National SCIENCE Textbook

Grade 6

Papua New Guinea
Department of Education

JICA

'FREE ISSUE
NOT FOR SALE'

Issued free to schools by the Department of Education

First Edition

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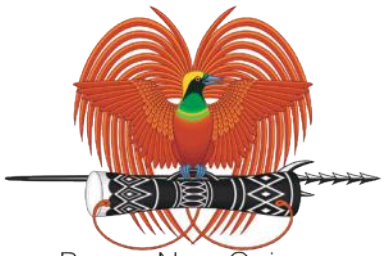
National Science Textbook

Grade 6



Minister's Message

Dear Grade 6 Students,

I am honoured to give you my message in this National Science Textbook. The Government of Papua New Guinea through the National Department of Education has been giving priority to improve standards of learning in the area of Science for many years. A big thank you to the Government and the people of Japan for the continuous support in improving the quality of education in Papua New Guinea.

Students, this Science Textbook was developed by our very own Textbook Writers, Pilot teachers and Curriculum officers who have worked together with the Japanese specialists for three years to complete this Textbook. This is the first of its kind and also the best National Textbook for Grade 6 students in PNG. Do you know why? Because what you will learn from this textbook is comparable with international standards.

This textbook is exciting because it contains a lot of interesting student-centred topics and activities recommended for Grade 6 Science. The photographs, illustrations, charts and diagrams are based on PNG contexts and are interesting and exciting for learning. I am confident that this textbook will motivate you to explore more about Science.

Students, Science is a very important subject because it allows you to explore the things around you by using all your senses. You will have the opportunity to investigate scientific problems by yourself using the Science process skills; make predictions, test predictions and find solutions to the scientific problems.

I encourage you to be committed and to enjoy and love Science, because one day in future you will be a very resourceful person, participating in developing and looking after this very beautiful and resourceful country of ours and improving the quality of living.

I wish you a happy and fun learning experience with this Grade 6 Science Textbook.

Joseph Yopyyopy, MP
Minister of Education

Message from the Amassador of Japan

Greetings to Grade 6 Students of Papua New Guinea!

It is a great pleasure that the Department of Education of Papua New Guinea and the Government of Japan have worked together to publish the national textbooks on science for the first time.

The officers of the Curriculum Development Division of the Department of Education made full efforts to publish this textbook with Japanese science experts. To be good at science, you need to keep studying with this textbook. In this textbook, you will learn many things about science with a lot of fun and interest, and you will find it useful in your daily life. This textbook is made not only for you but also for the future students.

You will be able to think much better and smarter if you gain more knowledge on numbers and diagrams through learning science. I hope that this textbook will enable you to enjoy learning science and enrich your life from now on. Papua New Guinea has a big land mass with plenty of natural resources, and a great chance for a better life and progress. I hope that each of you will make full use of the knowledge you obtained and play an important role in realising such potential.

I am honoured that, through the publication of this textbook, Japan helped your country develop science education to improve your ability, which is essential for the future of Papua New Guinea. I sincerely hope that, through the teamwork between your country and Japan, our friendship will last forever.

Satoshi Nakajima

Ambassador of Japan to Papua New Guinea

SCIENCE...

It's exciting...

It's amazing...

It's fun...

It's Science

Secretary's Message

Dear students,

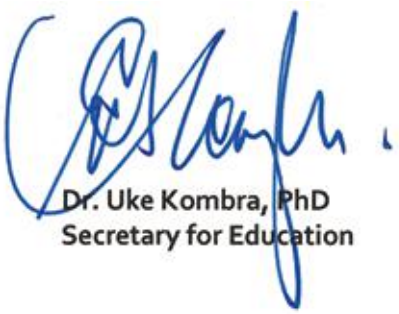
This is your Science Textbook that you will use in Grade 6. It contains a lot of very interesting and enjoyable activities that you will be learning in your daily Science lessons.

In our everyday lives, we come across many situations such as food chains in different environments, things falling down and breaking, the moon changing its shape and the list goes on. These situations are real and they are part of the way we live. By learning Science using this textbook, you will be able to find out why these things occur.

This Textbook provides a variety of enjoyable and interesting science activities and ideas. It provides the opportunity for the learner to learn together with the class or as an independent learner. The activities are designed in a way that a scientific problem is identified and the learner will have to solve the problem using the different scientific skills like making predictions, measuring, recording data and communicating the results. These are the important skills needed in order to understand the concepts of the lessons. The use of science process skills will help you to make decisions that will benefit you, your family, your community, your province and the country to improve the standard of living in the 21st Century and beyond.

I encourage you to enjoy learning Science and use the scientific knowledge learned to solve problems and issues that are encountered in the community and country today.

I wish you all the best in studying Science using this Textbook.



Dr. Uke Kombra, PhD
Secretary for Education

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Strand

- Life
- Physical Science
- Earth and Space

How to learn SCIENCE

1 Wonder or Question

- Look carefully at things in nature around you and things in your daily life.
- Realise things that you wonder about.
- Identify the key question of the lesson.

2 Research

- Guess what will happen at the end of the activity.
- Understand the steps of the activity.
- Observe or conduct experiments in the activity.
- Record the result in your exercise book.
- Check if the result is the same with your guess.
- What do you find from the observation or experiment?

Symbols in this textbook

Each symbol gives you an attention about:

- : Key question of the lesson.
- : Activity that you will try.
- : Discussion question with your classmates.
- : Caution and warning.
- : Try it!

with this Textbook

Learn about nature, learn from nature

3 Findings

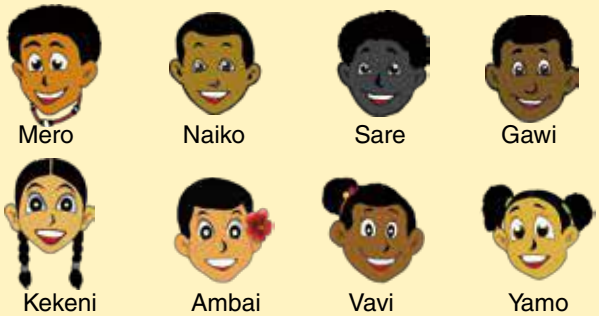
- Present and share your findings with your classmates.
- Discuss with your classmates to make sure if your findings are correct.
- Make conclusion to the key question.

4 Summary

- Read the textbook and confirm what you learnt in the lesson.
- Summarise what you did in the lesson.
- Let's try to use things you learnt in your daily life.

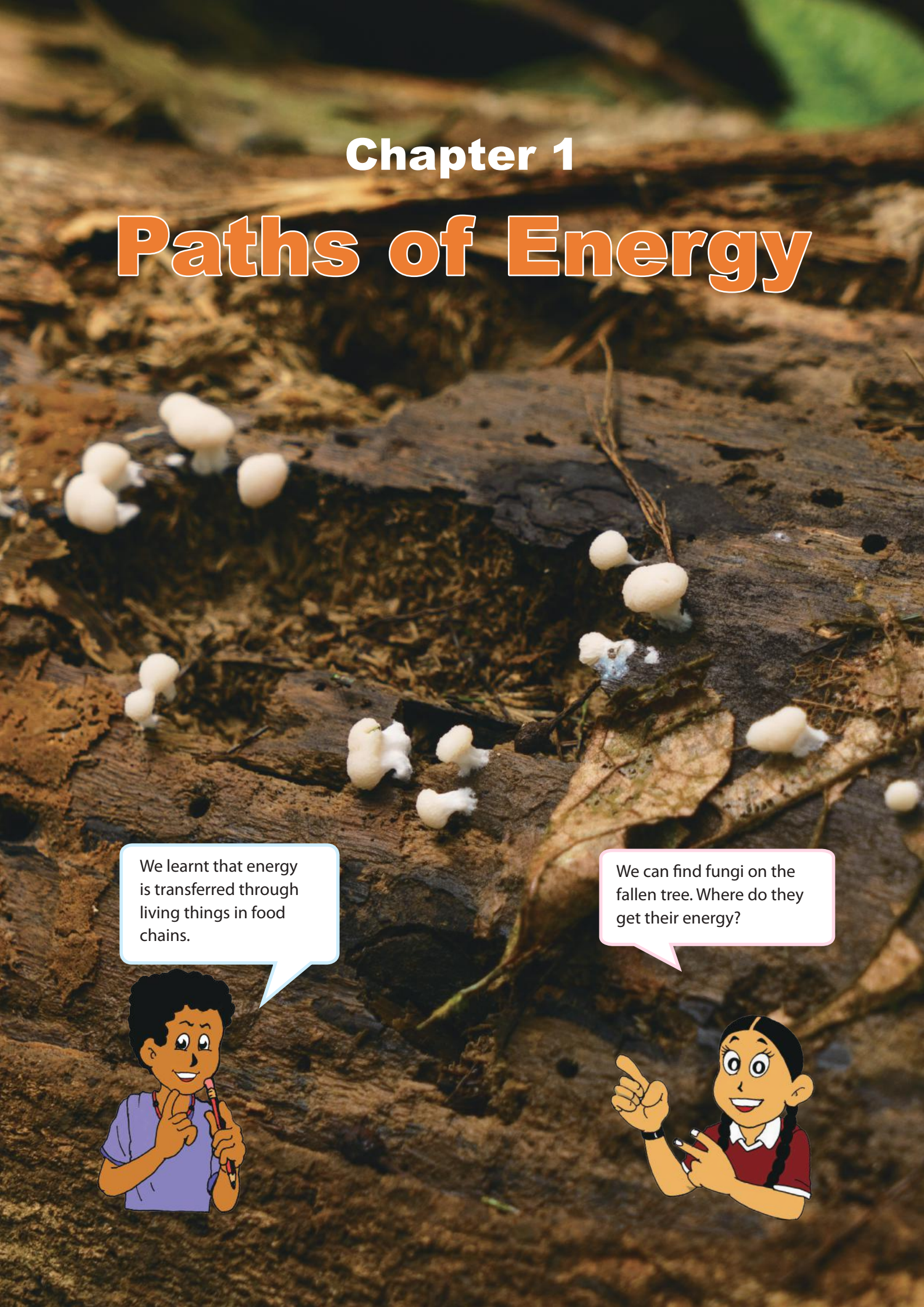
Friends learning together with you

Friends learning together in this textbook



Chapter 1

Paths of Energy



1.1 Food Chain and Food Web

Lesson 1 Living Things in a Food Chain

A **food chain** is the path of food energy from plants to animals. Plants are eaten by some animals and some animals are eaten by other animals. What are the roles of living things in a food chain?

How do living things play a role in a food chain?

Activity : Roles of living things in a food chain

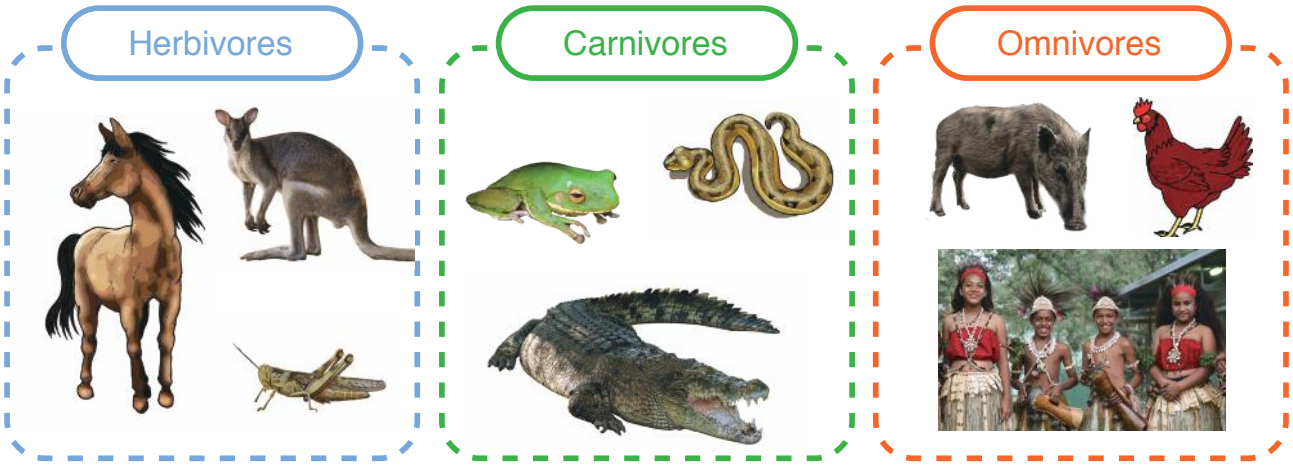
What to Do:

1. Study the picture of the food chain below.
2. Think about the following questions:
   (1) How do plants and animals get energy? How are they different?
   (2) What types of food do the two animals eat? How are they different?
   (3) Which animal eats another animal and which animal is eaten by another? What is the relationship between the two animals?
3. Share your ideas with your classmates. Discuss how living things play their roles in the food chain.

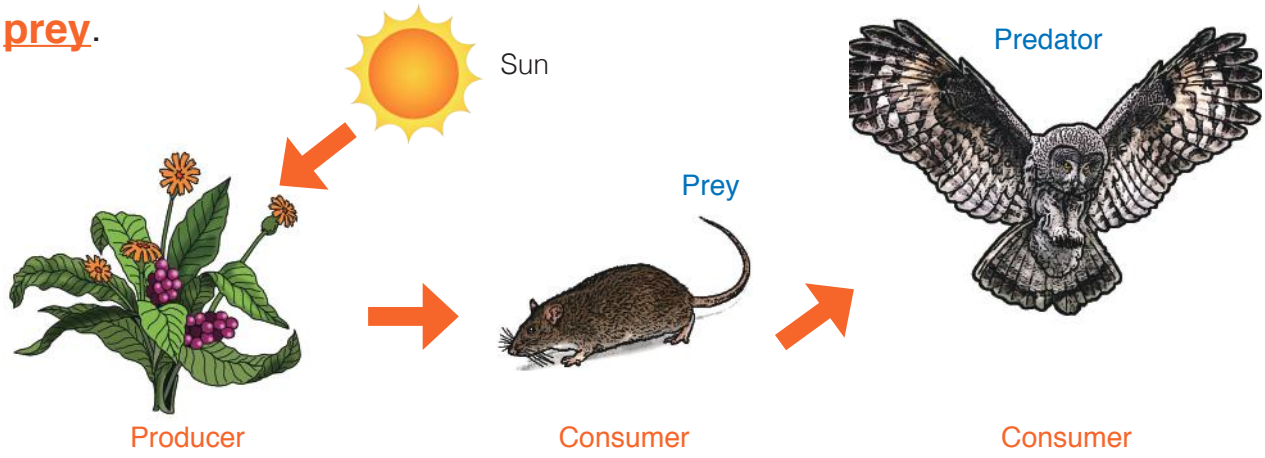
Summary

Living things are parts of a food chain. Plants are called **producers** because they produce their own food by using light energy from the Sun. Animals in a food chain are called **consumers** because they consume other plants and animals.

Consumers can be classified into three groups by their food source. An animal that eats only plants is called a **herbivore**. Deers and kangaroos are herbivores. An animal that eats only animals is called a **carnivore**. Snakes and owls are carnivores. An animal that eats both plants and animals is called an **omnivore**. Humans are omnivores.



Among consumers, some animals eat other animals and some animals are eaten by other animals. An animal that hunts and eats other animals is called a **predator**. An animal that is hunted and eaten by predators is called a **prey**.



Animals can be both predators and preys. For example, a frog eats other animals such as grasshoppers or butterflies, but it is also eaten by a snake or an owl. A frog can be both predator and prey.

Lesson 2 Food Chain in Different Environments

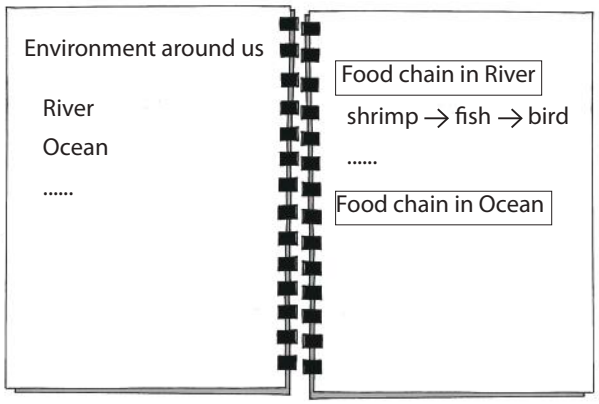
Living things live in different environments such as deserts, rainforests, grasslands, rivers, lakes and oceans.

What food chains are found in different environments?

Activity : Food chains around you

What to Do:

1. Study the pictures of the environments below and the environment around you. Write the names of different environments in your exercise books.
2. Make a list of living things that live in the different environments you found.
3. Draw the food chains in these environments using arrows.
4. Share your ideas with your classmates. Discuss the food chains in the different environments.



Summary

Food chains exist wherever living things are found. Food chains are different in different environments. The following are examples of some food chains in different environments.

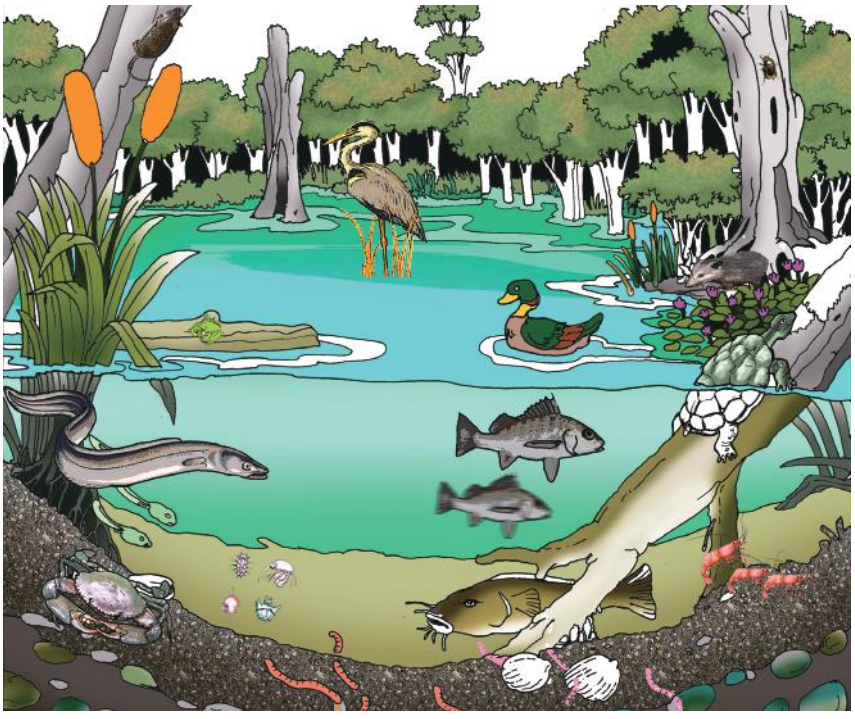
Food Chains in Forests

Different types of food chains exist in forests because many types of plants and animals can be found in forests. For example, some insects eat plants to get energy. Mice eat the insects and then snakes eat the mice. The snakes are then eaten by owls.

Plants and animals in a forest

Food Chains in Ponds

Different types of food chains can be found in ponds. For example, algae get their energy from the sun. Freshwater shrimps often eat algae to get energy. Small fish eat the shrimps. Then the small fish are eaten by big fish.



Plants and animals in a pond

Lesson 3 Food Web in Different Environments

Food chains are different in different environments. How about food webs?

What food webs are found in different environments?

Activity : Food webs around you

What to Do:

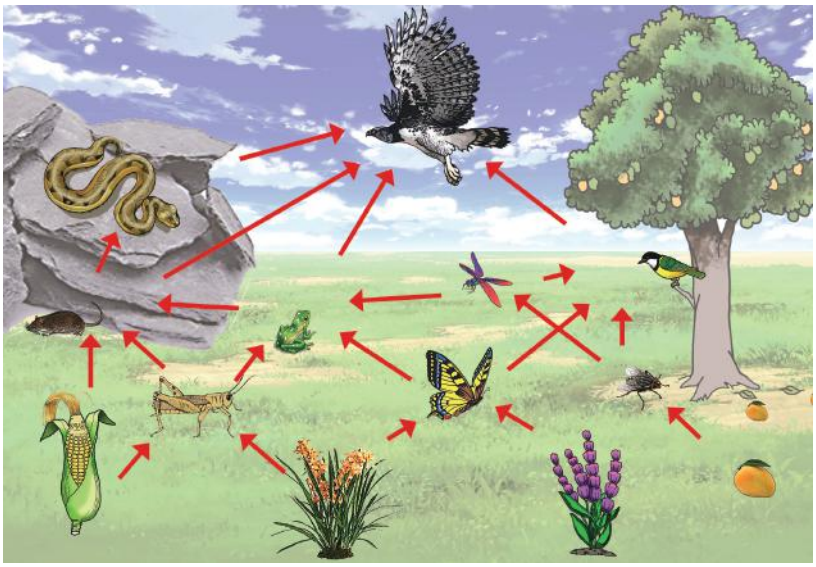
1. Study the picture below. Write the names of the animals in your exercise book.
2. Draw arrows to show how one living thing is eaten by other living things.
3. Share your ideas with your classmates. Discuss:
   (1) How many food chains can you find?
   (2) How is one living thing interconnected with other living things?
   (3) How is the interconnection different from food chains?

Summary

A food web is made up of several food chains connected together in an ecosystem. It shows how consumers and producers are interconnected in many ways to help them survive. An **ecosystem** is made up of all the living and non-living things in a given area interacting with one another. Different food webs can be found in different ecosystem.

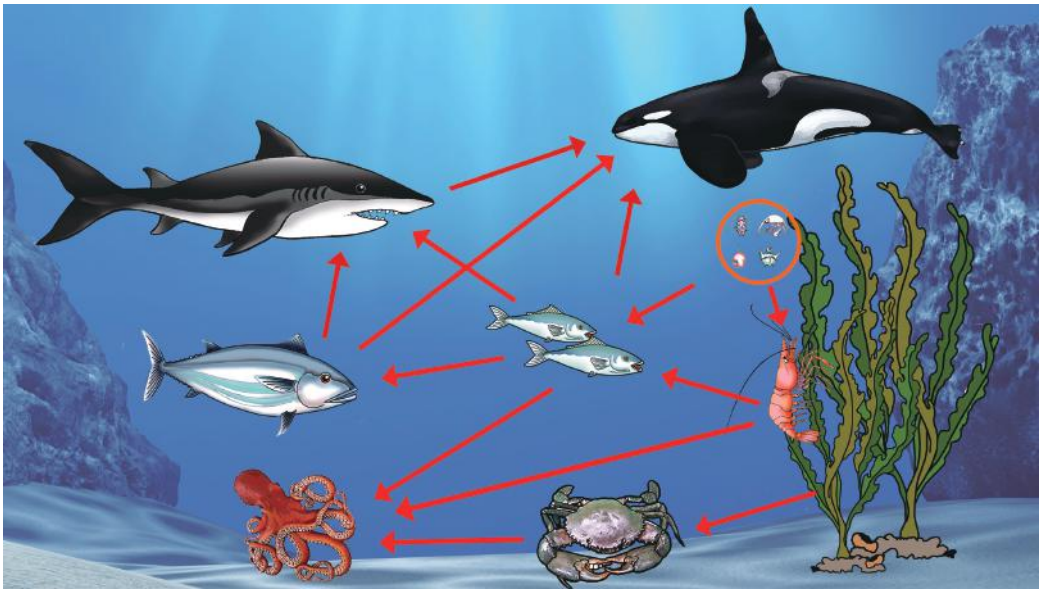
Food Webs in Forests

The diagram shows an example of a food web in a forest. Plants are producers in a forest. Plants are eaten by insects. Insects may be eaten by mice, frogs or small birds. Snakes eat the insects too but they also eat frogs or mice.



Food Webs in Oceans

Different food webs can also be found in oceans. The picture below shows an example of a food web in the ocean. Sea weed is a producer. It is eaten by crabs or shrimps. The shrimps are not only eaten by small fish but also the octopus. The small fish are eaten by big fish or sharks.



Lesson 4 End of Food Chains

Energy from food is transferred from producers to consumers through food chains. What happens to the energy after living things die?

What happens to the energy in food chains after living things die?

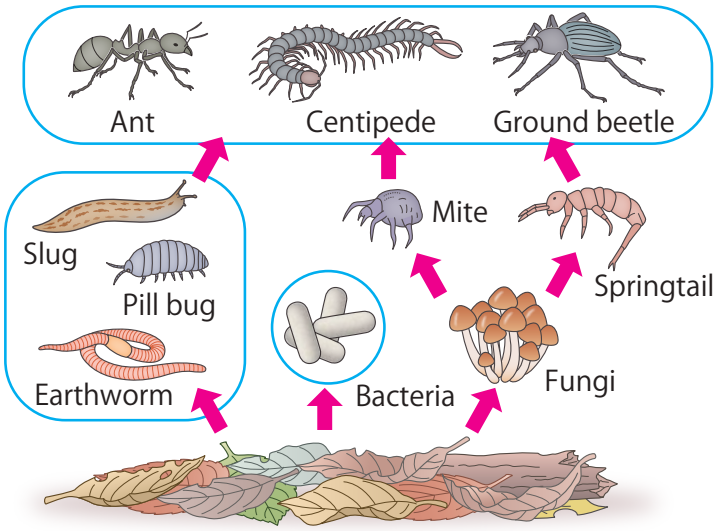
Activity : Food chains on and in soil

What to Do:

1. Go to a place where fallen leaves are piled up over a period of time.
2. Remove the leaves and record what you observe under the fallen leaves.
3. Dig out the top soil and record the types of living things and the things you observed.
4. Share your ideas with your classmates. Discuss:
   (1) What types of living things you found?
   (2) How the fallen leaves and the soils look like?
   (3) Why the Earth is not covered with dead plants and animals?

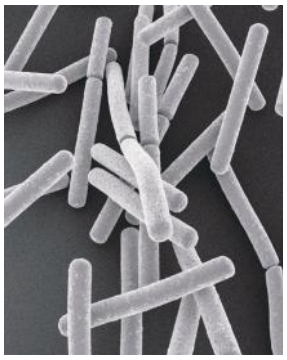
Summary

Many small living things feed on dead plants or animals to get energy. Some examples of these living things are fungi, earthworms, pill bugs and slug. All of them form food chains on and in the soil.



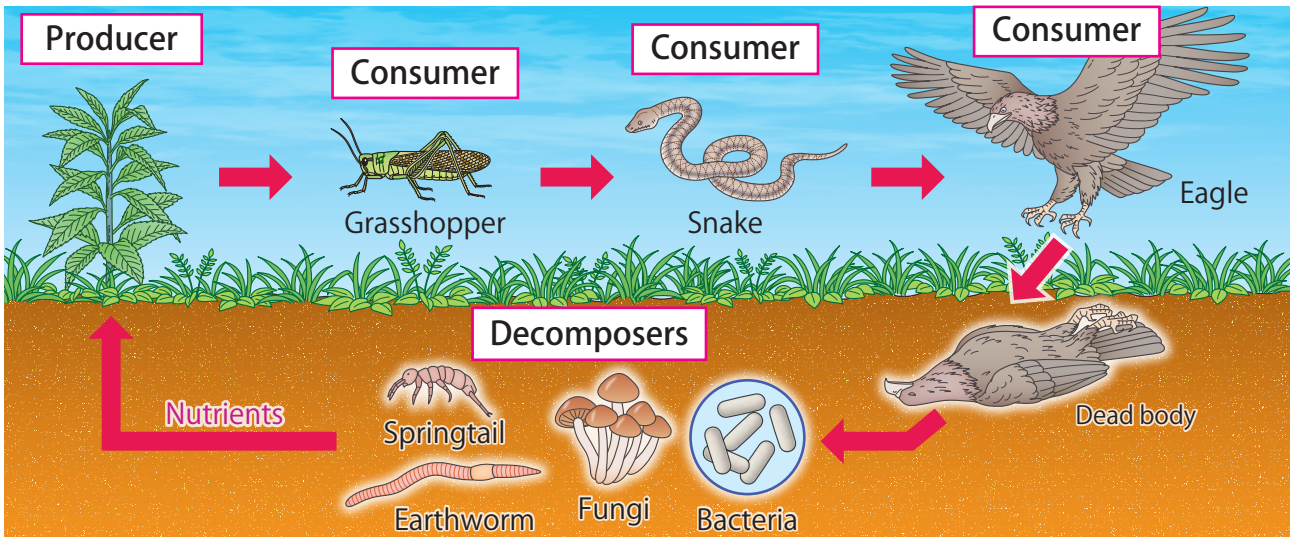
Soil food chains

Organisms that break down dead animals and plants are called **decomposers**. Worm, fungi, bacteria and some insects are examples of decomposers. **Bacteria** are tiny little organisms that are everywhere around us. We cannot see them without a microscope.



Bacteria

Decomposers are part of a food chain. They are the last link in the food chain. Plants get energy from the Sun and animals eat plants or other animals to get energy. When a plant or an animal dies, decomposers break down the dead plants or animals into smaller pieces. They then turn them into nutrients in the soil. Plants use the nutrients to grow again. Thus the food chain becomes a complete cycle. Without decomposers, dead plants or animals would pile up on the Earth.



Summary and Exercise

Summary 1.1 Food Chain and Food Web

Living Things in a Food Chain

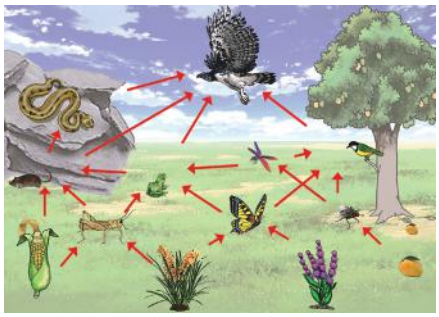
- Plants are producers that produce their own food.
- Animals are consumers that consume plants and other animals to get energy.
- Herbivores are animals that eat only plants.
- Carnivores are animals that eat only animals.
- Omnivores are animals that eat both plants and animals.
- A predator is an animal that hunts and eats other animals.
- A prey is an animal that is hunted and eaten by predator.

Food Chain in Different Environments

- Food chains exist wherever living things are found.
- Food chains are different in different environments because different types of plants and animals live there.

Food Web in Different Environments

- A food web is made up of several food chains connected together in an ecosystem. It shows how consumers and producers are interconnected in many ways to help them survive.

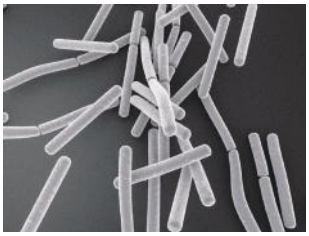


Example of food web

- An ecosystem is made up of all the living and non-living things in a given area interacting with one another.
- Different food webs can be found in different ecosystems.

End of Food Chains

- Decomposers are organisms that break down dead plants and animals to get energy.
- Bacteria are tiny little organisms that are everywhere around us. We cannot see them without a microscope.



Example of decomposers

Summary and Exercise

Exercise 1.1 Food Chain and Food Web

Q1. Complete each sentence with the correct word.

(1) An animal that eats both plants and other animals is called an _____.

(2) An animal that is hunted and eaten by other animals is called a _____.

(3) An _____ is made up of all the living things and non-living things in a given area interacting with one another.

(4) Organisms that break down the remains of dead animals and plants are called _____.

Q2. Choose the letter with the correct answer.

(1) Which of the following eats other animals only?

A. Carnivore

B. Prey

C. Herbivore

D. Omnivore

(2) What do decomposers provide for soil and plants?

A. Bacteria

B. Nutrients

C. Water

D. Sunlight

Q3. Answer the following questions.

(1) Place each living thing below under the correct heading.

tomato, frog, seaweed, butterfly, snake, hibiscus

Producer	Consumer

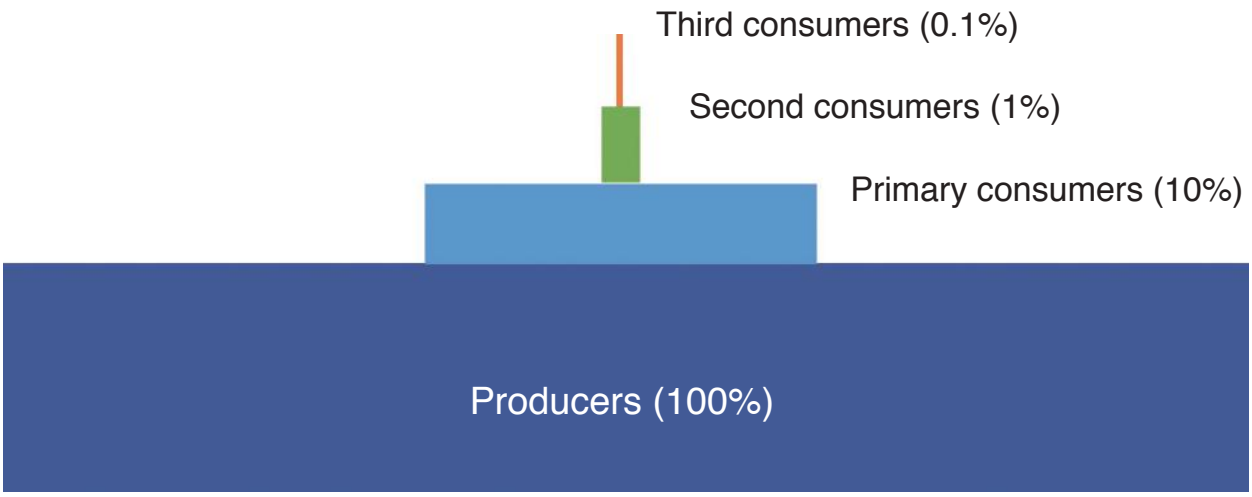
(2) What makes a food web different in different environments?

Q4. Why is the Earth not piled up with dead plants and animals?

How much energy is transferred in a food chain?

When a plant is eaten by a primary consumer, only 10% of the energy is passed on. The low percentage of transferred energy can be recognised for different reasons like some of the organism not being eaten, incomplete digestion of the eaten organism, energy lost in remove of waste processes or energy lost as heat.

Consumers pass 10% of their energy onto other consumers that feeds on them. Because they are far more able than plants when passing on the energy. A lot of the energy is lost in the removal of waste and some is lost in trying to maintain a constant body temperature.



Energy pyramid

The pyramid shows the total energy stored in organisms at each feeding level in an ecosystem. Starting with the primary consumers at the base feeding level of the pyramid. The pyramid makes it clear why there can be only a limited number of feeding levels in a food chain or web. Because there is less energy at higher feeding levels, there are usually fewer organisms as well. Organisms tend to be larger in size at higher feeding levels.

Chapter Test

1. Paths of Energy

Q1

Complete each sentence with the correct word.

(1) Organisms that break down the bodies of dead animals and plants to get energy are called _____.

(2) Animals in a food chain are called _____ because they eat other plants and animals.

(3) Humans are called _____ because they eat both plants and animals.

(4) Tiny decomposers that cannot be seen without a microscope are called _____.

Q2

Choose the letter with the correct answer.

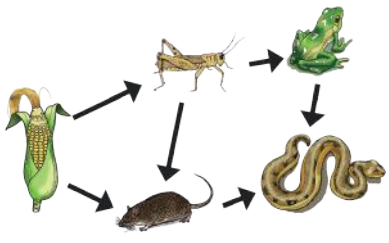
(1) What do all food chains end with?

A. Producers
B. Herbivores
C. Carnivores
D. Decomposers

(2) Which is a food chain that is found in a pond?

A. Seaweed → Grasshopper → Fish → Shark
B. Seaweed → Shrimp → Small fish → Large fish
C. Grass → Grasshopper → Frog → Snake
D. Shrimp → Seaweed → Fish → Shark

(3) Study the food web shown in the picture on the right and identify the omnivore.



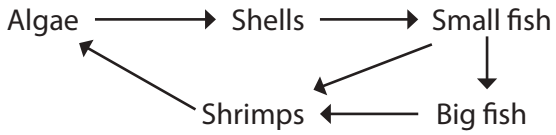
A. Corn plant
B. Grasshopper
C. Rat
D. Snake

(4) Why do food chains differ from others in different environments?

A. Because same animals eat the same food.
B. Because same living things live in different environments.
C. Because different living things live in different environments.
D. Because same plants live in different environments.

Q3

(1) A student observed living things in an environment and drew a food web as shown below, however there was something wrong with his food web. Explain why.



_____

_____

(2) How do algae get their energy?

_____

Q4

(1) A bird died and laid on the soil. After some days the bird looked as though it had disappeared into the ground. What had happened? Explain your answer.

_____

_____

_____

_____

(2) What would happen to the energy that was in the bird?

_____

_____

_____

Chapter 2

Change and Formation of Land

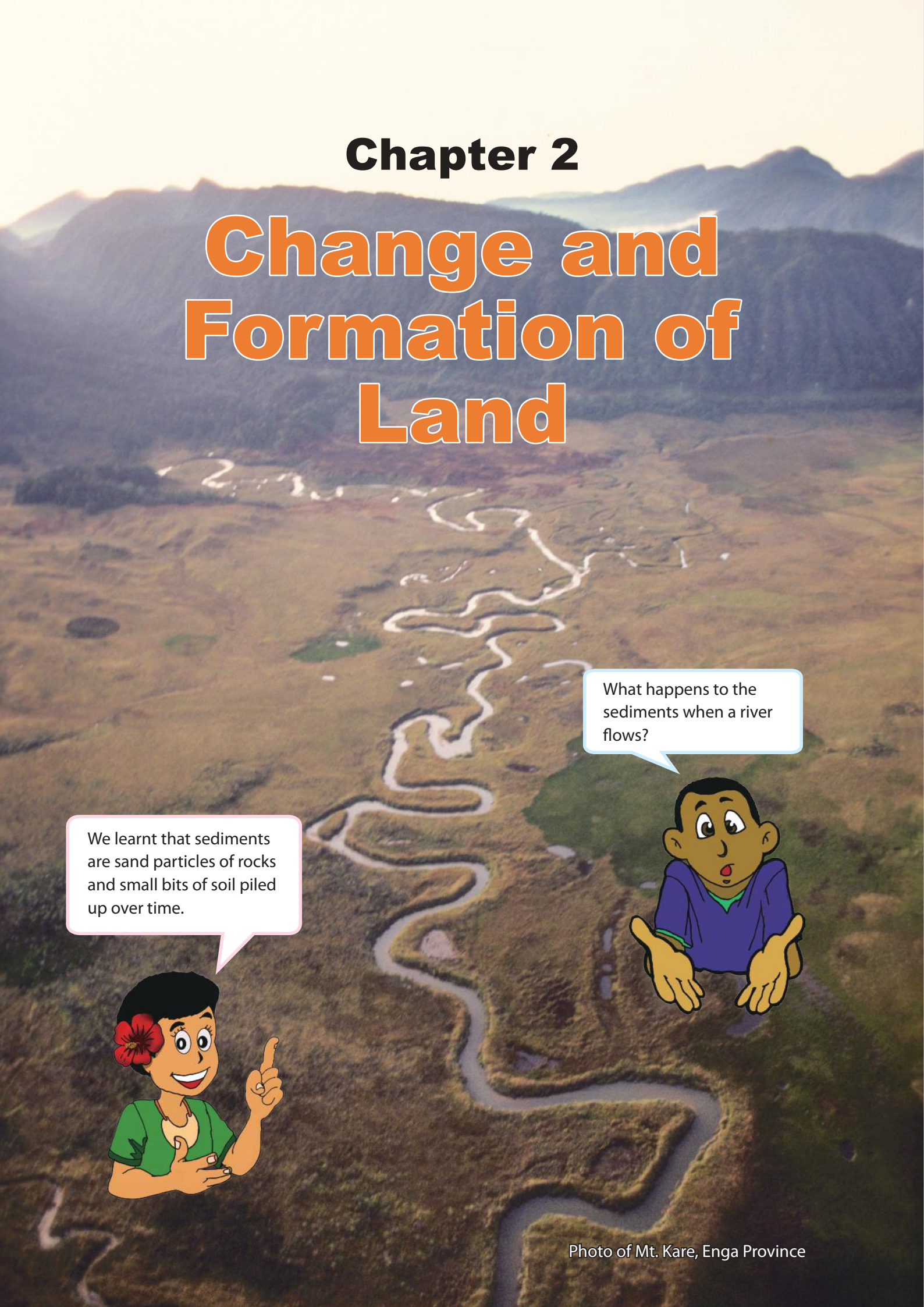


Photo of Mt. Kare, Enga Province

2.1 The Changes of the Earth's Surface

Lesson 1 Breaking Apart of Rocks

Study the picture on the right. The rock looks like a giant mushroom! How was it formed?

How does the surface of the Earth change?

Activity : Shaking a mixture of chalk and salt

What We Need:

- jar, some pieces of the same coloured chalk, salt

What to Do:

1. Record the size and shape of the chalk.
2. Put the chalk into the jar and pour salt until it covers the chalk. Close the lid tightly and shake it over 100 times.
3. Pour the mixture of chalk and salt on a paper. Observe the colour of salt, and the size and shape of the chalk.
4. Think about the following questions:
   (1) Why did the colour of the salt and the size and shape of the chalk change?
   (2) Salt represents sand. What makes sand move in nature?
   (3) Chalk represents rocks. What changes the size and shape of rocks in nature?
5. Share your ideas with your classmates. Talk about what causes rocks to change in nature.

Summary

The surface of the Earth is slowly changing. The change of the Earth's surface is caused by weathering. **Weathering** is a process where rock is broken down into smaller pieces over time. The smaller pieces of rock are called **sediments**.

Weathering can shape rocks into unusual formations. Wind, water, ice, chemicals and living things are causes of weathering.

Sand blown by wind and rain hits large rocks over and over. The rocks are weakened and broken down into smaller pieces of rocks.

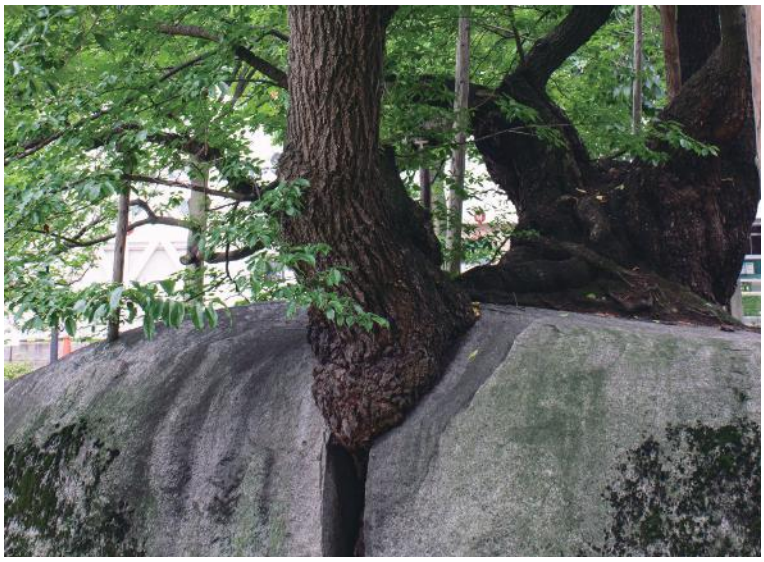
Most rocks have tiny cracks in them. Rainwater gets into the cracks. In cold climates, the water freezes and expands. The expanding ice makes the cracks bigger and breaks rocks over time.

Gases such as carbon dioxide in the air react with rainwater to form acid rain. Acid rain weakens rocks such as limestone, causing it to break.

Plants also cause weathering. They slowly grow into cracks in the rocks and widen the cracks and the rock breaks.

An arch of rock is a result of weathering.

A rock wall is damaged by acid rain.



A plant is growing out of the cracks in the rocks.

Lesson 2 Carrying Away of Sediments

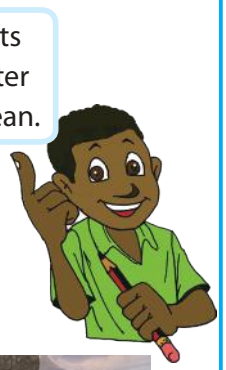
Wind, water, ice, chemicals and living things cause rocks to break down into sediments.

What happens to sediments after weathering?

Activity : How do waves change the beach?

What We Need:

- tray, sand, ruler, water



What to Do:

1. Place some sand on one side of the tray to make a beach model and then add enough water to cover the bottom of it.
2. Place the ruler at the opposite end of the tray to the beach. Slowly move the ruler back and forth to create waves against the sand for 3 minutes.

3. Observe the beach and record your observations in your exercise book.
4. Based on your observations, think about the following questions:
   (1) What happened to the shape of the beach when waves hit it?
   (2) What happened to the sand after the waves hit the beach?
   (3) How did the waves change the beach?

5. Share your ideas with your classmates. Discuss how flowing water changes the Earth's surface.

Summary

Once rocks are broken up by weathering, the small pieces of rocks called sediments are carried away. The movement of sediments from one place to another is called **erosion**. Erosion is caused by water, wind and ice.

