

# Strand : LIFE

## Unit : INTERACTION IN THE ENVIRONMENT

### Chapter 9. Habitat and Adaptation

#### Chapter Objectives

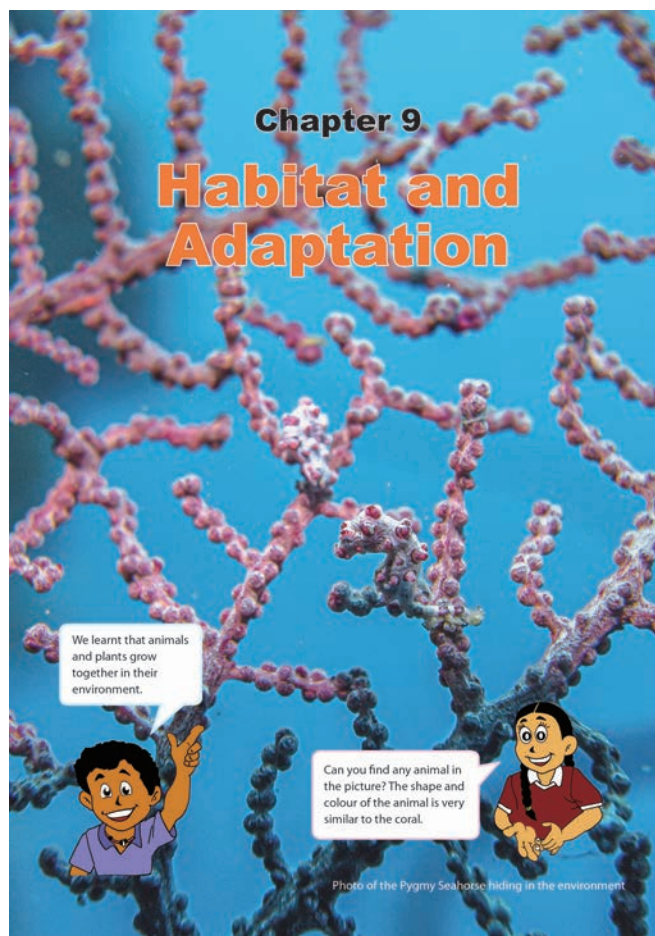
Students will be able to understand the characteristics of the different habitats, their conditions, the different needs provided for plants and animals that live in them. Students will also be able to understand the ways the animals adapt to their habitats to survive.

#### Topic Objectives

##### 9.1 Habitats

Students will be able to;

- Describe the types and conditions of a habitat that enable living things to live in.
- Describe the types of plants and animals that live and grow in the types of freshwater habitats.
- Explain the different plants and animals in the two main areas of the ocean habitat.
- Explain how the rainforest habitat provides for the needs and conditions of plants and animals to live.
- Explain how the grassland habitat provides for the needs of plants and animals to live.
- Explain the effects of the habitat changes and types of living things that will be affected.



This picture is from the chapter heading of the textbook showing a seahorse camouflaging to blend in amongst the corals in the sea.

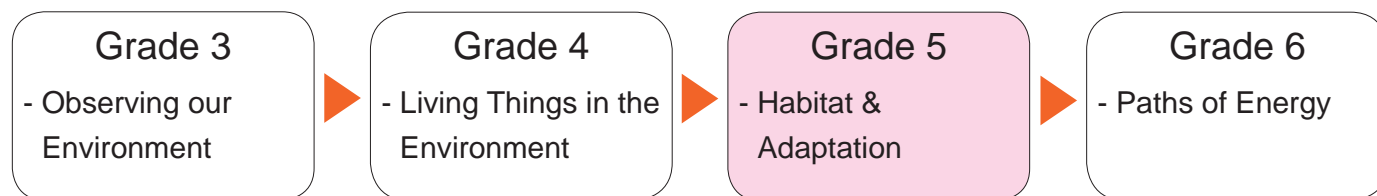
##### 9.2 Adaptations

Students will be able to;

- Describe animal adaptation and behaviour.
- Explain how different organisms adapt to their habitats.
- Explain how animals camouflage.
- Identify how animals use their body parts to mimic.
- Identify the different types of behavioural adaptation displayed by different animals.

## Related Learning Contents

The learning contents in this chapter connect to the following chapters.



Prior knowledge for learning this chapter:

- The ways in which animals depend on the plants and other animals in the environment.
- The ways in which people depend on living things in the environment.

## Teaching Overview

This chapter consists of 14 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
9.1 Habitats	1	<b>Habitats</b> What kinds of environments do living things live in?	5.1.4	133 - 134
	2	<b>Freshwater Habitat</b> What is a fresh water habitat?		135 - 136
	3	<b>Ocean Habitat</b> What is an ocean habitat?		137 - 138
	4	<b>Rainforest Habitat</b> What is a rainforest habitat?		139 - 140
	5	<b>Grassland Habitat</b> What is a grassland habitat?		141 - 142
	6	<b>Habitat Changes</b> What happens to living things when habitats change?		143 - 144
	7	Summary and Exercise		145 - 146
9.2 Adaptations	8	<b>What is Adaptation?</b> How do adaptations help organisms?		147 - 148
	9	<b>Adaptation to Habitats</b> How do organisms adapt to their habitats?		149 - 150
	10	<b>Camouflage</b> What is camouflage?		151 - 152
	11	<b>Mimicry</b> What is mimicry?		153 - 154
	12	<b>Behavioural Adaptation</b> How do organisms behave to survive in their environment?		155 - 156
	13	Summary and Exercise, Science Extra		157 - 159
Chapter Test	14	Chapter Test		160 - 161

**Lesson**  
1 / 14

**Lesson Title**  
**Habitats**

**Preparation**

pictures of different plants and animals,  
A3 papers or charts, markers, rulers

**Lesson Flow**

**1 Introduction (10 min.)**

- Take the students for a little excursion to a flower garden, to a growing tree trunk, to a patch of grass etc...

Q: What kind of living things did you see?

Q: Where did you see these living things?

**2 Introduce the key question**

What kinds of environment do living things live in?

**3 Activity (20 min.)**

- Organise students into groups.
- Explain the steps of the activity.
- Advise students to spot the important points in steps 2 and 3.
- Refer the students to the pictures of different animals and plants below the activity.
- Ask students to do the activity.
- Check the students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their activity.
- Ask students to discuss their findings with their groups.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity.
- Write their findings on the blackboard.  
(Continue)

**9.1 Habitats**

**Lesson 1 Habitats**

**1** The environment is everything around us. Plants and animals live in the environment.

**2** ? What kinds of environment do living things live in?

**3** **Activity : Place where plants and animals live**

**What to Do:**

1. Draw a table like the one shown below.

Name of living thing	Place where it lives	Conditions of the place where it lives

2. Study the pictures of plants and animals below. Think about where they live and the conditions of the place. Complete the table.

3. Share your ideas with your classmates. Discuss the place where plants and animals live.

Bird of Paradise   Sea turtle   Water lily   Beetle   Seaweed

Frog   Cuscus   Crab   Crocodile

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**Teacher's Notes**

- Students have learnt about the relationship between living things and environments in 'Observing Our Environment' in Grade 3 Chapter 1 and 'Living Things in the Environment' in Grade 4 Chapter 1. In this chapter, students will learn the relationship between living things in a particular environment more specifically. This chapter is also linked to 'Food Chain' and 'Food Web' in Chapter 1 of Grade 5 and Grade 6.
- Habitat**- is a place where an organism or a community of organisms lives, including all living and non-living factors or conditions of the surrounding environment. A host organism inhabited by parasites is like a habitat and is similar to a terrestrial place such as a grove of trees or an aquatic location such as a small pond. Microhabitat is a term for the conditions and organisms in the immediate vicinity of a plant or animal.
- Temperature variations **influence** the distribution of organisms more in terrestrial **habitats** than aquatic habitats. Living organisms must develop necessary physiological and behavioural adaptations to cope with extremes of temperatures. This therefore **affects** the distribution of organisms in a **habitat**.
- Conditions like adequate temperature, moisture and light are important for plant and animal survival in a habitat.**

## Lesson Objectives

Students will be able to:

- Distinguish the different types of habitats.
- Describe how habitats are helpful to living things.
- Appreciate each other's responses on the different habitats.

## Assessment

Students are able to:

- Discuss the types of habitat and types of plants and animals that live in them.
- State what habitats provide to animals and plants by relating to the basic needs of living things and the conditions
- Listen to others' opinions attentively.

### Summary

Different living things live in different environments. The part of an environment where a plant or an animal lives is called its **habitat**. The habitat provides plants and animals with food, water, shelter and space to live. Rainforests, grasslands, rivers and oceans are different kinds of habitats. Each habitat has different conditions such as temperature, light and moisture. Some habitats are hot and dry. Other habitats are cold and wet. Plants and animals live in the conditions that best meet their needs.



Different living things live in different habitats.



Grassland habitat



Freshwater habitat



Rainforest habitat



Ocean habitat

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5

- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

Q: Do all the places where living things live have the same conditions? (No)

Q: What do living things get from the places where they live? (Basic needs such as food, water, shelter, etc.)

Q: Can a cuscus get its needs from the sea? (No)

Q: Why can't a cuscus get its needs from the sea? (The conditions of the sea are different from those of the rainforest etc...)

Q: Why do different living things live in different places? (Different living things have different needs to meet, they live in the place to meet their needs, etc...)

- Conclude the discussions.

5 **Summary (10 min.)**

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What are the different types of habitats?
  - Q: What are types of plants and animals and the habitats they live in?
  - Q: What are the conditions that enable the plants and animals to live in a particular habitat?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

**Title:** Habitats

**Key question:** What kinds of environment do living things live in?

**Activity:** Place where plants and animal live

Name of Living thing	Place where it lives	Conditions of .....
cuscus	forest	moist, dense trees, etc
Sea turtle	sea	Very wet, bright, etc
...		

**Discussion**

Q: Do all the places where living thing lives have the same conditions? **No**

Q: What do living things get from the places where they live? **Basic needs such as food, water, shelter, etc.**

Q: Can a cuscus get its needs from the sea? **No**

Q: Why can't a cuscus get its food from the sea? **The conditions of sea are different from those of rainforest, etc.**

Q: Why do different living things live in different place? **Different living things have different needs to meet, they live in the place to meet their needs, etc.**

**Summary**

- **Habitat** is the part of an environment where a plant or an animal live.
- Different plants and animals live in different habitat.
- Deserts, rainforests, grassland, rivers, lakes and oceans are different kinds of habitat.
- Habitats have different conditions such as wind, temperature, light and moistures etc.

**Lesson**  
2 / 14

**Lesson Title**  
**Freshwater Habitat**

**Preparation**

pictures of freshwater plants and animals,  
A3 papers or charts, markers, rulers

**Lesson Flow**

**1 Introduction (10 min.)**

- Review the last lesson.

Q:What are the different types of habitats?

Q:Why do different living things live in different habitats?

- Motivate students to think about freshwater habitat by asking:

Q:What types of freshwater habitats are there?

**2 Introduce the key question**

What is a freshwater habitat?

**3 Activity (20 min.)**

- Explain the steps of the activity.
- Refer the students to the picture below the activity and the character.
- Ask the students to name the place where freshwater exist in the picture with the plants and animals that live in and around the freshwater.
- Ask students to do the activity.
- Check the students' activity and if necessary guide them towards their findings.
- Give enough time for the students to do their findings.
- Ask students to discuss the living things they found in their groups.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity.

