

## Chapter 9

# Force



What is the girl in this picture doing with the ball?



What makes the ball move and fly in the air?



# 9.1

## Objects in Motion

### Lesson 1: “How Objects Move”

Look around us! A lot of objects are moving. When we play basketball the ball bounces and rolls.



What makes objects move?



#### Activity : Making objects move

##### What We Need:

- different objects such as pen, book, and stone

##### What to Do:

1. Make a table like the one shown below in your exercise book.

Name of Object	How you make it move?

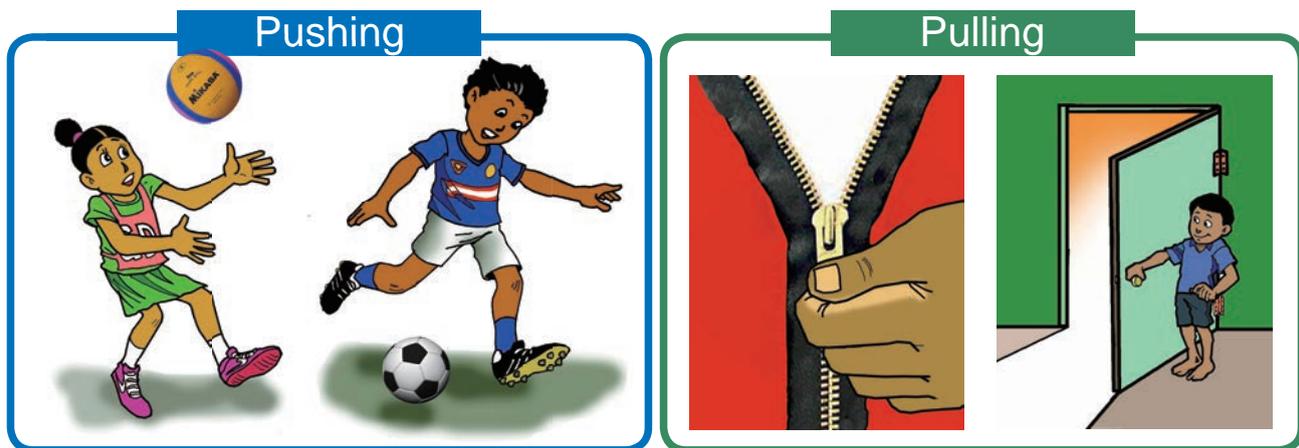
2. Collect different types of objects around you and write the names of the objects in the table.
3. Try to make each object move in many ways, and make a list of how you moved it in the table.
4. Share your ideas with your classmates. Talk about what makes objects move.

Do you have any idea what makes objects move?



## Summary

We can move objects by pushing and pulling them. A push and pull is a **force**. When we move an object, we use a force. A force can make objects move. There are different types of forces around us. When we throw or kick a ball, we push the ball. When we zip our clothes, we pull the zipper. When we open a door, we push or pull the door.

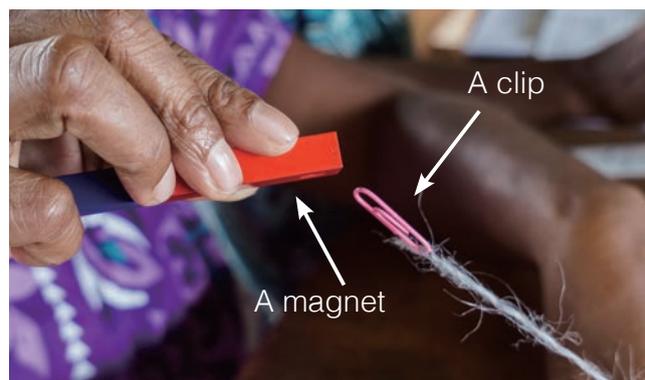


Magnets can move objects because magnets have forces. Iron clip is attracted to a magnet because the magnet pulls the clip.

An object falls to the ground when we drop it because the Earth pulls the object. The force that pulls objects towards the Earth's centre is called **gravity**.



Objects fall down to the ground.



A magnet pulls an iron clip.

Can you give other examples of forces around you?



## Lesson 2: “Push and Pull”

An object moves when we push or pull it. If an object is lighter or heavier, how do we push or pull it?



How do we push or pull a heavy or light object?



### Activity : Pulling and pushing your classmate

#### What We Need:

- ➔ tyres, ropes

#### What to Do:

1. Tie the tyre with the rope as shown on the right.
2. Push the tyre by hand and then pull the tyre by holding the end of the rope.
3. Ask one of your classmates to sit on the tyre. Push and pull the tyre.
4. Record how you push or pull the tyre with or without a friend.
5. Share your ideas with your classmates. Talk about how a force affects the movement of the tyre.

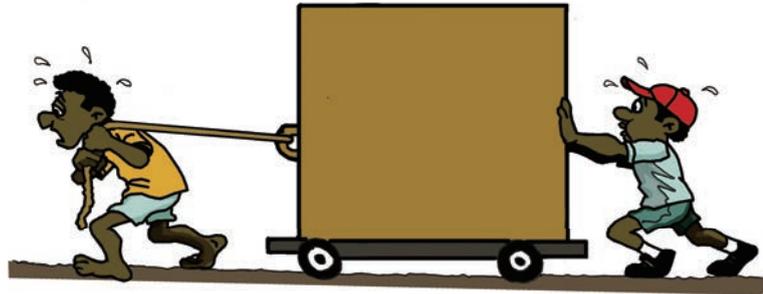


How can you make it easier to move the tyre with your classmate?



## Summary

A push or a pull is a force. A **push** is a force moving something away from us. A **pull** is a force moving something towards us.



A push and a pull is a force.

We can move heavy object when we push or pull harder. When we move a lighter object, we need a smaller push or pull. A larger force is needed to move a heavy object. A smaller force is needed to move lighter objects.



A small force can move a light object.



A large force is needed to move a heavy object.

A kick is a pushing action. If we kick a ball with a lot of force, the ball goes further. If we kick a ball with a small force, the ball does not go far.



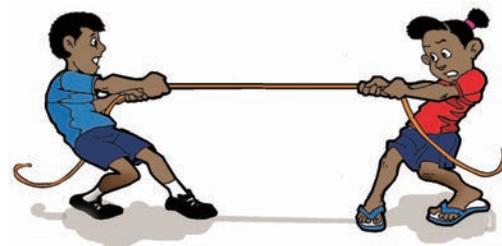
A large force can move a ball further .



## Discussion

### Which force is stronger?

“Look at the picture shown on the right. They are pulling on the rope, but the rope doesn’t move. Which student is using larger force?”



# Lesson 3: “Slower and Stop”

When we kick a ball, it travels then slows down and stops. A car slows down and stops when we step on the brake.



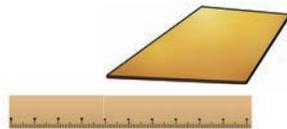
**What makes things slow down and stop?**



## Activity : Moving things on surfaces

### What We Need:

- toy car, books, ruler and cardboard.



Can you guess on which surface the toy car will travel the furthest?

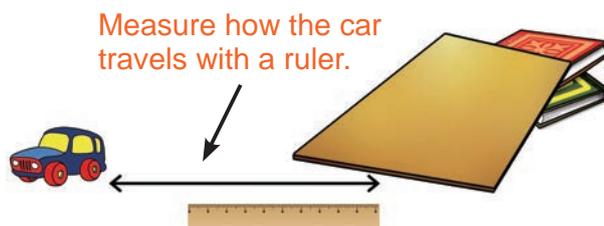
### What to Do:

1. Make a table like the one shown below.



	How you feel the surface	How far a car travelled (cm)
Concrete Floor		
Ground		

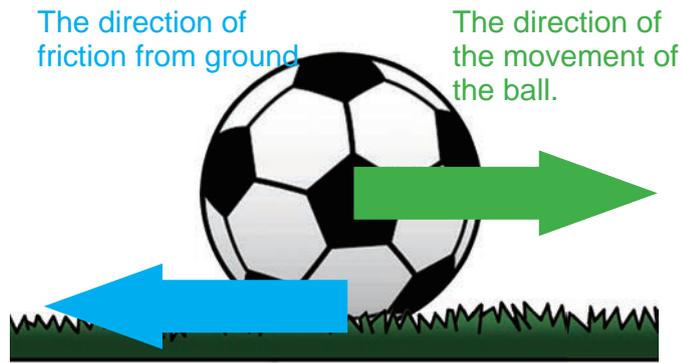
2. Touch the surfaces of the concrete floor and ground and write how it feels in the table.
3. Put two books on the concrete floor and place the cardboard on the edge of the two books.
4. Let the car off from the top of the cardboard.
5. Measure how far the car travelled using the ruler and record it in the table.
6. Repeat steps 3, 4 and 5 on the ground.
7. Share your observation with your classmates. Talk about which floor the car travelled the furthest and provide reasons.



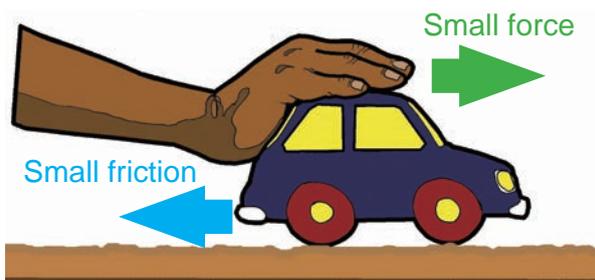
## Summary

Moving objects slow down and stop because of forces. A force that makes an object slow down and stop when two surfaces of objects are rubbed against each other is called **friction**.

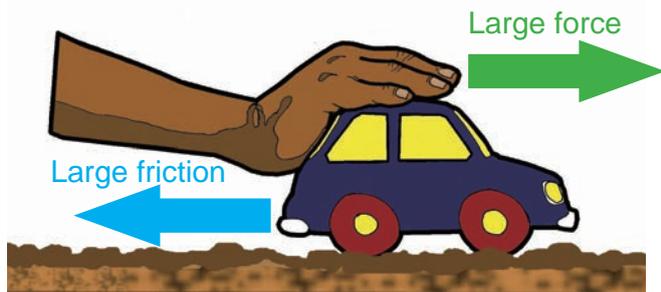
Friction acts in the opposite direction to the movement of an object. The rougher the surface, the more friction is produced. When we try to push an object on the rough surface, friction makes this more difficult than on smooth surfaces.



Direction of friction and movement of a ball.



Smooth surface



Rough surface

A liquid makes the surface smoother and reduces its friction. We easily slip and fall if we walk across a wet floor because the wet floor reduces friction.

Can you find where friction occurs around you?



Without friction, we cannot grip a cup.



A wet floor is slippery.

Friction can be useful. Without friction, we cannot grip a pen. If you run down the road, you can stop quickly because of the friction between your shoes and the ground.

# Lesson 4: “Speed Up and Slow Down”

Force makes things move. If we apply a force on a moving object, what will happen to the object?

**?** How can force change the movement of things?



## Activity : Kicking and catching a ball

### What We Need:

- ➔ Balls

### What to Do:

1. Make a table like

the one shown below in your exercise book.

	How does the ball move?
Place the ball on the ground	
Kick the ball slowly	
Kick the rolling ball	
Catch the rolling ball	



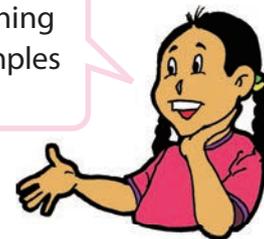
Can you guess what will happen to a ball if you kick a rolling ball?



2. Go out of the classroom and place the ball on the ground. Observe how the ball moves and record your observations in the table.

3. Kick the ball slowly and then kick the rolling ball again. Observe how the ball moves and record your observations in the table.

Kicking and catching the ball are examples of force!



4. Catch the rolling ball with your foot. Observe how the ball moves and record your observations in the table.



5. Share your findings with your classmates. Talk about how force changes the movement of the ball.

## Summary

A force can start, move, speed up, slow down and stop an object. In other words, a force can change the speed of an object. **Speed** is a measure of how fast or slow an object is moving.

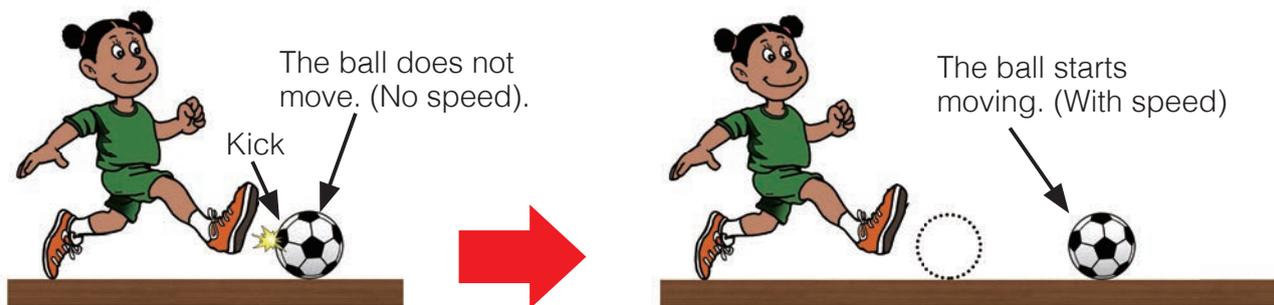
Kicking and catching are examples of forces.