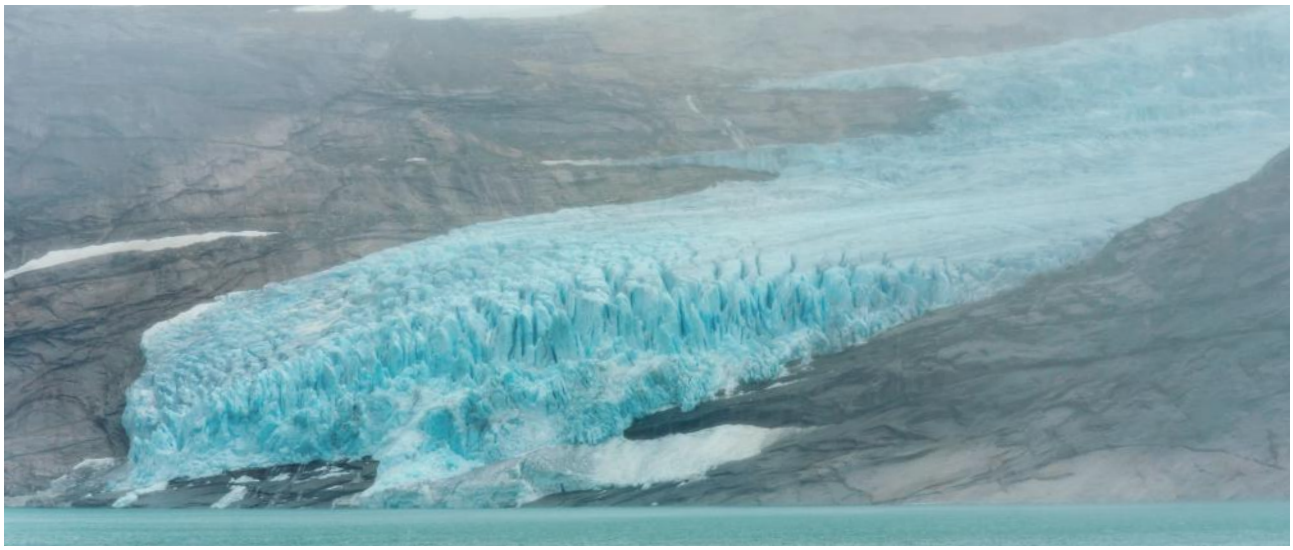
Water is the main cause of erosion. Rain, rivers, floods and the ocean carry away sediments. For example, rivers erode the riverbed and pick up sediments. The flowing water carries them away downstream. Ocean waves also erode the Earth's surface. Waves hit the coastline over time, causing the rocks to break down and are washed away.

Flowing water break down rocks and carries sediments downstream.

Waves cause the rock to break down and be carried away.

In dry areas, wind picks up and carries away sand and soil to different places.

A glacier is a large mass of moving ice. As the glacier moves slowly, it digs out huge areas of rocks and soil and carries them away.



Glaciers dig out huge areas of rock and soil and carries them away.

Lesson 3 Works of Rivers

Water is the main cause of erosion. Rivers or flowing water carry away sediments. What happens to sediments? Where do they go?

What happens to sediments after they are carried away by rivers?

Activity : Making a river model

What to Do:

1. Make a heap of soil and dig a winding waterway in the soil as shown in the picture below.
2. Start pouring water slowly into the waterway from the top of the mound and observe the following points:
   (1) At which part of the waterway is water running faster or slower?
   (2) At which parts of the waterway is soil most eroded?
   (3) At which parts of the waterway does soil accumulate most?
3. Record your observations in your exercise book.
4. Share your ideas with your classmates. Discuss how rivers work to change the Earth's surface.

Result

We found out that at the steep slope, water runs faster. Soil is eroded deeply and is carried away by flowing water. At the gentle slope, water runs slowly and soil accumulates most. At the outside of the curve in the waterway, soil is eroded. At the same time, soil also accumulates at the inside of the curve in the waterway.

At the steep slope, water runs faster. Soil is eroded and carried away.

At the gentle slope, water runs slowly and soil accumulates most.

At the outside of the curve, soil is eroded. At the inside of the curve, soil accumulates.

Summary

As water in a river flows fast, the rushing water erodes the ground, picks up sediments from the riverbed and carries them downstream. This process makes the river channel deeper and wider over time. The river tends to slow down as it flows into the ocean or lake. When the river slows, sediments are dropped and deposited at mouths of the river or in the oceans. Slowly sediments build up into a landform such as a delta or beach. The dropping of sediments moved by water, wind and ice is called **deposition**. Erosion and deposition occur in the river.

Lesson 4 Other Causes that Change the Earth's Surface

Weathering and erosion cause the changes on the surface of the Earth. Are there any other causes that change the Earth's surface?

What else changes the surface of the Earth?

Activity : Changes of mountain

What to Do:

1. Draw a table like the one shown below.

How does the mountain change?

2. Study the pictures below. Both are the pictures of the same mountain taken over time.
3. Compare the two pictures and record how the mountain has changed in your exercise book.
4. Share your ideas with your classmates. Discuss what causes the change to the surface of the Earth.

Photo taken in 1973

Photo taken in 1982

Summary

The surface of the Earth rapidly changes. Some of these changes are caused by earthquakes, volcanoes and landslides.

Earthquakes

An **earthquake** is the shaking of the Earth's surface. When earthquakes occur, they can change the shape of mountains. The land is lowered in certain areas. Cracks appear on the ground. Earthquakes may create mountains and valleys.

Earthquakes cause cracks on the ground.

Volcanoes

A **volcano** is an opening (usually in a mountain) on the Earth's surface which allows hot magma, volcanic gas and ash to escape. After a volcano erupts, the shape of the mountain will change. A new mountain, a large bowl-shaped hole in the ground or lakes may be formed.

A lake is formed after a volcanic eruption.

Landslides

A **landslide** is the rapid downhill movement of large amount of rock and soil. Heavy rains, earthquakes and volcanic activities often cause landslides. Parts of mountains and hills are destroyed by landslides.

Parts of a mountain and a town destroyed by landslide.

Summary and Exercise

Summary

2.1 The Changes of the Earth's Surface

Breaking Apart of Rocks

- ☑ Weathering is a process where rock is broken down into smaller pieces overtime.
- ☑ Wind, water, ice, chemicals and living things are causes of weathering.

An arch of rock is the result of rock being weathered by wind.	A rock wall is damaged by acid rain.	A plant slowly grows into cracks in rocks.

Carrying Away of Sediments

- ☑ Erosion is the movement of sediments from one place to another caused by water, wind and ice.
- ☑ The dropping of sediments moved by water, wind and ice is called deposition.
- ☑ Erosion and deposition occur in the river.

Erosion and depostition in the river

Other Causes that Change the Earth's Surface

- ☑ Rapid changes to the surface of the Earth are caused by earthquakes, volcanoes and landslides.
- ☑ An earthquake is the shaking of the ground caused by the sudden movement of the Earth's surface.
- ☑ A volcano is an opening in the Earth's surface which allows hot magma, volcanic gas or ash to escape.
- ☑ A landslide is the rapid downhill movement of a large amount of rocks and soil.

Summary and Exercise

Exercise

2.1 The Changes of the Earth's Surface

Q1. Complete each sentence with the correct word.

(1) The process where a rock is broken down into smaller pieces over time is called _____.

(2) Erosion is mainly caused by water, _____ and ice.

(3) The rapid downhill movement of a large amount of rocks and soil is called a _____.

(4) The shaking of the ground caused by the sudden movement of the Earth's surface is called an _____.

Q2. Choose the letter with the correct answer.

(1) Which of the following is the best explanation of erosion?

A. Erosion is the process of dropping rocks.

B. Erosion is the movement of sediments from one place to another.

C. Erosion is the process of breaking down rock.

D. None of the above.

(2) What are the small pieces of rocks that are broken down by weathering called?

A. Glacier

B. Carbon dioxide

C. Acid rain

D. Sediments

Q3. Answer the following questions.

(1) What are the causes of weathering? List at least three.

(2) Study the picture on the right and explain how acid rain affects the rock wall.

Q4. What changes would be observed when a volcano erupts?

2.2 Formation of Rock Layers and Rocks

Lesson 1 Cross Section of a Cliff

When we look at a cross section of a cliff, we find the striped patterns.

? Why does a cross section of a cliff have the stripe pattern?

Activity : Observing a cross section of a cliff

What We Need:

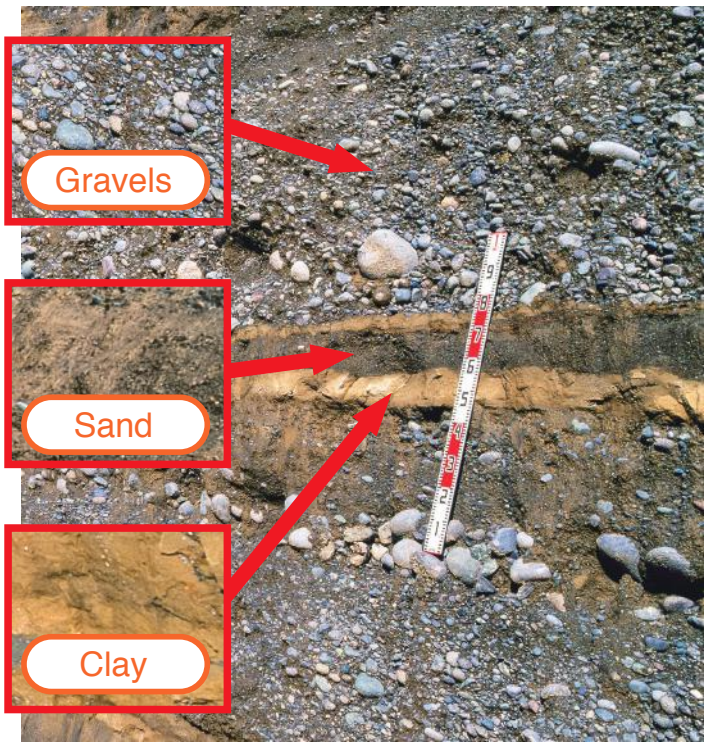
- tape measure, hand lens, shovel

What to Do:

1. Go to a cliff, road cuts or river banks near your school.
2. Observe the cross section based on the following points:
   (1) Colour of each layer
   (2) Components and properties of each layer
3. Sketch the cross section and record your observations in your exercise book.
4. Share your ideas with your classmates. Discuss why a cross section of a cliff has striped patterns.

Result

We found out that there are many different layers on the cross section of a cliff. Each layer had different colours. Some are pale or dark grey and some are khaki(dull brownish yellow). Each layer has different size and types of materials. Some layers consists of clay and sand. Others consist of sand and small rocks.



Each layer has different size and colour of materials.

Summary

The striped patterns of the cross section are formed with many layers that consist of materials such as gravels, sand, volcanic ash or silt known as **sediment**. Each of the sediment has a different colour. This makes the cross section appear in different colours, forming striped patterns. The horizontal layers of sediment are called **strata**. In nature, strata come in many layers.

These are different types of strata. Why do they look different?

Different types of strata

Lesson 2 Formation of Strata

Strata come in many layers. Each layer of strata consists of different materials such as gravels, sand and silt.

How are strata formed?

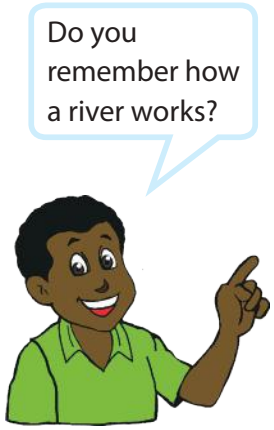
Activity : Making a model of strata

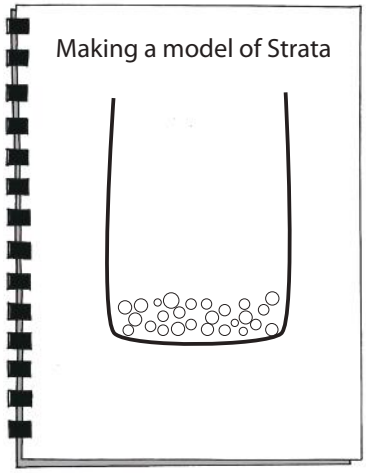
What We Need:

- soil with gravels, sand and clay, clear plastic bottle, water,

What to Do:

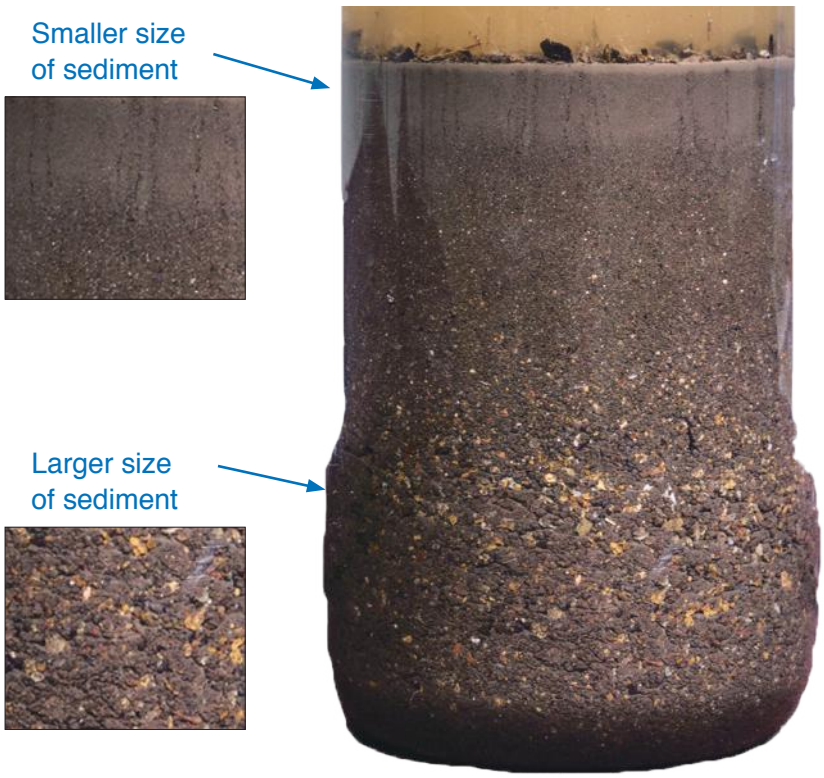
1. Pour soil and water into a plastic bottle. Fasten the bottle cap and shake it well.
2. After shaking, leave it for a while until the water becomes clear.
3. Observe the soil in the bottle and sketch your observations in your exercise book.
4. Share your ideas with your classmates. Discuss how layers of soil are formed.





Result

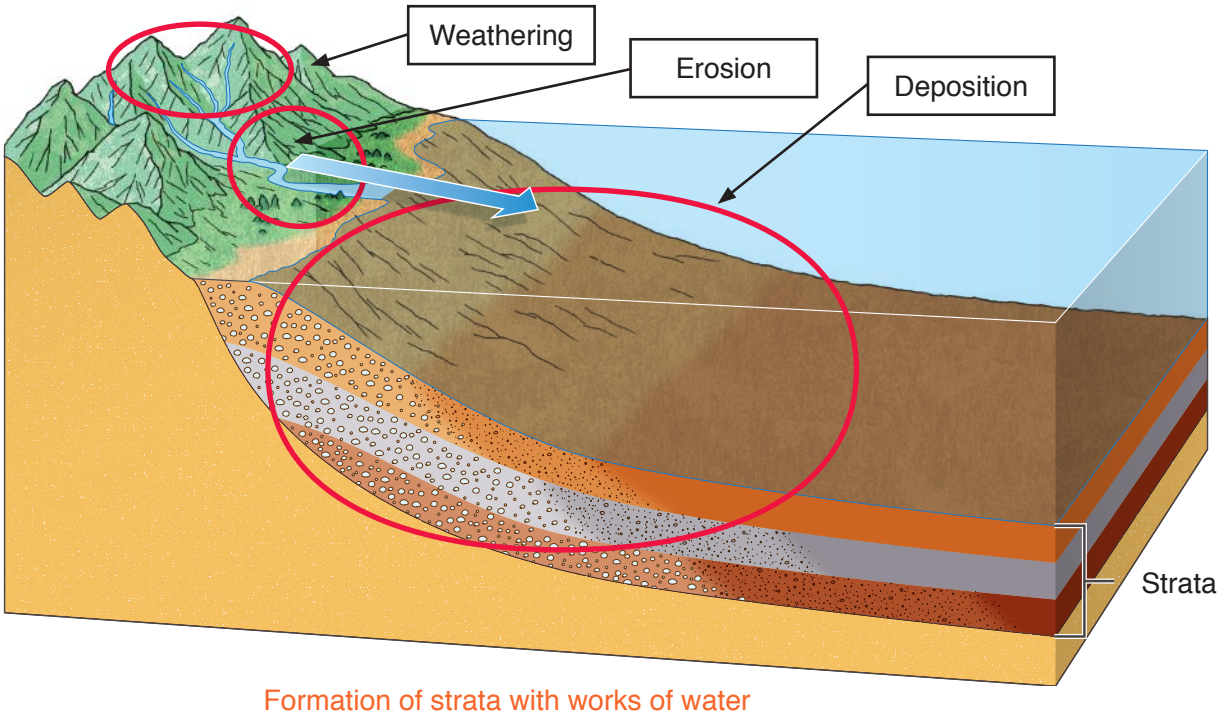
We found out that some layers can be observed. The different sizes and colours of sediments are deposited and divided into layers of gravels, sand and clay.



Layers of soil

Summary

Strata are formed by works of flowing water or rivers. Sediments such as gravels, sand and soil are carried by rivers to the ocean or lakes. As rivers slow down, sediments are deposited at the bottom of the oceans and lakes as layers and are divided into different sizes. When weathering, erosion and deposition processes are repeated over time, strata are formed.



Formation of strata with works of water

Lesson 3 Formation of Sedimentary Rock

A **sedimentary rock** is formed by sediments such as minerals, sand, mud and even fossils.

How are sedimentary rocks formed?

Activity : Making a model of sedimentary rock

What We Need:

- syringe with the end cut off, two paper cups, sugar, sand, water, spoon, tissue

What to Do:

1. Pour a spoonful of sand into the paper cup.
2. Add 5 spoonfuls of sugar and a spoonful of water in another paper cup and stir it until it is dissolved.
3. Pour the sugar water mixture slowly into the cup of sand until it is moistened. Pour off any excess water.
4. Fill the syringe with the sand and compress it with your finger or the palm of your hand to squeeze out any air.
5. Carefully push the sand out onto the piece of paper and observe what happens to the sand.
6. Share your ideas with your classmates. Discuss how a rock is formed.

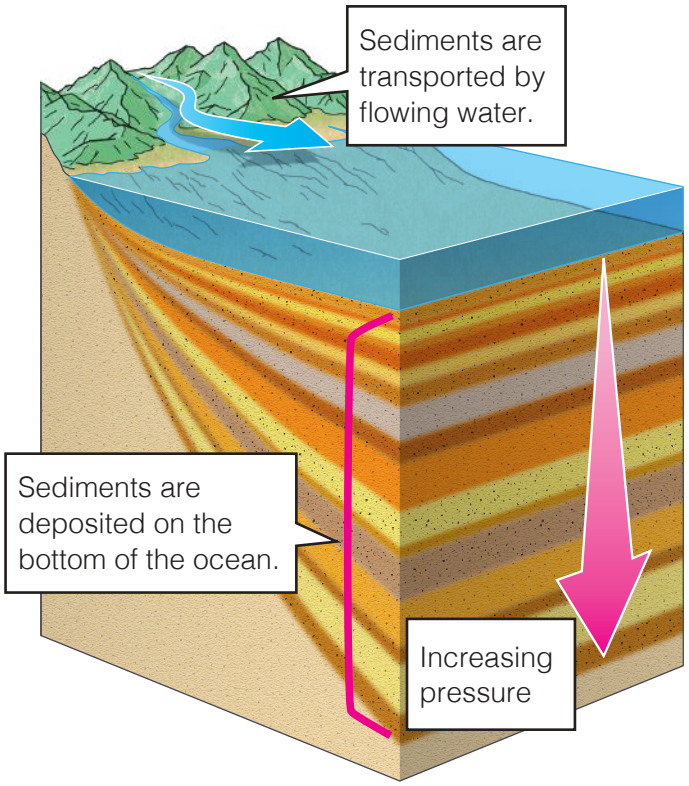
Summary

A sedimentary rock is formed from layers of sediments called strata, usually at the bottom of rivers, lakes and oceans.

As thick layers of sediments build up over millions of years, the weight of the upper layers press the sediments at the bottom.

The pressure forces out the water and slowly turns the sediments into sedimentary rocks. Sedimentary rocks may contain fossils of animals and plants.

There are different types of sedimentary rocks such as siltstone, shale, sandstone, conglomerate and limestone. Sedimentary rocks can be classified based on what they are made of and how they are formed.



Formation of sedimentary rock

Shale

Shale is formed from mud.

Sandstone

Sandstone is formed from grains of quartz in sand.

Conglomerate

Conglomerate is formed from different size of pebbles cemented together with sand and dissolved minerals.

Limestone

Limestone is formed from the remains of shells, corals, planktons and other marine animals.

Summary and Exercise

Summary

2.2 Formation of Rock Layers and Rocks

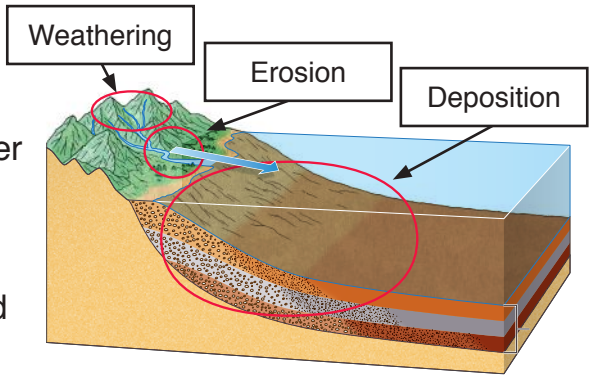
Cross Section of a Cliff

- The strata are the horizontal layers of sediments.
- The striped patterns of the cross section of a cliff are formed with many layers that consist of materials such as gravels, sand, volcanic ash or silt known as sediment.
- Each of the sediment has a different colour. This makes the cross section appear in different colours, forming striped patterns.

Strata

Formation of Strata

- Strata are formed by works of flowing water.
  1. Sediments that are eroded by flowing water are transported to the ocean or lakes.
  2. Sediments are deposited at the bottom of ocean and lakes as layers and are divided into different sizes.
  3. When weathering, erosion and deposition processes are repeated over time, strata are formed.



Formation of strata by works of water

Formation of Sedimentary Rocks

- A sedimentary rock is formed from layers of sediments usually at the bottom of rivers, lakes and oceans.
- The pressure due to the weight of the upper layers forces out the water and slowly turns the sediments into sedimentary rocks.
- There are different types of sedimentary rocks such as siltstone, shale, sandstone, conglomerate and limestone.

Sandstone

Conglomerate

Summary and Exercise

Exercise

2.2 Formation of Rock Layers and Rocks

Q1. Complete each sentence with the correct word.

(1) The horizontal layers of sediments are _____.

(2) The rock that is formed from layers of sediments is called _____ rock.

(3) Strata are formed by works of _____ water.

Q2. Choose the letter with the correct answer.

(1) Study the picture of a cross-section of a cliff. Why does it have striped patterns?

A. Because different layers have different colour and size of sediments.

B. Because all layers have same colour of sediments.

C. Because all layers have same size of sediments.

D. Because different layers have different smells of sediments.

(2) What type of sedimentary rock is formed from remains of shells, corals, plankton and other marine animals?

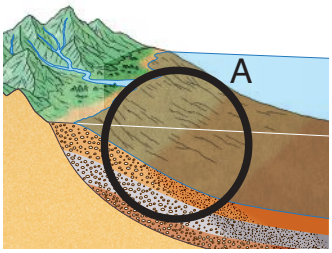
A. Shale

B. Conglomerate

C. Limestone

D. Sandstone

Q3. Study the diagram on the right that shows formation of strata with works of water. What is the name of the process of dropping sediments moved by flowing water caused at place A?



Q4. Answer the following questions.

(1) Sedimentray rocks are formed at the bottom part of the thick layers of sediments. Why do sedimentary rocks not formed at the top part of sediments?

(2) There are several kinds of sedimentary rocks. How are the sedimentary rocks classified?

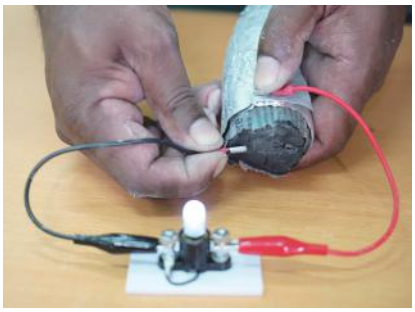
When electricity is cut off during natural hazards, such as floods, earthquakes and landslides, there is a simple way to produce electricity using another source and that is by using a charcoal.

Let's make a charcoal cell for natural hazard!

1. Soak newspaper properly in the salt solution.

2. Wrap the newspaper around the charcoal except the two ends.

3. Completely cover the newspaper with a sheet of aluminum foil carefully. (**Make sure the aluminum foil does not touch the charcoal.**)



4. Connect one of the wire from the lamp to the aluminum foil and the other wire to one end of the charcoal.

Chapter Test

2. Change and Formation of Land

Q1

Complete each sentence with the correct word.

(1) The process by which eroded material drops or settles is called _____.

(2) A sedimentary rock formed from mud is _____.

(3) An opening in the Earth's surface which allows hot magma, volcanic gas or ash to escape is a _____.

Q2

Choose the letter with the correct answer.

(1) What is sediment?

A. Decaying plant or animal material.

B. The process of rocks being broken down and carried away.

C. The top layer of the soil.

D. Bits of rock, sand and silt caused by weathering of rocks.

(2) What happens when glaciers slowly move down a mountain?

A. The glaciers cause no change.

B. The glaciers melt and form giant lakes.

C. The glaciers cause erosion by taking sediments and moving them somewhere else.

D. The glaciers melt and freeze.

(3) Which of the following is a rapid change in the Earth's surface?

A. Deposition

B. Erosion

C. Weathering

D. Landslide

(4) How do plants weather rocks?

A. When the leaves dissolve the rocks.

B. When roots grow into cracks of rocks and expand the rocks.

C. When the plants moves water from the roots to the leaves.

D. When water in the leaves evaporates.

Q3

(1) A student took this picture on the right during a holiday trip. What process has made the rock to look the way it is?

_____

(2) Explain how freezing water can cause the weathering of rocks.

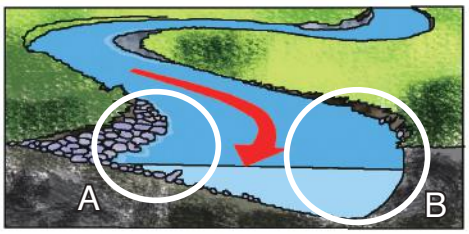
_____

_____

(3) The diagram below shows a river. Points A and B are locations on the banks of the river. What process is occurring at locations A and B?

Position A: _____

Position B: _____



Q4

(1) A group of students studied rocks. They collected different samples of sedimentary rocks. One of the rocks had different size of pebbles that got cemented together with sand and dissolved minerals. What is this rock called? _____

(2) Why do sedimentary rocks appear in strata?

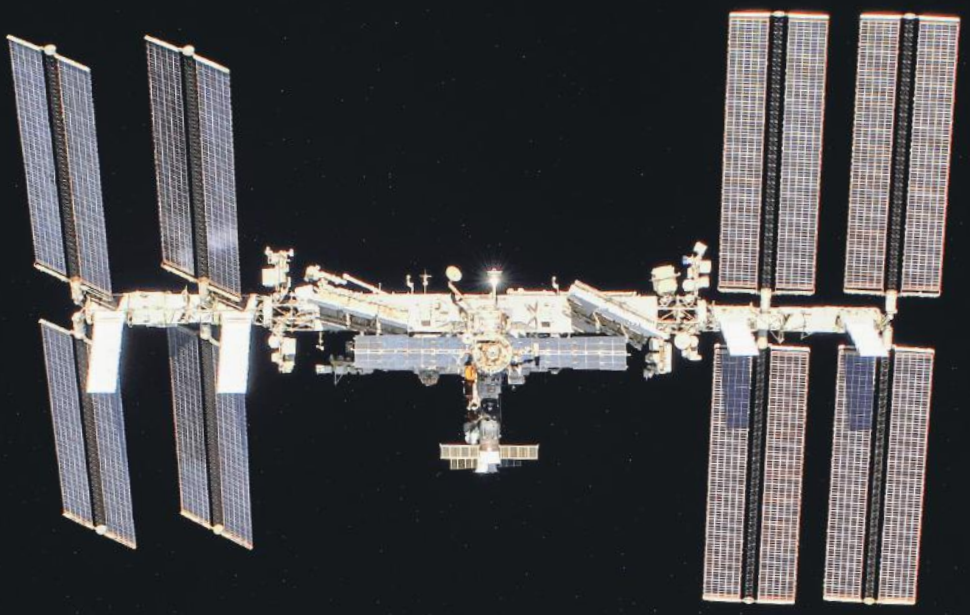
_____

_____

_____

Chapter 3

Force



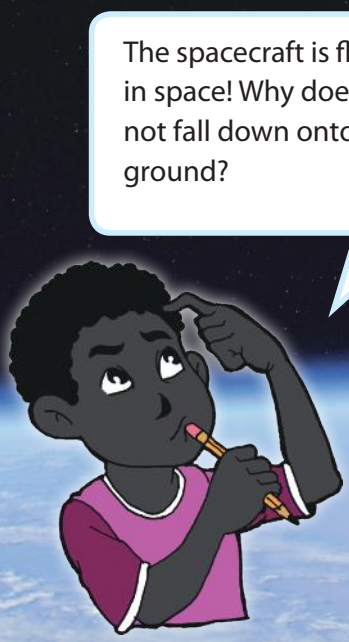


Photo of the International Space Station

3.1 Forces around Us

Lesson 1 Forces in Daily Life

Forces act on everything around us. Pushing or pulling are kinds of forces. What other types of forces act on objects around us?

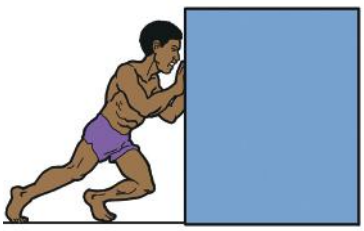
What types of forces can we find in our daily lives?

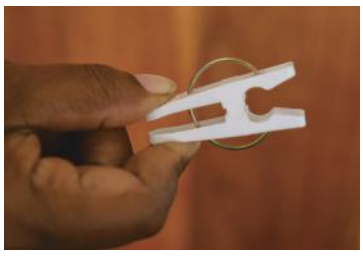
Activity : Finding and classifying forces

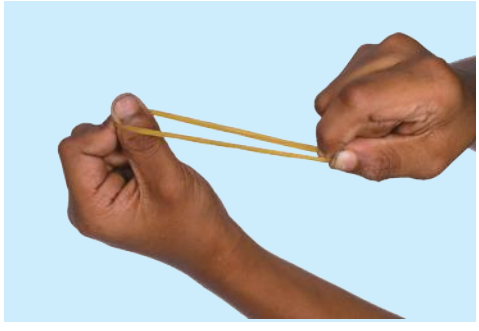
What to Do:

1. Draw a table like the one on the right.
2. Observe the pictures below and find the forces acting on the following objects; rubber band, compass, glass, cloth peg and a box.
3. Record your observations in your exercise book.
4. Share your ideas with your classmates. Talk about:
   (1) What types of forces did you find?
   (2) How can you classify the forces into two types?

Forces in daily life	Does the force act on the object directly or not?



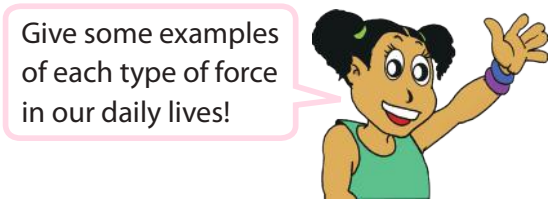




Summary

There are different types of forces in daily life. Basically forces can be classified into two; Contact forces and Non-contact forces.

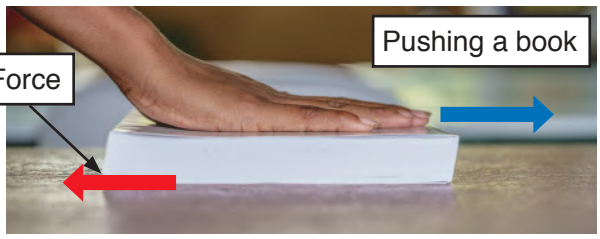
1. Contact Forces



Contact forces are forces when two objects are physically interacting with each other by touching. Some types of contact forces are:

A. Frictional force

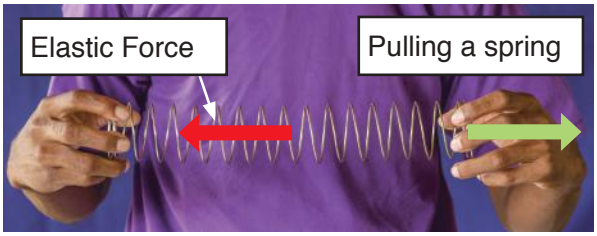
This force is the force that is created when two surfaces slide against each other.



Frictional force: A book sliding on the table is creating an opposite direction of force.

B. Elastic force

This force is the force exerted by an object trying to return to its original shape like a spring or rubber band.



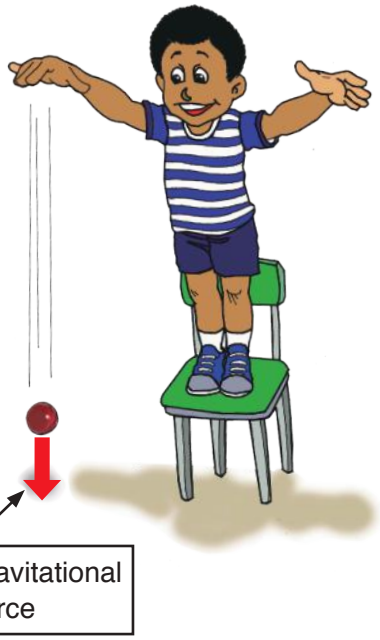
Elastic force: A stretched spring is trying to return to its original shape.

2. Non-contact Forces

Non-contact forces take place when two objects are not in contact with each other but act through the space between them. Some types of non-contact forces are:

A. Gravitational force

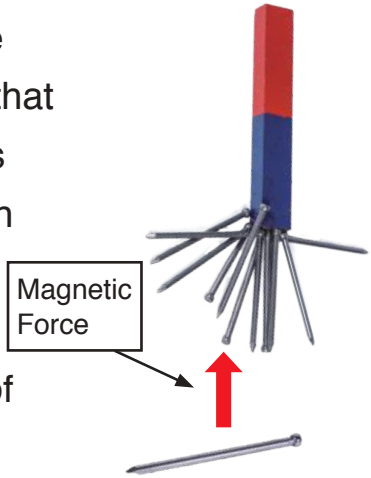
This force is the force that attracts any two objects with mass towards each other.



Gravitational force: The Earth is attracting a ball to the ground.

B. Magnetic force

This force is the force of attraction or repulsion exerted by a magnet.



Magnetic force: Magnet attracting nails.

Lesson 2 Gravity

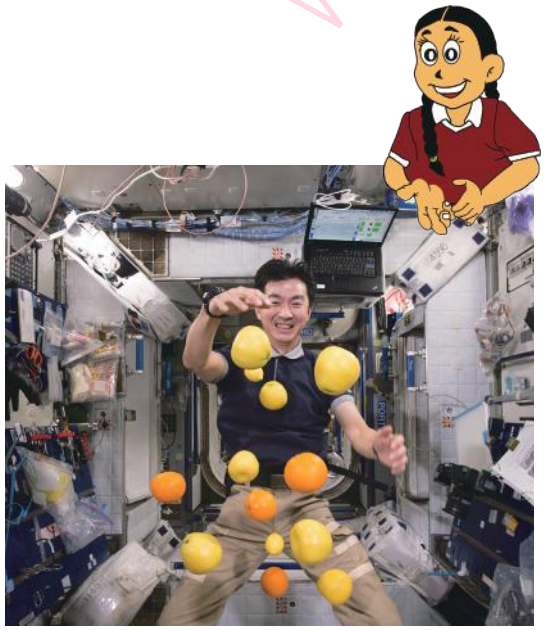
When we drop a stone, it falls towards the ground. Why does it fall to the ground? The answer is 'gravity', but what is gravity?

What is gravity?

Activity : What happens if there is no gravity?

What to Do:

1. The picture below shows astronauts in a spaceship. The spaceship and astronauts are both moving together and rotating around the Earth in orbit. But inside the spaceship there is zero gravity!
2. Study the pictures and observe the following points:
   (1) What is happening to the astronauts in the spaceship?
   (2) What is happening to the fruits in the spaceship?
3. Share your ideas with your classmates. Discuss:
   (1) What would happen if there is no gravity?
   (2) How does gravity work on objects?



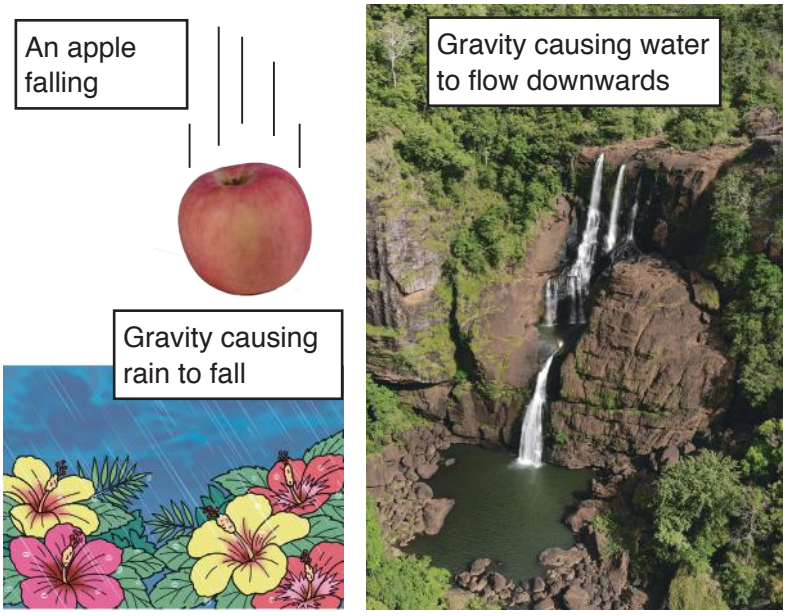
Summary

Gravity is also known as gravitation. It is a non-contact force that attracts objects towards each other. It exists between all objects, not just between the Earth and other objects.

Gravity acts on all objects. For example, Earth's gravity pulls a flying bird and airplane towards the ground. It also keeps a book on a desk. Earth's gravity even holds the Moon in orbit around the Earth. Without gravity, everything would be floating around and nothing would be able to stay on the Earth.

The Earth's gravity acts on all objects on earth.

The strength of gravity depends on the amount of matter in an object. The greater the amount of matter, the greater the gravity. For example, the Earth has a greater amount of matter than the Moon, so the gravity of the Earth is more than that of the Moon.



Phenomena caused by Gravity

The first person who discovered gravity is **Sir Isaac Newton**. During his lifetime he developed the theory of gravity. His theory is called 'Newton's Law of Universal Gravitation'. The story is that his theory of gravity was inspired when he watched an apple fell from a tree to the ground.

Lesson 3 Measuring and Describing Force

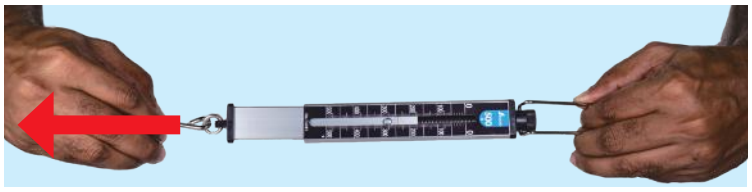
When a force acts on an object, the effect of the force can be seen. For example, when we release a ball from a hand, it falls to the ground and bounces on the ground. But, we cannot see the force itself.

How can we measure and describe a force?

1. How to Measure Force

The unit of force is '**newton**' (**N**). Force can be measured with a spring balance or a bathroom scale. The gravity acting on an object on the Earth can also be measured with a spring balance because gravity is a force. When a 100 g object is hung on a spring balance, it shows about 1 N. This means that the Earth's gravity pulls the 100 g object towards the ground with the force of 1 N. If an object is 200 g, the magnitude of gravity is about 2 N. When we pull a spring balance, the force (pull) can also be measured.

Measuring the magnitude of gravity



The magnitude of the pull can be measured with a spring balance.

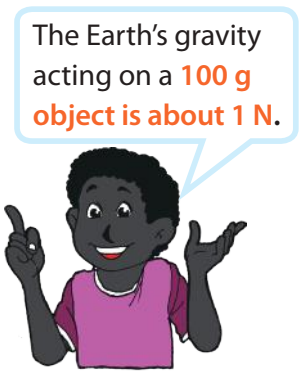
Exercise

What is the force in newton of the following objects below?

300 g banana

40 kg person

50 g stone



2. How to Describe Forces

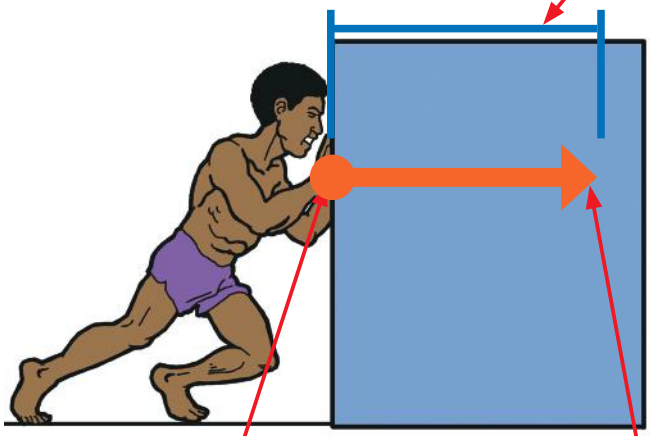
A force can be shown with an arrow. It indicates the **magnitude**, the **direction** and the **point of application** of the force. The length of the arrow shows the magnitude of the force and the direction of the arrow gives the direction of the force. The point of application is the location at which a force is applied to an object.

Three Components of Force:

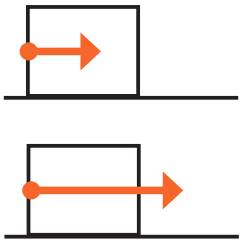
1. The Point of Application of Force
2. The Direction of Force
3. The Magnitude of Force

3. The Magnitude of Force

The length of the arrow shows the amount of force acting on an object.



How to show the Magnitude of Forces



If 1 cm represents force of 1 N, 2 N force can be shown in the length of 2 cm arrow.

How to Show Gravity acting on Objects

Draw an arrow from the centre of an object.

1. The Point of Application

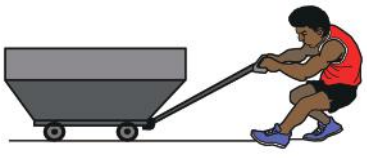
Showing a force begins with a dot that shows where the force begins.

2. The Direction of Force

The direction of the arrow should be the same as the direction of the force.

Exercise

Show the force acting on the following objects with arrows. (1 cm represents force of 1 N)



Pulling a cart with a force of 3 N

Kicking a ball with a force of 2 N

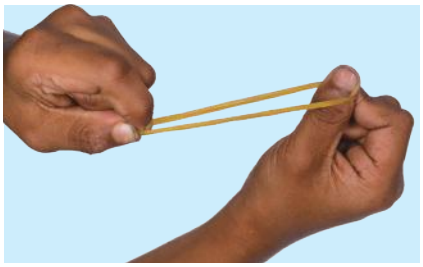
A 200 g mango fruit falling down.

Summary and Exercise

Summary 3.1 Forces around Us

Forces in Daily Life

- Contact forces are forces that take place when two objects physically interact with each other by touching. Examples are Frictional and Elastic forces.
- Non-contact forces are forces that take place between two objects not in contact with each other but act through the space between them. Examples are Gravitational and Magnetic forces.



Elastic force in a rubber band

Magnetic force in a magnet

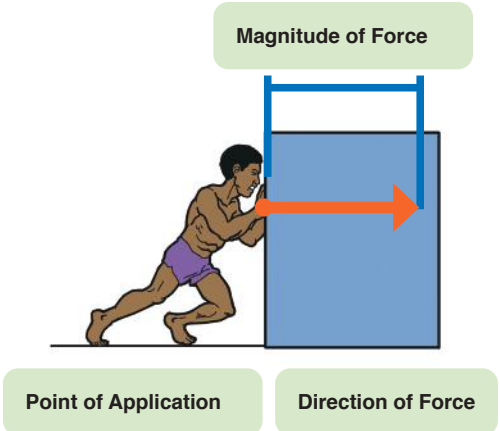
Gravity

- Gravity is a non-contact force.
- Gravity exists between all objects, not just between the Earth and other objects.
- The greater the amount of matter, the greater the gravity.
- Zero gravity is the condition in which there is no force of gravity acting on an object.
- Sir Isaac Newton was the first person who discovered the theory of gravity.

The Earth's gravity acts on all objects on earth.

