervous system. The nervous system is like a manager inside our body. It makes sure that parts of our body work together and do their jobs at the right time.

The brain is inside our skull. It coordinates all actions of the body. The brain gives commands to the organs and muscles.

We have special organs that enable us to detect and respond to changes in our surroundings. For example, the nose uses parts of the nervous system so we smell things.



Nervous system

Testing your senses



Activity 6

Work in groups of five.

You need things with different surfaces, such as cotton balls, aluminum foil, cloth, a pineapple, rough-edged rocks or stones, marbles and shells, and a large bag to hold the things.

- 1 Put all the mystery things in the bag.
- 2 One person reaches into the bag, without looking, and touches one item (without removing it from bag).
- 3 That person describes the item to the rest of the group by the way it feels and tries to identify it by touch.
- 4 The person removes the item from the bag. Was that person correct? Are they a good “touch” detective?



Activity 7

Work in groups of five.

Your teacher will provide you with brown paper bags containing various things, with a common smell, such as toothpaste, coffee, onions and perfume and a scarf to use as a blindfold.

- 1 Use the scarf to blindfold one person at a time.
- 2 Collect an “aroma” bag from the teacher. Ask a person to smell the contents. See if they can identify the aroma. Group members can give hints if the smell is too difficult to identify.
- 3 Each group member should have a chance to smell an aroma bag and identify its contents.



Activity 8

Work in a small group.

You need two chairs, a sheet, some household items, such as spoons, plates, coins, a peanut in a plastic jar and a bag for the things.

- 1 Place the sheet over the two chairs. This makes a curtain to keep the things out of the sight.
- 2 One person makes one sound at a time, by tapping, dropping or knocking an item.
- 3 The others try to identify what it is by listening carefully. Give hints if it is too difficult (for example, “You might find it on a table”).
- 4 Every person makes the sound of one item under the curtain.



Activity 9

Work in a small group.

You need a pair of eye glasses.

- 1 Send the others outside.
- 2 Hide the glasses in the room so that they are not under or inside anything.
- 3 Ask the others to find the glasses. The first one to find them hides them for the next round.
 - Do you think you would find the glasses if you are blindfolded?
 - What do you think it would be like if you couldn't see at all?
 - What would it be like if you could only see things in black and white?
 - Do you know anyone who has had their eyes improved? How?

Activity 10

Work in groups of five.

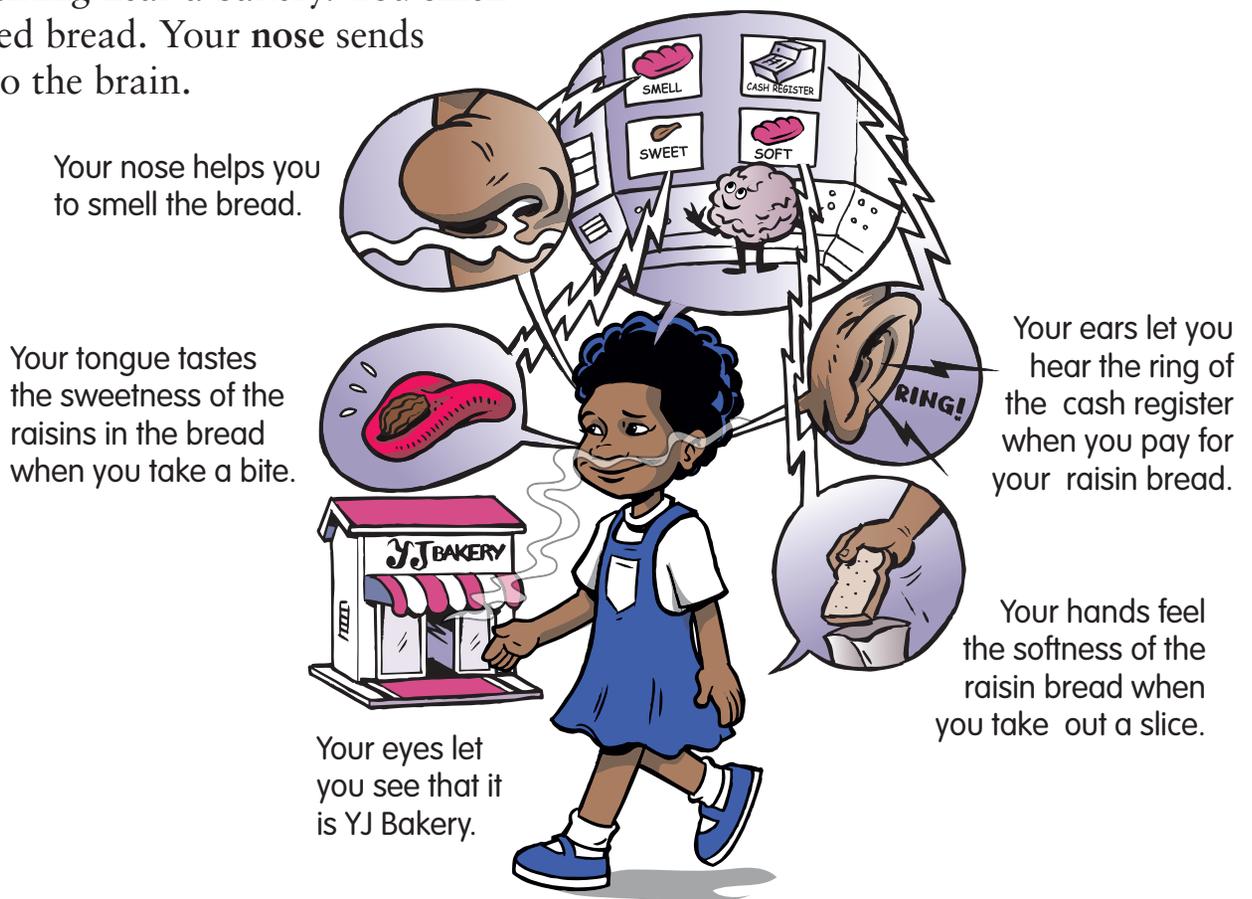
You need three different kinds of fruit juices, such as bush lime, orange and pineapple, paper cups, and a scarf to use as a blindfold.

- 1 Pour a small amount of each kind of juice into a small paper cup. Talk about and describe each juice as it is being poured.
- 2 Blindfold one person at a time and let that person taste each sample.
- 3 Ask the person to identify each juice.
- 4 Repeat the activity, with each person holding their nose while tasting the juice. Ask the person to identify each juice. Is it harder to identify when you could not smell?

Sense organs

The senses of **smell**, **sight**, **hearing**, **touch** and **taste** help us to find out about changes in our environment.

Imagine walking near a bakery. You smell freshly baked bread. Your **nose** sends a message to the brain.

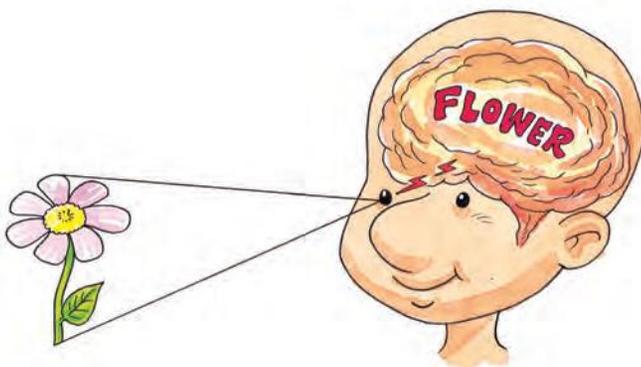
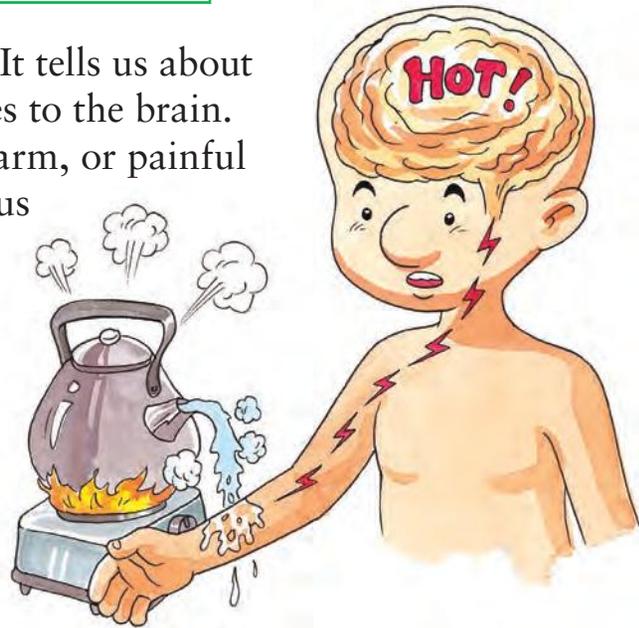


Where are our sense organs?

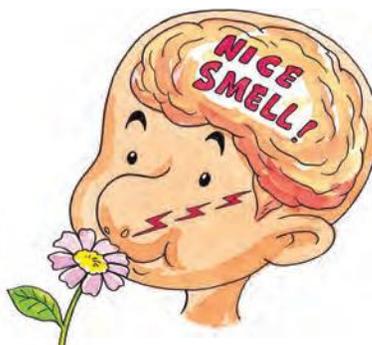
The table shows the five special senses and where they are found on the body.

Activity	Observations
Touch	Skin
Sight	Eyes
Smell	Nose
Taste	Tongue
Hearing	Ears

The **skin** is the largest organ in our body. It tells us about our surroundings. The skin sends messages to the brain. The brain tells us if an object is cold or warm, or painful for us to touch. These messages also help us to feel the pressure when something or someone presses against us. We can feel **pressure, mass, temperature difference and pain**. The sense of touch is really more than one sense.



The eyes enable us to form images of objects. These images are passed to our brain. The brain interprets the images and we see the objects. This is an important sense. We interpret much of the world using our sight.

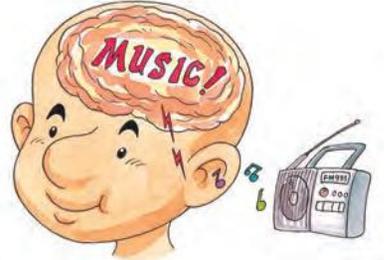


The nose enables us to smell things in the air. The brain interprets a smell. It tells us what it is. It also tells us whether the smell is pleasant or unpleasant.

The **tongue** enables us to taste. The taste buds on the tongue send messages to our brain. The messages tell us if a taste is sweet, sour, bitter or salty.



The **ears** enable us to hear **sounds**. The sound vibrations move from the ears to the brain where we interpret the vibrations as sounds.



Other animals also have **sense organs**. For instance:

- Cats have eyes that allow them to see well in dim light.
- Dogs have a better sense of smell and hearing than we do.
- Bats can find their prey in the dark by hearing sounds that humans cannot.
- The feelers of insects act as sense organs.
- The legs of spiders enable them to feel vibrations when prey lands on their web.
- Pigeons, dolphins and honey bees, have sense organs that enable them to respond to the Earth's magnetic field.

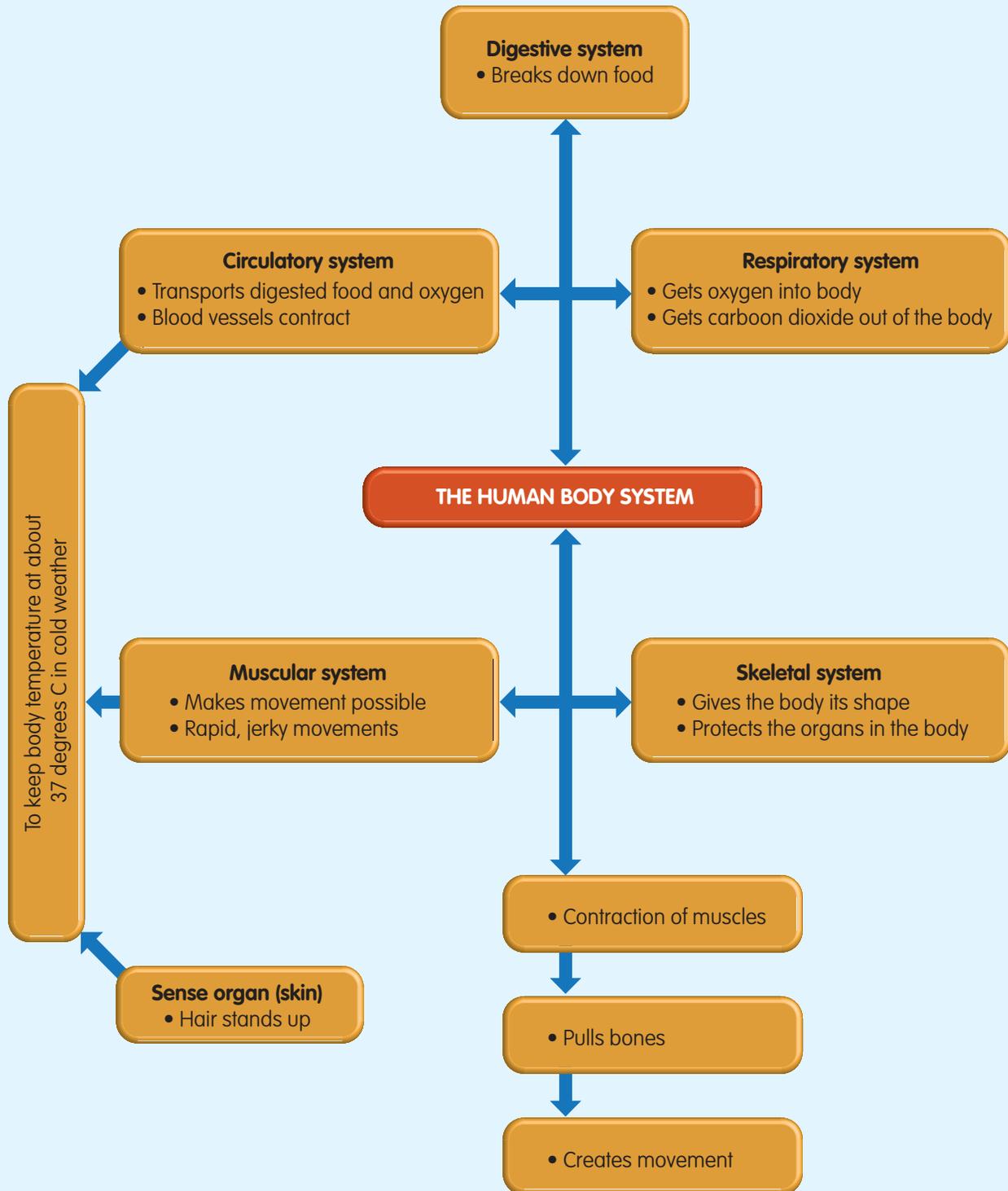
Chapter Review

- 1 All organisms are made of cells, tissues, organs and systems.
- 2 Cells, tissues, organs and systems reflect the level of organisation in organisms.
- 3 Plants have organs and parts organised into two systems: the shoot system and the root system.
- 4 Some human organ systems and their functions are shown in the table on page 38.
- 5 Some organs, such as the heart and brain, are vital organs—we cannot live without them. Some organs, such as our hands or eyes, are non-vital—we can live without them.
- 6 Humans have sense organs, such as eyes, a nose, skin, ears and a tongue, which help them to find out more about their environment.
- 7 The brain controls the body and keeps it going, enabling life processes to be carried out.
- 8 The skeletal and muscular systems must work together for movement to take place.
- 9 The circulatory and respiratory systems must work together for oxygen from the atmosphere to reach all the cells in the body.
- 10 The circulatory and digestive systems must work together for the food that we eat to reach all the cells in our body.
- 11 The nervous system has to work with other systems to coordinate their work.

Organ systems and their work

System	Organs	Function of system
Digestive	<ul style="list-style-type: none"> • Mouth (teeth, tongue) • Gullet • Stomach • Small intestine • Large intestine • Anus 	Breaks food down into small, simple substances and absorbs these substances into the bloodstream
Respiratory	<ul style="list-style-type: none"> • Nose (nostrils) • Windpipe (trachea) • Lungs • Diaphragm 	Uses digested food and oxygen in the air to release energy from digested food
Circulatory	<ul style="list-style-type: none"> • Heart • Blood • Blood vessels (arteries, veins) 	Brings digested food, oxygen and water to all parts of our body and carries away waste produced by the body
Skeletal	<ul style="list-style-type: none"> • Some of the 206 bones—skull, jaw bone, ribs, backbone, pelvis (hip bones), upper arm bones, lower arm bones, finger bones, thigh bones, knee caps, shin bones, heels, toe bones 	Supports our body, gives it shape, protects organs and works with muscles for movement
Muscular	<ul style="list-style-type: none"> • About 600 muscles. • Some weave together to make a fleshy cover for the body • Others work in organs such as the heart, stomach and intestines 	Helps to work our bones so that movement is possible, as well as to work other organs such as the heart, stomach and intestines

Concept Map



Activity

Draw up a table like the one below in your exercise book. Make a list of some of your daily activities. The activity of 'eating' has been done as an example. Decide which of your systems are working together to enable you to do each activity. Record your answers in the table.

Activity	Digestive system	Circulatory system	Skeletal system	Muscular system	Respiratory system	Sense organs
Eating	x		x	x	x	x

Sense survey

Find out what people know about the senses by conducting a survey. A survey is one way that you can collect data.

The first thing you need to do is to construct a questionnaire. Write down questions that you can ask to get information that you want. A sample questionnaire is shown on the next page.

Then you need to get a sample of people. They will answer the questions on your questionnaire.

Use a table to record your data.

You can then present the data in a way that makes it easier to understand. The bar graph on page 41 is one way to do this.

Do most people think that we have only five senses?

Do most people know the five senses?

You can also ask for information on people's sex and age. You can then find out if people in certain age groups think differently. For example, do male people older than 10 years think differently from female people who are seven years or younger?

Sample questionnaire

Name of person being surveyed _____

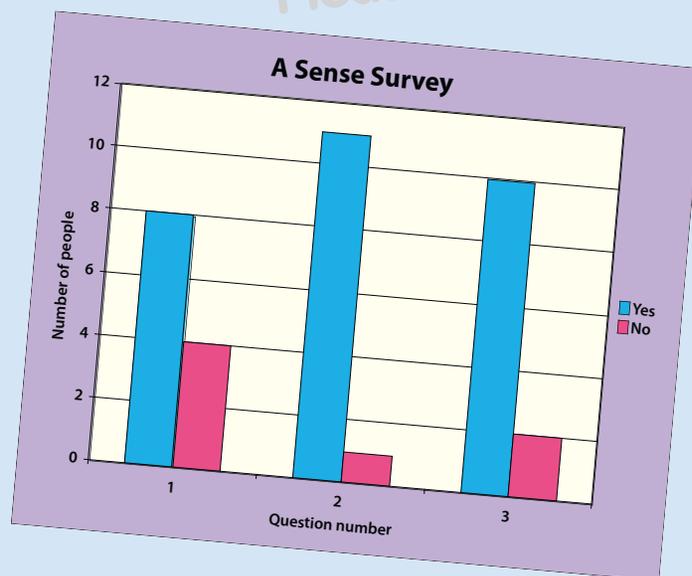
(It is okay if the person does not want to give a name.)

Sex: Male Female

Age _____

- | | | | |
|----|--------------------------------|-----|----|
| 1 | Do we have only five senses? | YES | NO |
| 2 | Do we have a sense of sight? | YES | NO |
| 3 | Do we have a sense of smell? | YES | NO |
| 4 | Do we have a sense of hearing? | YES | NO |
| 5 | Do we have a sense of touch? | YES | NO |
| 6 | Do we have a sense of taste? | YES | NO |
| 7 | Do we have other senses? | YES | NO |
| 8 | Do we have a sense of balance? | YES | NO |
| 9 | Do we have a sense of hunger? | YES | NO |
| 10 | Do we have a sense of thirst? | YES | NO |

Thank you for taking part in our survey.



Energy sources and energy changes

In this chapter, you will:

- learn that energy sources may be renewable or non-renewable
- learn that the Sun is the primary source of light and heat energy
- understand that there is a limited supply of energy on our planet
- identify types of energy resources used in the school, the community and the country
- learn that the process of energy conversion involves many energy changes
- appreciate that people must use their energy resources carefully
- appreciate that energy allows our bodies to do different tasks.

No Sun, no life

Imagine waking up in the morning to the rays of the Sun shining into your room. You see your toys, books and clothes around you. You can feel the warmth of the Sun. Now, imagine what it would be like if you woke up in the same room and it was in total darkness. Could you see anything? Could you feel the warmth of the Sun?



Activity 1

Work in groups of five.

Go out of the classroom to an open area where the Sun shines, without any shade.

- 1 Stand still for 2 minutes. How do you feel?
- 2 Move back into your classroom or a shady place and sit still for 2 minutes. How do you feel?
- 3 Copy the table in your exercise book and fill it in to describe how you feel.

What I did	Observation (what I feel)
Standing in the Sun for 2 minutes	
Sitting in the classroom/shade for 2 minutes	

- 4 How would you feel if you were asked to stand still in the hot Sun for 20 minutes? Why?
- 5 What makes you feel what you feel?

The Sun is a source of energy

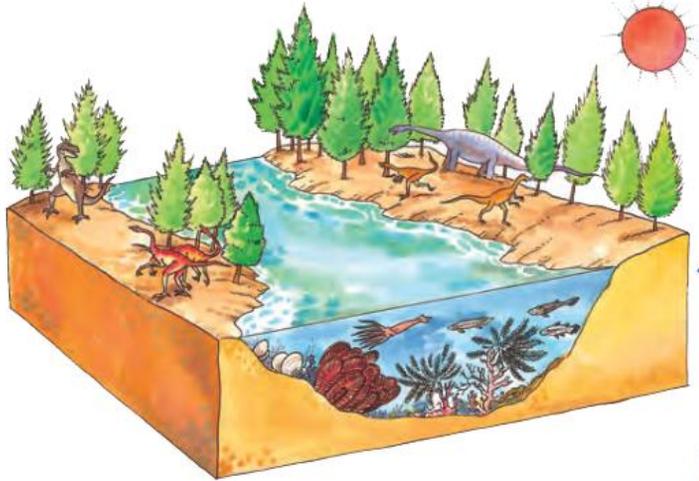
Can you see the Sun in the sky? How many of us appreciate the importance of the Sun in our lives? Would life, as we know it, be possible without the Sun?

The Sun is a star made up of very hot gases. It gives out a large amount of energy. Only a very tiny amount of this energy reaches the Earth. We get this energy from the Sun in the form of heat energy and light energy. Heat energy gives us warmth. Light energy enables us to see. The Sun is the major source of energy for the Earth.

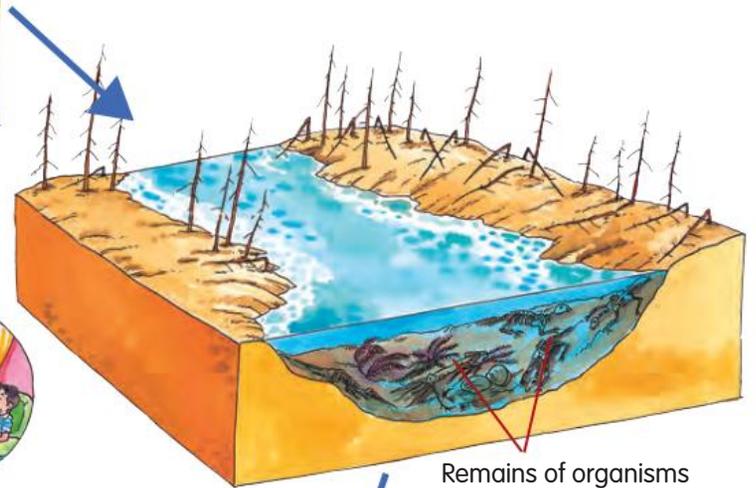
Energy for fossil fuels came from the Sun

The Sun is the source of energy for all organisms. It is also the source of energy for our vehicles, homes and industries. They use fossil fuels such as coal, natural gas and oil. Fossil fuels are the remains of plants and animals that died millions of years ago. When they were alive, these plants used the Sun's energy to

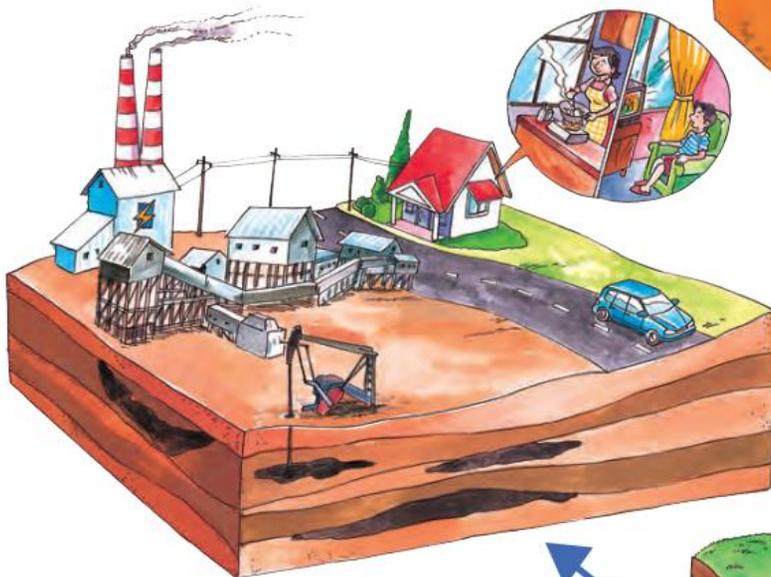
photosynthesise. Animals also ate the plants and other animals. The Sun is the source of energy for plants. When we use fossil fuels, we are using energy from the Sun. This energy was stored millions of years ago. It was stored as chemical-potential energy. The diagrams below show how this happened.



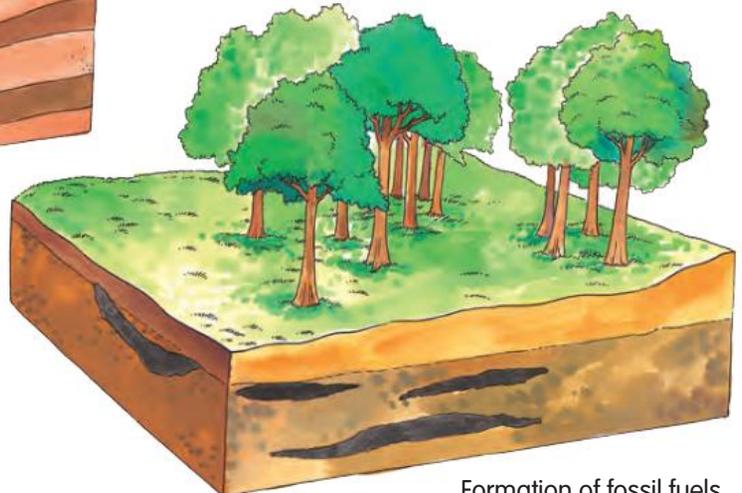
300 million years ago



Remains of organisms



Use of fossil fuels in vehicles, power stations, homes and industries



Formation of fossil fuels

What is energy?

Scientists use the word “energy” to mean the ability to do work. Energy exists in different forms. These different forms of energy allow us to do work and play.

Think about the forms of energy that allow the things in these drawings to happen.



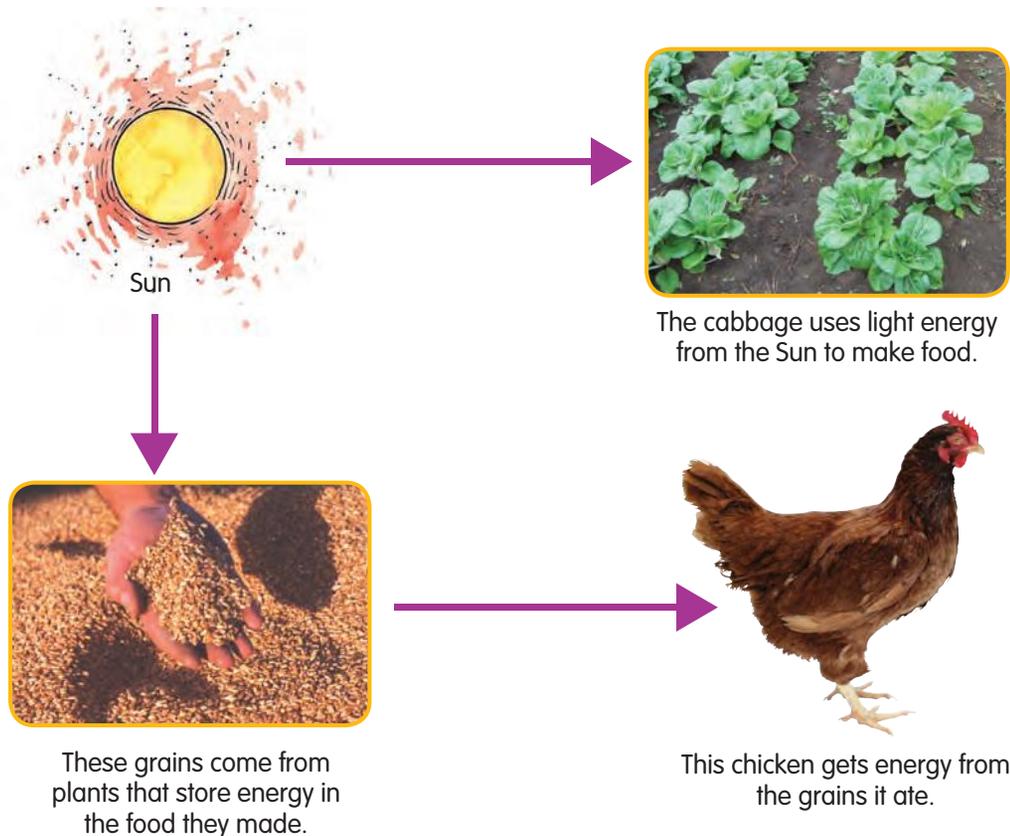
None of these activities would be possible without energy. Energy is needed to make things work or move. We need energy to carry out the day-to-day life processes that keep us alive.

All from the Sun

Our day begins at sunrise. We do our daily activities such as cooking and eating, playing, studying, walking and cycling. Would our activities be possible without energy? Energy allows us to change things. For instance, when we lift a book from the table, where do we get the energy that we need to lift the book? The energy for lifting the book comes from the food we eat.

Imagine that you have eaten chicken and cabbage. Where does your energy come from? Look at the pictures below. Where do you think the chicken gets its food from? What does the food give to the chicken? Does the chicken eat cabbage? Do humans eat cabbage?

The chicken eats the grains from plants. Plants are food producers. They produce food by using the Sun's energy. The Sun is the source of energy for all plants. The chicken cannot make its own food. The chicken is a consumer. All animals are consumers.





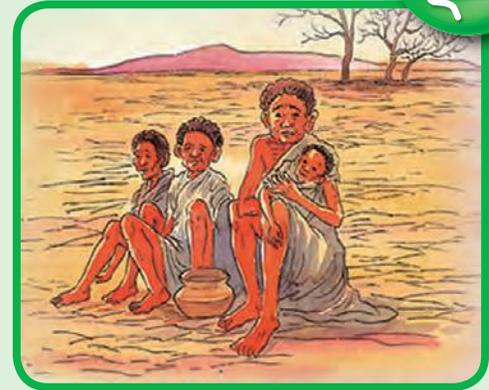
Activity 2

Many children and adults in the world die from lack of food. Why do you think people die when they do not get food to eat? What does food give us?

Food is the source of our energy. During respiration, oxygen releases the energy from digested food.

Do factories need energy to carry out their work? Do buses and other vehicles need energy so that we can use them? Just as factories and vehicles need energy to work, your body needs energy to do its work. Think of all the things that your body does to keep you alive.

Is your body like a busy factory working to keep you alive? Are you like a factory that operates 24 hours a day, or a factory that operates eight hours a day?



Why is food necessary?



Activity 3

Make a list of organisms and classify them as producers, herbivores, omnivores or carnivores in the table. For each organism, trace its source of energy. An example is given.

Organism	Producer (makes its own food)	Herbivore (eats plants)	Omnivore (eats plants and animals)	Carnivore (eats animals)
Pig	–	Pigs eat food scraps and grain meal from plants. Plants make their own food using energy from the Sun.	–	

Please do not write in this book

Do you agree that the Sun is our ultimate source of energy? Why or why not?

Also from the Sun

A ship sails across the ocean. An aeroplane flies in the sky. A bus and a motorcycle drive on the road. A man fries food on a gas stove. A woman boils water in an electric kettle. What do all these have in common?

The ship, the aeroplane, the bus, the motorcycle, the stove and the electric kettle need energy. In the beginning the energy comes from the Sun. The Sun is the source of all energy.



These powerful machines are driven by energy that comes from the Sun.

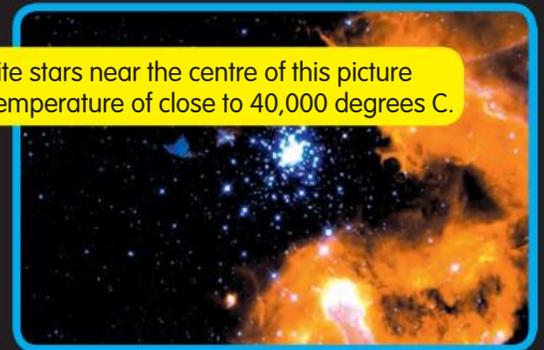
Energy from the Sun enters the living world as light energy. Plants need light energy to make food. Other organisms such as ourselves gain this energy indirectly when we eat plants or other animals that ate plants. Light from the Sun is the major source of energy for the Earth.

When materials are heated until they glow, they give out light. The energy transfers to the environment as light. The Sun is a star. It gives out white light. An electric current heats the filament of a light bulb. The filament glows. The electric energy changes to light energy.

Glow-worms, jellyfish, fireflies, bacteria and fungi light up through chemical changes.

Look at the solar-powered toy and the calculator. These objects do not use batteries. Can you see the solar cells on these objects? It is the solar cells that convert light energy to electrical energy.

The blue-white stars near the centre of this picture have a surface temperature of close to 40,000 degrees C.