When we place a ball on the ground, the ball is at rest. The ball at rest does not have speed.

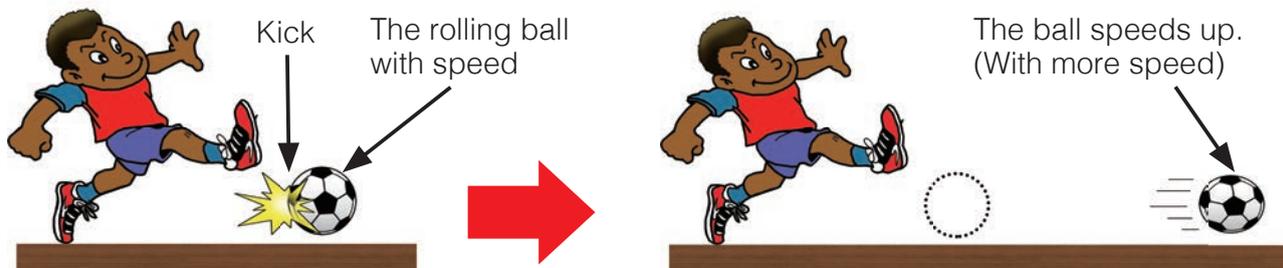


A ball at rest does not have speed.

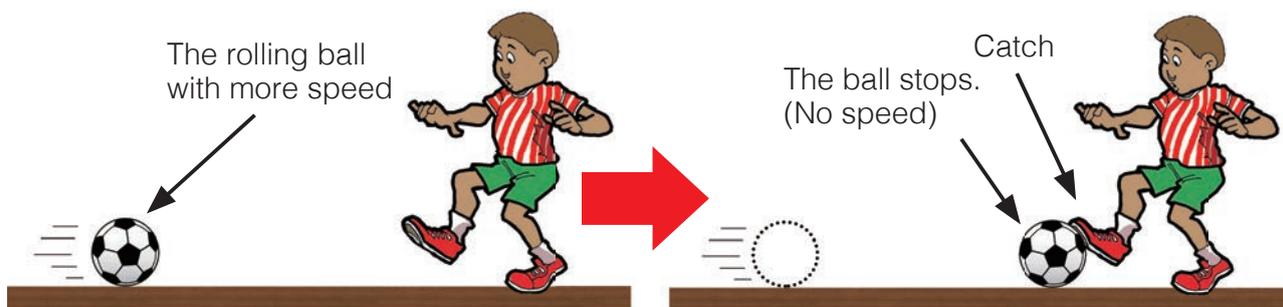
When we kick the ball slowly, it starts to move and has speed.



We kick the rolling ball again, it moves faster and speeds up.



When we catch the rolling ball, it stops and does not have speed.



## Lesson 5: “The Way Objects Move”

When we bounce a ball, the ball keeps moving down until it hits the ground and it bounces back up. The ball changes the direction from up to down and from down to up.



**What makes the direction of things change?**



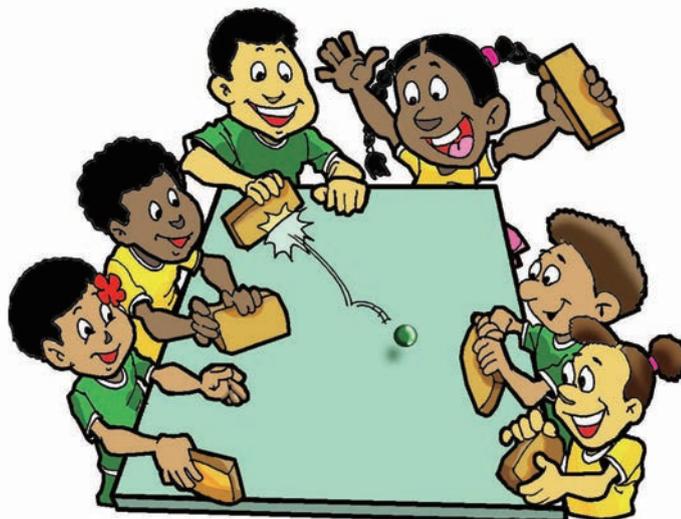
### Activity : Passing a marble to friends

#### What We Need:

- ➔ marble, large table, wooden blocks

#### What to Do:

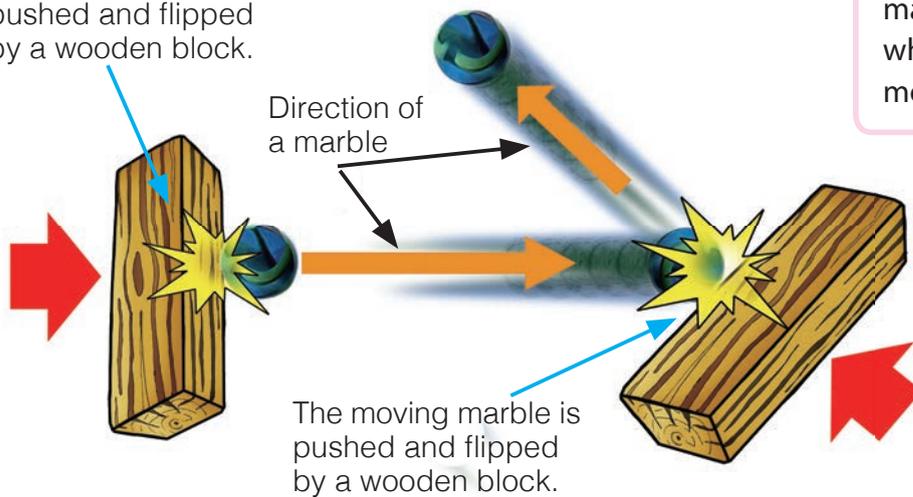
1. Form a group and sit around a table.
2. Hold the wooden block and place the marble on the table.
3. Pass the marble to a friend slowly by using the wooden block.
4. When the marble comes to you, try to pass it to another friend.
5. Continue this play until the marble falls off the table.
6. Think about the following questions:
  - ➔ Did the direction of the moving marble change when you passed it to your friends?
  - ➔ How did you change the direction of the moving marble?
7. Share your ideas with your classmates. Talk about what makes a moving marble change its direction.



## Result

When we pushed and flipped the marble at rest with a wooden block, the marble started to move straight. The marble moved straight in the different direction when we pushed and flipped the moving marble with the wooden block.

The marble at rest is pushed and flipped by a wooden block.



## Summary

Pushing and flipping are example of forces. When we push and flip a moving marble, we can change the direction of the moving marble.

This means that **a force can change the direction of a moving object.**

**Direction** is the path that an object takes. The direction tells us where the object is going. A force makes the direction of a moving object change.



## Lesson 6: “More about Forces”

A force can make things move, speed up, slow down and stop. A force also changes the direction of things.



What else can force do?



Activity : Use your force!

### What We Need:

- ➔ empty plastic bottles without a cap, clay



Can you guess what will happen to these things when we apply different forces?

### What to Do:

1. Make a table like the one shown below.

What happened to the things?

2. Apply different types of forces to the empty plastic bottle and clay.
3. Record what happened to the plastic bottle and clay in the table.
4. Share your findings with your classmates. Talk about what forces can do.

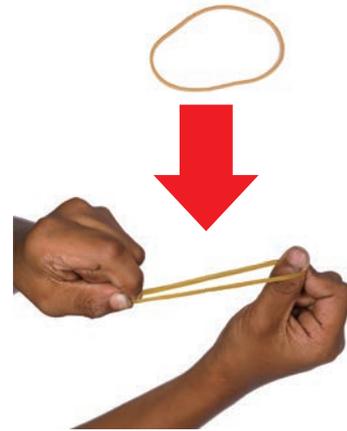


What types of force can you apply to these things?



## Summary

A force can change the shape of an object. For example, we create new shapes of clay when we push, press or pull clay. When we pull a rubber band, we change its shape.



A force changes the shape of rubber band and clay.

A force can also change the size of an object. Size tells us how big or small an object is. For example, an empty bottle shrinks when we crush it. Sometimes we see crushed cans on the road because cars press the cans.



A force changes the size of the bottle and can.



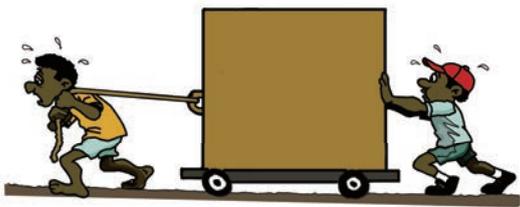
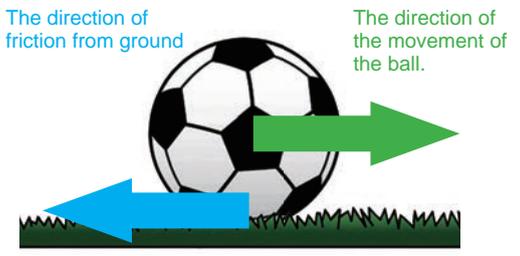
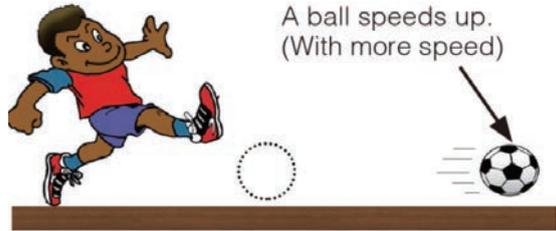
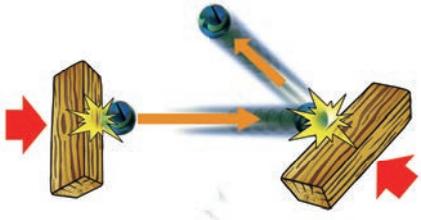
## Discussion

### More about forces?

1. Give examples from daily life where forces may change the shape and size of things.
2. Talk about your ideas with your classmates.



## Forces

<p><b>A force is a push or a pull.</b></p> <ul style="list-style-type: none"> <li>- A push is a force moving something away from us.</li> <li>- A pull is a force moving something towards us.</li> </ul>	
<p><b>A force can make an object slow down and stop</b></p> <p>A force that makes an object slow down and stop when two surfaces of objects are rubbed against each other is called friction.</p>	
<p><b>A force can change speed</b></p> <ul style="list-style-type: none"> <li>- A force can change the speed of an object.</li> <li>- Speed is a measure of how fast or slow an object moves.</li> </ul>	
<p><b>A force can change direction</b></p> <ul style="list-style-type: none"> <li>- A force can change the direction of a moving object.</li> <li>- A direction is the path that an object takes.</li> </ul>	
<p><b>A force can change shape and size</b></p> <ul style="list-style-type: none"> <li>- A force can change the shape of an object.</li> <li>- A force can also change the size of an object.</li> </ul>	

Q1. Complete the sentence with the correct word.

- (1) How fast or slow an object moves is called \_\_\_\_\_.
- (2) A \_\_\_\_\_ is a push or a pull.
- (3) The path a moving object follows is called \_\_\_\_\_.
- (4) A force can change the \_\_\_\_\_ and size of an object.

Q2. Choose the letter with the correct answer.

- (1) Which of the following is not correct about force?
  - A. It makes objects slow down and stop.
  - B. It can change the speed and direction of a moving object.
  - C. It can change the shape and size of an object.
  - D. It can change the weight of an object.
- (2) Which action is not a pull force?
  - A. Kicking a ball
  - B. Raising a flag up a flagpole
  - C. Combing hair
  - D. Dragging a heavy bag

Q3. Answer the following questions.

Look at the picture on the right. What force is applied by the kids to move the car backward?



Q4. John pushes a box across a rough concrete floor. Mary pushes a box across a smooth tile floor. The boxes have the same weight. Which box will slide more easily? Why?

# 9.2

## Simple Machine

### Lesson 1: “What is a Simple Machine?”

Think of your home. We can find a lot of tools that help us do things easier. For example, we use an axe to cut down a tree. An axe makes it easier to cut a tree.



### ? What tools help us do things easier?



#### Activity : Finding tools that help us

##### What to Do:

1. Make a table like the one shown below in your exercise book.

Name of Tool	How do we use it?
e.g. axe	e.g. We use it to cut a tree.