Measuring and Describing Force

- Force is described by its point of application, the direction of the force and the magnitude. Force is measured in newton (N).
- A force can be shown with an arrow.
  1. The length of the arrow shows the magnitude of the force.
  2. The direction of arrow shows the direction of force.



Summary and Exercise

Exercise 3.1 Forces around us

Q1. Complete each sentence with the correct word.

(1) A force created when surfaces of two objects slide against each other is called _____ force.

(2) An invisible force of attraction and repulsion exerted by a magnet is called _____ force.

(3) A force that attracts any two objects with mass towards each other is called _____.

Q2. Choose the letter with the correct answer.

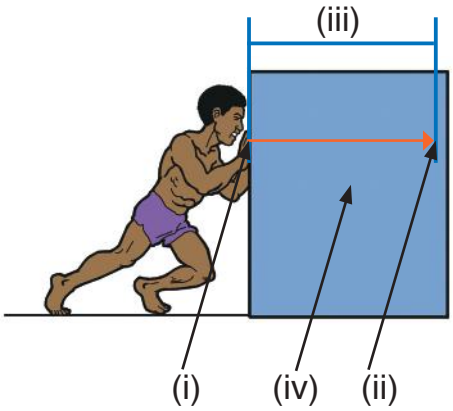
(1) Which letter indicates the point of application in the picture on the right?

A. (i)

B. (ii)

C. (iii)

D. (iv)



(2) Which list contains the non-contact forces?

A. Magnetic force and frictional force

B. Frictional force and gravity

C. Magnetic force and elastic force

D. Gravity and magnetic forces

Q3. Answer the following questions

(1) Name the instrument shown on the right.

(2) What is the unit of force?

(3) What is the difference between contact force and non-contact force?

Q4. Jonathan plays soccer for the school team. During the training of target practice, he kicked the ball to the right with a force of 3 N. Draw an arrow to show this force (1 cm represents force of 1 N).

Weight and Mass

Measuring mass with a balance

Measuring weight with a spring

When you stand on a scale, you measure your weight. But, what is weight? **Weight** is a force caused by gravity.

In other words, weight is a measurement of how much gravity pulls on an object. Weight depends on the strength of gravity. Weight can be measured with a spring balance or a scale. The unit of weight is also newton (N) because weight is a force.

All objects are made up of matter. Matter is anything that has mass and takes up space, but what is mass? **Mass** is a measurement of the amount of matter in an object. In other words, mass is how heavy an object is **without gravity**. Mass is not a force! Mass is usually measured with a balance. The unit of mass is kilograms (kg) or grams (g).

Difference between Weight and Mass

In our daily life, we often use 'weight' as the same meaning of 'mass', but weight is totally different from mass in science. We should use two terms of 'weight' and 'mass' differently when we study science.

The weight can change from place to place, but the mass will never change. The gravity of earth is greater than that of the moon. The moon's gravity is 1/6 of Earth's gravity.

Astronaut:
Mass: 60 kg
Weight: 600 N

Earth

Weight can change, but the mass never change.

Astronaut:
Mass: 60 kg
Weight: 100 N

Moon

An object with a mass of 60 kg has a weight of about 600 N on Earth. On the Moon, the weight of the object will be only about 100 N. But, the mass of the object will be 60 kg everywhere even on the Moon.

Chapter Test

3. FORCE

Q1

Complete each sentence with the correct word.

(1) A force that attracts two objects with mass towards each other is _____ .

(2) A _____ force is a force of attraction and repulsion exerted by a magnet.

(3) The unit for measuring force is the _____.

Q2

Choose the letter with the correct answer.

(1) Gravity was discovered in the 1680s by a famous scientist when he watched an apple fall from the tree to the ground. Who was this famous scientist?

A. Albert Einstein

B. Isaac Newton

C. Benjamin Franklin

D. Thomas Edison

(2) Which of the following is an example where elastic force is exerted?

A. Fred pushed a trolley across the lawn onto the concrete path.

B. Sandy shot a basketball into the loop to score two points.

C. Ketsin shot a bird high up in the tree with a forked sling shot.

D. Lolo used a coconut palm to slide downhill into the river below.

(3) What type of force is gravitational force classified as? It is classified as.....

A. a contact force.

B. an elastic force.

C. a magnetic force.

D. a non-contact force.

(4) Fred was sick and went to the clinic. He was asked to stand on the bathroom scale so the nurse would know his weight before giving him some medicine. Fred weighs 40 kg. What is the force of gravity in newton?

A. 4 N B. 400 N

C. 40 N D. 4000 N

(5) The strength of gravity depends on:

A. the mass of an object.

B. the size of the object.

C. the colour of an object.

D. the hardness of an object.

Q3

Answer the questions.

Melo releases a ball from his hand and the ball falls to the ground. The mass of the ball is 400 g.

(1) What force is exerted on the ball when it is falling?

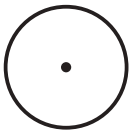
_____

(2) Calculate the amount of the force exerted on the ball.

_____ newton

(3) Show the force acting on the ball with an arrow on the diagram on the right. (1 cm equals 1 N)

Ball falling to the ground



Q4

The cleaner in the store had just finished mopping a section of the tiled floor when Ketsin walked onto it. Ketsin could not keep his feet firmly on the floor and he slipped and fell. Why did he slip? Explain using the word 'friction'.

_____

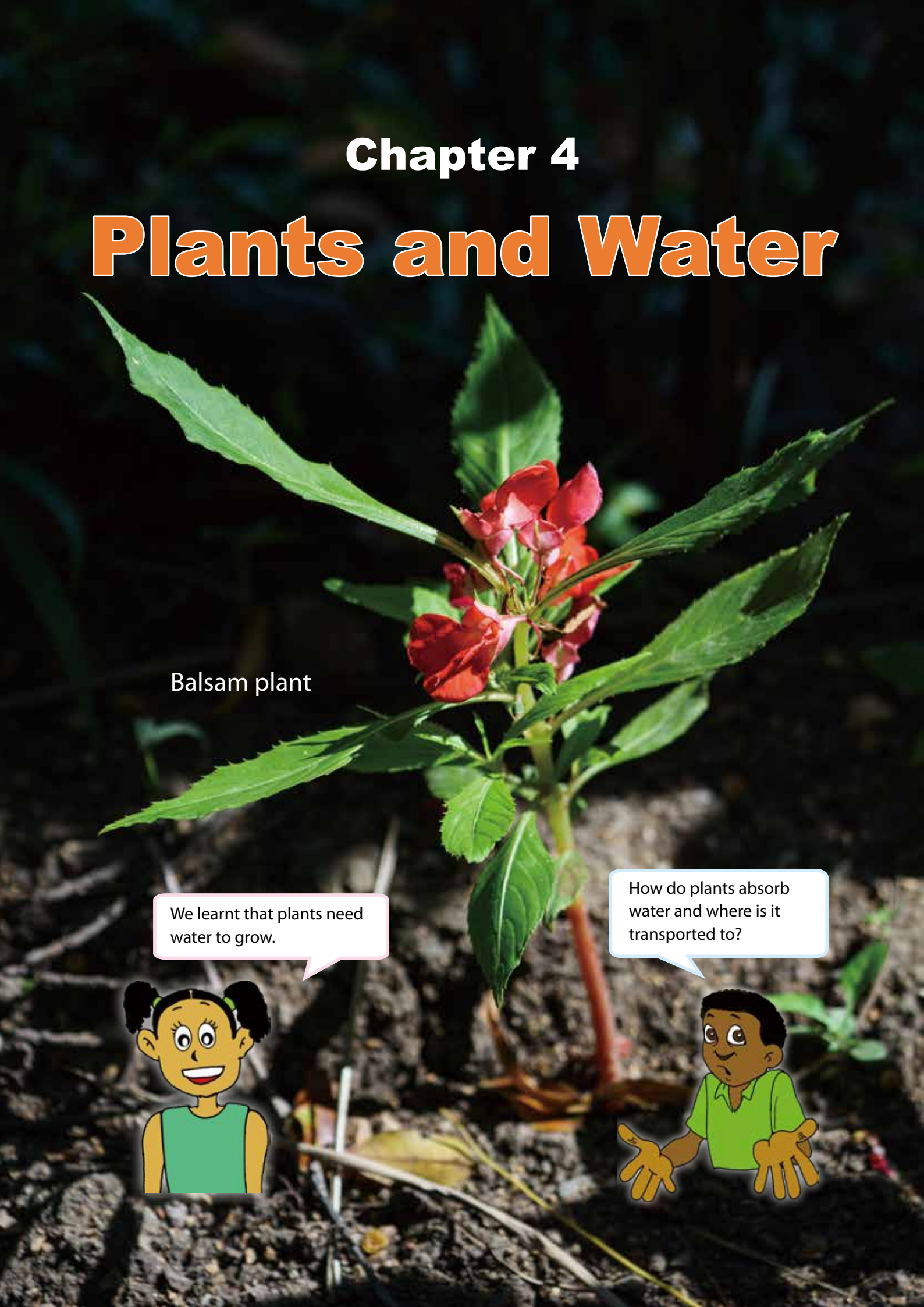
_____

_____

_____

Chapter 4

Plants and Water



4.1 Water in Plants

Water is very important for plants. Without water, plants will become weak and eventually die. How is water transported in a plant?

Lesson 1 Paths of Water in Plants

Plants use their roots to absorb water from the soil. How do plants transport the water absorbed by the roots?

Which parts of a plant does water pass through?

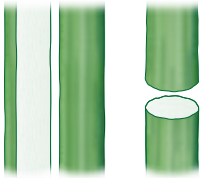
Activity : Observing paths of water

What We Need:

- balsam or cabbage with roots, food colouring, hand lens, cutter knife, clear plastic bottle

What to Do:

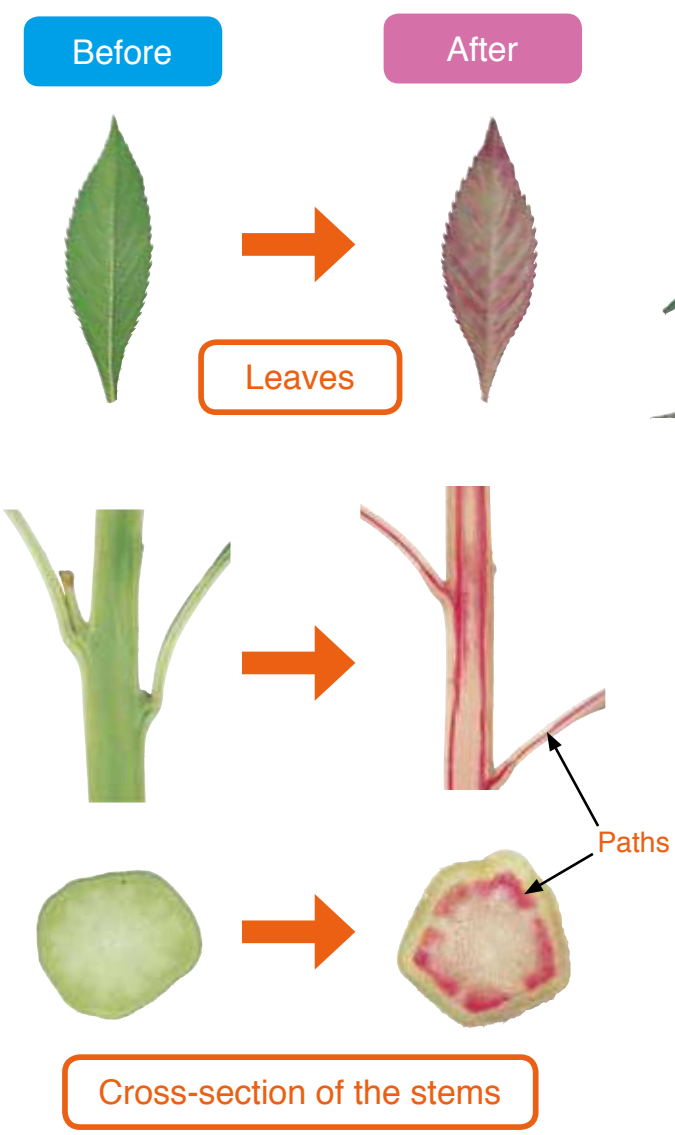
1. Pour water into the clear plastic bottle and add food colouring.
2. Place the balsam plant into the plastic bottle and leave it overnight.
3. Cut the stem of the balsam plant with a cutter knife as shown in the diagram on the right.



4. Observe the cross-section of the stem and the leaves with the hand lens and record your observations.
5. Share your ideas with your classmates. Discuss how water is transported in a plant.

Result

We found out that the paths that coloured water took were from the roots through the stem and to the leaves.



Let's compare the colours of this flowers and the flowers on the previous page. Why did the colour of the flowers change?

Summary

Water absorbed by roots pass through the tubes from the roots to the stem, to the leaves and to the flowers. The tubes act like a drinking straw carrying a flow of water. They help plants transport water to all parts of the plant.

Lesson 2 Water in Leaves

Water absorbed by the roots is transported to the leaves. What will happen to the water in the leaves?

Where does the water in the leaves go?

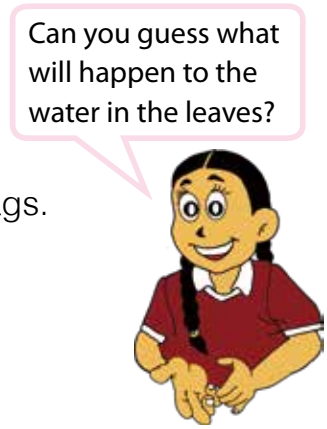
Activity : Where is the water going?

What We Need:

- two clear plastic bags, string, two plants

What to Do:

1. On a clear day, select two same sized plants. Remove all leaves from one of the plants.
2. Cover both plants with the plastic bags and firmly tie them with the string.
3. After 2 or 3 hours, observe the inside of the plastic bags. Sketch and record your observations.

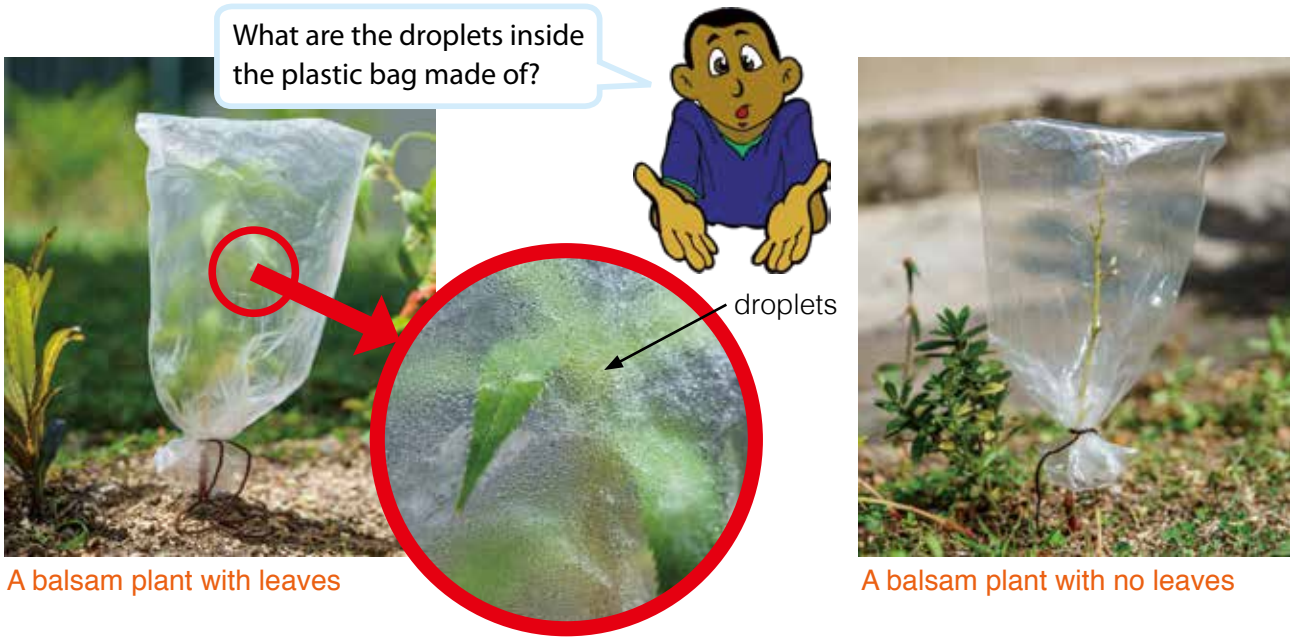


A plant with leaves

A plant with no leaves

Result

We found out that with the plant with leaves, there were a lot of droplets inside the plastic bag. However, with the plant with no leaves, there was no change inside the plastic bag.



A balsam plant with leaves

A balsam plant with no leaves

Discussion

Think about the following questions based on your result.

1. Why were there droplets inside the bag of the plant with leaves but no droplets inside the bag of the plant with no leaves?
2. Where did the droplets come from?
3. Where did the water in leaves go?
4. What did you find about the function of the leaves?

Summary

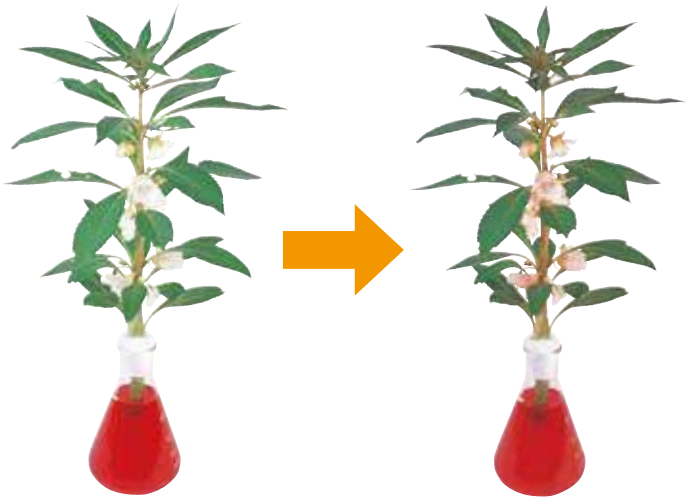
Water is absorbed from the soil and transported from the roots to the stem and to the leaves. Then it is released from the leaves into the air in the form of water vapour. The process of water moving through plants and evaporating from leaves is called **transpiration**.

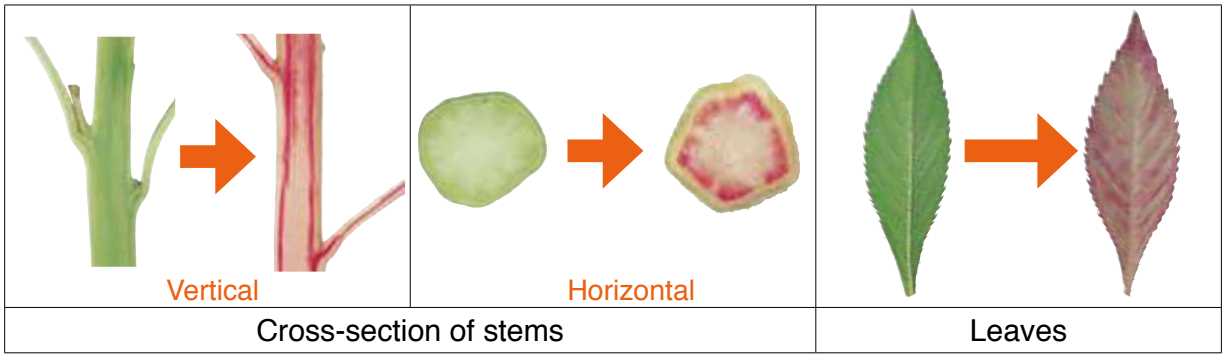
Summary and Exercise

Summary 4.1 Water in Plants

Path of Water in Plants

- Water absorbed by roots pass through the tubes from the roots to the stem, to the leaves and to the flowers.
- Tubes in the stem act like a drinking straw carrying a flow of water continuously to all parts of the plant.

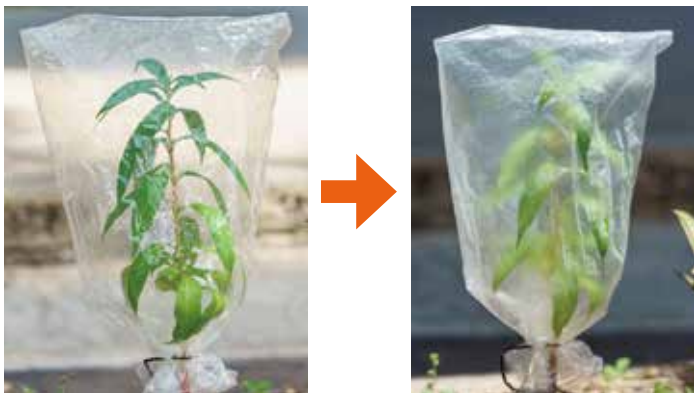




Cross-section of stems	Leaves

Water in Leaves

- Water is absorbed from the soil and is transported from the roots to the stem and to the leaves.
- Water is then released from the leaves into the air in the form of water vapour.
- This process is called transpiration.



Summary and Exercise

Exercise 4.1 Water in Plants

Q1. Complete each sentence with the correct word.

(1) Water is released from the _____ of plants into the air in the form of water vapour.

(2) The _____ help transport water to all parts of the plant.

(3) The process of water moving through plants and released into the air is called _____.

Q2. Choose the letter with the correct answer.

(1) Where do the long tubes in plants that water uses to move through are found?

A. Roots

B. Stems

C. Leaves

D. Flowers

(2) Which of the following correctlly shows the flow of water in plants?

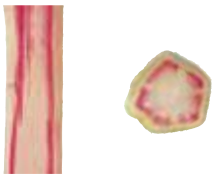
A. Leaves → Stem → Roots

B. Leaves → Roots → Stem

C. Roots → Stem → Leaves

D. Roots → Leaves → Stem

Q3. Study the diagrams on the right. The cross-sections of the plant stem is observed to see the movement of coloured water in the stem. What are found from the observations?



Cross-sections of the stems

Q4. Look at the picture on the right. Explain why the plant with no leaves did not have water droplets in the plastic bag.

Plant with leaves

Plant with no leaves

How much water do plants transpire? What are the things that cause more or less transpiration in plants?

During a growing season, a leaf will transpire many times more water than its own weight. An acre of corn gives off about 11 400 - 15 100 litres of water each day and a large oak tree can transpire151 000 litres per year.

The amount of water that plants transpire varies greatly to their location on the earth and over time. Higher temperatures cause the plant cells which control the openings (stomata) where water is released to the atmosphere to open, whereas colder temperatures cause the openings to close.

The amount of water vapour in the air surrounding the plant rises and the transpiration rate falls. It is easier for water to evaporate into dryer air than into the air with a lot of water vapour.

The increased movement of the air around a plant will result in a higher transpiration rate. Wind will move the air around, resulting in a lot of water vapour close to the leaf is replaced by drier air.

When there is lack of moisture, plants begin to premature in age, resulting in leaf loss and less transpiration of water.

Some types of plants that grow in harsh regions such as the thick, fleshy plants like the cacti conserve water by transpiring less water.

Chapter Test

4. Plants and Water

Q1

Complete each sentence with the correct word.

(1) Plants use their _____ to take in water from the soil.

(2) The water taken in by the plant will _____ from leaves.

(3) The process of water moving through plants and its evaporation from leaves is called _____.

Q2

Choose the letter with the correct answer.

(1) After the plant takes in the water, the water evaporates from the _____ into the air.

A. roots

B. stems

C. leaves

D. flowers

(2) Water is transported to all parts of the plant through the path in the coloured dye. What are these parts known as?

A. The skins

B. The flower

C. The stem

D. The tubes

(3) Which of the following is the correct explanation about the path for the water in plants? Water is transported from the

A. roots to the stem and to the leaves.

B. leaves to the stem and to the root.

C. stems to the roots and to the leaves.

D. roots to the leaves and to the stem.

(4) Samuel prepares two setups as shown in the picture below to investigate where the water absorbed by the plant evaporates from. Why does he have to remove all the leaves from plant 2? To observe if the water

A. evaporates from stems.

B. evaporates from leaves.

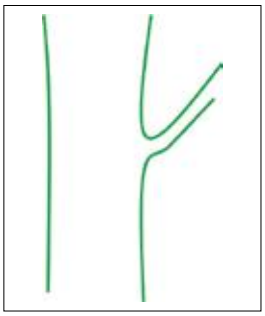
C. comes from air.

D. comes from soil.

Plant 1 Plant 2

Q3

(1) In the experiment, the balsam plant is placed into the bottle filled with coloured water as shown in the picture on the right.



(i) Draw the expected result on the diagram on the far right to show the cross section of the stem.

(ii) Why did the colour of the flowers change?

_____

_____

(2) The plant covered with the plastic bag is shown on the right. In the experiment, we found that there were a lot of droplets inside the plastic bag. Why were there droplets inside the bag covering the plant with leaves?

_____

_____

Q4

After cutting the stem and observing the coloured dye on the stem and the leaves of the plant, can you describe how the tubes transport water in plants?

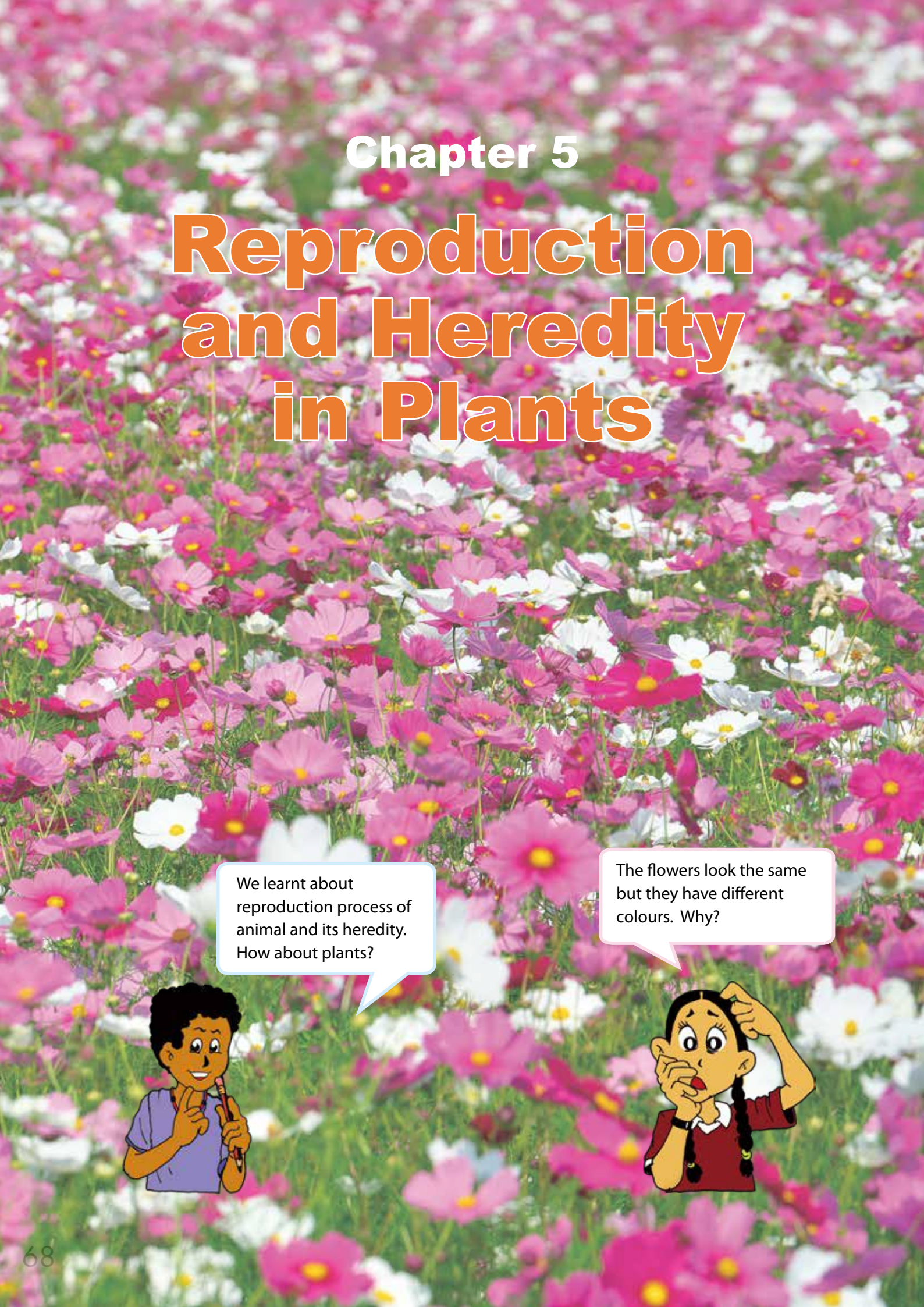
_____

_____

_____

Chapter 5

Reproduction and Heredity in Plants



5.1 Reproduction and Heredity

All animals produce young ones similar to themselves. How do plants reproduce? Is reproduction in plants similar to or different from animals?

Lesson 1 Flowers

Flowers are made up of different parts. The main parts of a flower are stamen and pistil.

What are the structures of a stamen and a pistil?

Activity : Observing a stamen and a pistil

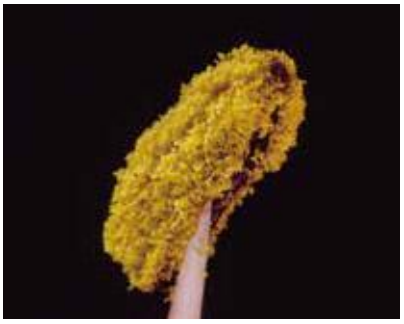
What We Need:

- flower, hand lens, cutter knife

What to Do:

1. Carefully remove the stamens and petals from the flower.
2. Observe the anther using the hand lens. Sketch the anther and record your findings in your exercise book.
3. Carefully cut the pistil in half and observe the inside of the pistil with the hand lens. Sketch the pistil and record your findings in your exercise book.
4. Share your ideas with your classmates. Discuss the structures of a stamen and a pistil.

Be careful when using the cutter knife.



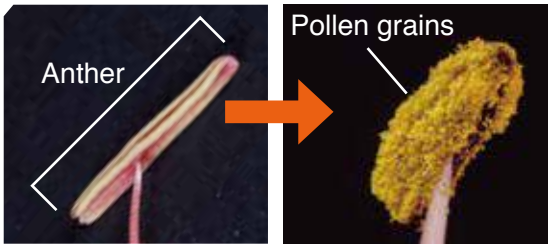
Summary

How are the reproductive parts of plants and animals similar or different?

Flowers are the reproductive parts found in flowering plants. The main reproductive parts of a flower are the stamen and pistil.

Stamen

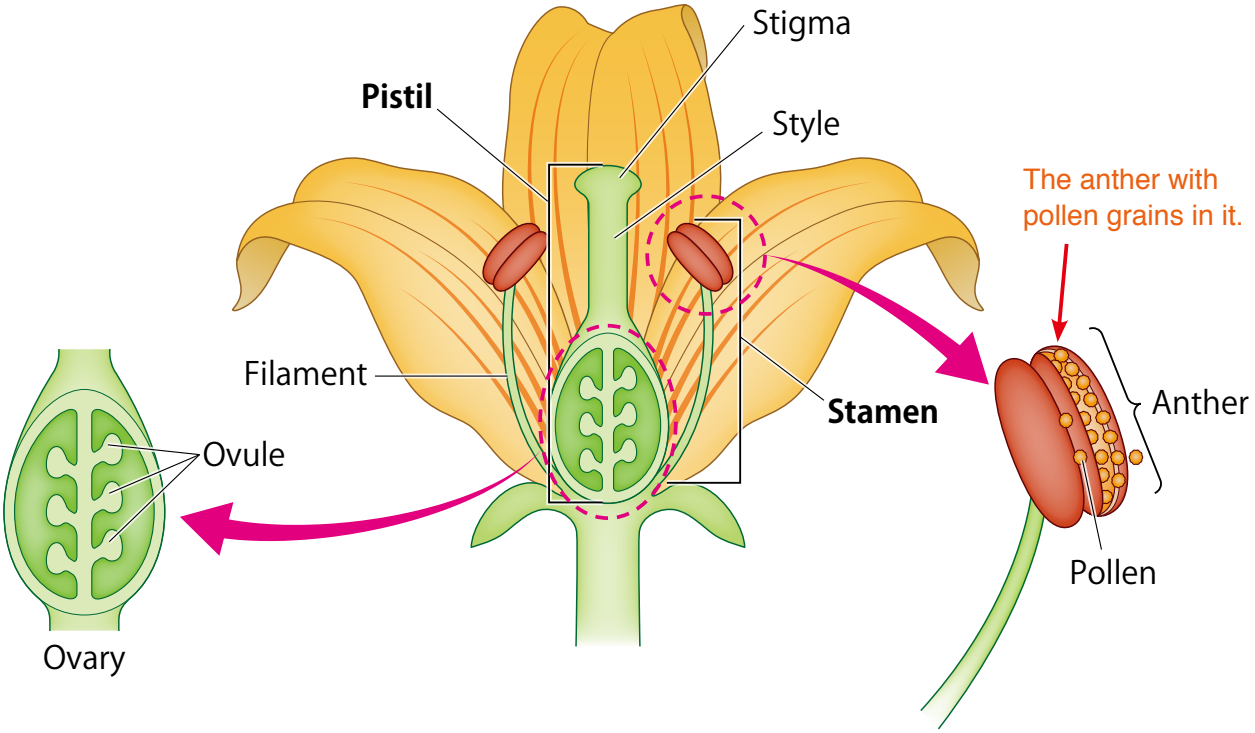
A **stamen** is the male reproductive part of a flower. The stamen is made up of two parts; filament and anther. The **filament** is the stalk that holds up the anther. The **anther** produces and stores **pollen**.



Pollen produced in an anther comes out when the anther tears open.

Pistil

A **pistil** is the female reproductive part of a flower, where the seeds are made. The pistil is found in the centre of a flower. It is made up of three parts; stigma, style and ovary. The **stigma** is the area where pollen grains are received. The **style** is the long stalk that connects the stigma to the ovary. The **ovary** produces one or more ovules which contains the egg cell.



Structures of stamen and pistil

Lesson 2 Pollination

The transfer of pollen grains from the anther to the stigma of a flower is called **pollination**. Pollination is very important for flowering plants to reproduce. How do plants transfer pollen from the anther to the stigma?

How are pollen grains transferred to the stigma?

Activity : The ways that pollen grains are transferred

What to Do:

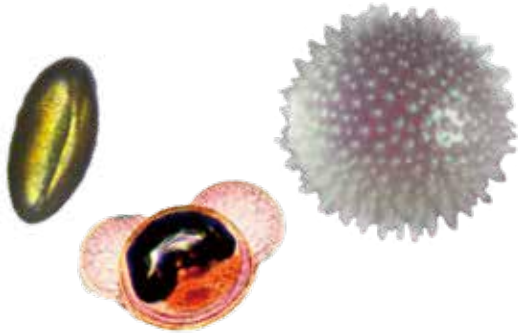
1. Draw a table like the one shown below.

The ways pollen grains are transferred

2. Study the picture below and think about the ways that pollen grains are transferred from the anther to the stigma. Record your ideas in the table.
3. Share your ideas with your classmates. Discuss how pollen grains are transferred from the anther to the stigma.

Summary

Insects, birds, water or wind help flowering plants carry pollen grains from the anther to the stigma. Pollen looks like powder or dust. Pollen can be transferred in many ways.



Pollen grains from different plants (Magnified)

Self-pollination

In some plants, pollen can move directly from the anther to the stigma of the same flowers without the help of others.

Animals

Animals can help pollination in plants. Some flowers have bright colours and sweet smell. Animals such as insects, birds and bats are attracted to the colours and the smell of the flowers. When they come to feed on sugary nectar, pollen gets stuck on their bodies. The pollen is transferred to the stigma of the same flower or different flowers as the animals move.

Honeybees help pollination in plants.

Wind

Many plants depend on the wind for pollination. Pollen grains are very light in weight. When plants release pollen into the wind, the pollen can easily float in the air and move to the stigma of the same flower or different flowers of other plants.

Pollen grains are transferred by wind.

Water

Water also helps pollination in plants. When it rains, pollen can be washed away from the anther and transferred to the stigma. Some plants that live in water also use water to carry pollen. The pollen grains float on water and move from the male parts to the female parts of the plant.

Lesson 3 Reproduction in Flowering Plants

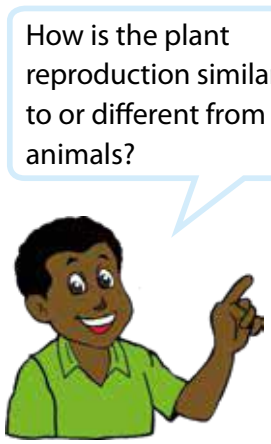
All living things have different life cycles. Plants also have life cycles. Most plants' life cycles start with a seed.

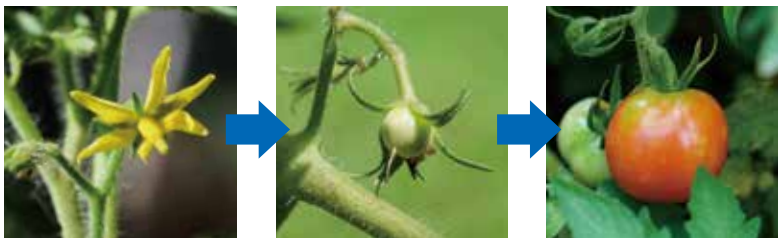
How do plants produce seeds?

Activity : Process of seed development

What to Do:

1. Study the pictures at the bottom of this page and the diagram on the next page. These pictures show the process of seed development of platns.
2. Observe the pictures carefully and record how seeds in a flower develop and change.
3. Think about the following questions based on your observations:
   (1) What happens to the pollen grain after it lands on the stigma?
   (2) In which part of a flower do seeds develop?
   (3) How does an ovary change its shape, size, texture and colour?
   (4) Which part of a flower grows and becomes a fruit?
4. Share your ideas with your classmates.
   Discuss how plants produce seeds.



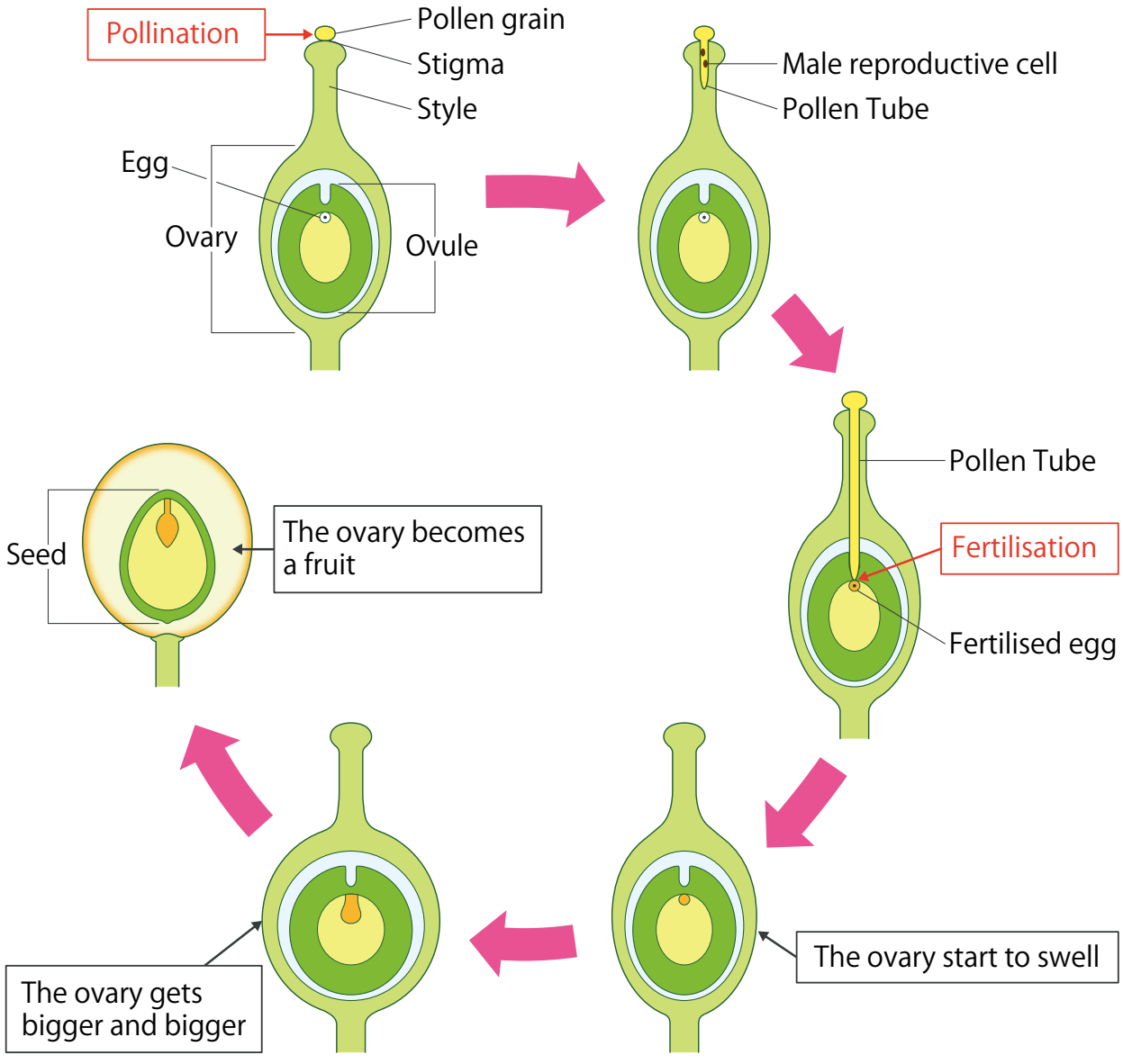


Process of seed development

1. After a pollen grain lands on the stigma, a tube .....
2. .....
3. .....

Summary

After the pollen grain lands on the stigma, it produces a tube which is called the **pollen tube**. This tube grows down from the stigma through the style and into the ovary. A male reproductive cell in the pollen grain reaches the ovule and joins the egg cell in the ovule. This joining of the male reproductive cell and the egg cell in a flower is called **fertilisation**. The ovules in the ovary develop into seeds. As the seeds develop, the ovary gets bigger and bigger and changes to become a fruit. The fruit protects the seeds until they are ready to be released. The fruits we eat are matured ovaries that surround the seeds inside.



Process of an apple seed development

Lesson 4 Heredity in Plants

Animals look like their parents because they inherit the traits from their parents when they reproduce. How about plants?

Do plants inherit the traits from their parents?

Activity : Traits of plants

What to Do:

1. Draw a table like the one shown below.

Similarities between an adult and a young tomato plant

2. The pictures below show the young and adult tomato plants. Compare the two pictures and write their similarities in the table.
3. Share your ideas with your classmates. Discuss what kinds of traits are inherited from the adult plant to the young plant.

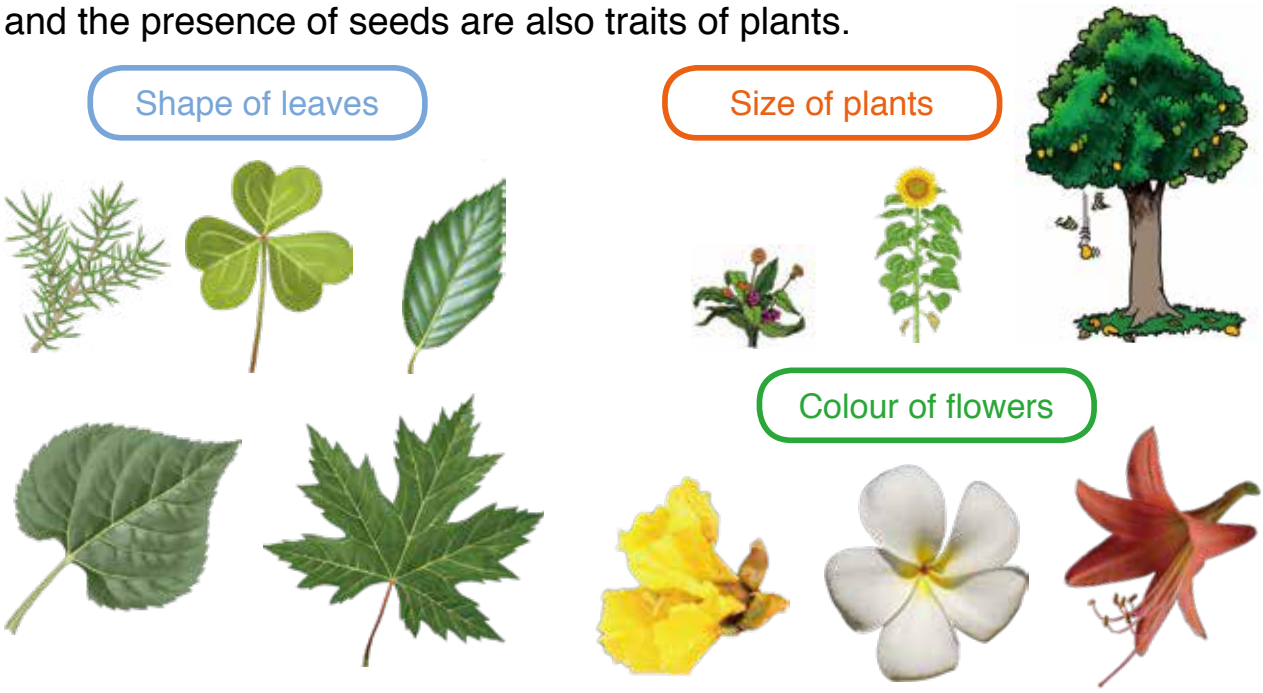
A trait is a feature or characteristic of a living thing! How can we compare and describe the traits of an adult and a young tomato?