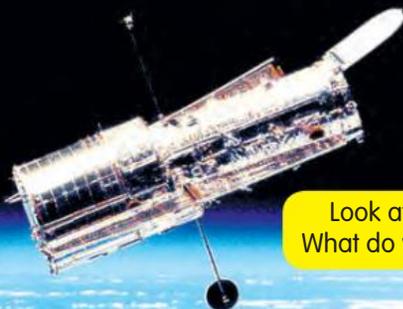
Jellyfish



Glow-worm



Solar cell



Look at the Hubble Space telescope. What do you think is its source of energy?

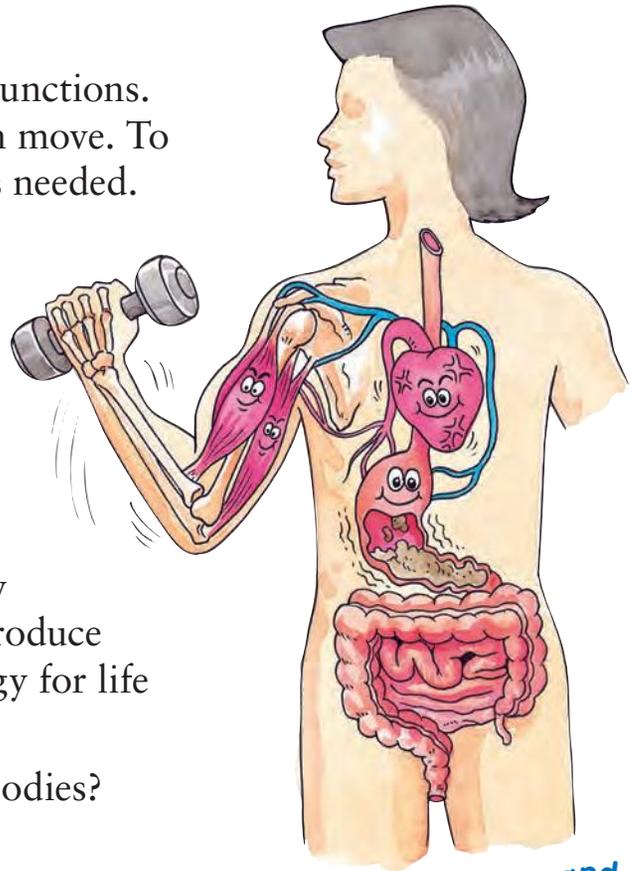
How do we use energy in our bodies?

Energy enables the body to perform different functions. Without energy you cannot grow taller or even move. To move food along your digestive tract, energy is needed.

Our bodies use energy to make more cells so that we can grow. The heart muscles use energy to contract. The heart pumps blood around the body all the time. The muscles on the skeleton use energy to contract so that we can move. Stomach muscles use energy to squeeze our food and help in digestion.

Our bodies use energy to reproduce, grow new tissue, repair old and damaged tissue and to produce **chemicals** for the body. We humans need energy for life processes. Without energy, life is not possible.

Can you think of other uses of energy in our bodies?



Activity 4

Can you get through a day without energy? Think about what you do in a day. Make a list of some of the activities you do that need energy. Do not forget the energy that is needed to keep you alive.

Different types of energy

Energy is all around us in many forms. Energy can make things move, can make sound, can give us light, can make things hot.

Light energy

Light energy lets us see what is around us.



Light bulb at night

A star gives us light.

Candlelight

Human beings have used fire for as long as we can remember. Fires give us heat and light energy. We use the light energy from the fire at night to help us to see.



Honiara town glows with many colourful street lights at night.

Heat energy

Heat energy cooks our food. It keeps us warm when the nights are cool. Heat is a type of energy we feel on our skin. It is the form of energy that hot objects have.



Woman cooking on a fire



Candles are made by dipping strands of cotton into animal fat.



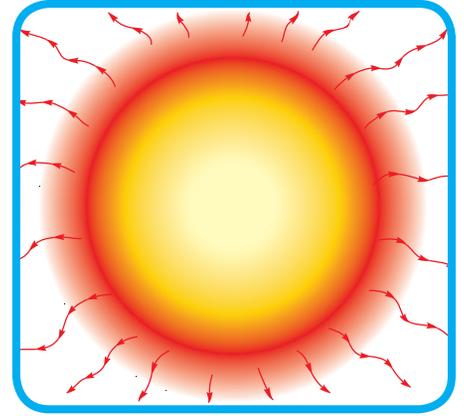
Light bulbs give out light energy and heat energy.



A car engine gives off heat energy.



A burning wood fire gives off heat energy.



The Sun gives off heat energy.

Sound energy

You hear sound energy when something vibrates. Sound energy travels from place to place as sound waves.



You hear sound energy when the vocal cords in your throat vibrate as you sing.



You hear sound energy when a Solomon Airlines plane takes off.

Stored energy

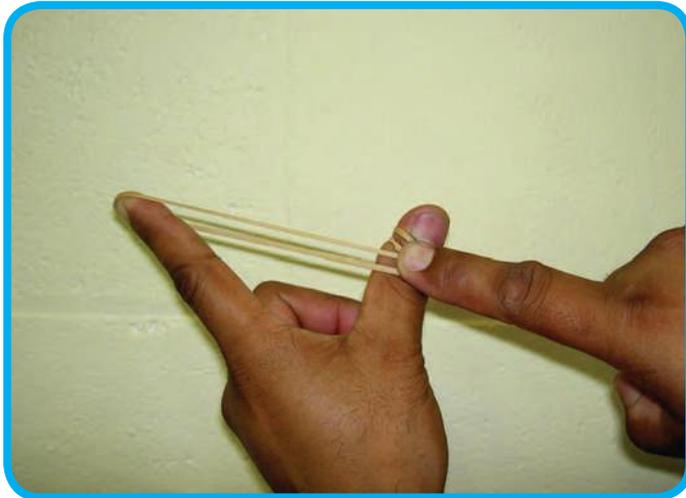
Stored energy is energy that a material can release to do work.



Rice, taro and kumara contain stored energy. When we eat this stored energy, the body releases it. We can run and play.



Petrol contains stored energy. When a car engine burns this stored energy, it moves along the road.



A stretched rubber band has stored energy. When you let it go, it flies across the room.



The batteries inside your torch contain stored energy. When you put the batteries in your torch, the light shines. The batteries release their energy.

In Solomon Islands, we have strong sunlight on most days. Should we use solar panels for water heating? Why or why not?

Heat (thermal) energy

A burning candle, a car engine and burning firewood, all transfer heat to the surroundings. This causes the **temperature** of the surroundings to rise.



When an object is made hotter, its heat energy increases. The heat energy transfers from the hotter part to the cooler part. Look at the cup of hot tea. What happens when you place a metal teaspoon in the cup? Does the teaspoon feel warmer after

a while? Has energy been transferred from the hot tea to the cool metal teaspoon?



Solar water heaters on the roof of a house



The Sun transfers a huge amount of heat energy into space.

Activity 5

Work in groups. Set up the activity as shown in the pictures. The cups of hot water must be exactly the same size.

Which blob of margarine do you expect to melt first?

If the blob of margarine on the metal teaspoon melts first, does this show that metal is a good heat conductor? Does it show that heat energy is transferred from a hotter part to a cooler part?



Metal is a good heat conductor, transferring heat energy rapidly, but plastic is a poor heat conductor.

If you want your bowl of noodles to stay warm, would you use a metal bowl or a polystyrene bowl for your noodles?



Metal bowl



Polystyrene bowl

Movement energy

When something is moving, it has movement energy. The faster it is moving, the more energy it has.

When you watch trees moving in a strong wind, you see how much energy the wind can have. The energy of the wind is movement energy. Movement energy is also called “kinetic energy”. These pictures show more examples of kinetic energy.

The energy of these moving objects can be changed to other forms of energy. A ball at rest will not move until it receives energy. When you kick a ball, the kinetic energy in your foot is transferred to the ball. The moving ball has kinetic energy.



Moving wind turns the wind turbines



Falling water



A flying bird



A moving car

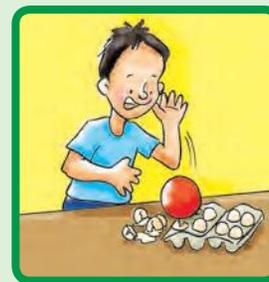
Activity 6

What happens when you drop a heavy metal ball on a carton of eggs? What happens when you drop a table tennis ball on a carton of eggs? Which ball gives a greater impact?

A moving, heavy object has more kinetic energy than a moving, light object.

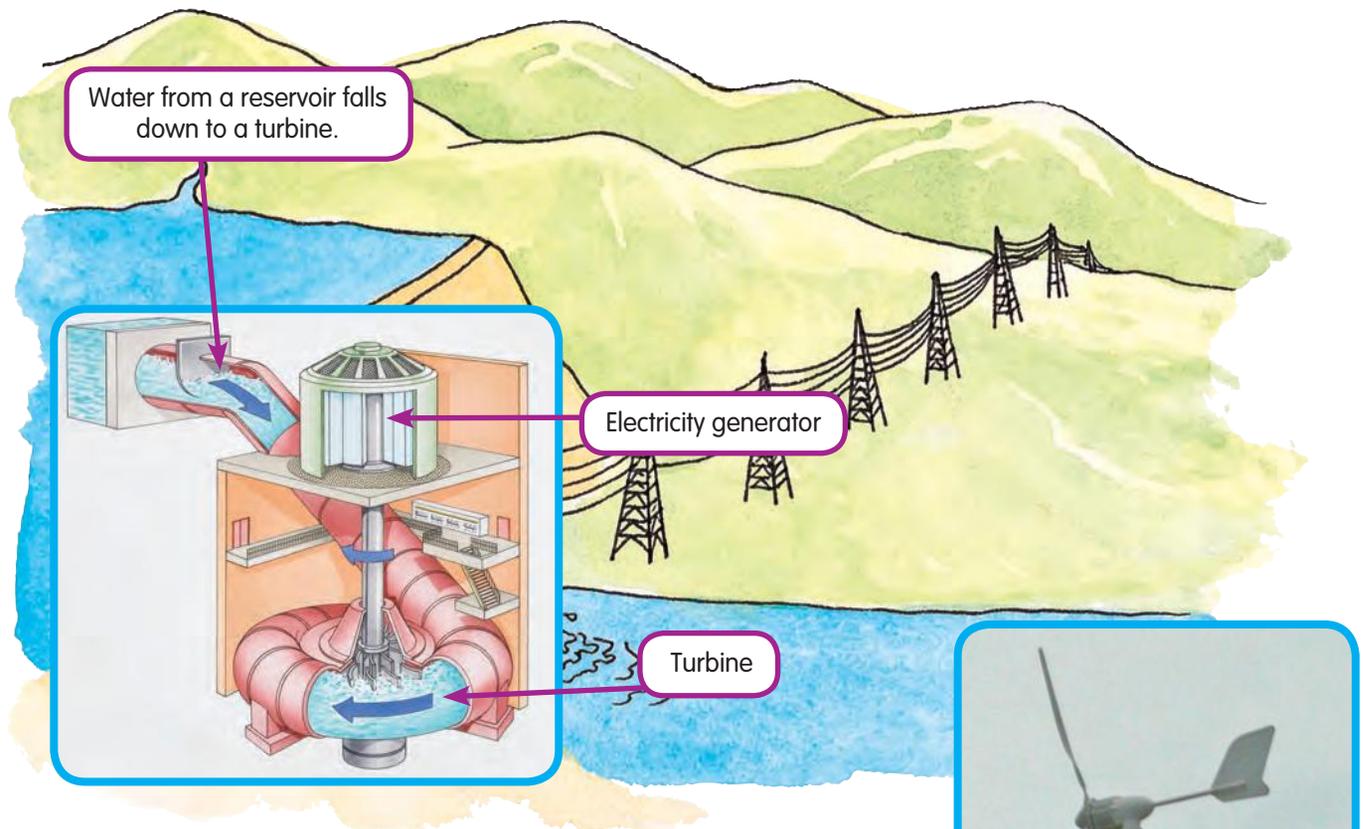
What happens when a car driven at a high speed crashes into a tree? Is the impact worse than that of a car driven at a low speed?

An object that moves fast has more kinetic energy than an object that moves slowly.



Kinetic energy to electrical energy

This picture shows how the kinetic energy of moving water is changed to electrical energy. The moving water turns a turbine. The turbine spins the electricity generator. We use this method of generating electricity in places where there are strong rivers. There must be plenty of rainfall to supply the river with water. In Solomon Islands there are two electrical power stations like this. One of them is in Malaita.



We can also convert the kinetic energy of the wind to electrical energy. We use windmills. Some countries use wind-driven generators because they do not pollute the environment.



Windmill electrical energy, Honiara

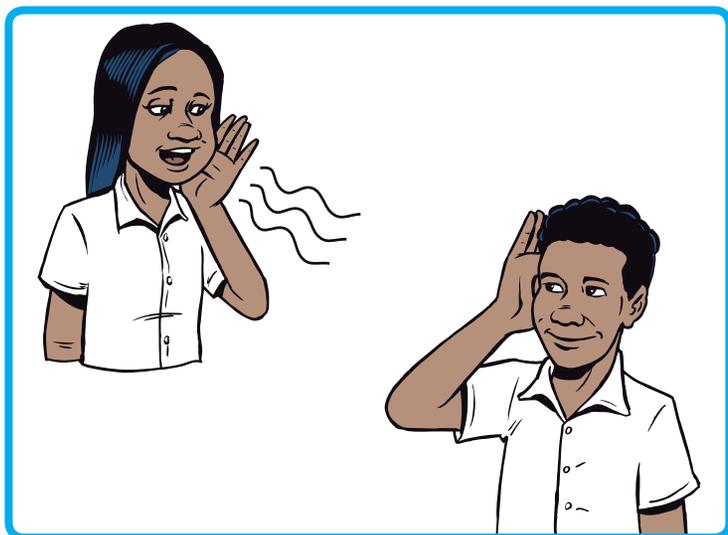
The kinetic energy of the moving wind and water can sometimes cause huge changes to the environment. The large amount of kinetic energy in the moving wind and water causes natural disasters. Look at what happens when we have flooding rivers.



This photograph shows what the kinetic energy of the Usumani River (Guadalcanal) did in 2009. It washed away part of the concrete bridge.

Sound travels

Sound travels through the air very well. The vibrations move because of their kinetic energy. When we speak, we make vibrations that travel through the air. These vibrations have kinetic energy. Our ears have a drum. The drum moves because the vibrations strike it. The kinetic energy of the vibrations change to sound energy in the ear.



This picture shows the vibrations moving from a person speaking to a person listening.

Activity 7

Think of the sounds you heard today. You heard your teacher calling you. You heard the sounds of the bus or an outboard motor. You heard the news on the television or radio. With all these, you are hearing sounds in the air. Air transmits sounds well.

Can you hear sounds in water? Can you hear the banging of stones when you dive under water? Sound travels through water very well. This allows whales and dolphins to communicate.

Can sounds be transmitted by solids? Ask a friend to knock on a wooden door while you stand on the other side. Press your ear against the door. Can you hear the knocking? Sound vibrations travel through solids.

Activity 8

Can you feel the vibrations in your voice? Place your fingertips lightly on the lower part of your voice box in the throat. Sing a single, prolonged note. What do you feel?

A guitar is shaped so that we can hear the musical notes when the taut strings are plucked and vibrate.

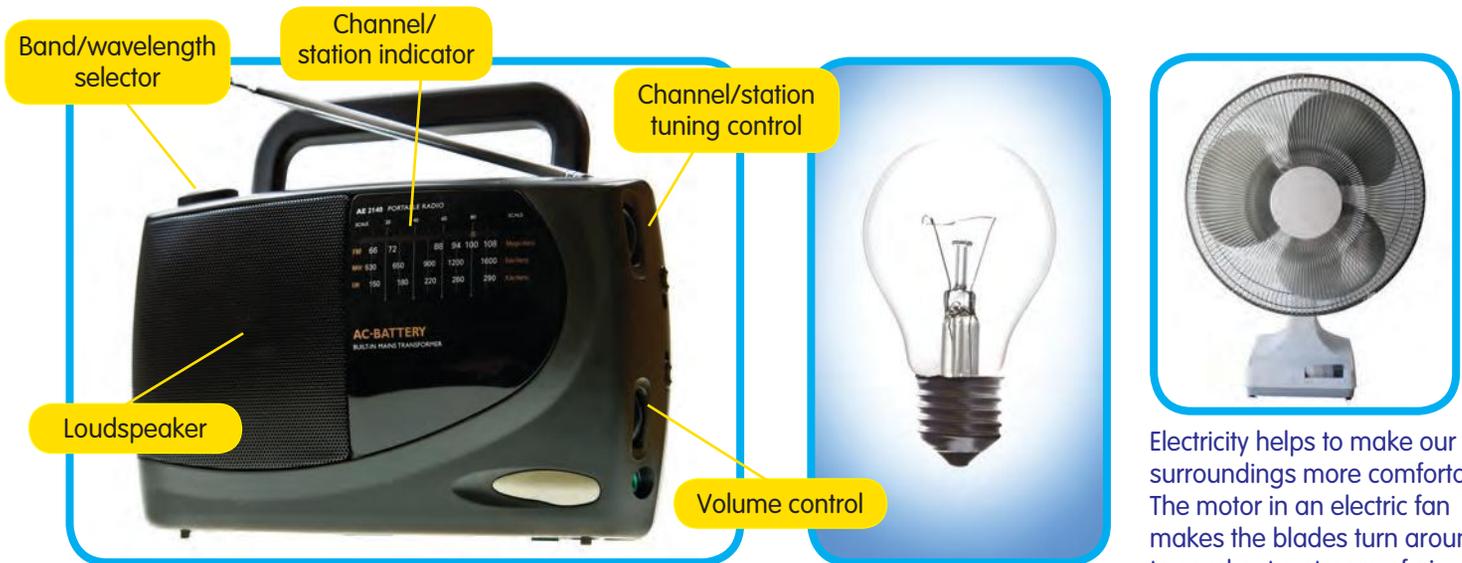
You can make your own guitar using a cardboard carton and rubber bands of different lengths and widths.



Electrical energy

Electricity is a form of energy. Electrical energy can make things light up and warm up, and can give power to machines. The electrical energy causes changes to other forms of energy such as light, heat, sound and kinetic energy.

For example, a light bulb changes electrical energy to light energy. A fan changes electrical energy to kinetic energy. In a radio, electrical energy changes to sound energy.



Many people in Solomon Islands use electrical energy for lighting. Large towns have diesel generators. Some people use hydrogenerators. Many village people use solar panels.

Activity 9



Work in groups of five. Conduct this mini survey in your neighbourhood.

- 1 Identify five different families/households.
- 2 Draw up a table for your group's findings.
- 3 Ask each of the families these questions:
 - What appliances do you use to produce light?
 - What is the source of energy used?
 - What other appliances do you use that depend on electrical energy?
- 4 Choose a representative from your group to report your findings to the class.

Potential energy

We eat food to get energy. We use the energy from the dry cells in a torch. We store water in large tanks. We store fuel oil in jerry cans. We store gas in cylinders.



Food



Fuels



Some sources of chemical-potential energy

These are all examples of energy readiness. It is ready to be changed to other forms. It is called “potential energy”.



Batteries

During photosynthesis green plants take in light energy. The plants use the light energy to make food. The chemical-potential energy in plants is the origin of all food.

Plants have a store of chemical-potential energy. When animals eat plants, they get energy to grow. When animals do activities they use the energy.

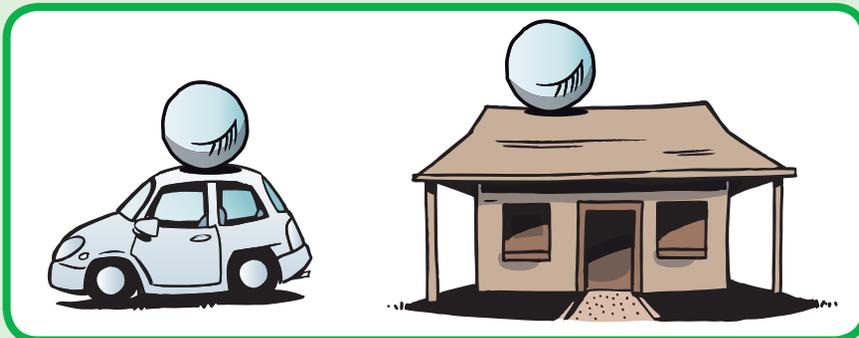


Animals eat. This gives them potential energy to move.



Activity 10

The two stones are at different heights. One is on the roof of a house, and the other is on the roof of a car. Which of the two stones has greater potential energy?



In the picture of a tree, the two stones are at the same height. One is small, one is big. Which of the two stones in the tree has greater potential energy? The stones have potential energy because of their height above the ground. This is called “gravitational-potential energy”.

Elastic-potential energy

Elastic-potential energy is the energy that is stored in elastic objects such as bouncy balls, rubber bands and springs.

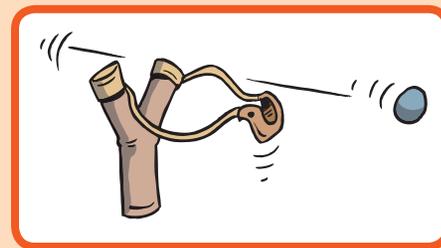
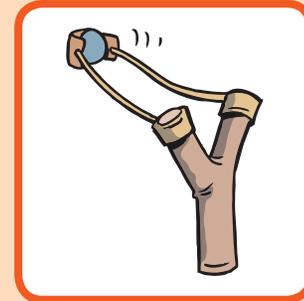


Activity 11

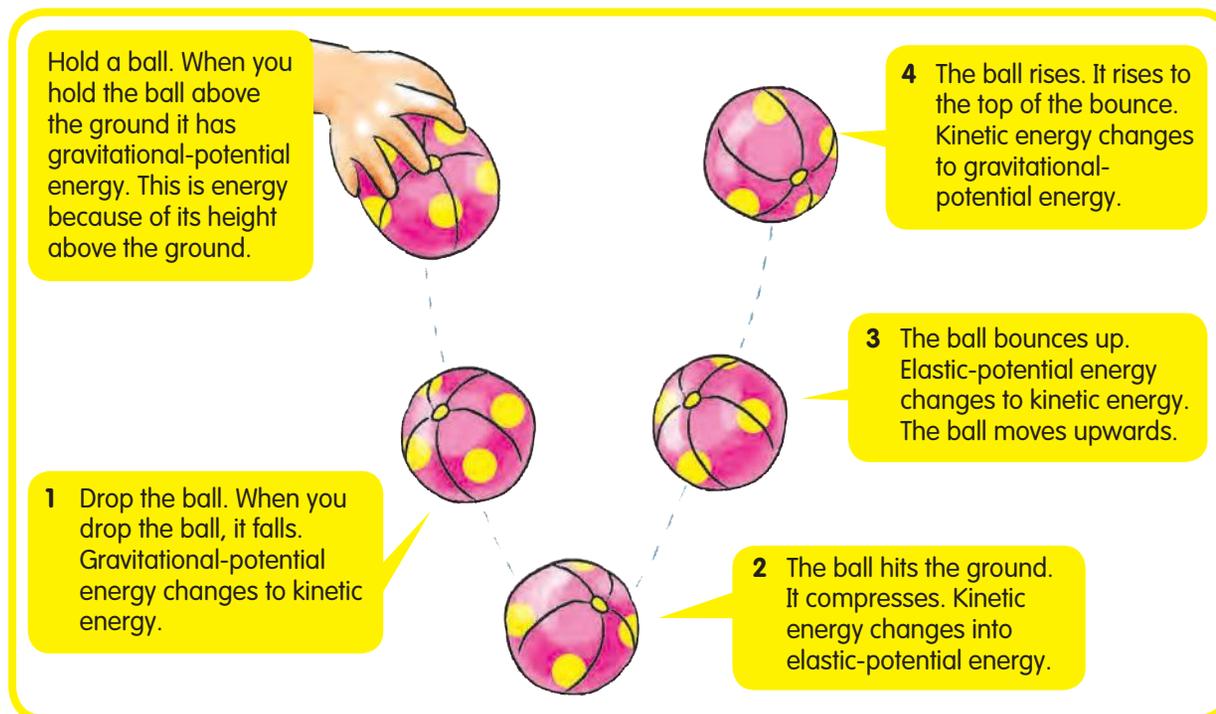
- 1 Put a stone in a catapult (sling). Pull the rubber band back a small distance and release the stone. Mark the ground where the stone falls.
- 2 Now pull the rubber band back all the way. Release the stone and mark the ground where the stone falls.
 - What do you notice?
 - Why do you think there is a difference?

The elastic-potential energy is greater when the catapult rubber is pulled back all the way. The stone travels further.

In the catapult the elastic-potential energy transfers to the moving stone as kinetic energy.



Look at what happens when you bounce a ball.



Count the changes. How many are there?

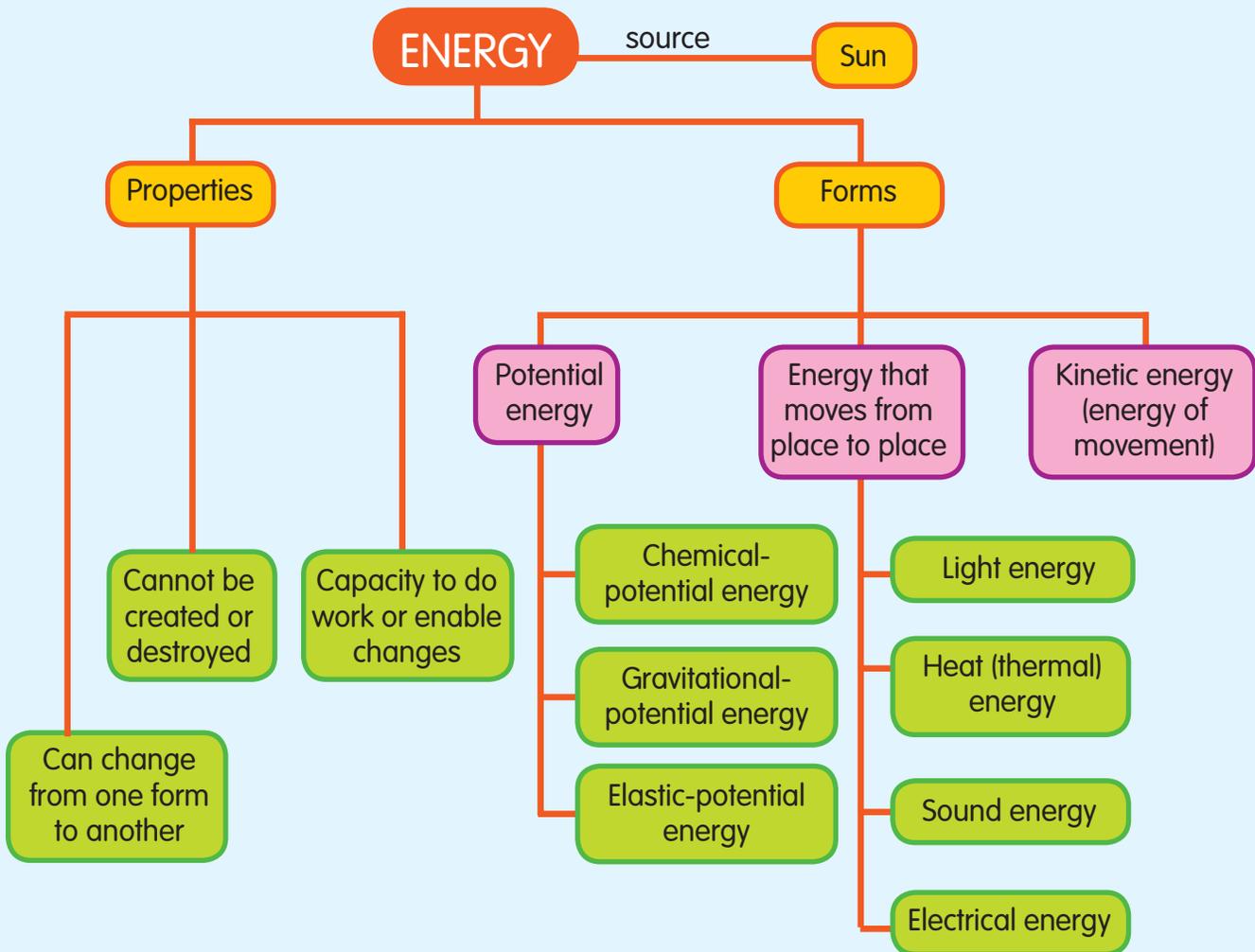
Chapter Review

- 1 Energy cannot be created. It can change from one form to another. It can transfer from one object to another.
- 2 The Sun is the source of fuel for our vehicles, power stations, homes and industries. The fossil fuels we use such as coal, natural gas and oil come from the Sun. At one time, all these fuels were in the form of plants.
- 3 The Sun is the source of energy for plants and animals.
- 4 The forms of energy are light energy, heat (thermal) energy, kinetic energy (energy of movement), sound energy, electrical energy, chemical-potential energy, gravitational-potential energy and elastic-potential energy.
- 5 Chemical-potential energy, gravitational-potential energy and elastic-potential energy are forms of energy held in storage. These forms of energy are ready to use.

Think about these energy examples from the letters in the word “energy”.

- E**lastic band on your shorts—elastic-potential energy
- N**etball on top of a slide—gravitational-potential energy
- E**lectric current to charge batteries—electrical energy
- R**adio waves bringing music to your ears—sound energy
- G**as stove boiling noodles—heat energy
- Y**our food—chemical-potential energy

Concept Map



Answer these questions in your exercise book.

1 Which of these statements are true?

- A** Energy changes when we throw a ball upwards.
- B** The Sun is not important as a source of energy for humans.
- C** Batteries transfer chemical-potential energy to the circuit as electrical energy.
- D** When you wind up your clock, you are transferring energy from elastic-potential energy to kinetic energy.

- (1)** A and B only
- (2)** A, B and C only
- (3)** A, C and D only
- (4)** All of the above

2 Which of the following is the best description of throwing a ball?

- A** Chemical-potential energy from your body is transferred as kinetic energy to your arm which, in turn, transfers kinetic energy to the ball and heat energy to the surroundings.
- B** Chemical-potential energy from your body is transferred as gravitational-potential energy to your arm which, in turn, transfers kinetic energy to the ball and heat energy to the surroundings.
- C** Heat energy from your body is transferred as gravitational-potential energy to your arm which, in turn, transfers kinetic energy to the ball and thermal energy to the surroundings.

3 Write two sentences to explain why photosynthesis is the origin of food. Your sentences should contain these words: Sun, leaves, plant, energy, food, light, green and photosynthesis.

4 Is the Sun important in your life? Write two reasons.

Magnets in our lives

In this chapter, you will:

- understand that a magnet can be used for orientation on the Earth's surface
- understand that magnets attract some materials, but not others
- learn that some materials are magnetic and others are non-magnetic
- learn that unlike poles of magnets attract and like poles repel
- learn that there is a link between magnetism and electricity
- appreciate that the electromagnetic effect is applied in everyday technology devices such as the electric bell.

What do we use magnets for?

Magnets are at work all around us, but most of them are hidden inside machines.

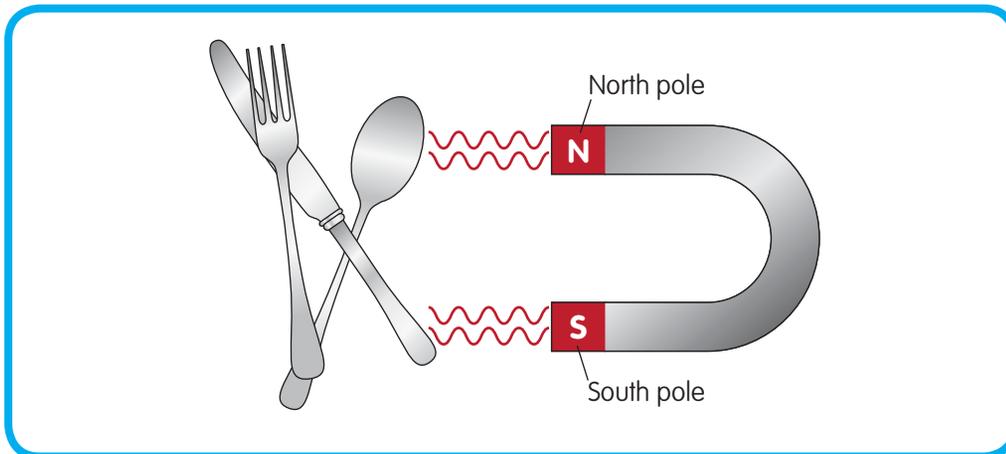
Magnets are used in turbines to generate electricity. They are used in circuit breakers and in the starters of cars.

Magnets help us to keep doors and lids, such as in your pencil case, closed.

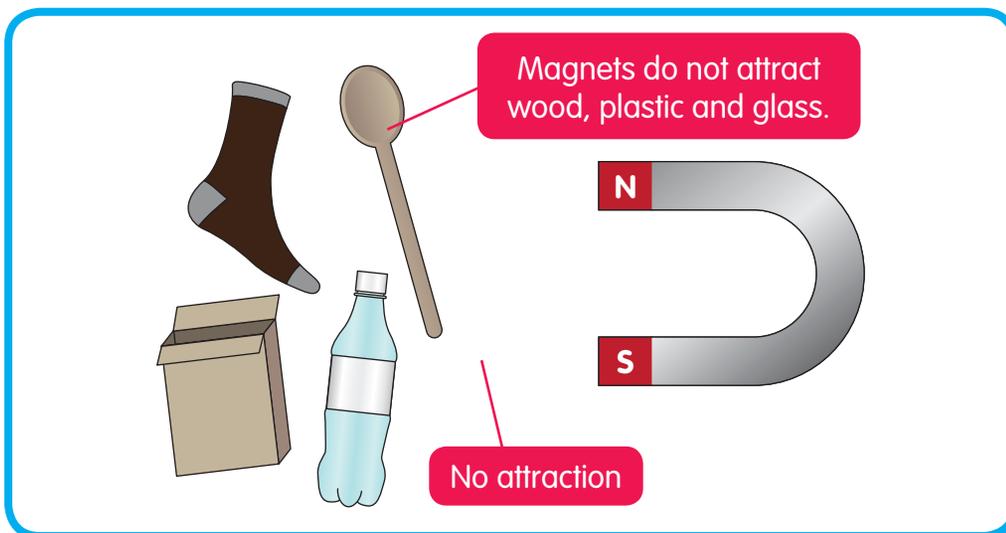
They are used in compasses so that we know which direction we are going in.