2. Make a list of tools that help us do things easier and how we use them in the table.
3. Share your ideas with your classmates. Talk about how these tools help us to do things.

Everyday we use things that makes work easy.  
Can you find them?



## Summary

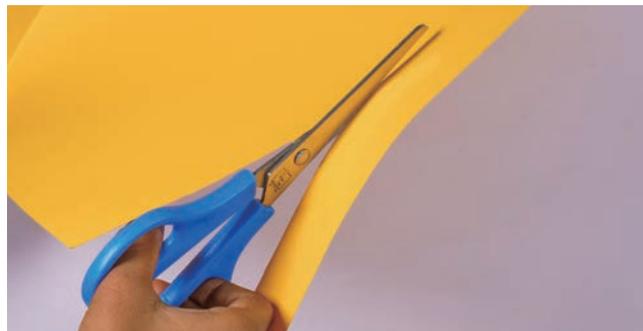
We use many tools to do things easier. When we cut papers, we use scissors. Scissors can help us cut papers easily. We turn a doorknob to open the door. A wheelbarrow can make it easier to carry an object. A tool that helps us do things easier is called a **simple machine**. There are different types of simple machines such as lever, pulley and ramp.



A doorknob makes it easier to open the door.

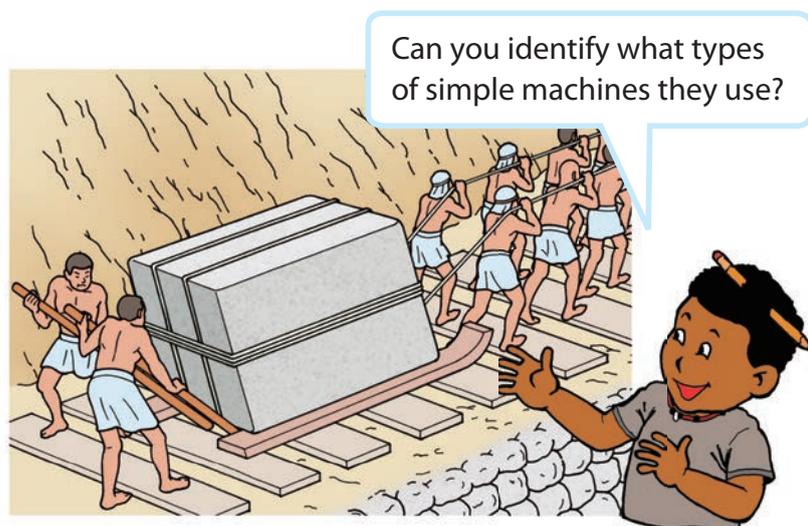


A wheelbarrow makes it easier to carry objects.



Scissors helps to cut papers easily.

Simple machines have been used for a very long time. Early people began using them to push, pull, lift, divide and crush things. Today there are many types of simple machines in every place and all around us.



## Lesson 2: “Inclined Plane”

An inclined plane is one of the simple machines. It has a flat surface connecting a lower place to a higher place.



How does an inclined plane work?



### Activity : Lifting up a tyre

#### What We Need:

- ➔ tyre, a flat wooden board

#### What to Do:

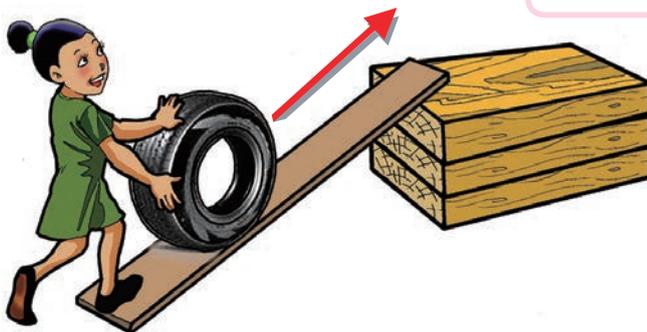
1. Place the tyre on the ground, and try to lift it straight up onto a step.
2. Place the board on the edge of a step. Try to move the tyre from the ground onto a step using the board.
3. Record which way is easier to move the tyre from the ground onto the step.
4. Share your ideas with your classmates. Talk about how an inclined plane helps us.



Let's think of how we can move a tyre to a higher place easily!



Which way do we need less force to move the tyre to a higher place? inclined



## Summary

An **inclined plane** is a simple machine made up of a flat and slanted surface. An inclined plane can help move heavy objects easier from one level to another.



Inclined plane: Ramp

A ramp or a wheelchair ramp are examples of inclined planes. If we need to move a heavy object from the ground onto the truck, we could use less force to move the object up a ramp than to lift it straight up.



A stronger force is used to lift boxes straight up.



A ramp helps move boxes easier.

A ramp is also used as a wheelchair ramp. A ramp makes it easier to push a wheelchair up or down.



A ramp makes it easier to push the wheelchair up.

# Lesson 3: “Lever”

Lever is another simple machine. A lever has a bar that moves around a fixed point. We can find levers everywhere in our daily life.

## How does a lever work?



### Activity : Making a simple lever

#### What We Need:

- ➔ pencil (or thin marker), wooden ruler (or wooden bar), book

We can make a simple lever with a ruler and a pencil!

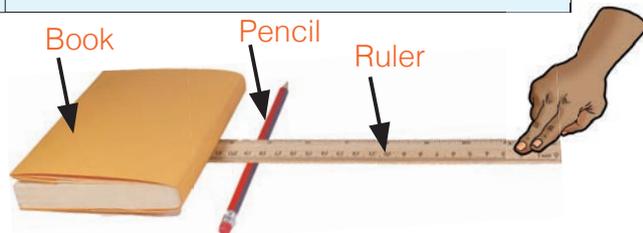


#### What to Do:

1. Make a table like the one shown below.

Which direction does the book move?	Where did you put the pencil to lift the book easily?

2. Make a lever with the pencil and the ruler as shown on the picture on the right.



3. Put the book on one end of the ruler. Press the other end of the ruler down and observe which direction the book moves.



4. Move the pencil to different places on the ruler and find how to lift the book easily.

5. Record your findings in the table.

6. Share your ideas with your classmates. Talk about how a lever works.

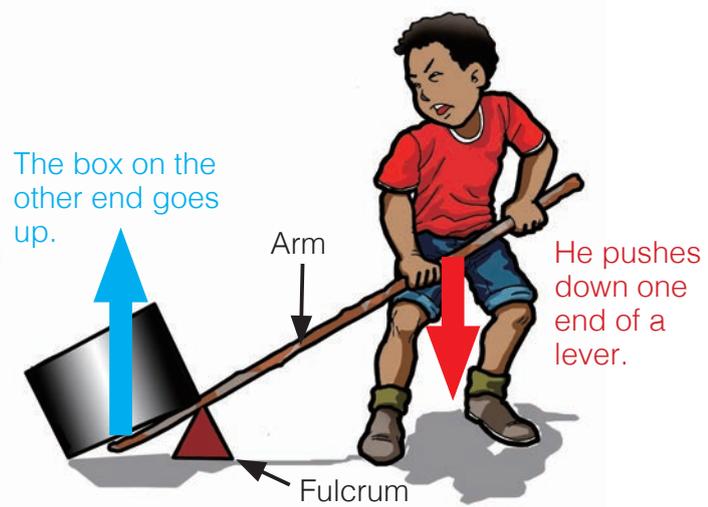
Let's move the pencil closer to or further away from the book!



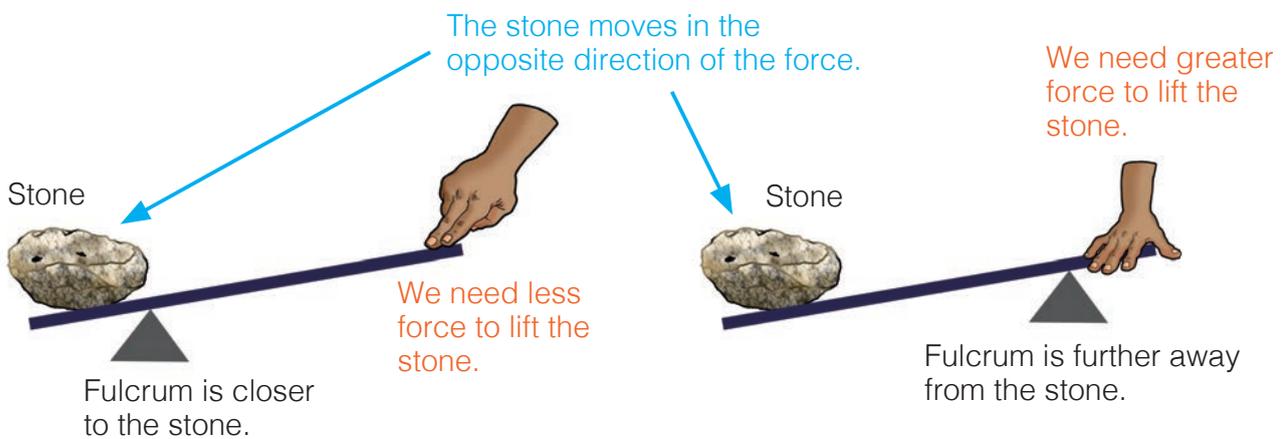
## Summary

A **lever** is a simple machine made up of an arm and a fulcrum. The bar or handle of the lever is called the **arm**. The **fulcrum** is the point on which the lever turns or balances. A lever makes it easier to lift and move objects.

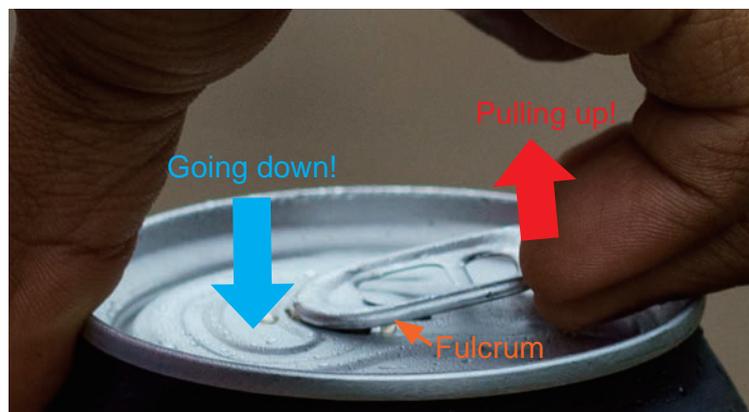
When we push down one end of a lever, the other end will go up in the opposite direction. A lever can change the direction of the force. The closer the fulcrum to an object on one side of the lever, the easier it is to lift the object. The further the fulcrum is from the object, the greater the force needed to lift the object.



He is pushing down a lever to lift up a box.



A lever is a very useful simple machine. We can find levers everywhere. Examples of levers are flip top and shovel.



Flip top is a lever.

# Lesson 4: "Pulley"

A pulley has a wheel and a rope. We use pulleys in different ways in our daily lives.



## How does a pulley work?



### Activity : Lifting up objects

#### What We Need:

- ➔ pulley, string, a bottle of water



If you don't have a pulley, you can use a bar or a hand rail instead!

#### How We Do:

1. Make a table like the one shown below.

	In which direction does it move?	
	Bottle of Water	Your Pulling
Without a pulley		
With a pulley		

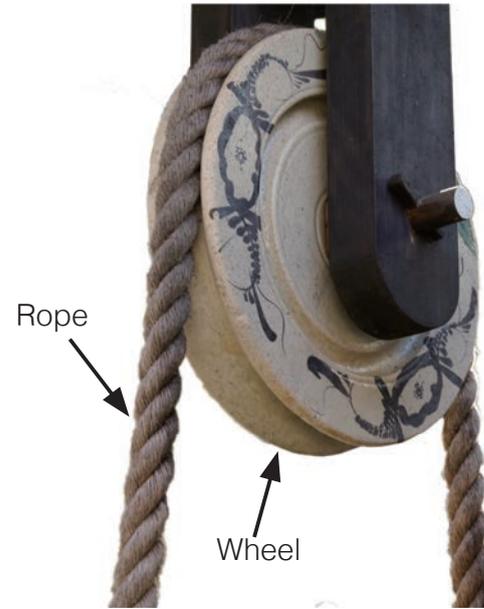
2. Tie one end of the string around the bottle of water and lift up the bottle by pulling the string without the pulley.
3. Set up the pulley like the picture on the right and then pull another end of the string to lift the bottle.
4. Record which direction you pulled the string and which direction the bottle moves with and without the pulley.
5. Share your ideas with your classmates. Talk about how a pulley works.