(Continue)

**Lesson 2 Freshwater Habitat**

- 1** Even though freshwater covers only 3 percent of the Earth's surface, it is also a habitat for many kinds of plants and animals.

**2 ? What is a freshwater habitat?**

**3 Activity : Living things in freshwater habitats**

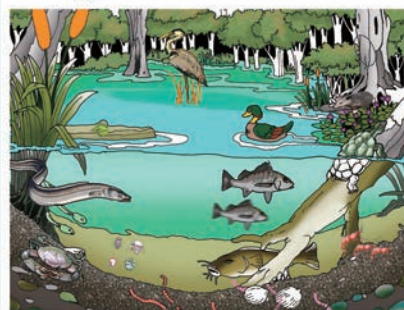
**What to Do:**

- Go out of the classroom and find a freshwater habitat such as; a river, a pond, a wetland or a lake around you.
- Observe the freshwater habitat and find the living things that live in or around it.
- Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss what kinds of living things that live in and around the freshwater habitat.

**4**



I found different kinds of living things in different places.



Living things in freshwater habitat

Date: \_\_\_\_\_

Place: pond

Frog Bird

Grass Small fish Water lilies

List of living things

1. frog

2. ....

**Teacher's Notes**

**Freshwater Habitat** includes lakes and ponds, rivers, streams, springs and wetlands. **Freshwater habitats** can be classified by different factors, including temperature, light penetration and vegetation. In Papua New Guinea, there are 5,383 mostly small natural freshwater lakes and the largest rivers are the Sepik, Fly, Purari and Markham (Source: The Food and Agriculture Organisation [FAO]).

**The two major sources of freshwater are:**

- Ground water - water found in shallow aquifers beneath the earth's surface. This water is generally found at depths up to around 2 000 feet.
  - Surface water - water found in streams, rivers, lakes, and reservoirs and glaciers.
- Water lilies, algae, and duckweed** float on the surface. **Cattails and reeds** grow along the shoreline of many freshwater ecosystems.
  - A wide variety of species from **insects**, to **amphibians, reptiles, fish, birds** and even mammals. **Turtles, ducks, otters, crocodiles, catfish, dragonfly and crabs** can be found in rivers all around the world.

## Lesson Objectives

Students will be able to:

- Identify the different types of freshwater habitats.
- Explain the relationship between living things and freshwater habitats.
- Value other pupils' effort by respecting different perspective.

## Assessment

Students are able to:

- List the different types of freshwater habitats and their characteristics.
- Describe how living things rely on freshwater habitats.
- Listen to each others' comments with respect.

## Summary

**Freshwater habitats** are natural water sources that do not contain salt. They include streams, rivers, ponds, lakes, wetlands and the area around them. Streams and rivers are flowing water. Ponds and lakes are still water. A wetland is a place where the land is covered by shallow water.



River

Lake

Wetland



Many kinds of plants live in freshwater habitats.

Many kinds of animals and plants live in or near freshwater habitats. They rely on the habitats to provide food, water and shelter. Freshwater habitats contain different kinds of plants such as grass, algae, reed and water lily but very few trees.

Some animals like frogs and dragonflies rely on water to complete

their life cycles. Others such as fish and shrimps spend their entire life in the water. Many birds, reptiles and mammals visit freshwater habitats to feed.



Different kinds of animals rely on freshwater habitats.

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- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the Freshwater sources and plants and animals that live in and around them.
- **Based on their findings**, ask these questions as discussion points.

Q:What types of freshwater habitat do you know? (Streams, rivers, ponds, lakes, wetlands)

Q:What kinds of animals live in or near freshwater habitats? (Fish, snails, worms, frogs, birds, turtle, snakes, insects, shrimps, etc...)

Q:What kinds of plants live in or near freshwater habitats? (Grass, algae, reed, water lily, etc...)

Q:Why do many kinds of living things live in or near freshwater habitats? (The habitats provide food, water, shelter and space for living things to live. Some animals like frogs depend on water to lay eggs, etc...)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What are the types of freshwater habitat?
  - Q:What are the types of plants and animals living in or near the freshwater habitats?
  - Q: What are conditions for the plants and animals to live in or near freshwater?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title:

### **Freshwater Habitat**

Key question

What is a freshwater habitat?

Activity

Living things in freshwater habitats

Place: River

Plants/animals that live in and around it
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Reeds, birds
--------------

Water lilies, fish
--------------------

Duckweeds, beetles
--------------------

Algae, crabs
--------------

Discussion

Q: What types of freshwater habitat do you know? Streams, rivers, ponds, lakes, wetlands

Q: What kinds of animals live in or near freshwater habitats? Fish, snails, worms, frogs, birds, turtle, snakes, insects, shrimps, etc...

Q: What kinds of plants live in or near freshwater habitats? Grass, algae, reed, water lily, etc...

Q: Why do many kinds of living things live in or near freshwater habitats?

The habitats provide food, water, shelter and space to live to living things. Some animals like frogs depend on water to lay eggs, etc...

Summary

- **Freshwater habitat** are any sources of water that doesn't contain salt.

- The main Freshwater Habitats are rivers, lakes, and wetlands.

- Freshwater habitats provides food and shelter for both the plants and animals in and around them.

- Plants and animals found in and around freshwater habitat eg. weeds, frogs etc ...

**Lesson**  
3 / 14

**Lesson Title**  
**Ocean Habitat**

**Preparation**

pictures of ocean plants and animals, A3 papers or charts, markers, rulers

**Lesson Flow**

**1 Introduction (5 min.)**

- Review the last lesson.

Q:What are the different types of freshwater habitats?

Q:What types of plants and animals live in or near the freshwater habitat?

- Motivate students to think about ocean habitat by asking:

Q:How are freshwater and ocean habitats different?

**2 Introduce the key question**

What is an ocean habitat?

**3 Activity (25 min.)**

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to the pictures below the activity and the character.
- Ask the students to do the activity.
- Check the students' activity and if necessary guide them towards their findings.
- Give enough time for the students to do their findings.
- Ask students to discuss their findings in the groups.

**4 Discussion for findings (25 min.)**

- Ask students to present the findings from their activity.  
(Continue)

**Lesson 3 Ocean Habitat**

- 1** An ocean is one of the habitats. Oceans cover about 70 percent of the Earth's surface.

**2 ? What is an ocean habitat?**

**3 Activity : Living things in ocean habitats**

**What to Do:**

1. Draw a table like the one shown below.

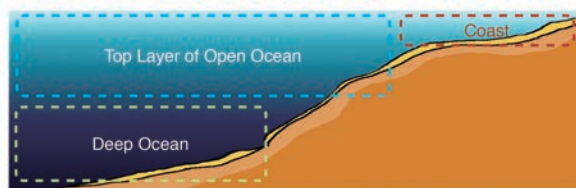
Area	Name of living things
Coast	
Top layer of open ocean	
Deep ocean	

Do you know other living things that live on the coast, top layer of open ocean and deep ocean?



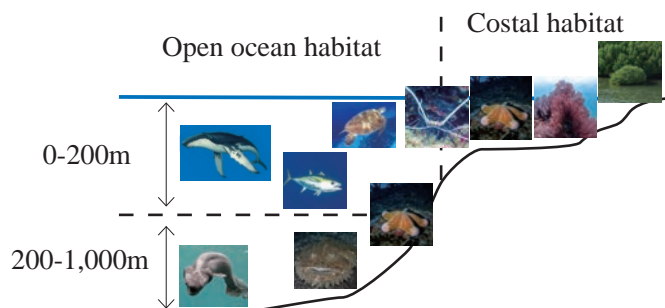
2. Study the pictures of plants and animals below and think about the area of the ocean which they live in. Make a list of the living things in the table.

3. Share your ideas with your classmates. Discuss the types of living things and the area where they live in the ocean habitat.



**Teacher's Notes**

The ocean is divided into zones based upon  
a) Water Depth, b) Availability of Light and  
c) Distance from the Shore.



**Characteristics of Frill shark that lives in deep ocean**

- Frill shark has an eel-like shape with 6 pairs of very large gill slits that enables maximum absorption of oxygen from the deep ocean waters.
- Most of them have developed very sensitive eyes to sense the bioluminescent animals and the environmental light coming from the surface. The eyes are tubular, which consist of a multi-layer retina and a big lens that allows them to detect the maximum quantity of light in one direction. Some species have secondary lens in the laterals and a bigger lens to improve lateral vision.

## Lesson Objectives

- Students will be able to:
- Identify the features of the ocean habitat.
  - Classify living things that live in the ocean habitat in accordance with the areas of ocean.
  - Communicate their ideas with others.

## Assessment

- Students are able to:
- Describe the features of coastal habitats and open ocean habitats.
  - Name different types of living things that live in coastal habitats and open ocean habitats.
  - Express their ideas to classmates actively.

### Summary

An **ocean habitat** is a place with salty water. Each plant and animal lives in a certain ocean habitat depending on how much sunlight they receive. Ocean habitats can be divided into two: coastal and open ocean habitats.

#### Coastal Habitats

A coast is a place where the land meets the sea. Coastal habitats are shallow, sunny and warm. Coastal habitats include beaches, rock pools, coral reefs, estuaries and mangrove forests. Animals such as shore birds, fish, crabs, corals and starfishes can be found in the coastal habitats. Mangroves, algae and kelp are examples of plants found in the coastal habitats.



Coral reefs



Rock pools

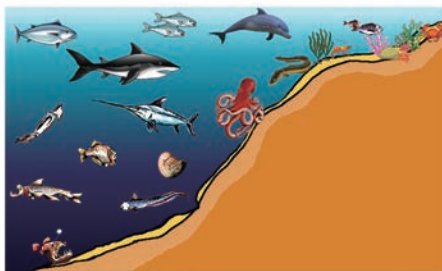


Estuaries

#### Open Ocean Habitats

The open ocean is the area of the ocean outside of coastal areas. The top layer of the open ocean gets the most sunlight. Tiny algae floats near the surface. Dolphins can be found near the surface in the open ocean.

The deeper the water, the less the sunlight reaches. So, the deepest parts of the ocean are very dark and cold. Many types of living things including fish, shrimps, worms, crabs and clams live in this habitat.



Living things in ocean habitats.

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- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

**Q:** How are the conditions of the coast, top layer of ocean and deep ocean different? (Coast: shallow, sunny and warm, Top layer: open and sunny, Deep ocean: dark and cold.)

**Q:** Why do mangroves grow in the coastal habitat? (The condition of coast helps mangrove get light and air that they need to survive.)

**Q:** Can you guess how angler fish gets its foods in area of deep ocean? (Angler fish uses its glowing lure to attract other animals to feed on.)

- Conclude the discussions.

### 5 Summary (5 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What is an ocean habitat?
  - Q: What are two main types of ocean habitats?
  - Q: What kinds of living things can be found in coastal habitats and open ocean habitats?
  - Q: What are the conditions of coast, top layer of ocean and deep ocean?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title:

### Ocean Habitat

Key question:

What is an ocean habitat?

Activity

Living things in ocean habitats

Area	Name of living things
Coast	Coral, mangrove, turtle, lobster, starfish
Top Layer	Tuna, turtle, whale
Deep Ocean	Whale, angler fish, starfish, nautilus

Discussion

Q: How are the conditions of the coast, top layer of ocean and deep ocean different?