Magnetic materials

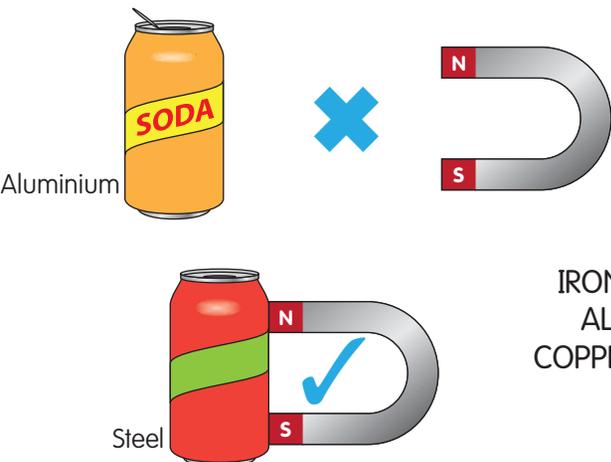
1 Only metals are attracted to magnets.



2 Other materials are not attracted to magnets.



3 Not all metals are attracted to magnets.



Aluminium

Steel

IRON and STEEL = YES
ALUMINIUM = NO
COPPER and BRASS = NO



Activity 1

- 1 Draw up a table like the one below in your exercise book.
- 2 Record which objects are attracted to magnets and which are not.

Objects	Attracted	Not attracted
Cotton wool		
Peg		
Steel screw		
Paper clips (metallic)		
Scissors		
Plastic spoon		
Pencil		
Safety pin		
Key		
Book		
Leaf		
Copper coin		
Plastic		
Eraser		

Metals that contain **iron** are attracted to a magnet. **Aluminium** and **copper** do not contain any iron. They are not attracted to magnets.

Machines use magnets

Many everyday machines use magnets. The generator in a car works because of magnetism. Fridges have **magnetic** strips to keep the door tightly closed. Speakers for a sound system have magnets. Chainsaws also have magnets.

Here are some machines that make use of magnetism.



Car generator



Fridge



Speakers



Computer disks



CD player



Chainsaw



CD/radio



Bank card



Videotape

What are magnets made of?

Magnets have magnetic force that attracts some materials like iron or steel. Magnets are made from iron, steel or special alloys (mixture of metals).

History of magnets

The ancient Greeks used pieces of a rock called “magnetite” to attract pieces of iron. This rock attracted iron and other metal objects. Early sailors used it as a **compass** in ships.

The strength of a magnet does not depend on its shape or size. A small magnet can be stronger than a large magnet.

Heating or hammering can reduce the strength of a magnet.

Activity 2

Find out how magnetic materials are attracted by magnets.

- 1 Pick up some metal paper clips with a magnet. Pull the clips away from the magnet. Can you feel the magnet pulling the paper clips back towards itself? This pull is called “magnetic force”.
- 2 Try to pick up the same metallic paper clips with a piece of aluminium foil instead of a magnet. Does the aluminium foil attract the paper clips?

Aluminium foil is not a magnet, therefore it does not attract magnetic objects, such as the metallic paper clips, to itself.

What happens when you try to use ...

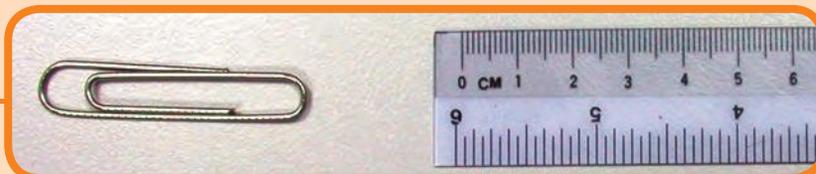
a wooden object



a rubber object



a plastic object



a piece of cotton cloth



... to pick up the metal paper clips?

Activity 3

1 Collect a variety of objects, such as:

- a piece of paper
- a piece of aluminium foil
- a small metal spoon
- a metallic paper clip
- a variety of coins
- a variety of other objects of your choice.
- a rubber ball
- a small plastic spoon
- a small wooden spoon
- a plastic paper clip
- a pencil

2 Draw up a table like this in your exercise book.

Predictions and test results for objects that a magnet may attract

Object	Prediction		Test result
	YES/NO	WHY?	YES/NO
Plastic paper clip	no	Plastic	no

3 Predict which objects the magnet will pick up. Record your predictions in the table.

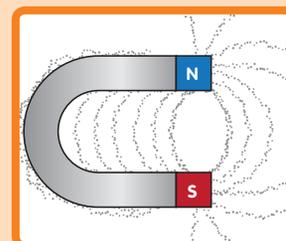
4 Test each object and record your observations in the same table. What can you conclude from this activity?

Activity 4

Put a bar magnet on the table. Place a sheet of cardboard over the magnet. Put some iron filings on the cardboard. Tap the table with your hands and see the pattern the iron filings make.

Would you expect to see more iron filings at the poles?

The ends of a magnet are called its “poles”. The magnet is strongest at the poles. That is why it shows more concentrated lines of force at the poles. Would you get the same magnetic field pattern with a horseshoe magnet? Look at the different magnetic field pattern of a horseshoe magnet.



Activity 5

Use different types of magnets to pick up paper clips.

- Can you pick up more clips with the end of the magnets or along the length of the magnets?
- Can magnetic forces pass through materials?

If you put a metallic paper clip in a glass of water, can you get the paper clip out of the glass with a magnet?

Hold a magnet against the side of the glass and move the magnet upwards. Does the paper clip move with it?



Magnetic fields

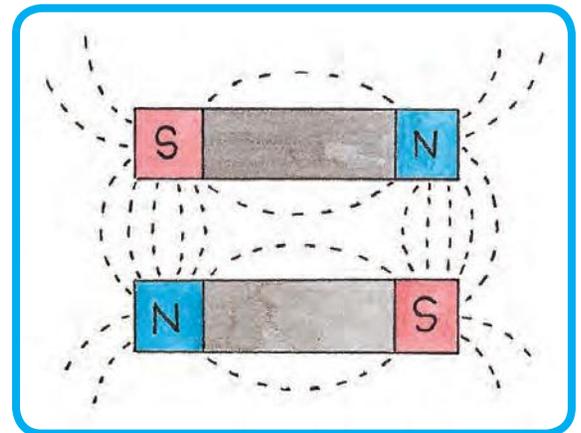
Every magnet has a “**magnetic field**”. This is the area in which its magnetic force has an effect.

The iron filings in the photo on page 69 line up along the lines of magnetic force to produce a pattern. Lines of magnetic force are usually invisible. By using the iron filings, we make the lines of magnetic force visible.

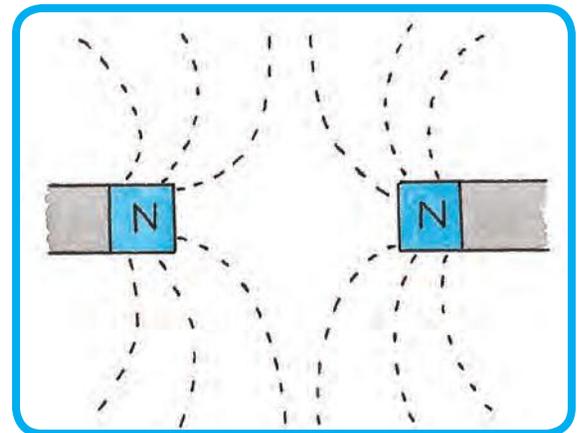
Would the magnetic field patterns be the same for two attracting (unlike) poles and two repelling (like) poles?

Look at the patterns shown opposite. See the attraction between unlike poles (N pole and S pole) of two magnets.

Look at the repulsion between two like poles (N pole and N pole; S pole and S pole) of two magnets.



N pole and S pole showing attraction



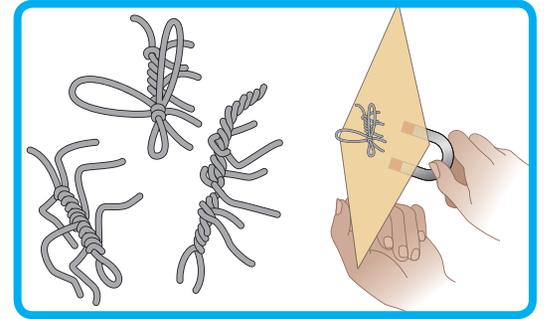
N pole and N pole showing repulsion

Magnetic forces

A magnet exerts its **force** in different directions. It forms a pattern of imaginary lines within the field around the magnets. These are called “lines of force”. They curve outwards from the magnetic north pole to the south pole.

Magnetic force can pass through non-magnetic materials such as wood, paper, copper, oil, sand, rubber, plastic and aluminium. This property of magnets is used for tricks. The model insects in the drawing are made from steel wire. A person moves a magnet behind the sheet of cardboard. The moving magnet makes the insects move along the cardboard.

Magnetic forces cannot pass through magnetic materials such as iron, steel, cobalt, nickel and alloys.



Magnetic poles

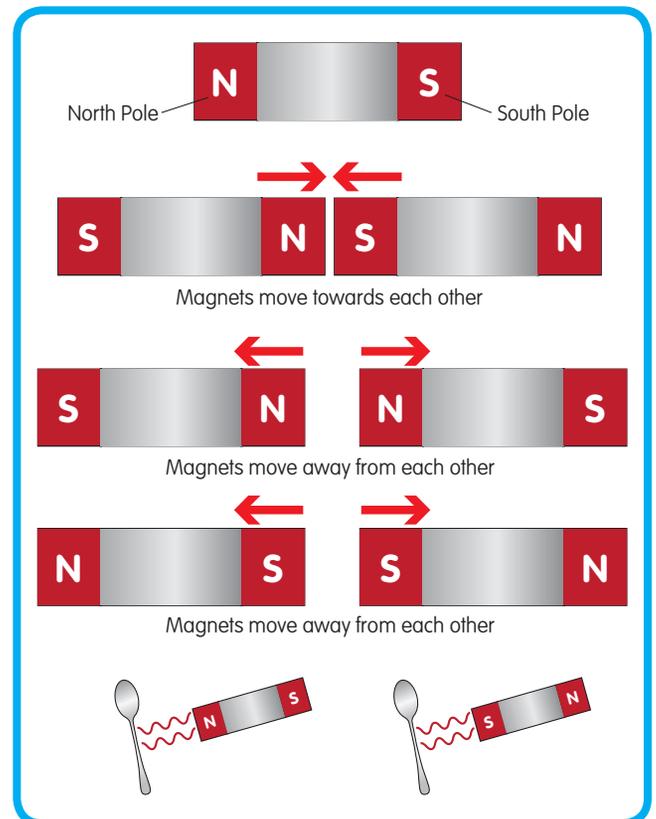
All magnets have two poles. One is called its “north pole” and the other is called its “south pole”.

The magnetic force of a magnet is strongest at its poles. The centre of a magnet is its weakest point. The poles of a magnet are attracted towards the magnetic poles of the Earth.

- 1 A magnet has a north pole (N) and a south pole (S).
- 2 A north pole and a south pole attract each other.
- 3 Two north poles **repel** each other.
- 4 Two south poles **repel** each other.
- 5 Both ends of a magnet will attract magnetic materials.

Remember the rule for two magnets—

“Opposite poles attract, like poles repel”.



Making magnets

Some magnets lose their magnetism quickly. These magnets are called “temporary magnets”. They are usually made from iron and mild steel. Some magnets do not lose their magnetism so quickly. These magnets are called “permanent magnets” and are made of hard steel or alloys.



Activity 6

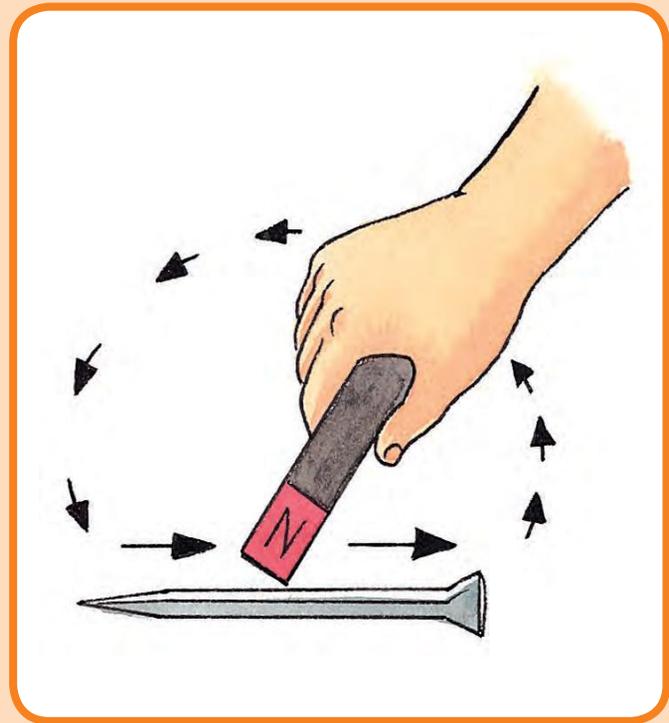
Make a magnet by stroking

Magnetise a sewing needle temporarily. Stroke the needle twenty times along its entire length with a strong bar magnet. Remember to stroke in one direction only.

Use the N pole of the magnet to stroke the sewing needle. Look at the drawing. The end of the needle at which you started stroking becomes a N pole.

If you use the S pole of the magnet to stroke the needle, the end at which you start stroking becomes a S pole.

Magnets made by stroking are weak magnets.



Activity 7



Make a paper holder for a bar magnet.

- 1 Tie a length of string to the holder and hang the magnet from the back of a chair. The drawing shows this.
- 2 Observe what happens when the bar magnet is hanging freely from the chair.
- 3 Spin the magnet and allow it to settle again. Observe what happens. The magnet comes to rest and points in the same direction each time.



A bar magnet points in a north–south direction when it hangs freely.

The end of the magnet that points north is the N pole of the magnet.

Magnets rest in a N–S direction, because the Earth itself behaves like a huge magnet.

The N pole of a magnet seeks the North Pole of the Earth and the S pole of a magnet seeks the South Pole of the Earth.

Activity 8



Use the hanging magnet from Activity 7 to observe how the poles of a bar magnet behave.

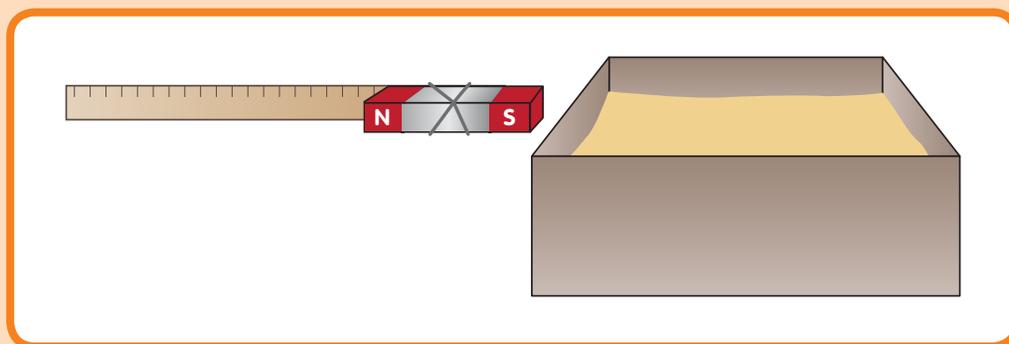
- 1 Slowly move a second bar magnet towards the magnet that is hanging freely. Observe what happens.
- 2 Use the other pole of the bar magnet, and move it towards the hanging magnet. Observe.
- 3 Repeat these actions. Record your observations. Read statement numbers 1 to 5 on page 71 to check your observations.

Activity 9

Work with a partner.

- 1 Hide a variety of magnetic materials in a small tray of sand.
- 2 Tape a bar magnet onto a stick or ruler.
- 3 Ask your partner to find the treasures you buried by using the bar magnet.
- 4 Now your partner buries magnetic materials. You find them using the magnet.

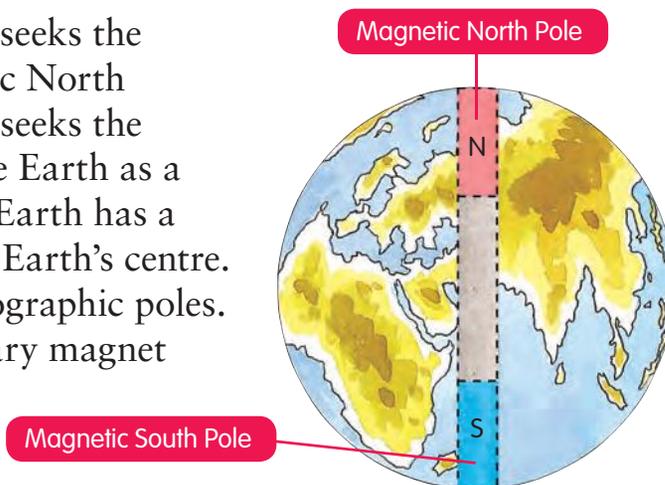
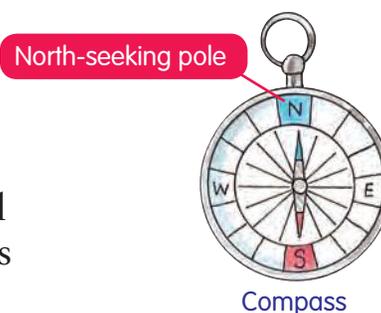
Who found the most items in the shortest time?



Compasses use magnets

Look at a real compass, if you have one. If not, look at a drawing of a compass. A compass is a small bar magnet on a pivot. It is free to spin. The magnet spins above a dial marked with the points of the compass. The magnet shows the North direction. So, we can use the compass marks to find other directions.

When we say that the North Pole of a magnet seeks the North Pole of the Earth, we mean the magnetic North Pole of the Earth. The South Pole of a magnet seeks the magnetic South Pole of the Earth. Think of the Earth as a huge magnet. It is like a magnetised ball. The Earth has a magnetic field. This is produced by iron at the Earth's centre. The Earth's magnetic poles are close to the geographic poles. The drawing shows the Earth with an imaginary magnet inside it.

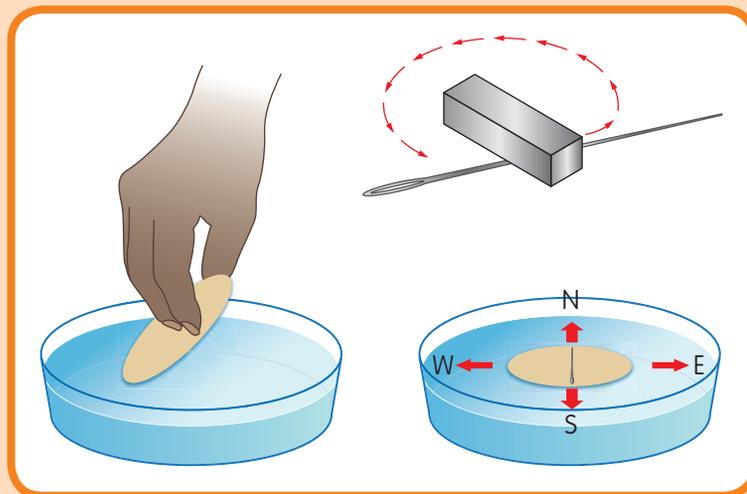


N at the North Pole. South at the South Pole.

Activity 10

Make a steel sewing needle into a compass. You will need a needle, a bar magnet, a circle of cardboard and a dish of water. Follow the step-by-step instructions.

- 1 Stroke the sewing needle from the sharp end about 15 times. Use only the North pole of the magnet and always stroke in the same direction.
- 2 Secure the magnetised needle to the piece of plastic. Use blutac or glue. Float the piece of plastic on the surface of the water in a dish. The drawings show how this looks.
- 3 Allow the needle on the piece of plastic to float freely. Observe what happens.
- 4 Lift the piece of plastic, turn it around, and place it on the surface of the water again. Observe again.



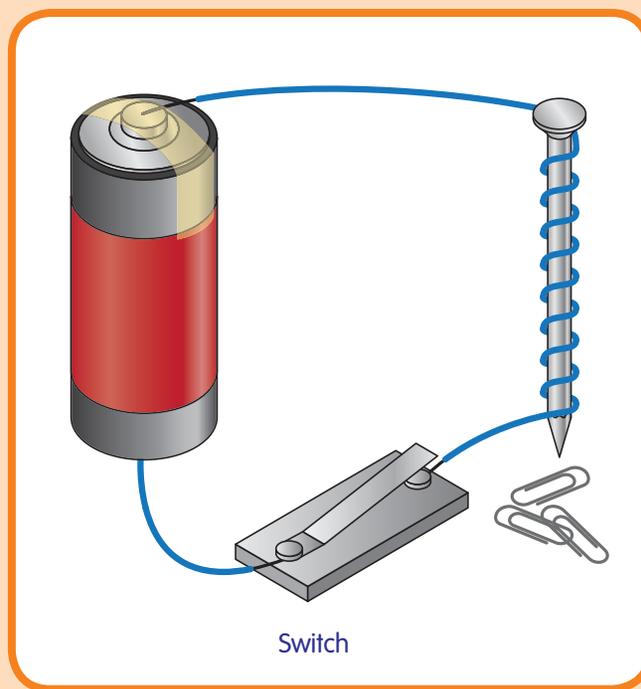
The floating needle always comes to rest in the North–South line.

Activity 11

Work in groups.

You will need **insulated** wire, a steel nail, sticky tape, metal paper clips.

- 1 Wrap an insulated wire around a steel nail as shown in the picture.
- 2 Connect the ends of the wire to the positive and negative terminals of the dry cell using sticky tape.
- 3 Put a simple switch into the circuit to control the flow of electricity.
- 4 Test your electromagnet:
 - Close the switch and try to pick up some metal paper clips. What happens?
 - Open the switch. What happens?



When the switch is closed, the electric current flows through the wire. The nail becomes a magnet.

When the switch is open, the electricity does not flow. The nail stops being a magnet.

Electromagnets

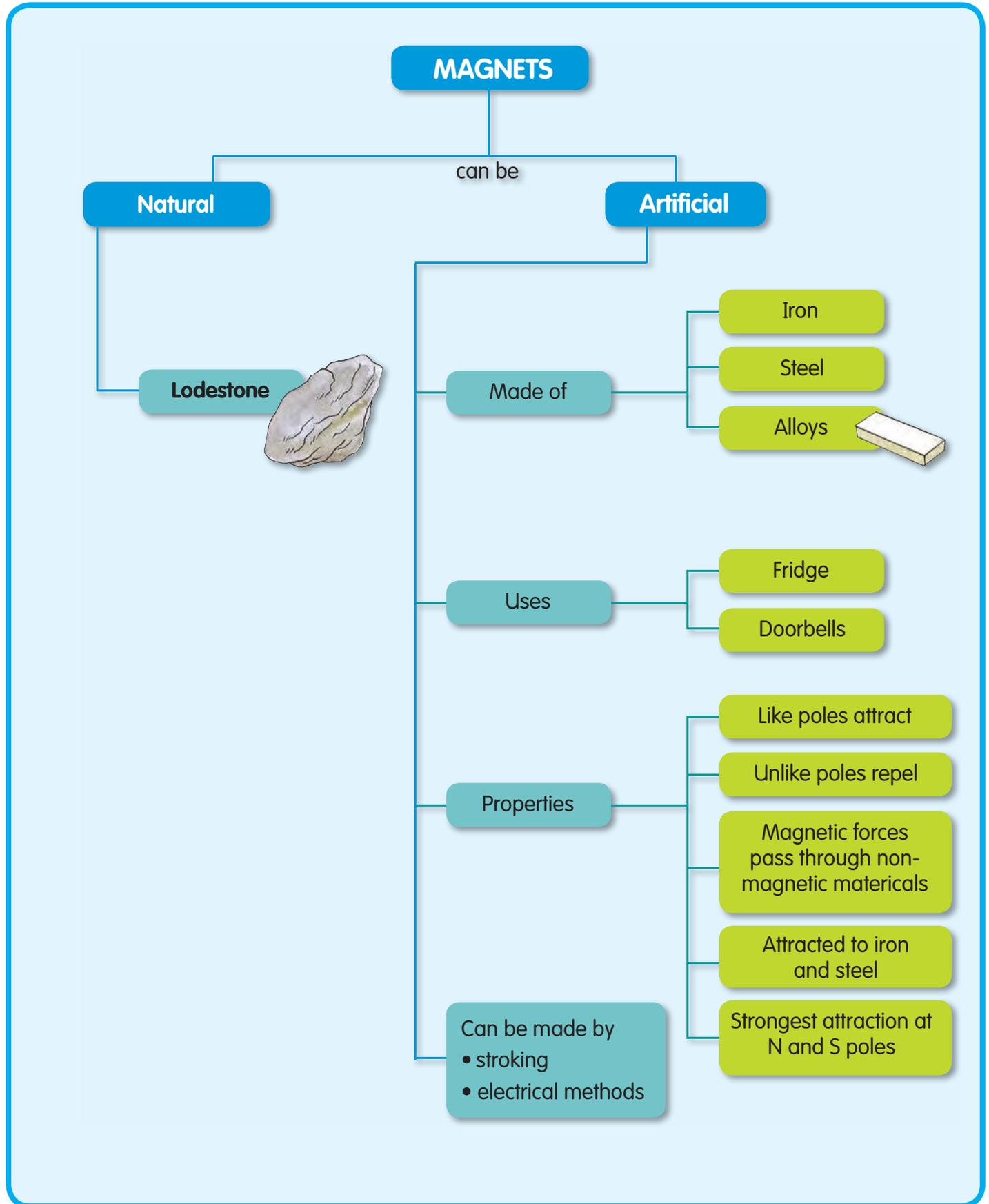
An **electromagnet** is a coil of wire that is wrapped around an iron rod. The rod becomes a magnet when electricity flows through it. Electromagnets are useful because they are very strong. They can pick up heavy metals. The photograph shows a huge electromagnet lifting large pieces of scrap iron and steel.



Chapter Review

- 1 Magnets have many uses in our lives, from motor car generators and refrigerators to CD players and video tapes.
- 2 Magnets are usually made of iron and steel or special alloys.
- 3 Magnetic materials, such as iron, steel, cobalt and nickel, are attracted to magnets.
- 4 Non-magnetic materials, such as wood, glass, rubber, plastic, copper, aluminium, gold and silver, are not attracted to magnets.
- 5 Magnets have two poles, the **north-seeking pole** and the **south-seeking pole**. Magnets rest in a N–S direction when freely suspended.
- 6 The pull of a magnet is strongest at the two poles.
- 7 Like poles (N–N or S–S) repel. Unlike poles (N–S) attract.
- 8 Magnets can be made by stroking a nail or needle with a bar magnet.
- 9 Electric current flowing through a coil of wire will magnetise a steel nail.
- 10 An electromagnet can be switched on and off.

Concept Map



Answer these questions in your exercise book.

1 Choose the correct words to complete the sentences.

North iron copper magnet unlike magnetism field

Magnets attract objects made of _____ or steel. Steel and _____ are magnetic, but brass and _____ are not.

A suspended bar _____ points in a north-south direction.

A _____ could be used to separate steel and brass screws.

A magnet will pick up a steel needle which is lying on the bottom of a glass of water because _____ acts through materials. Like poles repel and _____ poles attract.

When freely suspended, the north pole of a magnet points to the Earth's _____ Pole.

There is an invisible _____ of magnetic force around a magnet.

2 Make two separate lists of magnetic and non-magnetic things from this list :

wooden chair	brass screw	eraser
iron nail	glass jar	steel needle
steel razor blade	copper wire	iron bar
aluminium saucepan	safety pin	plastic comb
steel knife blade	piece of cloth	newspaper
plastic spoon		

Solubility

In this chapter, you will:

- understand the terms: mixture, soluble, insoluble, solute, solvent, solution, suspension
- describe what substances around you are made of
- produce solutions by dissolving solutes in solvents
- investigate substances mixed with water (water mixtures)
- learn that a mixture contains two or more pure substances
- investigate some methods for the separation of mixtures, for example, filtration, decanting, sieving, evaporation
- conduct the separation of water mixtures using the filtration method
- investigate sea water and fresh water
- appreciate the importance of having clean drinking water
- apply appropriate methods for the separation of mixtures.

Solubility



What do I know about water?

- Where does the water you use come from?
- How often do you use water each day?
- What do you use it for?
- What sorts of things do you mix with water?

Describing the substances around us

Scientists describe many of the **substances** around us as **mixtures**. This means that there are several different things mixed together. Mixtures can be **solids, liquids or gases**.



Sea water is a mixture of salt and water.



Soft drinks are a mixture of water, sugar, carbon dioxide and colouring.

Examples of mixtures		
Examples of mixtures	Type of mixture	Main parts
Black coffee	Solid in liquid	Coffee powder, water
Soft drink	Gas in liquid	Carbon dioxide, water
Galvanized iron (iron roofing)	Solid in solid	Iron, zinc
Sea water	Solid in liquid	Salt, water
Air	Gas in gas	Nitrogen, oxygen
Face paint	Solid in liquid	Clay, water
Smoke	Solid in gas	Soot, air

Some of the substances around us are not called mixtures. They are described as “pure substances”.



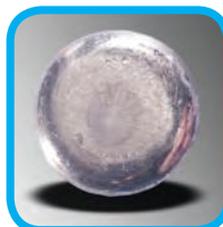
Salt



Sugar



Copper



Lead



Gold

Pure substances are different from mixtures. They are the same stuff all the way through.



Activity 1

You will need

- samples of different solids, for example, salt, flour, sugar, instant coffee, curry powder, milk powder, Milo powder, dirt
- a clean glass jar (or a cup, or a plastic container)
- a spoon
- water

What to do

- 1 Copy the table below into your exercise book.
- 2 Half fill the glass jar (or cup, or plastic container) with water.
- 3 Carefully stir in half a teaspoonful of the first substance into the water.
- 4 Observe what happens. Is your water clear or cloudy? Record your results in the table.
- 5 Clean out the jar (or cup, or plastic container) and repeat with all the other samples you are going to test.

What has happened to the substances you added in the clear mixtures? Are they still there? How do you know?

Investigating substances and mixing with water	
Substance investigated	Clear or cloudy mixture?
Please do not write in this book	

Water mixtures

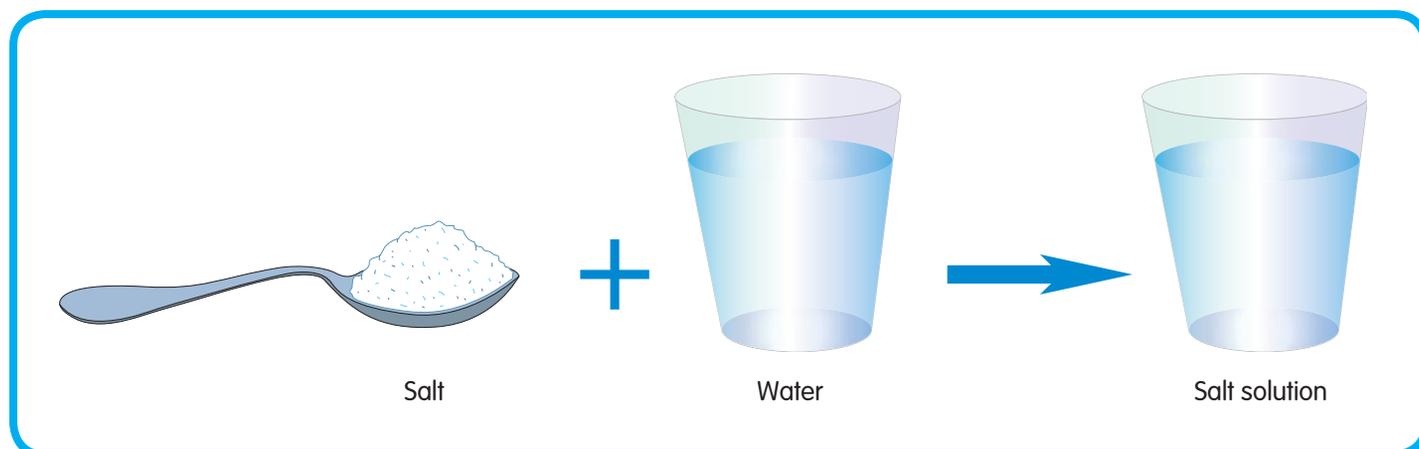
Water is an important and common substance in our lives. Water is often mixed with other substances. We use water all the time when we are preparing and cooking food in the kitchen.

In Activity 1 you made some common water mixtures. There are two main groups of water mixtures. We call them “solutions” and “suspensions”.

Solutions

Look at the results you recorded for Activity 1 when you mixed salt with water. What did you observe?

You cannot see the salt. The water is clear. We say that the salt has **dissolved** in the water. The clear liquid is a solution.



A solution is a mixture in which a solid substance (for example, salt) dissolves in a liquid (for example, water). Solutions may be coloured, but they are always clear. You can see through them.

We give names to the two parts of the solution. The substance that dissolves is called the “**solute**”. The substance that does the dissolving is called the “**solvent**”.



Activity 2

Look at your observations from Activity 1. Copy and complete the table below in your exercise book. Write *yes* if you think it is a solution, and *no* if you don't.