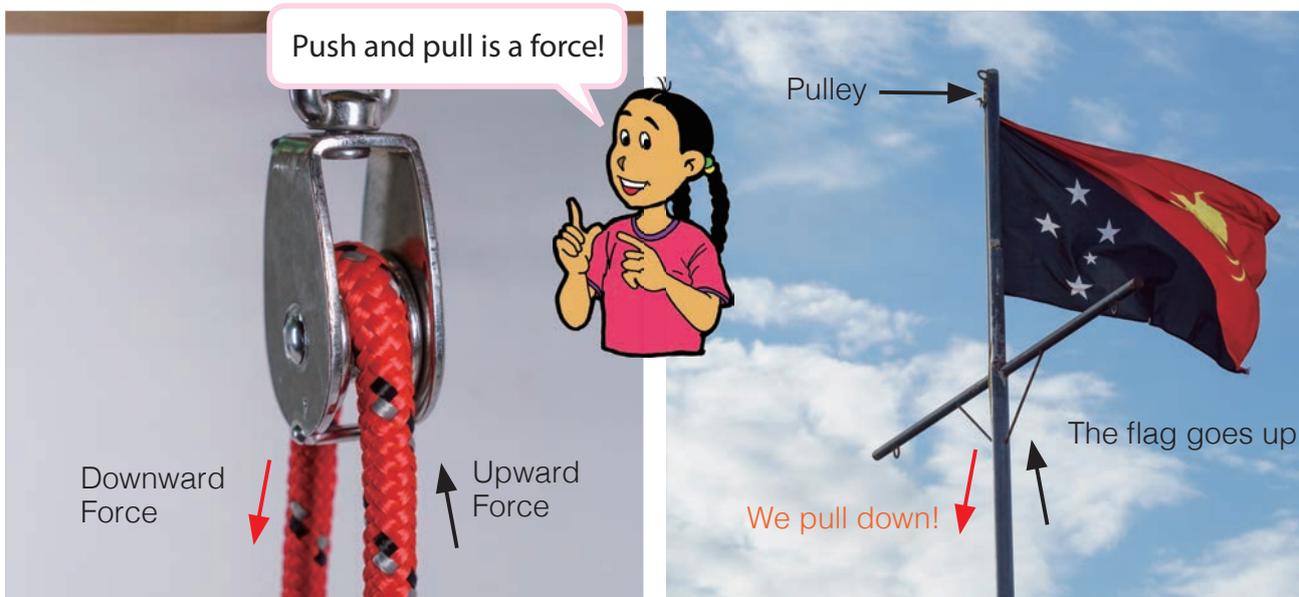
## Summary

A **pulley** is a simple machine made up of a wheel through which a rope moves. A pulley helps us to lift an object.

When we lift up an object to a higher position, we use a pulley. If we pull down one end of the rope, the object goes up. A pulley changes the direction of a force.



A Simple Machine: Pulley



A pulley changes the direction of force.

Examples of uses of pulleys are flagpole, well and crane.



Flagpole



Water well



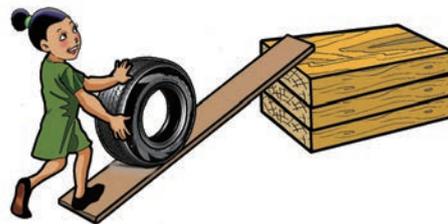
Crane

## What is a Simple Machine?

- A tool that helps us do things easier is called a simple machine.
- There are different types of simple machines such as inclined plane, lever and pulley.

### Inclined Plane

- It is a simple machine made up of a flat and slanted surface.
- It can help move heavy objects easier from one level to another.



### Lever

- It is made up of an arm and a fulcrum. The arm is a bar or handle of the lever and the fulcrum is the point on which the lever turns or balances.
- It can help to lift and move heavy objects easily.



### Pulley

- It is made up of a wheel through which a rope moves.
- It helps to lift objects to a higher position.
- It changes the direction of the force.



Q1. Complete each sentence with the correct word.

- (1) A tool that makes do things easier is called a simple \_\_\_\_\_.
- (2) A simple machine made up of an arm and a fulcrum is a \_\_\_\_\_.
- (3) A simple machine that is made up of a rope and a wheel is a \_\_\_\_\_.
- (4) A simple machine that has a slanted surface is an \_\_\_\_\_.

Q2. Choose the letter with the correct answer.

(1) Which of the following is an example of an inclined plane?

- |   |  |   |   |
|---|--|---|---|
| A.  | B.  | C.  | D.  |
| scissors  | ramp   | door knob   | pulley  |

(2) What type of simple machine is a scissors?

- A. Inclined plane
- B. Pulley
- C. Lever
- D. Wedge



Q3: Answer the following questions.

Look at the picture on the right.

- (1) What type of simple machine is it?
- (2) What is it used for?

Q4. A student wants to look under a heavy rock. Which simple machine would be BEST used to lift the rock?

## Chapter 9

### • Science Extras •

## How do we travel into space?

When you throw an apple up, the apple must fall back to the ground. Is it possible to send objects into the space? Using rocket is a way to send objects into space! The rocket can create a large upward force by burning up the fuel and the force makes its heavy body lift off the ground. The rocket can fly upward and straight into the space!



Large force makes the rocket lift off the ground!

## Chapter Test

# 9. Force

**Q1**

Complete each sentence with the correct word.

- (1) A push or a pull is called a \_\_\_\_\_.
- (2) A force that makes an object slow down and stop when two surfaces of objects are rubbed against each other is called \_\_\_\_\_.
- (3) There are different types of simple \_\_\_\_\_ such as lever, pulley and inclined plane.
- (4) How fast or slow an object moves is called \_\_\_\_\_.

**Q2**

Choose the letter with the correct answer.

- (1) What must be applied to make objects move?
  - A. Direction
  - B. Force
  - C. Speed
  - D. Distance
- (2) When you release a ball from your hand, which force causes the ball to fall back to the ground?
  - A. Friction
  - B. Gravity
  - C. Magnetism
  - D. Electricity
- (3) How does a simple machine make work easier?
  - A. Takes less force to move something heavy.
  - B. Changes the weight of something heavy.
  - C. Improves the way something looks.
  - D. Makes something become a different shape.
- (4) A slide and a ramp are examples of what type of simple machine?
  - A. Lever
  - B. Pulley
  - C. Wedge
  - D. Inclined plane

(5) Which of the followings is not an explanation about force?

- A. A force can make an object slow down.
- B. A force can start to move an object.
- C. A force can change the colour of an object.
- D. A force can change the direction of a moving object.

**Q3**

(1) Look at the picture on the right. Paul pulls down on the rope of the pulley. In which direction does the bottle move?

\_\_\_\_\_



(2) Samuel is pushing a wheelbarrow. When he puts some heavy objects on it, does he need to apply larger force or smaller force to move the wheelbarrow?

\_\_\_\_\_

**Q4**

(1) How does an inclined plane make work easier?

\_\_\_\_\_  
\_\_\_\_\_

(2) Friction can be useful for our life. Suggest two examples of what would happen if there is no friction in our daily life?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

# Chapter 10

# The Earth

How big is the rock in this picture?



Do you know of a similar place where you can find such rocks?



# 10.1

## Surface of The Earth

### Lesson 1: “Covering the Earth”

We live on the Earth. Plants and animals also live on the Earth. It is important for living things. What is Earth? Let’s study the Earth.



What is the surface of the Earth covered with?

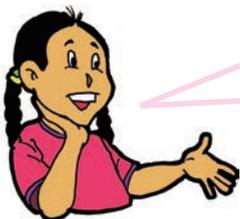


#### Activity : Earth’s surface

##### What to Do:

1. Look at the picture below. The picture shows our Earth taken from space.
2. Think about the following questions when observing the Earth carefully:
  - ➔ We can see different colours of different parts on the Earth. The white parts show the clouds. What do the green and brown parts show?
  - ➔ What is the blue part on the Earth?
  - ➔ Which part covers the surface of the Earth more, the green and brown parts or the blue part?
3. Share your ideas with your classmates. Talk about what the surface of our Earth is covered with.

Can you find where Papua New Guinea is?



PNG is the green part and is surrounded by the blue part! What is the blue part?

## Summary

The Earth's surface is covered with water and land. Almost three quarters of the Earth's surface is water.

### Water

Water covers most of the Earth's surface. Most of the Earth's water is salt water. We can find salt water in the oceans and seas. A different kind of water is fresh water. Fresh water can be found in streams, rivers, or lakes.



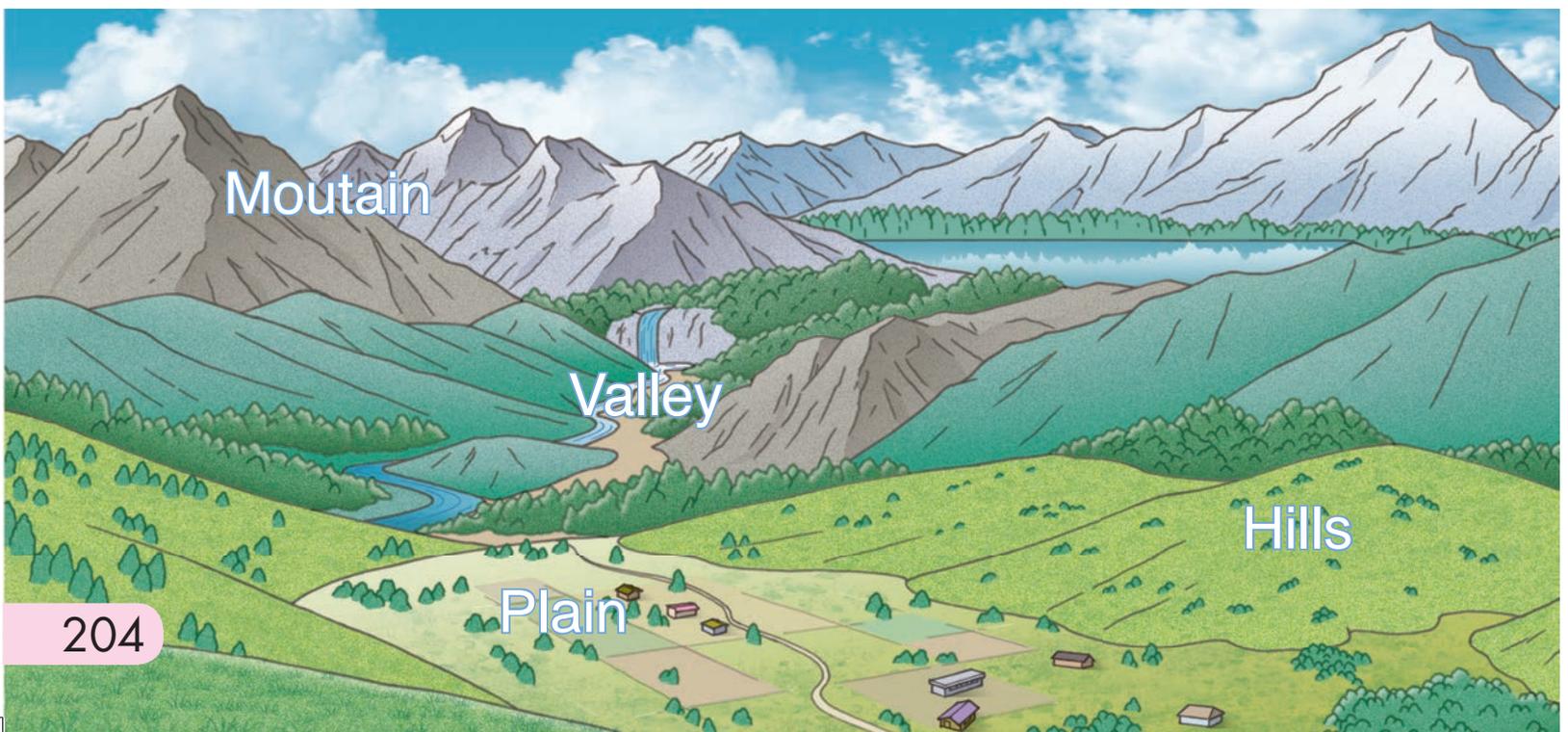
Salt Water: Ocean



Fresh Water: River

### Land

Earth's surface is also covered by land. Land has several different features. Mountains, hills, valleys and plains make up the land.



Mountain

Valley

Hills

Plain

## Lesson 2: “Rocks”

We can find rocks around us, but do you know what rocks are? What are rocks made of? Are there different kinds of rocks? What properties do rocks have?



**What is a rock?**



### Activity : Observing rocks

#### What to Do:

1. Make a table like the one shown below.
2. Go out of your classroom and fetch two different rocks.
3. Sketch each rock in the table.
4. Observe the rocks carefully and write the properties of each rock in the table.
5. Share your ideas with your classmates. Talk about the properties of each rock and how they are alike or different.