Coast: shallow, sunny and warm, Top layer: open and sunny, Deep ocean: dark and cold.

Q: Why do mangrove grow in the coastal habitat? The condition of coast helps mangrove get light and air that they need to survive.

Q: Can you guess how angler fish gets its foods in area of deep ocean? Angler fish uses its glowing lure to attract other animals to feed on.

Summary

- An **ocean habitat** is a place with salty water where animals and plants live.
- Ocean habitats can be divided into two: coastal and open ocean habitats.
- **Coastal habitat** is area where land meets the oceans. They are shallow, sunny and warm.
- **Open ocean habitat** is the area outside of the coastal areas. The top layer of the open ocean gets the most sunlight. The deepest parts of the ocean are very dark and cold.



**Lesson**  
4 / 14

**Lesson Title**  
**Rainforest Habitat**

**Preparation**

pictures of rainforest plants and animals,  
A3 papers or charts, markers, rulers

**Lesson Flow**

**1 Introduction (10 min.)**

- Review the last lesson.

Q:What are two main types of ocean habitats?

Q:What kinds of living things can be found in costal habitats and open ocean habitats?

- Motivate students to think about rainforest habitat by asking:

Q:What is the relationship between a rainforest habitat and living things that live in the rainforest?

**2 Introduce the key question**

What is a rainforest habitat?

**3 Activity (20 min.)**

- Explain the steps of the activity.
- Refer the students to the pictures below the activity and the character.
- Draw a table like the one as shown in the 'Teachers notes and Blackboard Sample.'
- Ask the students to do the activity.
- Check the students' activity and if necessary guide them towards their findings.
- Give enough time for the students to do their findings.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity.
- Write their findings on the blackboard.  
(Continue)

**Lesson 4 Rainforest Habitat**

- 1** A rainforest is one of the habitats. Rainforests are found closer to the equator.

**2** **?** What is a rainforest habitat?

**3** **🔍** **Activity : Living things in rainforest habitats**

**What to Do:**

1. Study the picture of plants and animals below.

2. Think about the following questions:

- What kinds of animals live in a rainforest?
- How do different kinds of plants grow in a rainforest?
- Where do different kinds of animals live in a rainforest?
- Why do many kinds of animals live in a rainforest?

3. Share your ideas with your classmates.

Do you know other living things that live in a rainforest?



**Teacher's Notes**

- Example of the table to be drawn.

Questions	
1. What kinds of animals live in a rainforest?	Birds, lizard, tree kangaroo, frog, beetle etc.
2. How do different kinds of plants grow in a rainforest?	They tend to grow close together.
3. Where do different kinds of animals live in a rainforest?	Some animals live on the trees and others live in the bushes.
4. Why do many kinds of animals live in a rainforest?	A rainforest provides many shelters and foods for animals.

- The largest rainforests are in the Amazon River Basin (South America) and the Congo River Basin (Western Africa).
- Smaller rainforests are located in Central America, Madagascar, Australia and Papua New Guinea.
- Rainforests are populated with insects (like butterflies and beetles), arachnids (like spiders and ticks), worms, reptiles (like snakes and lizards), amphibians (like frogs and toads), birds (like parrots and toucans) and mammals (like sloths and jaguars).
- Different animals live in different strata of the rainforest (i.e. emergent, canopy, understory and forest floor layers.)

## Lesson Objectives

Students will be able to:

- Explain the relationship between rainforest habitat and living things that live in the rainforest.
- Communicate their ideas with others.

## Assessment

Students are able to:

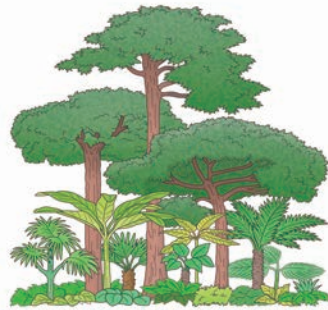
- Describe how the rainforest habitat provides the needs and conditions for plants and animals to live.
- Share their ideas with groups and classmates.

## Summary

A **rainforest habitat** is a place with a lot of rain, warm climates and tall trees. Though a rainforest covers less than 2 percent of the Earth's surface, about 50 percent of the Earth's plants and animals live in rainforests. It also produces 20 percent of the oxygen on the Earth.

Different kinds of plants in a rainforest tend to grow close together. Some plants grow taller than other plants. This dense forest has the different heights of branches and leaves and provide shelter and food for many kinds of animals to live.

A lot of animals get energy by eating plants or by eating other animals in a rainforest. Tree kangaroos, cuscus and many kinds of birds find their shelter among the branches of trees in the rainforest. Different kinds of insects also find their shelter in the rainforest.



Plants in rainforests grow densely and in different sizes.



A bird builds its nest among the branches of trees.



Bees make hives on trees.



Cuscus find shelter in trees.

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- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

**Q:**How do animals depend on a rainforest habitat? (They get foods and shelter from trees, moss and fern.)

**Q:**What enable the moss and the fern to live in these parts of the rainforest habitat? (Moist, warmth, shady.)

**Q:**What are the reasons for the plants and animals to live in particular parts of the rainforest habitat? (Each living thing needs different conditions such as food, water, sunlight and adequate temperature.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q:** What kinds of plants and animals do you find in the rainforest habitat?
  - Q:** What conditions does a rainforest habitat provide to living things?
  - Q:** Why do different living things live in the different parts of a rainforest?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

**Title:** Rainforest Habitat

**Key question**

What is a rainforest habitat?

**Activity :** Living things in rainforest habitats

Questions
1. What kinds of animals live in a rainforest?
<i>Write down the answers of students.</i>
2. How do different kinds of plants grow in a rainforest?
<i>Write down the answers of students.</i>
3. Where do different kinds of animals live in a rainforest?

*Write down the answers of students.*

4. Why do many kinds of animals live in a rainforest?

*Write down the answers of students.*

**Discussion**

**Q:**How do animals depend on a rainforest habitat? *They get foods and shelter from trees, moss and fern.*

**Q:** What enable the moss and the fern to live in these parts of the rainforest habitat? *Moist, warmth, shady.*

**Q:** What are the reasons for the plants and animals to live in particular parts of the

rainforest habitat? *Each living thing needs different conditions such as food, water, sunlight and adequate temperature.*

**Summary**

- **Rainforest** is place with a lot of rain, warm climates and tall trees.
- Rainforest is very dense because trees and plants grow close together.
- A dense forest has different heights of branches and leaves that provides shelter and food for many living things.
- Rainforest contains most of the plants that produce the Earth's oxygen.

**Lesson**  
5 / 14

**Lesson Title**  
**Grassland Habitat**

**Preparation**

pictures of grassland plants and animals,  
A3 papers or rulers, markers, rulers

**Lesson Flow**

**1 Introduction (10 min.)**

- Review the last lesson.

Q:What kinds of plants and animals do you find in the rainforest habitat?

Q:What conditions does a rainforest habitat provide for living things?

- Encourage students to think about a grassland habitat by asking:

Q:What relationships are there between a grassland habitat and living things that live in the grassland?

**2 Introduce the key question**

What is a grassland habitat?

**3 Activity (20 min.)**

- Explain the steps of the activity.
- Refer students to the pictures below the activity and the character.
- Ask the students to think about the three questions based on the pictures.
- Draw the table as the one shown in the Teachers notes and blackboard sample.
- Ask the students to do the activity.
- Check the students' activity and if necessary guide them towards their findings.
- Give enough time for the students to do their activity.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity. **(Continue)**

**Lesson 5 Grassland Habitat**

- 1** Living things live in grassland. Grassland is an area mostly covered by grasses.

**2 ? What is a grassland habitat?**

**3 Activity : Living things in grassland habitats**

**What to Do:**

- Study the pictures below and think about the following questions:
  - What kinds of plants grow in grassland habitat?
  - What kinds of animals live in grassland habitat?
  - How do plants in rainforest and grassland look different?
  - Which habitat is easier for animals to hide themselves? Explain why.
  - Where can animals find their shelter in a grassland habitat? Explain why.
- Share your ideas with your classmates.

Let's compare the types and heights of plants in a rainforest and a grassland.



Rainforest



Grassland

**Teacher's Notes**

**Grassland Habitats** are places where only grasses grow and very little rain falls for trees to grow in great numbers. The lowland that spreads along the Fly River in Papua New Guinean is a great grassland widely known in the world.

- Animals living in grasslands, lack the protection of the trees and must cope with extreme weather and temperatures that accompany the exposed habitat. In doing so, many species dig tunnels or burrows that provide shelter for relief from such extreme weather and temperatures. Many rodents are excellent diggers and create a network of tunnels.

**Example of the table to be drawn.**

Questions
1. Whats kinds of plants grow in a grassland habitat? Grass
2. What kinds of animals live in the grassland habitat? Insects, wallabies, lizards, snakes, rats, birds, etc.
3. How do plants in rainforest and grassland habitat look different? There are many huge trees and many different kinds of plants in the rainforest while there are few or no trees in grassland. Most of the plants in a grassland habitat are grasses.

**Note:**

This lesson is about grasslands, Guide the students to pay attention on features of grasslands rather than rainforests.

## Lesson Objectives

Students will be able to:

- Explain the relationship between grassland habitat and the living things that live in the grassland.
- Recognise how animals adapt to the conditions of a grassland habitat.

## Assessment

Students are able to:

- Describe how the grassland habitat provides for the needs of plants and animals to live.
- Explain how animals find their shelter or protect themselves in the grassland habitat.
- Listen to others' opinions with respect.

### Summary

A **grassland habitat** is a place with few or no trees. The grassland receives more rain than deserts but less than forests. Grasslands are too dry for many trees to grow. Most of the plants there are grasses.



Most of the plants in grasslands are grasses.

Grasslands are sometimes called prairies, savannahs or steppes. Most animals that live in a grassland feed on grasses and their seeds. Some animals feed on other animals to get energy. Grassland animals include wallabies, lizards, snakes, rats, a variety of birds and insects.



A wallaby lives in grassland.



A grasshopper feeds on grasses.

A grassland is a big open space, therefore provides limited places for animals to hide. Grassland animals find different ways to shelter and protect themselves from danger. For example, many grassland animals find shelter and make their homes underground.

Why do many grassland animals make their homes underground?



A rat appearing from its home underground.

5

- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

**Q:How do living things depend on a grassland habitat?** (They get foods and shelter from a grassland.)

**Q:How is the height of plants in a grassland different from that in a rainforest?** (The plants in a grassland are shorter than that in a rainforest.)

**Q:Which habitat is difficult for animals to hide in?** (A grassland habitat)

**Q:How do rats hide themselves in the grassland?** (They make their shelters underground)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:  
Q: What characteristics does a grassland have?  
Q: How do the animals find shelter or protect themselves from danger in the grassland?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

**Title:** Grassland Habitat

**Key question** What is a grassland habitat?

**Activity :** Living things in grassland habitat

**Results:**

Questions
Whats kinds of plants grow in grassland habitat? <i>Write down the answers of students.</i>
What kinds of animals live in grassland habitat? <i>Write down the answers of students.</i>
How do plants in rainforest and grassland habitat look different? <i>Write down the answers of students.</i>

**Discussion**

Q: What kinds of living things live in a grassland habitat? *Insects, wallabies, lizards, snakes, rats, birds*

Q: How do living things depend on a grassland habitat? *They get food and shelter.*

Q: How is the height of plants in a grassland different from that in a rainforest? *The plants in a grassland are lower than that in a rainforest.*

Q: Which habitat is difficult for animals to hide in? *A grassland*

Q: How do rats hide themselves in the grassland? *They make their shelters underground.*

**Summary**

- **Grassland** is a place with few or no trees. It receives more rain than deserts but less than forests.
- Grassland is too dry for trees to grow so most plants that grows there are grasses.
- Grassland animals feed on grasses and their seeds.
- Many grassland animals find their shelter underground.