Young tomato plant

Adult tomato plant

Summary

Heredity is the process through which traits are passed on from parents to young organisms. Like animals, plants also pass on their traits to their young. The traits of plants include the size of the adult plants, the shape of its leaves, the colour of its flowers and the kind of roots. The flavour of fruits and the presence of seeds are also traits of plants.



Young plants inherit many traits from their adult plants. For example, plants grow to be about the same height as their parents. A young tree has the same leaf shape and colour as an adult tree. The colour of a flower is usually similar to that of its parent plant. A plant with red flowers comes from an adult plant with red flowers. A mango tree produces fruits of the same shape, colour and taste as its parent tree.

A mango tree always has fruits of the same shape, colour and taste as its parent tree.

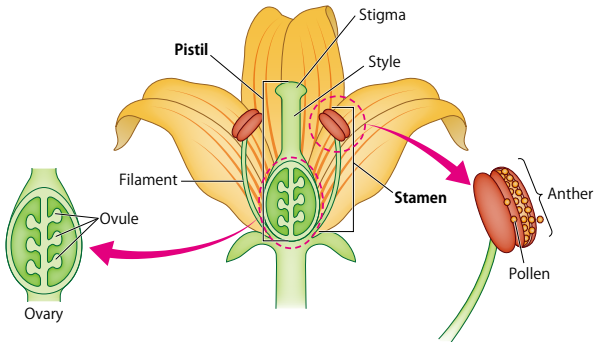
The colour of the flowers is inherited from their parents.

Summary and Exercise

Summary

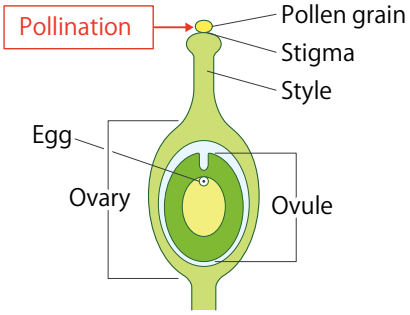
5.1 Reproduction and Heredity

Flowers



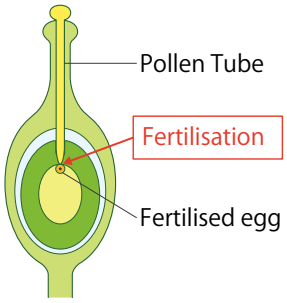
- The stamen is the male reproductive part of a flower and it is made up of the filament and the anther.
- The anther produces and stores pollen.
- The pistil is the female reproductive part and it is made up of the stigma and style.
- The ovary produce one or more ovules which contain the egg cell.

Pollination



- Insects, birds, water and wind help flowering plants carry pollen grains from the anther to the stigma.
- Pollen can be carried in many ways such as self-pollination, by animals, wind and water.

Reproduction in Plants



- Fertilisation is the joining of the male reproductive cell in the pollen grain and the egg cell in the ovule.
- The ovules in the ovary develop into seeds. As the seeds develop, the ovary gets bigger and bigger and changes to become a fruit.

Heredity in Plants

- The fruits we eat are matured ovaries that surround the seeds.
- Heredity in plants is when parent plants pass on their traits to their young plants.
- The traits of plants include the size of the adult plants, the shape of its leaves, the colour of its flowers and the kind of roots.
- The flavour of fruits and the presence of seeds are also the traits of plants.

Summary and Exercise

Exercise

5.1 Reproduction and Heredity

Q1. Complete each sentence with the correct word.

(1) The male reproductive part of a flower is called _____.

(2) The transfer of pollen grains from the anther to the _____ of a flower is called pollination.

(3) The _____ are matured ovaries that we eat and are surrounded by the seeds.

(4) Young plants inherit _____ from their parents such as shape of their leaves and the colour of their flowers.

Q2. Choose the letter with the correct answer.

(1) Which of the following parts of the flower does the pollen tube travels through to reach the egg cell?

A. Anther

B. Filament

C. Pistil

D. Style

(2) What is the name of the process through which traits are passed on from parents to young organisms?

A. Pollination

B. Fertilisation

C. Heredity

D. Germination

Q3. Answer the question below. What are some ways in which pollen grains are transferred from the flower to the stigma?

Q4. Explain what happens to the ovary after fertilisation.

Did you know that vanilla flowers cannot be pollinated naturally like other flowers? How did the method of pollination for Vanilla flowers come about?

Fruits of vanilla plant

In 1829 on the island of Reunion on the east of Madagascar, a 12 year slave boy by the name of Edmund Albius was the first to solve the botanical mystery by inventing a technique of pollination for the sterilised vanilla flower to produce fruits. His technique of hand-pollination is still being used to this day.

He observed that little bees were happily pollinating the plants everywhere, but here the bees were nowhere to be found near the vanilla flowers.

He also learnt to hand-pollinate a watermelon 'by joining the male and female parts together.'

Flower of vanilla

Edmund observed the vanilla closely, looking for the part of the flower that produced pollen. He also discovered the part that needed to be dusted, so that the plant could bear fruit. He noticed that the two reproductive parts of the flower, the male anther and the female stigma, were separated by a little lid. He lifted the flap and while holding it up, simultaneously rubbed the pollen in with a little stick. He had discovered the rostellum, the lid that many orchid plants have, including the vanilla orchid, probably was the part that was stopping the plants from self-pollination.

Chapter Test

5. Reproduction and Heredity in Plants

Q1

Complete each sentence with the correct word.

(1) The main reproductive parts of a flower are stamen and _____.

(2) Pollination is the process of transferring _____ from the anther to the stigma of a flower.

(3) The ovules in the ovary develop into _____.

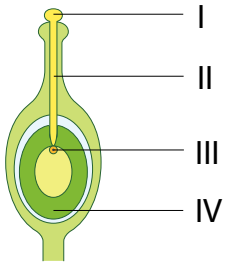
Q2

Choose the letter with the correct answer.

(1) Which part of the flower produces pollen grains?

A. Ovule
B. Anther
C. Style
D. Filament

(2) Which roman numeral represents the female egg cell of a flower?



A. I
B. II
C. III
D. IV

(3) What is the name of the process that joins a male reproductive cell in the pollen grain and egg cell in the ovule?

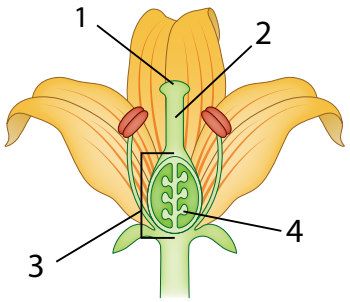
A. Fertilisation
B. Heredity
C. Pollination
D. Germination

(4) What would cause insects to be attracted to plants for pollination?

A. Shape and colour of the leaves
B. Colour and smell of the fruits
C. Colour and smell of the flowers
D. Colour and shape of the stem

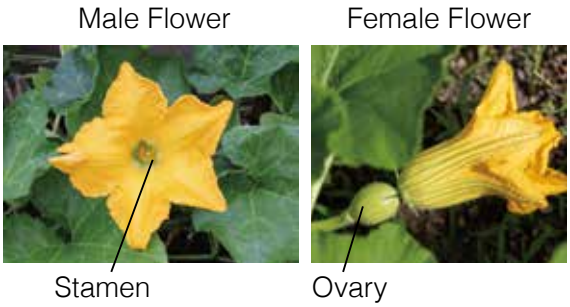
Q3

(1) What are the names of parts of the flower labeled in the picture on the right?



1. _____
2. _____
3. _____
4. _____

(2) A student observed the flowers of the pumpkin plant on the right and noticed that the male flower and female flower are two different flowers. If there were no insects for pollination, what would be a way for pollen grains to be transferred to the stigma from the stamen?



_____

(3) Why does the shape of leaves on the young and the adult tomato plant the same?

_____

Q4

(1) How do the light weight pollen grains help in the pollination process in a wind pollinated plant?

_____

_____

(2) On the way from school, you came across two very similar plants but only the shapes of their leave edges were different. If the plants flower, what can you infer about their flowers?

_____

_____

_____

Chapter 6

Star

Look at the night sky. We can see many stars. Can you find the Southern Cross?

We learnt about the Earth, Sun and the Moon. How are stars similar?

6.1 Stars

Lesson 1 Stars

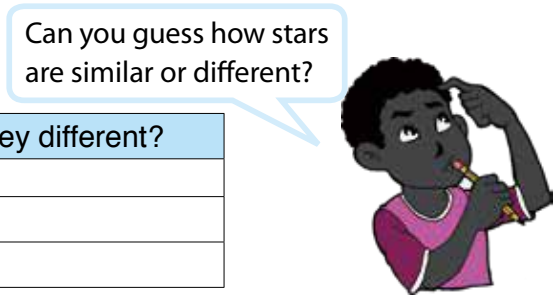
When we look at the night sky we can see thousands of stars. What do they look like? How are they similar or different?

What is a star?

Activity : How are stars similar and different?

What to Do:

1. Draw a table like the one shown below.



How are they similar?	How are they different?

2. Study the picture below and discuss how stars are similar or different.
3. Write the properties of stars in the table.
4. Share your ideas with your classmates. Discuss how stars can be classified.

Summary

A **star** is a giant ball of hot gasses. The Sun is also a star. It gives off light, heat and other forms of energy. There are many different types of stars.

Colours

Stars appear to be in different colours such as blue, white, yellow, orange and red. The colours of stars depend on how hot they are. Hot stars are white or blue, whereas cooler stars appear as orange or red. The Sun is a yellow star. The surface temperature of the Sun is about 5 500°C.

The colours and temperatures of stars

Brightness

Some stars appear to be brighter than the others. For example, Sirius which resides in the constellation of Canis Major is the brightest star in the night sky. Canopus in the constellation of Carina is also a bright star that can be seen in the southern sky.

Sirius in the constellation Canis Major

Size

Stars come in different sizes. The diameter of the Sun is about 1 390 000 km. It is one hundred and nine times bigger than the diameter of the Earth. The smallest star is only about 20 km across in diameter. The largest star is up to two thousand one hundred times the size of the Sun.

Lesson 2 Movement of Stars

The Sun and the Moon seem to move from east to west. How about stars? Do stars also move like the Sun and the Moon?

How do stars move?

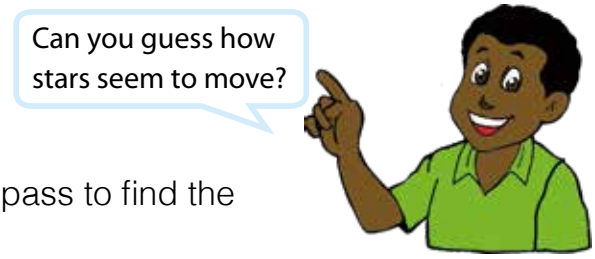
Activity : Observing the movement of stars

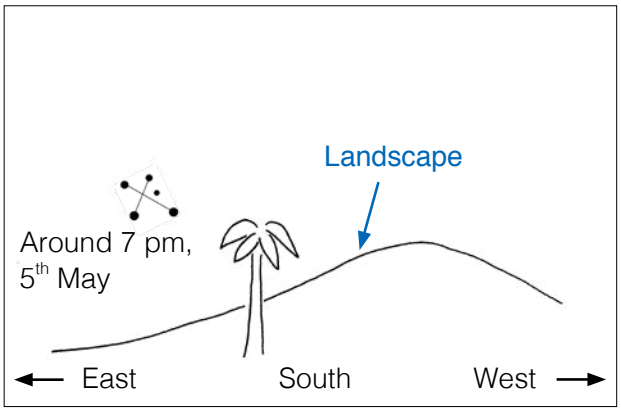
What We Need:

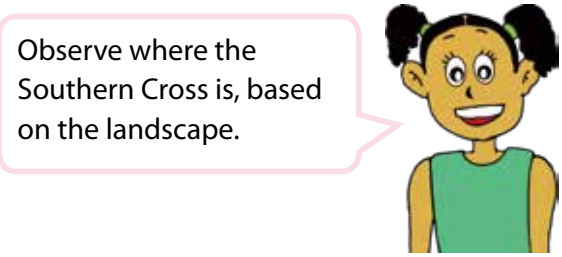
- compass

What to Do:

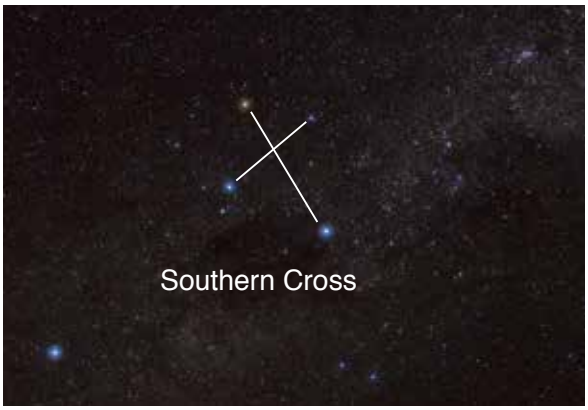
1. Study the night sky and use the compass to find the Southern Cross in the southern sky.
2. Mark the position where you observe the Southern Cross.
3. Sketch the landscape you see and the direction in your exercise book.
4. Observe and record the position of the Southern Cross and the time like the one shown below.
5. After one hour stand at the same position as in Step 2 and repeat Step 4.
6. Share your ideas with your classmates. Discuss how stars move.





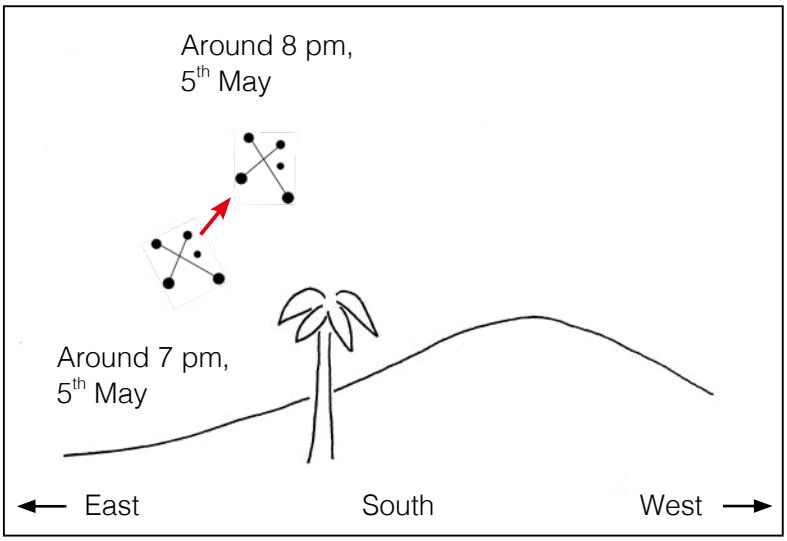


Observe the stars at night with adults.



Result

We found out that the Southern Cross changes its position in the sky without changing its shape each hour.



The position of the Southern Cross changes each hour.

Summary

The stars actually do not move. The stars seem to rise in the east, move across the sky and set in the west. This is because the Earth spins on its axis from west to east. But the shape of each constellation does not change. The stars in each constellation has the same pattern even though the constellation appears to be moving.

Stars seem to move from the east to the west without changing their shapes.

Lesson 3 Constellations

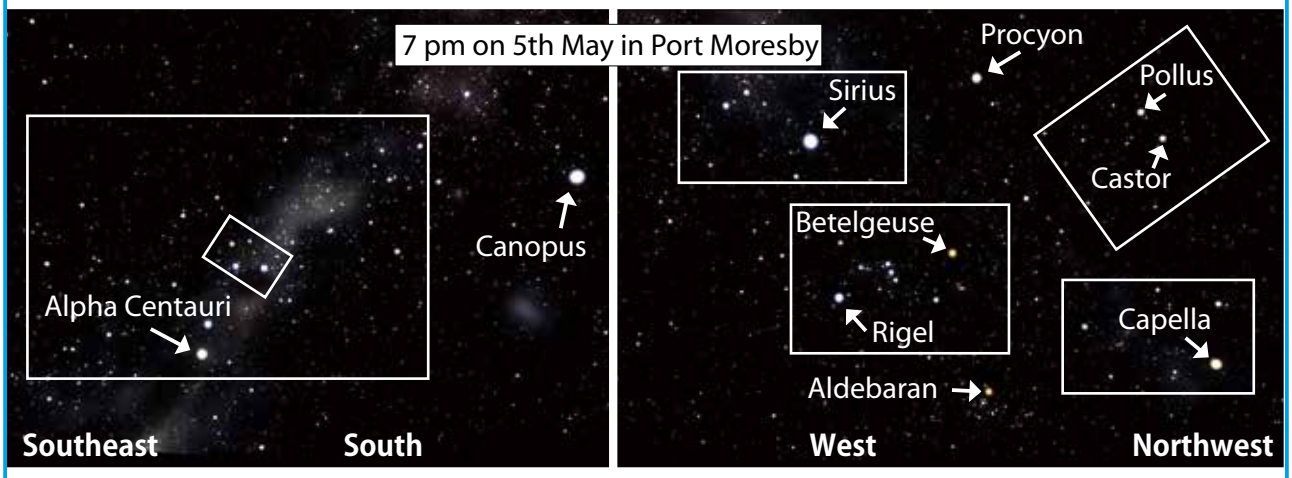
We can see a lot of stars in the night sky. Have you ever seen a group of stars that look like objects or animals?

What are constellations?

Activity : Finding constellations

What to Do:

1. Go to a clear space out of the house on a clear night where the sky can be clearly seen.
2. Find the direction of south and west with a compass. Find the southern and the western direction in the sky chart below.
3. Study the southern and the western night sky and observe the stars.
4. Find the bright stars pointed by white arrows and a group of stars surrounded by rectangles shown in the sky chart below.
5. Sketch the patterns of the stars you observed in your exercise book.
6. Can you find the same patterns of the stars in the sky chart as observed from the sky? Share your findings with your classmate about how star patterns look like.

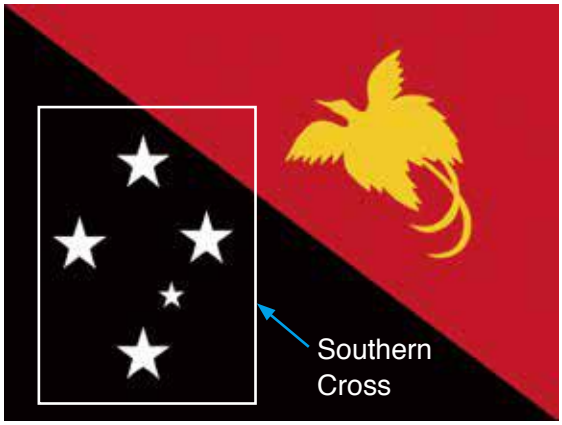


Let's read 'how to use a compass' in Science Tool Box.

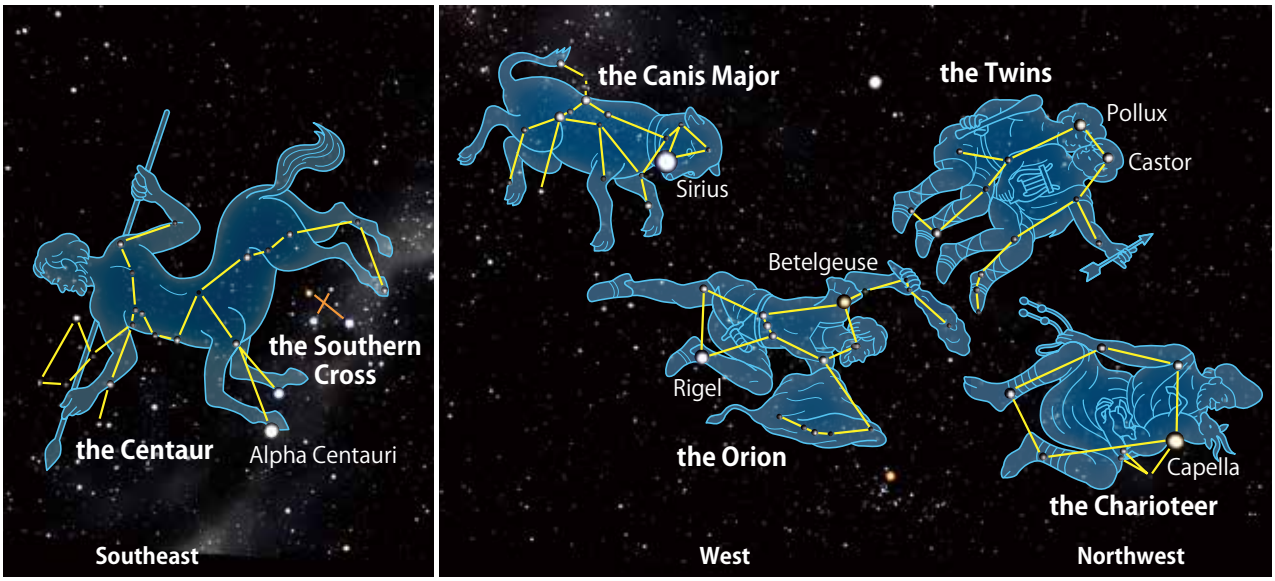
Observe stars with adults!

Summary

A group of stars that form a particular pattern is called a **constellation**. The pattern may take the shape of a person, animal, tool or musical instrument. People all over the world tell stories about the constellations they see. Constellations appear in season. But they appear in the same place in the same day, every year. After a rainy season, an early night sky in Papua New Guinea is best for star observation with major stars and constellations. Constellations are useful. People used constellations for navigation. By observing the constellations, people can work out the direction to help travel across the oceans. Constellations are also used for agriculture. The constellations helped ancient people know when to plant and harvest crops. There are eighty-eight different constellations. One well-known constellation in Papua New Guinea is the **Southern Cross** which is featured on our national flag. The pictures below show some examples of constellations that can be seen from Papua New Guinea.



The Southern Cross is featured on the national flag.



Major stars and constellations

Summary and Exercise

Summary 6.1 Stars

Stars

- A star is a giant ball of hot gases.
- The Sun is a star.
- A star gives off light, heat and other forms of energy.
- Stars come in different sizes.
- Stars come in different colours such as blue, white, yellow, orange and red.
- The colours of stars depend on how hot they are.
- Hotter stars are white or blue and cooler stars are orange or red.

The colours and temperatures of stars.

Movement of Stars

- The stars seem to rise in the east, move across the sky and set in the west. This is because the Earth spins on its axis from west to east.
- The pattern of the stars in each constellation does not change because the stars actually do not move.
- An example of a constellation is the Southern Cross. It changes its position in the sky without changing its shape.

Constellation

- Constellation is a group of stars that form a particular pattern in the sky.
- The pattern appears in the shape of a person, animal, tool or musical instrument.

The Southern Cross on the national flag.

- There are eighty-eight different constellations which are very useful to people for navigation and agriculture.
- Southern Cross is a well-known constellation seen in a Papua New Guinea night sky. Hence, it is featured on the national flag.

Summary and Exercise

Exercise 6.1 Stars

Q1. Complete each sentence with the correct word.

(1) The _____ is a giant ball of hot gases.

(2) Stars come in different colours based on their surface _____.

(3) The stars seem to rise in the _____ and set in the _____.

(4) People used constellations for navigation and _____.

Q2. Choose the letter with the correct answer.

(1) Which constellation is featured on our national flag?

A. the Canis Major

B. the Charioteer

C. the Twins

D. the Southern Cross

(2) Based on your observations of the night sky, which of the following is the correct statement about the movement of the stars?

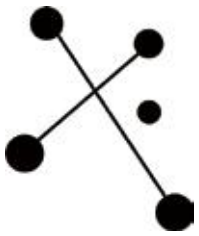
A. The stars move across the sky from east to west.

B. All stars never move in the sky.

C. All stars move randomly in the sky.

D. The stars appear to rise in the west.

Q3. Answer the following questions.



(1) Study the star pattern on the right. What is the name of this constellation?

(2) Two stars were observed. One was red and another was blue in colour. Which of the two stars is higher in temperature?

Q4. Anna observes a star in the night sky every one hour and noticed that it was moving. What is causing the star to move from one position to another position?

Are new stars born like living things?

Yes! Like living things on the Earth, star is born in the universe. A star is formed in a large thick cloud of dust and gas where it is called a Nebula. The cloud of dust and gas begins to come together and form a cloudy ball because of its gravity, and when it is hot enough it glows like our Sun and then the new star is born. Stars live for thousands to billions of years until it uses up its energy.

Look at the picture below taken by the telecsope. This is the Orion Nebula, the brightest nebula in the night sky, which is visible with the naked eye as a reddish patch in the constellation of Orion. The Orion Nebula is a place where thousands of new stars are forming from the dust and gas.

The centre part of the Orion Nebula

Thousand of stars are born in the Orion Nebula that is located in the constellation of Orion.
(NASA, ESA, M. Robberto (Space Telescope Science Institute/ESA) and the Hubble Space Telescope Orion Treasury Project Team)

Chapter Test

6. Star

Q1

Complete each sentence with the correct word.

(1) The _____ of stars depend on how hot they are.

(2) Hot stars are _____ or blue.

(3) The stars appear to rise in the _____ and set in the _____.

(4) There are _____ different constellations in the sky.

Q2

Choose the letter with the correct answer.

(1) What is a constellation?

A. A group of stars that appear to form a pattern.

B. A group of stars that are physically close to each other.

C. A large, round object that orbits the Sun.

D. A single collection of cloud of gases and dust.

(2) Why do stars come in different colours?

A. Because they seem to move from east to west.

B. Because they have different temperatures.

C. Because of their distance from the Earth.

D. Because of their sizes.

(3) What is the name of the constellation featured on the national flag of Papua New Guinea?

A. the Twins

B. the Orion

C. the Canis Major

D. the Southern Cross

(4) Which of these is the brightest star in the sky at night?

A. Alpha Centauri

B. Canopus

C. Rigel

D. Sirius

Q3

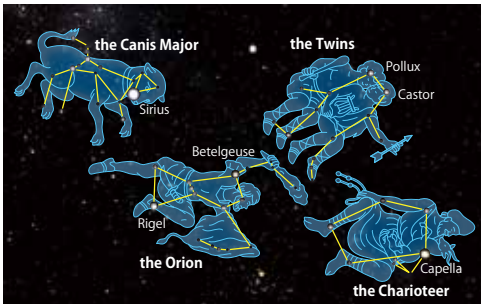
(1) Why are constellations useful to people in ancient times or even today?

_____

_____

(2) In which constellation does Sirius belong to?

_____



(3) Stars come in different colours such as blue, white, yellow, orange and red. What is the difference between white and blue stars and orange and red stars?

_____

_____

Q4

Study the picture shown on the right. Stars do not move but they appear to rise in the east, move across the sky and set in the west.

(1) Why do stars move in this manner without changing shape of constellation?

_____

_____

(2) Explain the similarity of the movement of the Sun, the Moon and the stars in the sky.

_____

_____

Chapter 7

Energy

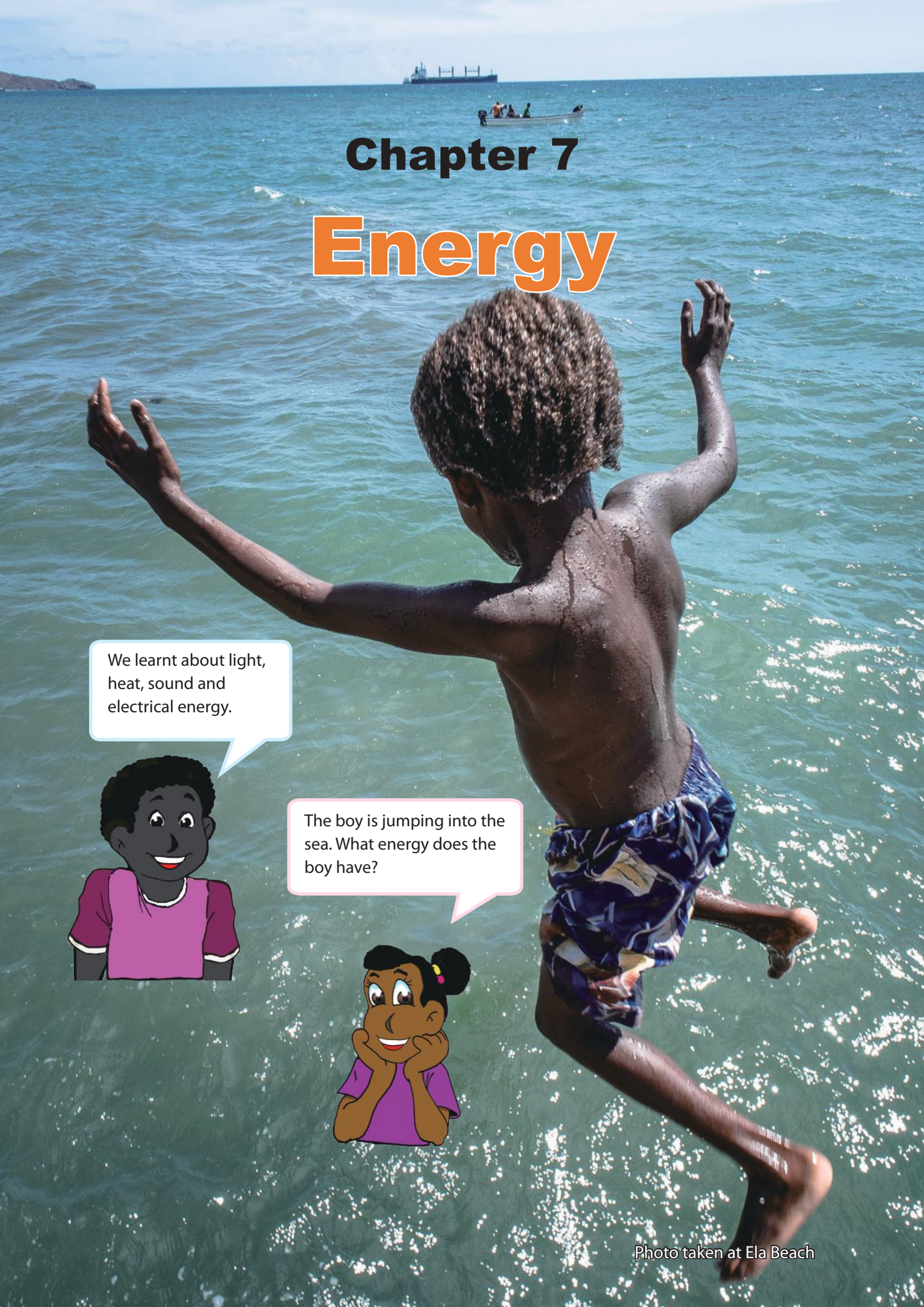


Photo taken at Ela Beach

7.1 Forms and Uses of Energy

Lesson 1 Kinetic Energy

There are many different forms of energy around us such as; light, heat, sound and electricity. How about an object in motion? Does a moving ball also have some kind of energy?

What form of energy does a moving object have?

Activity : Knocking down bottles of water

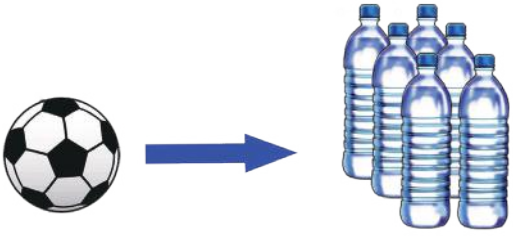
What We Need:

- 6 bottles of water, ball

What to Do:

1. Draw a table like the one shown on the right.
2. Arrange the bottles of water on the ground as shown in the picture below.
3. Roll the ball slowly towards the bottles and record the number of bottles knocked down.
4. Repeat Steps 2 and 3 three times.
5. Arrange the bottles again and this time, roll the ball faster towards the bottles.
6. Record the number of bottles knocked down.
7. Repeat Steps 5 and 6 three times.
8. Share your results with your classmates. Discuss what causes the difference in the results.

	Number of bottles knocked down		
Speed of ball	1st attempt	2nd attempt	3rd attempt
Slow			
Fast			



Result

We found out that when the ball moved faster, it knocked down more bottles of water than when it moved slower.

Discussion

Think about the following questions based on your result.

1. Does the moving ball have energy? Why do you think so?
2. What is the relationship between the amount of energy and the speed of the ball?

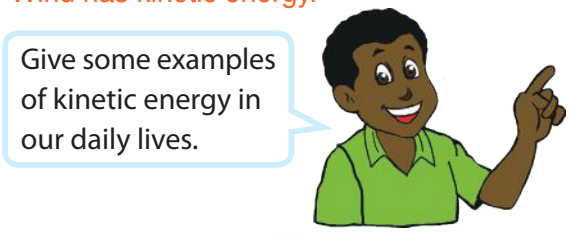
Summary

A moving object has kinetic energy. **Kinetic energy** is the energy of a moving object. Any object in motion has kinetic energy. For example, a moving car has kinetic energy. When you are running, your body also has kinetic energy. Wind is moving air so it also has kinetic energy.

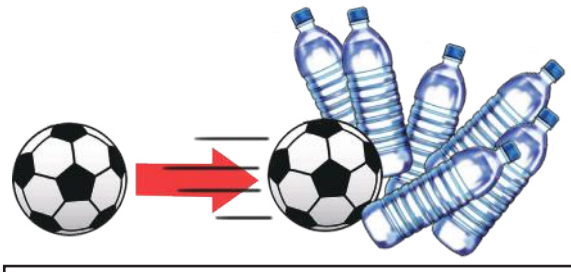
The amount of kinetic energy that an object has depends on the speed of the object. The faster the object moves, the larger kinetic energy it has.

A running animal has kinetic energy.

Wind has kinetic energy.



Slow moving ball has smaller kinetic energy.



Fast moving ball has larger kinetic energy.

Lesson 2 Potential Energy 1: Gravitational Potential Energy

A pencil rolling on a desk has kinetic energy because it is in motion. Does a pencil on a desk also have any energy when it is at rest?

What form of energy is stored in an object at rest?

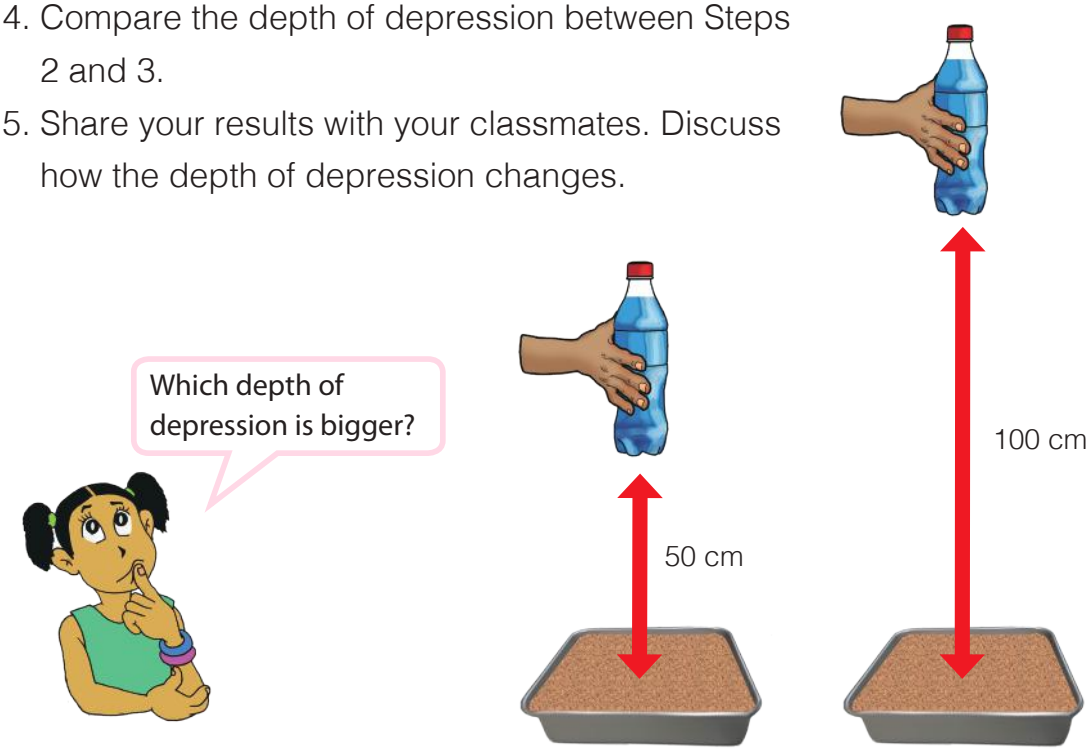
Activity : Dropping an object from different heights

What We Need:

- a bottle of water, deep tray, sand, tape measure

What to Do:

1. Fill the tray with sand.
2. Hold the bottle at the height of 50 cm above the tray of sand. Drop the bottle on the tray and measure how deep the depression is on the sand. Record the measurement in your exercise book.
3. Flatten the sand on the tray. Hold the bottle at the height of 100 cm above the same sand. Drop it again and measure the depth of depression. Record the measurement in your exercise book.
4. Compare the depth of depression between Steps 2 and 3.
5. Share your results with your classmates. Discuss how the depth of depression changes.



Result

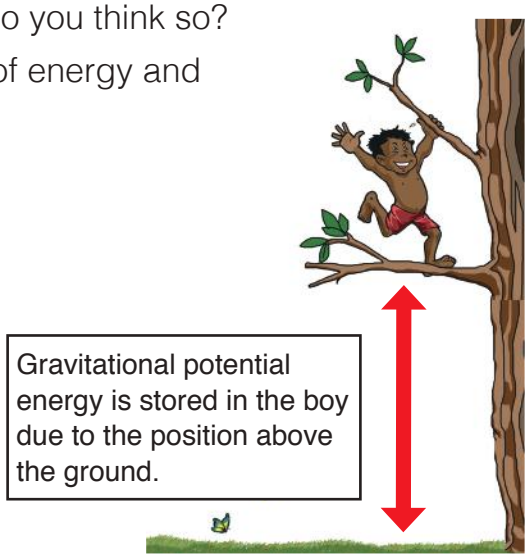
We found out that a deeper depression was created when the bottle of water was dropped from a higher position.

Discussion

Think about the following questions based on your result.

1. What happened to the sand when the bottle was dropped from a higher position?
2. Did the bottle at rest have any energy? Why do you think so?
3. What is the relationship between the amount of energy and the height of the bottle?

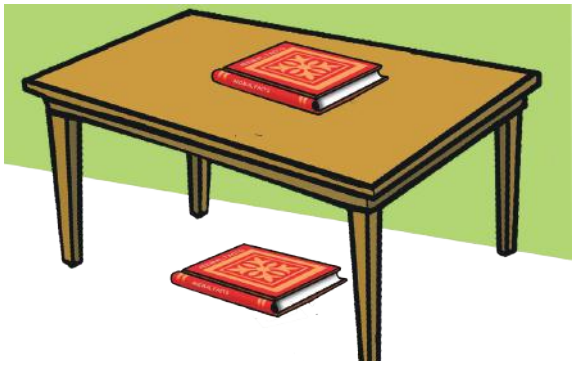
Summary



Gravitational potential energy in the boy depends on his height above the ground.

Gravitational potential energy is the energy stored in an object. Gravitational potential energy in an object depends on its height above the Earth's surface. For example, a boy standing on a branch of a tree has energy. He does not seem to have any energy when he is not moving but he has stored energy. He has stored gravitational potential energy due to his position above the ground.

The higher an object is, the more gravitational potential energy it stores. Therefore, the higher a bottle of water is, the deeper the depression it can create on the ground.



Objects at higher position have greater gravitational potential energy.

Lesson 3 Potential Energy 2: Chemical Energy

We eat food to get energy. We burn wood to get heat and light. What form of energy is stored in the food and wood?

What different forms of energy are stored in objects?

Activity : Energy stored in objects

What to Do:

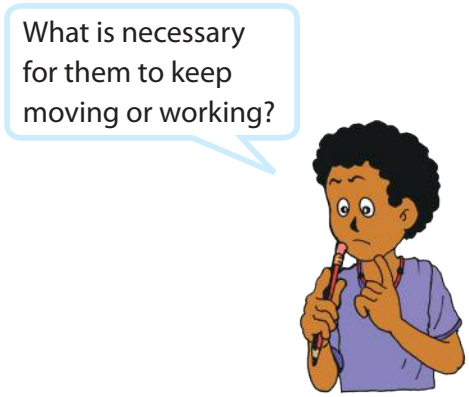
1. Draw a table like the one shown below.

	How do they get energy to move or work?
A mobile phone working	
A boy running	
A fire producing heat and light	
A flashlight lighting	
A car speeding	

2. Study the pictures below. Identify how each of them get energy to move or work and record your findings in the table.
3. Share your ideas with your classmates. Discuss how energy is stored and how they are classified.

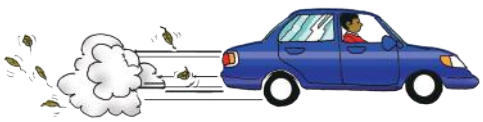
A mobile phone working

A boy running



A fire producing heat and light

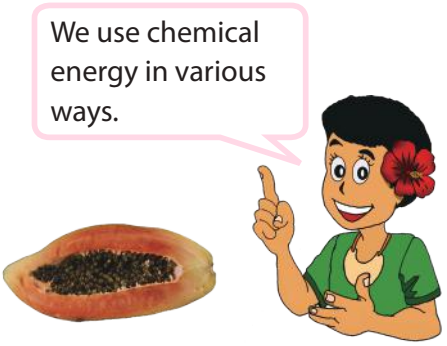
Flashlight lighting



A car speeding

Summary

Chemical energy is energy stored in foods, batteries and fuels. It is a form of potential energy. Unlike gravitational potential energy, chemical energy does not depend on the position of the object. Chemical energy stored in an object can be changed into other forms of energy through chemical changes.



Food

Food stores chemical energy. When food is eaten, the food is digested and the stored energy in the food is used by our body to do work. The chemical energy helps to keep us warm, enabling us to move and carry out all life processes.

Battery

The chemical energy is stored in batteries. A flashlight gets its energy from batteries (dry cells) inside it. When an electrical device operated by batteries is switched on, the chemical energy stored in the batteries is changed into electrical energy. This enables the device to work.

Fuel

Chemical energy is also stored in fuels such as gasoline, charcoal, natural gas and wood. The way chemical energy is used in fuels is by burning. Heat and light energy come from burning wood. Gasoline is burnt to produce motion in the engine of a car and the motion moves the car.

Lesson 4 Forms of Energy

There are many forms of energy around us. Can you identify what forms of energy can be found in our daily lives?

What situations do the different forms of energy exist in?

Activity : Finding the different forms of energy

What to Do:

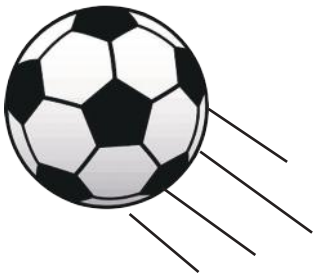
1. Draw a table like the one shown below.

Forms of Energy	What situation?

2. Study the picture below and find the different forms of energy; kinetic, gravitational potential, chemical, electrical, light, sound and heat energy.
3. Write in the table the forms of energy and the situations they are used or stored.
4. Share your ideas with your classmates. Discuss how the different forms of energy can be classified and in what situation these different forms of energy can be found in our lives.

Summary

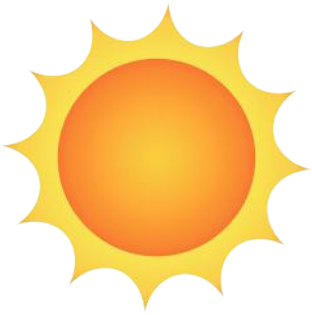
Energy can be widely found in our everyday lives and comes in many different forms.
A moving ball has kinetic energy. An apple on the tree stores gravitational potential energy and chemical energy inside it. The Sun produces heat and light energy.
Electrical energy enables us to run electrical appliances to make our lives easier.



Kinetic Energy

Gravitational Potential Energy

Chemical Energy



Heat and Light Energy

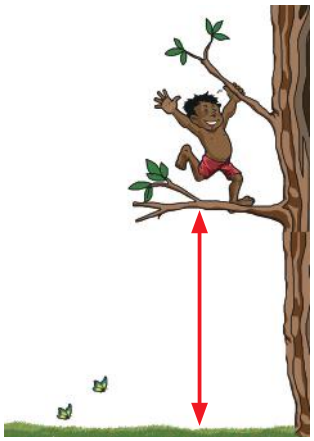
Electrical Energy

Forms of Energy	Description	Sources of Energy	Examples in daily life
Kinetic Energy	Energy in objects that are moving.	Movement of an object.	To move an object.
Gravitational Potential Energy	Energy that is stored in an object because of its position.	Position of an object above the Earth's surface.	To fall objects into ground.
Chemical Energy	Energy that is stored in an object.	Foods, batteries, fuels	To enable us to work. To light a torch. To move cars.
Electrical Energy	Energy that runs electrical appliances.	Power outlet, batteries	To run electrical appliances and other machines.
Sound Energy	Energy that we can hear.	Drum, speaker, voice	To hear music. To communicate with others.
Light Energy	Energy that enables us to see.	The Sun, fire, flashlight, burning of fuels	To see objects. To light up dark place.
Heat Energy	Energy that makes objects warm and hot.	The Sun, fire, burning of fuels	To cook food. To make our body warm.