Do you remember what properties are? How can we observe the properties of rocks?



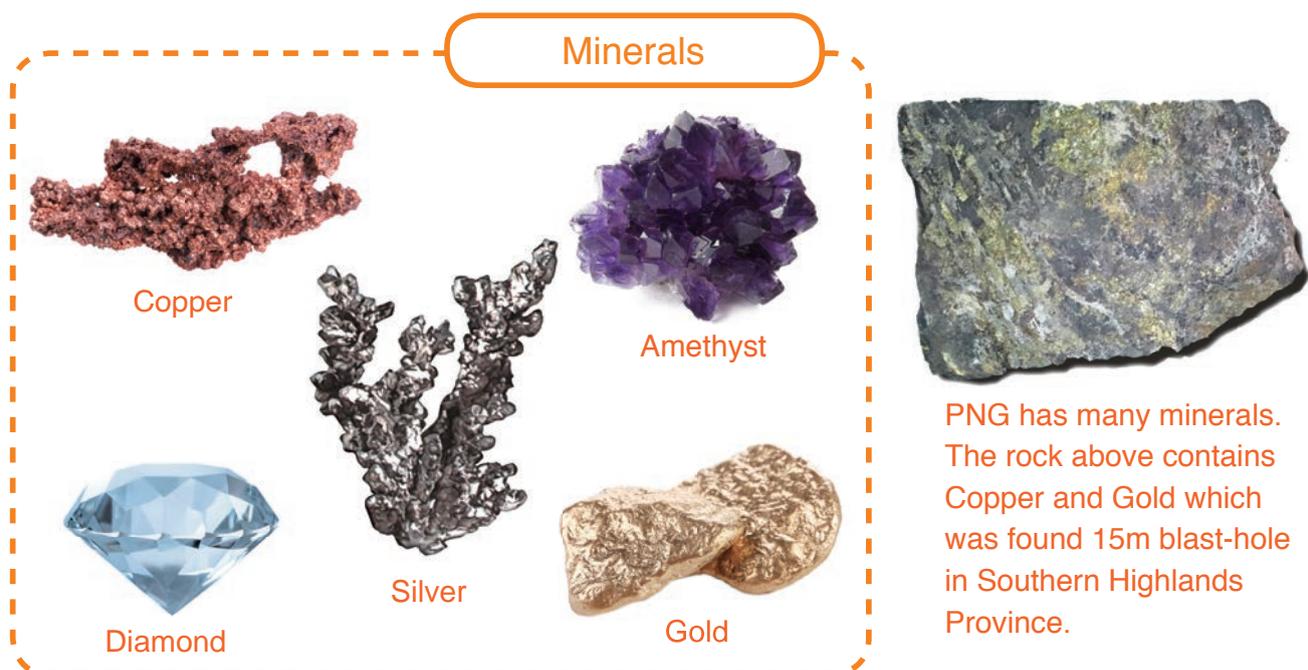
	Rock A	Rock B
Sketch		
Properties of rock		

## Summary

There are many kinds of rocks. Limestone, sandstone and granite are examples of rocks. Conglomerate and marble are also rocks. Each rock is different from other rocks. Some rocks are dark coloured and some are light coloured. Some rocks are harder or softer than others.



A rock is made of one or more **minerals**. A mineral is a non-living thing found in nature. There are many different kinds of minerals on the Earth. Gold, diamond and copper are examples of minerals.



## Lesson 3: “Soil around Us”

Look outside. We can see soil around us. What do you know about soil? Rocks are made of minerals but what is soil made of?

**?** What is soil made of?

### Activity : Observing soil

#### What We Need:

➔ a clear plastic bottle, soil, water

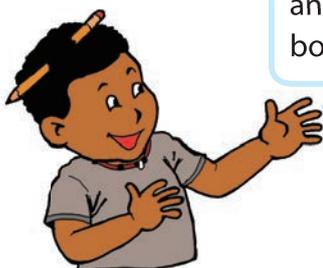


#### What to Do:

1. Go out of the classroom and collect some soil.
2. Put the soil into the plastic bottle and pour water into the bottle.
3. Screw on the cap tightly and shake the plastic bottle well.
4. After a while, sketch the mixture of soil and water in your exercise book.
5. Observe the mixture carefully and record what you found in the mixture.
6. Share your ideas with your classmates. Talk about what makes up soil.



We can see different things on the surface, in the middle and at the bottom of the bottle! What are they?



## Summary

**Soil** is the top layer that covers the Earth's surface. Soil is made of stones, gravels, sand and clay. Soil also has air, water and small pieces of things such as the dead insects bodies and pieces of leaves, wood and bark.



The small pieces of things in the soil have broken down, mixed together and changed into something over time. This is called **humus**. Humus is usually black or dark brown colour. Humus helps plants grow well.



Humus

## Lesson 4: “Properties of Soil”

There are different types of soil. Sandy soil, loamy soil and clay soil are examples of different types of soil. How are they alike or different?



What properties do soils have?



### Activity : Comparing soils

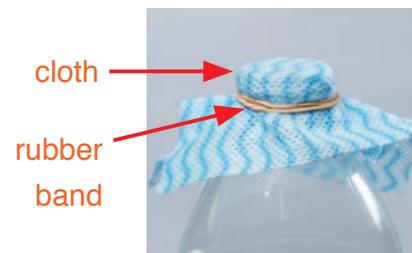
#### What We Need:

- ➔ sandy soil, loamy soil, clay soil, water, three plastic bottles, cloth, rubber bands



#### What to Do:

1. Observe three kinds of soils and record the properties of each soil.
2. Cut off the top of the plastic bottles and make three funnels with the rubber band and a piece of cloth. Place the funnels on the bottom part of the plastic bottles.
3. Pour one type of soil into each funnel and then pour water into the funnels.
4. Observe how fast water can pass through each soil. Record your observation in your exercise book.
5. Share your ideas with your classmates. Talk about the properties of each soil and how they are alike or different.



## Summary

Different types of soil have different properties such as colour, texture, size of particles, the substances it contains and how fast water can pass through the soil. Sandy soil, loamy soil and clay soil also have different properties.

### Sandy Soil

The colour of sandy soil is often tan or light grey. The size of sandy soil particles is larger than clay soil. It feels dry and gritty. Water can pass through sandy soil quickly.



Sandy soil

### Loamy Soil

Loamy soil is dark in colour. It feels coarse, soft and dry. Loamy soil contains various sizes of particles. Loamy soil holds onto water, but it lets water pass through well.



Loamy soil

### Clay Soil

The colour of clay soil is often brown, red or yellow. The particles of clay soil are the smallest among the three types of soils. It feels sticky when wet but smooth when dry. Water can pass through clay soil slowly.



Clay soil

## Lesson 5: “Importance of Soil for Plants and Animals”

Soil is very important for plants and animals to survive. How does soil help plants and animals to survive?



Why is soil important for plants and animals?



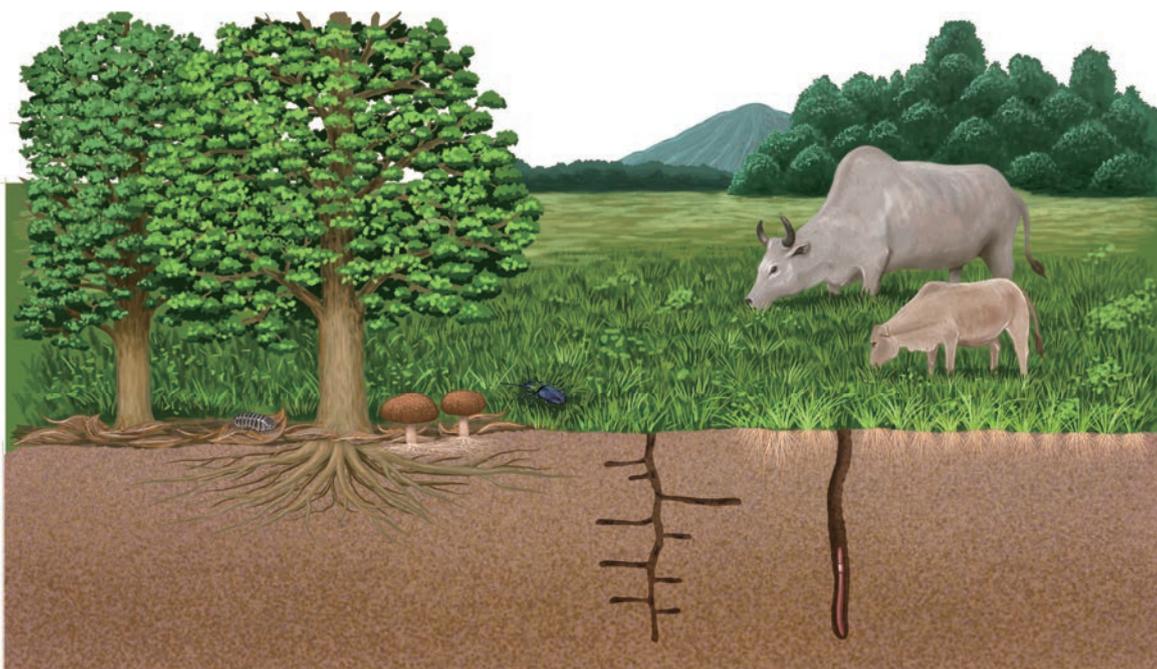
**Activity :** How plants and animals use soil

### What to Do:

1. Make a table like the one below.

Living things	How do plants and animals use soil?
Plants	
Animals	

2. Look at the picture below and think about how plants and animals use the soil to survive. Write your ideas in the table.
3. Share your ideas with your classmates. Talk about why soil is important for plants and animals.

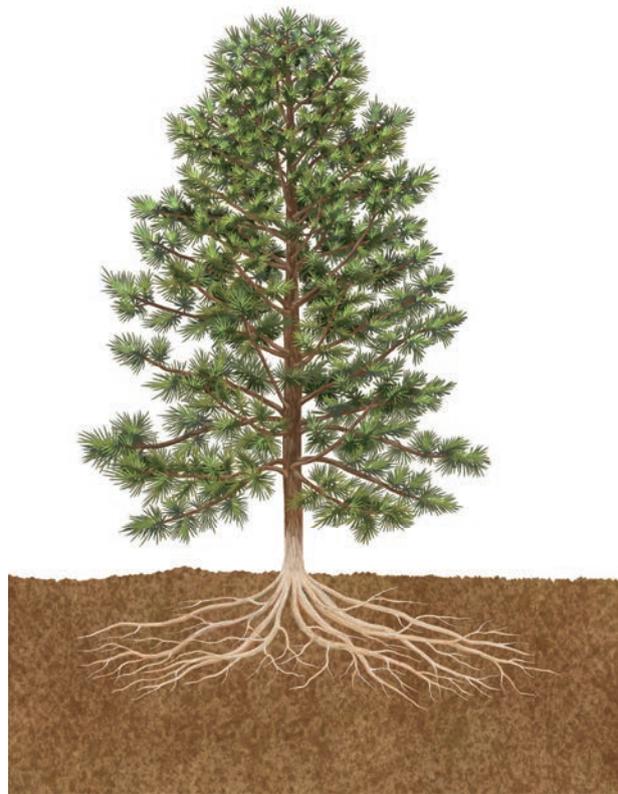


## Summary

Plants and animals depend on the soil to live and grow in many ways.

### Plants

Soil helps plants grow and live. Plants depend on soil for space to live. Soil supports roots and keeps plants upright for growth. Soil contains water and humus in it. Plants use the water to live and the humus to grow well.