**Lesson**  
6 / 14

**Lesson Title**  
**Habitat Changes**

**Preparation**

pictures of habitat changes, A3 papers or charts, markers, rulers

**Lesson Flow**

- 1 Introduction (10 min.)**
  - Remind students of the contents learned so far in Topic 9.1 by asking:  
Q: What types of habitats did you learn?
  - Ask students to look at the pictures in the summary of Lesson 1, and ask:  
Q: What would happen if those habitats change? What would cause the habitats to change?
- 2 Introduce the key question**  
What happens to living things when habitats change?
- 3 Activity (20 min.)**
  - Explain the steps of the activity.
  - Refer the students to the character and study the pictures below the activity.
  - Ask the students to investigate effects of what is happening in the pictures.
  - Ask the students to do the activity.
  - Check the students' activity and if necessary guide them towards their findings.
  - Give enough time for the students to do their findings.
  - Ask students to discuss their findings in their groups.
- 4 Discussion for findings (20 min.)**
  - Ask students to present their findings of the activity.  
(Continue)

**Lesson 6 Habitat Changes**

- 1** Different plants and animals live in different habitats. Fish live in freshwater or ocean habitats. Tree kangaroos and cuscus live in rainforest habitats.

- 2** **?** What happens to living things when habitats change?

**3** **🔍 Activity : Effects of habitat change**

**What to Do:**

1. Draw a table like the one shown below.

Do you have any idea about the causes of habitat change?



Causes of habitat change	What will happen to the habitats and living things?
People cut down trees in a forest.	
It rains heavily and rivers flood.	
It does not rain for a long time and a pond dries up.	
A forest fire occurs and burns a large portion of a forest.	
People drain oil or harmful materials into rivers or land.	

2. Think about the relationship between the causes of habitat change and its effects on the habitats and the living things that live there.
3. Describe your ideas in the table.
4. Share your ideas with your classmates. Discuss the causes and effects of habitat change.

**4**



**Teacher's Notes**

**Habitat Change** - Change in the local environmental conditions where a particular organism lives.

- Habitat change can occur naturally through droughts, disease, fire, hurricanes, mudslides, volcanoes, earthquakes, slight increases or decreases in seasonal temperature or precipitation, etc.
- Habitat change can also be induced by human activities such as land use change and physical modification of rivers or water withdrawal from rivers.
- Habitat change is the current trend in biodiversity loss is the conversion of land for agriculture, settlement, or other human uses. When there is a loss of habitat, these species are at a greater risk of extinction than those which have larger habitat ranges.
- Biomes with concentrated populations have undergone the most conversion, but the rate of change is now highest in developing countries within Southeast Asia and South America. Currently, grasslands and tropical dry forests are being converted faster than any other biome. Growing coastal communities are also seeing an increase in habitat loss and degradation due to dredging, port expansion, and shoreline stabilization efforts. And, mangroves are being degraded or destroyed at nearly twice the rate of tropical forests.

## Lesson Objectives

Students will be able to:

- Recognise the effects of habitat changes.
- Identify the causes of habitat changes.
- Display an active attitude in their participation.

## Assessment

Students are able to:

- State good and bad effects of habitat changes on the living things.
- Explain how natural events and human activities cause habitat changes.
- Participate in the investigation actively.

## Summary

The habitat is the place where an organism lives. An **organism** is any living thing. Plants, animals and other living things are organisms. Organisms are affected in many ways when their habitats change. Habitats can be changed by natural events and people.

### Natural Events

Natural events such as droughts, fire and floods can cause habitats to change. For example, the ponds or streams will dry up when a drought happens. Most plants that live in ponds will die. Many pond animals would not get the food and shelter they need. They would have to find other places to live or they will die, but new plants and animals may make the dried-up pond as their habitat.



Drought



Bush fire



Plants growing on ground after drought.

### People

Habitats can also be changed by human activities. People cut down trees to build houses and roads, and change streams or rivers to build dams. In the process, people destroy the habitats of organisms. Pollution is also caused by human activities. People pollute the habitats by throwing away trash, emitting smoke in the air and allowing harmful materials to leak into the soil. Pollution kills plants and causes animals to get sick or die.



Human activities destroy the habitats.



Pollution causes organisms to get sick or die.

What are the causes of habitat change?



5

- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

Q: How can you classify the causes of habitat changes? (They can be classified into two: natural events and human activities.)

Q: What are the bad effects of habitat changes on the habitats and living things? (The habitats are destroyed, living things lose their habitats, they may die, etc.)

Q: What are the good effects of habitat changes on the habitats and living things? (The new habitats may be created, other living things may find new habitats, etc)

- Conclude the discussion.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What are some examples of habitat changes?
  - Q: What are the main causes of habitat changes?
  - Q: What are the good and bad effects of habitat changes?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

### Title: **Habitat Changes**

Key question What happens to living things when habitats change?

Activity : Effects of habitat change

Causes	What will happen to....
People cut down ...	Write students' answers'
It rains heavily.	Write students' answers
It does not ....	Write students' answers
A forest fire ...	Write students' answers
People drain oil ....	Write students' answers

### Discussion

Q: How can you classify the causes of habitat changes? **They can be classified into two: natural events and human activities.**

Q: What are the bad effects of habitat changes on the habitats and living things? **The habitats are destroyed, living things lose their habitats, they may die, etc.**

Q: What are the good effects of habitat changes on the habitats and living things? **The new habitats may be created, other living things may find new habitats, etc**

### Summary

- An **organism** is any living thing.
- Organisms are affected in many ways when their habitats change. Habitats can be changed by **natural events** and **people**.

#### 1. Natural Events:

- Natural events such as droughts, fire and floods can cause habitats to change.
- Living things lose their shelter and die.
- New living things may make their habitat.

#### 2. People:

- Habitats can also be changed by human activities. People pollute the habitats.

**Lesson**  
7 / 14

**Lesson Title**  
**Summary and Exercise**

**Tips of lesson**

**1 Summary (30 min.)**

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - How can we describe a habitat?
  - How can we describe each habitat?
  - What are any three things in each habitat that makes them different from the other?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.

**2 Exercise & Explanation (30 min.)**

- Go through the instructions of the exercise.
- Allow students to answer the questions individually and give them enough time in response to the questions based on their understanding.
- After the exercise give them the answers to the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strengthen the learnt concepts in this topic.


**1 Summary and Exercise 9.1 Habitats**

**Habitat**

- Habitat is the part of an environment where a plant and an animal live.
- The habitat provides plants and animals with food, water, shelter and space to live.
- Different kinds of habitats have different conditions such as temperature, light and moisture.

**Different Kinds of Habitats**

- Freshwater habitats** are any natural water sources that do not contain salt including rivers, ponds, lakes, wetlands.
- Ocean habitat** is a place with salty water. There are two main types of habitats; the coastal habitat and the open ocean habitat.
- A rainforest habitat** is a place with a lot of rain, warm climate, and tall trees. The rainforest is always moist and warm, more kinds of plants and animals live in the rainforest than in any other habitats.
- A grassland habitat** is a place with few or no trees. Grasslands are too dry for many trees to grow and most of the plants here are grasses.



**Habitat Changes**

- Habitats can be changed by natural events and people. The habitat changes have good and bad effects on organisms that live there.
- Natural events such as droughts, fires and floods can cause habitats to change.
- Human activities such as cutting down trees, building dams, throwing away trash, emitting smoke in the air and leaking harmful materials into the soil can cause habitats to change.


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**2 Summary and Exercise 9.1 Habitats**

**Q1. Complete each sentence with the correct word.**

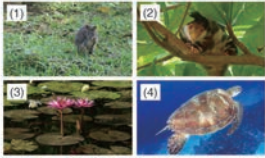
- The part of an environment where a plant and animal live is called \_\_\_\_\_.
- Coastal and open ocean habitats make up the \_\_\_\_\_ habitat.
- A \_\_\_\_\_ habitat is a place with a lot of rain, warm climates and tall trees.
- Most animals in the \_\_\_\_\_ habitat feed on grasses and their seeds.
- Rivers, lakes and streams are examples of \_\_\_\_\_ habitat.

**Q2. Choose the letter with the correct answer.**

- What is the cause of habitat change shown in the picture on the right?
 
  - Drought
  - Earthquake
  - Flood
  - Bush fire
- Which of the living things are found in the coastal habitat?
  - Coral and Mangrove
  - Turtle and Tuna fish
  - Seaweed and Angler fish
  - Whale and Nautilus

**Q3. Answer the question below.**

What is the name of the habitats for the living things labelled (1), (2), (3) and (4) in the pictures on the right?



**Q4. Explain what will happen to the living things in the rainforest habitat if there is a bush fire.**

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## Exercise answers

Q1.

- (1) **habitat**
- (2) **ocean**
- (3) **rainforest**
- (4) **grassland**
- (5) **freshwater**

Q2.

- (1) **C**
- (2) **A**

Q3.

- (1) **grassland**
- (2) **freshwater**
- (3) **forest**
- (4) **ocean**

Q4. Expected answers:

- **If there is a big bush fire in the forest some animals will run away from their habitat while the others will be burnt to death.**
  - **If there is a big bush fire in the forest habitat most of the plants will be burnt to death.**
- 
-



**Lesson**  
8 / 14

**Lesson Title**  
**What is Adaptation?**

**Preparation**

animal pictures, papers, markers

**Lesson Flow**

**1 Introduction (5 min.)**

- Recap Topic 9.1 'Habitats' by asking:  
Q:What types of habitats do you know?  
Q:What do the habitats provide to living things?
- Provoke students to think about the adaptation by asking:  
Q:How do living things live in the habitats to meet their needs?

**2 Introduce the key question**

How do adaptations help organisms?

**3 Activity (25 min.)**

- Organise students into pairs.
- Explain the steps of the activity.
- Refer students to study pictures below the activity and the character.
- Let students predict how the body parts help animals and write their predictions in their exercise books.
- Allow students to do the activity.
- Give enough time for students to do their findings.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity.
- Write their findings on the blackboard.
- Facilitate active students' discussion.  
(Continue)

**9.2 Adaptations**

**Lesson 1 What is Adaptation?**

**1** Different organisms live in different habitats. Organisms can survive in their habitats only if their needs are met.

**2** **?** How do adaptations help organisms?

**3** **🔍 Activity : Body parts of animals**

**What to Do:**  
1. Draw a table like the one shown below. Do you have any ideas on body parts that help organisms?

Body parts	How the body part helps the animal?
Long neck of a giraffe	
Thick fur of a polar bear	
Long and sharp spines of an echidna	

2. Study the pictures of the animals below. Think about how each of the body parts help animals to survive and write your ideas in the table.