Substance	+ Water	Solution—yes or no?
Salt	mixed with water	
Curry powder	mixed with water	
Flour	mixed with water	
Milk powder	mixed with water	
Sugar	mixed with water	
Milo powder	mixed with water	
Instant coffee	mixed with water	

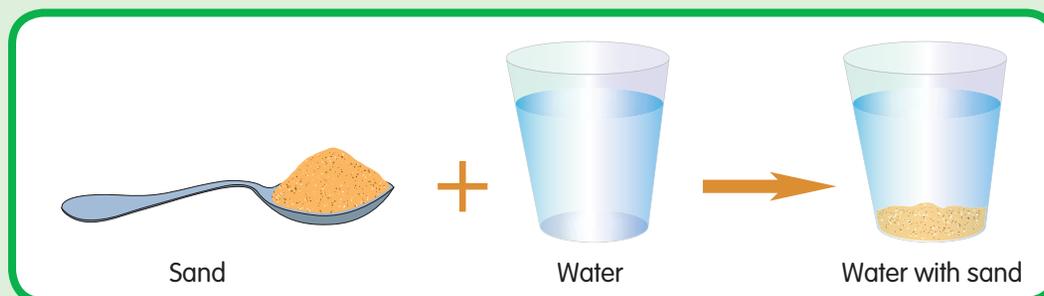
- Which were clear solutions?
- Which clear solutions were also coloured?
- Write the name of the solvent you used.
- Write the name of the solutes you used.



All these substances dissolve in water.

Different solutions		
Solute (substance that dissolves)	Solvent (substance that does the dissolving)	Solution (colour)
Sugar	Water	Clear
Water (ice cubes)	Water	Clear
Instant coffee	Water	Clear brown
Lemon jelly crystals	Water	Clear yellow
Copper sulfate	Water	Clear blue
Lime powder	Water	Clear/cloudy

When we see salt dissolve, we say that salt is “**soluble** in water”. Sugar is also soluble in water. Sand does not dissolve in water. We say that sand is “**insoluble**”.



Water is not the only solvent

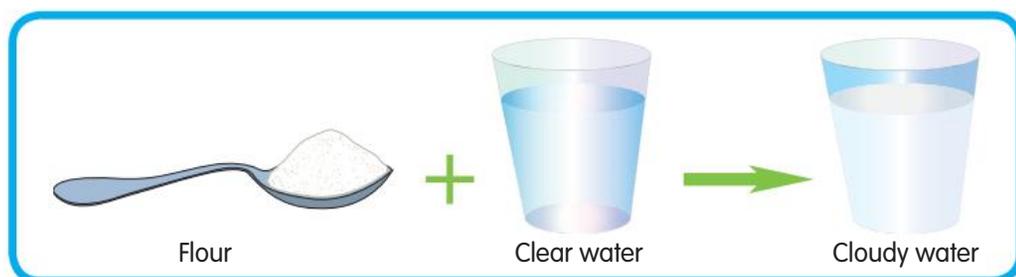
Water is not the only substance that dissolves things. Other liquids act as solvents.

- Nail polish remover is a liquid called “acetone”. It dissolves nail polish.
- Methylated spirits or kerosene dissolves biro ink.
- Turpentine or kerosene dissolves oil-based house paint.
- Petrol dissolves grease.



Suspensions

Look at the results you recorded for Activity 1 when you mixed flour with water. What did you observe?



You can see the flour spread out in the water. The flour has not dissolved. The water is cloudy because the flour is suspended in the water. If the glass is left to stand, the flour will settle. It forms a layer at the bottom of the glass. We call this cloudy mixture a “suspension”.



The ground-up chalk does not dissolve. It forms a suspension.



Activity 3

Look back at the observations you made in Activity 1. Copy this table into your exercise book. Column 1 lists seven substances. If each substance is mixed with water, is the mixture a suspension? Write *yes* if you think it is a solution, and *no* if you don't.

Substance	+ Water	Suspension— yes or no?
Salt	mixed with water	
Curry powder	mixed with water	
Flour	mixed with water	
Milk powder	mixed with water	
Sugar	mixed with water	
Milo powder	mixed with water	
Instant coffee	mixed with water	

Activity 4

Which substances did not dissolve in water? What happens to the flour in the water when you stop stirring the mixture?

Draw what you observe.



All the substances in the picture form suspensions in water.

Using coloured mixtures

The narrator of this story is Neverlyn Oloia from Lagata Village, East Kwaio, Malaita Province.

My people are the Kwaio people of Eastern Malaita Province. We use three main colours for our body and traditional decorations—black, red and yellow. This is how we prepare the coloured mixtures.

The red is made from a combination of three different substances, namely the Fa'aboru tree leaf, Aba (young coconut shoot) and geru(noni) root. We take the leaf of Fa'aboru, add an Aba and place it in a piece of bamboo. The mixture is heated over a fire for 30 minutes. We then add water to the mixture in the piece of bamboo and leave it for three days. We collect geru roots and scrape them with Keu'u (mangrove swamp shell). We remove the Fa'aboru leaf from the mixture and add the geru. The mixture of geru, the Aba plus Fa'aboru leaf solution is then boiled for another 30 minutes. During the final heating, the bright red colour appears.

The yellow colour comes from a tree called Adi. The Adi plant grows in the interior of Kwaio highlands. We split the stem into fine strips. We use these for weaving traditional armbands and traditional baskets.

The black colour comes from a mineral stone called ogo (a shiny silvery black stone) in rivers. We grind the stone until it is a fine powder. We collect eight to ten young shoots of the Akwasi plant. We wrap the Akwasi shoots with leaves. We place them directly on a fire and burn them for 10 minutes. We unwrap the shoots and squeeze them to produce Akwasi juice. We add the fine silvery black powder to the squeezed young shoots of the Akwasi tree. Then we mix thoroughly until there is a dark shiny black colour. The mixture is then ready to be used as a black paint or dye.



Activity 5

- Do you make coloured face or body paint for custom dances or other special events in your place?
- What colours do you use? Find out how they are prepared. Do the different colours have special meaning?
- Are special dyes used to colour the strings used in traditional bag making in your place? What is used to make the different colours? How are they prepared?

Separating mixtures

Often we need to separate water mixtures. We want to take out the things that are in the water, for example, the dirt from drinking water.

There are two ways to separate mixtures. Solutions can be separated using evaporation. Suspensions are separated using filtration.

Separation by filtration

A **filter** is something that allows some substances to pass through, but not others. For example, a kitchen sieve is a filter. You use it to separate rice from water.

Paper towels, serviettes, or pieces of toilet roll can act as a filter.

When a liquid contains insoluble substances, we can remove them by filtering.

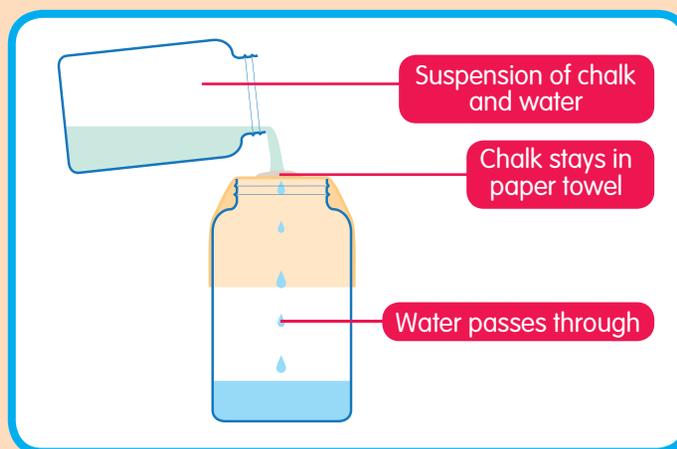
Activity 6

You will need

- suspension water mixtures, e.g. muddy water, flour and water, chalk powder and water, sand and water
- different filtering materials, e.g. fly wire, a tea strainer, mosquito netting material, filter paper (if available)
- paper towelling, serviettes, pieces of toilet paper

What to do

- 1 Test each filtering material one by one for each of the suspensions.
- 2 Pour the mixture through filter paper or a paper towel.
- 3 In your exercise book describe what you observe.
 - Which filtering material was the most successful at separating the water mixtures?
 - Which filtering material was the least successful at separating the water mixtures?

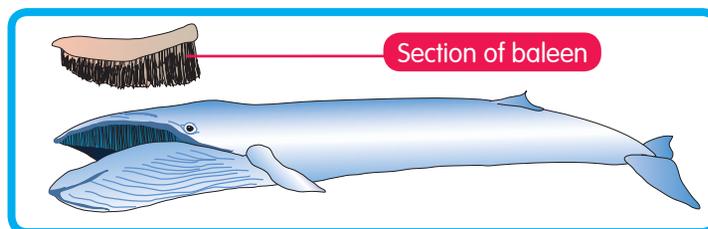


Paper towel over jar

What do you predict will happen if you pour a salt solution through a piece of filtering material? Test your prediction. Were you correct? Suggest an explanation for your observations.

Whales have filters

The Right whale and the Blue whale are known as “baleen whales”. This is because they have filters along each side of their jaw called “baleen plates”. The Baleen plates act as strainers or filters to collect the food. The plates have hundreds of tangled hair-like tubes to filter the water. As they swim along with their mouths open, very small shrimp are trapped in the baleen plates and the whale swallows them.



Activity 7

There are many types of filters in everyday life. Here are some examples. For each example, does it:

- a** filter a solid from a gas?
- b** filter a solid from a liquid?
- c** filter gases from air?



Hairs in nose



Vegetable sieve



Swimming pool filter



Air filter in car engine



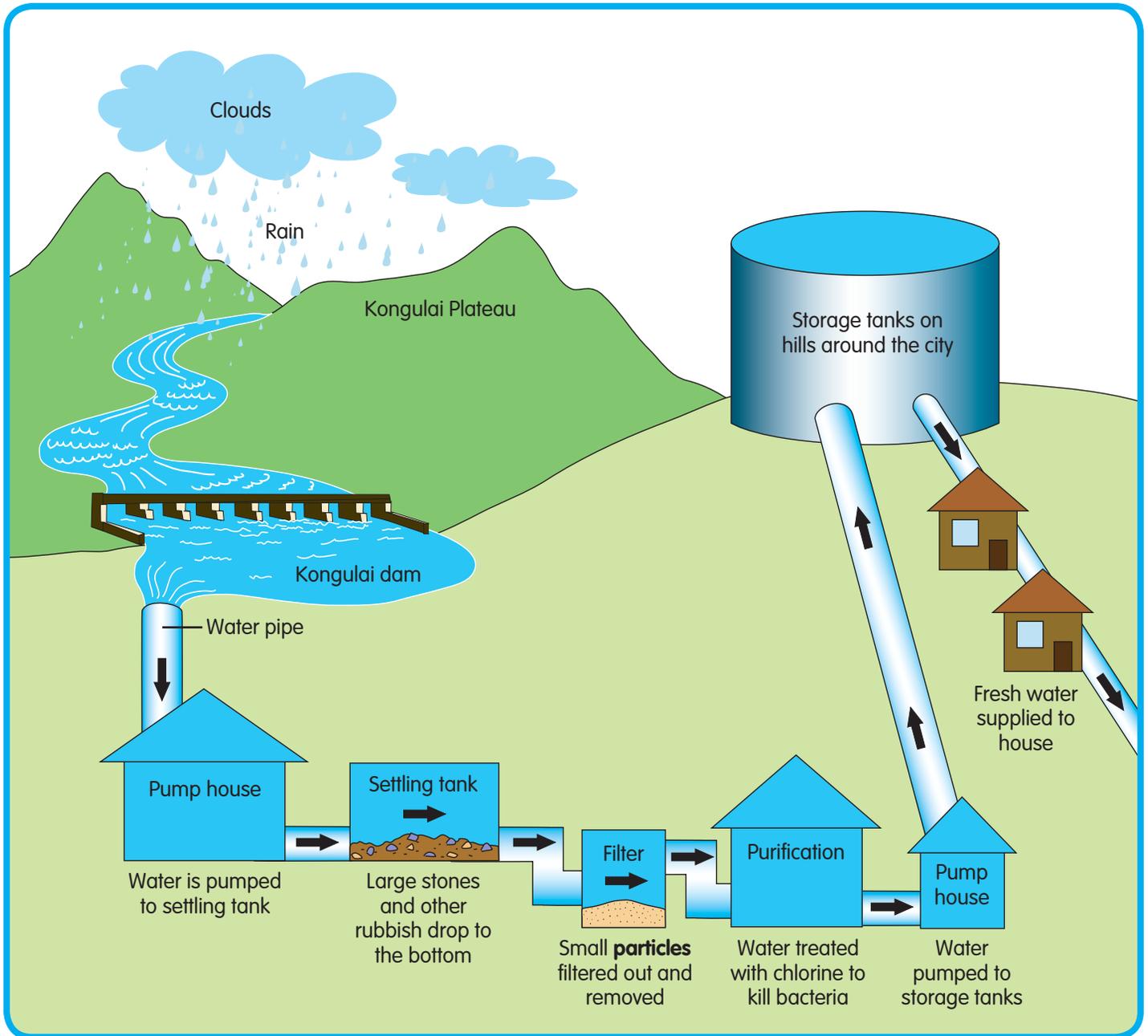
Filter in air conditioner

Clean water for us to drink



If you are lucky enough to live by a fast-flowing river, you can drink fresh water straight from the river. If your home has a rainwater tank, you can drink fresh water from the tap.

The water supply for large towns needs to be treated before people can drink it. SIWA (Solomon Islands Water Authority) in Honiara cleans the water for the town. SIWA's job is to make sure everyone living there gets clean, safe water to drink. Here is the story of how tap water gets to Honiara.



Every day SIWA technicians check to make sure that everything is working well. They check the pumps and the pipes. They also fix things when they are broken.

Fresh water is a valuable resource. We all must work together to make sure it is not wasted.

SIWA water storage tank at Panatina Ridge



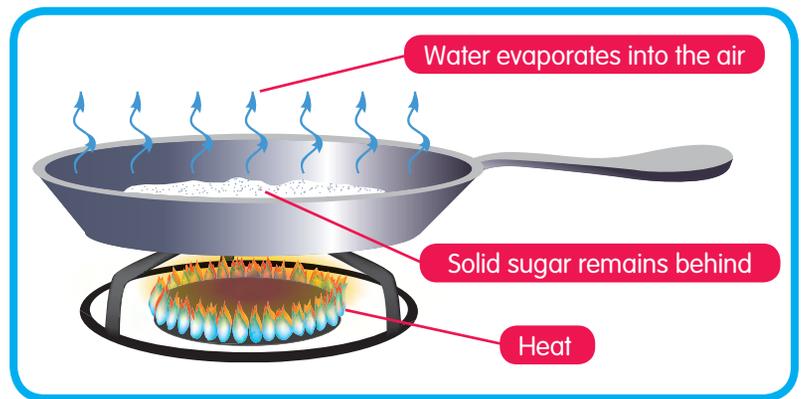
Activity 8

- 1 Find out where your house water supply comes from. Draw a flow chart to show how water from the clouds gets to a glass of water so you can drink it.
- 2 We are sometimes very careless about how we use our fresh water. Think of six different ways we can use water wisely, so that it is not wasted. List them.

Separation by evaporation

The process of filtration cannot separate a solution of salt and water. To separate a soluble substance, like salt or sugar, from water, we use a process called “evaporation”.

In evaporation the solution is heated. The heat causes the water to evaporate into the air, leaving behind the solid.



Separating a sugar solution

Getting salt from sea water

To get salt from seawater, we use evaporation. Large amounts of sea water are pumped into huge salt pans. The Sun’s heat evaporates the water. The salt is left in the pans.

The Dead Sea

The Dead Sea is between Jordan and Israel in the Middle East. It is at the lowest point on the Earth’s surface. Nothing lives in the Dead Sea. It is so salty a person cannot sink in its water—it has six times the amount of salt as a normal ocean.

It is a very hot part of the world, so the water in the Dead Sea evaporates very quickly. There are no rivers or streams replacing the water so the Dead Sea is getting saltier and saltier.



Activity 9

How can you compare sea water with fresh water?

You will need

- fresh tap water
- a jar, glass or cup
- sea water (to make your own, dissolve 1 tablespoon of salt in 1 cup of water)
- a tall thin bottle (for example, a soft drink bottle)
- food colouring (or red/blue coloured chalk in water)
- an eye dropper
- a **thermometer**

What to do

Work in groups. Design some investigations to compare sea water with fresh water. Investigate salt content (evaporate a small amount of each), taste, **freezing** time (if you have a freezer), boiling temperature.

Write a report of your findings and compare them with other groups.

Activity 10

Can fresh water float on salt water?

- 1** Dissolve as much salt as you can in a jar of water. Colour this solution blue (or use blue chalk dust). Pour the solution into a tall narrow container until the container is half full.
- 2** Fill another container with fresh tap water. Add some red food colouring to it (or use red coloured chalk dust).
- 3** Very carefully, use an eyedropper to drip the fresh water down the side of the tall container into the salt water. Write down a description of what you observe.
- 4** Leave the container to stand undisturbed for a few days and observe what happens. Describe what you observe.
 - Try dripping salt water onto fresh water. What happens?
 - What do you think happens in the ocean if there is a less salty solution under a more salty solution?
 - If you live near where a river flows into the sea, investigate the salty and fresh parts of the water.



Activity 11

What is the effect of temperature on dissolving?

You will need

- sugar or salt
- water
- spoon
- heat source
- thermometer (if available)

What to do

- 1 Draw up a table like the one below in your exercise book.
- 2 Measure 1 cup of water from a tap into a jar. Measure the temperature of the water and record your result in a table.
- 3 Add 1 teaspoon of sugar at a time, stirring after each addition, until the sugar dissolves. Continue to add a teaspoon of sugar to the water until no more will dissolve. Record the total number of teaspoons added in the table. A solution that will not dissolve any more solute is called a “**saturated solution**”.
- 4 Repeat steps 1 and 2 using:
 - 1 cup hot water
 - 1 cup boiling water
- 5 Record your results. If you don’t have a thermometer, use the words “cool”, “hot” and “boiling” in the Temperature column of the table.

Saturated solutions	Temperature °C	Number of teaspoons of sugar dissolved
Tap water		
Moderate temperature water		
Boiling water		

- Did the temperature of the water affect how much sugar would dissolve? Write a sentence to describe your observations.
- Draw a diagram to explain the terms: solute, saturated, solvent, solution.

Chapter Review

- 1 A water mixture is a mixture of water and another substance(s).
- 2 Water mixtures can be either solutions or suspensions.
- 3 When a substance dissolves in water, a solution is formed.
- 4 In a solution, the substance that is dissolved is the solute.
- 5 In a solution, the substance that does the dissolving is the solvent.
- 6 Water is a solvent.
- 7 When a substance does not dissolve in water, it is said to be insoluble in water.
- 8 Increasing the temperature of a solvent increases the amount of solute that will dissolve.
- 9 Insoluble substances form a suspension in water.
- 10 A solution can be separated by the process of evaporation.
- 11 A suspension can be separated by the process of filtration.

Answer these questions in your exercise book.

- 1 The difference between a liquid and a solid is that:**
 - a a liquid does not have its own mass
 - b a liquid does not have its own volume
 - c a liquid does not have its own shape
 - d a liquid has a smooth surface

- 2 A spoonful of instant coffee is added to a glass of water. A brown solution forms. The instant coffee:**
 - a is insoluble
 - b has not dissolved
 - c is soluble
 - d is saturated

- 3 To separate the coffee from the water again, you would:**
 - a freeze the solution
 - b dilute the solution
 - c filter the solution
 - d evaporate the solution

- 4 If you dissolve a medicine tablet in water, the water is the:**
 - a solvent
 - b solute
 - c solution
 - d suspension

- 5 For each of the following examples, identify the solute and the solvent:**
 - a Brushes used for oil-based paint must be washed in turpentine.
 - b Nail polish can be removed from fingernails with acetone.
 - c Grass stains can be removed from clothes with methylated spirits.
 - d Vinegar can be used to remove coffee stains from a table cloth.

- 6** A girl has two glass jars which she forgot to label. One jar has a sugar solution in it. The other jar has plain water. How can she find out which jar is which without tasting them?
- 7** A woman was carrying a packet of salt from the canoe to the house. She dropped the packet in the sand and it broke. She scooped all the sand and salt together in a plastic bag and took it into the house. To separate the sand from the salt, which is the correct sequence of steps she should follow?
- a** evaporate → mix with water → filter
 - b** mix with water → filter → evaporate
 - c** mix with water → evaporate → filter
 - d** filter → mix with water → evaporate
- 8** Add some flour to water in a jar. Stir it and let it stand. From the words below, choose a word to complete the following sentences that describe what happened.
- a** The flour _____ dissolve.
 - b** The flour _____ settle to the bottom.
 - c** Flour and water make a mixture called a _____.
 - d** Suspensions are _____.

does does not clear cloudy solutions suspension

Sound and light

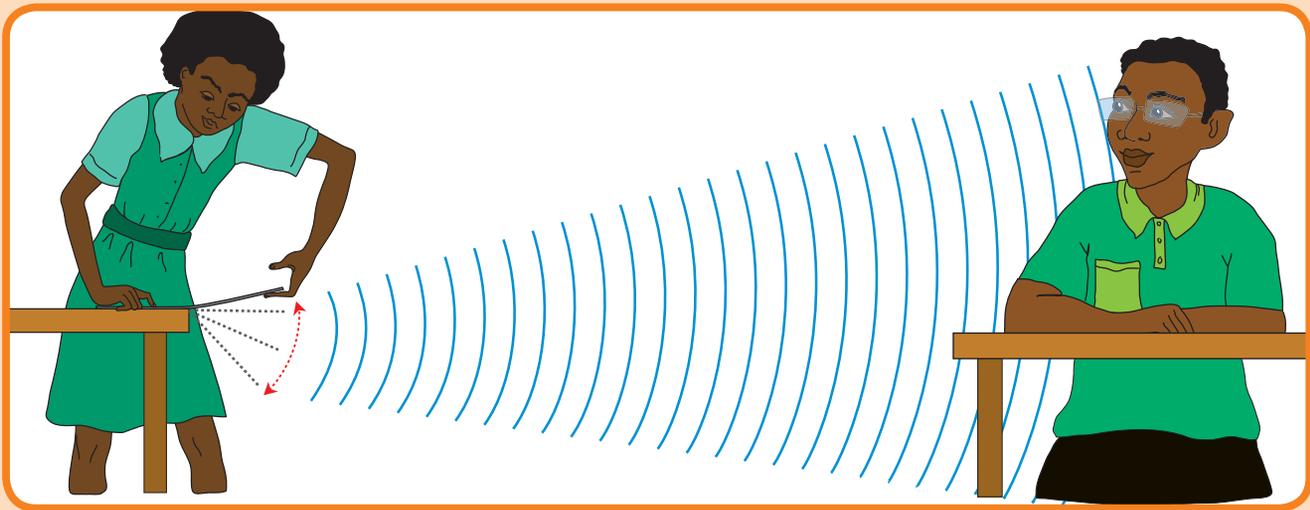
In this chapter, you will:

- learn that vibrating objects produce sound
- appreciate that sound travels through different materials
- understand that sound travels through the air as a wave (like ripples on water)
- appreciate that sound takes time to travel
- learn that objects vibrating at different speeds make sounds of different pitch
- understand how the human ear hears sounds
- appreciate that very loud sounds can damage the ear
- learn that the unit of sound volume is the decibel
- understand that many animals make use of their sense of hearing to communicate and to detect things around them
- infer that an object can be seen when it reflects light or is a source of light
- investigate the transparency of materials
- recognize that a shadow is formed when light is completely or partially blocked
- learn that light can be made to change direction
- understand that light travels in straight lines
- understand that light beams can be bent—this is refraction
- learn that white light is composed of different colours.

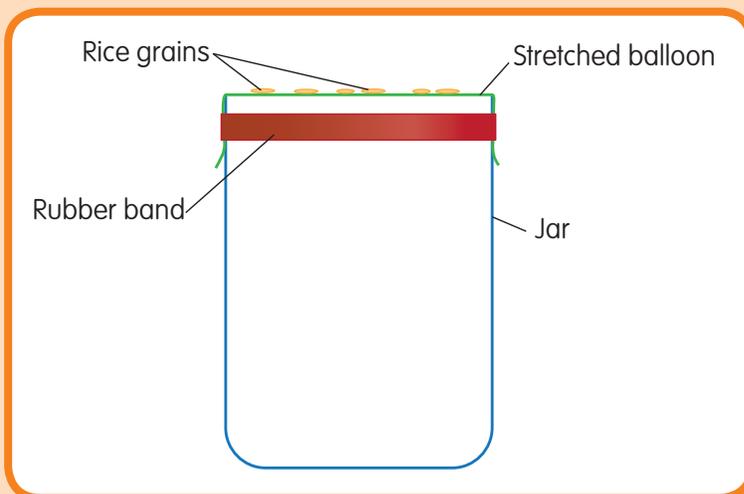
Activity 1

- 1 Hold a ruler over the edge of a table, with about 3 centimetres jutting out over the edge. Flick the ruler so that it **vibrates**. Listen to the pitch of the sound and look at how fast the ruler vibrates. Note what you observe in your exercise book.
- 2 Increase the length of the ruler jutting over the edge of the table. Flick it again. Listen to the pitch of the sound and look at how fast the ruler vibrates. Note what you observe.

The vibrations from the ruler are carried through the air to your ears.



- 3 Stretch a piece of balloon across the top of a glass jar. Secure it in place with a rubber band. Flick the balloon with your finger. Can you see it vibrating? Put a few rice grains on the balloon and flick it again. Note what you observe.

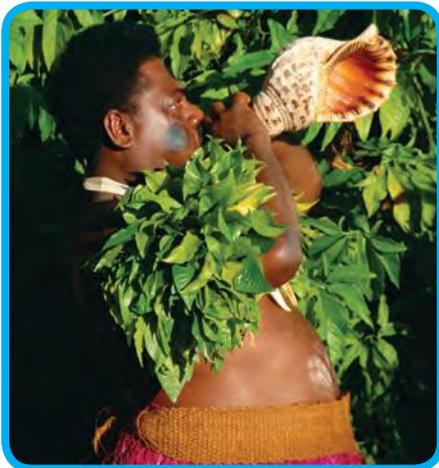
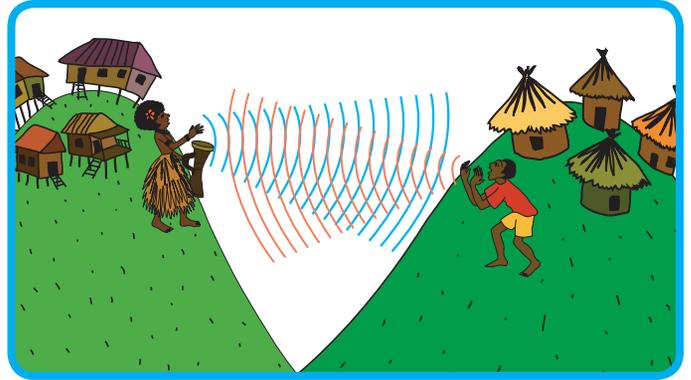


The vibrating balloon makes the rice grains move. Your ears hear the sounds of the moving grains.

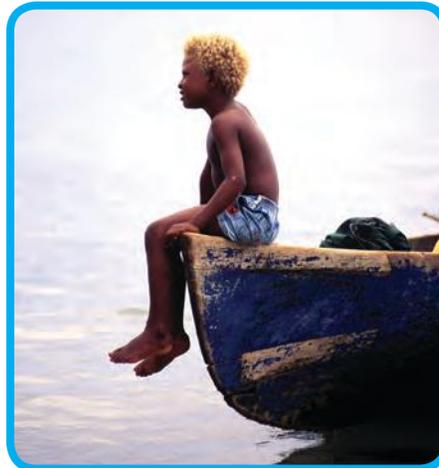
When you flicked the ruler, its vibrations made the air around the ruler vibrate. The vibrations in the air spread out like ripples across water.

Make a list of all the things you can feel or see vibrating.

- Which of them makes sounds you can hear?
- Have you heard the sound of messages being passed from one hilltop to another, or across a wide valley?



Vibrating air in shell ...



... sends sounds through the air

Most of the sounds we hear travel through the air. Sound can also travel through liquids and solids. You can hear someone tapping a long metal pipe when you are far away from the tapping.

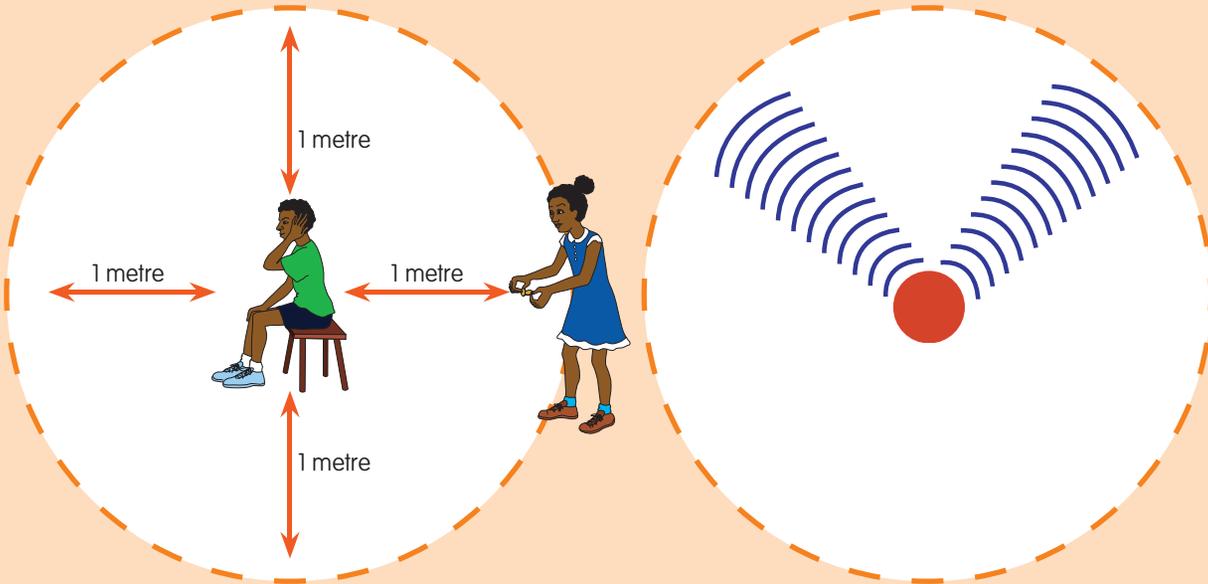
You can clearly hear sounds underwater. Whales and dolphins send sound messages to each other over long distances through the water.



Activity 2

Work in pairs.

- 1 Sit in a chair. Shut your eyes. Cover your left ear with your hand.
- 2 Your partner should stand about 1 metre away and tap two coins together. Your partner will tap the coins at different positions around where you are sitting.



- 3 Record on a diagram where the sounds seem to be the loudest, the softest and the clearest.
- 4 Repeat step 2, but this time cover your right ear with your hand.
- 5 Repeat the steps 1–4. This time place a paper cone near your ear canal instead of covering your ears.
- 6 Write answers to these questions in your exercise book.



- Does using the paper cone increase your hearing ability?
- Which was your best position for hearing the sounds?
- Which was your worst position for hearing the sounds?
- What difference did the cone make to your hearing?
- Why would it be an advantage to be able to swivel your ear flaps like a dog?



Hearing sounds

Hearing is one of our most important senses. We get information about what is going on in the world around us. A sound is made when an object vibrates. This vibration causes a movement that travels through the air. Look closely at the strings of a guitar when someone is playing it. You will see the strings vibrating. You will hear a sound. When the strings vibrate, you hear a sound. When the strings do not move, you do not hear a sound.

The bamboo drum (*o'o* in South Malaita language) is a common instrument for making sounds. The player strikes the drum with a stick. This causes the air in the drum to vibrate. The vibrations then moves through the air.



Waves of energy

When you throw a stone into water, waves spread out from the splash. They move across the surface. The water particles vibrate up and down at right angles to the wave direction. This is a wave.



Sound waves need something in order to move through empty space. Sound can travel through solids, liquids and gases, but not through empty space. Sounds cannot be made in space.

Why do we hear the whooshing sound of the hornbill's wings as it flies?

The hornbill's huge wings cause vibrations in the air. The vibrations travel to our ears.

The sounds of the vibrating ruler in Activity 1 are different. The lengths of the vibrating ruler are different. The ruler is vibrating at different speeds. The vibrations of a high pitched sound are faster than the vibrations of a low pitched sound.

The **pitch** of a sound describes how high or how low the sound is. Pitch depends on the frequency of a sound. The **frequency** is how fast the sound waves are vibrating.

The low roar of an adult lion produces sound waves with a low pitch. The sound waves produced from the roar of a lion cub have a higher pitch.

The bamboo panpipes (*au..* in South Malaita language) use different sized bamboo tubes. The player blows across the pipe. The air in the pipe vibrates. The smaller pipes give sound of a higher pitch.



Activity 3



Work in pairs.