Summary and Exercise

Summary

7.1 Forms and Uses of Energy



Forms and Uses of Energy

- **Kinetic energy** is energy of a moving object.
  - The amount of kinetic energy of an object depends on the speed of the object.
- **Gravitational potential energy** is energy stored in an object.
  - Gravitational potential energy in an object depends on its height above the Earth's surface.
- **Chemical energy** is energy stored in foods, batteries and fuels.
  - Chemical energy stored in an object can be changed into other forms of energy through chemical changes.
- Energy can be widely found in our everyday lives and comes in many different forms. Some forms of energy, their descriptions and sources are provided in the table below.

Forms of Energy	Description	Sources of Energy
Kinetic Energy	Energy in objects that are moving.	Movement of an object.
Gravitational Potential Energy	Energy that is stored in an object because of its position.	Position of an object above the Earth's surface.
Chemical Energy	Energy that is stored in an object.	Foods, batteries, fuels
Electrical Energy	Energy that runs electrical appliances.	Power outlet, batteries
Sound Energy	Energy that we can hear.	Drum, speaker, voice
Light Energy	Energy that enables us to see.	The Sun, fire, flashlight, burning of fuels
Heat Energy	Energy that makes objects warm and hot.	The Sun, fire, burning of fuels

Summary and Exercise

Exercise

7.1 Forms and Uses of Energy

Q1. Complete each sentence with the correct word.

(1) Energy stored in an object at a height above the Earth's surface is called _____ _____ energy.

(2) Energy of a moving object is known as _____ energy.

(3) Form of energy stored in food, fuel and batteries is _____ energy.

Q2. Chose the letter with the correct answer.

(1) Which pictures are examples of kinetic energy?

(A)	(B)	(C)	(D)

(2) Which of the following has stored chemical energy in fuel?

A. A girl running

B. Charcoal for barbeque

C. A boy standing on top of the roof

D. Sound from a speaker

Q3. Answer the following questions.

(1) What does the amount of kinetic energy of an object depend on?

(2) Look at the picture of the two books on the right. Which of these would have the largest gravitational potential energy stored?

Q4. Ketsin observed a very tall coconut tree on a windy day. The wind blew so strong that a coconut fell off the tree to the ground. Describe the forms of energy Ketsin observed on that day.

7.2 Energy Conversion

Lesson 1 Relationship between Kinetic and Gravitational Potential Energy

When we hold a ball above the ground, it has potential energy because of its position. When we drop the ball, it has kinetic energy because of its motion.

What is the relationship between kinetic and potential energy?

Activity : A marble rolling down and up

What We Need:

- clear plastic tube, marble

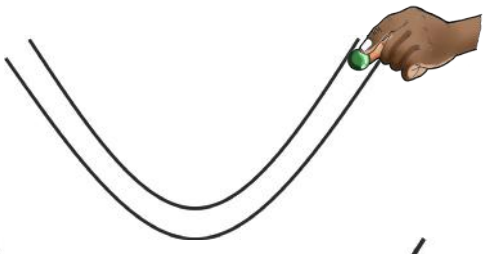
How does the speed of the marble change as its position changes?

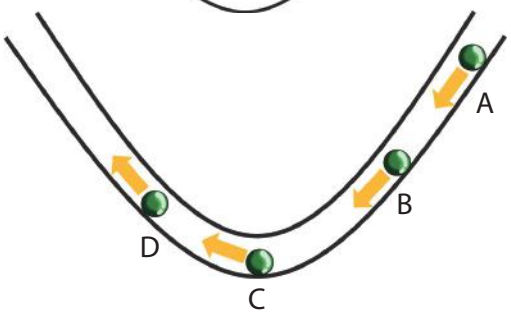
What to Do:

1. Draw a table like the one shown below.

	Before the marble reaches the ground	After the marble passes through the ground
Height of marble		
Speed of marble		

2. Curve the plastic tube as shown in the picture below.
3. Predict how the movement and the height of the marble will change if you drop the marble into the tube.
4. Drop the marble into the top of the tube.
5. Observe how the height and the speed of the marble changes in the tube.
6. Record your observations in the table.
7. Share your findings with your classmates. Discuss the relationship between the speed and the height of the marble.





Result

We found out that as the marble fell, its height decreased but its speed increased. After passing through the ground level, its height increased but its speed decreased.

	Before the marble reached the ground level	After the marble passed through the ground level
Height of marble	decreased	increased
Speed of marble	increased	decreased

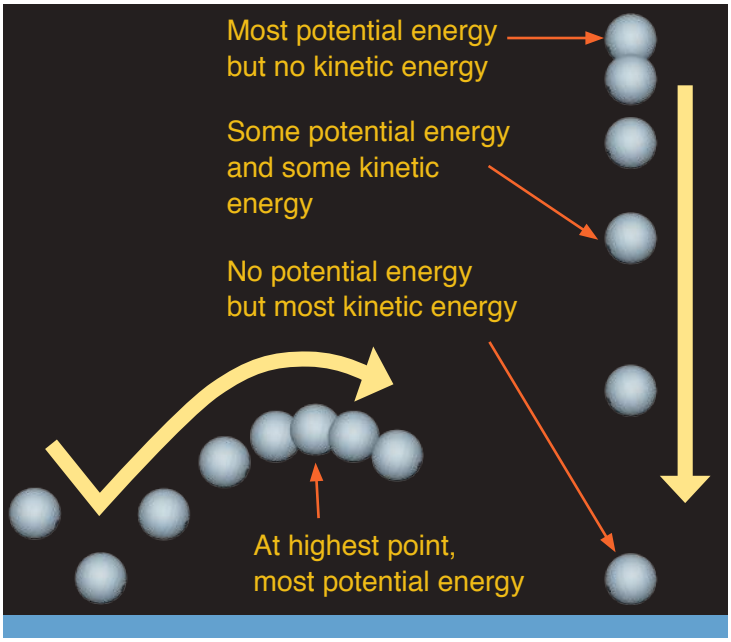
Discussion

Think about the following questions based on your result.

1. At which point does the marble has the most and least potential energy?
2. At which point does the marble has the most and least kinetic energy?
3. How does gravitational potential and kinetic energy change when the marble goes down and up?

Summary

Gravitational potential energy can be changed to kinetic energy and back again. When we hold a ball above the ground it has only gravitational potential energy. When we release the ball it starts moving. Some of its potential energy is transformed into kinetic energy. Kinetic energy increases while gravitational potential energy decreases during its fall. The moment before the ball hits the ground, all of its potential energy is transformed into kinetic energy. When the ball bounces off the ground, it moves upward. Its kinetic energy is decreased and potential energy is increased. When the ball is at its highest point, it has the most potential energy.



Relationship between potential and kinetic energy

Lesson 2 Change in Forms of Energy in Daily Life

Energy changes from gravitational potential to kinetic and back again. How about other forms of energy? Does energy also change into different forms?

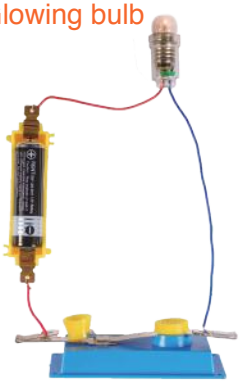
How does energy change form?

Activity : The ways energy changes forms

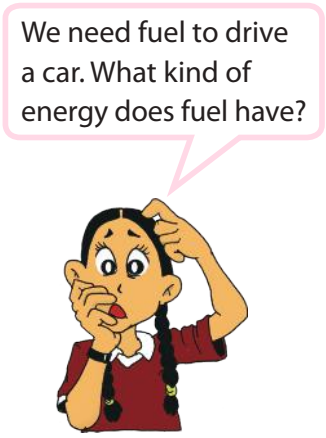
What to Do:

1. Study the pictures below. Identify the forms of energy in each picture and describe how the forms of energy changes in your exercise book.
2. Share your ideas with your classmates. Discuss how energy changes forms in our daily lives.

A. Glowing bulb



B. Moving car



C. Watching TV

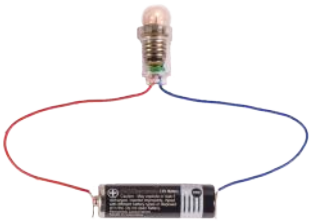
D. Releasing water from a dam

Summary

Energy can exist in many forms and it can be changed from one form to another. The change in the forms of energy can be observed everywhere in our daily life. The following show some examples of the change in forms of energy in our daily lives.

Chemical Energy → Electrical Energy → Light and Heat Energy

Chemical energy stored in a dry cell changes to electrical energy when it is connected to a closed circuit. The electrical energy changes to light and heat energy when the current passes through the light bulb.



Glowing bulb

Chemical Energy → Kinetic, Sound and Heat Energy

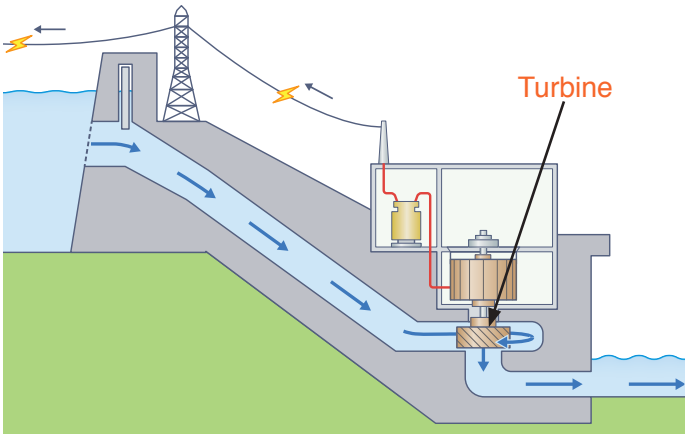
A car needs fuel to move. Fuel stores chemical energy. The engine in a car changes the chemical energy to kinetic energy to move the car. Then sound and heat energy are also released.

Electric Energy → Light and Sound Energy

Electricity comes from power points in a house. A television changes electrical energy to light and sound energy so we can see image and hear sound while watching program.

Potential Energy → Kinetic Energy → Electrical Energy

People build dams to produce electricity. Large amounts of water stored in dams have a lot of gravitational potential energy. The energy changes to kinetic energy that turns the turbine in power plants. When the turbine spins, electricity is generated.



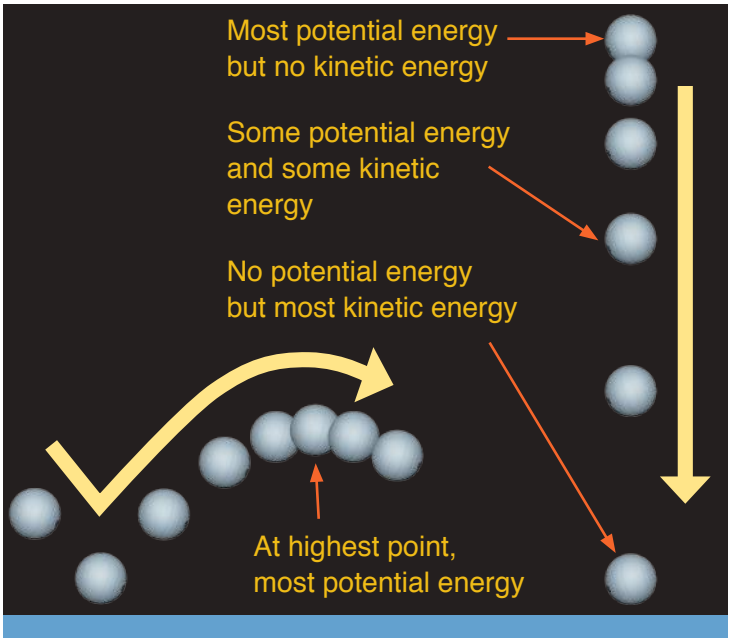
Hydroelectric plant

Summary and Exercise

Summary 7.2 Energy Conversion

Kinetic Energy and Gravitational Potential Energy

- Gravitational potential energy can be changed to kinetic energy and back to gravitational potential energy again.
- Kinetic energy of an object increases while its gravitational potential energy decreases in falling.
- Kinetic energy of an object decreases while its gravitational potential energy increases in object moving upward.

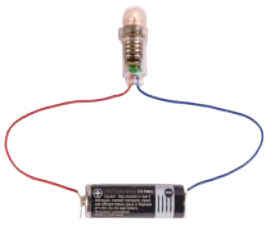


Conversion of Energy

- Energy exists in many forms and changes from one form to another.
- The change in the forms of energy can be observed everywhere in our daily lives.

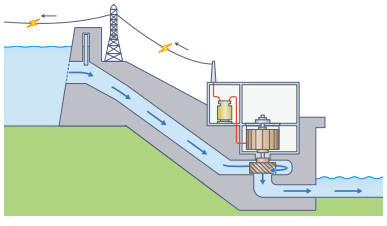
Chemical Energy ⟶ Electrical Energy ⟶ Light and Heat Energy

Chemical energy stored in a battery changes to electrical energy that changes to light and heat energy when the electrical current passes through the circuit.



Potential Energy ⟶ Kinetic Energy ⟶ Electrical Energy

When the water flows down through the dam, the gravitational potential energy changes to kinetic energy to turn the turbine in the power plant. When the turbine is spinning, electricity is generated.



Summary and Exercise

Exercise 7.2 Energy Conversion

Q1. Complete each sentence with the correct word.

(1) Chemical energy stored in a dry cell changes to _____ energy when it is connected to an electrical circuit.

(2) After a ball is bouncing off the ground, gravitational potential energy can be changed to _____ energy.

(3) Energy that is generated by moving turbines in a power plant is _____ energy.

Q2. Choose the letter with the correct answer.

(1) Fuel is used to move a car. Which of the following is the correct order of energy changes when the car moves?

A. Chemical energy → Kinetic energy

B. Sound energy → Kinetic energy

C. Gravitational potential energy → Chemical energy

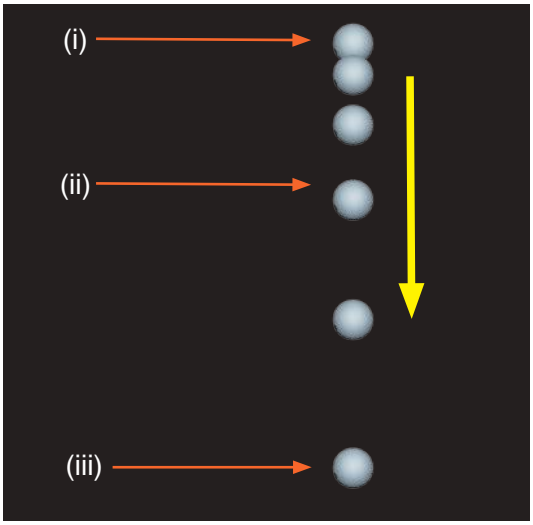
D. Light energy → Chemical energy

Q3. Study the picture on the right and answer the following questions.

(1) At which position is there more gravitational potential energy?

(2) At which position is less gravitational potential energy?

(3) Describe the change of kinetic energy of the ball during the fall.



Q4. When going uphill Jonathan stood up and pedaled the bicycle with great effort, when he reached the top he sat down and went downhill without pedalling. Why did Jonathan pedal uphill with great effort?

How do we use wind?

We can feel winds on our faces and body. We can see wind sway trees. Wind is moving air all the time in the Earth's atmosphere. Winds have kinetic energy.

Sailing across oceans

The kinetic energy of winds was used by our ancestors to sail their boat and travel across ocean to other places to trade. Lakatoi is sail boat of Papua New Guinea. They are named in the Motu language and traditionally used in the Hiri trade voyages.

A Lakatoi at seashore during Hiri Moale Festival.

Generating electricity

Today there are many homes and industries that depend on electricity to power electric appliances. But producing electricity often leaves wastes in the land, air and water. People are now looking for clean energy and wind is one of the sources of clean energy that is renewable. In order to generate electricity from wind, large windmills called wind turbines are used. The wind turbine converts kinetic energy of wind to electrical energy by turning the blades which spin the turbine. When the turbine spins, electricity is generated.

Wind turbines to generate electricity

Chapter Test

7. ENERGY

Q1

Complete each sentence with the correct word.

(1) The stored energy in a battery is called _____ energy.

(2) The energy that a moving object has is called _____ energy.

(3) A generator is a machine that generates _____ by converting kinetic energy when its turbine is spinning.

(4) The stored energy in an object placed at high place is _____ _____ energy.

Q2

Choose the letter with the correct answer.

(1) Which list contains sources of chemical energy?

A. Power outlet, battery and bulb

B. Voice, speaker and drum

C. Fuel, battery and food

D. Air, sunlight and fire

(2) There are four marbles on each cupboard at different heights. Which is true if the marbles were to fall off the cupboards?

A. Marble ❸ has more gravitational potential energy.

B. Marble ❶ will have more speed when it falls.

C. Marble ❷ will have more kinetic energy than ❹.

D. Marble ❹ has more gravitational potential energy.

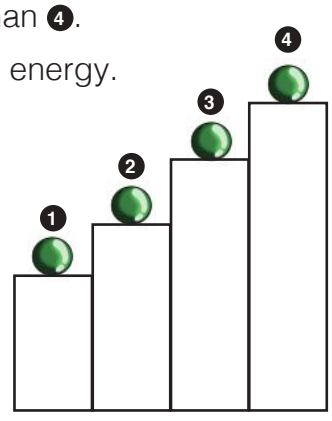
(3) Which of the marbles would increase in speed more than the others during the fall?

A. ❶

B. ❷

C. ❸

D. ❹



(4) Which of the following is <u>not</u> correct about energy?

A. Energy can change from one form to another.

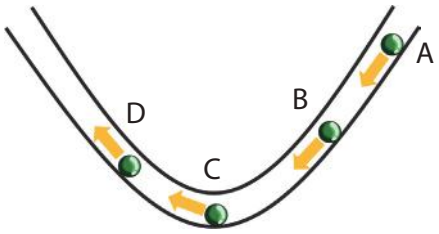
B. Kinetic energy can be changed to gravitational potential energy.

C. An object being at rest does not have any energy.

D. The Sun is a source of heat and light energy.

Q3

(1) Study the diagram. A marble started rolling at point A and moved down the slope.



(i) At which point does the marble have the most gravitational potential energy?

_____

(ii) At which point does the marble have the most kinetic energy?

_____

(iii) Describe the energy change during the marble moving from point C to D.

_____

_____

(2) Name the energy as it changes form in each situation as shown by the arrows.

i) Listening to the radio working by batteries

_____ energy → _____ energy → _____ energy

ii) Cooking using a gas stove

_____ energy → _____ energy + _____ energy

iii) Generating electricity at a hydroelectric plant

_____ _____ energy → _____ energy → electrical energy

Q4

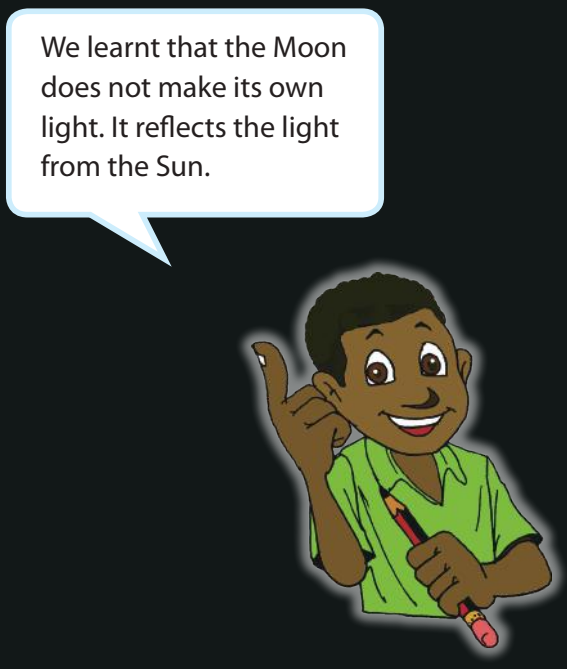
Melo is riding his bike along the path. He starts on level ground. But when he gets to a hill, he has to pedal harder to go up the hill at the same speed. Why does this happen?

_____

_____

Chapter 8

Moon



8.1 Moon in Motion

Lesson 1 Movement of the Moon

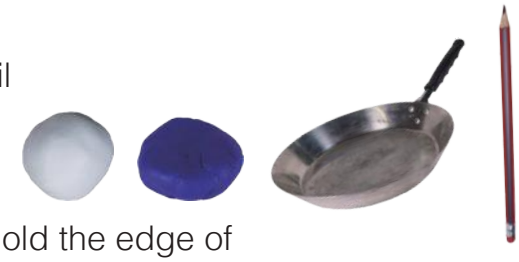
We can see the Moon moving from east to west in the sky from the Earth. But how does the Moon move when we see it from space?

How does the Moon move in space?

Activity : Revolving and spinning

What We Need:

- one blue clay, one white clay, pan, pencil



What to Do:

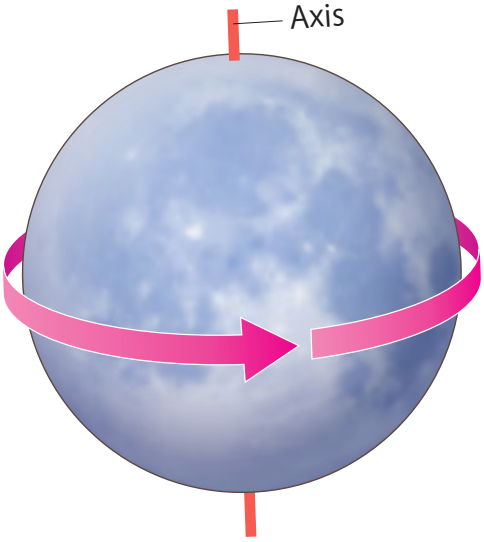
1. Shape the white clay into a ball.
2. Stick the pencil through the white clay. Hold the edge of the pencil and spin it. Observe how the white clay moves.
3. Remove the white clay from the pencil and put it in the pan. Attach the blue clay in the middle of the pan.
4. Hold the pan and move the white clay around the blue clay in the pan. Observe how the white clay moves.
5. Think about the following questions:
   (1) How are the movements of the white clay in Steps 2 and 4 different?
   (2) The white clay represents the Moon and the blue clay represents the Earth. Can you guess how the Moon moves?
6. Share your ideas with your classmates. Discuss your answers.

Summary

The Moon has two main movements: Rotation and Revolution.

Rotation

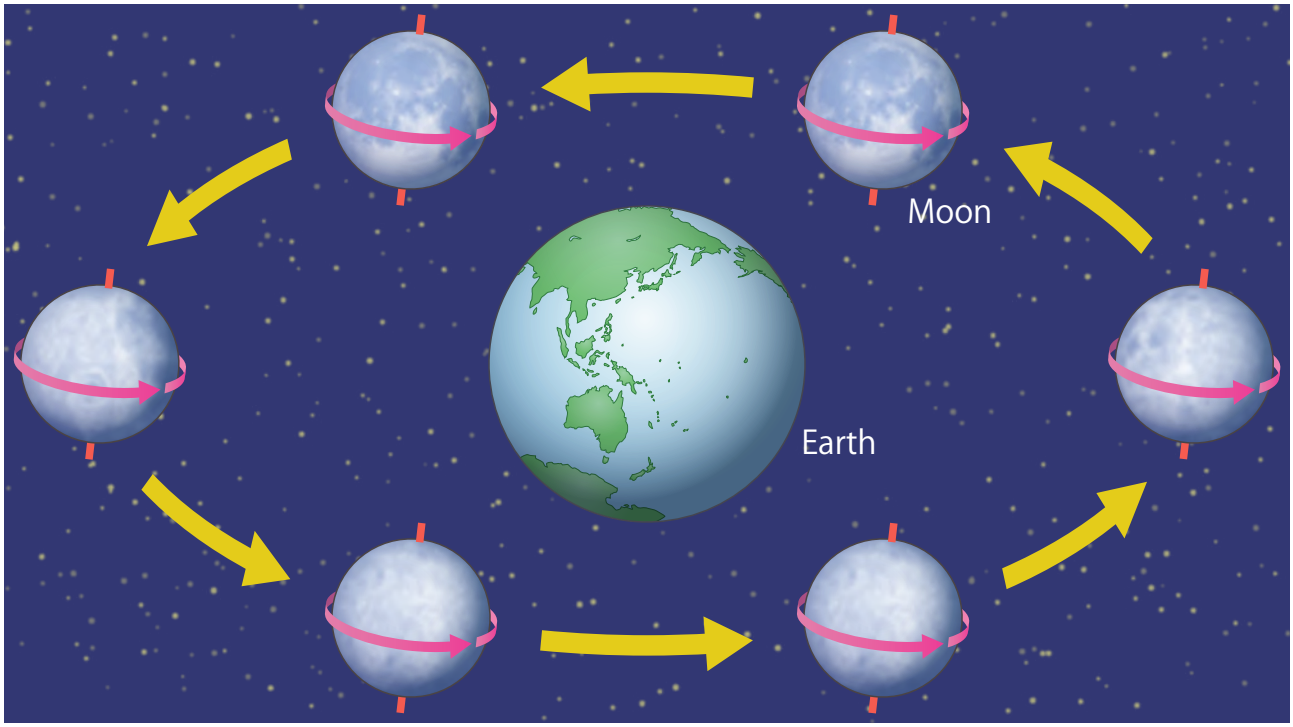
The Moon spins in space. This movement is called **rotation**. The Moon also rotates on its axis. An **axis** is an imaginary line through the centre of an object around which it rotates or spins. It takes about 27.3 days for the Moon to rotate once.



The Moon rotates or spins on its axis.

Revolution

The Moon also moves around the Earth. This movement is called **revolution**. The Moon revolves in an orbit around Earth by rotating on its axis. An **orbit** is the path the Moon takes to go around the Earth. It also takes about 27.3 days for the Moon to orbit the Earth once.



The Moon revolves in an orbit around the Earth by rotating on its axis.

Lesson 2 Causes of Moon Phases

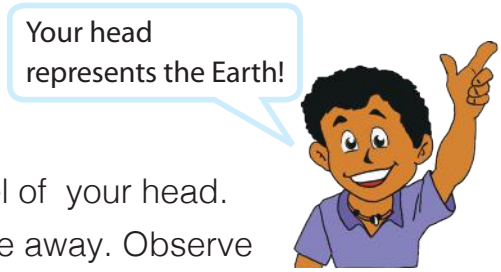
The Moon seems to change its shape every night. Why do the phases of the moon occur?

What causes the phases of the Moon?

Activity : Modelling the Moon Phase

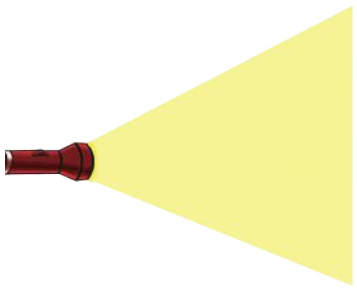
What We Need:

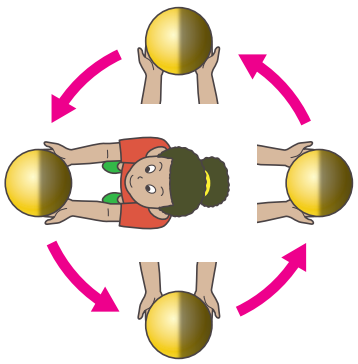
- small ball, flashlight



What to Do:

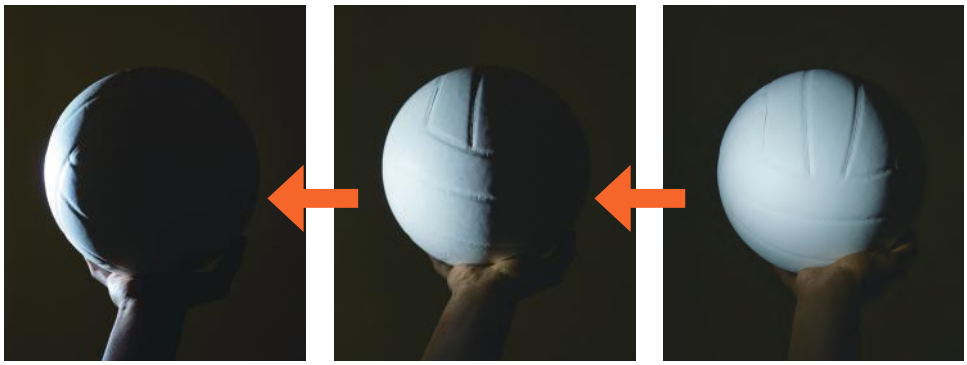
1. Hold the ball in front of you above the level of your head. Have your friend hold the flashlight a metre away. Observe how the ball appears to you.
2. As you hold the ball, slowly make a turn in anticlockwise direction, keeping the ball in front of you. Observe how the ball appears to change its lit surface in this position.
3. Draw the shape of the light and the dark surface of the ball that you observed.
4. Share your findings with your classmates. Discuss how the Moon appears to change its shape.





Result

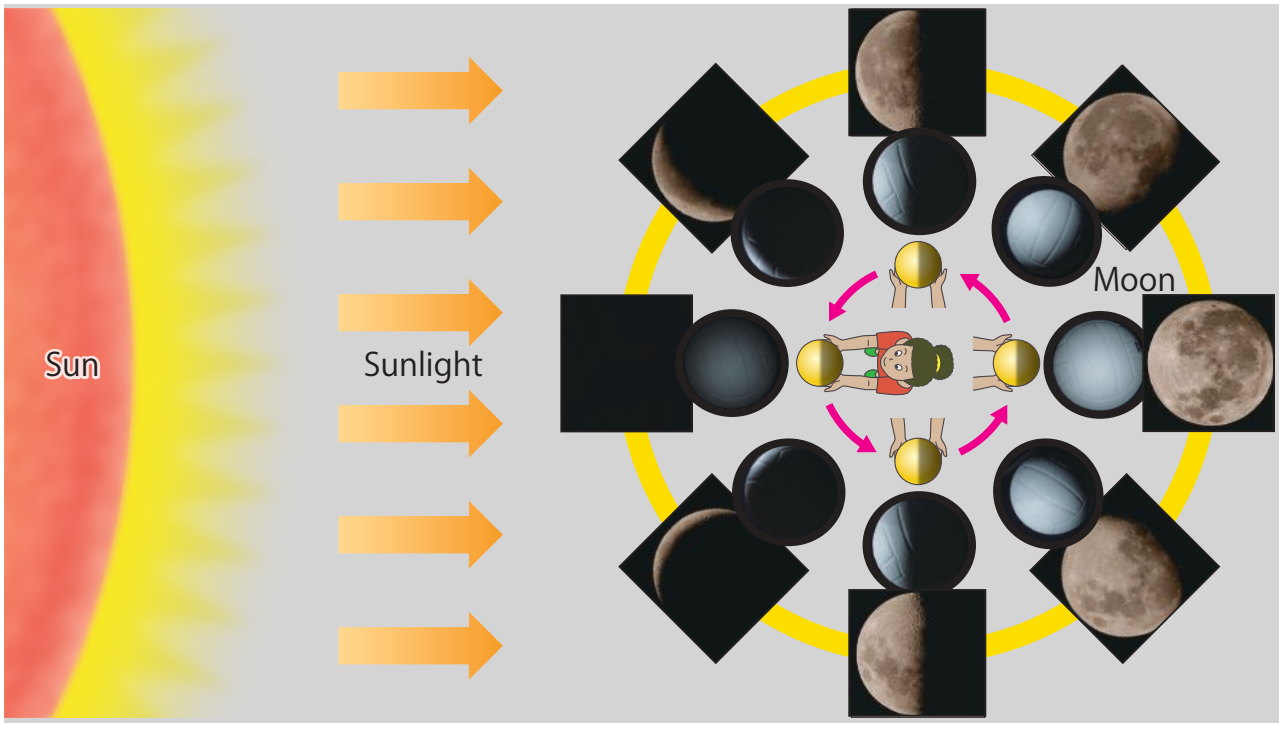
We found out that the amount of the lit area of the ball changed when we made a turn.



Changes in the amount of the lit area of the ball represents the moon phases.

Summary

The changes in the amount of the lit areas of the Moon that can be seen from the Earth are called **moon phases**. The moon phases depend on the Moon's position in relation to the Sun. The Moon does not produce its own light like the Sun. The Moon reflects light from the Sun. We only see the lit side of the Moon that is facing the Sun. The amount of the lit side of the Moon changes according to the relationship between the position of the Moon and the Sun. These changes cause moon phases.



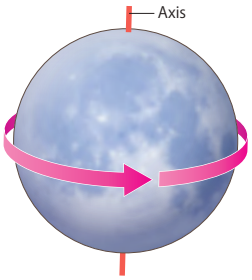
The amount of the lit side of the Moon changes according to the relationship between the position of the Moon and the Sun.

Summary and Exercise

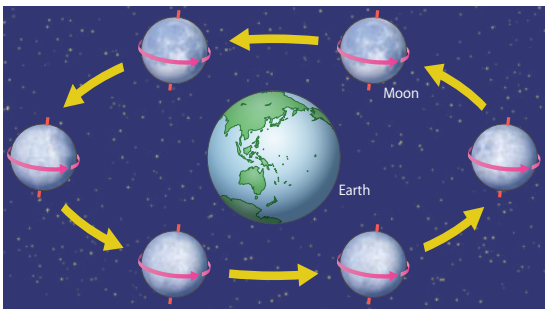
Summary 8.1 Moon in Motion

Movement of the Moon

- The Moon has two main movements; rotation and revolution.
- The Moon rotates on its axis as it spins in space.
- It takes about 27.3 days for the Moon to spin once.
- The Moon also moves around the Earth and this movement is called revolution.
- The Moon revolves in an orbit around the Earth.
- An orbit is the path the Moon takes to go around the Earth.
- It takes about 27.3 days for the Moon to orbit the Earth.



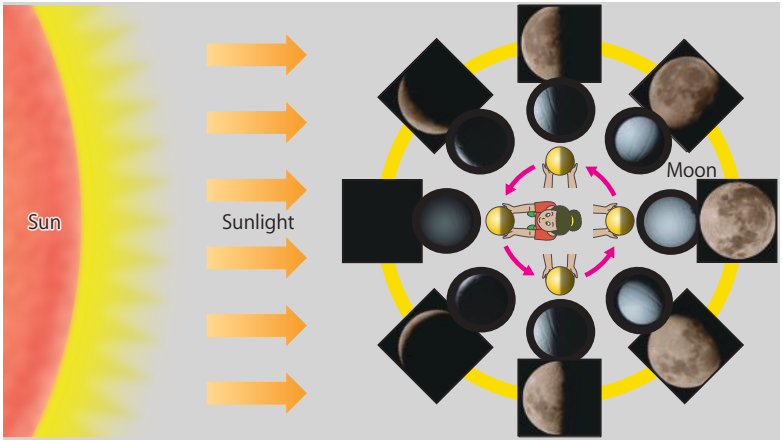
The Moon rotates or spins on its axis.



The Moon revolves in an orbit around the Earth.

Causes of Moon Phases

- The Moon does not make its own light like the Sun but it reflects light from the Sun.
- The changes in the amount of lit areas of the Moon that can be seen from the Earth are called moon phases.
- The amount of the lit side of the Moon changes according to the relationship between the position of the Moon and the Sun. These changes cause moon phases.
- The moon phases depend on the moon's position in relation to the Sun.



Summary and Exercise

Exercise 8.1 Moon in Motion

Q1. Complete each sentence with the correct word.

(1) The path taken by the Moon to go around the Earth is called _____.

(2) The movement of the Moon around the Earth is called _____.

(3) The changes in the amount of lit area of the Moon are moon _____.

(4) The lit side of the _____ facing the Sun is seen from the Earth.

Q2. Choose the letter with the correct answer.

(1) What is the name of an imaginary line through the centre of an object around which it rotates or spins?

A. Revolution

B. Orbit

C. Phase

D. Axis

(2) Which of the following is <u>not</u> a correct statement about the Moon? The Moon..

A. revolves the Earth once every 27.3 days.

B. phase depends on the Moon's position in relation to the Sun.

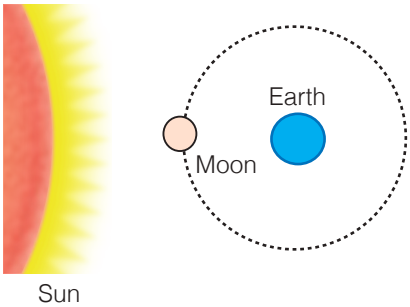
C. does not spin on its axis.

D. has two movements of rotation and revolution.

Q3. Draw the Moon phases represented by the figures (i), (ii) and (iii) shown in the pictures on the right.

(i) (ii) (iii)

Q4. Look at the diagram on the right. What would the moon phase look like when you see it from the Earth? Explain why.



What does ocean tides creates?

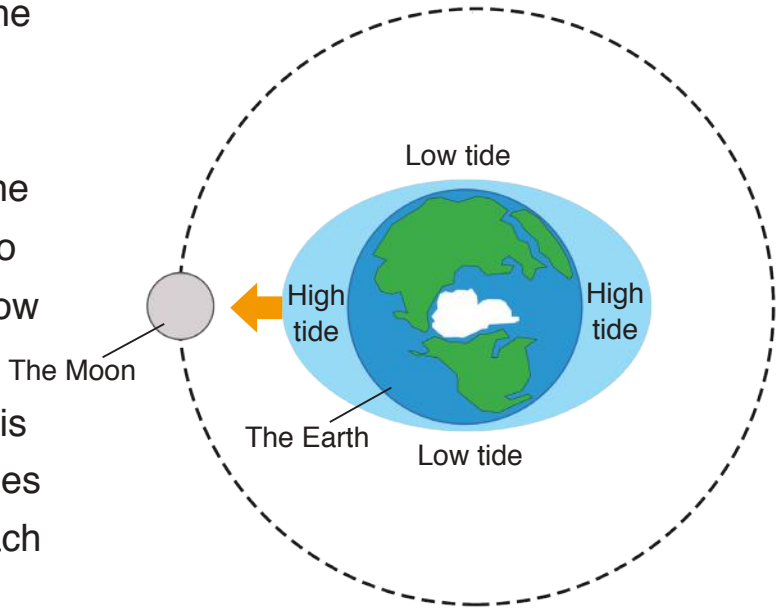
Tides are rise and fall in sea level in relation to the land. Each day, there are two high tides and two low tides. There is about 6 hours between the high tide and the low tide.

High tide

Low tide

Tides are created because the Earth and the Moon are attracted to each other due to gravitatioal force, just like unlike poles of magnets are attracted to each other. The Moon tries to pull anything on the Earth closer to it. But the Earth holds onto everything except the water in the oceans. As shown in the diagram below, the gravitational force of the Moon pulls the water in the oceans upwards making the oceans bulge, which creates high tide in the areas of Earth facing the Moon and on the opposite side. At the same time, in other parts of the planet, the ocean water drains away to fill these bulges, creating low tides.

The Earth rotates on its axis once a day, so two high tides and two low tides occur each day.



The gravitational force of the Moon makes the water in the oceans bulge and causes a high and low tide on the Earth.

Chapter Test

8. Moon

Q1

Complete each sentence with the correct word.

(1) The Moon can be seen moving from _____ to West in the sky.

(2) The Moon reflects light from the _____.

(3) It takes the Moon about 27.3 days to orbit the _____.

(4) The path taken by the Moon to go around the Earth is called _____.

Q2

Choose the letter with the correct answer.

(1) What causes the Moon's phases to change?

A. The Moon's spin

B. The Moon's revolution around the Earth

C. The Earth's spin

D. The Sun's spin

(2) What happens when you see the Moon's phases change? The Moon seems to change its

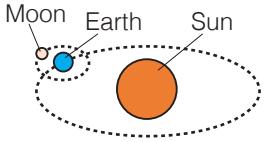
A. colour.

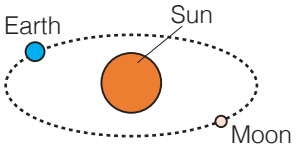
B. speed.

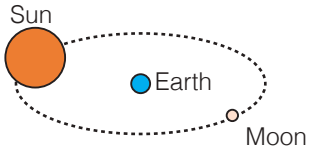
C. shape.

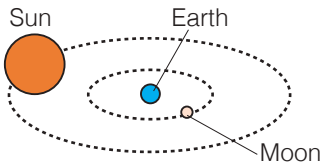
D. distance.

(3) Which of these best shows that the Earth revolves around the sun as the Moon revolves around the Earth?

A. 

B. 

C. 

D. 

(4) Why does the Moon appear to move across the sky in the day?

A. It travels around the Earth every day.

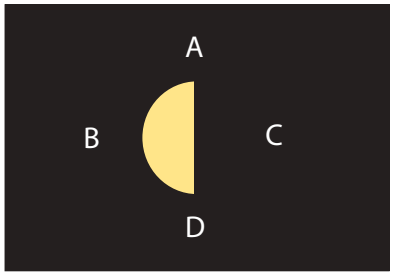
B. The Earth rotates on its axis.

C. All objects in space are moving.

D. It is extremely far away.

Q3

Use the picture of the moon shown on the right to answer the two questions below.



(1) At what direction is the sun?

_____

(2) The area between A, B and D is lit by the Sun. Why is the area between A, C and D shaded black?

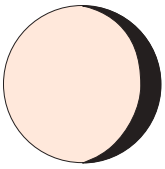
_____

(3) The Moon moves around the Earth. What do we call this movement?

_____

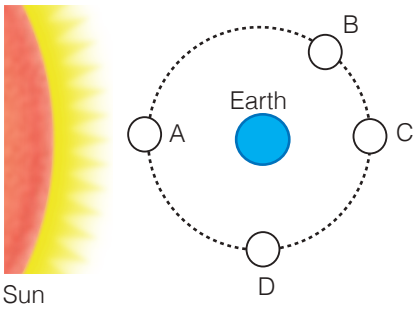
Q4

Edward is keeping a journal of the Moon phases for homework assignment. His sketch of how the Moon appeared on a clear night is shown on the right.



(1) Study the diagram on the right. Which position was the Moon located in space when he observed it?

_____



(2) How will the phase of the Moon look like if the Moon is at position C in the diagram? Explain why.

_____

_____

_____

Chapter 9

Electromagnet

9.1 Properties of Electromagnet

Lesson 1 Characteristics of Electromagnet

An **electromagnet** is a type of magnet which consists of a coil of wire wrapped around an iron core with electric current flowing in the coil.

What are the characteristics of an electromagnet?

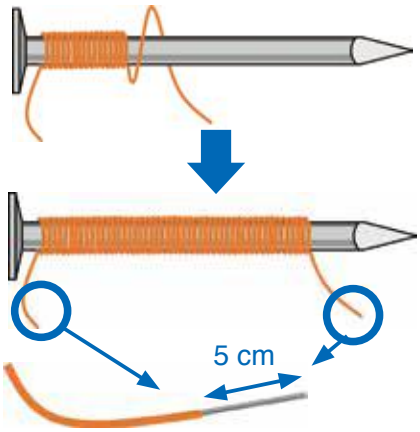
Activity : Making an electromagnet

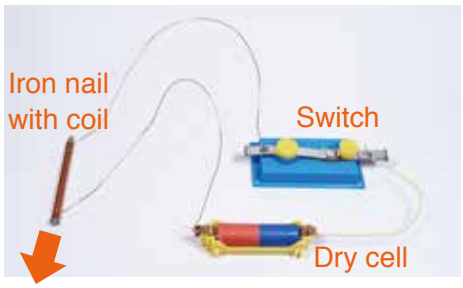
What We Need:

- iron nail, enamel wire, dry cell, cell holder, switch, sand paper, steel clips

What to Do:

1. Wrap the wire 50 times around the iron nail in the same direction to make a coil as shown on the right.
2. Strip the coating 5 cm on both ends of the wire by using sand paper because the coating does not conduct electricity.
3. Connect the wires to the positive (+) and negative (-) side of the dry cell as shown in the figure on the right.
4. Bring the iron nail closer to the paper clips. Record what you observed in your exercise book.
5. Share your findings with your classmates. Discuss the similarities and the differences between an electromagnet and a bar magnet.



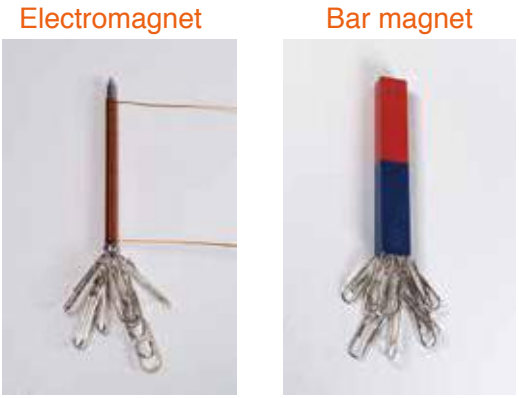


What happens if the electric current stops flowing through the coil?

Which part of the iron nail can attract more paper clips?