3. Share your ideas with your classmates. Discuss how the body parts help the animals.

**4**

**Giraffe** **Polar bear** **Echidna**

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**Teacher's Notes**

- An adaptation is behavioural or physical characteristics of an animal that helps it to survive in its environment. It matches to their way of surviving which includes coping with physical factors, obtaining food, escaping from predators and reproduction. Each group of animals has its own general adaptations.
- Body coverings are the examples of adaptations such as fur, feathers sharp hair or quills, whiskers, scales and hair.
- Shape of body is another adaptation such as long neck of giraffes to reach leaves in tall trees and long ears of rabbits for better hearing.

**There are three different types of adaptations:**

- Behavioural - responses made by an organism that help it to survive/reproduce.
- Physiological - a body process that helps an organism to survive/reproduce.
- Structural - a feature of an organism's body that helps it to survive/reproduce.

## Lesson Objectives

Students will be able to:

- Understand what an adaptation is.
- Describe how adaptations help animals to survive.
- Communicate their ideas with others.

## Assessment

Students are able to:

- Explain how animals adapt their body parts to the environment.
- List the ways how adaptations help animals to survive.
- State their ideas to others actively.

## Summary

**Adaptation** is the use of body parts or a behaviour that helps an organism survive in its environment. **Behaviour** is the way organisms act in a certain situation. Adaptations help organisms survive in many ways.

### Getting Food

Adaptations help organisms get food to survive. For example, giraffes have long necks. The long neck helps giraffes to eat leaves of trees that other animals cannot reach.



A long neck helps a giraffe to eat the leaves of a tree.

### Surviving Severe Conditions

Some habitats have severe conditions. Some are very cold and snowy. Some are very hot and dry. Organisms living in severe conditions have adaptations that help them to survive. For example, some animals such as polar bears have thick fur. The thick fur helps keep them warm to survive in cold habitats.



The thick fur helps keep polar bear warm.

### Self-Defence

Most organisms have adaptations for self-defence. For example, some organisms such as echidnas and cactus plant are covered with long sharp spines. The spines help keep organisms from being eaten by enemies. Some animals such as octopus change colour as their environment changes. Some adaptations help organisms hide in their surroundings.



Spines help keep echidna from being eaten.

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- Confirm the finding with the students.
- **Based on their findings**, ask these questions as discussion points.

Q: If a giraffe didn't have a long neck, what would happen to the giraffe? (The giraffe wouldn't get food easily.)

Q: If a polar bear didn't have thick fur, what would happen to the polar bear? (The polar bear would die soon because it is very cold near Arctic area.)

Q: If a hedgehog didn't have long and sharp spines, what would happen to the hedgehog? (It would be eaten by enemy easily and die.)

Q: Why do animals have the characteristic body parts? (Their characteristic body parts would help themselves survive in their habitats or environments.)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:  
Q: What is adaptation?  
Q: How does an adaptation help animals?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

### Title: What is Adaptation?

#### Key question

How do adaptations help organisms?

Activity : Body parts of animals

Body parts	How does the body part help animals
Giraffe: long neck	To reach the leaves of trees easily to eat
Polar bear: thick fur	To keep the bear warm from the cold temperature
Hedgehog: Long and sharp spines	For protection from its enemies

#### Discussion

Q: If a giraffe didn't have a long neck, what would happen to the giraffe? **The giraffe wouldn't get food easily.**

Q: If a polar bear didn't have thick fur, what would happen to the polar bear? **The polar bear would die soon because it is very cold near arctic area.**

Q: If a hedgehog didn't have long and sharp spines, what would happen to the hedgehog? **It would be eaten by enemy easily and die.**

Q: Why do animals have the characteristic body parts? **Their characteristic body parts would help survive in their habitats or environments.**

#### Summary

- An **adaptation** is the use of body part or a behaviour that helps an organism survive in its environment.
- **Behaviour** is the way organisms act in a certain situation.
- Adaptations help organisms survive in many ways: **getting food, surviving severe conditions and self defence.**

**Lesson**  
9 / 14

**Lesson Title**  
**Adaptations to Habitats**

**Preparation**

pictures of animals, papers, markers

**Lesson Flow**

- 1 Introduction (5 min.)**
  - Review previous lesson by asking:  
Q:What is adaptation?  
Q:How does adaptation help animals?
  - Encourage students to think about the adaptation of organisms to habitats, by asking:  
Q:How does organisms adapt their body parts to their habitats?
- 2 Introduce the key question**  
How do organisms adapt to their habitats?
- 3 Activity (25 min.)**
  - Organise students into pairs.
  - Explain the steps of the activity.
  - Allow students to study the picture and questions in the textbook.
  - Refer students to what the characters are saying for their investigation.
  - Ask students to think about how a sea turtle and a tortoise are alike or different.
  - Give enough time for students to do their findings.
- 4 Discussion for findings (20 min.)**
  - Ask students to present their findings from the activity.
  - Write their findings on the blackboard.
  - Facilitate active students' discussion.
  - Confirm the findings with the students.  
(Continue)

**Lesson 2 Adaptations to Habitats**

- 1** Adaptations help organisms get food, hide from other animals and survive in conditions of their habitats.

**2 ? How do organisms adapt to their habitats?**

**3 Activity : Turtles adaptation**

**What to Do:**

1. Draw a table like the one shown below.

How are they similar?	How are they different?

Both of them are turtles but what are the differences between them?

2. Study the pictures of the two turtles below.
3. Compare and describe how they are similar or different in the table.
4. Based on your results, think about the following questions.  
(1) Where do they live?  
(2) How do their body parts adapt to their habitats?

Think about what body parts they use to move in their habitat. Explain why.

- 4** 5. Share your ideas with your classmates.



Sea turtle



Freshwater turtle

**Teacher's Notes**

- The name of the freshwater turtle in the activity is 'red-bellied shartnec turtle' living in Papua New Guinea. The freshwater turtle lives on land near rivers and ponds.
- Turtles and tortoise are similar. Both are reptiles and have a shell. But sea turtle adapts to the habitat in the ocean. It has flippers to swim fast whereas tortoise has feet to walk and adapts to live on land. It has dome-shaped shell to safely keep its body inside when it is attacked by predators.
- Facilitate students to link these characteristics (adaptations) and their habitats by carefully observing from the pictures. Uncertain facts that cannot be identified from these pictures are not necessary to be discussed, because they may be difficult to confirm.

**Additional Information about Adaptation to Habitats**

- Animals can live in many different places in the world because they have special adaptation to the area they live in.
- Animals depend on their physical features which is called the structural adaptation which enables them to obtain food, keep safe, build homes, withstand weather and attract mates.
- Structural adaptations include; body colour, body covering, beak type, claw type, etc.

## Lesson Objectives

Students will be able to:

- Explain how different organisms adapt to their habitats.
- Infer how a sea turtle and tortoise adapt to their environments.
- Investigate the adaptations with interest.

## Assessment

Students are able to:

- Describe how different organisms adapt their body parts to the different habitats.
- Describe the adaptations of a sea turtle and a tortoise to their environments by comparing their body parts.
- Enjoy investigating the adaptation actively.

## Summary

Organisms need to adapt to their habitats to survive. Habitats are different, so organisms living in different habitats need different adaptations to survive. A **desert** is one of the habitats. The desert is a place with very little water. It can be hot and dry. It is hard for organisms to get food and water in a desert. Desert organisms have adaptations to desert habitats. A camel stores fat in its hump(s) that helps it to survive long periods without food and water. A cactus plant has thick stems and waxy skin that holds water for survival in a dry habitat.



A camel stores fat in its hump.



A cactus has thick stems and waxy skin that holds water.

Organisms living in water also have adaptations that help them to meet their needs. Some animals such as fish and dolphins have fins or flippers that help them swim through water. Animals living on land have different adaptations. They have legs that help them to walk easily on land. Some animals such as birds have wings that help them fly in the air.



Fins are adapted for swimming.



A pig has legs for walking.



Wings help birds to fly.

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- **Based on their findings**, ask these questions as discussion points.

Q:Where do they live? (A sea turtle lives in the ocean, but a freshwater turtle lives on land near rivers and ponds.)

Q:Why do they have the different shape of legs? (Because they live in different habitats.)

Q:How do the flippers of a sea turtle help it to live in the ocean? (Flippers help a sea turtle to swim in the ocean.)

Q:If a freshwater turtle lives on land what body parts helps it to move around? (The feet helps it to walk on land.)

Q:How do animals adapt to their habitats? (They adapt their body parts to their habitats to survive.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

Q: Why do organisms need to adapt to their habitats?

Q: How do they adapt to their habitats?

- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title:

### Adaptations to habitats

Key question

How do organisms adapt to their habitats?

Activity: Turtles adaptation

How are they similar?	How are they different?
They have a scale.They have four legs, etc.	Habitats are different. Shape of legs are different, etc.

Discussion

Q:Where do they live? **A sea turtle lives in the ocean but a freshwater turtle lives on land near rivers and ponds.**

Q:Why do they have the different shape of legs? **Because they live in different habitats.**

Q:How do the flippers of a sea turtle help it to live in the ocean? **Flippers help a sea turtle to swim in the ocean.**

Q:If a freshwater turtle lives on land what body parts helps it to move around? **The feet helps it to walk on land.**

Q:How do animals adapt to their habitats?

**They adapt their body parts to their habitats to survive.**

Summary

- Organisms need to adapt to their habitats to survive.
- Habitats are not the same so organisms need different adaptations. For example:
  - In water, animals need fins and flippers to swim.
  - On land, they need feet to walk.
  - In the air, they need wings to fly.
  - In desert, organisms need the body parts that hold water or store food.

**Lesson**  
10 / 14

**Lesson Title**  
**Camouflage**

**Preparation**

nil

**Lesson Flow**

**1 Introduction (10 min.)**

- Recap previous lesson by asking :  
Q: Why do organisms need to adapt to their habitats?  
Q: How do organisms adapt to their habitats?
- Provoke students to think of different kinds of adaptations by asking:  
Q: What kinds of adaptation do animals have in order to survive?

**2 Introduce the key question**

What is camouflage?

**3 Activity (20 min.)**

- Organise students into pairs.
- Explain the steps of the activity.
- Allow students to study pictures and questions in the textbook.
- Refer students to what the characters are saying for their activity.
- Ask students to do the activity.
- Give enough time for students to do their findings.
- Ask students to discuss their findings in their groups.

**4 Discussion for findings (20 min.)**

- Ask students to present where they found animals in the pictures.
- Write their findings on the blackboard.  
**(Continue)**

**Lesson 3 Camouflage**

- 1** Organisms need to adapt to their habitats to survive. What other kinds of adaptations do organisms have?

- 2** **?** What is camouflage?

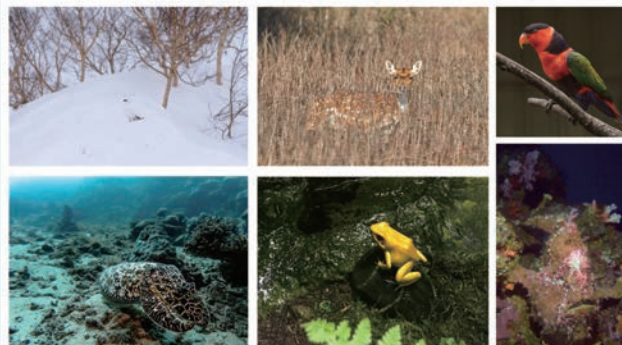
**3** **Q** **Activity : Can you find animals?**

**What to Do:**

- Study the pictures below carefully and find the animals.
- Make a list of the animals you find.
- Think about the following questions.
  - Which animals were easy or hard to find? Explain why.
  - How are the colours and patterns of the animal body parts helpful to them?
- Share your ideas with your classmates.