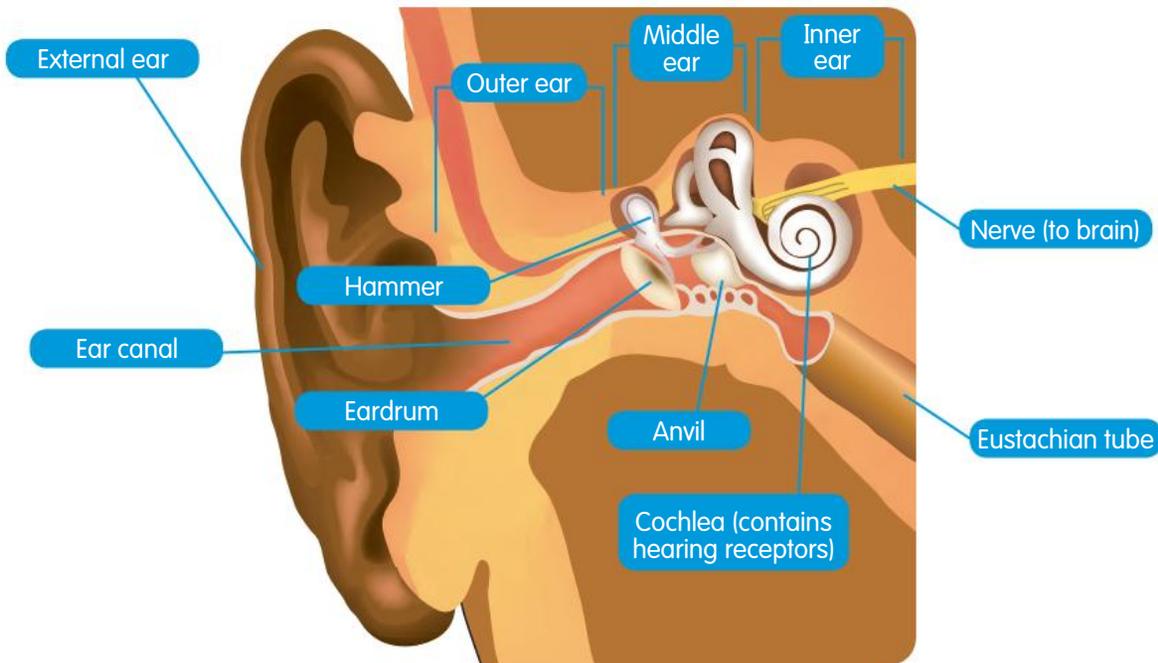
- 1 Use a hammer and nail to punch a hole in the bottom of two tin cans.
- 2 Thread string through each hole. Tie a knot so that the string cannot come out.
- 3 Hold the tins apart so that the string is tight.
- 4 One person talks into the string telephone while the other person listens.
- 5 Write answers to these questions in your exercise book.
 - Does pulling the string tighter make the sound different?
 - Experiment with different lengths of string. Try it shorter. Try it longer.
 - How long is your telephone string before you cannot hear your friend talking?
 - Can you hear your friend if he or she is around the corner or behind a tree?
 - How is the sound of your voice carried to your partner?



Where are our sound sense organs?

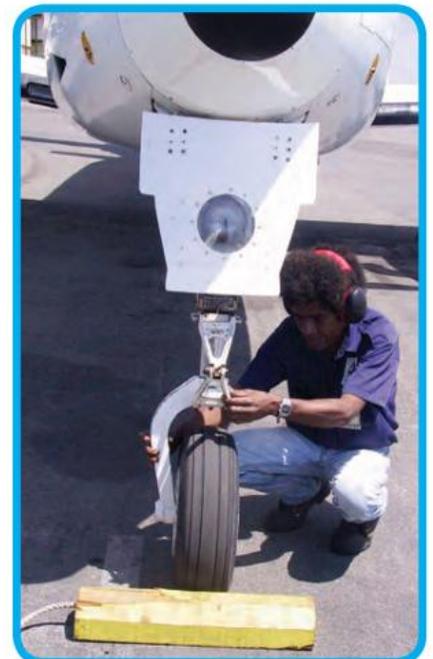
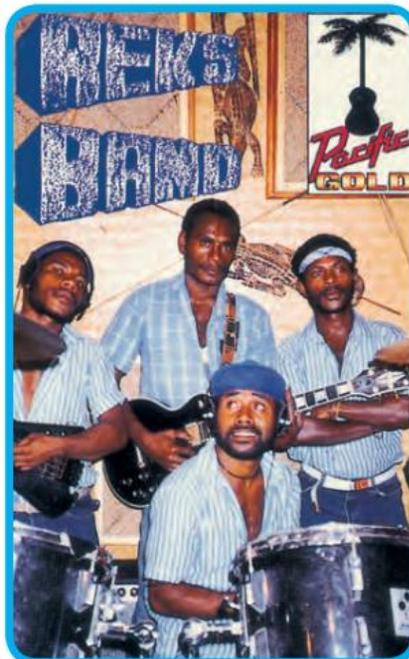
Our sound sense organs are our ears. Other mammals, birds, reptiles and amphibians also have ears.

- Sounds make air in the ear canal vibrate.
- The vibrating air makes the eardrum vibrate.
- The vibrating eardrum makes tiny bones in the middle ear move.



- The moving bones in the middle ear send vibrations into the inner ear. The inner ear receives the vibrations. It sends messages to the brain.
- A nerve carries the sound messages.

If you damage your ears, you can become deaf. You are deaf when you cannot hear certain sounds. Loud noise for a long time can cause permanent damage to your inner ear.



People who regularly hear loud noises often protect their ears with ear muffs.

Problems with hearing

Sounds can vary in volume from soft to loud. When a sound is very loud, it means the vibrations are very strong. Sometimes the vibrations are so strong, they can break your eardrums and damage your inner ear. The volume of sound is measured in **decibels**. Zero decibels is the lowest sound that the human ear can hear.

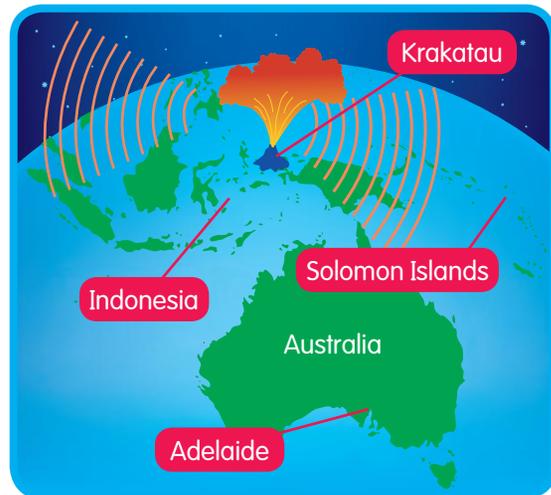
This table lists some sources of sound vibrations. It also gives the sound level of each one in the units of sound volume (decibels). Column 3 shows how the sound affects the human ear.

Average volumes of different sounds

Source of sound	Sound intensity decibels (dB)	Effect on your ears
	0	Sound just able to be heard
	10	Faint sounds
Ticking watch	20	
Soft whisper at 5 metres	30	Very quiet
Normal conversation	50	Quiet
Street traffic, noisy party	70	Annoying
Outboard motor	90	
Chainsaw	110	Very annoying, damage after 8 hours
Jet plane taking off	130	Painful to ear
Explosion, guns firing	140	
	150	Eardrum can break

The loudest noise on Earth

When the **volcanic** island of Krakatau in Indonesia exploded in 1883, it made the loudest sound ever made on Earth in living memory. It was heard 3500 kilometres away in Adelaide, Australia.



Activity 4

From the table, estimate the decibel readings for these situations:

- lunchtime in your school grounds
- travelling home in a bus, or in a canoe with an outboard motor
- early in the morning at the beach
- in a crowd watching a soccer match.

Look at the table below. Does the speed of a car affect the loudness of the sound it produces? Describe how.

Source and decibel of different noises

Source of noise	Decibel level
Car at 60 km per hour	65
Car at 100 km per hour	75
Truck at 60 km per hour	100

Looking after our ears

Sometimes small children come to my clinic because they have poked something in an ear. We should never put sharp objects in our ears. These objects can damage the eardrum and stop us hearing properly.

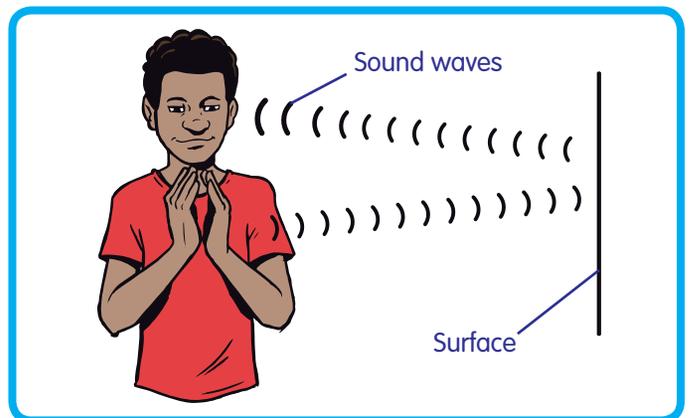


Headphones convert electrical energy into sound energy which is channelled directly to our ears.

Echoes

If you stand some distance away from a wall and make a sound, it will be reflected back to you shortly after.

Sound waves which bounce off a surface are called “echoes”. In many everyday sounds, we hear the original sound and the echo together.



Hearing in other animals

Birds do not have ears on the outside of their heads. However, birds hear very well. Early in the mornings and in the evenings, birds communicate with their songs.

Reptiles, for example crocodiles or lizards, have an ear opening on the side of their head. Geckoes live in groups and are active at night. They communicate with one another by sound. You can hear their clicks as they run across the roof of your house. Listen tonight.



Rainbow lorikeet



Gecko

Dolphins send out short clicking sounds. The sound waves bounce off objects and return to the dolphins. Dolphins use these reflected sound waves to locate fish. They can also tell the size of the fish.



A special organ in the dolphin's head, called a "melon", senses returning sound waves. The brain interprets the waves as images.



Light

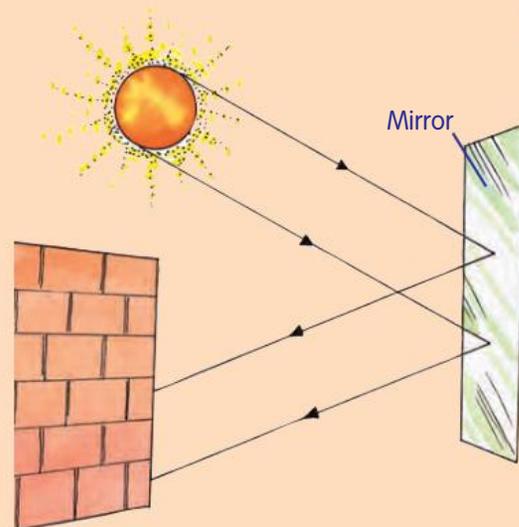
Imagine that you are lost, deep in the rainforest, without a torchlight or match. Very little sunlight comes through the thick growth of plants. It is difficult for you to see anything clearly. As night approaches, it gets darker and darker. Soon, the rainforest is totally dark. Can you see anything?



Activity 5

Hold a flat mirror so that the Sun's ray fall on it. What do you notice? Move the mirror so that the sunbeam falls on a wall, on a tree or on a house.

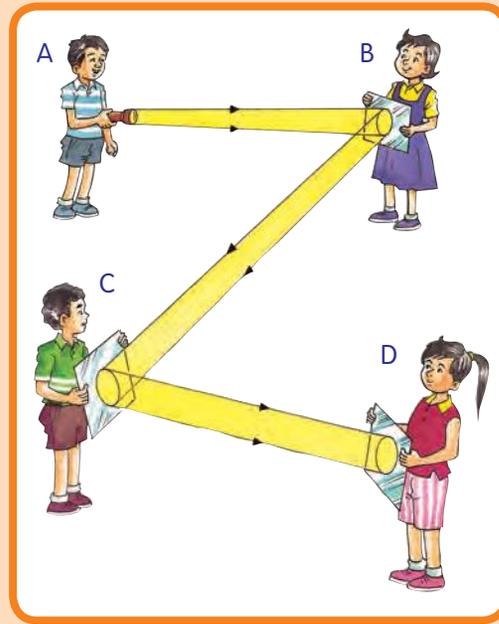
Safety note: Do not direct a sunbeam at another person's eyes.



Activity 6

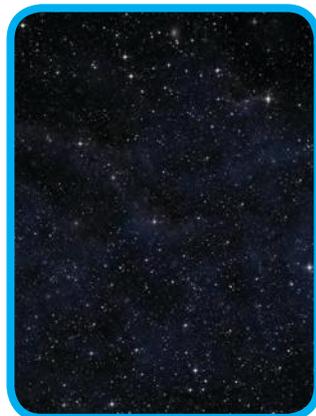
Work in groups of four.

Play light beam tag with your friends. You will need one powerful torchlight and each person will need a mirror. Person A shines the torchlight onto person B's mirror. Person B will then try to reflect the light to person C. Person C will try to reflect the light to person D's mirror. See if you can successfully reflect one another's light.



The Sun shines brightly during the day. The stars shine at night. There are flashes of light from the fireflies. There is steady light from burning logs. There is flickering light from a candle. There is bright light from **fluorescent** lamps. All these things give off light. We see them because they give off light. We see these things because the light reaches our eyes. It enables us to see them. Light is a form of energy. It enables our eyes to do their work.

When light falls on a mirror, the light reflects. Mirrors and other shiny surfaces, reflect light. They produce beams of light that are not spread out.

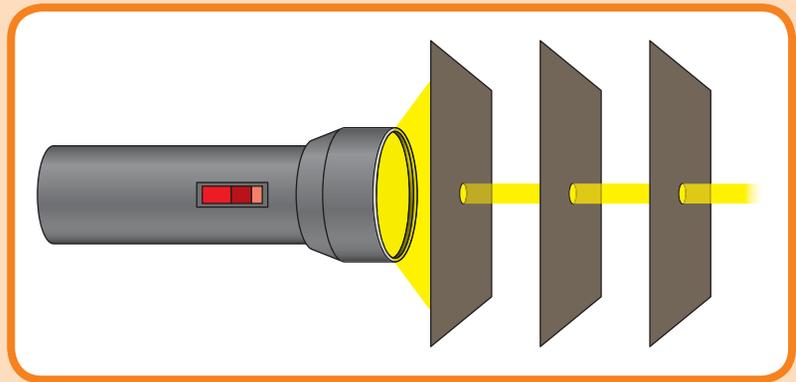


Most things do not give off light. We see things because light falls on them and bounces off. We say that the light reflects. The light reaches our eyes and enables us to see them. Look around you. Make a list of the things you see. Perhaps you see the Moon, trees and your cat. The Moon is not a source of light. However, it reflects sunlight. Trees are not sources of light, but we can see them when they reflect the sunlight. During the day, you can see your cat because it reflects the sunlight.

Activity 7



- 1 Cut three squares of cardboard exactly the same. Then use a hole punch to make a hole in the centre of each square.
- 2 Line up the three squares so that the light from the torch shines through all three holes. (You may need a friend to help you hold the squares in a straight line.)
- 3 Move any square to one side or the other. What happens?



Cardboard is opaque. Light cannot pass through it. However, light can pass through a hole. When the holes in the cardboard squares were lined up, light from the torch passed through them all. When one of the squares was moved, the light was blocked. This experiment shows that light beams travel in straight lines. A straight beam of light is called a “ray”.

How reflection works

If you drop a ball straight down, it hits the ground and bounces straight back up. If you throw it at an angle, it bounces away at the same angle. Light rays work in the same way.



Activity 8

- 1 Fill a black tray almost to the top with water.
- 2 Darken the room. Turn on the torch. Hold it above the water so the light hits the water's surface from directly above.
- 3 Shine the torch at a low angle across the water's surface.
 - What happened when you directed the torch beam directly above the surface of the water? Did the water seem very dark? How much light was reflected back into the room?
 - What happened when you shone the torch at a low angle? How much light reflected into the room? Which torch position reflected more light into the room?

When light strikes water from directly above, the water seems very dark. The light passes through the surface of the water and falls onto the base of the pan. However, when light hits water at a low angle, some is reflected back into the room.

Light rays are reflected from a surface at the same angle at which they hit the surface.

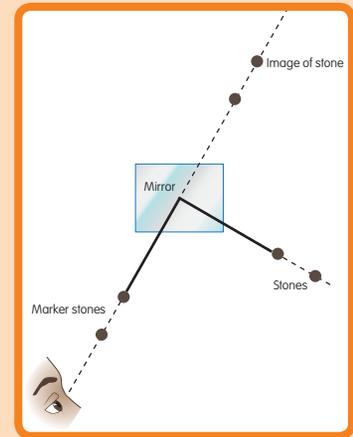


Hands-on Activity



Activity 9

- 1 Place a small mirror on its edge on a sheet of paper like this:
- 2 Place two small stones in a line, in front of the mirror at an angle to the mirror.
- 3 Put your head down, close to the table, move your head from side to side until you can see the two stones in the mirror. You are seeing the image of the stones.
- 4 Continue to look at the images and place another two stones on the paper. Place these stones so that they are in line with the images.



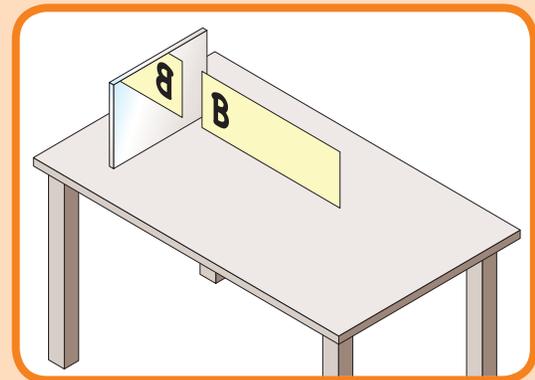
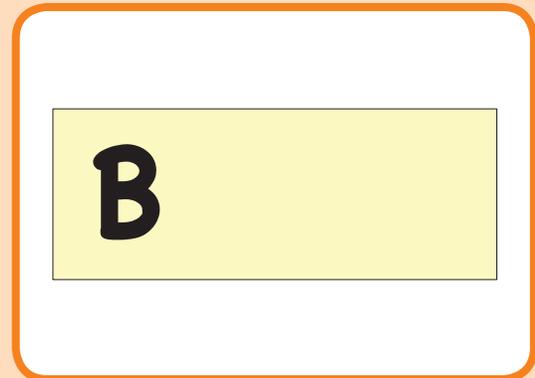
This is a model of reflection. You see the stones because the mirror reflects the light to your eye. The two marker stones show the line of the reflected light. The images are not real.

Activity 10

What happens when things are reflected in a mirror?

- 1 Write the letter B, on a piece of card.
- 2 Set a mirror on its edge, on a table.
- 3 Hold the piece of card in front of the mirror as shown in the diagram.
- 4 Look at the image of the B. What do you notice?
- 5 Hold a photograph of two people against a mirror. Notice that the image is reversed. The person on the right in the photo is on the left in the mirror.

We say that the image in a mirror is inverted. This means that the right side of the object appears as the left side of the image. The image is the same size as the object.



Refraction

Light travels in a straight line through empty space. When it strikes an object, it changes direction. Some surfaces, such as mirrors, reflect light like a ball bouncing off a hard surface. Other materials, such as glass and water, slow down the light beam and slightly change its direction.

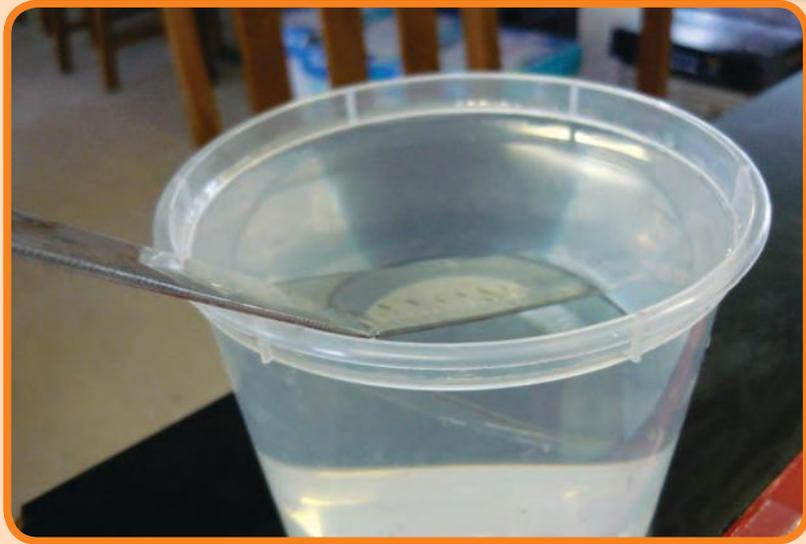


Activity 11

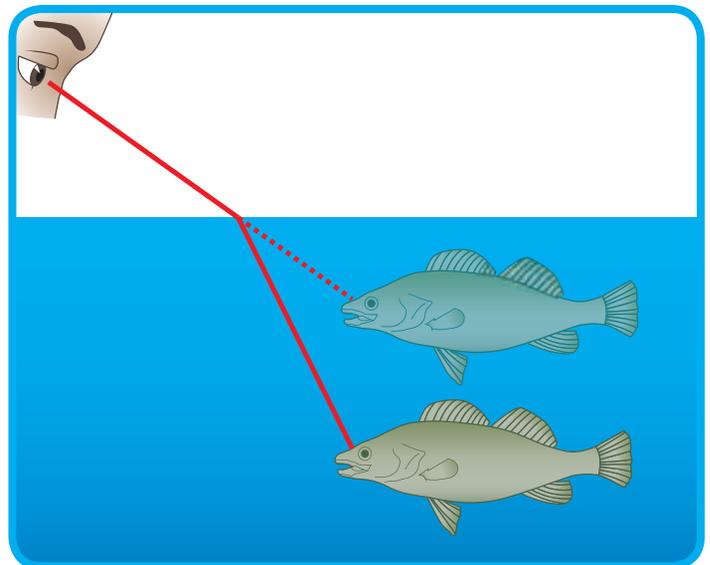
Fill a clean plastic bowl up to the top with water.

Place a ruler in the bowl of water like this. Look closely. What do you notice?

The ruler seems to be broken. The light rays coming from the ruler to your eye pass through the water and then through the air. The light travels at a different speed in water so the light changes direction. It appears that the ruler in the water is nearer to your eye.

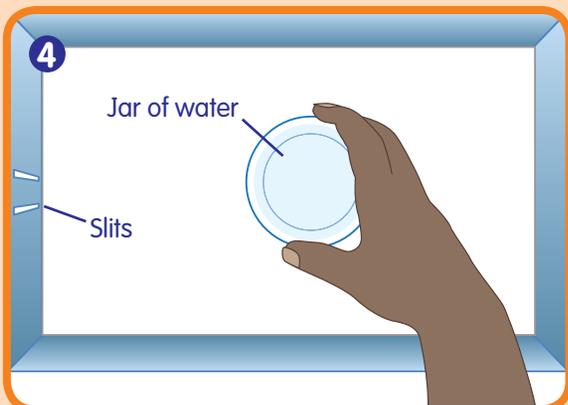
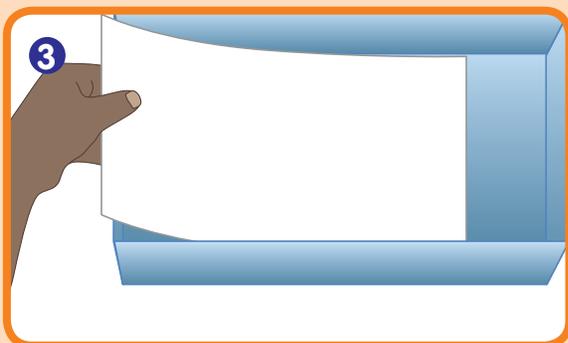
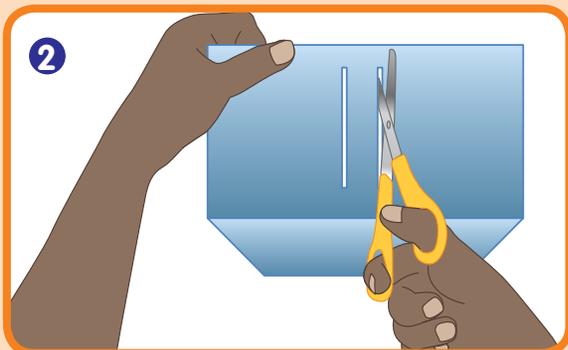
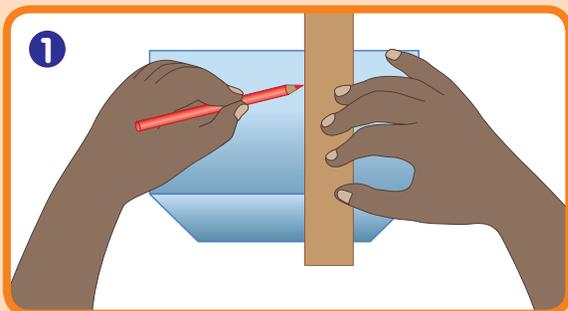


Light passes through different substances at different speeds. When the light rays go from air into water, they slow down and change direction. The rays bend again as they leave the water. This is “refraction”.



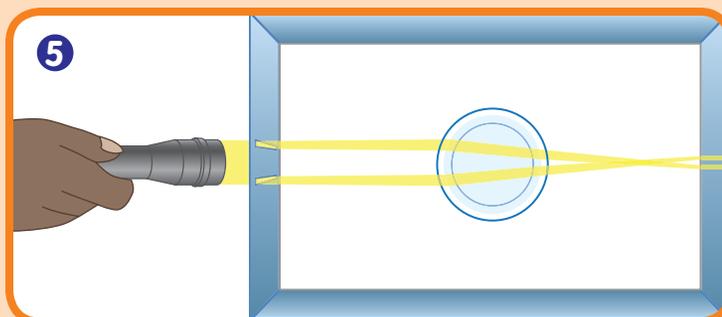
When people fish using spears, they must allow for refraction. The light coming to their eyes is bent. They must aim the spear at a place lower than the image.

Activity 12



How does light refract?

- 1 Draw two vertical lines, about 2.5 cm apart, down the middle of one short end of a shoe box.
- 2 Cut narrow slits along both lines with the scissors, leaving at least 2.5 cm uncut at the top and at the bottom.
- 3 Cut a white sheet of paper so that it fits in the shoe box. Place the paper in the bottom of the box so that it lies flat.
- 4 Fill a glass jar with water and set it carefully in the box. Line it up with the two slits.
- 5 Darken the room. Then shine the torch through the two slits in the box.
 - How many rays shine into the box?
 - Does each ray continue in a straight line inside the jar?
 - Where do the light rays first change direction?
 - Do the rays bend again as they leave the jar?

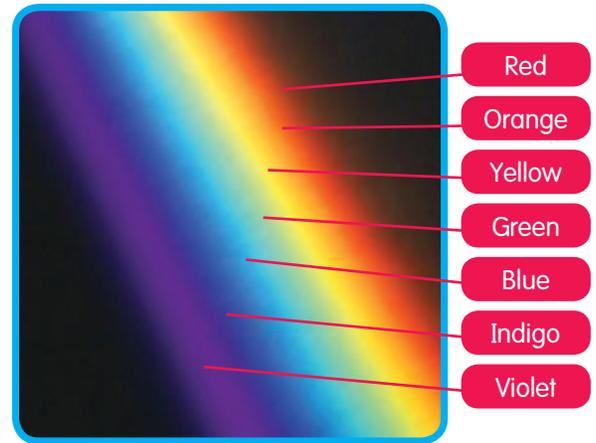


Rainbows

Why do you sometimes see a rainbow during a rain shower? Raindrops are refracted sunlight. Some colours bend less than other colours. As sunlight is refracted, the colours are separated.



You can see all these colours when the raindrops separate them.



The picture above shows the seven colours of a rainbow. This is called a "spectrum".

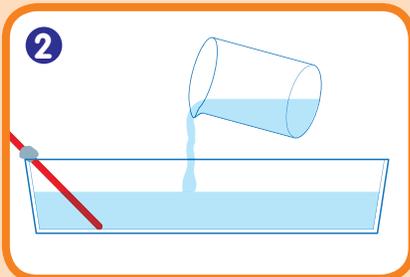
Activity 13



Can you make a rainbow?

Sunlight is made up of coloured light. Create your own rainbow to see for yourself.

- 1 Place a mirror in the dish at an angle of about 45 degrees. Use modelling clay to secure it so it does not slip.
- 2 Half fill the dish with water.
- 3 Hold the mirror at an angle in the dish.
- 4 Move the dish so that the Sun's bright light shines onto the water in the dish. Swing the mirror little by little, until it reflects the Sun's light.
- 5 Catch the reflection on a large piece of white paper or material. What do you notice? Can you see colours? How many colours can you see?



In Activity 13 the Sun's light is refracted as it passes from the air into the water in the dish. Then the mirror reflects the light onto the white surface.

Sunlight appears colourless, but it is actually a mixture of all seven colours. This is called "white light".

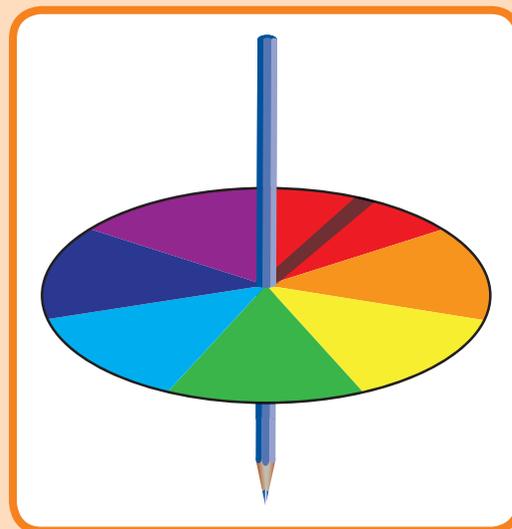
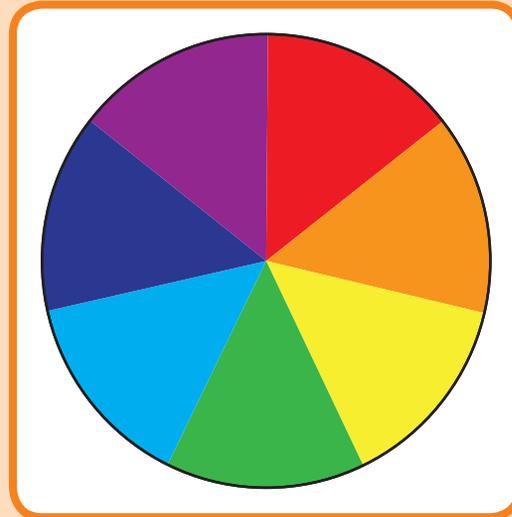
Activity 14



Can you make a multi-coloured disc change to white?

- 1 Cut out a circular disc from a piece of cardboard.
- 2 Mark seven equal segments on the disc. Colour them with the seven colours of the rainbow (red, orange, yellow, green, blue, indigo, violet) as shown in the diagram.
- 3 Poke a pencil through the middle of your disc.
- 4 Spin your disc on the table.
- 5 Observe the colour of your disc while it is spinning.

Why do you think the spinning coloured disc appeared white?



Seeing colours

Things have colour because they absorb some of the colours of white light. They reflect other colours. When sunlight hits a green leaf, the leaf reflects the green light. It absorbs the other colours.



Objects that appear black absorb most of the light that hits them. They do not allow much light to be reflected. This means that a small amount of light reaches our eyes when we look at the object.

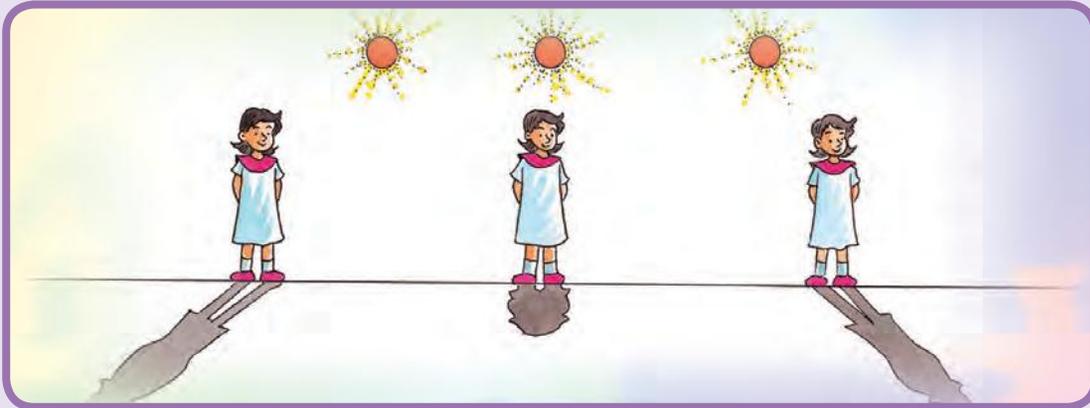


Some objects scatter the light that they reflect. For instance, the rough surface of a leaf, a puddle of water or a tin can scatter light in all directions. The light spreads out.



Activity 15

Stand outdoors early in the morning, at noon and late in the afternoon. What do you notice about your shadow? Do you cast the same shadow at all these times? Here is how the three shadows appear. Do shadows change in position and length? Remember that the position of the Sun changes during the day.



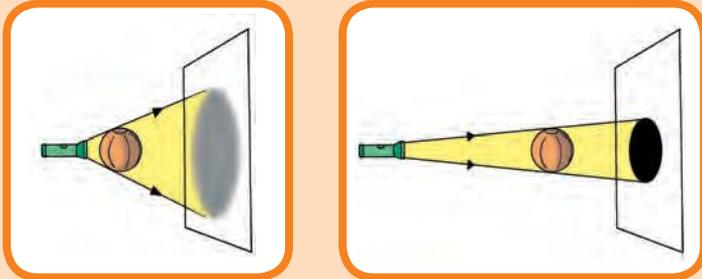
Shadows

A shadow is the dark space that is formed behind an object when the object blocks light. When an object blocks light from a light source, it stops some of the light. The rest of the light goes past the object. A dark space forms behind the object. This is the shadow. The shadows of the children in the drawing shows this.

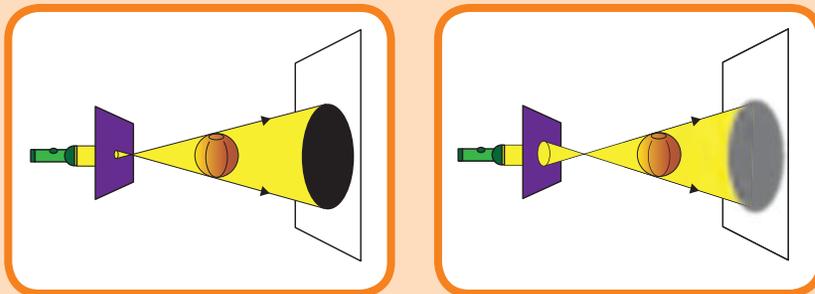


Activity 16

- 1 Shine a torch on an object as shown in the diagram. Look at the shadow on the wall. What happens when you move the torchlight away from the object?
- 2 Continue moving the torchlight away until you get a sharp shadow on the wall. Now, move the torchlight nearer to the object. Observe the changes in the shadow of the object.