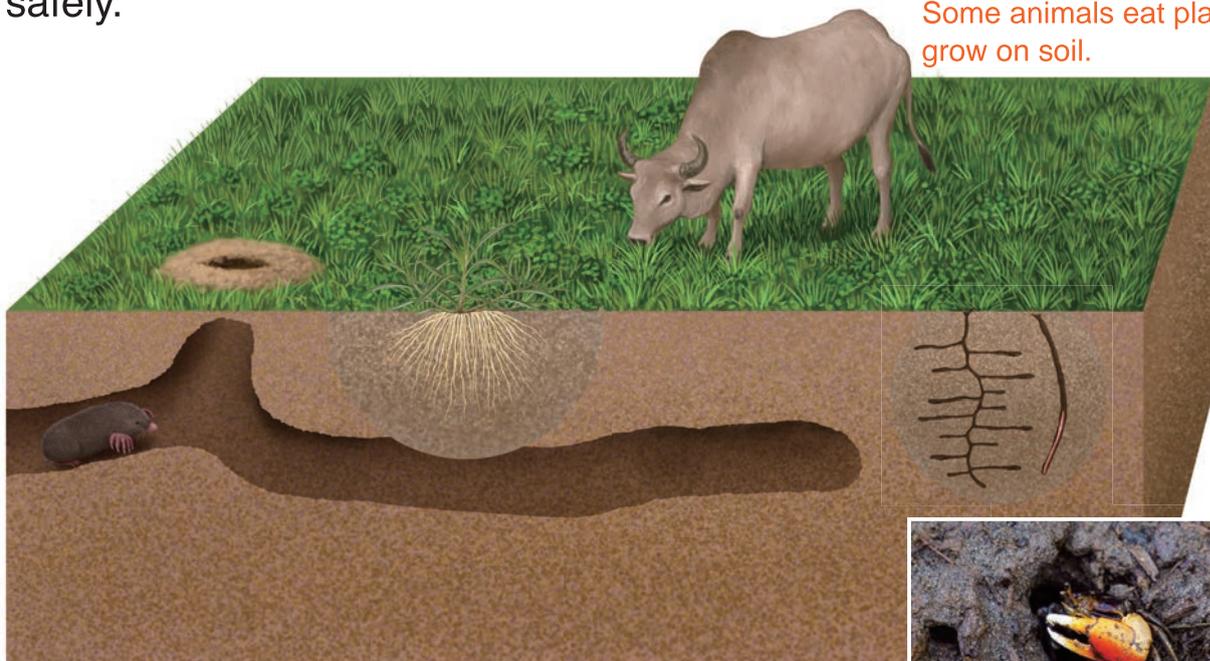


Plants depend on soil in many ways.

### Animals

Soil is important for animals too.

Animals depend on soil for food. Plants grow in soil. Some animals eat the plants grown on the soil. Soil provides many animals with a place to live. Some animals such as insects or moles live in soil safely.



Some animals eat plants that grow on soil.

Some insects and other animals use soil as a place to live.



Some crabs also use soil as a living place

## Surface of the Earth

- The Earth's surface is covered with water and land.
- Water covers most of the Earth's surface. Land covers the rest of it.
- There are two types of water covering the Earth's surface, salt water and fresh water.

## Rocks

- There are many kinds of rocks and minerals. They are non-living things. A rock is made of one or more minerals.

Rocks			Minerals		
					
Granite	Sandstone	Marble	Copper	Gold	Amethyst

## Characteristics of Soil

- There are different types of soil.

Type	Sandy soil	Loamy soil	Clay soil
Example			
Colour	Tan or light grey	Dark colour	Brown, red or yellow
Particle size	Larger than clay soil	Various sizes	Smallest in all soils
Texture	Gritty and dry	Coarse, soft and dry	Sticky (wet) / smooth (dry)

- Use of soil for plants and animals.

Plants	Animals
<ul style="list-style-type: none"> <li>- Plants grow root into soil and the soil supports it to keep it upright.</li> <li>- Plants use water and humus in soil.</li> </ul>	<ul style="list-style-type: none"> <li>- Some animals eat plants that grow on the soil.</li> <li>- Soil provide animals with safe homes.</li> </ul>

Q1. Complete each sentence with the correct word.

- (1) The Earth's surface is covered by water and \_\_\_\_\_.
- (2) \_\_\_\_\_ is the top layer material covering the Earth's surface and is made of stones, gravels, sand, clay, air and water.
- (3) \_\_\_\_\_ is small pieces of dead plants and animals in soil.
- (4) A rock is made of one or more \_\_\_\_\_.

Q2. Choose the letter with the correct answer.

Which of the following is the correct explanation about soil?

- A. All kinds of soil have the same colour.
- B. The size of clay soil particles are larger than sandy soil.
- C. Water can pass through clay soil more quickly than sandy soil.
- D. When clay soil is wet, it feels sticky.

Q3. Answer the following questions.

Look at the picture on the right. What features can you find? Choose the correct answers from the list.

Desert	Ocean	River
Lake	Valley	Plain



Q4. What might happen to the plants if the soil is removed from where they grow?

## Chapter 10

### •Science Extras•

# Why does the Earth's surface looks different at different places?

Look at the picture showing the surface of the Earth. Around 80 percent of land in Papua New Guinea is covered by forest and therefore looks green.

How does the African continent look like? The middle part of the continent looks green and is covered by deep forest, while the northern part seems light brown and is covered by desert sands. The area of the desert is larger than Papua New Guinea.

Let's look at the Antarctic Continent located at the most southern part of the Earth. The continent is covered with ice and snow without growing plants, so it looks white.



Papua New Guinea is covered by forest.



The Earth's surface.

## Chapter Test

# 10. The Earth

**Q1**

Complete each sentence with the correct word.

- (1) The surface of the Earth is covered by \_\_\_\_\_ and land.
- (2) A rock is made of one or more \_\_\_\_\_.
- (3) Soil is mainly classified as loamy, sandy and \_\_\_\_\_ soil.
- (4) Soil can be classified by its \_\_\_\_\_, size of particles and the substances it contains.
- (5) Mountains, hills, valleys and flat places make up the \_\_\_\_\_.

**Q2**

Choose the letter with the correct answer.

- (1) Which of the following is not a component of soil?
  - A. Humus
  - B. Rocks
  - C. Minerals
  - D. Plastic
- (2) Which of the following is not provided by soil for plants?
  - A. Space to take root in
  - B. Water to survive
  - C. Humus to grow well
  - D. Sunlight to make food
- (3) What kind of soil has the largest particle size?
  - A. Sand
  - B. Loam
  - C. Clay
  - D. All have the same particle size
- (4) What do all rocks have in common? They have the;
  - A. Same size.
  - B. Same colour.
  - C. One or more minerals.
  - D. Same shape.

**Q3**

(1) A student observed a mixture of soil and water as shown on the right. What are the things floating on the water?



\_\_\_\_\_

(2) There are three main types of soil; sand, loam and clay. Sticky soil holds a lot of water. Which type of soil mostly makes sticky soil?

\_\_\_\_\_

**Q4**

(1) How do animals help soil?

\_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_

(2) Look at the two rocks shown below.  
Are Rock A and Rock B the same kind of rock? Write your answer with reasons.



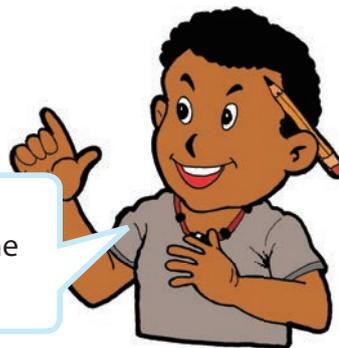
\_\_\_\_\_  
\_\_\_\_\_

# Science Tool Box

1. How to use a Balance
2. How to use a Thermometer
3. How to use a Compass
4. How to draw a sketch



I would like to use the science tools in the lesson!



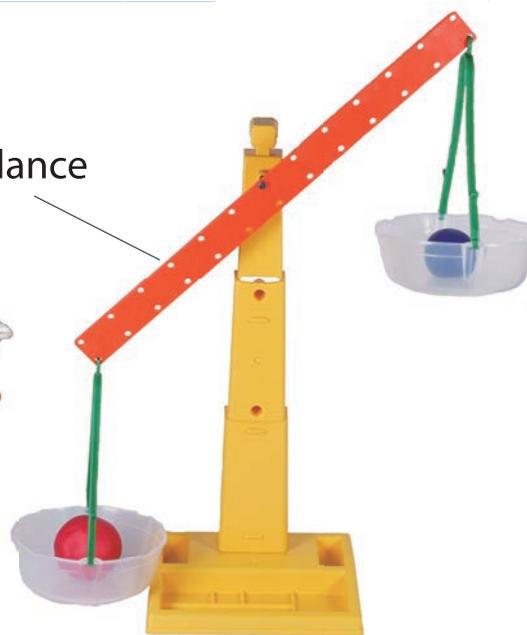
Let's check and learn how to use the science tools here.



Compass



Balance



Thermometer



## How to use a Balance

### 1. What is a balance?

A balance is an instrument that is used to compare weight. Weight is a property of matter in an object. A balance has two pans, on the left and right of the arm. To compare the weight of two objects, place an object on the left and another on the right pan. The arm tilts down to the heavier side. If two objects have equal weight, then the left and right pans are balanced.

### 2. Comparing the weight of coins

#### STEP 1:

Check that the empty pans are balanced. If it needs to be adjusted, move the slider or adjuster until the pans are balanced.

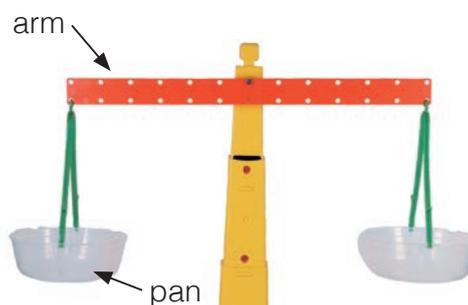
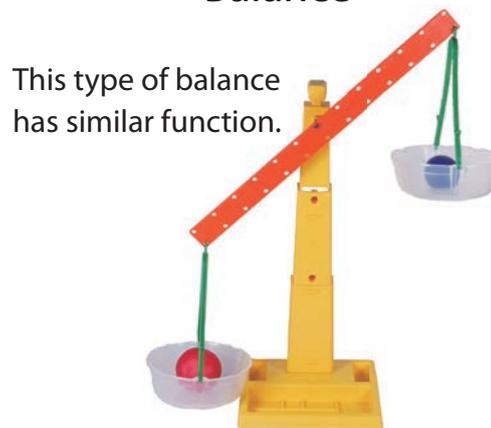
#### STEP 2:

Place a coin on the left pan and another coin on the right pan. When the arm tilts down to the right, then it means the coin on the right pan is heavier than the left side. If the left and right pans are balanced, the two coins have the same weight.



Balance

This type of balance has similar function.



## How to use a Thermometer

### 1. What is a thermometer?

A thermometer is an instrument we can use to measure temperature. A thermometer consists of a glass tube with marks on it. When the liquid in the glass tube gets heated, it expands and begins to rise up the tube. Temperature is measured in degree Celsius [ $^{\circ}\text{C}$ ].



### 2. Measuring temperature

#### STEP 1:

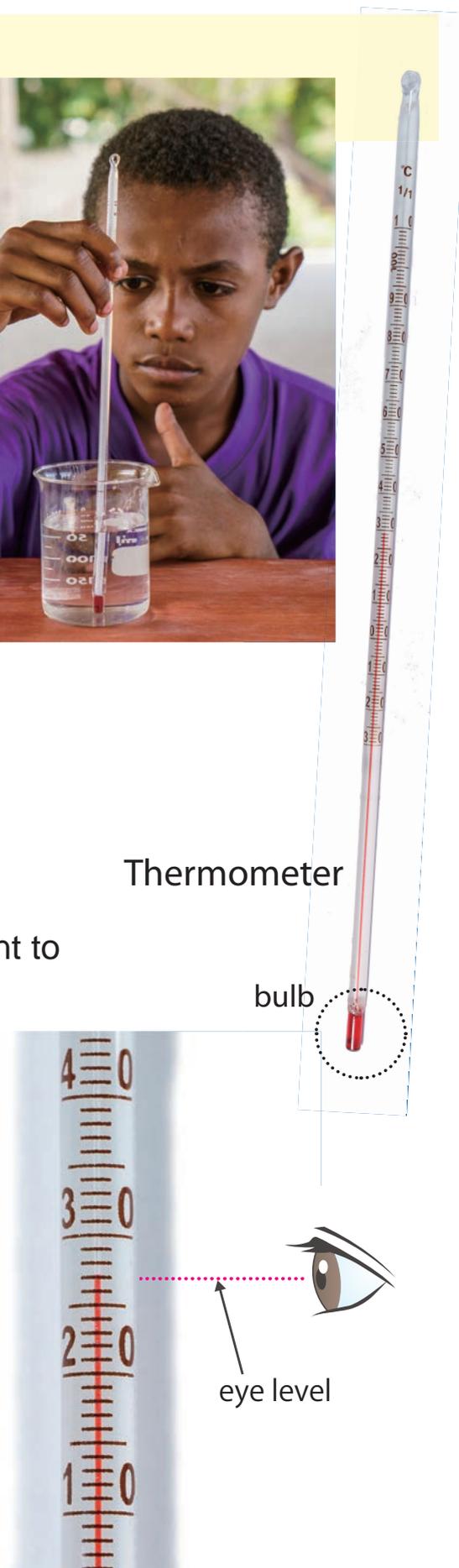
Place the bulb in the place where you want to measure the temperature. Make sure that there are no bright lights or direct sunlight shining on the bulb.