How many animals can you find?

Why are some animals difficult to find?



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**Teacher's Notes**

- Camouflage** is one example of **adaptation** that help animals to survive in their environment. Animals utilise camouflage to avoid detection by both predator and prey species.
- The animals that are hunted are called prey. Prey animals often use **camouflage** to hide from predators. **Camouflage** is a way of hiding that allows an animal to blend in with its environment or otherwise go unnoticed by predators. Some animals hide themselves by blending with the background that matches their colours.
- Camouflage only works if it matches the environment. Animals that live in a variable environment must change their camouflage to continue to avoid detection.
- Animal behaviour can also influence its camouflage ability since it may manifest a stronger tendency to physically hide, flee or swing away from tree to tree as soon as they sense danger.
- As soon as some animals perceive changes in their environment, they relocate and select an environment which closely matches their colour. This then increases their chances for survival.

## Lesson Objectives

Students will be able to:

- Understand what camouflage is.
- Explain how camouflage helps animals.
- Participate in the investigation with interest.

## Assessment

Students are able to:

- Explain how animals camouflage themselves in the environment.
- State that animals camouflage themselves to help them to find food and to hide from enemies.
- Enjoy finding animals in the pictures.

## Summary

**Camouflage** is a type of animal adaptation. It is the colours, patterns or shape of body parts of an animal that allows it to blend in with its surroundings. Camouflage helps animals to hide from enemies and to find their food.

The colour and pattern of an owl's feathers helps it to blend in with trees, making it easier to stay hidden from other animals in the daytime. A tiger also uses camouflage. Its striped fur helps it to blend in with the tall grasses. The tiger can hunt without being seen.

Some insects use their body parts to camouflage. A stick insect uses camouflage to look like the branches or leaves of the trees where it lives. Its physical appearance helps the stick insect to blend in with its surroundings and hide from its enemies.

The following pictures show examples of animals camouflaging.



An owl blends in with a tree.



Striped fur helps tigers blend in with the tall grasses.



A stick insect looks like twigs.



Examples of animals camouflaging to blend in with their surroundings.

152

5

- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

**Q: Which animals were easy or difficult to find? Why?** (Difficult to find: rabbit, deer, octopus, and angler. Because their colour is similar to the colour of their environment. Easy to find: bird and frog. Because their colour is different from the colour of their environment.)

**Q: What body parts of animals help them to hide in their environment?** (Their colours and patterns and shapes of body parts.)

**Q: Why are the colours and patterns of animals' body parts helpful?** (They help animals blend in with the environment, looking like one of the environment or hide from their enemies.)

**Q: Do you know some other animals that can blend in with the environment?** (Answers may vary.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

Q: What is camouflage?

Q: How does camouflage help animals?

Q: How do animals camouflage in the environment?

- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

**Title:** Camouflage

**Key question:** What is camouflage?

**Activity:** Can you find animals?

**Results:**

What kinds of animals did you find? (tick)

Animals	Easy	Hard	Why?
Birds		✓	
Deer		✓	
Bird	✓		vivid colour
Octopus		✓	
Frog	✓		vivid colour
Angler fish		✓	

**Discussion**

Q: Which animals were easy or difficult to find? Why? Difficult to find: rabbit, deer, octopus, and angler. Because their colour is similar to the colour of their environment. Easy to find: bird and frog. Because their colour is different from the colour of their environment.

Q: What body parts of animals help them to hide in their environment? Their colours and patterns and shapes of body parts.

Q: Why are the colours and patterns of animals' body parts helpful?

They help animals blend in with the environment, looking like one of the environment or hide from their enemies.

Q: Do you know some other animals that can blend in with the environment?

Answers may vary.

**Summary**

- **Camouflage** is an animal's adaptation, that helps animals to hide from their enemies and to find food.
- Animals use their colour, pattern and shape of body parts to blend with their surroundings.

**Lesson**  
11 / 14

**Lesson Title**  
**Mimicry**

**Preparation**

animals picture, paper, markers

**Lesson Flow**

- 1 **Introduction (5 min.)**
  - Recap previous lesson by asking:  
Q:What is camouflage?  
Q:How do animals camouflage?
  - Encourage students to think about other types of adaptation by asking:  
Q:Do you think organisms use their body parts in different ways too?
- 2 **Introduce the key question**  
What is mimicry?
- 3 **Activity (20 min.)**
  - Organise the students to work in pairs.
  - Explain the steps of the activity.
  - Ask students to do the activity
  - Allow students to study pictures and questions in the textbook.
  - Refer students to what the character is saying for their activity.
  - Have students identify the owls' eyes or the spots on the butterfly's wings.
  - Give enough time for students to do their findings.
- 4 **Discussion for findings (20 min.)**
  - Ask students to present their findings from the activity.
  - Write their findings on the blackboard.
  - Facilitate active students' discussions.
  - Confirm the findings with the students.  
(Continue)

**Lesson 4 Mimicry**

- 1 Organisms use their body parts to camouflage themselves. Do organisms use their body parts in different ways?

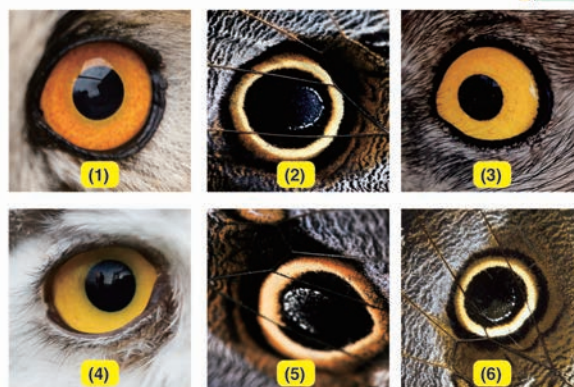
2 **What is mimicry?**

3 **Activity : Which one is an owl's eye?**

**What to Do:**

1. Study the pictures below carefully. Some are owls' eyes and others are the spots on butterflies' wings.
2. Think about the following questions.
  - (1) Which pictures are the owls' eyes or the spots of butterflies?
  - (2) How do the spots help the butterflies?
3. Share your ideas with your classmates.

The spots on the butterflies' wings are similar to the owl's eyes. Explain why.



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**Teacher's Notes**

- Mimicry is when animals or insects look like other dangerous, bad tasting or poisonous animals or insects. They pretend to be what they are not.
- Animals copy or mimic other animals(called models) to fool their predators. Most often the mimics make predators believe that they are an animal the predator fear or does not like to eat. Mimicry helps animals to live longer.
- Some snakes, butterflies and moths use this type of camouflage. Examples are the scarlet king snake, the hawk moth and the Viceroy butterfly.
- In evolutionary biology, mimicry is a similarity of one organism, usually an animal, to another that has evolved because the resemblance is selectively favoured by the behaviour of a shared signal receiver that can respond to both.
- Some birds can sing and dance to pretend to be like another bird example a Blue Jays can mimic several species of hawks. Also Parrots and cockatoo mimicking sounds and human language.

**Answers for activity**

- Pictures 1, 3 and 4 are owls' eyes and the spot on the butterfly's wing are pictures 2, 5 and 6.

## Lesson Objectives

Students will be able to:

- Understand what mimicry is.
- Explain how mimicry helps animals.
- Participate in the investigation with interest.

## Assessment

Students are able to:

- Explain how animals mimic themselves in the environment.
- State that mimicry helps animals get food or protect themselves from enemies.
- Enjoy finding animals in the pictures.

## Summary

**Mimicry** is a type of animal adaptation that allows an animal to look like another kind of animal. Mimicry can keep them from being eaten or it can help them get food.

Mimicry helps protect some types of butterflies from birds. Some butterflies have large eye-spots on their wings. These spots resemble the eyes of animals such as owls to scare away birds that want to eat the butterfly.



Some butterflies have large eye-spots to scare away birds.

Other animals use mimicry to behave like another animal. Some harmless snakes have colours and patterns that look like dangerous snakes. Birds see these colours and patterns and stay away.



A snake with poison (Coral snake)



A snake without poison (Scarlet king snake)

How does mimicry help animals to survive?



Some animals use mimicry for hunting. Angler fish has a lure that sticks out from its head. The lure looks like small animals such as worms, shrimps or smaller fish to attract a fish's attention. Once a fish gets closer to the lure, the angler fish eats it.



Angler fish has a lure to attract other fish.

5

- **Based on their findings**, ask these questions as discussion points.

**Q: Why was it too difficult to identify the owls' eyes from the spots on the butterfly's wing?** (The spots on the butterfly's wing look like owls' eyes.)

**Q: Can you guess why the spots of butterflies look like the owls' eyes?** (If the spots on the butterfly's wing look like the owls' eyes, other animals would think that that butterfly is an owl, so it scare them away, etc.)

**Q: Do you know some other animals that look like another animal?** (Answers may vary.)

- Conclude discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:  
Q: What is the meaning of mimicry?  
Q: How do mimicry help animals?  
Q: Give some examples of mimicry.
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title:

### Mimicry

Key question What is mimicry?

Activity: Which one is an owl's eye?

Result:

Which pictures are owls' eye?

(Write down the ideas from students.)

(1) Owl's eyes	(2) Spots of butterflies	(3) Owl's eyes
(4) Owl's eyes	(5) Spots of butterflies	(6) Spots of butterflies

Discussion

Q: Why was it too difficult to identify the owls' eyes from the spots on the butterfly's wing? **The spot on the butterfly's wing looks like the owl's eye.**

Q: Can you guess why the spots on the butterfly's wing look like the owls' eyes? **If the spots on the butterfly's wing look like the owls' eyes, other animals would think that that butterfly is an owl, so it scare them away, etc.**

Q: Do you know some other animals that look like another animal? **Answers may vary**

Summary

- **Mimicry** is a type of adaptation that allows an animal to look like another animal.
- Mimicry can keep animals from being eaten or it can help them get food.
- Animals mimic to pretend and behave like other animals.
- Mimicry helps animals to look for food and hide from their enemies.



**Lesson**  
12 / 14

**Lesson Title**  
**Behavioural Adaptation**

**Preparation**

pictures, papers, markers

**Lesson Flow**

**1 Introduction (5 min.)**

- Recap previous lesson by asking:  
Q:What is mimicry?  
Q:How does mimicry help animals?  
Q:Give some examples of mimicry.
- Refer students' to their experience of an animal behaviour in their environment.

Q:Why does a snake or a lizard stay in the shade of plants and rocks?  
(To avoid gaining too much heat from direct sunlight, or to hide themselves)

**2 Introduce the key question**

How do organisms behave to survive in their environment?

**3 Activity (20 min.)**

- Organise students into pairs.
- Explain the steps of the activity.
- Allow students to study the pictures and questions in the textbook.
- Refer students to what the characters are saying for their activity.
- Give enough time for students to do their findings.
- Ask students to discuss their findings in their groups.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity.
- Write their findings on the blackboard.  
**(Continue)**

**Lesson 5 Behavioural Adaptation**

**1** Behaviour is also an adaptation. It is the way organisms behave to survive.

**2** **?** How do organisms behave to survive in their environment?

**3** **Q** **Activity : Animal Behaviour**

**What to Do:**

- Study the pictures below.
- Think about the following questions.  
(1) Why do penguins come together?  
(2) Why does a rat live in a burrow?  
(3) How do their behaviour help them?
- Record your ideas in your exercise book.
- Share your ideas with your classmates.