Result

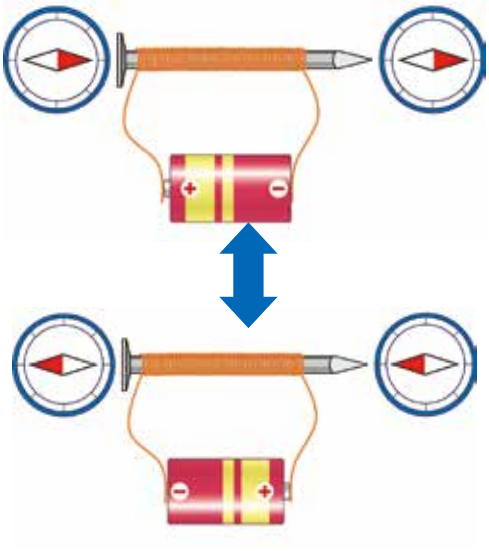
We found out that more clips were attracted to both ends of the iron nail. The iron nail attracted steel clips only when electric current flows in the coil. Unlike a bar magnet, the electromagnet did not attract clips when the electric current stopped.



An electromagnet attracts magnetic objects like a bar magnet.

Discussion

Both ends of an electromagnet can attract more steel clips. Does an electromagnet also have two poles like the bar magnet? Let's investigate the characteristics of electromagnetic poles.

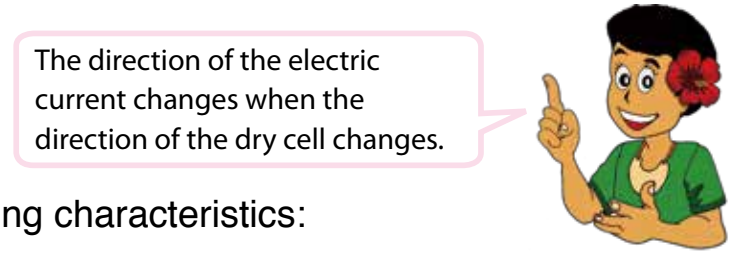


Step 1. Place a compass near the both ends of an electromagnet. Observe the needle of the compass and identify which magnetic pole it has.

Step 2. Change the direction of the dry cell in the coil and then repeat Step 1.

Step 3. Based on the results, think about the characteristics of the electromagnetic poles.

Summary



An electromagnet has the following characteristics:

1. An electromagnet remains a magnet as long as electric current flows in the coil. Unlike a bar magnet, the electromagnet stops being a magnet when the current stops flowing in the coil.
2. An electromagnet has two poles: the north and the south pole. Unlike a bar magnet, the poles of the electromagnet changes when the direction of the electric current changes.

Lesson 2 How to Strengthen an Electromagnet 1

A bar magnet cannot change its strength. How about an electromagnet? Can we change the strength of an electromagnet?

How can we change the strength of an electromagnet?

Activity : Changing the number of dry cells in a circuit

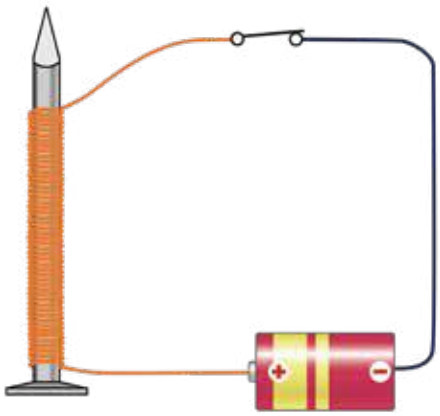
What We Need:

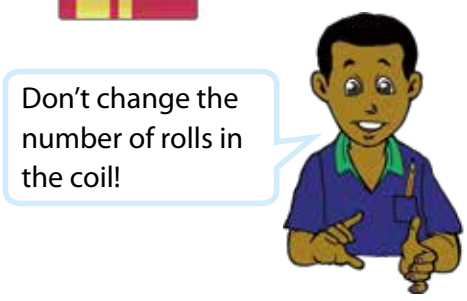
- electromagnet, two dry cells, three cell holders, switch, wires, paper clips

What to Do:

1. Draw a table like the one shown on the right.
2. Make an electrical circuit like the one shown on the right.
3. Switch on the circuit and bring one end of the nail close to the clips. Try to pick up as many paper clips as possible. Do this three times.
4. Record the number of paper clips attracted to the electromagnet. Calculate the average of the number of paper clips picked up.
5. Add the second dry cell in series to the circuit and repeat Steps 3 and 4.
6. Share your results. Discuss the relationship between the number of dry cells and the strength of an electromagnet.

Name of dry cells	How many paper clips can be picked up?			
	1st attempt	2nd attempt	3rd attempt	Average
1				
2				





Turn the switch on ONLY during testing. If electric current flows continuously, the coil will get hot.

Result

We found out that an electromagnet attracted more paper clips when more dry cells were added to the circuit in series.

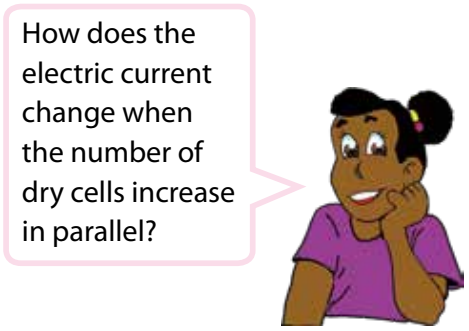
Examples of the Results

Number of dry cells	How many paper clips can be picked up?			
	1st attempt	2nd attempt	3rd attempt	Average
1	5	6	5	5.3
2	13	11	12	12

Discussion

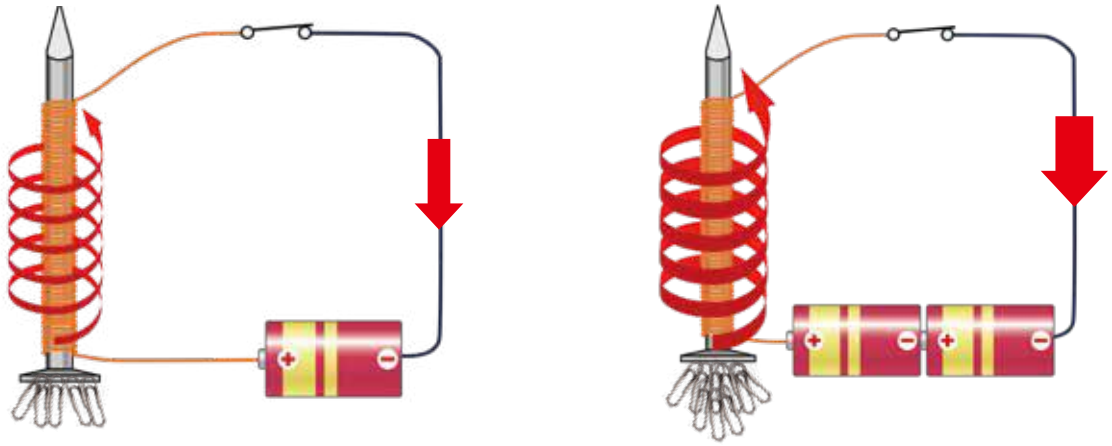
Think about the following questions based on the results.

1. What condition did you change in this activity?
2. How did the electric current change with the increased number of dry cells in series?
3. What is the relationship between the strength of the electromagnet and the amount of electric current in the coil?



Summary

The strength of the electromagnet depends on the amount of electric current in the coil. The larger the electric current in a circuit, the stronger the strength of the electromagnet. When the number of dry cells in series increases, the strength of the electromagnet also increases and more paper clips are attracted.



When an electric current in the coil increases, the strength of the electromagnet also increases.

Lesson 3 How to Strengthen an Electromagnet 2

One of the ways to strengthen an electromagnet is to increase the amount of electric current in the coil. Is there a different way to strengthen an electromagnet?

What is another way to change the strength of an electromagnet?

Activity : Changing the number of coils

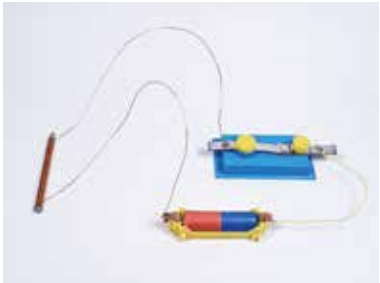
What We Need:

- electromagnet, a dry cell, a dry cell holder, switch, wires, paper clips

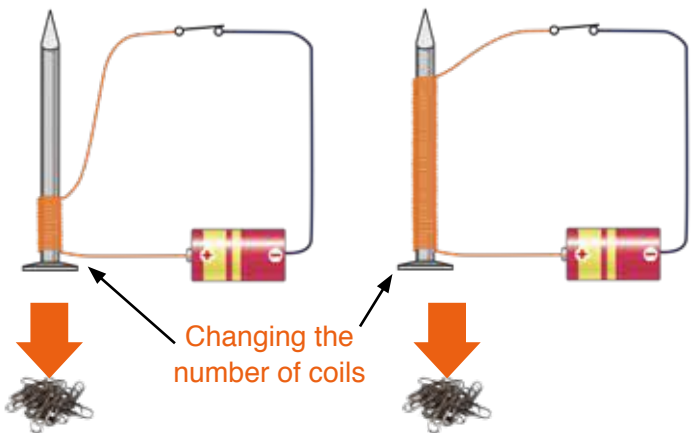
No. of rolls in the coil	How many paper clips can be picked up?			
	1st attempt	2nd attempt	3rd attempt	Average
10				
30				
50				

What to Do:

1. Draw a table like the one show above.
2. Make ten coils and then construct the electric circuit as shown on the right.



3. Switch on the circuit and bring one end of the nail close to the clips. Try to pick up as many paper clips as possible. Do this three times.
4. Record the number of paper clips attracted to the electromagnet. Calculate the average of the number of paper clips you picked up.
5. Repeat Steps 3 and 4 by changing the number of coils to 30 and 50 respectively.
6. Share your results and discuss the relationship between the number of rolls in the coil and the strength of the electromagnet.



Result

We found out that the electromagnet attracted more paper clips when the number of coils increased.

Examples of the Results

No. of the coils	No. of dry cells	How many paper clips can be picked up?			
		1st attempt	2nd attempt	3rd attempt	Average
10	1	4	6	5	5
30	1	7	9	8	8
50	1	13	10	12	11.7

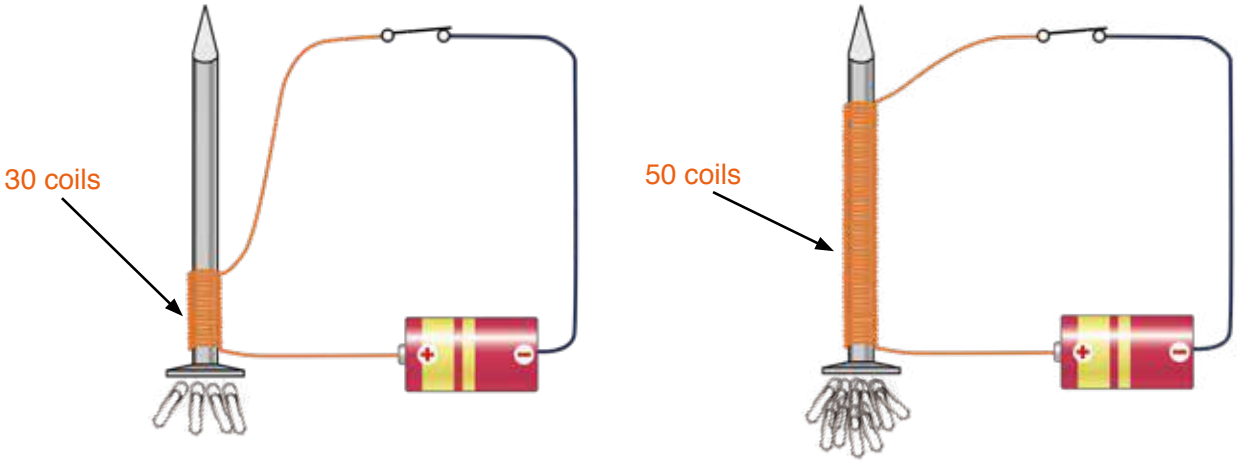
Discussion

Think about the following questions based on your results.

1. What condition did you change in this activity?
2. What is the relationship between the strength of the electromagnet and the number of coils?

Summary

The strength of the electromagnet depends on the number of coils. As the number of coils increase, the strength of electromagnet also increases.



When the number of coils increase, the strength of the electromagnet also increases.

The strength of an electromagnet can be increased by:

(1) Increasing the amount of electricity in a coil.

(2) Increasing the number of coil.

Lesson 4 Uses of Electromagnets in Daily Life

Electromagnets are used in many ways because of their characteristics. How are their characteristics helpful in our daily lives?

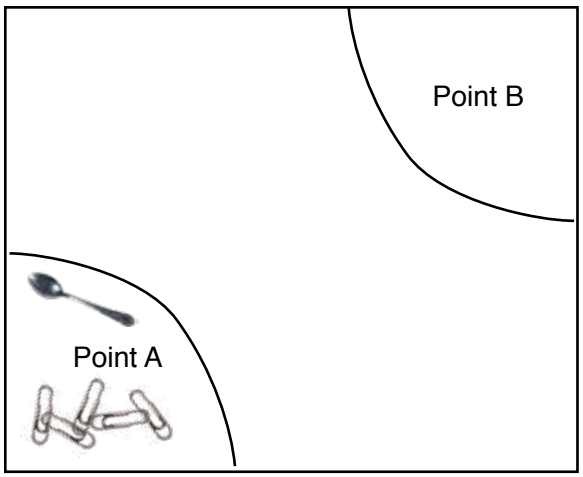
Scrap metal yard

How are electromagnets used in our daily lives?

Activity : Transporting objects using battery, wire and nail

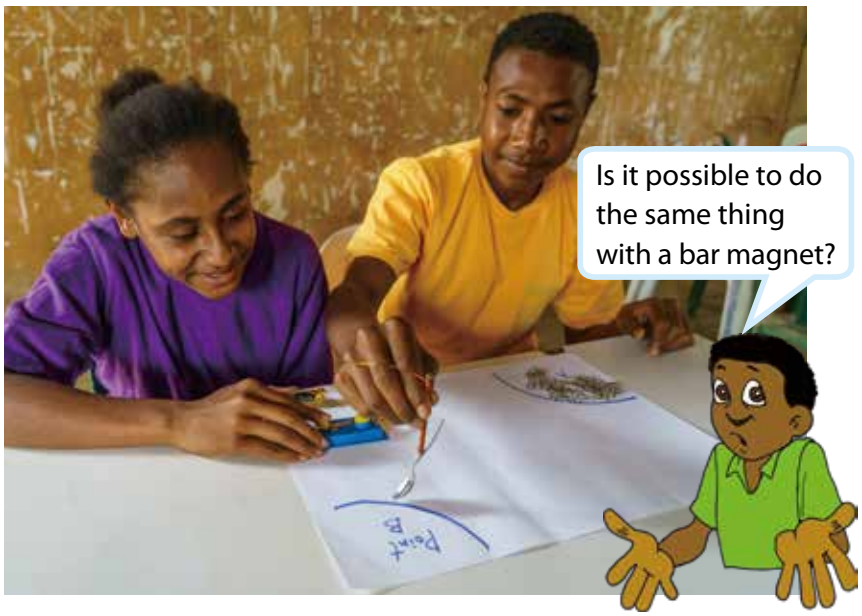
What We Need:

- electromagnet, two dry cells, two cell holders, switch, bar magnet, paper clips, metal spoon and A3 paper



What to Do:

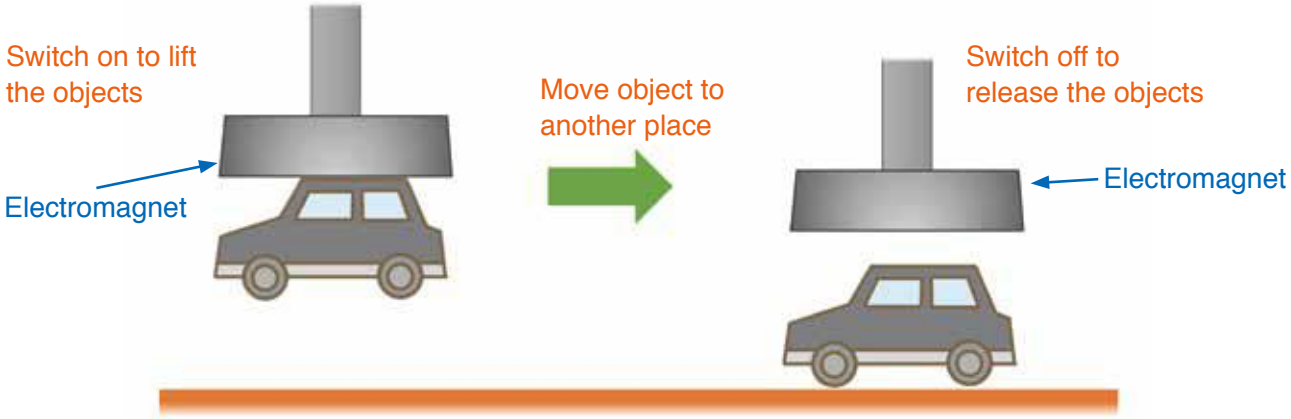
1. Draw point A and B on the A3 papper as shown on the right.
2. Put paper clips and metal spoon on point A.
3. Plan how you can transport these items to point B without touching them.
4. Carry out your plan and record your results in your exercise book.
5. Share your results with your classmates. Discuss how an electromagnet can be used in daily life.



Summary

Uses of electromagnet: How electromagnets are used in daily lives

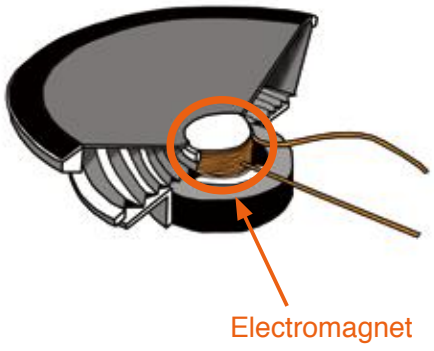
An electromagnet is used as a tool to lift heavy objects. A heavy object containing iron or steel is attracted to the electromagnet and lifted up when the electric current is switched on. The magnetic object is transported to another location and released by switching off the power supply to the electromagnet. The strength of the electromagnet is designed to change upon the weight of the object by changing the amount of electric current.



Large electromagnets are used in recycling factories to move old wrecked vehicles.

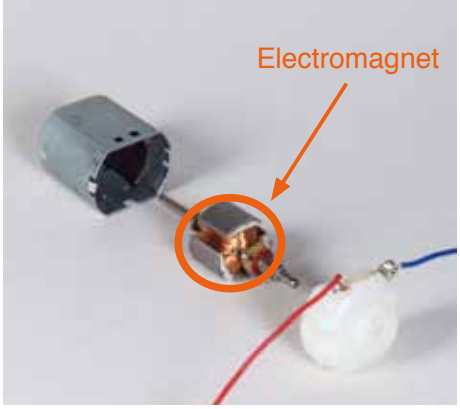
Use in Speakers

Electromagnet is used in radio speakers, cell phones, television sets and others. A speaker consists of several parts as shown on the right. An electromagnet is one of the parts which can convert electrical signal into physical vibration to produce sound.



Use in Motors

An electric motor is a device which powers machines such as fans, refrigerators, car parts and others. Electromagnet is one of the main parts which converts electrical energy into kinetic energy to rotate the axle of a motor.



Summary and Exercise

Summary

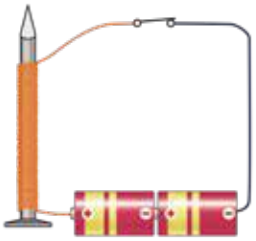
9.1 Properties of Electromagnet

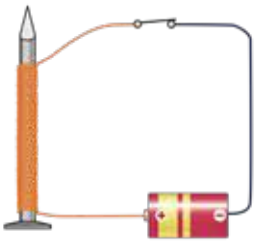
Characteristics of Electromagnet

Electromagnet

- An electromagnet is a type of magnet which consists of a wire wrapped around an iron core with electric current flowing in the coil.
- Characteristics of an electromagnet are:
  1. It remains a magnet as long as electric current flows in the coil. Unlike a bar magnet, electromanget stops being a magnet when the current stops flowing in the coil.
  2. It has two poles; the north and the south pole. Unlike a bar magnet, the poles of the electromagnet changed when the direction of the electric current changes.

Strength of Electromagnet





- The strength of an electromagnet depends on;
  1. the amount of electric current in the coil
  2. the number of the coils
- As the amount of electric current in the coil increases, the strength of the electromagnet also increases.
- As the number of coils increases, the strength of electromagnet also increases.

Uses of Electromagnet in Daily Life

Scrap metal yard

- An electromagnet is used as a tool to lift heavy objects. A heavy iron or steel object is attracted by turning on the electromagnet and lifted up. It is transferred to another location and released by switching the electromagnet off.
- It is used in radio speakers, cell phones, televisions and motor in fans and refrigerators.

Summary and Exercise

Exercise

9.1 Properties of Electromagnet

Q1. Complete each sentence with the correct word.

(1) An _____ is a type of magnet which consists of a wire wrapped around an iron core and electric current flowing in the coil.

(2) The electromagnet remains a _____ as long as electric current flows in the coil.

(3) The strength of the electromagnet depends on the amount of _____ _____ in the coil.

(4) The strength of the electromagnet also depends on the number of _____.

Q2. Choose the letter with the correct answer.

(1) Which of the following is a characteristic of an electromagnet?

A. It has a north and a south pole.

B. It can attract plastic clips.

C. It can be used to pick up coals.

D. It does not use electricity.

(2) What happens to the number of paper clips when the number of the coils is increased?

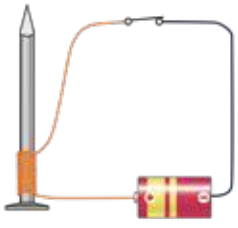
A. It decreases.

B. It stays the same.

C. It increases.

D. It does not attract any paper clips.

Q3. Study the picture on the right and answer the following.



(1) How can we increase the strength of the electromagnet?

(2) List two examples of the use of electromagnet.

Q4. Peter wants to move the heavy steel blocks from a ship onto the land. How can he move the steel blocks from the ship to the land?

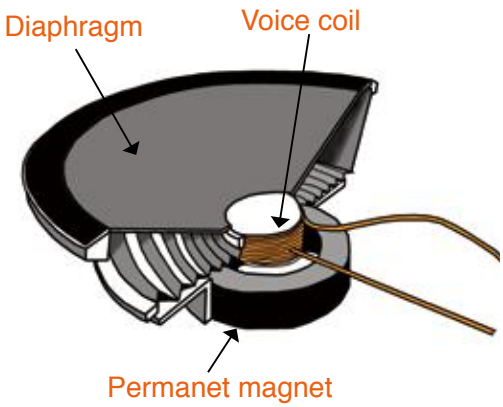
How a speaker works!

Have you ever realise something interesting? In nearly every device you buy there is a speaker. Speakers are all around us. Our television set, mobile phones, headphones, radios and even computers all use speakers of different types. Although they come in many different sizes, shapes, prices and sounds, speakers use the same underlying system, which relies on electricity and magnetism. A speaker is the opposite of a microphone. It takes an electric signal and transforms it into sound waves that humans can hear. There are three main parts of a speaker: the diaphragm, the voice coil and the magnet.

The **diaphragm** is a cone shaped structure. The cone is a flexible sheet of paper, metal, or plastic attached to the wide end of the diaphragm. The suspension (also known as surround) is a flexible rim that allows the cone to move. It in turn is attached to the frame of the diaphragm. The narrow end of the diaphragm is attached to the voice coil by the spider.

The **voice coil** is the electromagnetic part of the speaker. The voice coil is a tight coil of wire hooked up the speaker's power source. Alternating current electricity runs through the voice coil, causing it to constantly switch polarity.

The **magnet** is a permanent magnet that sits beneath the voice coil. The side that is facing the voice coil has one unchanging pole. Since the voice coil keeps changing polarity, it is constantly being attracted to and repelled from the magnet.



The voice coil's back and forth movement causes the diaphragm to vibrate. This vibration translates electrical signals into sound waves which humans can hear.

Chapter Test

9. Electromagnet

Q1

Complete each sentence with the correct word.

(1) One of the characteristics of electromagnet is that it has a north and a south _____.

(2) As the electric current and the number of rolls increases the _____ of the electromagnet also increases.

Q2

Choose the letter with the correct answer.

(1) Which of the following lists contain the materials needed to make an electromagnet?

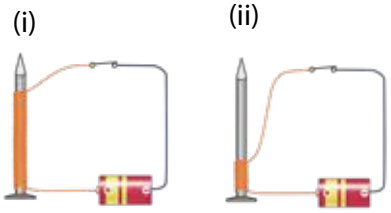
A. Dry cell, wire and piece of wood

B. Dry cell, wire and iron nail

C. Magnet, iron nail and wire

D. Magnet and dry cell

(2) Study the pictures on the right. Which of the following is the reason why electromagnet (i) is stronger than (ii)?



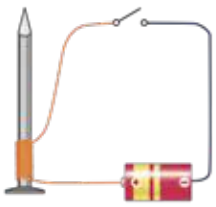
A. Because (i) has shorter iron nail.

B. Because (i) has more rolls of coil.

C. Because (i) has many dry cells.

D. Because (i) has thinner iron nail.

(3) Study the picture on the right. Why does the electromagnet not attract paper clips?



A. Because the iron core is too short.

B. Because the number of dry cells is not enough.

C. Because the weight of iron core is too light.

D. Because the electric current does not flow in the coil.

(4) How are electromagnets different from magnets?

A. Only bar magnet can be turned on/off.

B. Only electromagnet can be turned on/off.

C. Only bar magnet can change its strength.

D. Only electromagnet has north and south poles.

Q3

(1) A student conducted an experiment with an electromagnet and a bar magnet using magnetic substances as shown on the right. How are they alike?

_____

_____

_____

(2) Where can you find electromagnets in your home?

_____

_____

(3) This is a diagram of a simple electromagnet. How do you make an electromagnet stronger?

1. _____
2. _____

Q4

(1) How does the pole of an electromagnet change?

_____

_____

(2) Scrap metal yards use an electromagnet to separate iron from scrap materials. Explain how using an electromagnet instead of a regular magnet helps to separate iron from scrap materials?

_____

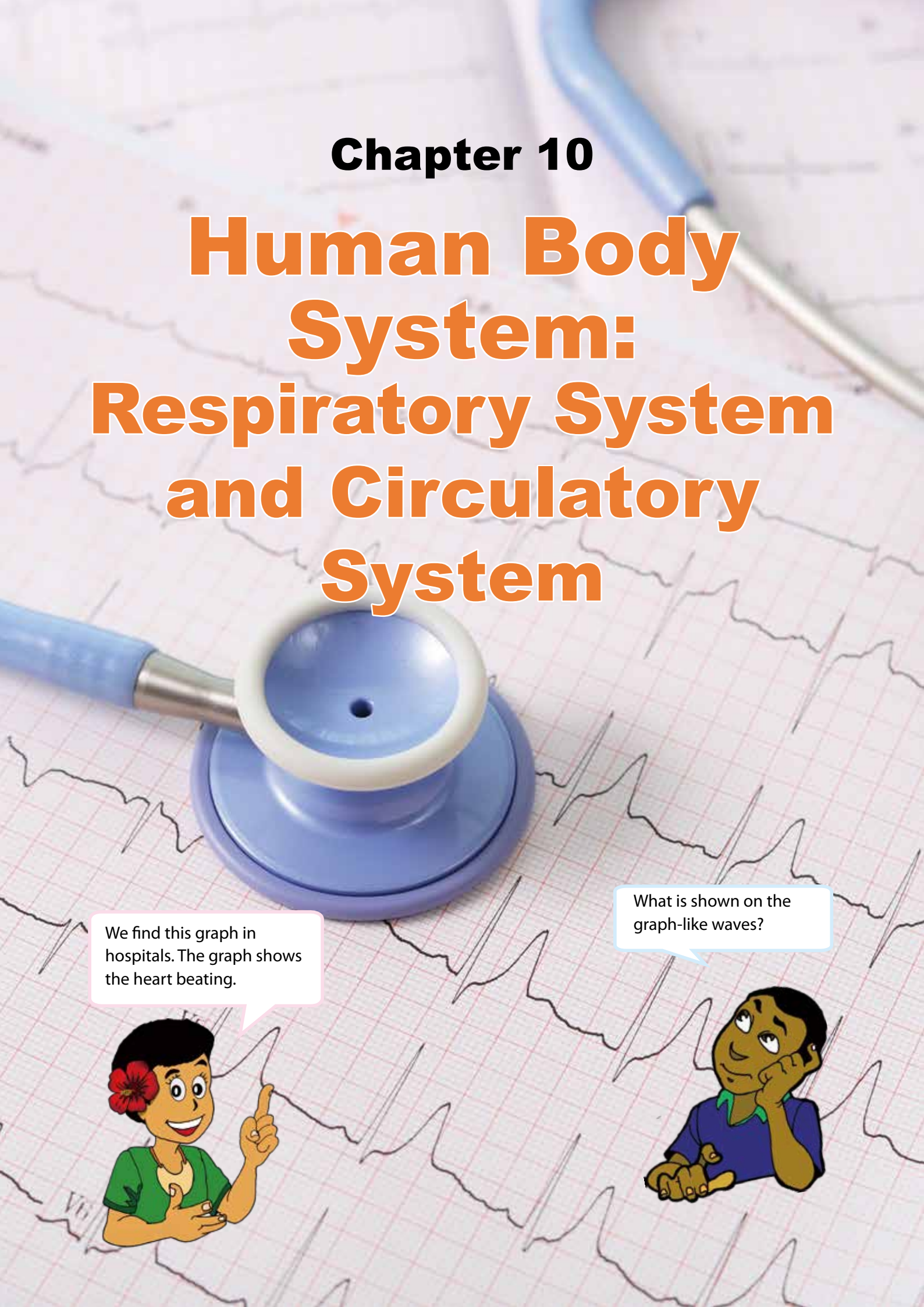
_____

_____

_____

Chapter 10

Human Body System: Respiratory System and Circulatory System



10.1 Respiratory System

Lesson 1 Breathing

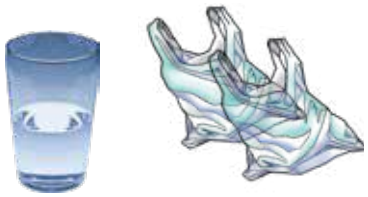
We cannot live without air. When we breathe, we take in and give out air.

How does air move in and out of our body?

Activity : What is contained in exhaled air?

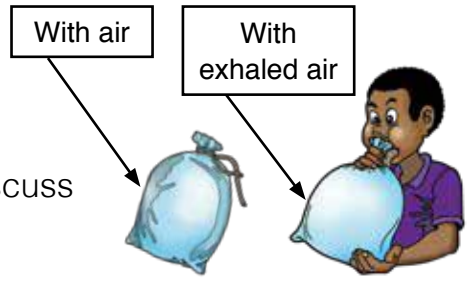
What We Need:

- limewater, two clear plastic bags



What to Do:

1. Fill a plastic bag with air around you. Pour the limewater into it and tie the mouth of the plastic bag tightly. Shake it well and observe what happens to the limewater. Record your observations.
2. Blow up another plastic bag with your exhaled air. Pour limewater into it and tie the mouth of the plastic bag tightly. Shake it well and observe what happens to the limewater. Record your observations.
3. Share your findings with your classmates. Discuss what is contained in the exhaled air.

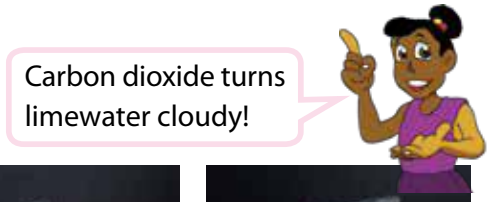


Result

We found out that limewater with air did not change its colour. On the other hand, the limewater with the exhaled air turned cloudy. From this result, exhaled air contained more carbon dioxide than the air.

Air

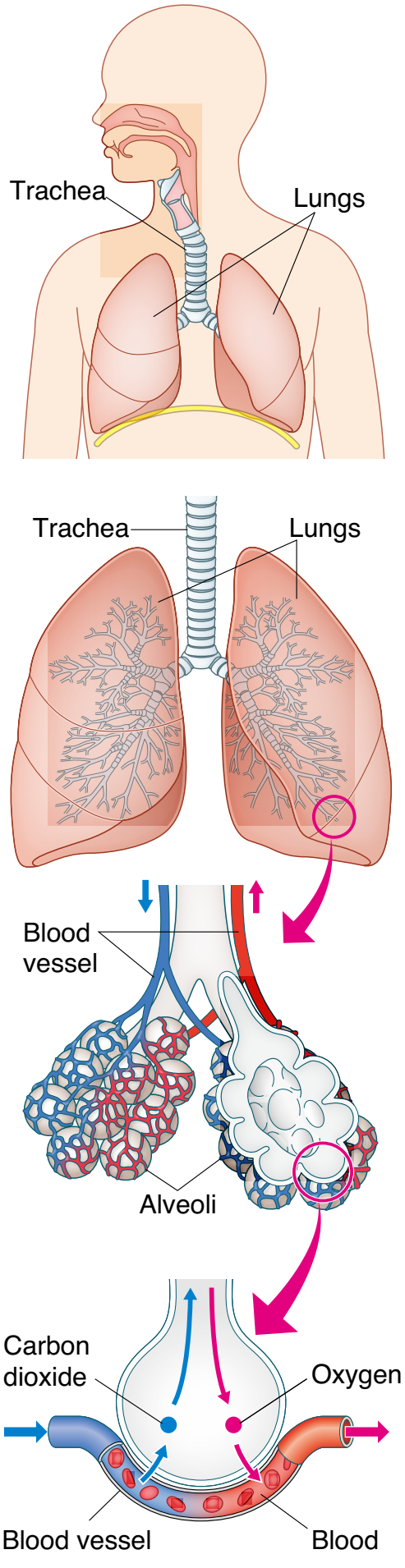
Exhaled air



Summary

Breathing is the process of moving air in and out of the body. When we breathe, we take in oxygen and give out carbon dioxide.

The group of organs in our body that enables us to breathe is called the **respiratory system**. An **organ** is a special part of the body that has a specific form and function. Eyes, ears, brain and heart are examples of organs. The major organs of the respiratory system are nose, trachea, alveoli and lungs. When we breathe in, we take air into our body through our nose. The air moves into our **trachea**, which connects the throat to the **lungs**. In the chest, the trachea is divided into two tubes and each of these tubes leads to one of the two lungs. Each tube is divided into smaller tubes that end in millions of tiny balloon-like air sacs which are called **alveoli**. In the alveoli, oxygen is transferred to the blood. Blood carries oxygen to all parts of our body. At the same time, carbon dioxide is transferred from the blood to the alveoli. When we breathe out, our body gets rid of carbon dioxide.



Mechanism of Lungs

Lesson 2 Lungs

Lungs are the main organs of the respiratory system. How do the lungs work? What structures do lungs have?

What are the functions and structure of lungs?

Activity : Making a lung model

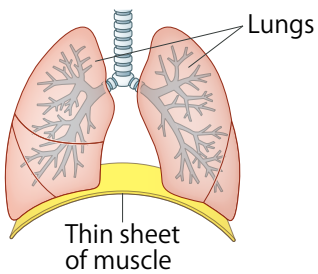
What We Need:

- a plastic bottle with the end cut-off, a balloon, a balloon with the half cut-off

What to Do:

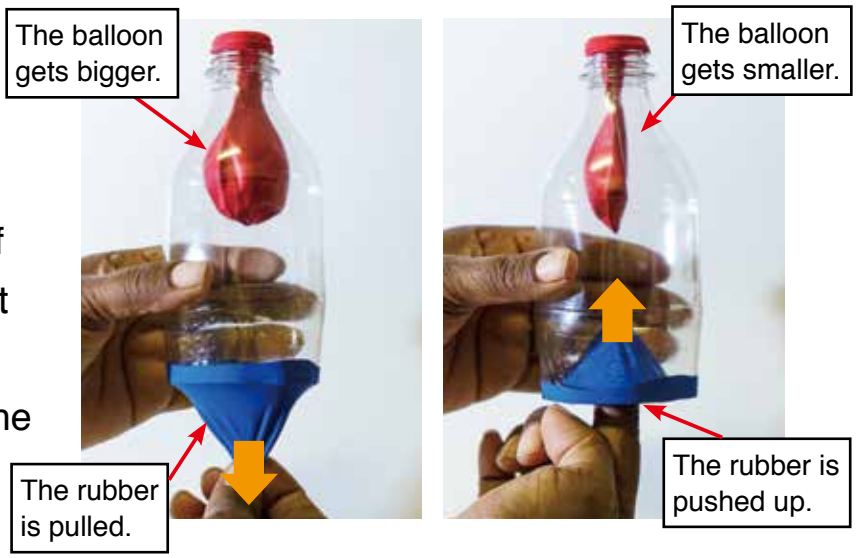
1. Push the balloon into the neck of the bottle and fold its end around the neck of the bottle.
2. Place the half cut-off over the open end of the bottle.
3. Pull on the middle of the half-cut balloon and let go. Observe what happens.
4. Gently push in the half-cut balloon as shown on the right. Observe and record what happens.
5. Think about the question below based on your observations.

   The figure below shows the structure of the lungs. Which parts of the lung are represent in lung model?
6. Share your findings with your classmates. Describe how the lungs work when breathing.



Result

We found out that when we pulled on the middle of the half-cut balloon and let go, the balloon got bigger. When we gently pushed the half-cut balloon up, the balloon got smaller.

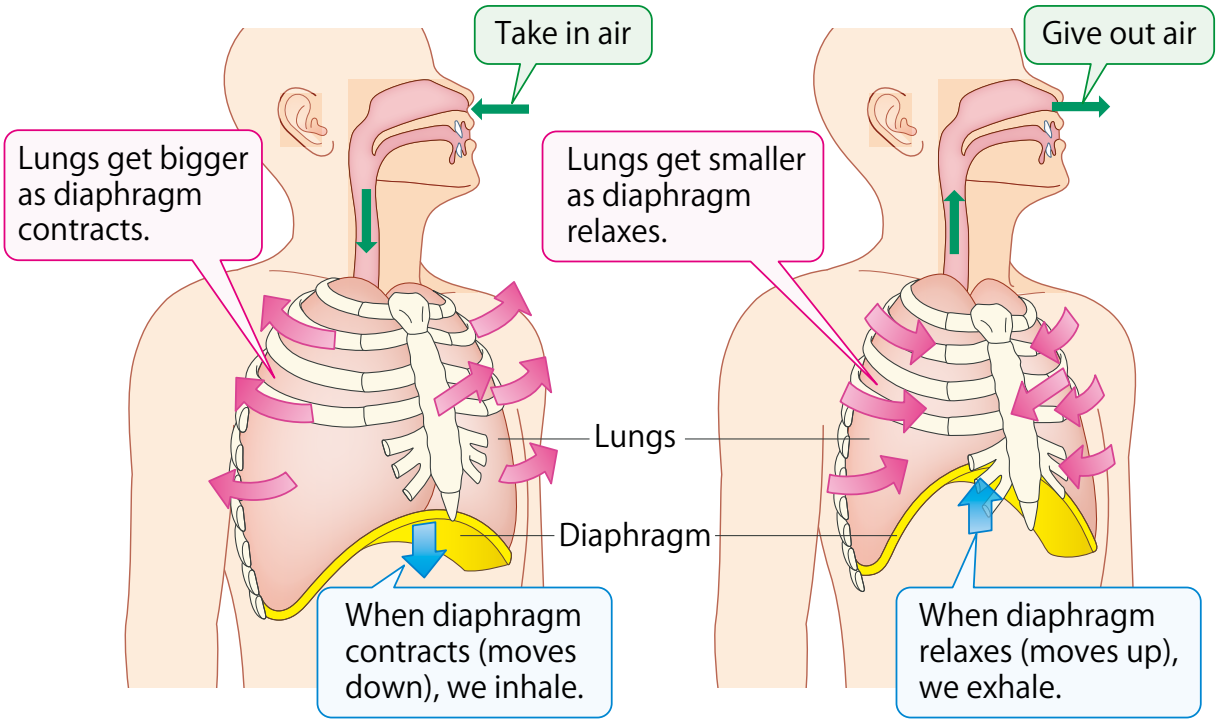


Summary

As we breathe, we have a special muscle that helps our lungs move. The muscle is called the **diaphragm**. It makes our lungs larger and smaller as we breathe in and out.

When we inhale, the diaphragm contracts and moves down in our chest. This causes our lungs to become bigger and allows air to come into our lungs.

As we exhale, the diaphragm relaxes and moves up towards the lungs, this causes our lungs to become smaller and air is forced out of our lungs.



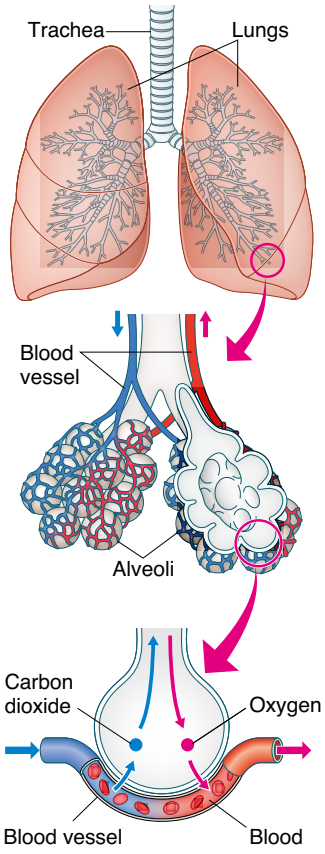
Mechanism of breathing

Summary and Exercise

Summary 10.1 Respiratory System

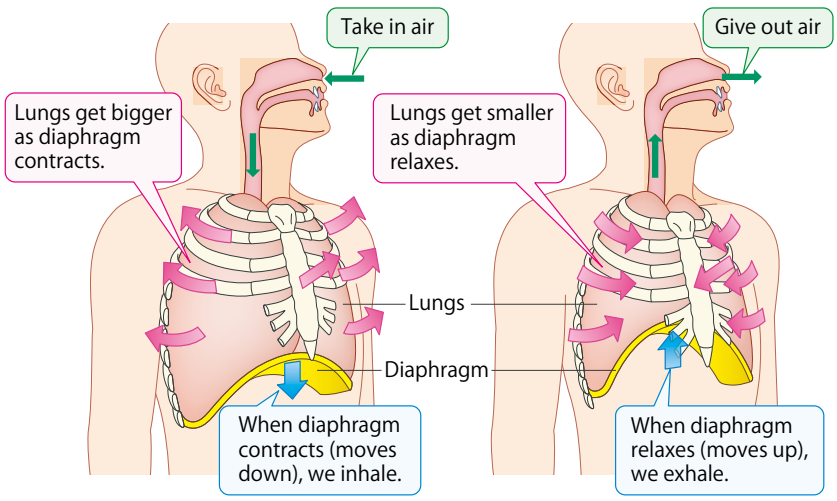
Breathing

- ☑ The group of organs in our body that enables us to breathe is called the respiratory system.
- ☑ The major organs of the respiratory system are nose, trachea or windpipe, alveoli and lungs.
- ☑ When we breathe, we take in oxygen and give out carbon dioxide.
- ☑ The air moves into our trachea, which connects the throat to the lungs.
- ☑ In the alveoli, oxygen is transferred to the blood which is carried to all parts of our body.



Lungs

- ☑ Diaphragm is the muscle that makes our lungs larger and smaller for the action of breathing.
  1. Lungs get bigger as the diaphragm contracts and the air comes in our lungs when we inhale.
  2. Lungs get smaller as the diaphragm relaxes and the air is forced out of our lungs when we exhale.



Summary and Exercise

Exercise 10.1 Respiratory System

Q1. Complete each sentence with the correct word.

(1) The process of moving air in and out of the body is called _____.

(2) An _____ is a special part of a body that has a specific form and function.

(3) The group of organs in our body that enable us to breathe is called the_____ system.

(4) The muscle that makes our lungs larger and smaller during breathing is called the _____.

Q2. Choose the letter with the correct answer.

(1) What are the major organs of the respiratory system?

A. Eyes, ears and mouth

B. Nose, trachea and heart

C. Trachea, lungs and oxygen

D. Nose, trachea and lungs

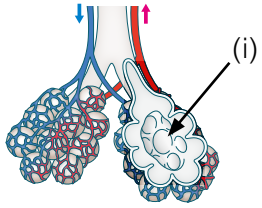
(2) What is the correct name of the organ labeled (i) shown in the diagram on the right?

A. Heart

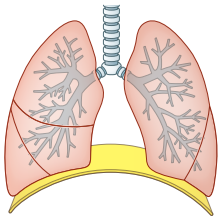
B. Trachea

C. Alveoli

D. Diaphragm



Q3. How does the diaphragm help the lungs to move when breathing?



Q4. Name the gas that we breathe in and how it moves through the main organs of the respiratory system.

10.2 Circulatory System

Lesson 1 The Heart

After a heavy exercise, we can feel the beat of our heart on our chest.

What does the heart do?