#### 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  $27^{\circ}\text{C}$ .



## How to use a 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.



Compass

### 2. Finding directions

#### STEP 1:

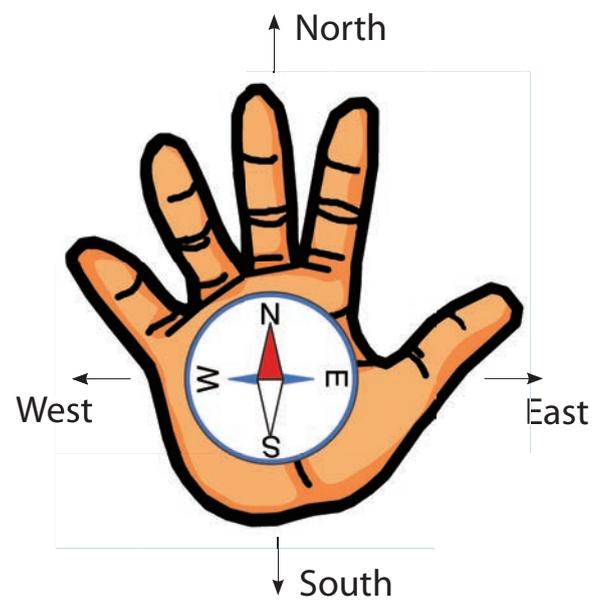
When you want to face North, place a compass flat on your palm and hold in front of your chest as shown in the picture on the right.

#### STEP 2:

Turn your body until the magnetic needle comes to the sign of North 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 draw a sketch

Scientific sketch is NOT an artwork. The sketch requires precise drawing. If the plant has two leaves, the sketch should have two leaves only as they are.

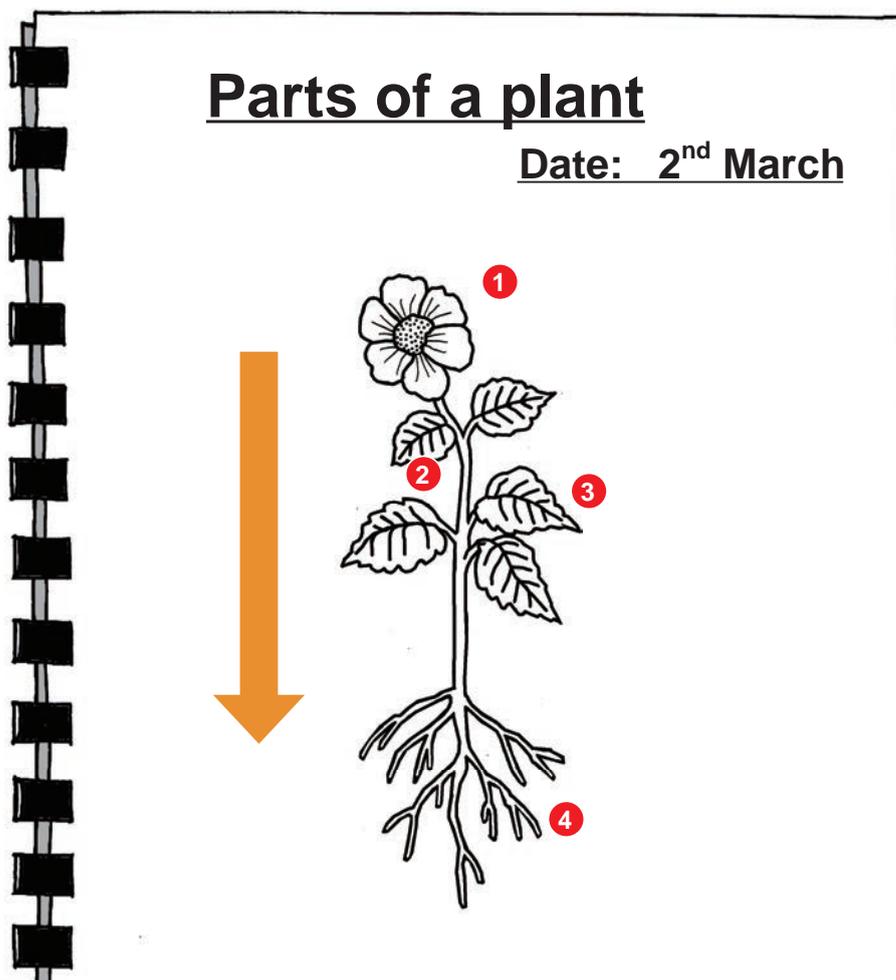
The principle of sketch is “top to bottom” and “front side to back side”. For example, look at the sample below;

**STEP 1:** Start by drawing the flower of the plant.

**STEP 2:** Next draw the stem.

**STEP 3:** Next the leaf. Draw from front leaves to back.

**STEP 4:** Lastly draw the root.



Write down a title and date when you are drawing a sketch.



## Answer of Exercise

### Chapter 1, Topic 1, Page 20

- Q1. (1) environment (2) living (3) natural (4) man-made (5) air  
Q2. (1) D (2) C  
Q3. Living things: trees, water lilies, grass,  
Non-living things: Water, Air  
Q4. (Example of the answer) A cloud is a non-living thing because it does not need food or water and does not reproduce its children.

### Chapter 1, Topic 2, Page 26

- Q1. (1) wetlands (2) ocean (3) trees (4) food (5) air  
Q2. B  
Q3. (Example of the answer) (1) Living things in a river: Fish, Shrimp, Crab, Water grass (2) Living things in a forest: Cuscus, Birds, Insects, Tree, Grass  
Q4. (Example of the answers) Some animals eat fruits bearing on trees, Some animals use tree for their home.

### Chapter 2, Topic 1, Page 44

- Q1. (1) Matter (2) Properties (3) Balance  
Q2. (1) D (2) C  
Q3. Object A  
Q4. (Example of answer) By placing the objects at a time into the cup of water and observing the increase of the size of water in the cup.

### Chapter 2, Topic 2, Page 56

- Q1. (1) space (2) millilitres, litres (3) Shape (4) Different  
Q2. (1) A (2) B  
Q3. Plastic bottle cap  
Q4. (Example of answer) Because the amount of space in the cup is being taken up by the shells; therefore nothing else can take up the same space at the same time

### Chapter 2, Topic 3, Page 62

- Q1. (1) Mixtures (2) matter (3) properties (4) Strainer  
Q2. (1) D (2) D  
Q3. Matter that are made from iron and can be

attracted to magnet and in this situation the matter are nails.

- Q4. (Example of answer) Sand can be separated from the rice grain and pieces of wood by strainer so that he left with rice and pieces of wood, and then rice can be separated by using water so pieces of wood can float and rice will sink. So he can pour out the water slowly and collect all rice grains.

### Chapter 3, Topic 1, Page 74

- Q1. (1) Different (2) Sunlight (3) Stem (4) Flowers  
Q2. (1) C (2) A  
Q3. (1) (A) flower (B) leaves (C) stem (D) roots  
(2) Take in water and nutrients from soil, and hold the soil and keep plants upright.  
Q4. Plants will have no water and nutrients taken from the roots and the plant would die

### Chapter 3, Topic 2, Page 82

- (1) parts (2) margin (3) taproot (4) stem (5) parallel  
Q2. (1) C (2) D  
Q3. (Examples of the answers) (1) Mango, guava, croton, hibiscus, rain tree, rose, bougainvillea  
(2) Grass, corn, lily, bamboo, coconut, betelnut, oil palm  
Q4. (Example of the answers) A tree is bigger than shrub. A shrub is smaller than a tree. A tree is big like a mango and shrub is small like a rose. A tree is bigger than shrub. An example of a tree is the mango and an example of the shrub is a rose.

### Chapter 4, Topic 1, Page 104

- Q1. (1) mammals (2) insect (3) amphibian (4) fins (5) protection  
Q2. D  
Q3. (1) A. Insects B. Amphibians C. Birds  
D. Reptiles E. Fish F. Mammals (2) A. Ear  
B. Eyes C. Nose D. Mouse E. Wings F. Legs  
Q4. Legs, wings

## Answer of Exercise

### Chapter 5, Topic 1, Page 114

- Q1. (1) Energy (2) Forms (3) Heat (4) Light  
Q2. (1) C (2) D  
Q3. Heat and electrical energy  
Q4. (Example of the answer) An ambulance uses the siren to warn drivers and people to get out of the way. If there was no sound the other drivers wouldn't know and not make way for the ambulance.

### Chapter 6, Topic 1, Page 124

- Q1. (1) Sun (2) energy (3) heat (4) Light (5) food  
Q2. (1) C (2) B  
Q3. (1) The sun looks smaller because it is very far away from the earth. (2) (Example of the answer) The Sun keeps animals warm. / Light from the Sun helps animals to see objects / The sunlight helps plants to grow. etc.  
Q4. (Example of answer) There will be darkness everywhere, The earth will be so cold.

### Chapter 6, Topic 2, Page 132

- Q1. (1) Shadow (2) low (3) east (4) east (5) Night  
Q2. (1) C (2) B  
Q3. (1) The movement of the sun across the sky.  
(2) The shadow is made in the same direction as the sun.  
Q4. The rotation or spin of the earth.

### Chapter 7, Topic 1, Page 152

- Q1. (1) Light (2) energy (3) shadow (4) Translucent (5) lens  
Q2. (1) B  
Q3. (1) Sun and torch (2) 1. By moving the object closer to the light source 2. By moving the light source closer to the object  
Q4. (Example of answer) Because when light hits these objects the light is reflected off from these objects and travels straight to our eyes which enables us to see them.

### Chapter 8, Topic 1, Page 170

- Q1. (1) iron (2) South (3) South (4) repel  
Q2. (1) C (2) B  
Q3. B, E, H, J  
Q4. (Example of answers) The earth is big magnet whose south pole is placed at the North (Arctic). North pole on a compass always attracted by South pole of magnet. Therefore, North pole of a compass always indicates to the North of the earth.

### Chapter 9, Topic 1, Page 188

- Q1. (1) speed (2) force (3) direction (4) shape  
Q2. (1) D (2) A  
Q3. The force applied is push  
Q4. (Example of answer) The box Mary pushed across a smooth tile floor. Because on a smooth tile floor it has less friction.

### Chapter 9, Topic 2, Page 198

- Q1. (1) machine (2) lever (3) pulley (4) inclined plane  
Q2. (1) B (2) C  
Q3. (1) Pulley (2) It is used to lift objects such as containers and bigger objects.  
Q4. lever

### Chapter 10, Topic 1, Page 214

- Q1. (1) land (2) soil (3) humus (4) minerals  
Q2. (1) D  
Q3. Mountain, River, Valley  
Q4. (Example of answer) Plants are not able to keep upright without soil because soil supports plant's roots. / Plants would die without soil because plants are not able to use enough water to survive from soil.

## Glossary

<b>Amphibian</b> is an animal whose body is covered with moist skin. ....	88
<b>Axis</b> in the Earth is an imaginary straight line that passes through the North pole and South pole of the Earth. ....	130
<b>Balance</b> is a tool to compare the weight of matters. ....	36
<b>Bird</b> is an animal that has feathers and wings. ....	88
<b>Compass</b> is an instrument you use for finding directions. ....	168
<b>Direction</b> is the path that an object takes. The direction tells us where the object is going. ....	184
<b>Energy</b> is the ability to do work. Energy can change and move things. ...	110
<b>Environment</b> is everything that makes up our surroundings. ....	12
<b>Man-made environment</b> is the environment that is made of man-made things. ....	14
<b>Natural environment</b> is the environment made of natural things. ....	14
<b>Nonmagnetic object</b> is an object that is not attracted by a magnet. ....	160
<b>Fibrous root</b> is a root that has many smaller roots that spread out in different directions. ....	76
<b>Fish</b> is an animal that lives in water and has scales and gills. ....	88
<b>Force</b> is a push or a pull. ....	176
<b>Forest</b> is a place with many trees that grow close together. ....	22
<b>Friction</b> is force that makes an object slow down and stop when two surfaces of objects are rubbed against each other. ....	180
<b>Fulcrum</b> is the point on which the lever turns or balances. ....	194
<b>Gravity</b> is the force that pulls objects toward Earth's centre. ....	176
<b>Herbs</b> are plants that have soft and green stems. ....	78
<b>Humus</b> is tiny bit of dead plants and animals in soil. ....	208
<b>Inclined plane</b> is a simple machine made up of a flat and slanted surface. ....	192
<b>Insect</b> is an animal that has 6 legs and hard outer covering. ....	88
<b>Leaf</b> is a part of plants made up of a leaf stalk, a leaf blade, and veins. ....	70