What kind of conditions do they live in?



Each habitat has different conditions.



The Antarctic is covered with ice and is the driest and coldest continent on the Earth. It is where penguins come together.



A rat lives in the desert. It stays in its burrow during the daytime. A burrow is a hole or tunnel in the ground made by animals for shelter.

**Teacher's Notes**

Behavioural adaptations are the things organisms do to survive. For example, bird calls and migration are behavioural adaptations. Adaptations are the result of evolution. Evolution is a change in a species over long periods of time. Adaptations usually occur because a gene mutates or changes by accident! Some mutations can help an animal or plant survive better than others in the species without the mutation.

- Several adult lions and their cubs live together in a group, called a pride. When a mother lion catches food, she shares it with the pride.
- Sea turtles travel thousands of kilometres to find a warm beach to lay eggs.
- Many fish swim together in schools. It is hard for an enemy to see and catch a fish in a large school.
- Most animals in Earth's history have not adapted to changes. When animals cannot adapt to changes, they die out, or become extinct.

## Lesson Objectives

Students will be able to:

- Understand what behaviour is.
- Explain how behaviour helps animals.
- Communicate ideas with others.

## Assessment

Students are able to:

- Explain the meaning of behaviour.
- State the different ways that animals act or react to its environment.
- Listen to others' ideas with respect.

## Summary

**Behaviour** is a type of adaptation. It is the way that animals act or react to their environment. Behaviour helps animals to find food and water, move to safe places and protect themselves.

Some animals move from one habitat to another where the weather is warmer or where they can find food. This is called **migration**. For example, some birds move to another habitat during winter to be in a place where the habitat is warm.



Birds move to another habitat during winter.

Some animals have behavioural adaptations that help them to survive in cold winter. Bears go into a long deep sleep through the winter. This is called **hibernation**. They need little or no food during hibernation. So do frogs, snakes and even some insects. Emperor penguins gather together in the cold to keep warm.



A bear goes into a deep sleep during winter.

Other animals behave in different ways.

Female turtles always return to the same beach where they hatched to lay their eggs. Some animals such as birds and fish travel in a large group that helps to protect the members of the group from enemies.



Sea turtles return to the same beach to lay eggs.



Fish travel in a large group for protection.

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5

- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their findings**, asks these questions as discussion points.

Q: In what climate do penguins and rats live?

(Penguins live in very cold climate with negative temperature. Rats live in very hot and dry climate.)

Q: Why do penguins come together? (To prevent themselves freezing to death, to conserve heat and shelter themselves from the cold.)

Q: Why does a rat live in a burrow? (To conserve body water, to stay out of the heat, etc)

Q: How do their behaviours help them? (Their behaviours help them protect themselves and get water for surviving.)

Q: Do you know some other behaviours of animals? (Answers may vary.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What is behaviour?
  - Q: Why do animals act in such behaviour?
  - Q: How do animals act to survive in their environment?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title: **Behavioural Adaptation**

Key question: How do organisms behave to survive in their environment?

Activity: Animal behaviour

Animals	Behaviour	Reason for behaviour
Penguins	huddle together in tightly-packed groups	To prevent themselves freezing to death, conserve heat.
Rat	Lives in a burrow	For shelter and storing food.

Discussion

Q: In what climate do penguins and rats live?

Penguins live in very cold climate with negative temperature. Rats live in very hot and dry climate.

Q: Why do penguins come together? To prevent themselves freezing to death, to conserve heat and shelter themselves from the cold.

Q: Why does a rat live in a burrow? To conserve body water, to stay out of the heat.

Q: How do their behaviours help them? Their behaviours help them protect themselves and get water for surviving.

Q: Do you know some other behaviours of animals? *Answers may vary.*

Summary

- **Behaviour** is a type of adaptation which is a way that animals act or react to their environment.
- **Migration** and **hibernation** are examples of behavior.
- Behaviour helps animals to:
  - find food and water .
  - move from place to place.
  - protect themselves from enemies and severe conditions.

**Lesson**  
13 / 14

**Lesson Title**  
**Summary and Exercise**

**Tips of lesson**

**1 Summary (20 min.)**

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - Q: How do animals adapt to their habitats?
  - Q: What are some ways animals adapt to their habitats?
  - Q: Why do animals use camouflage?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.

**2 Exercise & Explanation (30 min.)**

- Go through the instructions of the exercise.
- Allow students to answer the questions individually and give them enough time to respond to the questions based on their understanding.
- After the exercise give them the answers to the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strengthen the learnt concepts in this topic.

**1 Summary and Exercise 9.2 Adaptations**

**What is Adaptation?**

- An adaptation is the use of a body part or a behaviour that helps an organism survive in its environment.
- Behaviour is the way organisms act in a certain situation.

**Adaptation to Habitats**

- Adaptation helps organisms to get food, hide from other animals and survive in conditions of their habitats.
- Organisms living in different habitats need different adaptations to survive.

**Camouflage**


- Camouflage is the colour, pattern or the shape of the body parts of animals that allows them to blend in with their surroundings.
- Camouflage helps animals to hide from enemies and to look for food without being seen.

**Mimicry**


- Mimicry is a type of animal adaptation that allows an animal to look like another kind of animal.
- Mimicry can keep animals from being eaten or help them to get food.
- Some harmless animals have colours and patterns that look like those of dangerous animals.

**Behavioural Adaptation**


- Behaviour is a type of adaptation. It is a way that animals act or react to their environment. Migration and hibernation are examples of the behaviour.
- Behaviour helps animals find food and water, move to safe place and protect themselves.



A camel stores fat in its hump to survive in a desert.



An owl blends in with a tree.



A harmless snake taking on the colour and patterns of the poisonous snake.

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**2 Summary and Exercise 9.2 Adaptations**


**Q1. Complete each sentence with the correct word.**

- An animal body part or its behaviour helps the organism to survive in its environment is called \_\_\_\_\_.
- Organisms live in different \_\_\_\_\_, so they need to adapt in order to survive.
- An adaptation that allows an animal to look like another kind of animal is called \_\_\_\_\_.
- An adaptation that makes animals to act or react to its environment is called \_\_\_\_\_.

**Q2. Choose the letter with the correct answer.**

- What is the adaptation for cactus plant to have thick stems and waxy skin?
  - To hold water in dry environment.
  - To attract animals for pollination.
  - To poke animals that try to eat it.
  - To allow water to run out easily.
- Why do some insects blend in with their surroundings?
  - To hide from enemies.
  - To scare away enemies.
  - To be eaten other animals.
  - To be easy to be seen.

**Q3. Some butterflies have large eye-spots on their wings. Why do the butterflies have such eye-spots?**



**Q4. How do some animals behave during cold winter to survive?**

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## Exercise answers

Q1.

- (1) **adaptation**
- (2) **habitat/Environment**
- (3) **mimicry**
- (4) **behaviour**

Q2.

- (1) **A**
- (2) **A**

Q3.

**To scare away the birds that want to eat the butterflies.**

Q4. Expected answer

**The animals such as bears go into a long deep sleep through the winter to survive with little or no food.**

### Explanation of Science Extras

#### 3 Science Extras (10 min.)

- Give opportunities to students to closely observe the nature and its phenomena in the world.
- Allow students to ask questions that demonstrate curiosity about the content in the science extra.


3Chapter 9  
•Science Extras•

### How does an octopus use camouflage, mimicry and change its colours?



Octopuses are masters in using camouflage to catch animals they want to eat and hide from animals that want to eat them. Octopuses have very good vision and they use it to better camouflage themselves.

An octopus can change the way its skin looks and feels. It controls the muscles under its skin by changing its skin to match the rock's or plant's bumpiness near to blend in it. It can also change the way it moves. It mimics a rock, by not only folding its eight tentacles (legs) close to the body but changing the way its skin looks. It can also change the way it swims to mimic the way waves might push a rock through the ocean.

The octopus can change the colour of its skin. It can control the colour of its skin because it has special cells in its skin that are filled with different colours. If the octopus relaxes the muscles connected to its red colour cells, these cells will become really small and we would not be able to see red on the octopus' skin. However, if the octopus stretches the muscles connected to its red colour cells, these cells will also stretch and get bigger so that we would be able to see lots of red on the octopus' skin. By changing the sizes of all the different coloured cells, the octopus can very rapidly create complex patterns that allow it to better blend in with its surroundings.



The octopus blends in the rock.



The octopus can change the colour and patterns of its skin.

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**Chapter Test**

**9. Habitat and Adaptation**

**Q1**

Complete each sentence with the correct word.

- (1) The part of the environment where plants and animals live to get all their needs is called **habitat**.
- (2) Animals can camouflage themselves by blending in with their surroundings using their **colour**, patterns or shapes of body parts.
- (3) Some butterflies use **mimicry** by having two large eye-spots on their wings to imitate an owl's eye to scare birds away.

**Q2**

Choose the letter with the correct answer.

- (1) Which animal lives in a freshwater habitat?  
A. Whale  
B. Tuna fish  
**C. Frog**  
D. Lobster
- (2) What is the type of adaptation when geese fly away from winter to summer in other regions?  
A. Mimicry  
**B. Behaviour**  
C. Acting  
D. Camouflage
- (3) Which statement best describes the rainforest habitat?  
**A. Trees and other plants tend to grow close together.**  
B. Most plants are grass which animals eat.  
C. There are a few trees growing with fewer rainfalls.  
D. Most plants grow in lots of water with areas of grass.
- (4) If the sea turtle was living on the land, which of its body part would adapt to that environment to survive?  
A. Eyes  
B. Head  
**C. Flippers**  
D. Nose



**Q3**

- (1) Observed the dried branches on the picture on the right. There is an insect among the branches. Explain what made the insect difficult to be spotted?

The insect looks like the branches of a tree with the similar colour, texture and shape.



- (2) Algae is a kind of plant. Why does it live and float near the top of the open ocean surface?

Because they need sunlight to make their own food.

- (3) What is the purpose of the lure on this fish?

(Expected answer) The fish use the lure to imitate a wriggling worm which attracts small fish closer to be eaten.



**Q4**

- (1) The picture on the right is the result of drought causing a pond to dry-up. How is the habitat change good for the plants and animals?

(Expected answer) Many pond animals and plants would die but the dried-up pond will become a habitat for other plants and animals to live in.



- (2) The giraffe lives in the savannah grassland of Africa. One of its main food is eating the leaves of a tree. How has the giraffe adapted to eat the leaves at the very top of the tree?

(Expected answer) The giraffe is adapted to the environment by having a very long neck that enables it to reach the leaves at the top of the tree.



**Strand : LIFE**  
**Unit : PLANTS**  
**Chapter 10. Plant Growth**

**Chapter Objectives**

Students will be able to understand the parts of a seed, necessary conditions for seed germination and plant growth through the experiments.