- 3 Describe the difference in the shadow.
- 4 Now leave the torchlight in the same position. Move the position of the object. Move the object nearer to the wall. What happens to the shadows? Move the object away from the wall. What happens to the shadow?
- 5 Place a piece of cardboard with a small hole in front of the torchlight. The cardboard must be between the torchlight and ball. See the diagram below. What kind of shadow does the object make?
- 6 Next, place a piece of cardboard with a large hole in front of the torchlight. What happens to the shadow?



Do objects always cast the same shadow? Use different objects, such as a ball and a plate, and find out. Rotate the ball and see if the shadows are always circular. Rotate the plate. See if you get shadows of different shapes. Rotate other objects. Observe the shadows they make.

All light, some light, no light

Look at the pictures. Can you see food in the food safe? Can you see toys clearly in the plastic container? Can you see shoes in the shoe box?

We see the food clearly, the food safe is made of wire mesh. Light can pass through the wire mesh with no scattering.

We can't see the objects in the plastic container because the container is made from a plastic that is not clear. Only some light can pass through the plastic. We get an image that is not clear.

We can't see the shoes because the box is made of thick cardboard. Light can't pass through the cardboard.



Food safe



Plastic container

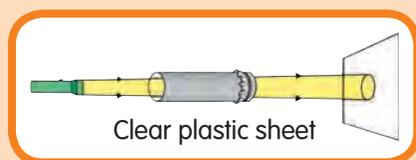


Shoe box

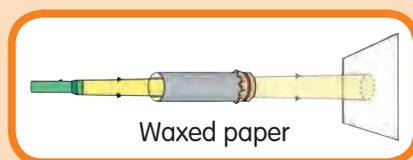
Activity 17



- 1 Find a piece of clear plastic bag and a piece of black plastic (or paper).
- 2 Rub some coconut oil on a piece of white paper. Allow it to dry. This is waxed paper.
- 3 Cover the ends of three toilet rolls—one with a piece of waxed paper, the second one with a piece of clear plastic and the third one with a piece of black plastic.



Clear plastic sheet



Waxed paper



Black paper

- 4 Shine a torchlight through each tube towards a white wall. What do you notice?

Which material allows all the light to pass through? Which allows some light through? Which allows no light through?

Transparent materials allow light to pass through them with no scattering. The image is clear. **Translucent** materials allow scattered light to pass through. We get hazy images. **Opaque** materials do not allow any light to pass through. We don't see any images.

Activity 18

Test a variety of materials to see if they are transparent (allow light to pass through), translucent (allow only some light to pass through), or opaque (do not allow any light to pass through).

Examples of objects you can use:

a clear plastic cup, a polystyrene cup, a glass of water, a clear plastic sheet, different types of plastic bags, cardboard, a sheet of white paper, aluminium foil, waxed paper, tissue paper, a mirror, clear glass, a piece of wood, a metal ruler, a wooden ruler, a plastic ruler, a leaf, cloth.

1 Draw up a table like this in your exercise book.

Object	Prediction				Observation		
	Transparent (clear image)	Translucent (hazy image)	Opaque (no image)	Reason	Transparent (clear image)	Translucent (hazy image)	Opaque (no image)
Clear plastic cup	✓			Clear plastic allows all light to pass through	✓		

2 Look at each object. Predict whether each object is transparent, translucent or opaque.

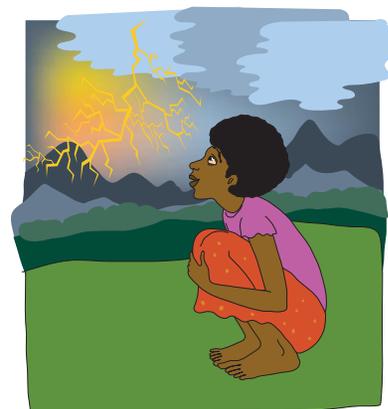
3 Record what you predict for each object in this table. An example is shown.

4 Shine a torch at each object in turn. For each object, record what you observe on your table.

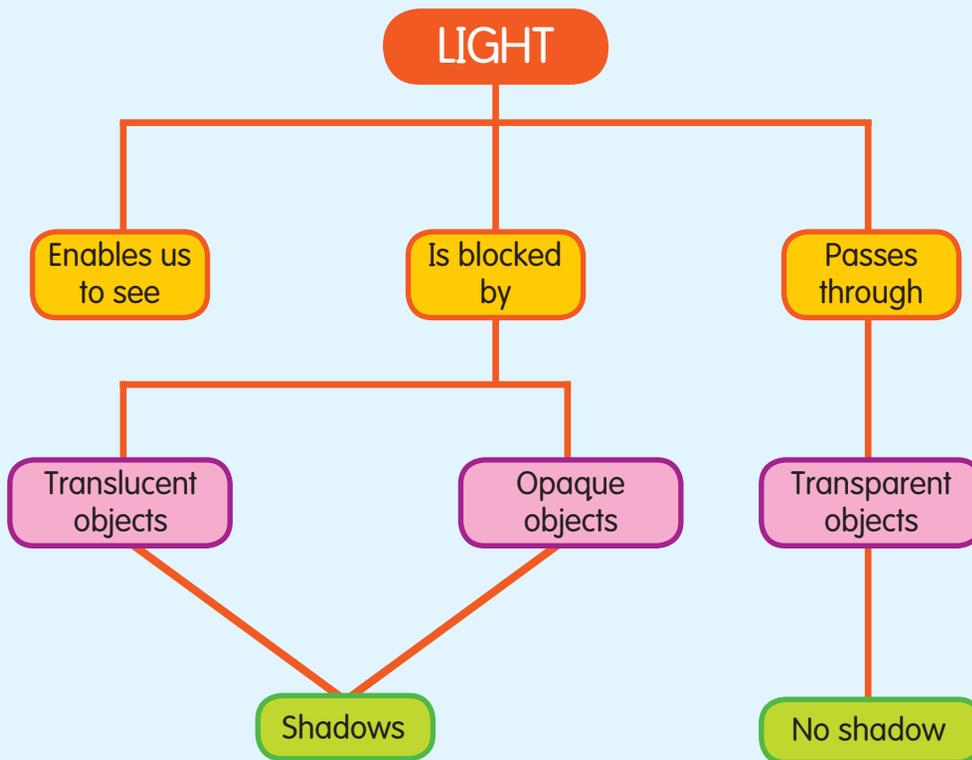
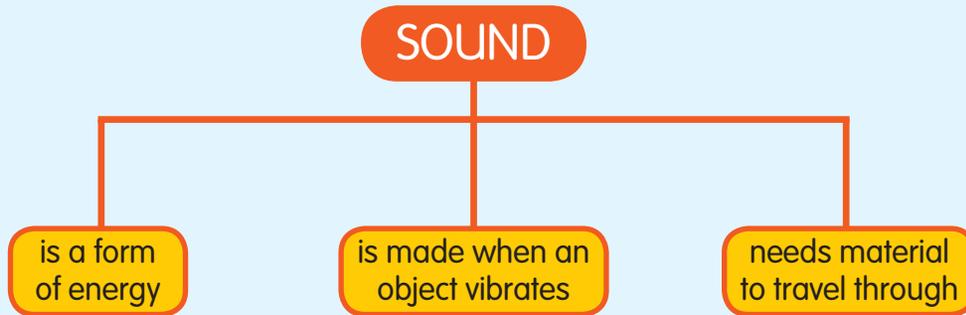
Did you predict correctly? Did any results surprise you? Why did you predict wrongly for those items? Often, scientists learn a lot when their predictions are wrong.

Thunder and lightning

Lightning and thunder occur during a storm or just before a storm. In a big storm you see lightning before you hear thunder. Light travels much faster than sound. If a storm is 3 kilometres away from you, its light reaches you in a fraction of a second—a period of time too small for you to notice. The sound takes 9 seconds to travel the same distance.



Concept Map



Chapter Review

- 1 Sound is made when an object vibrates.
- 2 Sound can travel through solids, liquids and gases but not empty space.
- 3 Vibrations cause movements through the air called sound waves.
- 4 Sound moves through the air like ripples through water.
- 5 Sounds have different pitches (high or low) because the vibrations are at different speeds.
- 6 The volume of sounds is measured in decibels.
- 7 Ears are the receptors that are sensitive to sound vibrations.
- 8 High decibel sounds can damage our ears.
- 9 Light enables us to see and enables our eyes to work.
- 10 Some objects give off light. The light reaches our eyes and enables us to see the objects.
- 11 Other objects reflect light falling on them. We see them because of the refracted light.
- 12 Transparent materials allow light to pass through with no scattering. Clear images are produced.
- 13 Translucent materials allow only scattered light to pass through. Hazy images are produced.
- 14 Opaque materials do not allow any light to pass through. No images are produced.
- 15 When light passes from one transparent material to another, it bends—this bending is called refraction.
- 16 Refraction can break up white light into its seven colours (violet, indigo, blue, green, yellow, orange, red). A rainbow shows the seven colours of white light.
- 17 The dark space that is formed behind an object when the object blocks light is called a shadow.
- 18 Objects, such as a plate, can cast shadows of different shapes when rotated.
- 19 Eyes are receptors that are sensitive to light.

1 Choose the correct words from this list to complete these sentences.

material air waves movement sound vibrate

Sound is produced when an object, such as a drum, is made to _____. The air around the drum is squeezed, and _____ travel outwards. The whoosh of the hornbill and the buzz of an insect are due to the _____ of their wings. The eardrum is made to vibrate by the _____ waves that enter the outer ear. Sound must have a _____ to travel through.

2 Choose the word that describes how each of these instruments makes a sound.

banging shaking plucking blowing



3 Which of the following are sources of light?

- a a candle
- b the Moon
- c a torch
- d the Sun
- e a piece of aluminium foil



4 Match each of these words to its correct meaning

Word	Meaning
Opaque	Allows some light to pass through
Transparent	Doesn't allow light to pass through
Translucent	Allows all light to pass through

5 Choose the correct words from this list to complete these sentences.

bent light reflect dark visible straight

All surfaces, even those that are dark in colour, _____ some light. White surfaces reflect more light than _____ surfaces. Objects become _____ when they reflect light rays into our eyes. Light travels in _____ lines. A spoon standing in a dish of water appears to be _____. This is because the _____ coming to the eye is refracted.

Crops and animals for food

In this chapter, you will:

- learn that there are three types of soil
- learn that good soil for gardening must have the constituents sand, humus, living things and water
- learn how to cultivate the soil and add natural fertilizers
- understand that there is a range of vegetative propagation methods: root, runner, sucker, leaf rhizome, tuber, corm, bulbis
- learn that many important food crops are propagated by vegetative methods
- learn how to reproduce plants artificially by planting cuttings, by layering and by grafting
- know about the methods of caring for crops: shading, mulching, thinning, staking, watering, intercropping, pest control
- understand the range of food crops that provide the nutrient food groups (energy, growth and protective food) for the human body
- understand the commercially important animals in the village: pigs, chickens and cows
- know that there are commercially valuable animals in rivers or oceans: shellfish, shrimps, crabs, trochus shells, fish.

Different types of soil



Activity 1

Work in groups of four or five.

- 1 Go outside and find three different areas close to school.
- 2 Pick up a handful of soil from each of the three areas and place it on a sheet of old newspaper.
- 3 Look closely at the soil sample. How many different things can you find in each soil sample?

Soil sample a: _____

Soil sample b: _____

Soil sample c: _____

- 4 Draw up this table in your exercise book and complete it.

Test	Sample a	Sample b	Sample c
Rub a small amount of the soil between your fingers. How does it feel?			
Roll the soil between the palms of your hands. How does it smell?			
Describe the colour of your soil.			

Please do not write in this book

Soil in different areas can be very different

There are different types of soil. The type of soil depends on the kind of rock that was worn down to make the soil.

Clay soil

This type of soil is made of tiny particles stuck close together. It can be sticky when wet. It also has few air spaces. Water is trapped between the particles. As a result, water does not easily drain quickly through clay soil.

Clay (like milk powder)



Sandy soil

This type of soil is made up of bigger particles with bigger spaces between the particles. Water can easily pass through these spaces. Sandy soils are light and easily drained.

Rough sand (like particles of sugar)



Loam soil

The best soil contains some clay, some sand and lots of **humus**. This type of soil is called loam soil. It is the best type of soil for gardening. It is a mixture of the other types of soil.

Sandy soil (like good garden soil)

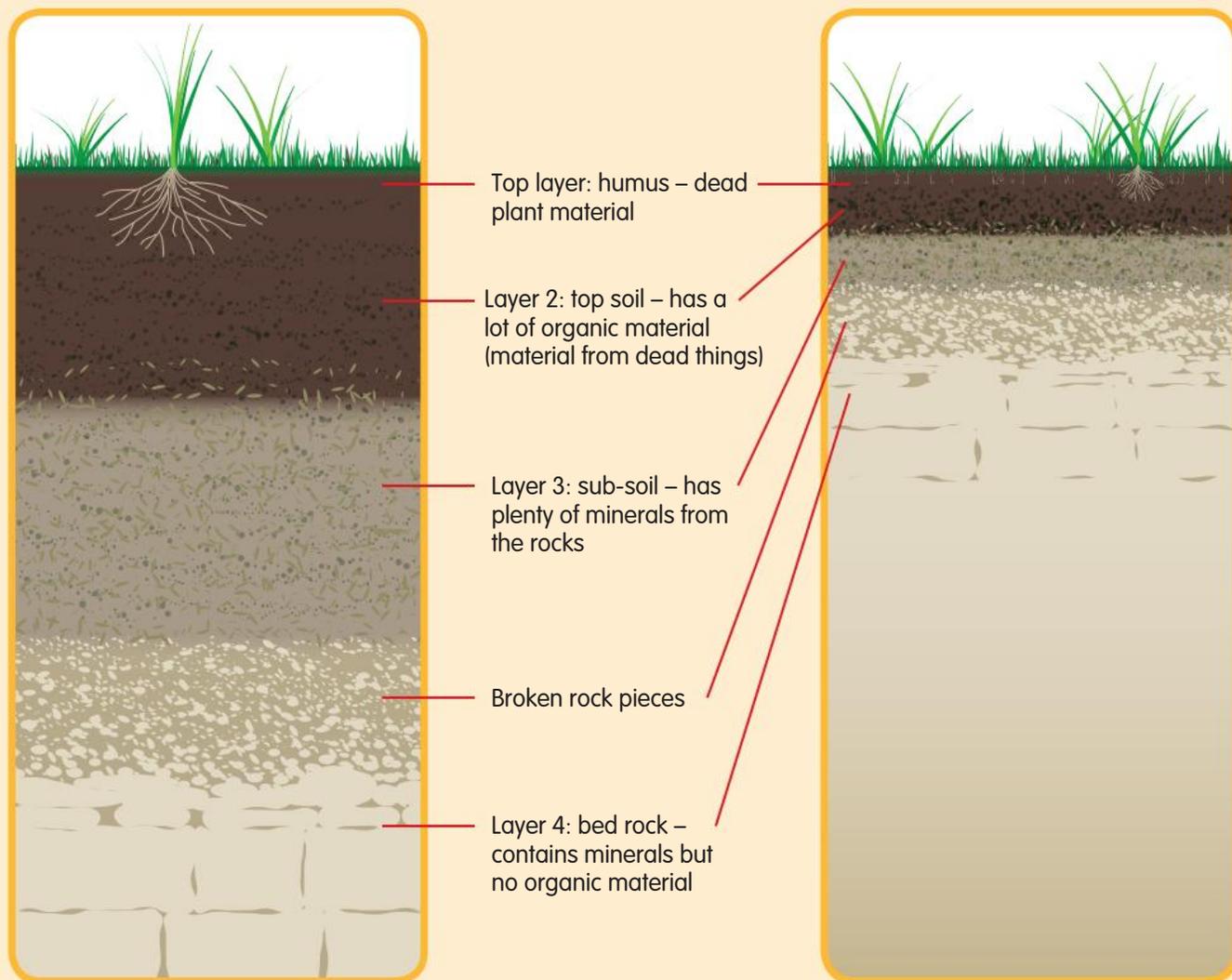


Activity 2

Go outside to a place where you can see the layers of soil under the surface. A river bank is a good place. A new site for a house is also good. Examine the layers you see.

Now move to a place where there is bad soil or a place where nothing is growing. Observe the layers. What differences do you notice?

These two drawings show the layers of the soil. The top layer is the humus. The bottom layer is the bed rock.

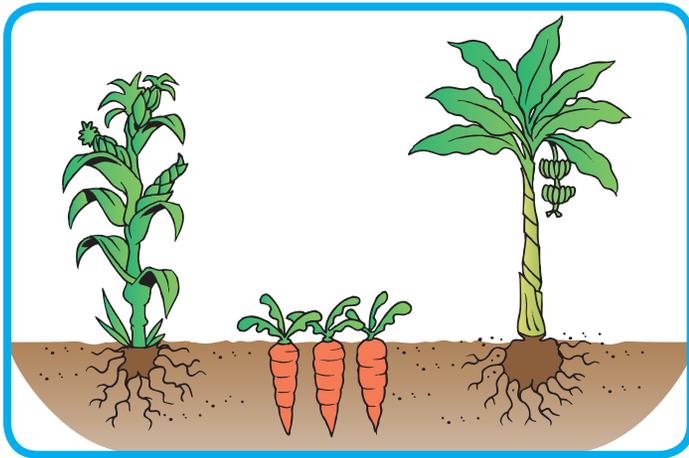


The drawing on the left shows soil that is good for growing crops. There is a deep layer of top soil, and a thick layer of sub-soil.

The drawing on the right shows soil that is bad for growing crops. The layer of top soil is very thin. The sub-soil has a lot of stones.

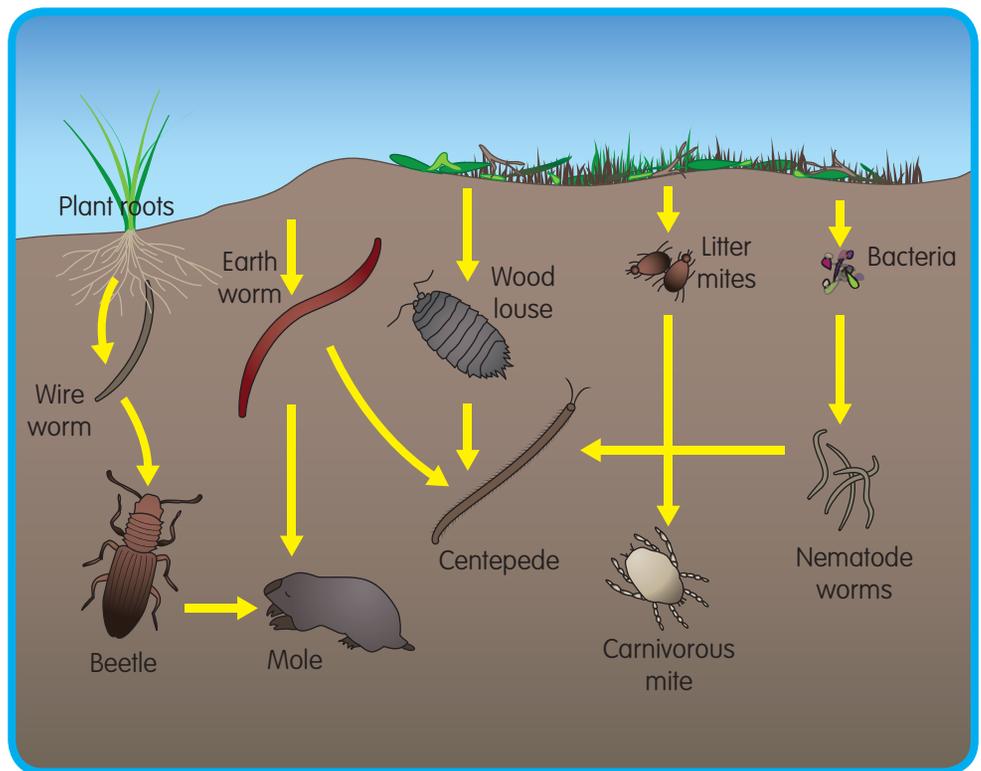
We need soil to grow plants for food

Soil covers most of the Earth.



Soil contains five things

- Humus—dead and rotting material.
- Living things—worms and some **insects**, such as termites and millipedes, live and die in the soil. **Microbes** break down dead plants and animals in the soil. The drawing shows a food web in the soil.
- Water—when it rains, water goes into the soil.
- Air—we dig the soil so that the air goes to the plants. Earthworm holes also allow air into the soil.
- **Minerals**—decayed remains of living things add minerals to the soil. Some crops, like peas and beans make minerals in the soil. Minerals also come from rock particles.



An underground food web

Vegetative propagation methods

Many plants can reproduce without seeds. New plants grow from parts of a parent plant. This kind of plant reproduction is called “**vegetative propagation**”. Examples are **runners**, **suckers**, **rhizomes**, **tubers**, **corm** or **bulbis**.

We grow many of our food crops in this way. We normally use stems or roots from parent plants.



Activity 3

Work in groups of four.

- 1 Go to a newly planted garden near the school. Ask the gardener how she used the vegetative **propagation** method.

For example:

Stem cuttings: for example, cassava

Vine cuttings: for example, kumara

Bulbis or swollen root cuttings: for example, yam, pana and taro

Sucker: for example, banana, pineapple

Layering: for example, guava

- 2 Answer these questions in your exercise books.
 - How many types of crops do you see in the garden?
 - How many crops in the garden have used stem cutting, vine cutting, bulbis or sucker?
 - Which method causes plants to produce new shoots?

Cuttings

A cutting may be a piece of root, vine, stem or leaf. It can grow to form a new plant.



Cassava stem cuttings



Kumara vine cuttings



Newly planted kumara vines showing new leaves



Newly planted cassava showing new shoots



There are important things to consider when making cuttings for planting materials:

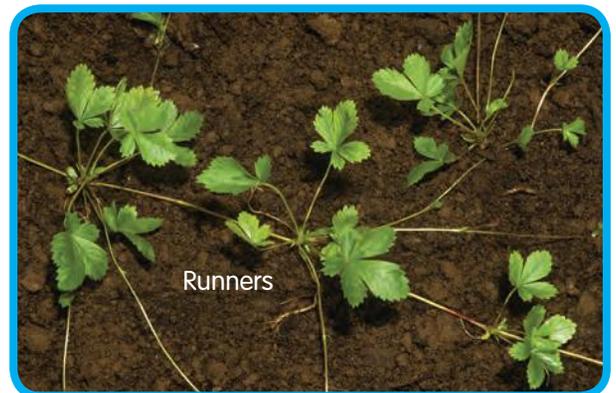
- Make the cuttings the correct size.
- Plant the cuttings the correct distance apart.
- Plant the different types of cuttings in the proper way.

Suckers

Suckers are upright shoots that develop from the stems of some plants. The new shoots can develop into new plants. Pineapple, banana and ginger are plants that can develop suckers.

Runners

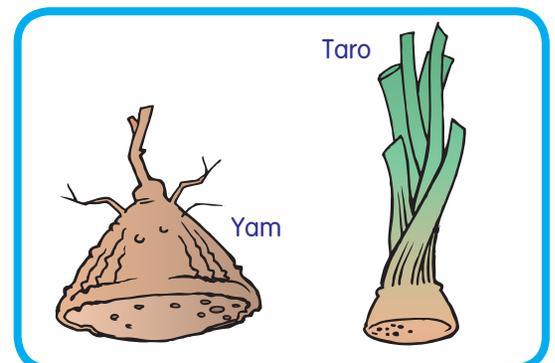
Runners are long stems that run along the surface of the soil. New plants can develop at certain places along the runner. The strawberry plant can reproduce from runners.



Strawberry plant with horizontal runners

Bulbis

The top of the swollen stem of some plants can form a new plant. This is called a bulbis. The yam and taro can propagate like this.



Roots

The kumara, yam and pana plants have buds that develop on their swollen roots. These buds can grow and develop into new plants.



Leaves

Some plants grow new plants from their leaves.

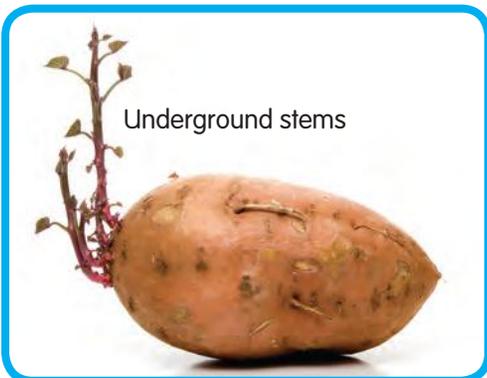
The leaves of some plants, such as bryophyllum, form small plantlets on the edge of leaves. The plantlets develop into new plants if cut off and planted.



Bryophyllum

Stems

Some plants, like the English potato and the onion, produce underground stems with buds. The buds can develop into new plants.



Potato



Onion

Some plants are difficult to grow from cuttings. **Layering** is another way to grow new plants from stems. We can reproduce the mango fruit in this way. There are two types of layering: land layering and air layering.



Activity 4

Land layering

Bend a branch into the soil. When roots grow, cut the branch with roots away from the parent plants. Then plant the branch with roots in suitable soil.

Mango trees can be grown using this method.

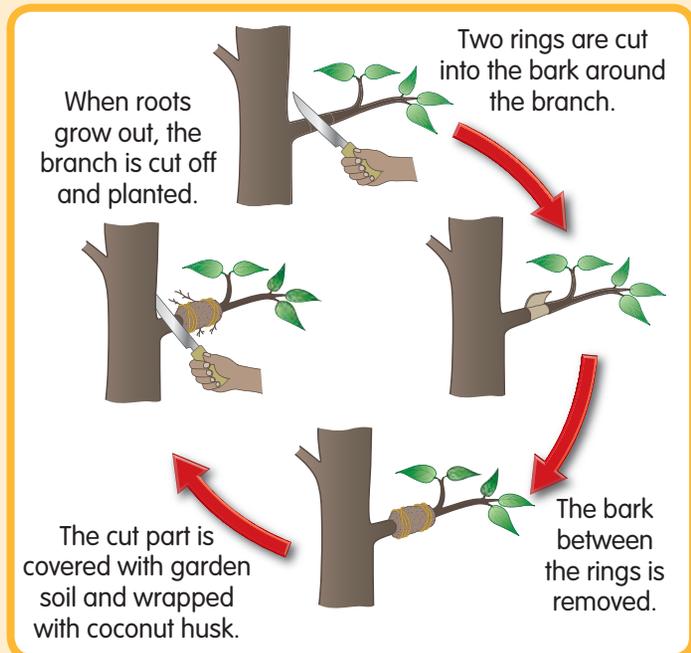
Air layering

Cut a section of bark from a branch of the stem. Wrap the cut section with moist soil. Use a coconut husk to hold the soil.

This method causes a new root and shoot to grow on a branch of the mother tree. When the new roots stick out of the husk, cut off the new plant with the husk. Then plant the new shoot with husk in the ground. The husk can stay with the shoot. It will decay in the soil.



Land layering



Air layering

Caring for food crops

It is important to look after food crops in the garden. There are many techniques. In this section, you will learn about:

- companion plants
- rotation
- mulching
- staking
- trellising
- fertilizing
- mixed cropping
- watering
- shading
- pruning
- weeding
- composting.

Companion plants

We can plant some crops together. For example, corn, yard long beans and peanuts can grow together.

This picture shows a garden in which the farmer is growing corn and yard long beans together.

These crops help each other to grow. They do not take nutrients from each other. The farmer gives the crops enough space.



Activity 5

Plant corn, yard long beans and peanuts 50–60 cm apart, like this.

Sow the yard long beans when the corn plant has 6–7 leaves.

The corn plants support the yard long beans. The stem of the corn is a stake for the beans.

When the corn and beans are grown together, the corn shades the beans from the hot sun. In return, the beans put nitrogen into the soil. This helps the corn to grow well.



Mixed cropping

Mixed cropping means planting different crops in one area at the same time. This method is common in village gardens.

Farmers often plant different crops in plots side by side. A common crop mixture is cassava, kumara, taro, tomato, beans and cucumber. Here is a picture of a mixed garden like this.

When there is a variety of crops, it is hard for pests and diseases to spread into the whole garden.



Activity 6



Visit a mixed crop garden near the school. Answer these questions.

- 1 What types of crops have you seen in the garden?
- 2 Are the crops growing together in one area healthy?
- 3 Why is the farmer planting different types of crops together in one area?

Crop rotation

Another good way of growing vegetable crops in a small area is to change to another crop after harvesting the first crop. Growing different vegetables on the same plot at different times is called “rotation”.

Different kinds of crops take different nutrients from the soil. For example, if we plant corn in the first round, the next round should be beans. This is because beans put food nutrients back into the soil. The next crop then uses the nutrients.

Any crops from a group can be used. There are four groups of crops.

Group 1: Leafy crops

- pac choi
- slippery cabbage
- saladeer
- lettuce
- shallot



Group 2: Fruiting vegetables

- capsicum
- pumpkin
- eggplant
- chilli
- cucumber
- tomatoes
- okra
- watermelon
- corn

Group 3: Legumes

- common beans
- peanuts
- wing beans
- soy beans

Group 4: Root crops

- cassava
- kumara
- taro
- yam
- pana

If a farmer chooses to plant pac choi in a plot, she harvests the pac choi. Then she plants cucumber (from group 2). She then harvests the cucumber. Next, she grows peanuts (from group 3). After harvesting the peanuts, she plants kumara (from group 4). Here is another example of rotation:

1st crop

Slippery cabbage
(from group 1)
1st harvest

2nd crop

Pumpkin
(from group 2)
2nd harvest

3rd harvest

Wing bean
(from group 3)
3rd harvest

4th harvest

Pana
(from group 4)
4th harvest

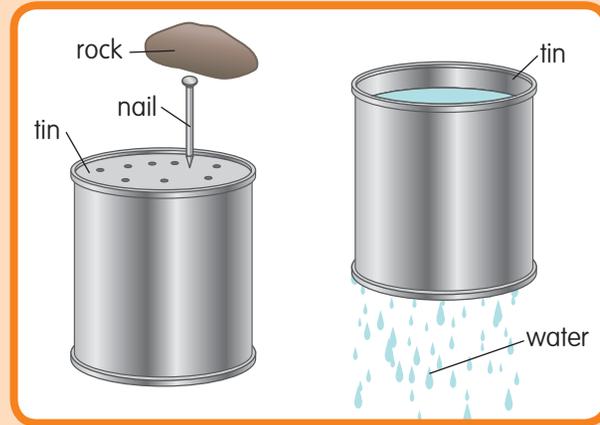


Watering

On hot dry days, the soil loses water by evaporation. So, farmers must water their crops regularly. There are some easy ways of doing this.

Activity 7

- Use a nail and a stone or hammer to make some holes in the bottom of a tin.
- Fill the tin with water.
- Test that the water comes out as a spray.



This is a hand-watering can.



The farmer uses a large drum to store water in the garden. She covers the drum to stop mosquitoes breeding. She uses a bucket to carry water to each plot. She then uses the home-made watering can.

Mulching

This is a simple way of protecting food crops while they grow.

The farmer puts a layer of material on the soil near to the growing plants.

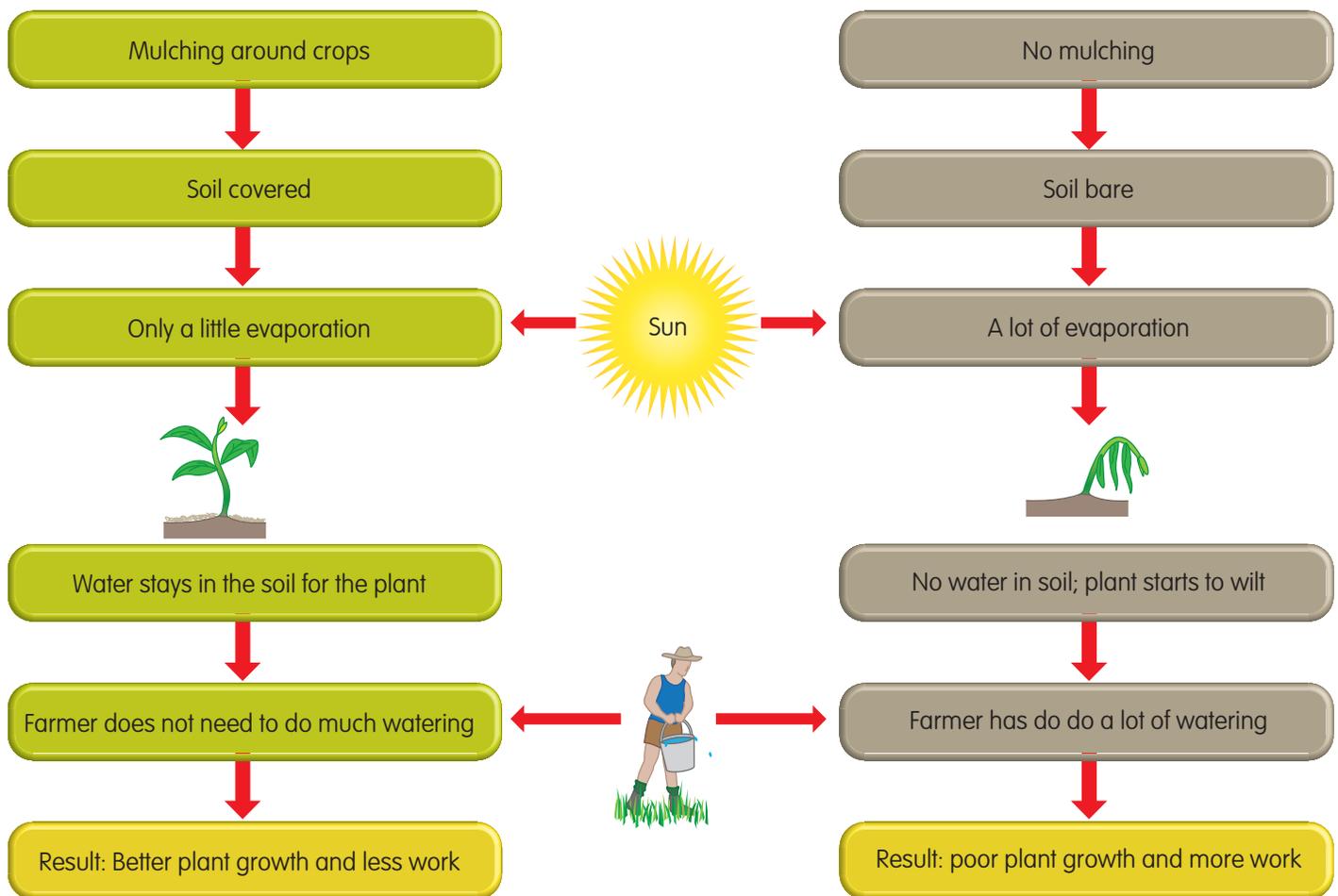
The material is **mulch**. Mulch can be grasses, leaves, wood shavings, sawdust, coconut husks or palm fronds.