Activity : Measuring your pulse rate

What to Do:

1. Draw a table like the one shown below.

	Pulse	
	Beats in 15 seconds	Beats in 1 minute
At rest		
After exercise		

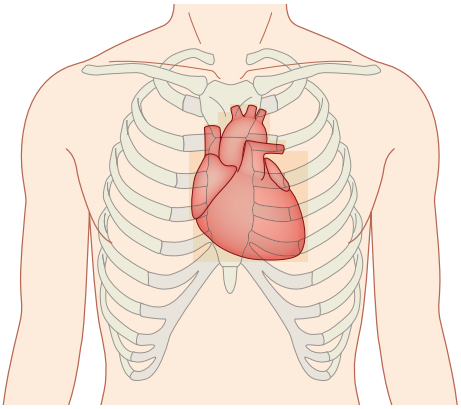
2. Take your pulse for 15 seconds and count the number of beats while at rest. Record your pulse rate in the table.
3. Jump at the same spot for one minute, then take your pulse for 15 seconds. Record your pulse rate in the table.
4. Calculate your pulse rate for one minute using the formula;

The number of beats in 15 seconds	X 4 =	The number of beats in 1 minute

5. Record your pulse rate for one minute in the table.
6. Share your findings with your classmates. Discuss:
   (1) How your pulse rate changed before and after the exercise.
   (2) Why your pulse rate increased after the exercise.
   (3) How your breathing rate was like before and after the exercise.

Summary

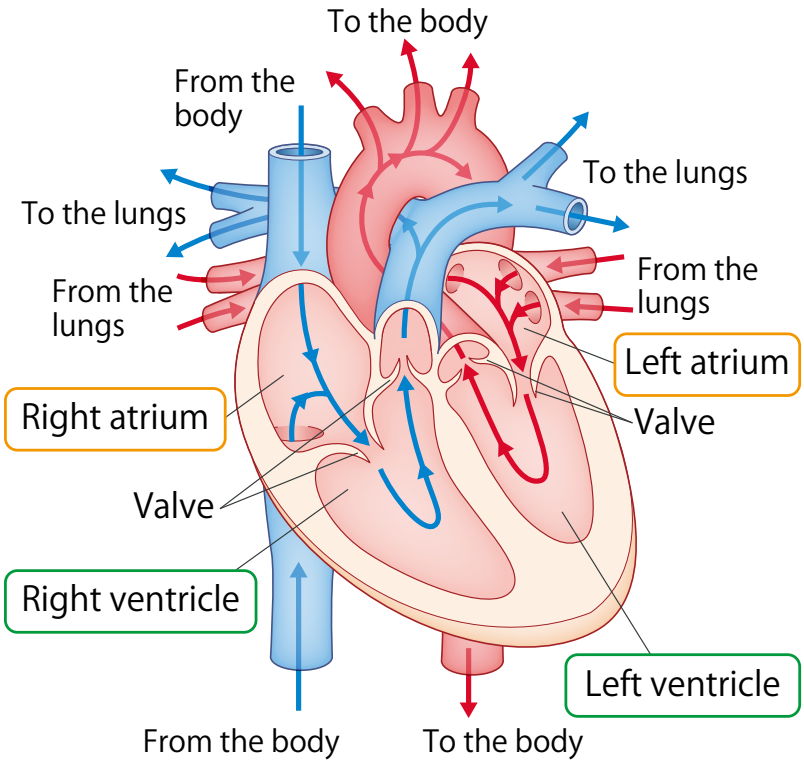
The **heart** is an important organ in the human body. It is about the size of our fist and is located within our rib cage to the left of the centre of the chest. The heart is made of a muscle called the heart muscle. We can control our arm and leg muscles, but we cannot control the heart muscle. This muscle in our heart works all the time even while we are sleeping.



The heart is located to the left of the centre of the chest.

The heart pumps thousands of litres of blood to all parts of our body every day. The heart has four spaces which are called **chambers**. These are called the left and right **atriums** and the left and right **ventricles**.

The atrium is a chamber that receives blood from the body and the lungs, and the ventricle is a chamber that pumps blood to the lungs and the body. Between the chambers there are valves. The valves open and close to control the movement and direction of blood flow.



When ventricles contract, blood is forced out of the heart. We can feel this contraction as a pulse. During physical exercise, more oxygen is needed in the muscles so the blood must carry oxygen to the muscles faster than when the body is at rest. To meet these demands the pulse rate increases.

Lesson 2 Circulation of Blood

The heart pumps blood to all parts of our body everyday.

How does blood flow through the body?

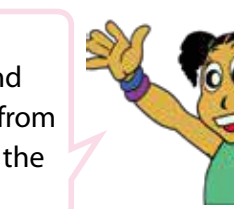
Activity : Observing the blood flow

What We Need:

- small live fish, small ziplock bag, microscope

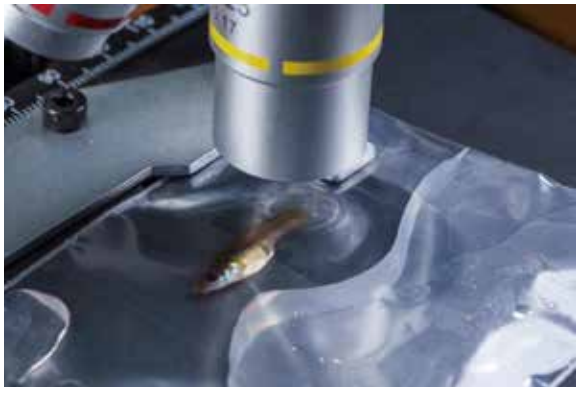
What to Do:

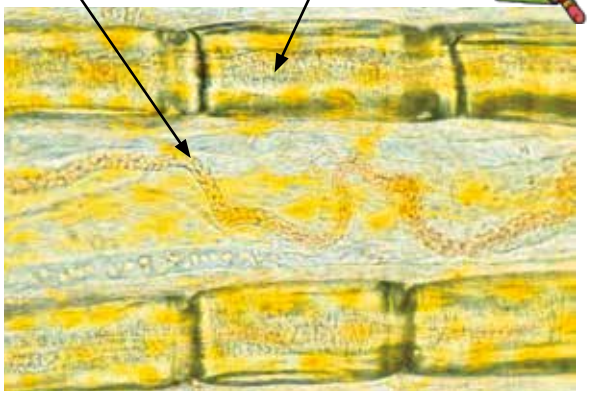
1. Put the live fish into a ziplock bag with water.
2. Put the ziplock bag with fish on the stage of the microscope and observe the flow of blood in the tail fin through the microscope.
3. Sketch the flow of blood and record your observations in your exercise book.
4. Share your findings with your classmates. Discuss about:
   (1) What you found in the tail fin.
   (2) The direction of the blood flow.
   (3) The thickness of the tubes that the blood is flowing through.



Don't touch the fish with your hand directly. The heat from your hand makes the fish die easily!

After observation, let's release the fish!





Microscopic view showing blood vessel in a fish.

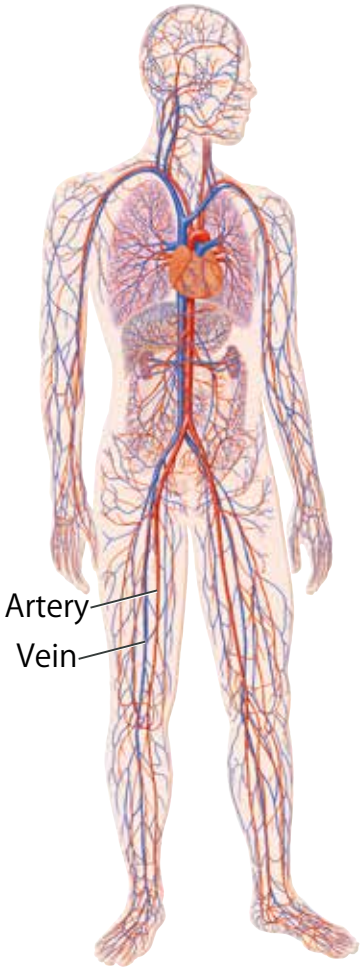
Summary

Blood flows through tubes to get to the different parts of our body. These tubes are called **blood vessels**. There are two types of blood vessels; an artery and a vein. **Artery** is the blood vessel that carries blood away from the heart. **Vein** is the blood vessel that carries blood back to the heart. The heart pumps blood to the lungs through the arteries, and the blood picks up oxygen from the lungs. The blood rich in oxygen flows into the heart through the veins and is pumped to all parts of the body through the arteries.

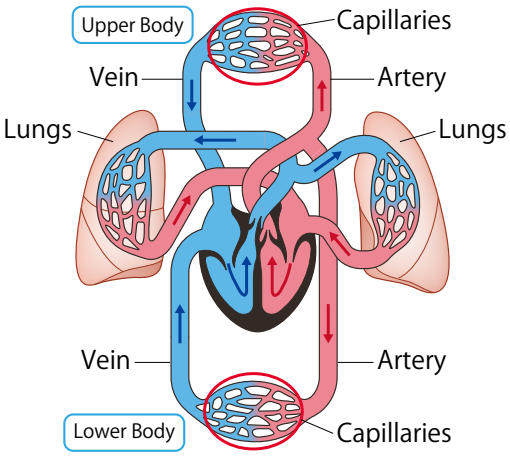
The arteries are divided into smaller tubes and end in tiny blood vessels which are called **capillaries**. The capillaries connect the arteries and veins.

The blood in the capillaries passes the oxygen to and picks up carbon dioxide from the cells. A **cell** is the basic unit that makes up all living things. After passing capillaries, blood flows through the veins. The blood in the veins have little oxygen. It enters the heart and goes to the lungs again to pass carbon dioxide to and picks up oxygen from the lungs.

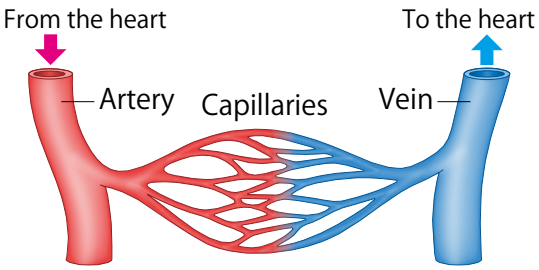
A network of organs such as the heart, blood and blood vessels that transport oxygen and nutrients to and carbon dioxide from the cells is called a **circulatory system**.



Blood vessels in body



A model of blood circulation



Structure of capillaries, artery and vein

Lesson 3 Blood

The blood passes oxygen to the cells and picks up carbon dioxide from the cells.

How does blood carry oxygen and carbon dioxide?

Activity : Components of blood

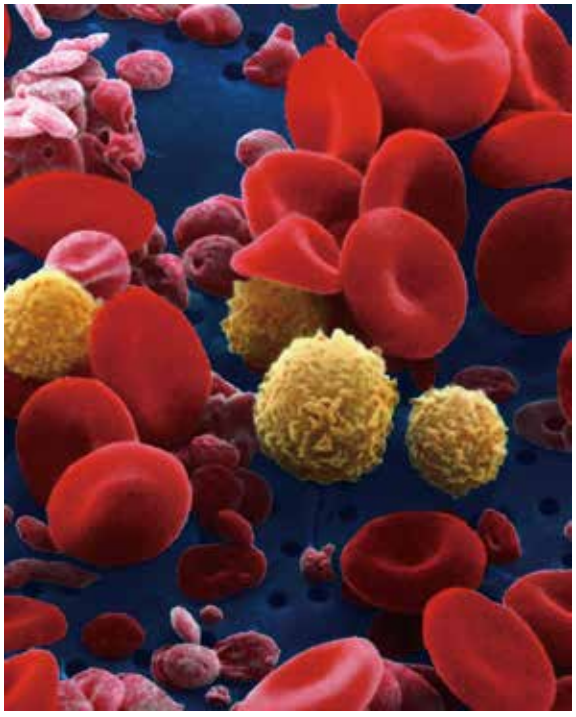
What to Do:

1. Draw a table like the one shown below.

Sketch	Its characteristics

2. Study the close-up photograph of blood below taken by an electronic microscope and identify the different types of particles.
3. Sketch them and record the characteristics of each type of particle in the table.
4. Share your ideas with your classmates. Discuss about:
   (1) The number of each type of particles you find.
   (2) The characteristics of each type of particles.

Is blood a solid or a liquid? Can you guess what blood consists of?



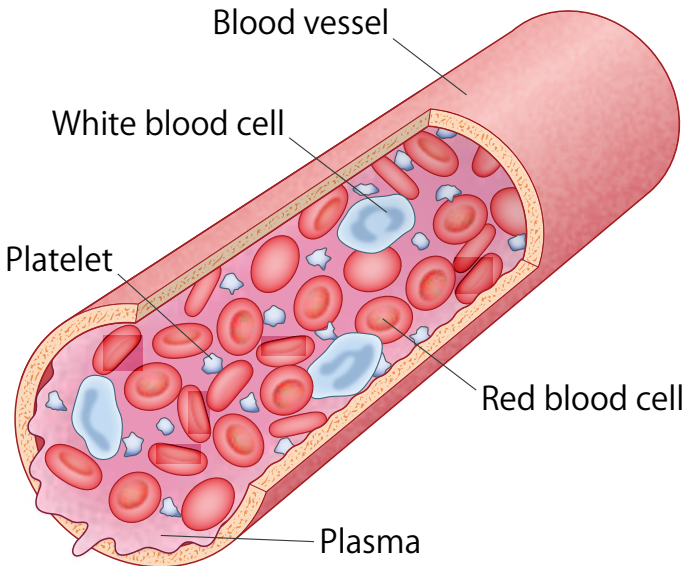
Summary

Blood carries oxygen, carbon dioxide, nutrients and wastes in our body. Blood is made up of solid and liquid parts. The solid parts of the blood are suspended in liquid.

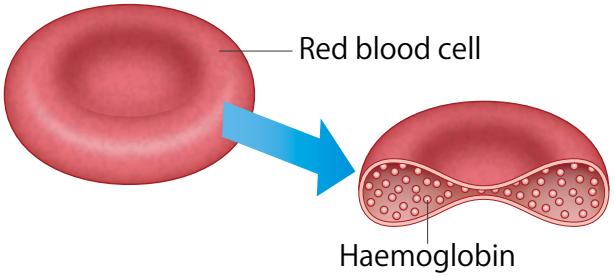
The solid parts of the blood include **red cells**, **white cells** and **platelets**. The liquid part of the blood is called **plasma**.

The red blood cells are disc shaped and they contain **haemoglobin**. Red blood cells use the haemoglobin to carry oxygen from the lungs through all parts of the body.

White blood cells are an important part of the body's immune system. They defend the body against bacteria, viruses and other infectious diseases.



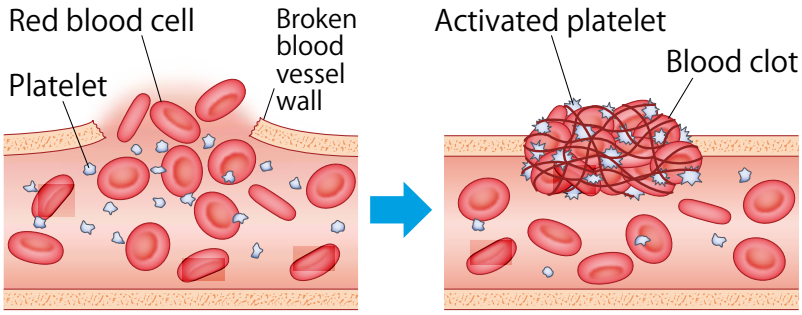
Components of blood



Cross section of red blood cell

White blood cell is attacking bacteria.

Platelets help blood clot in order to stop bleeding, to heal cuts and other injuries. Plasma is the main component of blood and mostly consists of water. Plasma carries nutrients and water to the cells and carries away wastes such as carbon dioxide from the cells.



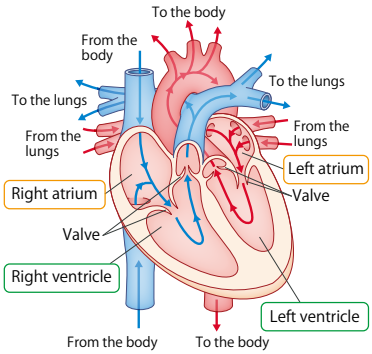
The way red blood cells and platelets form blood clot.

Summary and Exercise

Summary 10.2 Circulatory System

The Heart

- The heart is an important organ that pumps thousands of litres of blood to all parts of the body.
- The heart is about the size of our fist and is located within the rib cage to the left of the centre of the chest.
- The heart is made up of four chambers called left and right atriums and left and right ventricles.

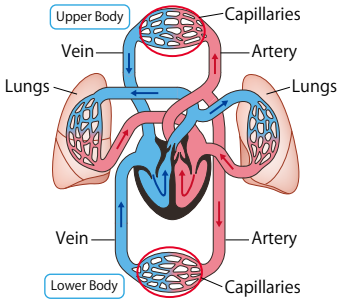


The model of heart

- The atriums receive blood from the body and the lungs and the ventricles pump blood to the lungs and the body.
- The valves open and close and help contol the movement and direction of the blood flow.

Circulation of the Blood

- Circulatory system is a network of organs such as the heart, blood and blood vessels that transport oxygen, and nutrients to and carbon dioxide from the cells.

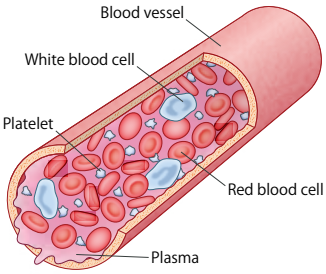


The model of blood circulation

- Blood flows through many tubes called blood vessels to get to different parts of our body.
  1. The artery is the blood vessel that carries blood away from the heart.
  2. The vein is the blood vessel that carries blood back to the heart.
- Capillaries are tiny blood vessels that connect the artery to the vein.
- The blood in the capillaries passes the oxygen to the cells and picks up carbon dioxide from the cells.

Blood

- Blood is made up of solid and liquid parts:
  1. The solid parts of the blood include red cells, white cells and platelets.
  2. The liquid part of the blood is called plasma.



The model of blood

- Blood carries oxygen, carbon dioxide, nutrients and wastes in our body.

Summary and Exercise

Exercise 10.2 Circulatory System

Q1. Complete each sentence with the correct word.

(1) The _____ is an organ that pumps blood to all parts of the body.

(2) The heart is made up of four _____.

(3) The tubes that blood flows through to different parts of the body are called _____ _____.

(4) Red blood cells contain _____ that is used to carry oxygen.

Q2. Choose the letter with the correct answer.

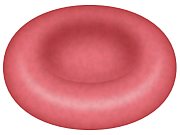
(1) What is the name of the particle in the blood shown below?

A. White blood cell

B. Plasma

C. Red blood cell

D. Platelet



(2) Which type of blood vessel does the blood rich in oxygen flow through?

A. Vein

B. Artery

C. Capillaries

D. Cell

Q3. Answer the following questions.

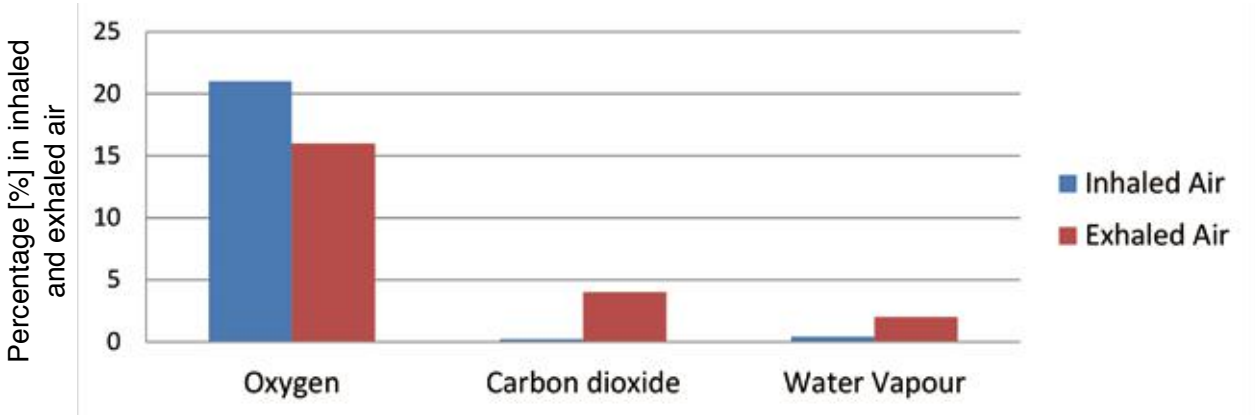
(1) Sam had a bad fall. He hurt his knee and was bleeding. Soon his wound stopped bleeding, leaving a red lump on the wound. What kind of cell in the blood helped to stop the bleeding?

(2) Describe the characteristics of the circulatory system.

Q4. Lora ran very fast to catch a ride on a bus. After she sat down she was breathing heavily. Explain the reason for her breathing using the word 'oxygen' in your explanation.

What does the air we inhaled and exhaled contain?

Lungs take in oxygen from the air and release carbon dioxide as waste product. There are other gases that are also inhaled and exhaled. Atmospheric air, which we breathe, is composed of the following gases: nitrogen, oxygen, carbon dioxide, water vapour and other small amounts of gases. Inhaled air by volume contains nitrogen about 78%, oxygen 21%, carbon dioxide 0.04% and watar vapour 0.4%. How does the percentage change in exhailed air? Exhaled air by volume contains nitrogen about 78%, oxygen 16%, carbon dioxide 4% and watar vapour 2%.



Percentage of oxygen, carbon dioxide and water vapour in inhaled and exhaled air.

Exhaled air contains less oxygen and more carbon dioxide.Oxygen in the inhaled air is transferred to the blood in the lungs and the blood carries oxygen to cells in all parts of our body. The cells recieve oxygen to produce its energy and release carbon dioxide as its waste into the blood. When the blood come back to the lungs, carbon dioxide is transferred from the blood to exhaled air. Therefore, exhaled air contains less oxygen and more carbon dioxide than inhaled air.

In addition, there is more water vapour in exhaled air than inhaled air because of the moisture in the airways.

Chapter Test

10. Human Body System

Q1

Complete each sentence with the correct word.

(1) After exercise, we feel the beat of our _____ on our chest.

(2) Blood flows through blood _____ to get to the different parts of our body.

(3) Blood is made up of _____ _____, white cells, platelets and plasma.

(4) When we breathe, we take in _____ and get rid of _____ _____.

Q2

Choose the letter with the correct answer.

(1) What is the name of the muscle that helps the lungs for breathing to occur?

A. Diaphragm

B. Nose

C. Alveoli

D. Trachea

(2) Which muscle in our body works all the time even when we are asleep?

A. Bicep muscle

B. Calf muscle

C. Heart muscle

D. Cheek muscle

(3) Why is the white blood cell an important part of the body's immune system?

A. They allow any bacteria to enter the body.

B. They defend against bacteria, viruses and other infectious diseases.

C. They transport oxygen to the heart.

D. They remove waste from the system.

(4) What caused the lime water to turn cloudy?

A. Oxygen present in the inhaled air.

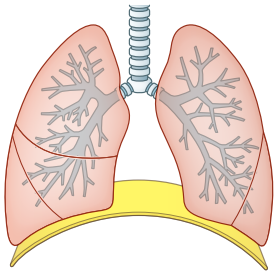
B. Carbon dioxide present in the exhaled air.

C. Heat present in exhaled and inhaled air.

D. Oxygen present in exhaled air.

Q3

Study the picture and explain how the diaphragm and the lung work as air is taken in and taken out.



(1) What happens to the diaphragm and the lungs when we breathe in?

_____

_____

_____

_____

_____

(2) What happens to the diaphragm and the lungs when we breathe out?

_____

_____

_____

Q4

(1) There are two types of blood vessels; an artery and a vein. What are the functions of the artery and the vein?

_____

_____

_____

(2) How does your pulse rate change before and after an exercise? Explain why.

_____

_____

_____

_____

Chapter 11

Mixtures and Solutions

11.1 Mixtures

Lesson 1 Mixtures and Substances

A mixture is something made of two or more kinds of matter but do you know what a mixture is? How are mixtures made? What properties do mixtures have?

What is a mixture?

Activity : How are mixtures made?

What to Do:

1. Draw a table like the one shown below.

Mixtures	Ingredients or materials

2. Study the picture below. Find the mixtures in the picture and write their names in the table.
3. Write the ingredients or materials that make up each of the mixtures in the table.
4. Share your ideas with your classmates. Discuss how mixtures are made.

Summary

Matter can be classified as solid, liquid or gas. Matter can also be classified as a substance or a mixture.

A **substance** is one kind of matter with certain properties. A substance is made of only one kind of matter. The colour, texture, smell and taste of all the particles in a substance is the same. For example, salt is a substance. Salt is made of one kind of matter. It does not contain any other kinds of matter. When we taste salt, it always tastes salty. Every part of the salt is the same colour. Water, oxygen, salt and gold are examples of substances.

Water

Salt

Gold

Examples of substances

A **mixture** is a matter that is made up of two or more substances that are combined physically. Sea water, soil and blood are examples of mixtures. Making a mixture results in a physical change. For example, sand, clay and pebbles are combined to make a soil mixture, but sand is still sand and clay is still clay. The physical properties of each substance in the soil mixture do not change.

Pebbles (substance)

Sand (substance)

Clay (substance)

Soil (mixture)

Sand, pebbles and clay in a soil do not change their properties.

Lesson 2 Types of Mixtures

Mixtures are everywhere. A salad is a mixture. An ocean is also a mixture. Are salad and ocean the same mixtures? How can we classify these mixtures?

What types of mixtures are there?

Activity : Different types of mixtures

What We Need:

- water, salt, sand, cooking oil

What to Do:

1. Draw a table like the one shown below.

Two substances	Their states

2. Choose two substances from the above to make a mixture.
3. Record the types of substances you chose and their states in the table.
4. Mix the two substances.

5. Think about the following questions based on your results:
   (1) Which two substances did you choose to make the mixture and what were their states?
   (2) How many combinations can you make with the four substances to make a mixture?
6. Share your findings with your classmates. Discuss what types of mixtures are there.

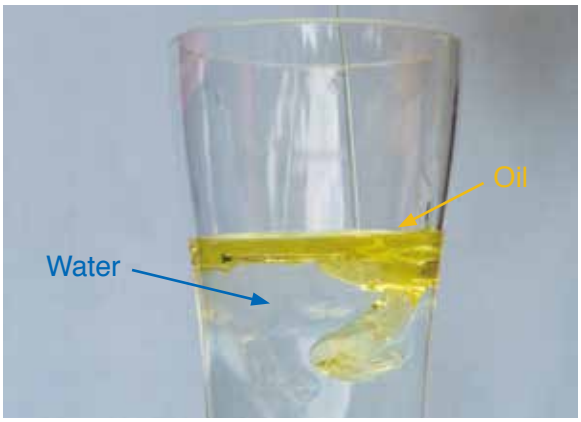
Summary

Substances are matter. They can be in the states of a solid, liquid and gas. Mixtures are combinations of three states of substances. There are many different types of mixtures: Solid-Solid mixture, Liquid-Liquid mixture, Solid-Liquid mixture, Gas-Gas mixture and Gas-Liquid mixture. The following are some examples of the different types of mixtures.

Rock is a mixture of minerals.

Solid-Solid Mixtures

This type of mixture consists of two or more different solid substances such as rocks. The rock is made of several different kinds of minerals. They are all solids.



Mixture of oil and water

Liquid-Liquid Mixtures

This type of mixture consists of two or more different liquid substances such as a mixture of vinegar and water and a mixture of oil and water. Vinegar, water and oil are all liquids.

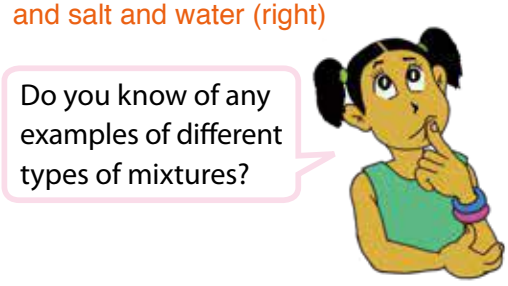
Mixture of sand and water (left) and salt and water (right)

Solid-Liquid Mixtures

This type of mixture consists of solid and liquid substances such as a mixture of sand and water and salt and water. Sand and salt are solids but water is liquid.

Gas-Gas Mixtures

This type of mixture consists of different gases. For example air. Air is mostly made of gases such as nitrogen, carbon dioxide, oxygen and water vapour.



Lesson 3 Separating a Mixture 1

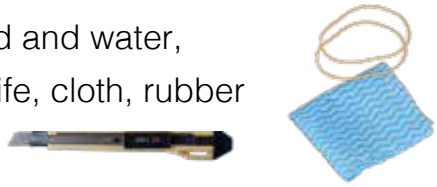
A mixture of rice and kidney beans in a bowl can be separated easily by picking them out by hand. How about a mixture of water and sand? Can you separate them by picking them out?

How can we separate sand from water in a mixture?

Activity : Separating a mixture of water and sand

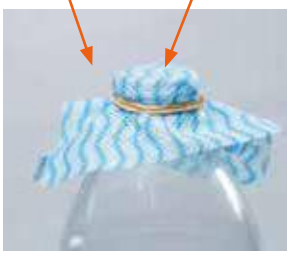
What We Need:

- glass, a mixture of sand and water, plastic bottle, cutter knife, cloth, rubber band



What to Do:

1. Cut off the top part of the plastic bottle where it is marked with the cutter knife to make a funnel.
2. Cover the mouth of the bottle with the cloth and tie it with the rubber band.
3. Place the funnel on the open-end of the cut plastic bottle.
4. Pour the mixture of water and sand into the funnel.
5. Observe what remains on the cloth and in the cut plastic bottle. Record your observations in your exercise book.



Funnel

Result

We found out that in the funnel, sand remained on the cloth but water was collected at the bottom of the plastic bottle.

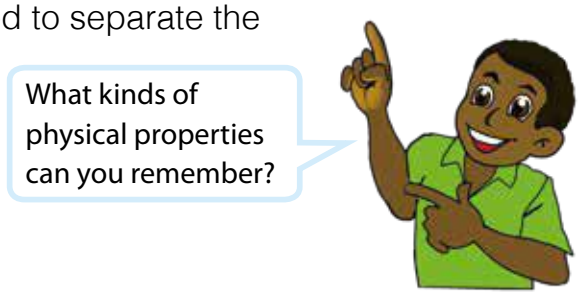
Funnel

Bottom part of the plastic bottle

Discussion

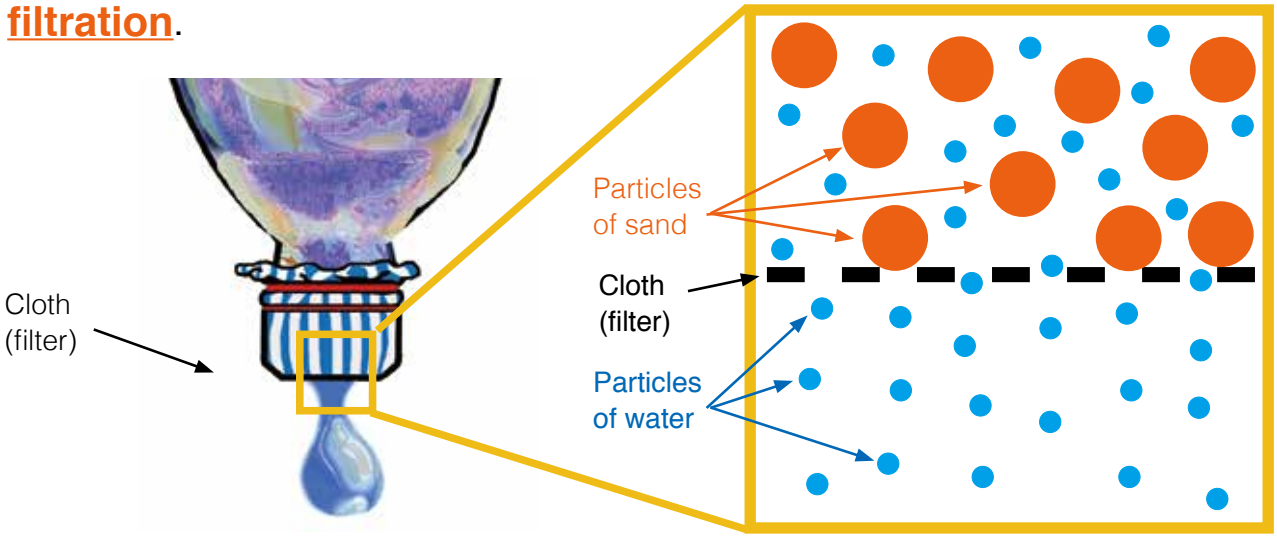
Think about the following questions based on your result.

1. Why did the water in the mixture drop to the bottom of the plastic bottle?
2. What kind of physical property was applied to separate the mixture of water and sand?



Summary

Mixtures can be separated according to the different physical properties of substances. The property to separate water and sand is ‘size’. The particles of water are so small that they can pass through the cloth. But the particles of sand are too large to pass through the cloth and remain in the cloth. The method for separating a solid from a liquid by using a filter is called **filtration**.



Particles of water can pass through the cloth but particles of sand cannot.

Lesson 4 Separating a Mixture 2

A mixture of water and sand can be separated by filtration. How about a mixture of water and salt? Can it also be separated by filtration?

How can we separate salt from water in a mixture?

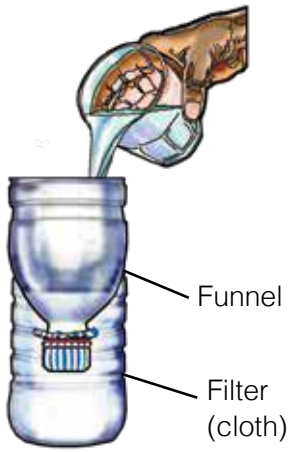
Activity : Separating a mixture of water and salt

What We Need:

- funnel with filter (cloth) from Lesson 3, a mixture of salt and water, burner, empty tin-can

What to Do:

1. Separate the mixture of water and salt using the funnel and filter. Record your result in your exercise book.
2. Pour the mixture of water and salt into the tin-can. Place the can on the burner. Heat it until all the liquid in the can evaporates.
3. Observe the inside of the tin-can and record your observations in your exercise book.
4. Share your observations with your classmates.



Burner with a mixture of salt and water

Be careful when handling hot objects.

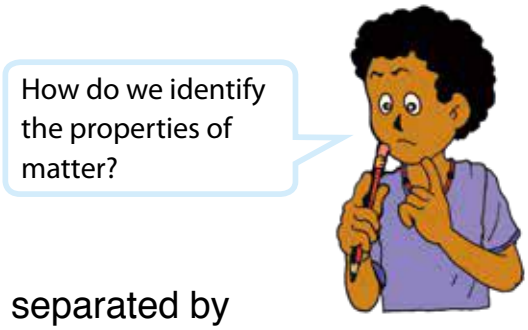
Result

We found out that when the mixture of water and salt was poured into the funnel, salt did not remain on the cloth. But when the mixture of water and salt was heated, all the liquid in the tin-can evaporated and a white substance remained.

Discussion

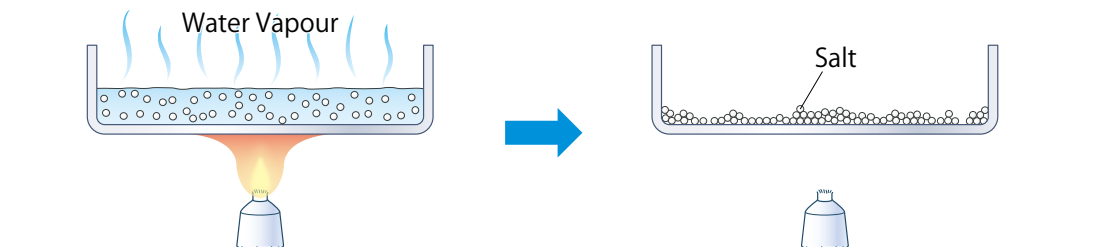
Think about the following questions based on your result.

1. What was the white substance that remained in the tin-can? Why do you think so?
2. Why didn't the salt remain on the cloth?



Summary

Salt in a mixture of water and salt cannot be separated by filtration. This is because the particles of salt in water are too small and can pass through the filter (cloth). Salt in water can be separated by boiling salt water until all the water has evaporated. A method for separating a solid in a mixture from a liquid is called **evaporation**. For example, when the mixture of water and salt in the tin-can was heated for some time, all the water evaporated as water vapour and salt was left behind.



When salt water is heated, water evaporates.

Salt remains after all had the water evaporated.

Summary and Exercise

Summary 11.1 Mixtures

Mixtures and Substances

- Matter can be classified as a substance or a mixture.
- A substance is made up of only one kind of matter.
- A mixture is a kind of matter that is made up of two or more substances.

Examples of substances			Examples of mixtures		
Water	Salt	Gold	Rock	Soil	Salt water

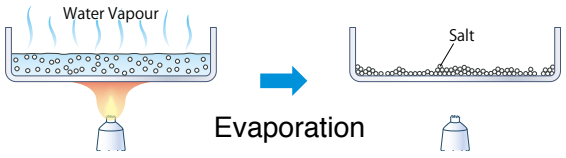
Types of Mixtures

- Mixtures are combinations of three states of substances; solid, liquid and gas.

Solid-solid mixture	Liquid-liquid mixture	Solid-liquid mixture	Gas-gas mixture
This type of mixture consists of two or more different solid substances. E.g. Rock	This type of mixture consists of two or more different liquid substances. E.g. Mixture of oil and water	This type of mixture consists of solid and liquid substance. E.g. Mixture of salt and water	This type of mixture consists of different gases. E.g. The air we breathe is made up of different gases.

Separating a Mixture 1 and 2

- Mixtures can be separated according to the different physical properties of substances that they are made up of.
- Filtration is a method for separating solid from liquid by using a filter.
- Evaporation is a method for separating solid from a liquid by evaporating all the liquid from the mixture.



- Salt in water cannot be separated by filtration. This is because the particles of salt in water are too small and can pass through the filter. Salt in water can be separated by evaporation.

Summary and Exercise

Exercise 11.1 Mixtures

Q1. Complete each sentence with the correct word.

(1) A _____ is made up of two or more substances that are physically combined.

(2) Liquid-liquid mixture consists of two or more different _____ substances.

(3) The method for separating solid from a liquid by evaporating all the liquid from the mixture is _____.

Q2. Choose the letter with the correct answer.

(1) Which of the following is an example of a solid-liquid mixture?

A. Rock

B. Sugar water

C. Water

D. Air

(2) What happens when salt dissolves in water?

A. The particles can be clearly seen.

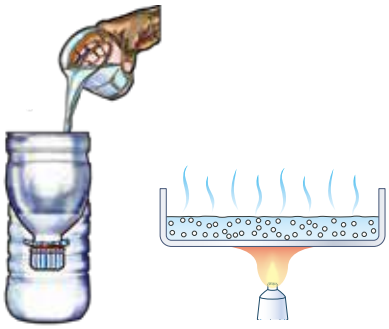
B. Salt particles are inactive or weak.

C. The particles cannot be seen.

D. It becomes a liquid.

Q3. Answer the following question.

Study figures (i) and (ii) shown on the right. Shirley dissolved two teaspoons of sugar in water. Which method (i) or (ii) will she use to separate the sugar from the water?



(i) (ii)

Q4. Samuel tried to separate mud from water by filtration, but the liquid after passing through the filter is still brown in colour. Explain why the mud water cannot be separated by filtration.

11.2 Solutions

Lesson 1 Mixtures and Solutions

In the last topic we studied about mixtures. We are now going to look at special types of mixtures, called **solutions**.

What is a solution?

Activity : Comparing mixtures

What We Need:

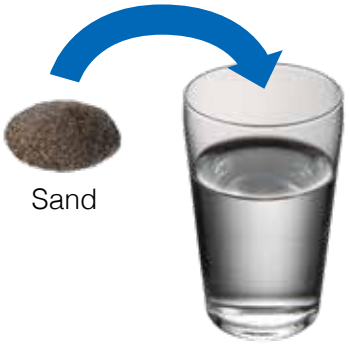
- two glasses, water, salt, sand, spoon

What to Do:

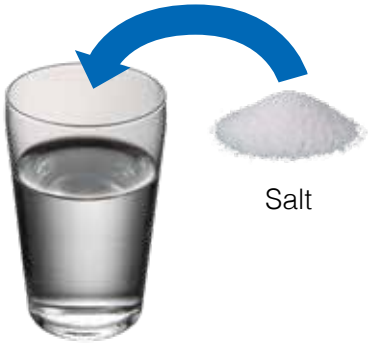
1. Draw a table like the one shown below.

	Your observation
A mixture of water and sand	
A mixture of water and salt	

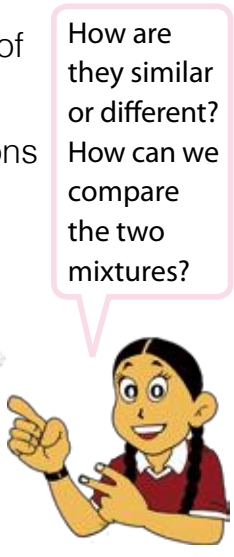
2. Pour the same amount of water into two glasses.
3. Add a half spoonful of sand in one glass and a half spoonful of salt in the other glass. Stir the contents of the two glasses.
4. Observe the two types of mixtures and record your observations in the table. Share your findings with your classmates.



Sand and water mixture



Salt and water mixture



Result

We found out that sand particles could be seen the in the mixture of sand and water, but salt particles could not be seen in the salt and water mixture.

Sand and water mixture

Salt and water mixture

Discussion

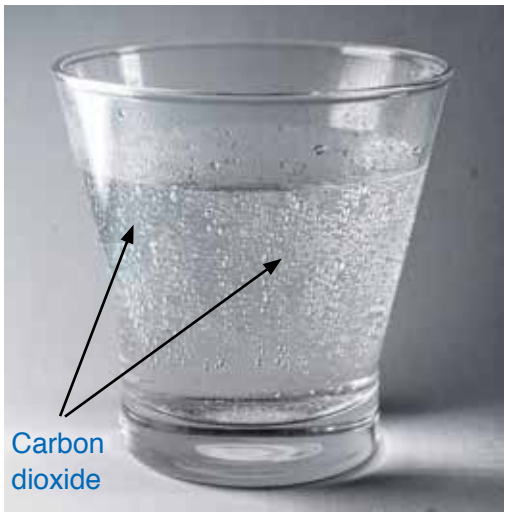
Think about the following questions based on your result.

1. What happened to the mixtures in each glass?
2. When we mixed salt and water, it disappeared. Where has the salt in the mixture gone to?

Summary

A **solution** is a mixture where one or more substances are dissolved evenly into another substance. Solutions have the same properties throughout the mixture. To **dissolve** means to mix completely by separating into particles that cannot be seen. For example, salt-water is a solution. When we mix salt and water, we can make a mixture of salt and water.

The salt particles in salt-water cannot be seen because the particles of salt become so small and they spread evenly in the water. But when we mix sand and water the sand settles at the bottom. The sand does not dissolve into the water. The mixture of sand and water is not a solution. Soda, air and gasoline are examples of solutions.



Soda is a solution where carbon dioxide is dissolved in water.

Lesson 2 Weight of Solution

When salt is mixed with water, the salt in the salt-water seems to disappear. How about the weight of the salt? Does the weight of salt also disappear?

What happens to the weight of a substance in a solution?

Activity : Measuring the weight of salt in salt-water

What We Need:

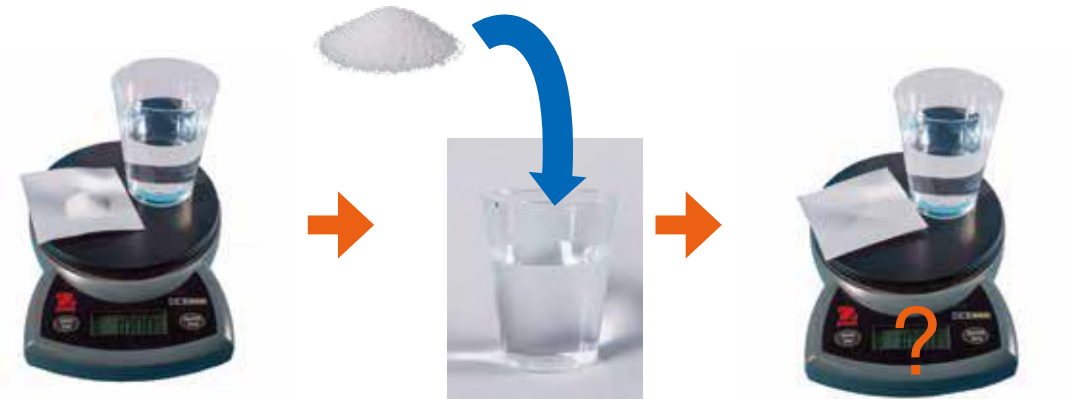
- glass, water, salt, paper, scale

What to Do:

1. Draw a table like the one shown below.

	Total amount of weight
Before dissolving salt in water	
After dissolving salt in water	

2. Pour water into the glass. Place the glass of water and the paper with salt on the scale.
3. Measure the total amount of weight and record it in the table.
4. Remove salt from the scale. Pour the salt into the glass and stir until the salt is completely dissolved.
5. Place the glass and paper on the scale again and measure the total weight. Record the weight in the table. Share your findings with your classmates.