## Glossary

<b>Leaf blade</b> is the main flat area of the leaf. ....	80
<b>Leaf margin</b> is shape of leaf edges. ....	80
<b>Leaf vein</b> is a tube that can help carry water and nutrients throughout the leaf. .....	80
<b>Lever</b> is a simple machine made up of arm and fulcrum. ....	194
<b>Light</b> is energy that we can see. ....	138
<b>Living things</b> are things that grow, change and breathe, can move by themselves and produce new living things. ....	16
<b>Magnet</b> is an object that attracts magnetic object. ....	158
<b>Magnetic object</b> is made of iron and attracts to a magnet. ....	160
<b>Magnetic poles</b> are the parts where a magnet attracts objects most strongly. All magnets have north and south pole. ....	162
<b>Mammal</b> is an animal that has fur or hair and breathe by lungs. ....	88
<b>Man-made things</b> are things made by people. ....	14
<b>Matter</b> is everything around us. ....	32
<b>Mineral</b> is a non-living thing found in nature such as gold, diamond and copper. ....	206
<b>Mixture</b> is something made of two or more kinds of matters. ....	58
<b>Natural things</b> are things that come from nature and not made by people. Plants, animals, soil, air and water. ....	14
<b>Non-living things</b> are things that do not grow, change, breathe and cannot produce new ones. ....	16
<b>Nutrient</b> is a material in the soil that living things need to grow ....	72
<b>Object</b> is a thing that we can see and touch. ....	41
<b>Ocean</b> is the vast body of salt water. ....	22
<b>Opaque objects</b> do not let any light travel through them. ....	142
<b>Property</b> is anything that we learn about a matter such as weight, size, colour, and texture. ....	34

<b>Pulley</b> is a simple machine made up of a wheel through which a rope moves. .....	196
<b>Reflection</b> is what occurs when light bounces off an object. ....	148
<b>Reptile</b> is an animal whose skin is covering with dry scales. ....	88
<b>Rock</b> is made of one or more minerals. ....	206
<b>Roots</b> are a part of plants that are usually found under the soil. ....	70
<b>Shrubs</b> are small to medium sized plants with hard and woody stems. ....	78
<b>Simple machine</b> is a tool that helps us do some things easier. ....	190
<b>Soil</b> is the top layer that covers Earth's surface. ....	208
<b>Speed</b> is a measurement of how fast or slow an object is moving. ....	182
<b>Stem</b> is a part of plants that connects the roots to other plant parts. ....	70
<b>Sun</b> is the brightest object in the day sky. ....	120
<b>Taproot</b> is a root that has one major root that grows very deep into the ground. .....	76
<b>Temperature</b> is how warm or cool something is. Temperature is measured in degrees Celsius(°C).....	122
<b>Thermometer</b> is an instrument we use to measure temperature. ....	122
<b>Translucent objects</b> allow some light to travel through them. ....	142
<b>Transparent objects</b> allow light to travel through them. ....	142
<b>Trees</b> are plants that have hard and woody stems.....	78
<b>Volume</b> is the amount of space that a matter takes up. ....	46
<b>Weight</b> is a measure of how heavy an object is.....	35
<b>Wetland</b> is a place that is very wet. ....	22

# Animals of PNG



▲ Raggiana bird of paradise



■ New guinea crocodile



● Common spotted cuscus



▲ White-naped friarbird



◎ Emerald green snail



▲ Papuan hornbill



△ Blue crowned pigeon



● Flying fox



▲ Southern cassowary



● Agile wallaby



● Goodfellow's tree kangaroo



● Barramundi



■ Pig-nosed turtle



■ Salvadori monitor



▲ Australian pelican



▲ Black-capped lory



★ Golden stag beetle



■ Green sea turtle



◆ White's tree frog



○ Yellowfin tuna



○ Whale shark



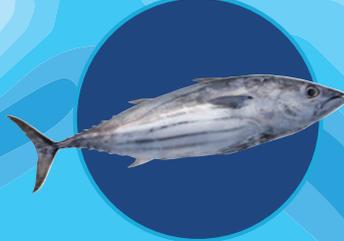
■ Green tree python



▲ Red-knobbed imperial pigeon



★ Rhinoceros beetle



○ Skipjack tuna



◎ Coconut crab



○ Lacey scorpionfish



○ Map puffer



● Bottlenose dolphin



★ Queen alexandra's birdwing



○ Clownfish



■ Saltwater crocodile



● Dugong

continued

● Mammals

▲ Birds

■ Reptiles

◆ Amphibians

○ Fish

★ Insects

◎ Others

## Animals in Land and River



● Short-beaked echidna



● New Guinea quoll



● Sugar glider



● Chestnut tree mouse



▲ Fawn breasted bowerbird



▲ Papuan frogmouth



▲ Azure kingfisher



▲ Grey crow



■ Slender emo skink



■ Ground gecko



■ Papuan tree dragon



■ Slaty-grey snake



◆ Striped rocket frog



◆ Brown river tree frog



★ Longhorn beetle



★ Rainbow ant



★ New Guinea birdwing



★ Katydid



◎ New Guinea tarantula



◎ Freshwater crab

# Animals of PNG

## Animals in Ocean



● False killer whale



■ Leatherback turtle



● Pacific crown toby



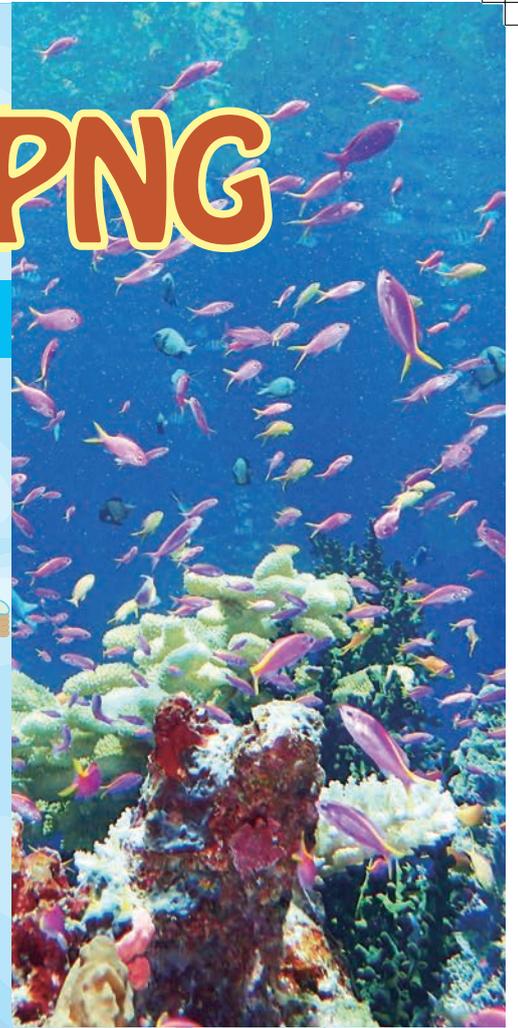
● Blue-girdled angelfish



● Teira batfish



● Yellow and blueback fusilier



● Purple anthias



● Grey reef shark



● Manta ray



● Blackfin barracuda



● Denise's pygmy seahorse



● Ornate ghost pipefish



● Cuttlefish



● Nudibranch



● Painted spiny lobster



● Squat shrimp



● Giant clam



● Cushion seastar

## National Science Grade 3 Textbook Development Committee

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.

### Joint Coordinating Committee members for QUIS-ME Project

Dr. Uke Kombra, Secretary for Education - Chairperson, Mr. Walipe Wingi, Deputy Secretary - Deputy Chairperson, Mr. Baran Sori, Mr. Samson Wangihomie, Mr. Titus Romano Hatagen, Dr. Eliakim Apelis, Mr. Godfrey Yerua, Mrs. Annemarie Kona, Mr. Camilus Kanau, Mr. Joseph Moide, Mr. Peter Kants, Mr. Maxton Essy, Mr. Steven Tandale, Ms. Hatsie Mirou, Mr. Paul Ainui, Mr. Packiam Arulappan, Mr. Allen Jim, Mr. Nopa Raki, Mr. Gandhi Lavaki, Mr. John Kakas, Ms. Philippa Darius, Mr. Alex Magun, Ms. Mary Norrie, Mr. James Namari, Ms. Kila Tau, Mr. Moses Hatagen Koran, Ms. Colette Modagai, Ms. Dorothy Marang, Mr. Dan Lyanda, Representatives from Embassy of Japan and JICA PNG Office, Mr. Akinori Ito, MPS, Mr. Chiko Yamaoka and other Project Experts

### Steering Committee members for QUIS-ME Project

Mrs. Annemarie Kona, First Assistant Secretary - Chairperson, Mr. Steven Tandale - Assistant Secretary, CDD - Deputy, Chairperson, Ms. Hatsie Mirou, Mr. Paul Ainui, Mr. Gandhi Lavaki, Mr. John Kakas, Ms. Philippa Darius, Mr. Alex Magun, Ms. Mary Norrie, Mr. James Namari, Ms. Kila Tau, Mr. Moses Hatagen Koran, Ms. Mary Phillips, Mr. Nopa Raki, Mr. Geoff Gibaru, Ms. Jean Taviri, Mr. Akinori Ito, MPS, Mr. Chiko Yamaoka, Mr. Satoshi Kusaka, Mr. Ryuihi Sugiyama, Mr. Kenichi Jibutsu, Ms. Masako Tsuzuki, Dr. Kotaro Kijima, Ms. Kyoko Yamada and Representatives from Textbook writers and JICA PNG Office

### Curriculum Panel

Mr. Steven Tandale, Mr. Gandhi Lavaki, Ms. Philippa Darius, Mr. Alex Magun, Mr. John Kakas, Ms. Mirou Avosa, Ms. Mary Norrie, Mr. Gilbert Ikupu, Mr. John Wek, Ms. Betty Bannah, Mr. Vitus Witnes, Ms. Clemencia Dimain and Ms. Celine Vavetaovi

### Editorial Supervisors

Mr. Ryuichi Sugiyama, Mr. Kenichi Jibutsu, Prof. Masakazu Kita, Dr. Kotaro Kijima, Mr. Susumu Komazawa, Mr. John Kakas and Mr. Moses Hatagen Koran

### Content Supervisors

Prof. Hiroaki Ozawa, Ass. Prof Kazuyuki Tamura and Prof. Yasuhiko Makino

### Writers & Proofreaders (Curriculum officers & Textbook writers - Science Working Group)

Mr. John Kakas - Science Working Group Leader, Ms. Collette Modagai, Mr. Moses Hatagen Koran, Mr. Emmanuel Ragu, Mr. Jimmy Pulpulis, Mr. Michael Kwadogi, Ms. Sandra Uramani, Ms. Brenda Kautu, Ms. Raphaella Barau and Ms. Aalia Nissar

### Chief Proofreader, Illustrations, Photos & Desktop Publishing

Mr. Alex Magun (Chief Proofreaders), Mr. Micheal John, Ms. Atsuko Yano, Mr. Fumihiko Kobori, Nihon Graphics Co.,Ltd. (Illustrations), Mr. Angus Fraser, Mr. Rocky Roe, Wildlife Conservation Society, Piku Biodiversity Network Inc., Mr. Chiko Yamaoka, Dr. Kotaro Kijima, Mr. Masaki Kubo, JICA Volunteers, Aflo, amana images, ARTEFACTORY, CORVET, Getty Images, NaRiKa, NASA, NICT, NNP, OASIS, PIXTA, PPS (Photos), Mr. David Gerega, Mr. Vitus Witnes (Graphic designers), HIZU INC., Mr. Haruo Yoshida, Ms. Ayako Sakano (Desktop Publishing) and Gakko Toshu Co.,Ltd. (Photos and illustrations)

### Validation Team (Science working group & Teachers from pilot schools)

Mrs. Anne Afaisa, Ms. Esther Yambukia, Mr. Freeman Kefoi, Ms. Heidi Supa, Ms. Ikai Koivi, Ms. Jill Koroi, Ms. Kila Vela Ymana, Ms. Lino Eaki, Ms. Louisa Kaekae, Ms. Lucy Paul, Ms. Margaret Ito, Ms. Martha Dimsock, Mr. Tom Ovia and Mrs. Wilfreda Efi

### Cooperation

Japan International Cooperation Agency (JICA), Department of National Planning & Monitoring (DNPM), PNG Conservation & Environment Protection Authority (CEPA-JICA Biodiversity Project), PNG Forest Authority (PNGFA-JICA, PNG FRIMS Project), Piku Biodiversity Network Inc., Okayama University, Naruto University of Education, Gakko Toshu Co.,Ltd. , Bank of Papua New Guinea, Gaire Primary School, Iobuna Kouba Primary School, Koki Primary School, Koiari Park Primary School, St. John Primary School, St. Peter Primary School, St. Therese Primary School, Sogeri Primary School, Tubuseria Primary School and Wardstrip Primary School