The mulch:

- keeps the moisture in the soil
- controls weeds
- keeps the soil cool
- stops the soil washing away
- keeps fruit clean, for example, tomatoes, eggplants
- decays over time and add nutrients to the soil

Study these two flowcharts.



What lesson do you learn from the flowcharts? Look at a garden near your school or at home. Is the gardener putting mulch on her crops?

Activity 8

Visit some village gardens near the school. Find out how farmers shade their young crops from the hot sun.

Observe how they help some plants to support their fruits as they develop.

Providing shade

When young seedlings are starting to grow, they need shade from the hot Sun. In this picture a stick supports a piece of banana stem. The banana stem shades the new plant after transplanting.



Young plants also need shade from the hot sun. In the photo opposite, a leaf shelter shades the young plants in a nursery plot.



Staking

Some plant stems need support, because they are soft. An example is the tomato. To support plants, push a wooden stick into the ground beside the plants. Tie the plant stem to the sticks. This is called “staking”.



Pruning

It is good to remove some branch stems from growing plants. This helps them to produce better fruits. For example, tomatoes, capsicum and eggplants produce better fruits when the farmer **prunes** them.

Trellising

Many food crops have soft stems that grow very long. When the fruit grow large, the plant stems need support. The long stem needs to cling to a frame. Here is a picture of yard long beans growing on a wooden trellis.

Sometimes the trellis is like a tent. It is also easy to build a frame of sticks in a cone shape.



Yard long bean on trellis

Weeding

Weeds are unwanted plants that grow close to food crops. Weeds compete with the crop for water, sunlight and nutrients. Also, many weeds carry organisms that infect crops and cause diseases. There are simple ways to control weeds. These pictures show the main methods.



Pulling weeds out



Digging weeds out with hoe



Brushing with bush knife

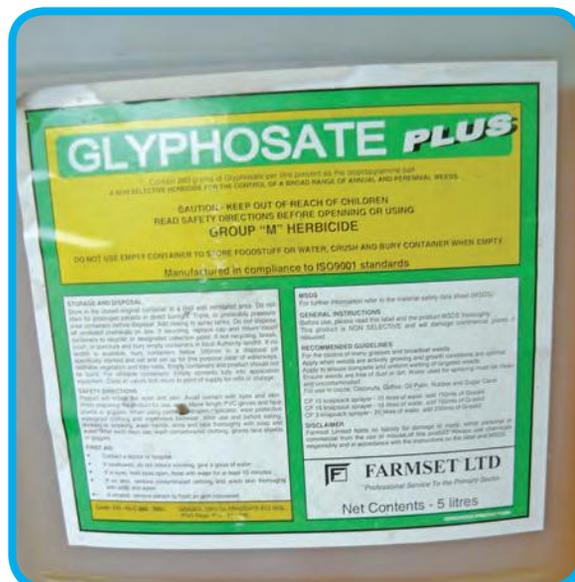
Activity 10

As you take care of your own garden plot at school, use the different methods of weeding. Remove the weeds regularly from your vegetable plot. This helps the plants to produce more.



Weedkillers

On large farms, people sometimes use special chemicals to kill weeds. Examples are Gramoxin and Glyphosate.



These chemicals can also kill the food plants. Farmers must use them carefully. When a farmer burns an area of bush to make a new garden, the fire kills weeds and weed seeds.

Traditional fertilizer

When people cut down the forest and burn it, the burned vegetation is the natural **fertilizer**. This natural fertilizer improves the soil.

This method works if the farmer uses the plot for a few years only. She must then leave the area unused for a couple of years. When a farmer leaves garden land unused for a few years, we say that it is “fallow”.

Composting

Compost is a fertilizer mixture of rotting grass cuttings, leaves, **manure** and food scraps. We use the compost mixture to give plant nutrients to the soil. A nutrient is food material for plant growth.



Burnt new garden area



New mounds with natural ashes on the surface

Activity 11



Can you make a compost pit?

- 1 Make a compost heap or pit at your school. Dig a large hole 1.5 metres deep. Another way is to build a wooden frame 1 metre high.
- 2 Put all waste plant material, animal manure, food scraps and grass cuttings into the hole or the frame. Heap up the material. Cover with banana leaves.
- 3 Allow the compost to stand until it is a dark, crumbly mixture. It is now ready to fertilize the crops. Always cover food scraps with some soil. This keeps rats away.



Advantages of making compost

- 1 It puts plant nutrients in the soil.
- 2 It improves the make-up of the soil.
- 3 It allows the soil to store more water.
- 4 It is a cheap way of fertilizing the soil.

Animals for food

Food is made of many different substances that our bodies need for a healthy life. These substances are the body's nutrients. There are four main types of nutrients. This table shows the nutrients and gives examples of each. It also says what the body uses it for.

Land animals and animals from the ocean and rivers are sources of food. We choose the animals we raise for traditional reasons. We also use them as sources of food. The land animals that we usually raise for food are chickens, pigs and cows.

Type of nutrient	Mostly found in ...	What it is used for in the body
Carbohydrates	Sugar—honey, sweet foods Starch—rice, potatoes, sago, bread, cakes, pasta 	Used by the body for energy.
Protein	Meat, fish and other seafood, eggs, nuts and dairy products 	Used by the body for growth and repair of cells.
Fats and oils	Nuts, seeds, margarine, avocados, fatty meat like pig legs and chicken skin 	Used by the body for energy. The body stores the extra fat that it does not use.
Vitamins and minerals	Fruit and vegetables, dairy foods, seafood 	Used by the body to keep all its processes working properly.

Raising chickens

Chickens give us meat and eggs. Chicken meat supplies protein. Eggs also supply protein.

There are two ways to raise chickens in the village. In the first way, the birds stay in a house for half of the day. The owner gives them food in the chicken house. They lay their eggs. Then they go outside and find their own food.

The other way is to keep the birds in a special chicken house all the time.



Activity 11

Visit a local chicken farm. Find out which method the farmer uses. Are the chickens in a chicken house all the time? Do the chickens run around freely most of the time?

These photos show chickens in a special chicken house.

The owner must provide all the chicken food. She must put fresh sawdust on the floor. She must give the chickens water regularly. She must clean out the floor each week.



These photos show the chicken water drinker and the feeder hanging inside the house.



This photo shows another kind of feeder at the side of the house.



This photo shows egg-laying baskets in the chicken house.

People sell chickens in the market. They store the cleaned and plucked chickens in “eskes” with blocks of ice. They stay fresh for the customers.

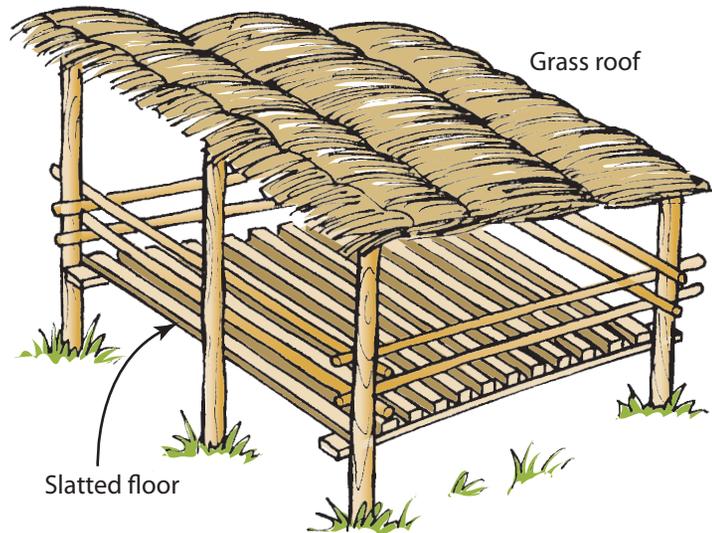


Eskes of chickens at the market.

Raising pigs

Pig meat gives us protein and fats and oils. In the village, people often raise pigs in a raised wooden pig house. It looks like this.

Some farmers raise pigs in special houses. The pigs stay in the houses and the yards all the time. These photos show a piggery, and the pigs in one section of the piggery.



The farmer must clean out the piggery every day. He must also provide all the food for the pigs.

Pigs need the same kind of food that we need.

They should eat:

- Energy foods—kumara, cassava, taro and bananas
- Body building food—meat or fish meal, coconut, beans or peas
- Protective food—green leaves of kumara, pawpaw fruits and leaves, cow pea
- Water—plenty of fresh clean water.

These photos show the pig's food mixture. The food is a mixture of copra meal, fish meal and meal.



Cattle

Cows give us meat and milk. In Solomon Islands, farmers raise cattle in special fenced areas.



Cattle at the Tenaru cattle project on Guadalcanal.



Milking a cow

At Tenaru farm on Guadalcanal, they slaughter cattle for beef. In many countries, farmers rear cows for their milk.

Some farmers milk their cows with their hands. They put the milk into a chilled storage container to keep it fresh.



Chilled storage of milk



Big piece of a slaughtered pig



Big pieces of meat are cut into small slices and chunks.

The shops and butcheries sell the meat to customers.

Food sources from the river and ocean

Many animals in the ocean and rivers provide people with food. These include prawns, shellfish, crabs and fish.

Shrimps

People in most islands of Solomon Islands dive in the creeks and rivers to catch shrimps.

Shrimp meat gives us protein (growth foods), vitamin and minerals (protective foods).

People who live on the coast harvest many kinds of fish and shell animals (crabs and prawns) from the sea. All these give us protein, vitamin and minerals too.



Reef fish for sale at the market



Shellfish, crabs and shimp at the Honiara central market

In this picture, people from the Weather Coast of Guadalcanal are using a circular net to catch fish on the reef. The fishermen stretch the net between two canoes. People in the water drive the fish towards the net. They pull the sinkers together so that the net closes. The people in the canoe pull the full net back into the canoe.



Pulling in a net of reef fish.



Activity 12

Discuss ocean and river animals in your local area that people use as food. List them.

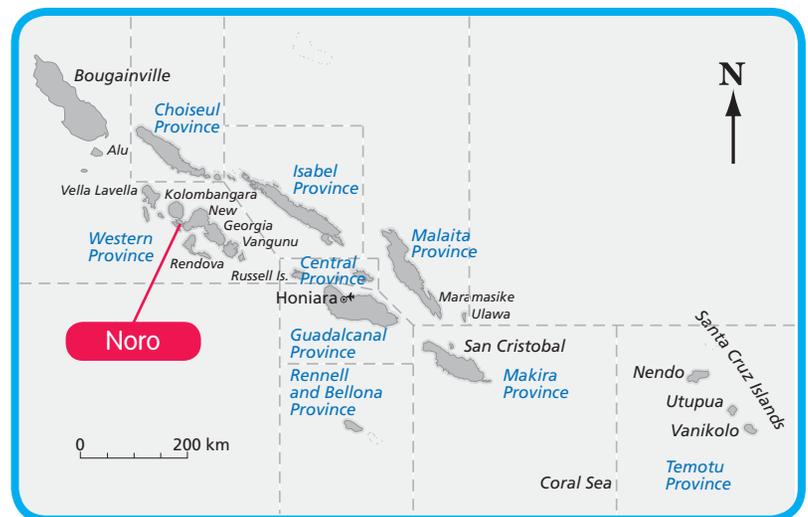
Find out how the people catch the animals. Also, find out how they are cooked.



Diver with shell

Tuna fishing is a very big industry here. The oceans of Solomon Islands have huge shoals of tuna. Here is a picture of a large tuna catching boat at Honiara. You can see the nets, slipway and the crane.

These huge fishing boats catch many thousands of tons of tuna in a very short time. The Solomon Islands Government controls how much tuna is caught in a year. The breeding cycle of the tuna should not be disturbed. The tuna fish cannery is at Noro on the island of New Georgia. The tuna fish meat is chopped up and put into cans for sale.



Tuna boat



Skipjack tuna

Canned food

Almost any kind of food can be preserved in sealed cans. In shops, there are canned fruits, vegetables, milk, meat and fish. Canned food gives variety to the family diet. Canned meat and fish are popular in Solomon Islands. They are a convenient source of protein when fresh foods are not available. Many people do not have refrigerators. Canning takes place in canning factories.

The shops in Solomon Islands sell tuna in cans. Shops overseas also sell Solomon Islands tuna. Here are some of the fish cans you can see in our shops.



Activity 13

Identify the different types of canned tuna that the Solomon Islands cannery produces. There are different grades, at different prices. There are also different flavours.

- List the different grades.
- List the prices.



Chapter Review

- 1 The three types of soil are clay, sandy soil and loam. Loam is the best for gardening
- 2 To grow crops, we must add natural fertilizers to the soil.
- 3 The planting material for the vegetative propagation methods are roots, runners, suckers, leaves, rhizomes, tubers, corms, bulbis.
- 4 The methods of caring for crops are shading, mulching, thinning, staking, watering, intercropping, controlling pests, weeding.
- 5 Companion planting, mixed cropping and crop rotation are ways of making sure that all crops get nutrients from the soil.
- 6 Rotating crops in a garden area means that one crop puts nutrients back into the soil, after a previous crop has taken nutrients out.
- 7 Regular watering and mulching are essential tasks when growing crops.
- 8 Shading plants, staking, pruning, trellising and weeding are various ways of caring for food crops and increasing the harvest.
- 9 Compost is natural fertilizer. It is a mixture of rotting grass cuttings, leaves, manure, food scraps and waste plant material.
- 10 The three nutrient food groups for the body are energy foods (carbohydrates, fats and oils); growth foods (proteins); protective foods (vitamins and minerals). These come from plants and animals.
- 11 The animals in the village that provide body nutrients are pigs, chickens and cows.
- 12 Some animals in the rivers and oceans that provide nutrients are shellfish, shrimps, crabs, fish.

Answer these questions in your exercise book.

- 1 Match the vegetative propagation method in the list on the left with the correct description in the list on the right.

Propagation method	Description
Cutting	Top of a swollen plant stem
Sucker	Stem that runs along the surface of the soil
Runner	Upright shoot that develops from the stem of a plant
Bulbis	Piece of plant root, stem, or leaf that can grow into a new plant

- 2 Which one of these sets of food crops is correct for a farmer who wants to rotate his crops?

- A wing bean; saladeer; cassava; eggplant
- B pac choi; pumpkin; soy bean; taro
- C pana; peanut; lettuce; okra
- D slippery cabbage; yam; cucumber; bean

- 3 Which of these three statements is true?

- A Trellising is a method used to support root crops.
- B Tomatoes and eggplants produce better fruits if the farmer prunes them.
- C Compost is an artificial fertilizer.

The solar system

In this chapter, you will:

- learn that the solar system consists of our Sun, eight planets and the moons of some planets
- use a model to represent our Sun, our Earth and our Moon
- understand that each planet moves around the Sun in a path called an "orbit"
- appreciate that an Earth year is the time Earth takes to complete its orbit of the Sun
- learn that an Earth year is 365 days and one quarter
- understand that the Sun gives heat and light energy to Earth
- represent the distances of the planets from the Sun and the orbits of the planets by creating a moving model
- learn that the planets are many, many thousands of millions of kilometres from the Sun
- learn that the shape of the Earth's orbit is an ellipse
- make a model to show how the Sun's rays give more heat to parts of Earth at some parts of the year
- learn that the Moon is Earth's satellite, and that it takes 28 days to orbit the Earth
- understand that we use the Moon's orbit period to divide our year into 12 months
- appreciate that we see the Moon from Earth because it reflects the Sun's light.

We experience the Earth, Sun and Moon every day. We live on Earth. The Sun gives us heat energy and light energy. We see the Moon changing shape during each month.



Activity 1

Attach a soft ball to a length of string. Swing the ball continuously around your head as shown in the drawing. Why do you think the ball pulls against the string when you swing it? What happens if you let the string go from your hand?

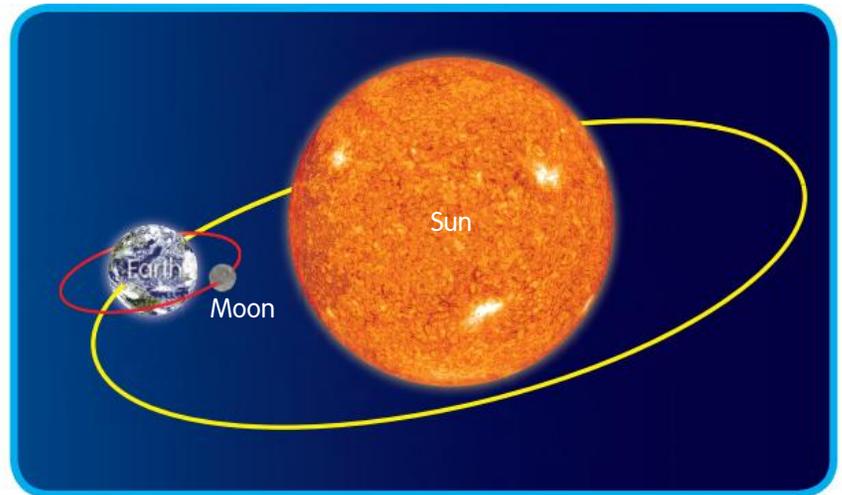


As long as you do not let go of the string, the ball will continue to swing around your head. The ball moving around your head is like our Earth moving around the Sun. It does not fly off into space. The Sun has a force that pulls the Earth towards it. We call this force a “**gravitational pull**”.

A very large body exerts a pulling force on a small body close to it. Earth stays close to our Sun because of the gravitational pull of the Sun. Earth moves in a path round the Sun because of this force. The path of Earth around the Sun is its **orbit**.

What is an orbit?

An orbit is the path an object takes when it travels around something. When we say a **planet** “orbits” the Sun, we mean it follows a path around the Sun. The Moon orbits the Earth. The picture shows these orbits.



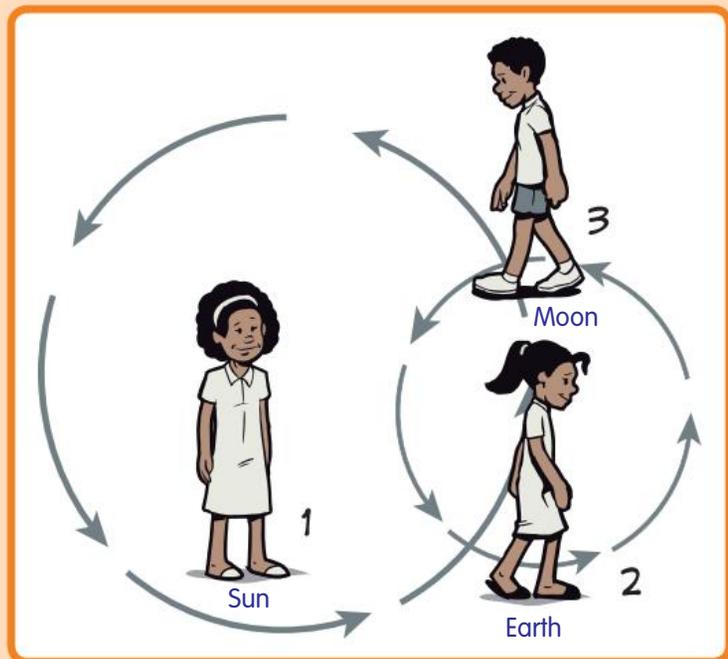
Activity 2



Working in groups of three.

Make a human model of these three moving bodies—Sun, Earth and Moon.

- 1 Person 1 stands in an open space. This person acts as the Sun. Person 2 is the Earth. Person 2 (Earth) must do two movements.
 - The first movement is the spinning on the axis. So person 2 spins (turns) on their feet.
 - As person 2 spins, she also moves in an orbit around person 1 (Sun).
- 2 Now person 3 (Moon) starts to move around the Earth. This is person 3’s orbit around person 2. Person 3 must keep moving around person 2. He moves so that he stays with Earth as it orbits the Sun.

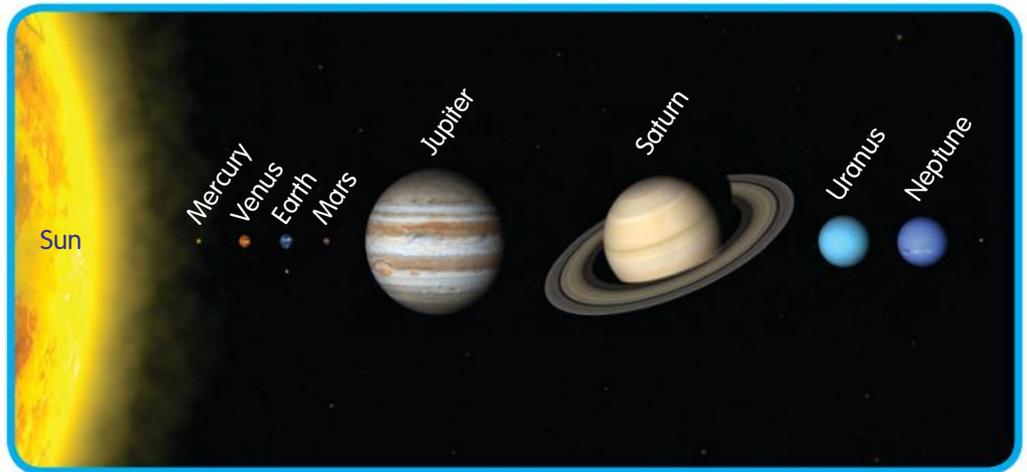


Was it difficult for the two people to keep all the movements going at the same time?

These movements are what happens with the Earth, Sun and Moon.

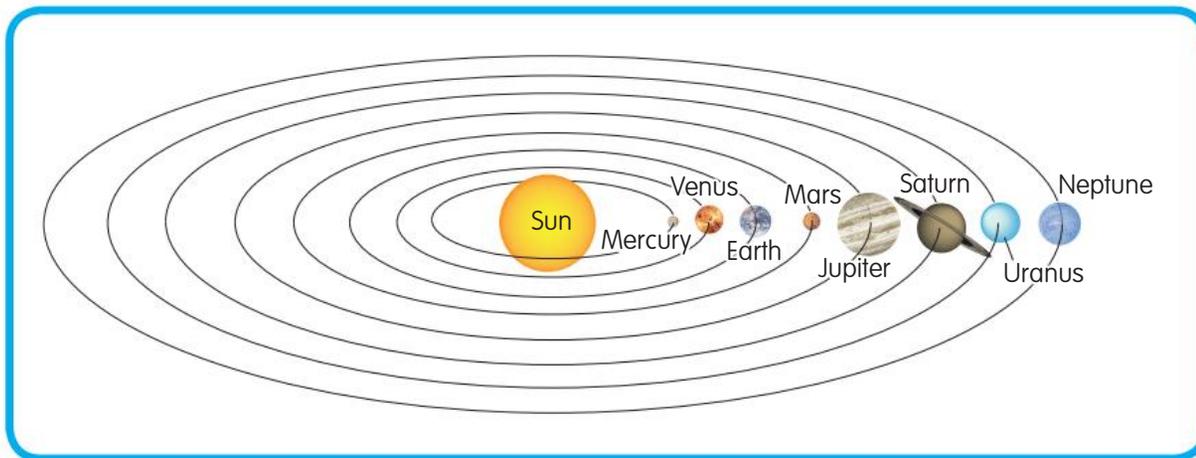
The planets

There are eight planets that orbit the Sun. This drawing shows the Sun and the eight planets. Mercury and Venus are closest to the Sun. Earth and Mars are next. They are mostly made of rock and metal. Jupiter, Saturn, Uranus and Neptune are further away from the Sun. They consist mainly of gas and liquid.



The eight planets in our solar system

This Sun and its eight planets make up our **solar system**. This picture shows the Sun, the eight planets and their orbits. The pictures of the planets are not according to their real size.



The solar system and the eight planets in their orbits.

Each planet in the solar system revolves around the Sun. This revolution is the planet's orbit. The time it takes to complete a **revolution** depends on the distance from the Sun. The planets furthest from the Sun take longer to make a revolution.

Like all stars, the Sun is a huge mass of very hot gases. It has a temperature of about 6000 degrees C at its surface. The temperature at its centre is 15 million degrees C. The Sun gives off a huge amount of energy.

Planets: diameter and distance from the Sun

There are huge differences in the sizes of the planets. They are also at different distances from the Sun.

Look at this table. It lists the eight planets and their **diameters**. It also lists the planets in order of their distance from the Sun and gives their distance from the Sun.

Planet	Diameter (km)	Distance from Sun (millions of km)	Distance on human model (m)*
Mercury	4,840	57,910,000	(Person 2) 1
Venus	12,300	108,210,000	(Person 3) 2
Earth	12,756	149,600,000	(Person 4) 3
Mars	6,790	222,940,000	(Person 5) 5
Jupiter	142,700	778,340,000	(Person 6) 16
Saturn	120,800	1,427,010,000	(Person 7) 29
Uranus	50,800	2,869,600,000	(Person 8) 57
Neptune	48,600	4,496,700,000	(Person 9) 90

* The distances in metres are rough estimates.

Activity 3



- 1 Which planet is nearest to the Sun?
- 2 Which planet is furthest from the Sun?
- 3 How many kilometres from the Sun is Earth?
- 4 Which is the biggest planet?
- 5 Which is the smallest planet?

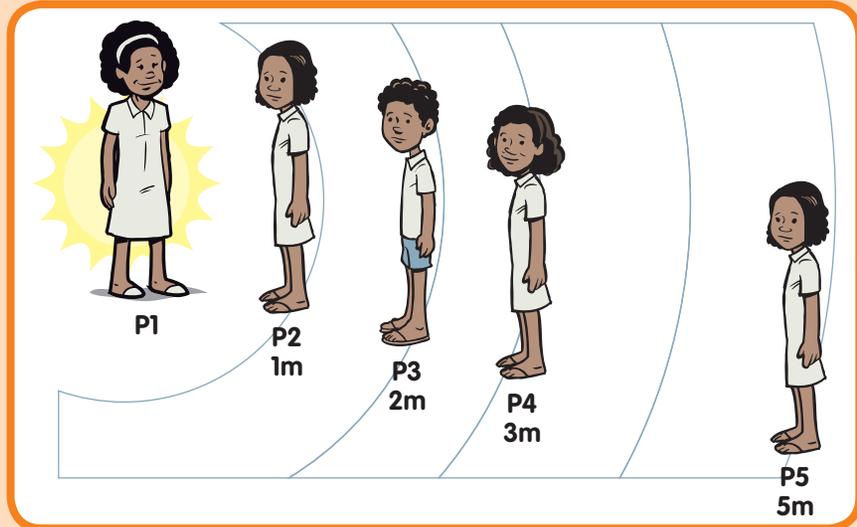
Remember! The diameter is the distance across a sphere at its widest point.

Activity 4

To get an idea of the distance of planets from the Sun, make a human model of the solar system. You need twelve people. Person 1 is the Sun. Eight people are the planets (person 2 to 9).

Column 4 of the table on page 156 is “Distance on human model (m)”. It gives the distance in metres from the Sun (person 1) for each of the eight planet people.

The drawing shows the position of person P1 (the Sun), and the first four planet people (P2, P3, P4 and P5). The next four planets cannot fit on this drawing. For example, the person P9 (Neptune) is 90 m from person 1 (Sun).



The three other people organise the nine models. They measure the distances. They help the models to get into their positions. They do this by stepping out the distances from the Sun. They use one long step for 1 metre.

For example, person P6 (Jupiter) is 16 steps from person 1 (Sun). Each planet person holds up a sign with the planet name. This drawing shows the model.



When the model is ready, ask all the planets to start moving in their orbits round the Sun. The others in the class watch the movements. They see the idea of the planets in the solar system. A very important thing to note is the huge difference in the times the planet people take to move once round the Sun.

Years, days and months

How old are you? Look at Nester and her sister. Nester is 11 years, 5 months and 2 days old. Florence is celebrating her eighth birthday. What do we mean when we use the words year, month and day?

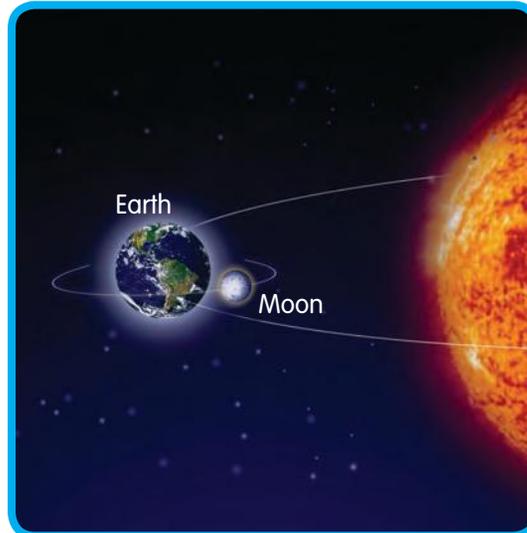
A year on Earth

The Sun is at the centre of our solar system. The Earth moves around the Sun in its orbit.

It takes the Earth 365 days and one quarter to go around the Sun. This is an Earth year.

It takes 365 days from one Christmas to the next. The Earth moves all the way round the Sun and back to where it started.

The world's fastest moving animal, the peregrine falcon, can fly at speeds of 350 km per hour. You can drive at 60 km per hour on the road. Imagine travelling more than 1750 times faster on the road. That is how fast the Earth moves around the Sun. The speed is 107,000 kilometres per hour.



Peregrine falcon



Earth's orbit and the climate

The Earth spins on its **axis** once every day.

Earth does not point straight up and down in space. It leans a little. The drawing below shows this. This is the Earth's "tilt".

The tilt is very important for some parts of the Earth.

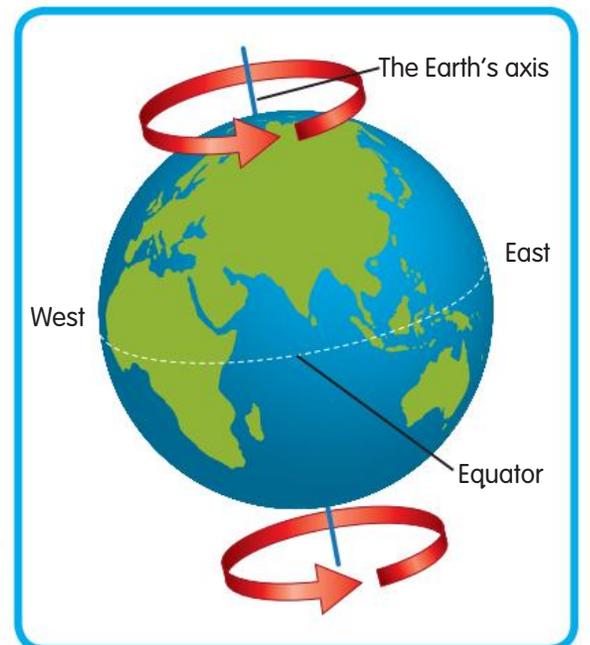
The drawing shows the Northern **hemisphere** and the Southern hemisphere. These are the two halves of the Earth's sphere.

The Equator is an imaginary line that runs around the Earth. The Equator is the same distance from the North Pole and the South Pole.

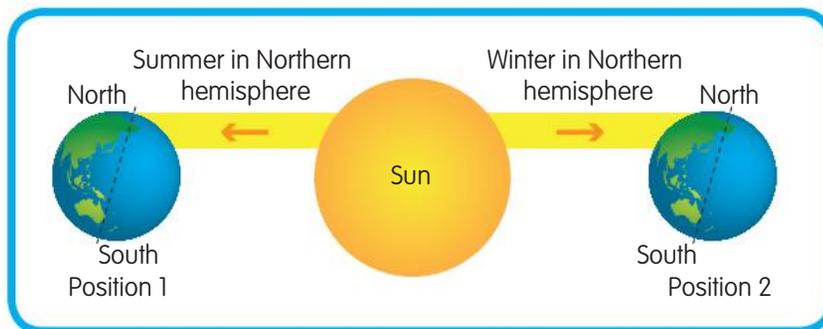
The drawing shows two positions of Earth in its orbit around the Sun.

In position 1, the Northern hemisphere is tilted towards the Sun.

In position 2, the Southern hemisphere is tilted towards the Sun.



Rotation of the Earth



Activity 5

You can model the Earth's orbit around the Sun.

Use a globe and a torch. If the school does not have a globe, use a netball.

Set up the globe in a dark place. Shine the torch onto the globe. The torchlight is the Sun's rays. The drawing shows position 2. The Southern hemisphere tilts towards the Sun so it is hotter.