Result

We found out that the total amount of weight before and after dissolving salt in water did not change.

Sample of the result

Before dissolving salt in water

After dissolving salt in water

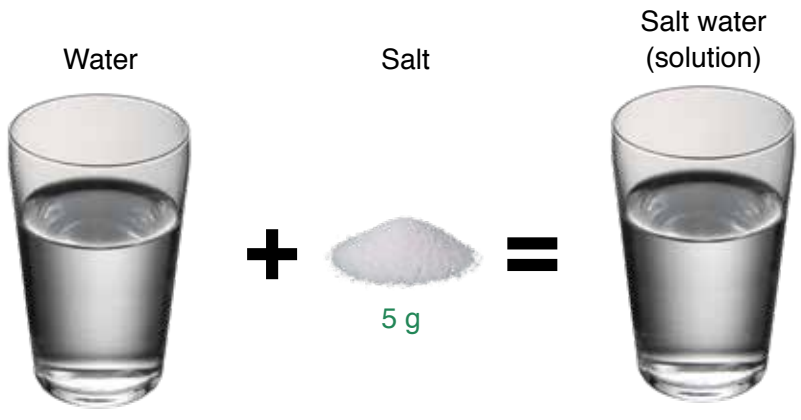
Discussion

Think about the following questions based on your result.

1. What was the total amount of weight before dissolving salt in water?
2. What was the total amount of weight after dissolving salt in water?
3. What happened to the weight of salt before and after it is dissolved in water?

Summary

When a substance is dissolved in water its weight does not change. The weight of a solution is equal to the sum of the weight of water and a substance to be dissolved. A substance dissolved in water cannot be seen but it actually exists in the solution.



The weight of salt water is equal to the sum of the weight of water and salt.

Lesson 3 Amount of Substance Dissolved in Water 1

Salt can be dissolved in water, but what will happen if we keep adding more salt? Will the salt continue to dissolve?

How much of a substance can dissolve in water?

Activity : Amount of salt to be dissolved in water

What We Need:

- glass, water, spoon, salt, paper, scale

What to Do:

1. Draw a table like the one shown below.

	The amount of salt dissolved
50 mL water	
100 mL water	

2. Pour 50 mL of water into the glass. Add 10 g of salt into the glass of water and stir it well with a spoon.
3. Measure 1 g of salt on the scale. Add 1 g of salt into the water and stir it well. Repeat this step until the salt no longer dissolves in the water. Record the amount of salt dissolved in 50 mL of water in the table.
4. Repeat Steps 2 and 3 using 100 mL of water. Record your results in the table.
5. Summarise your results in a graph and share your findings with your classmates.

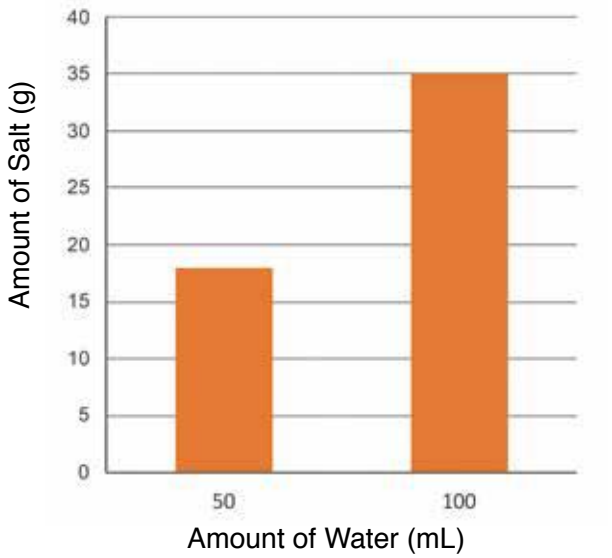
Result

We found out that salt dissolves in water as shown in the table and graph.

Sample of the results

	The amount of salt dissolved
50 mL water	18 g
100 mL water	35 g

Can you find any relationships between the amount of water and the salt dissolved in water?



Discussion

Think about the following questions based on your result.

1. Do you think salt can continue to dissolve in water? Why do you think so?
2. What happened to the amount of salt that dissolved in water when the amount of water increased?
3. Can you infer the relationship between the amount of water and the salt that dissolved in water?

Summary

If we keep adding salt to the salt-water solution, the salt will no longer dissolve but will settle to the bottom of the container. This is because the amount of salt that can be dissolved in a certain amount of water has been reached. The amount is different from substance to substance. More substances will dissolve in water when the amount of water increases. If the amount of water decreases the amount of substance to be dissolved in water will also decrease.

Lesson 4 Amount of Substance Dissolved in Water 2

More salt will dissolve in water when the amount of water increases.

How can we dissolve more substance without changing the amount of water?

Activity : Dissolving more sugar in water

What We Need:

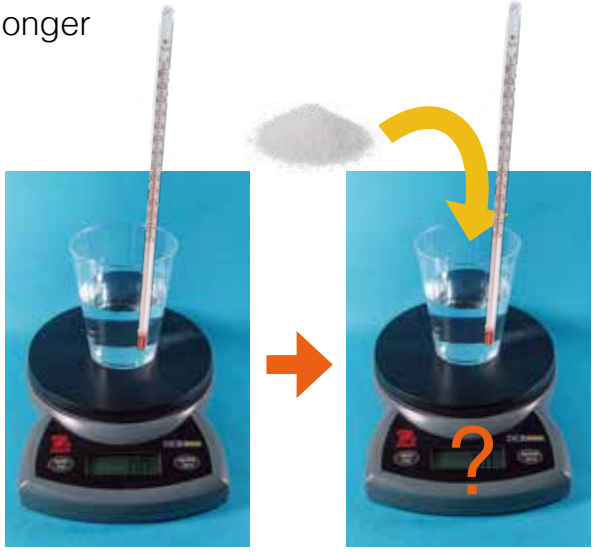
- glass, water (room temperature), hot water, spoon, thermometer, sugar, scale

What to Do:

1. Draw a table like the one shown below.

	Temperature (°C)	The weight of the glass with water (g)	The weight of the glass, water and sugar dissolved in water (g)
Water			
Hot water			

2. Pour 50 mL of water into the glass. Measure the weight of the glass with the scale and the temperature of the water with the thermometer. Record the measurement of the weight and the temperature in the table.
3. Add sugar into the glass and stir well. Repeat this step until the sugar no longer dissolves in the water. Then measure the weight of the glass and record it in your exercise book.
4. Repeat Steps 2 and 3 using 40˚C and 60˚C hot water.
5. Share your results with your classmates.



Result

We found out that more sugar can be dissolved in the same amount of water at different temperatures shown in the table and the graph.

Example of the results

	Temperature	The weight of the glass with water	The weight of the glass, water and sugar dissolved in water
Water (50 mL)	20°C	180 g	282 g
Hot water (50 mL)	40°C	180 g	300 g
Hot water (50 mL)	60°C	180 g	323 g

Amount of sugar and salt dissolved in 100 g water

Discussion

Think about the following questions based on the results above.

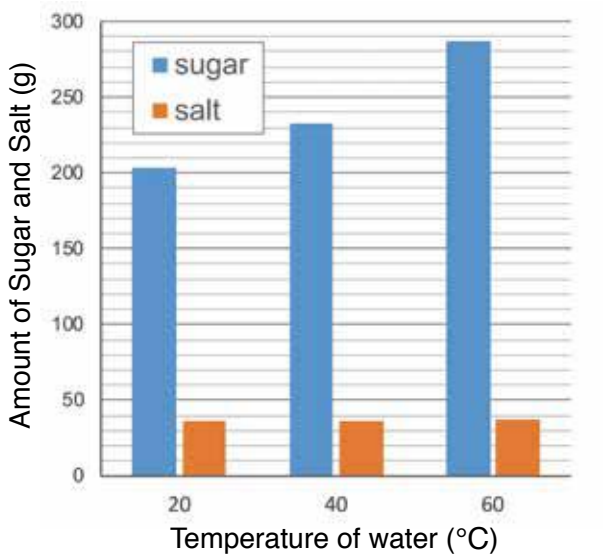
1. Calculate how much sugar is dissolved in 50 mL of water at 20°C, 40°C and 60°C.
2. What happened to the amount of sugar dissolved in water when the temperature of water increased?
3. Can you infer the relationship between the temperature of water and the amount of sugar dissolved in water?

Summary

Temperature of water	Amount of sugar dissolved in water	Amount of salt dissolved in water
20°C	203.9 g	35.9 g
40°C	233.1 g	36.4 g
60°C	287.3 g	37.0 g

Amount of sugar and salt dissolved in 100 g water

When the temperature of water increases more sugar can be dissolved, but the amount of salt to be dissolved does not change much. The amount of a substance that can be dissolved in water depends on the kind of substance even when the temperature of water increases.



Amount of sugar and salt dissolved in 100 g of water

Summary and Exercise

Summary 11.2 Solutions

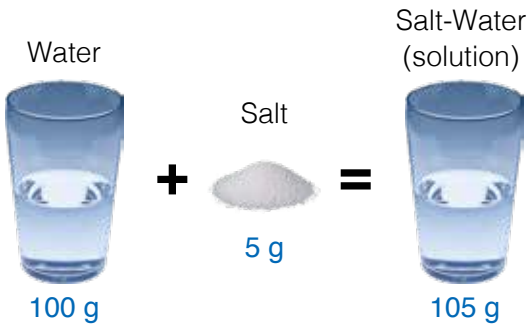
Mixtures and Solutions

Salt-water

- A solution is a mixture where one or more substances are evenly dissolved into another substance.
- Dissolve means to mix completely by separating into particles that cannot be seen.
- A solution has the same property throughout a mixture.
- Salt-water is a solution. When salt is mixed with water its particles spread evenly in the mixture where salt particles cannot be seen.

Weight of Solutions

- The weight of a solution is equal to the sum of water and the substance to be dissolved.
- The weight of a substance does not change when the substance is dissolved in water.
- A substance that dissolves in water cannot be seen but it exists in the solution.



Amount of Substance Dissolved in Water

- The amount of substance that dissolves in water depends on the amount of water and the temperature of water.
  1. More substances dissolve in water when the amount of water increases.
  2. More substances dissolve in water when the temperature of water increases.
- The amount of substances that dissolve in water depend on the type of the substances.

Summary and Exercise

Exercise 11.2 Solutions

Q1. Complete each sentence with the correct word.

(1) A kind of mixture where one or more substances are evenly dissolved into another substance is called a _____.

(2) Solution have the same _____ throughout a mixture.

(3) A substance in a solution is hard to see because it is _____.

(4) The weight of a solution is equal to the _____ of the weight of water and the substance to be dissolved.

Q2. Choose the letter with the correct answer.

(1) Which of the following is not a solution?

A. Mixture of salt and water.

B. Mixture of oil and water.

C. Mixture of sugar and water.

D. Soda water.

(2) What happens to the amount of sugar dissolved in water if the temperature of water is increased?

A. Less sugar will dissolve in water.

B. More sugar will dissolve in water.

C. The amount of dissolved sugar does not change.

D. The volume of water will decrease.

Q3. Answer the following questions.

Study and compare the picture shown on the right.

(1) What can you say about the particles of sand and salt in the mixture?

(2) What are the two factors that cause the change in the amount of salt dissolved in water?

A mixture of sand and water

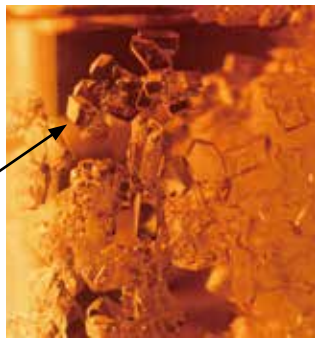
A mixture of salt and water

Q4. Celine added 50 g of sugar into 200 g of hot water. She stirred the sugar to dissolve completely in the hot water and recorded the weight. Explain the relationship between the weight before and after dissolving?

Solutions are types of mixtures. A mixture of sugar and water is an example of a solution. We learnt that when the temperature of water increases more sugar can be dissolved. What happens when more sugar is dissolved in hot water and it is cooled?

Let's make sugar crystal from sugar solution

1. Wet the end of the skewer in a glass of water. Coat it with sugar grains and gently tap to remove excess sugar and leave to dry.
2. Pour 200 ml of water into a medium sized pot. Dissolve 250 g of sugar in the pot for a start. Heat the sugar mixture.
3. Keep stirring the sugar mixture until it gets hot. Add another 250 g of sugar little by little into the pot and stir until all sugar completely dissolve.
4. Pour the thick sugar solution into the glass cup.
5. Place the skewer coated with sugar grains slowly into the glass cup.
6. Carefully move the glass cup to a place where it won't be disturbed.
7. Make sure not to touch the glass cup. Leave about one day for crystal to form and slowly build up.
6. Observe the crystal of sugar formed around the skewer.



Crystal of sugar

Chapter Test

11. Mixtures and Solutions

Q1

Complete each sentence with the correct word.

(1) Air is a mixture of _____ such as nitrogen, carbon dioxide.

(2) A _____ has the same properties throughout the mixture.

(3) To _____ means to mix matter completely into the liquid by separating into particles that cannot be seen.

(4) A _____ is a combination of two or more substances.

(5) Mixtures can be _____ using their physical properties.

Q2

Choose the letter with the correct answer.

(1) Which of the following is the correct explanation about filtration?

A. Let the water evaporate from the mixture.

B. Use filter paper to trap the solid from the mixture.

C. Use tweezers to pick out the solid from the mixture.

D. Use a magnet to attract the solid from the mixture.

(2) Sugar dissolved in water is an example of which type of mixture?

A. Liquid-solid mixture.

B. Gas-liquid mixture.

C. Liquid-liquid mixture.

D. Solid-liquid mixture.

(3) What happens to the weight of a substance in a solution? The weight of the solution

A. does not change.

B. increases.

C. disappears.

D. decreases.

(4) What is the correct method used to separate salt from water?

A. By evaporation

B. By condensation

C. By expansion

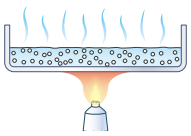
D. By filtration

Q3

(1) Josie wants to separate salt from water. Which method would she use A, B or C?

_____

A.



Heat gently
(Evaporate)

B.

By handpicking

C.

Filtration

(2) Explain two ways to increase the amount of salt dissolved in water.

a. _____

b. _____

(3) Angie added five teaspoons of salt in a glass of water and stirred it for a minute. After stirring, the salt disappeared. What had happened to the salt?

_____

Q4

(1) Helen used a screen to separate a mixture of gravel, sand and water. Why did the sand go through the screen but not the gravel?

_____

_____

_____

(2) Bonita added 10 g of salt into 100 mL of water and stirred it with a spoon. After the salt dissolved, she did not find any salt particles in the solution. Suggest what would happen to the weight of the salt dissolved in water.

_____

_____

Science Tool Box

1. How to use a Thermometer
2. How to use a Compass
3. How to use a Tape measure
4. How to use a Microscope
5. How to use a Digital Scale
6. How to read a Graph
7. How to make a Graph

Let's check and learn how to use the science tools here.

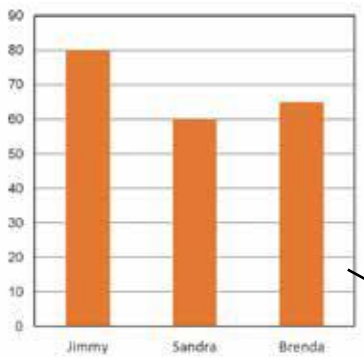
Tape measure

Compass

Thermometer

Digital scale

Microscope



Graph

How to use a Thermometer

1. What is a thermometer?

A thermometer is an instrument used to measure temperature. A thermometer consists of a glass tube with marks on it. When the liquid in the glass tube is heated, it expands and begins to rise up the tube. Temperature is measured in degree Celsius [°C].

2. Measuring temperature

STEP 1:

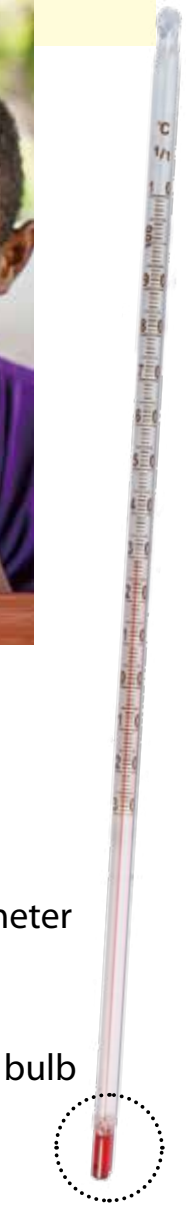
Place the bulb in the place where you want to measure the temperature. Make sure that there are no bright lights or direct sunlight shining on the bulb.

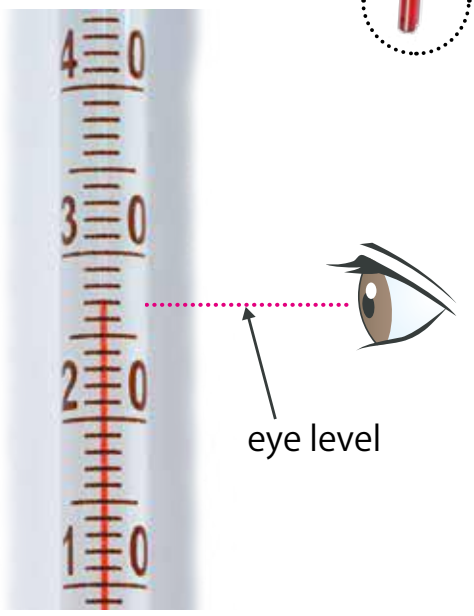
STEP 2:

Wait for a few minutes until the liquid in the tube stops moving. Position your eyes at the same level with the top of the liquid in the tube.

STEP 3:

Read the scale line that is closest to the top of the liquid. The thermometer as shown on the right shows 27 °C.





How to use a Compass

Compass

1. What is a compass?

A compass is an instrument you use for finding directions (North, South, East and West). It has a dial and a magnetic needle that always points to the north/south. This helps you to locate your position on a map and to set the direction you wish to travel.

2. Finding directions

STEP 1:

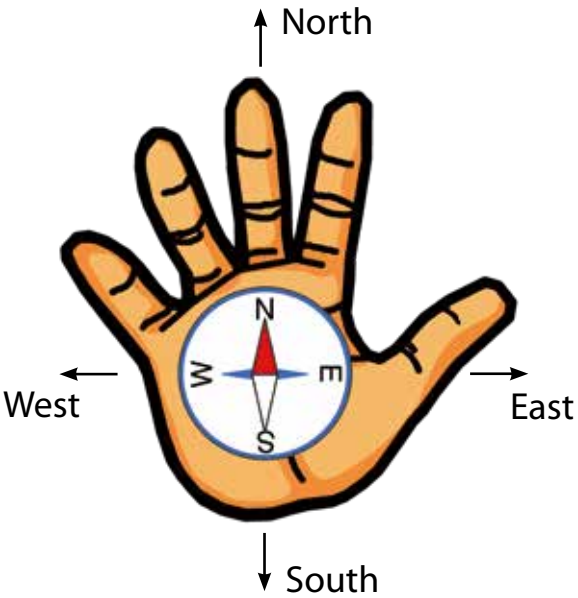
When you want to face North, place the compass flat on your palm and hold your palm in front of your chest as shown in the picture on the right.

STEP 2:

Turn your body until the magnetic needle comes to the North sign on the dial. When the needle overlaps the North sign on the dial, you are facing North.

STEP 3:

Find other directions when you are facing North. Your right side points to East and left side points to West, and your back is facing the South when you are facing North.



How to use a Tape measure

1. What is a Tape Measure?

A tape measure is also called a measuring tape. It is a type of flexible ruler. Tape measures may be in metric (centimetres and metres) and imperial units (Inches and feet).

2. Finding the circumference around your partners head

STEP 1:

Have your partner to stand in front of you with head up straight.

STEP 2:

Hold on one end of the tape that begins with 0 and wrap the tape around your partner's head just above the top of the ears.

STEP 3:

Find the line where the tape measure begins to wrap over itself or the end of the length of the object.

STEP 4:

Record the circumference of your partner's head to the nearest centimetre.

How to use a Microscope

1. What is a Microscope?

A **microscope** is a scientific equipment that is used to see small things that cannot be seen with naked eye. Most **microscopes** use lens, which are pieces of glass or plastic, to magnify objects.

A microscope breaks easily and has to be handled with care. Keep lens clear and avoid touching. Cover the microscope when not in use.

2. Observe some sugar grains

STEP 1:

Move the mirror towards a source of light. Avoid using the sun as a light source.

STEP 2:

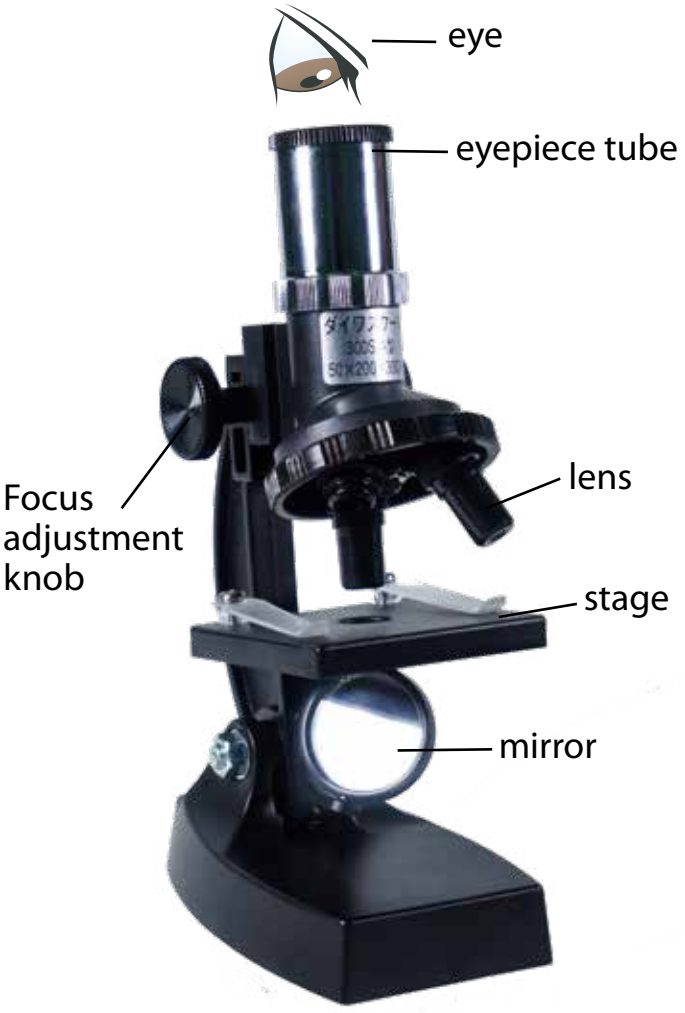
Put a few grains of sugar on the slide.Then put the slide containing the sugar grains on the stage of the microscope.

STEP 3:

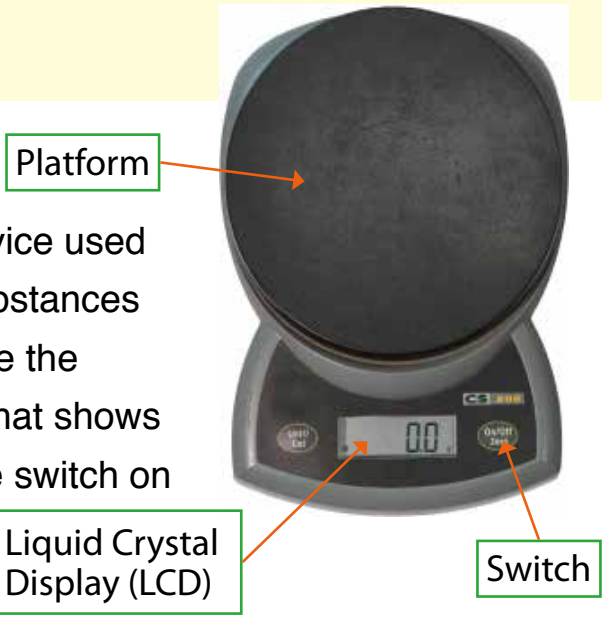
Look through the eyepiece.Turn the adjustment knob on the side of the microscope to bring the sugar grains to focus.

STEP 4:

To increase the magnification, use the longer lens. To decrease the magnification, use the shorter lens.



How to use a Digital Scale



1. What is a Digital Scale?

A digital scale is an electrical or solar device used to measure the weight of an object or substances precisely. It consists of a platform to place the object on, a liquid crystal display (LCD) that shows the reading (weight) of the object and the switch on or off button.

2. Measuring Weight

STEP 1:

Turn your digital scale on and wait until the reading is set to 0.0 g

STEP 2:

Place whatever needs to be weighed on the scale gently. Observe the display screen on the scale. Make sure to keep the contents steady until it stops at a certain reading.

STEP 3:

Read the measurement on the scale according to the unit given, for example in grams. The weight of the object on the scale would read as 107.0 grams.

How to read and make a Bar Graph

1. What is a Bar Graph?

A bar graph helps to compare data by using bar to represent numbers. In 2.1, it shows how to read a bar graph. In 2.2, it shows how to make a bar graph to compare the weight of three students.

2.1 Reading a Bar Graph

STEP 1:

Read the title of the bar. What is the bar graph about?

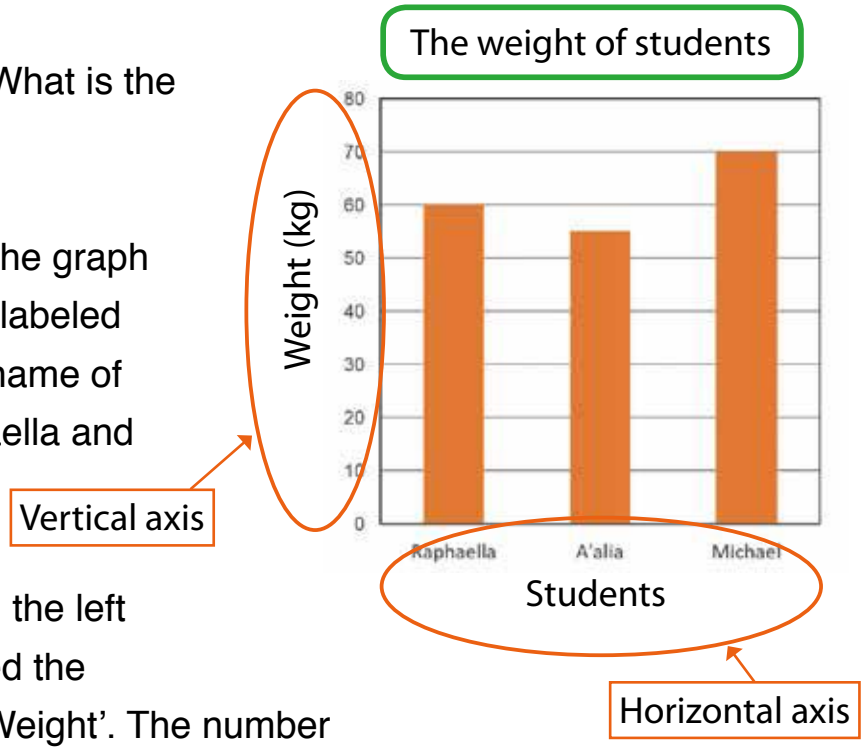
STEP 2:

Study the bottom part of the graph called the horizontal axis labeled 'Student' that shows the name of students; Michael, Raphaella and A'alia.

STEP 3:

(1) Study the numbers on the left side of the graph called the vertical axis labeled 'Weight'. The number represents the weight in kilograms.

(2) The highest represented number is 80 kg. Between any two numbers example between 30 and 40 the interval amount is10 kg.



STEP 4:

(1) Study the bar graph. Look at the bar labeled as 'Raphaella' and move across to the vertical axis to identify the weight in numbers. The bar shows that the weight of Raphaella is 60 kg.

(2) Read the question asked. Example: Which student is the heaviest? Compare all the heights of the bars. Follow the highest bar down to identify the name of the student on the horizontal axis. Michael is the heaviest among the students and his weight is 70 kg.

2.2 Making a Bar Graph

Jimmy weighs 80 kg, Sandra weighs 60 kg and Brenda weighs 65 kg. The table shows their weight in kilograms. Use the data in the table to make a bar graph showing their weights.

Student	Weight (kg)
Jimmy	80
Sandra	60
Brenda	65

STEP 1:

Title the graph. The title should help the reader understand what the graph describes.

STEP 2:

Choose a scale and mark equal intervals. The vertical scale should include the least value and the greatest value in the set of data.

STEP 3:

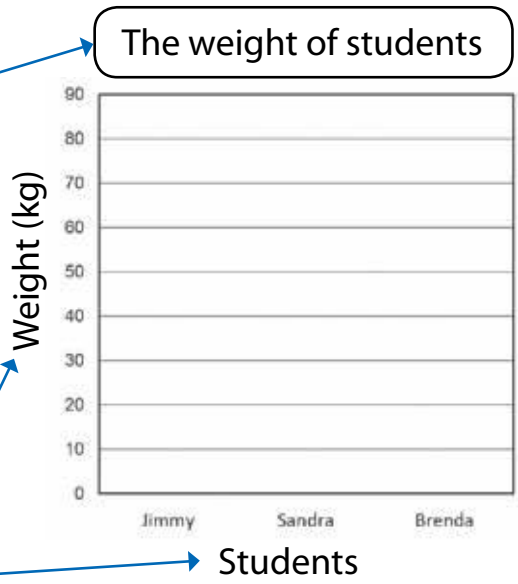
Label the vertical axis 'Weight' (kg) and horizontal axis 'Students'. Space the students' names equally.

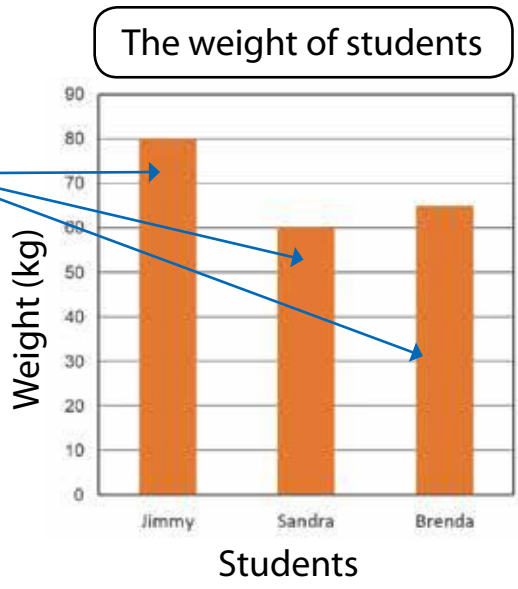
STEP 4:

Carefully draw the graph using the data. Depending on the interval you choose, some weights may appear between numbers.

STEP 5:

Check each step to make sure that the data in the table matches the bars you have made with the correct weights.





Chapter 1. Topic 1. Page 20

Q1. (1) omnivore (2) prey (3) ecosystem (4) decomposers

Q2. (1) A (2) B

Q3. (1)

Producer	Consumer
Tomato, seaweed hibiscus	Frog ,butterfly, snake

(2) Different plants and animals live in different environments.

Q4. (Expected answers) Because there are decomposers that break down dead plants and animals into smaller pieces and also they decay into the ground.

Chapter 2. Topic 1. Page 34

Q1. (1) weathering (2) wind (3) landslide (4) earthquake

Q2. (1) B (2) D

Q3. (Expected answers) (1) Wind, water, ice, chemical and living things (2) Acid rain weakens the rock wall causing it to break down.

Q4. (Expected answers) 1) Shape of the mountain would change. 2) A new mountain would be formed. 3) A large bowl-shaped hole would be formed in the ground. 4) A large-shaped lake would be formed

Chapter 2. Topic 2. Page 42

Q1. (1) strata (2) sedimentary (3) flowing

Q2. (1) C (2) C

Q3. Deposition

Q4. (1) (Expected answer) Because the weight of sediments at the top part presses the sediments at the bottom and the pressure forces turns the sediments at the bottom into sedimentary rocks.

(2) (Expected answer) Sedimentary rocks can be classified based on what they are made of.

Chapter 3. Topic 1. Page 54

Q1. (1) frictional (2) magnetic (3) gravity

Q2. (1) A (2) D

Q3. (1) Spring balance (2) newton (N)

(3) (Expected answer)Contact force is when two objects are physically touching each other. Whereas non-contact force is when two objects are not in contact with each other but act through the space between them.

Q4. (The length of the arrow should be 3 cm.)

Chapter 4. Topic 1. Page 64

Q1. (1) leaves (2) tubes (3) transpiration

Q2. (1) B (2) C

Q3. (Expected answers)There are tubes through which water passes in the stem of plant to all its parts.

Q4. (Expected answers) The plant with no leaves does not release water vapur into the air. Therefore, there were no water vapour in the plastic bag and water droplets were not observed in the plastic bag.

Chapter 5. Topic 1. Page 78

Q1. (1) stamen (2) stigma (3) fruits (4) traits

Q2. (1) D (2) C

Q3. (Expected answers) wind, insect and animals

Q4. (Expected answers) The ovule in the ovary develops into the seed. As the seed develops, the ovary gets bigger and bigger and changes into a fruit.

Chapter 6. Topic 1. Page 90

Q1.(1) star (2) temperature (3) East, West (4) agriculture

Q2. (1) D (2) A

Q3. (1) southern cross (2) The blue star has the higher temperature.

Q4. This occurs as a result of the Earth's spinning on its axis.

Chapter 7. Topic 1. Page 104

Q1. (1) gravitational potential (2) kinetic (3) chemical

Q2. (1) A (2) B

Q3. (1) The amount of kinetic energy depends on the speed of an object. (2) The book that is on top of the table.

Q4. (Expected answer) Ketsin observed kinetic energy in the wind (moving air) and gravitational potential energy in the coconut when it was attached to the tree and kinetic energy when the coconut fell of the tree.

Chapter 7. Topic 2. Page 110

Q1. (1) electrical (2) kinetic (3) electrical

Q2. (1) A

Q3. (1) (i) – because it is the highest point (2) (iii) – because it is the lowest point. (3) Kinetic energy of the ball increases during the fall.

Q4.(Expected answer) Jonathan used great effort to pedal uphill because the kinetic energy of the bicycle is converted into gravitational potential energy.

Chapter 8. Topic 1. Page 120

Q1. (1) orbit (2) revolution (3) phases (4) moon

Q2. (1) D (2) C

Q3. (i) (ii) (iii)

Q4. (Expected answer) The phase of the moon at this time would be new moon because the shadow part of the Moon is facing the Earth.

Chapter 9. Topic 1. Page 134

Q1. (1) electromagnet (2) magnet (3) electric current (4) rolls

Q2. (1) A (2) C

Q3. (1) Increases amount of electric current and number of rolls in the coil. (2) Cranes for heavy lifting, speaker, motor, etc.

Q4. (Expected answer) He will turn on the electromagnet to lift up the metal to transfer to another place then release the metal by switching off the electromagnet.

Chapter 10. Topic 1. Page 144

Q1. (1) breathing (2) organ (3) respiratory (4) diaphragm

Q2. (1) D (2) C

Q3. (Expected answer) Lungs get bigger as diaphragm contracts and air comes into our lungs as we inhale. Lungs get smaller as diaphragm relaxes and air is forced out of our lungs as we exhale.

Q4. (Expected answer) When we breathe in, we take air into our body through our nose. The air moves into our trachea, which connects the throat to the lungs. In the chest, the trachea divides into two tubes and each of these tubes leads to one of your two lungs.

Chapter 10. Topic 2. Page 152

Q1. (1) Heart (2) Chambers (3) Blood vessels (4) Haemoglobin

Q2. (1) C (2) A

Q3. (1) Platelets (2) Circulatory system is a group of organs for transporting oxygen and carbon dioxide to and from cells in our body.

Q4. (Expected answer) The cells in her body requires oxygen so she breathes fast to take in more oxygen and the heart beats quickly to send oxygen throughout her body.

Chapter 11. Topic 1. Page 166

Q1. (1) mixture (2) liquid (3) evaporation

Q2. (1) B (2) C

Q3. She should use (ii) which is the evaporation method.

Q4. (Expected answer) Some particles of mud in the mud water are so small that they can pass through the filter. That is why the filter cannot stop all the particles of mud and the liquid after passing through the filter still contains particles of mud.

Chapter 11. Topic 2. Page 176

Q1. (1) solution (2) properties (3) small (4) sum

Q2. (1) B (2) B

Q3. (1) Grains of the sand can be seen while the particles of salt cannot be seen.

(2) 1) Temperature of water

2) amount of water.

Q4. (Expected answer) The weight of solution is equal to the sum of water and the substance to be dissolved.

200 g + 50 g

Glossary

Anther is the male reproductive part that produces and stores pollen grains. 70

Artery is the blood vessel that carries blood away from the heart. 148

Atrium is a heart chamber that receives blood from the body or the lungs. 146

Axis is an imaginary line at which a body rotates. 116

Aveoli are the millions of tiny balloon-like air sacs in the lungs. 140

Bacteria are single – celled organisms that are not a plant or an animal. 18

Blood vessels are tubes that the blood flows through to get to the different parts of our body. 148

Breathing is the process of taking air in and out of the body. 140

Capillaries are the smaller and tiny vessels that connects the arteries and veins. 148

Carnivore is an animal that eats only animals. 12

Cell is the basic structure that makes up all living things. 148

Chambers are the spaces that consist two atriums and two ventricles of the heart. 146

Chemical energy are energy stored in foods, batteries and fuels. 100

Circulatory system is a network of organs that transport oxygen and nutrients to and carbon dioxide from the cells throughout our body. 148

Constellation is a group of stars that form a particular pattern. 88

Consumers are animals that consume other plants and animals in a food chain. 12

Contact forces are forces that take place when two objects are physically interacting with each other by touching. 48

Decomposer are organisms that break down dead animals and plants. 18

Deposition is the dropping of sediments moved by water, wind and ice. 30

Diaphragm is a muscle that helps to makes our lungs larger and smaller as we breathe air in and out. 142

Glossary

Direction is the way or path something moves..... 52

Dissolve is to become broken up or absorbed by a liquid until it cannot be seen to form a mixture. 168

Earthquake is a sudden movement of Earth's surface often causing severe damage. 32

Ecosystem is a community of living things and non-living thing interacting together to support each other..... 16

Electromagnet is a type of magnet in which magnetic field is produced by an electric current flowing in a coil. 125

Erosion Is the movement of sediments from one place to another caused by wind, running water etc. 28

Evaporation method is a way for separating a solid from a liquid in a mixture by evaporating the liquid substance..... 164

Fertilisation is the joining of the male reproductive cell and the egg cell. 74

Filament is the stalk that holds up the anther..... 70

Filtration is the method for separating a solid from a liquid by using a filter. 162

Food chain the path of food energy from plants to animals. 11

Gravitational potential energy is the energy stored in an object depending on its height from the ground. 98

Gravity is a non-contact force that attracts objects towards each other. 50

Haemoglobin are the red colour particles that are contained in the red blood cells to carry oxygen. 150

Heart is a muscle about the size of our fist that is located within our rib cage to the left of the chest. 146

Herbivore is an animal that eats only plants. 12

Heredity is the process through which traits are passed on from parents to young organisms. 76

Kinetic energy is the energy of a moving object. 96

Landslide is the rapid downhill movement of large amount of rock and soil. 32

Lungs are the main organs of the respiratory system in most animals living on land. 140

Magnitude of force is the amount of force. 52

Mass is a measurement of the amount of matter in an object. 55

Microscope is an instrument that is used to observe very small things that cannot be seen with our naked eyes. 147

Mixture is a matter that is made up of two or more substances that are combined physically. 158

Moon phases is the changes in the amount of the lit areas of the moon that can be seen from the earth. 118

Newton (N) is the unit of force. 51

Non-contact forces are forces that take place when two objects are not in contact with each other but act through the space between them. 48

Omnivore is an animal that eats both plants and animals. 12

Orbit is a path that an object takes in space around another object. 116

Organ is a part of the body that has a specific form and function. 140

Ovary is the female reproductive part that produces and contains the eggs. 70

Ovule is the structure that gives rise to and contains the female reproductive cells. 70

Pistil is the female reproductive part of a flower. 150

Plasma is the component of blood which is consist of liquid. 150

Platelets are tiny cells of blood that help blood clot in order to stop bleeding, to heal cuts and other injuries. 150

Point of application is the location at which a force is applied to an object. 52

Pollen grains are microscopic structures that carry the male reproductive cell of plants. 70

Glossary

Pollen tube is the tube through which sperm from the pollen reaches the egg cells and fertilises the plant to form seeds. 74

Pollination is the transfer of pollen grains from the anther to the stigma of a flower. 71

Predator is an animal that hunts and eats other animals..... 12

Prey is an animal that is hunted and eaten by other animals. 12

Producers are living things that produce their own food. 12

Red cells are the red disc shaped cells in the blood containing haemoglobin to carry oxygen from the lungs to all parts of the body.. 150

Respiratory system is a group of organs in our body that enables us to breathe. 140

Revolution is the movement of an object in a circular or elliptical course around another. 116

Rotation is the action of rotating on an axis or centre. 116

Sedimentary rocks are rocks that are formed from layers of sediments call strata, usually at the bottom of rivers, lakes and ocean. 39

Sediments are the materials that are carried by water or wind and deposited on the surface of the land or the seabed and may in time become into rocks. 26

Solution is a mixture where one or more substances are dissolved evenly into another substance. 168

Stamen is the male reproductive part of a flower 70

Star is a giant ball of hot gases..... 84

Stigma is the female reproductive part where pollen grains fall on 70

Strata is the horizontal layers of sediment. 36

Style is the long stalk that connects the stigma to the ovary. 70

Substance is a matter that is made of only one kind of matter. 158

Trachea is the tube that connects the throat to the lungs..... 140

Transpiration is the process of plants losing water from the leaves into the air in the form of water vapour. 62

Vein is the blood vessel that carries blood back to the heart. 148

Ventricle is a chamber that pumps blood to the lungs or the body. 146

Volcano is an opening (usually on a mountain) on the Earth's surface which explodes to allow hot magma, volcanic gas and ash to escape. 32

Weathering is a process where rock is broken down into smaller pieces over time. 26

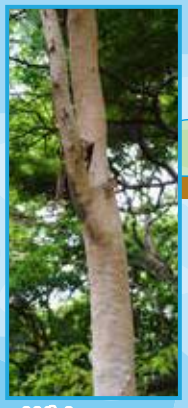
Weight is a force caused by gravity. 55

White cells are blood cells for our body's immune system to defend the body against bacteria, viruses and other infectious diseases. 150

Plants in PNG

Kleinhovia

Maniltoa


White gum

Casuarina

◆ Fishtail palm

Harpullia

Rusty berries

Hoop pine

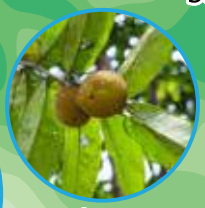
Sepik blue orchid

Blue ginger

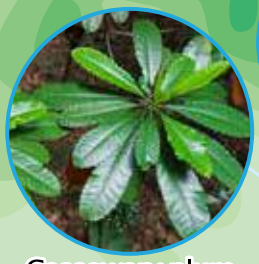
Coffee bush

◆ Yellow flame tree

Brown pine


Ebony

Big vine


Cassowary plum

◆ Galip nut

◆ Rain tree

Antelope orchid

Bird nest fern

Cycas palm

Coconut tree

Varirata National Park

◆ Plants found nationwide

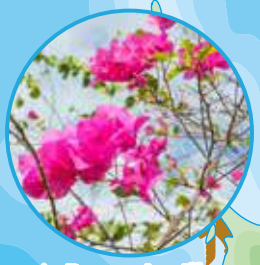
Mangrove

Candle tree pendula

Family palm

Kerosene tree

Screw pine



Bougainvillea

Hibiscus

Leichhardt tree

Mango

Frangipani

Nutmeg

Manatee grass

continued

Plants in Varirata National

Ant plant

Kangaroo grass

Umbrella tree

Shield fern

Clidemia

Butterfly tree

Birthwort

Tropical banksia

Chalmers' neonauclea

Brown pine

Sumac

Gymnostoma

Park in PNG

Varirata National Park is PNG's first national park. It is on state land on the Sogeri Plateau, 48 km east of Port Moresby city. The park has scenic views with beautiful rainforests and savannah grasslands. It is inhabited by some unique plants and animals.

Common pitcher plant

Melastome

Pandanus

Papuan oak

Semecarpus

Water chestnut

Bottlebrush orchid

Cycad

Tropical mistletoe

Spiked pepper

Hyacinth orchid

Planchonia

East New Guinea fig

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The National Science Textbook was developed by Curriculum Development Division (CDD), Department of Education in partnership with Japan International Cooperation Agency (JICA) through the Project for Improving the Quality of Mathematics and Science Education (QUIS-ME Project). The following stakeholders have contributed to manage, write, validate and make quality assurance for developing quality Textbook and Teacher's Manual for students and teachers of Papua New Guinea.

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