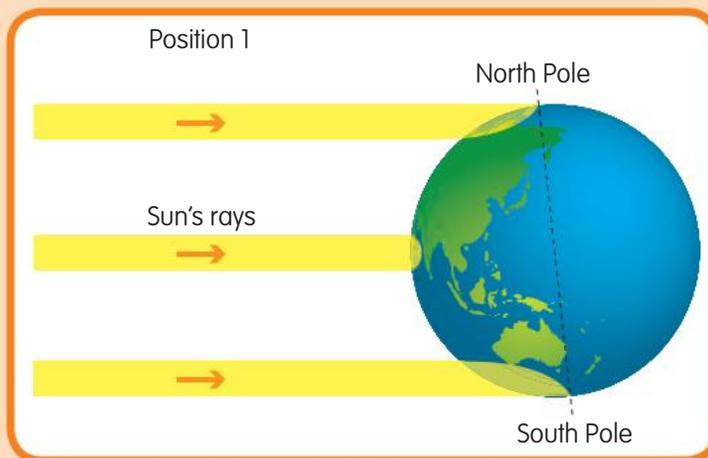
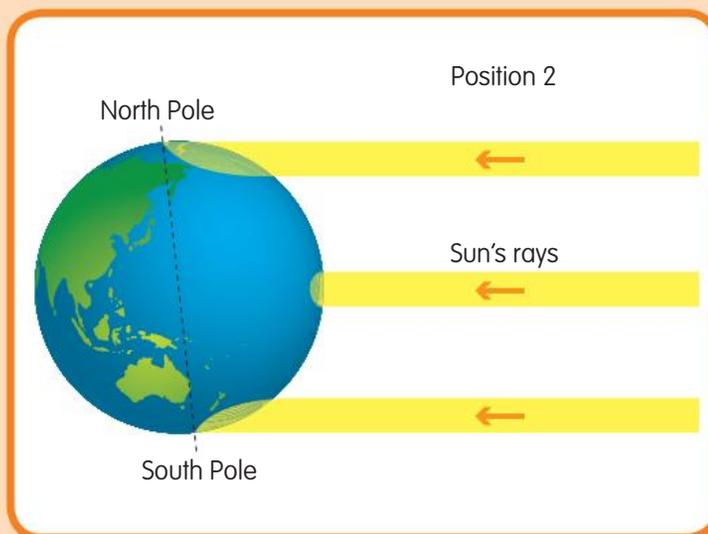
The Sun's rays fall on a much larger area of the Earth near the North Pole, so the North area is colder.

Now move the globe to the other side of the torch beam.

Which part of the Earth is tilted towards the Sun—the Southern hemisphere or the Northern hemisphere?

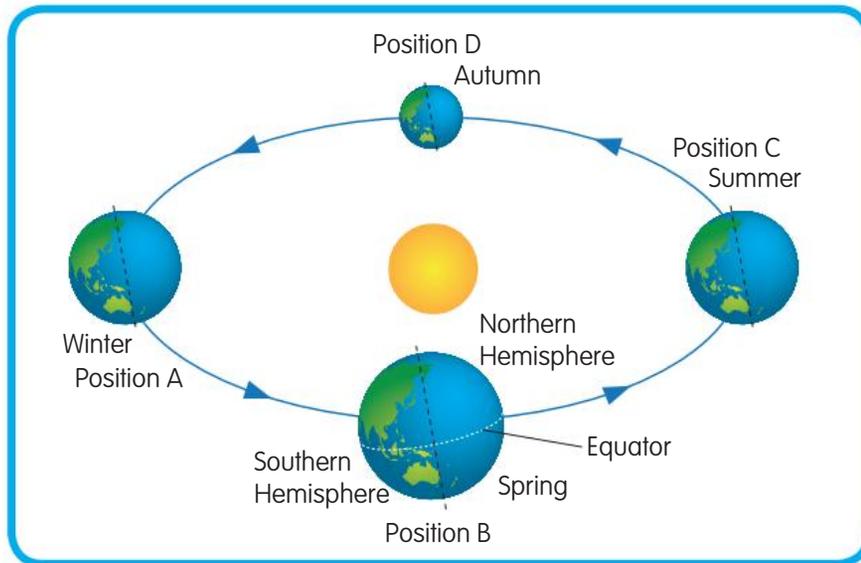
This drawing shows position 1 in the diagram on page 159.

The rays fall on a much larger area near the South Pole in position 1, so the Southern area is colder.



Near the Equator, the Sun gives more heat to the Earth. The Sun is overhead nearly all year round. So it stays hot all year round. The **climate** does not change much throughout the whole year.

This diagram shows the Earth in four positions of its orbit.



At position A, the Northern hemisphere is cooler than the southern. Places in the Northern hemisphere have winter.

At position C, the Southern hemisphere is cooler than the Northern hemisphere. Places in the Southern hemisphere have winter.

Winter is the cooler **season**. **Summer** is the warmer season. The colder parts of the Earth have these four seasons. The other two seasons are autumn and spring.

Places like Solomon Islands are close to the Equator. Areas close to the Equator do not have these seasons.

Moon

Look at the diagram on page 158 showing the Sun, the Earth and the Moon.

The Moon is our closest neighbour in space. It is made of rocks. The surface of the Moon has many holes. Plants and animals cannot live on the Moon because there is no air or water.

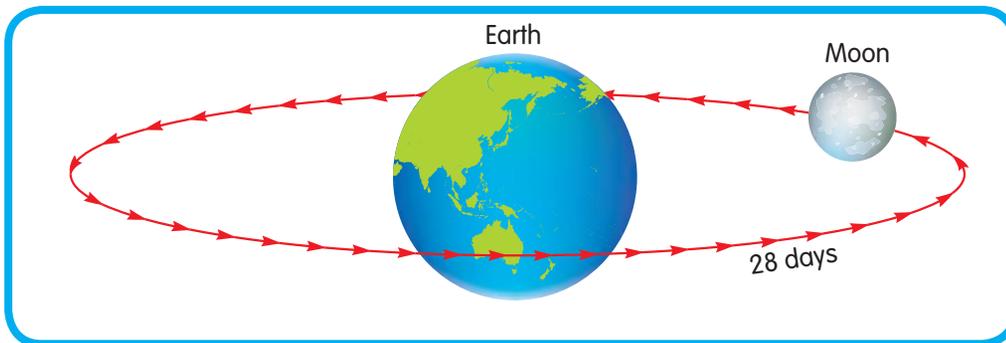
I am round like a ball.

I live in the sky.

You can see me at night
if you look up high.

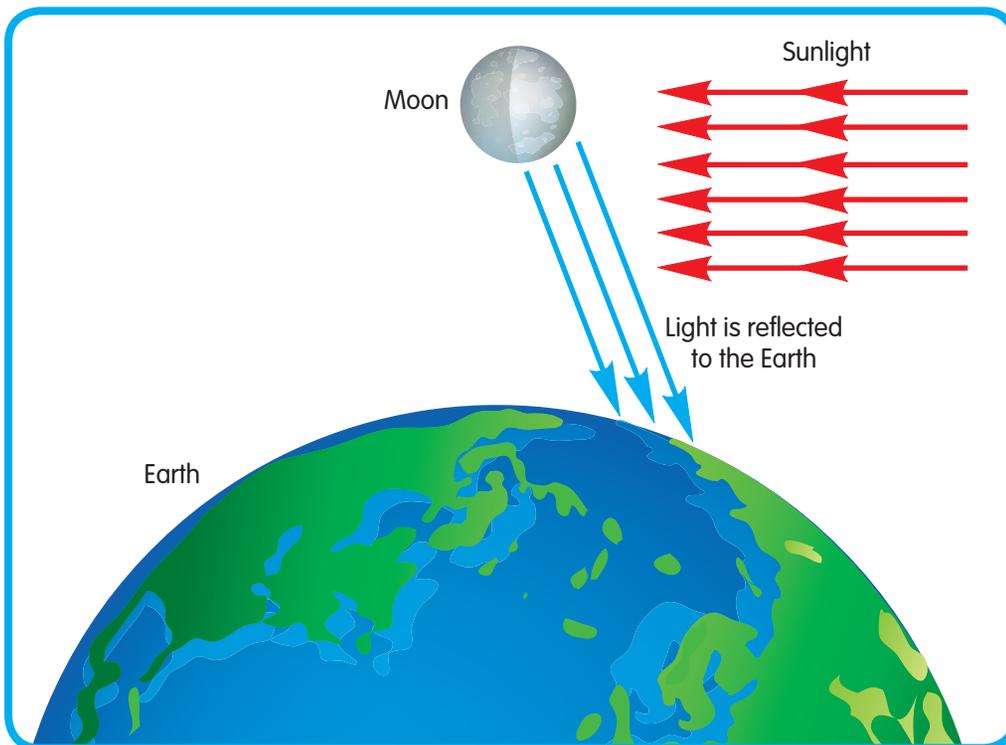


Our Moon moves around the Earth. It takes 28 days for the orbit of Earth. This drawing shows the Moon's orbit of Earth. As the Moon moves, only the part that is lit by the Sun can be seen on Earth.



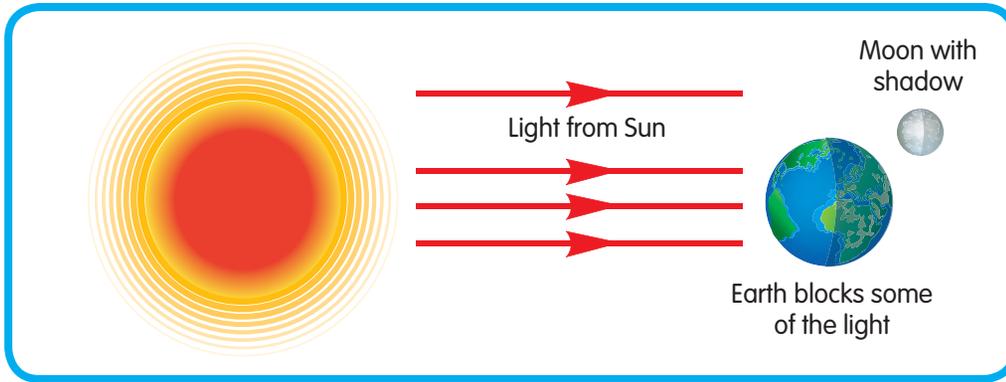
All the planets of our solar system have moons, except Mercury and Venus.

The Moon does not send out light of its own. We see the Moon because it reflects light that comes from the Sun. This diagram shows how this happens.

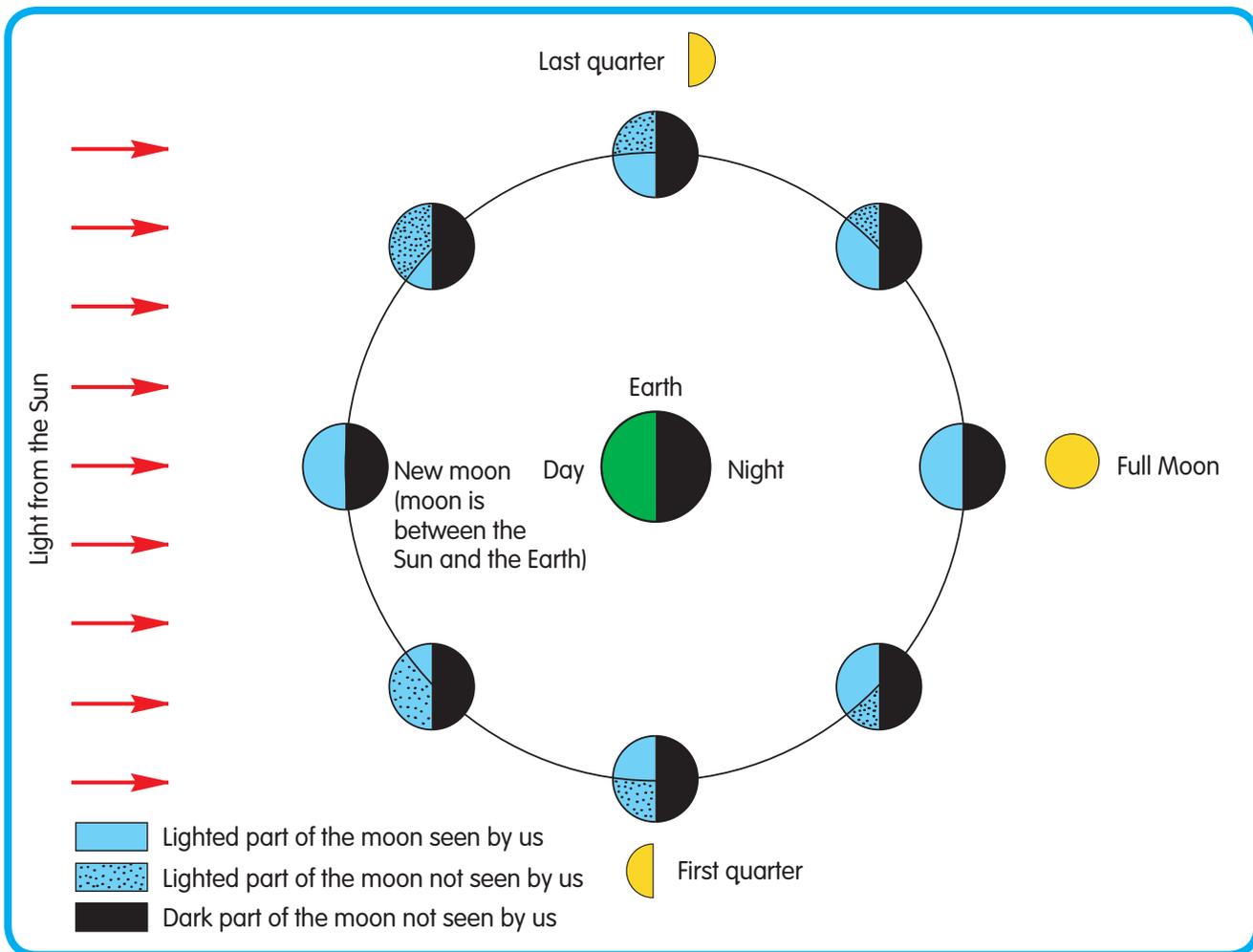


As the Moon moves, the Earth sometimes blocks the sunlight. The Earth comes between the Sun and the Moon. This causes a shadow to fall on the Moon's surface.

This is why the Moon seems to change shape.



This diagram shows the Moon at eight different positions in its orbit around the Earth. These positions are called “phases” of the moon. We see more of the Moon’s surface at some points in the Moon’s orbit. At other points in the Moon’s orbit, we see less of the Moon’s surface.

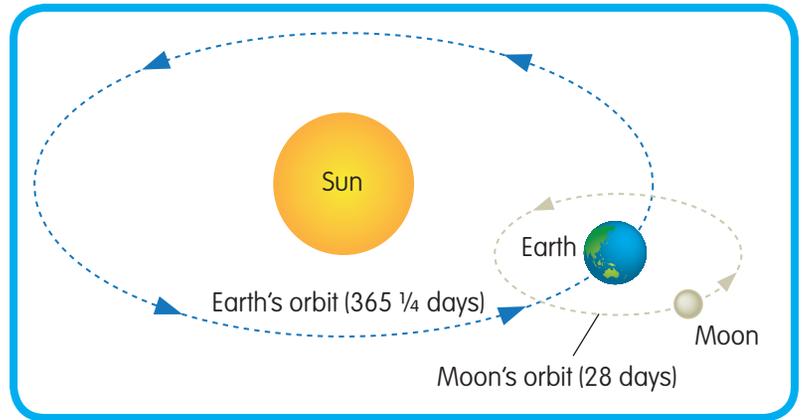


When the Moon falls completely in Earth’s shadow, we cannot see it. This is called a new Moon.

Phases of the Moon

The Earth and the Moon stay in their positions because of gravitational pull.

The Sun is bigger than the Earth, so its gravitational pull is larger than the Earth's. The Earth is bigger than the Moon, so its gravitational pull is larger than the Moon's.



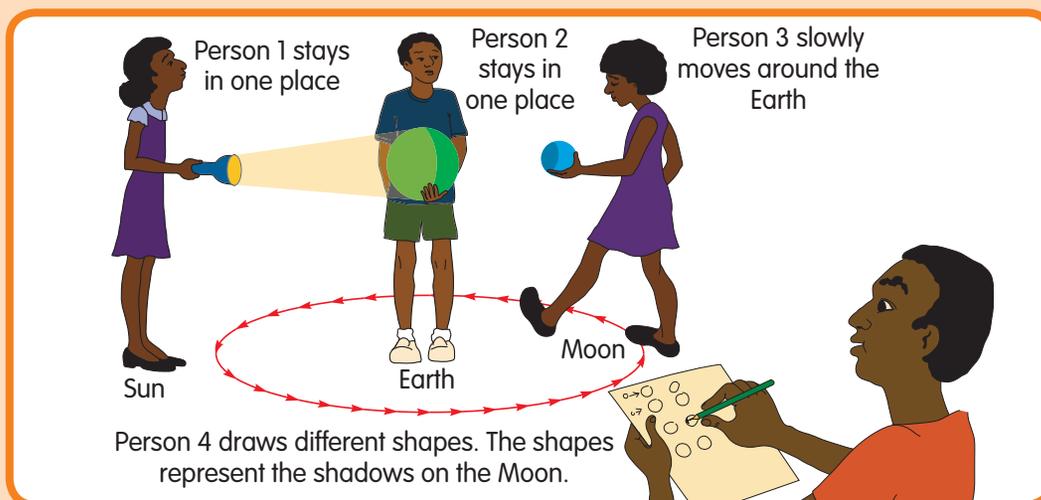
Activity 6



Model the Moon's shape

Work in groups of four.

- 1 Make sure the room is as dark as you can make it.
- 2 Organize the people in your group in the following way:
Person 1—the Sun (holding the torch)
Person 2—the Earth (holding the soccer ball)
Person 3—the Moon (holding the small ball)
Person 4—the recorder
- 3 Position yourselves according to the diagram below.



- 4 Person 4 records the shapes of the shadows made on the small ball. This model represents the Moon's phases.

Activity 7

Draw up this table in your exercise book.

- 1 Enter the number of days for each month in column 2.
Use 28 days for February.
- 2 For each month, subtract 28 from the number of days. For example, January has 31 days. Subtract 28 from 31. The answer is 3. Enter 3 in column 3 for January. This shows that January has 3 days more than 28.
- 3 Do this for all 12 months.

Months	Number of days	Days more than 28	
January	31	3	
February			
March			
April			
May			
June			
July			
August			
September			
October			
November			
December			
Earth year total days		Total days more than 28	
		12 x 28	

- 4 Add up the total days in all 12 months. What is the total? The total number of days is almost the same number as the time for the Earth's orbit around the Sun.
- 5 Find the total of the numbers in column 3. Enter this total into the box in the row "Total days more than 28".
- 6 Multiply 12 by 28. What answer do you get? Add this number to the total for column 3. What is the new answer?
- 7 Compare this answer with your total for column 2. Are they the same?

This activity shows how we make our twelve calendar months. We make each month by adding extra days to the 28 Moon month days.

Activity 8

- 1 Each night for one month, observe the shape of the Moon, as you see it in the sky. Each night, record your observations, by drawing the shape of the Moon. Here is an example:
- 2 Can you identify the eight different shapes of the Moon's phases, as in the diagram on page 163?

Month:	
Date	Moon's shape
1	☾
2	
3	
4	
5	
6	
7	
And so on	

The period of the Moon's orbit around the Earth is 28 days. We call this period one month. It is nearly one-twelfth of one year. The year is the period for Earth's orbit around the Sun.

We use the Moon's orbit period and the Earth's orbit period to make our calendar.

Satellites

We say the Moon is a satellite of the Earth. Five other planets also have moons. They are natural satellites. There are other satellites of the Earth. They are human-made. They also orbit the Earth.

Nowadays there are other satellites of the Earth. We have satellites that help with the weather forecast. Satellites also help us to communicate messages around the world. Ships and aeroplanes use satellites to work out the direction they are travelling in.



Sputnik means "travelling companion" in Russian. It was the first ever human-made satellite. Russia launched it in 1957.



The International Space Station is a satellite. There are science laboratories on it. Sometimes, scientists live on the satellite.

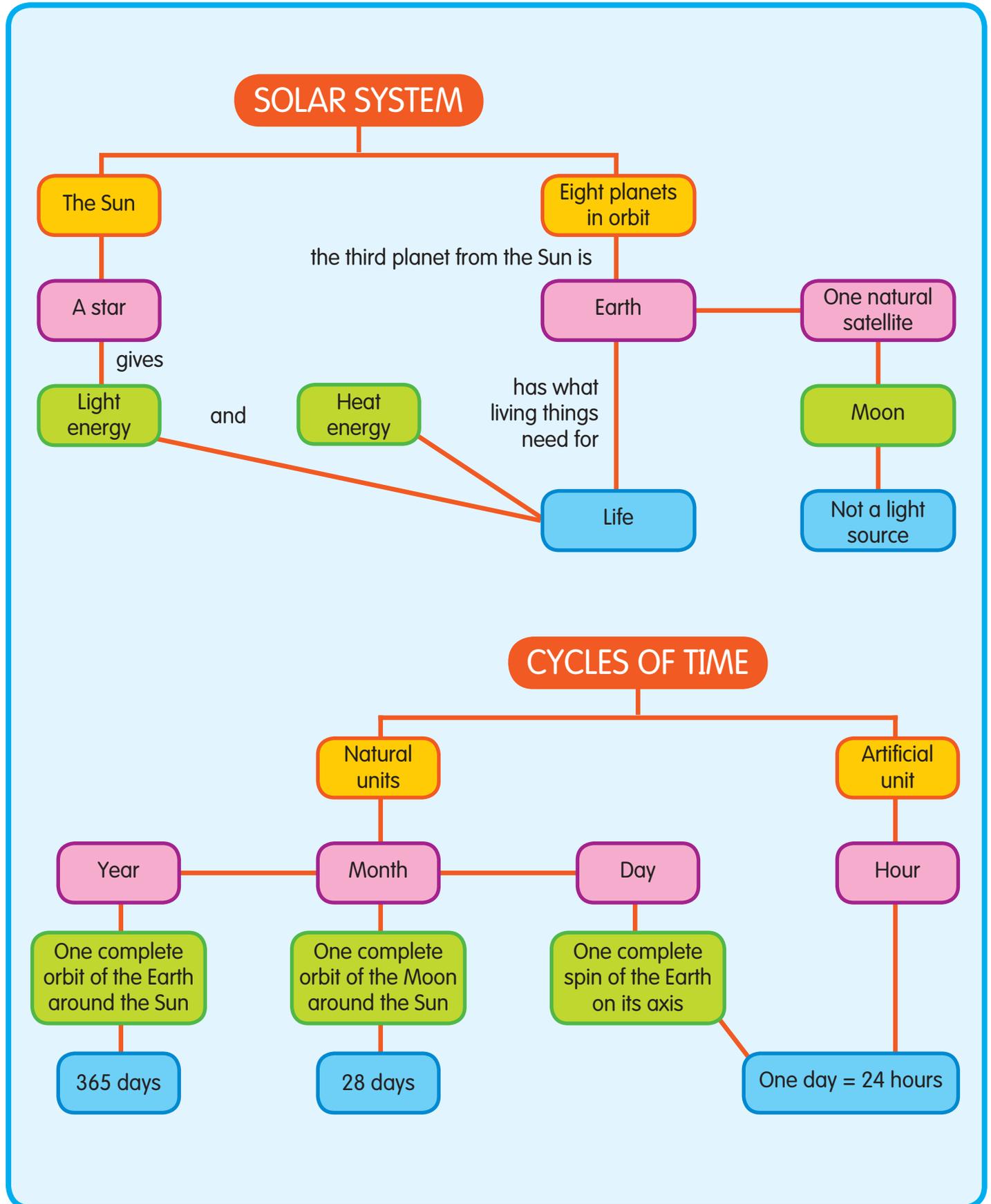


The Hubble space telescope is a special satellite. It takes pictures of stars and galaxies in outer space.



About 40 years ago, this satellite beamed its first TV signal from America all the way to Europe!

Concept Map



Chapter Review

- 1 The solar system consists of the Sun, the eight planets and their moons.
- 2 The Earth is a planet that moves around the Sun in our Solar System. It does not give off light.
- 3 The Sun's force keeps the Earth and the other planets in their orbits around the Sun. The Sun is the nearest star to the Earth. Its heat energy and light energy make life on Earth possible.
- 4 A year is the time taken for the Earth to move around the Sun. It has approximately 365 days.
- 5 A day is the time taken for the Earth to complete one spin on its axis. A day has 24 hours.
- 6 A Moon month is the time it takes the Moon to move around the Earth. It has 28 days.
- 7 The year, the day and the month are natural units of time. They depend on the movement of the Moon and the Earth.
- 8 The hour is an artificial unit of time. We break up a day into hours, so that we can plan according to time.
- 9 The phases of the Moon show the changes in the position of the Moon. The Moon changes shape as we watch it moving in its orbit.
- 10 Humans have sent artificial satellites into space.
- 11 Artificial satellites are vehicles that orbit the Earth.

1 What is a year?

- a** The time taken for the Sun to orbit the Earth
- b** The time taken for the Earth to orbit the Sun
- c** The time taken for the Moon to orbit the Earth
- d** The time taken for the Earth to spin on its axis

2 Which of these statements about the Earth are true?

- A** The Earth is the fifth largest planet in our solar system.
 - B** The Earth is the third planet from the Sun.
 - C** The Earth is not a natural source of light.
 - D** The Earth has a natural satellite that orbits it.
- a** A and C
 - b** C and D
 - c** A only
 - d** C only

3 Which one of these statements about the Sun is wrong?

- A** The Sun appears to move from west to east during the day because of the spinning of the Earth on its axis.
- B** The Sun is the source of energy for all organisms on the Earth.
- C** The Sun is a star.
- D** The Sun has a force that prevents the planets from flying off into space.

4 Which motion of the Earth give us:

- a** a year
- b** a day?

Choose from “rotation” or “revolution”.

Glossary

A

adventitious roots roots that grow directly from the stem of a plant, not from a main root

air an invisible mixture of gases surrounding the Earth

alloy mixture of two or more metals

aluminium grey metal, light in weight, often used for making pans for cooking

anus opening at the end of the gut

artery blood vessel that carries blood with oxygen from the heart to the rest of the body

axis imaginary line that runs through the centre of a planet which it spins around

B

blood mixture of fluid and tissue that carries various substances around the body

blood vessels thin tubes that carry blood around the body

bones the pieces of hard tissue making up the skeleton of vertebrates

brain organ in the skull of vertebrates that controls all the activity of the nerves and senses

breathing the act of inhaling (taking in oxygen) and exhaling (sending out carbon dioxide) in the body

buds plant parts that can grow into flowers or new shoots

bulbis tip of a swollen plant stem

C

carbohydrate energy-giving compound made up of carbon, hydrogen and oxygen, found in foods such as vegetables and bread

carbon dioxide gas produced during respiration by living organisms

carnivore animal that eats other animals

cell the basic unit of a living thing

chemical any substance that can change when joined or mixed with another substance

chlorophyll the green substance in leaves that traps sunlight energy during photosynthesis

circulatory system the body system responsible for the transportation of blood from the heart to all organs of the body

climate the normal weather conditions in an area over a long period

collar bone the bone that joins the shoulder to the chest bone

compass magnetic instrument that shows geographical directions

compost mixture of decayed vegetation that gives nutrients to soil

consumer animal that eats other organisms for food

copper reddish-brown metal that allows electricity and heat to pass through it easily

corm round underground part of certain plants, similar in appearance to a bulb, from which the new plant grows each year

D

decibel unit of measurement for the loudness or intensity of a sound

diameter the distance from one side of a circle to the other, passing through the centre

diaphragm thin, dome-shaped muscle that separates the stomach and intestines from the lungs and helps to bring air in and out of the lungs

digested food food that is broken down into simpler forms that the body can use

digestive system the body system responsible for breaking down food

dilute to make a liquid weaker by adding water or another liquid

dissolve to make a solid substance mix with a liquid and become part of it

dye substance that changes the colour of a material

E

ear the sense organ responsible for hearing sounds and for maintaining balance

echo sound waves that reflect off a surface and can be heard after the original sound

elbow the joint where the arm bends

electromagnet magnetised nail or iron rod, created when a nail or rod is placed inside a coil of insulated wire that has an electric current flowing through it

energy the ability to do work or cause change

environment the surroundings of an animal or plant

Equator imaginary circle around the middle of the Earth, midway between the north and south poles

evaporation the process by which a liquid changes into gas

eye the sense organ responsible for sight

F

fertilizer natural substance or chemical added to soil to make it more fertile and help plants grow

fibrous root cluster of thin roots of about the same size

filter device that allows one substance to pass through, but not others

fluorescence the property of a substance by which it gives off light

force a push, pull, lift or squeeze that causes an object to move or change its shape

freeze the process by which a liquid changes to a solid, for example, when water changes to ice

frequency the number of waves from a vibrating object that pass a point every second

G

galvanised iron iron metal coated with zinc metal

gas the state of matter that can change shape and volume, for example air

germination the process by which a seed develops into a plant

glucose natural form of sugar that exists in fruit

gravity a force that pulls objects towards other objects

gullet the tube through which food travels from the mouth to the stomach

H

hearing the sense that you use to hear sounds

heart the organ that pumps blood around the body

hemisphere a half of the Earth; one half is above the Equator and the other half is below

herbaceous stem thin stem that bends easily and does not get thicker as the plant gets older

herbivore animal that eats only plants

humus material formed by decayed vegetation that makes soil more fertile

I

insect organism with six jointed legs, three body sections and an outer skeleton

insoluble substance that cannot be dissolved

insulate to use a material that stops electricity, sound and heat from passing through it

interdependence the dependence of living things on each other and on non-living things for survival

intestine long tube in the body that helps process food; it carries the solid waste from the stomach out of the body

iron naturally occurring metal that is used to make steel; it is magnetic

L

layering way of growing new plants without seeds or cuttings

liquid state of matter that has a definite volume and flows to take the shape of the container it is in

lodestone rock that is a form of magnetic iron ore found in the ground

lung body organ where gas exchange takes place

M

magnet piece of iron, steel or alloy with the ability to repel or attract materials

magnetic property of a material which enables magnets to attract it

magnetic field space in which the magnetic force of a magnet can be felt

manure animal dung used for fertilising soil

mass the amount of matter in an object

metal naturally occurring substances found as ores in the rocks of the Earth's crust

microbe extremely small living thing you can see only if you use a microscope

mineral naturally occurring substance that makes up the rocks of the Earth's crust

mixture several different substances mixed together

mulch natural material placed on the ground, around a growing plant

muscle one of the pieces of tissue inside the body which cause bones to move

muscular system the body system that includes all of the muscles in the body

N

nervous system the body system that consists of the nerves, the brain and the spinal cord

north-seeking pole the pole of a magnet which, when hanging freely, points to the north magnetic pole of the Earth

nose the organ used for breathing and for the sense of smell

nutrients substances in food that are used by plants and animals for growth

O

omnivore animal that eats both plants and other animals

opaque property of materials that do not allow light to pass through

orbit the path that an object takes as it moves around another object

organ group of tissues that work together to carry out a particular job in the body

organism an individual living thing, made of one or more cells

oxygen gas found in air; oxygen is needed for respiration in living things

P

particle very small piece of matter

photosynthesis the process by which plants make their own food using energy from the Sun

pitch measure of how high or low a sound is

planet large body that orbits a star (such as the Sun)

pressure the amount of force applied to a unit of area

propagate to grow and increase the number of plants from seeds or other plant parts

prune to cut off some of the branches of a tree or bush to make it grow better

R

red blood cell cell in blood that carries oxygen throughout the body

reflection the bouncing back of light from a surface

refraction the change of direction of a light beam as it passes from one material to another of different density, for example from air to glass

repel to push away

reproduction the process by which organisms produce more organisms like themselves

respiration the process by which living organisms use oxygen to break down food to produce energy and carbon dioxide

respiratory system the system responsible for supplying body cells with oxygen and removing carbon dioxide

revolution a complete movement of one object around another

rhizome the thick stem of certain plants which grows along or under the ground and has shoots and roots growing from it

ribcage the set of curved bones from the breastbone to the spine which protect the heart and lungs

root system the parts of a plant that are found in the ground, namely the root and root hairs

rotation changing the food crops that are planted in a garden area

runners long plant stem that runs along the surface of the soil

S

saturated solution solution that does not allow more solute to dissolve in it

season period of the year which has weather conditions caused by the tilt of the Earth in relation to the Sun

sense organs the organs that help humans to monitor what goes on inside the body and to be aware of the environment

shading slight darkness caused by something blocking the direct light of the Sun

shoot system the parts of a plant above ground: the stem, leaf, flower and fruit

sight the ability to see

skeletal system the body system made up of the bones, for protection, movement and support

skin the outer covering of the body; the largest body organ

skull the collection of 22 bones that form the head and face

smell the ability to sense odours

soil the top layer of the Earth in which plants get nutrients for growth

solar system the Sun and everything that orbits around it, including the eight planets

solid the state of matter with a definite shape and volume that is not easy to change

solubility measure of the ability of any substance to dissolve in a liquid

soluble property of a substance that can dissolve in a liquid

solute substance that dissolves in a liquid

solution mixture in which tiny particles of one substance are dissolved evenly in a liquid

solvent the liquid substance that does the dissolving

sound form of energy produced by a vibrating object, which can be heard

south-seeking pole the pole of a magnet which, when hanging

freely, points to the south magnetic pole of the Earth

spectrum the band of colours in white light, visible as red, orange, yellow, green, blue, indigo and violet

stalk long narrow part of a plant that supports leaves, fruits or flowers

stamen the male sex organ of the plant, consisting of two parts, the “anther” and the “filament”

stem plant part that supports the plant and transports water and minerals to other parts of the plant

stomach the organ in which food is mixed with digestive juices before moving to the small intestine

stomata small pores on the under side of leaves that can open to allow gas exchange and water loss

substance anything that takes up space

sucker upright shoot on stems of some plants that can develop into a new plant

summer the season of the year when the Sun is hottest and the days are longest ; caused by Earth’s tilt on its axis, relative to the Sun

suspension cloudy mixture of a liquid and solid substance

T

taste the ability to perceive sensations, such as sweetness and sourness, using the tongue

temperature a measure of how hot or cold an object is

thermometer an instrument for measuring temperature

tissue a group of cells in living things that perform a specific function

tongue the sense organ responsible for taste

touch the sense of feeling

translucent the property of a material that allows some light through, but it is not “see through”

transparent the property of a material that allows nearly all light through, so that it is “see through”

tuber short, thick part of an underground stem which stores food

V

vegetative reproduction reproduction in plants that does not involve the male and female parts of the flower

veins blood vessels that carry blood from various parts of the body back to the heart

vibrate move quickly back and forth

vitamin a substance found in food which is essential for good health

volcano openings in the Earth's crust through which molten rock can flow

W

water colourless, odourless, tasteless, transparent liquid found in rain, seas, lakes and rivers

windpipe the tube that takes air from the nose to the lungs

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