**Topic Objectives**

**10.1 Needs for Seed Germination**

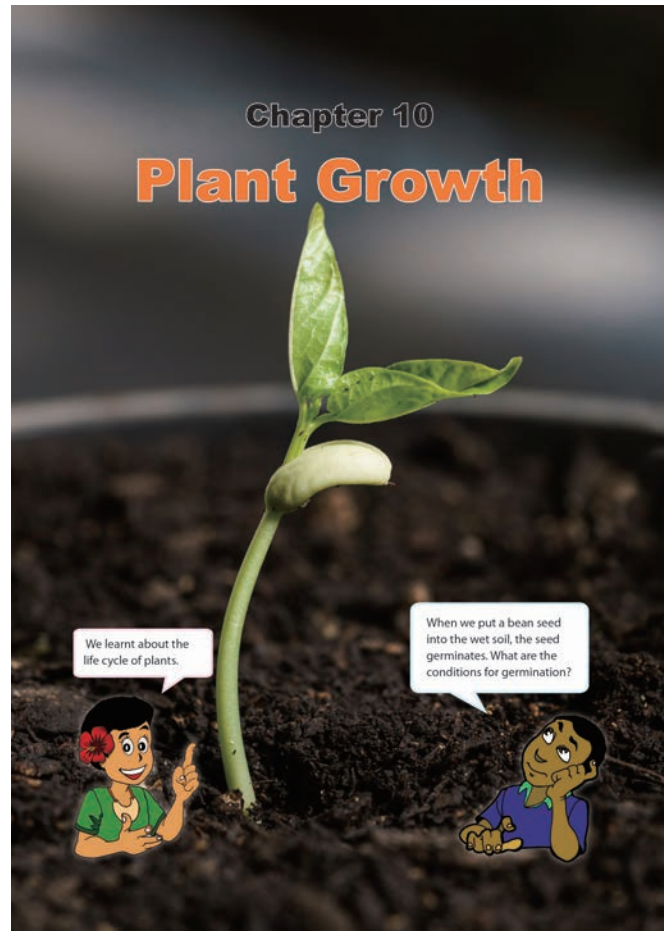
Students will be able to;

- Identify the three main parts of a seed.
- Explain the way water makes the seed to germinate.
- Recognise that air is a condition needed for germination.
- Investigate the way in which temperature affects the germination of seeds.

**10.2 Needs for Plant Growth**

Students will be able to;

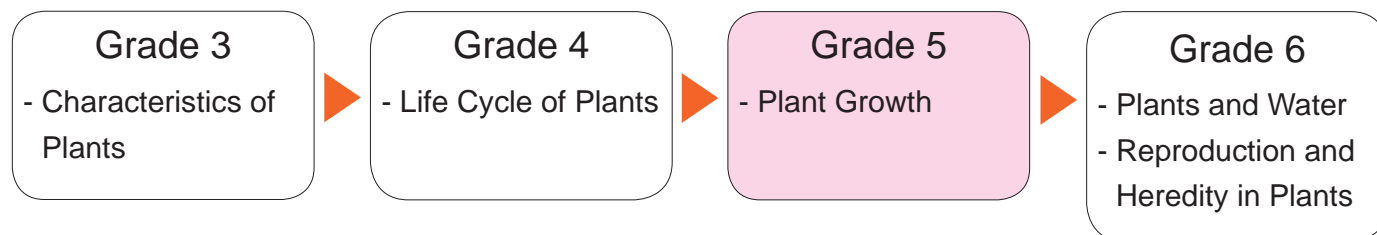
- Describe the changes the plant goes through when there is no water.
- Identify light as a condition for plant growth.
- Describe the changes in the plant that is grown with fertiliser.



This picture is from the chapter heading of the textbook showing a seedling of a bean seed.

## Related Learning Contents

The learning contents in this chapter connect to the following chapters.



Prior knowledge for learning this chapter;

- Explain the structure of plant parts.
- Describe the life cycle of plants.

## Teaching Overview

This chapter consists of 10 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
10.1 Needs for Seed Germination	1	<b>Inside of a Seed</b> What is the structure of a seed?	5.2.1	163 - 164
	2	<b>Conditions for Germination 1: Water</b> Do seeds need water to germinate?		165 - 166
	3	<b>Conditions for Germination 2: Air</b> Do seeds need air to germinate?		167 - 168
	4	<b>Conditions for Germination 3: Temperature</b> Do seeds need proper temperature to germinate?		169 - 170
	5	Summary and Exercise		171 - 172
10.2 Needs for Plant Growth	6	<b>Conditions for Plant Growth 1: Water</b> Do plants need water to grow?		173 - 174
	7	<b>Conditions for Plant Growth 2: Light</b> Do plants need light to grow?		175 - 176
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Chapter Test	10	Chapter Test		



**Lesson**  
1 / 10

**Lesson Title**  
**Inside of a Seed**

**Preparation**

magnifying glass, razor blade, black or dark paper to put the seed on while observing

**Lesson Flow**

**1 Introduction (10 min.)**

- Review the Grade 4 lesson on 'Life Cycle of Plants especially on 'SEEDS'.

Q:What are some properties of a seed?

- Motivate students to think about the inside of a seed by asking:

Q:If we cut open a seed, what do you think we will find?

**2 Introduce the key question**

What is the structure of a seed?

**3 Activity (20 min.)**

- Organise the students into groups.
- Explain the steps of the activity.
- Remind students of safety rules for using a cutter.
- Demonstrate how to cut the bean seed into half to the students.
- Ask students to do the activity.
- Check students' activity and if necessary guide the students towards their findings.
- Give enough time for the students to do their findings.
- Ask students to discuss their findings with their groups.

**4 Discussion for findings (20 min.)**

- Ask the students to present their findings from the activity.
- Write their findings on the blackboard.
- Facilitate active students' discussions.

(Continue)

**10.1 Needs for Seed Germination**

**Lesson 1 Inside of a Seed**

- Plant life cycle starts from a seed. A young plant comes out from a seed. Is there a part inside a seed that grows into roots or leaves?
- ? What is the structure of a seed?**
- Activity : Observing the inside of a seed**

**What We Need:**

  - bean seeds soaked in water overnight, cutter knife, hand lens

**What to Do:**

  - Remove the coat of the bean seed and cut it lengthwise with a knife.
  - Observe the inside parts of the bean seed using a hand lens. Sketch its structure.
  - Record your observations in your exercise book.
  - Share your ideas with your classmates. Discuss which parts of the seed will grow into roots, stem and leaves.

**Be careful when you cut a bean seed with the knife.**

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- 

**Teacher's Notes**

Flowering plants can be classified into two categories: dicotyledon and monocotyledon. A bean seed, a dicotyledon (dicot), has a tiny embryo tucked between two halves of the seed. These two halves of a bean seed are cotyledons or seed leaves. The cotyledons are filled with stored food. The seed leaves are usually quite different in form from the leaves that develop later.

A corn seed is a monocotyledon that has a tiny embryo inside it. However, the seed will not separate into two parts when the seed coat is removed. The inside layer of tissue around the embryo of the seed called the endosperm stores food for the embryo. There is only one seed leaf (the cotyledon) which is quite thick and not packed with food.

**Dicotyledon**  
Two cotyledons when it germinates.



Bean



Tomato

**Monocotyledon**  
Single cotyledon when it germinates.



Corn

**SAFETY**

Keep their fingers away from the knife cutting edge.

## Lesson Objectives

Students will be able to:

- Identify the three main parts of a seed through their observation.
- Understand what the three main parts of a seed are.
- Observe the inside of a seed with interest.

## Assessment

Students are able to:

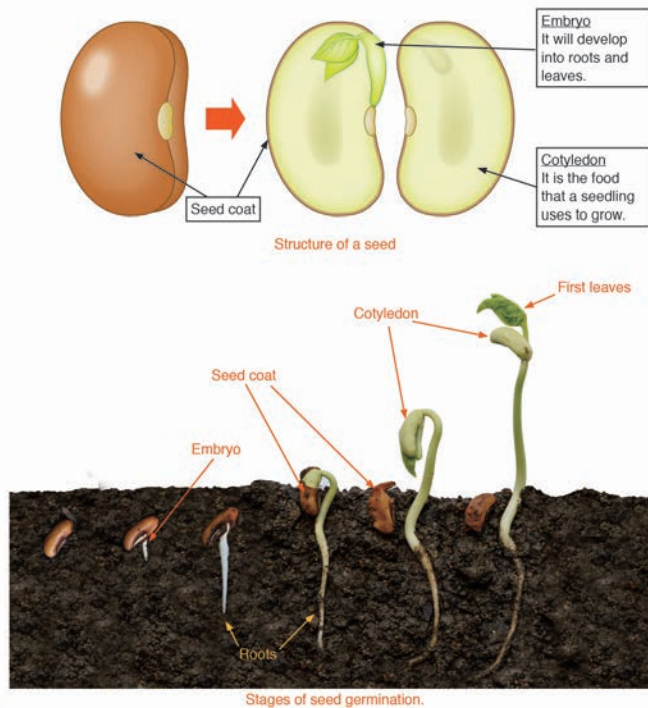
- Describe the three main parts of a seed based on the results of observation.
- State the characteristics of the three main parts of a seed.
- Sketch the inside of a seed by paying attention to the three main parts of a seed.

## Summary

There are three main parts of a seed: seed coat, embryo and cotyledon.

**Seed coat** is the hard outer layer of the seed covering around the embryo and the cotyledon. It protects the embryo and the cotyledon. **Embryo** is the tiny plant inside the seed. It will develop into roots and leaves. The embryo rests inside the seed until the conditions are right for it to start to grow.

**Cotyledon** is the part that stores food, known as **starch**. A young plant uses the starch until it is big enough to make its own food.



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- Confirm the findings with the students.
- **Based on their findings**, ask these questions as discussion points.

**Q: What kinds of seed parts did you find?** (Peel or cover, a part that looks like a small plant, white part.)

- Explain three main parts of a seed as seed coat, embryo and cotyledon, ask these questions:

**Q: What part of the seed covers the embryo and the cotyledon of the seed?** (Seed Coat)

**Q: How can you describe the seed coat?** (Hard outer layer covering the whole seed.)

**Q: Can you guess which parts of a seed grow into roots, stem and leaves?** (Embryo, because it looks like a small plant.)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What are the three main parts of a seed?
  - Q: How does seed coat work?
  - Q: Where does the leaf and root grow from?
  - Q: Where does the seed get its food from when it's growing?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title:

### Inside of a Seed

Key question

What is the structure of a seed?

Activity: Observing the inside of a seed

Drawing



Discussion

Q: What kinds of parts did you find? **Peel or cover, a part that looks like a small plant, white part**

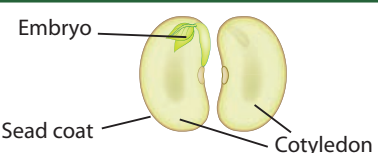
Q: What part of the seed covers the embryo and the cotyledon of the seed? **Seed Coat**

Q: How can you describe the seed coat? **Hard outer layer covering the whole seed)**

Q: Can you guess which parts of a seed grow into roots, stem and leaves? **Embryo because it looks like a small plant.**

Summary

- There are three main parts of a seed.



- **Seed coat** is the hard outer layer of the seed covering around the embryo and the cotyledon. It protects the seed.
- **Embryo** is the tiny plant inside the seed. It will develop into roots and leaves.
- **Cotyledon** is the part that stores food, known as 'starch'. A young plant uses the starch to grow.

**Lesson**  
2 / 10

**Lesson Title**  
**Conditions for Germination 1: Water**

**Preparation**

plastic/paper cups or cut-water plastic containers (improvised cups)

**Lesson Flow**

**1 Introduction (10 min.)**

- Review the last lesson.
- Q:What are the three main parts of a seed?
- Explain the meaning of germination.
- Encourage students to think about the conditions for seed germination by asking:

Q:What does a seed need to germinate?

**2 Introduce the key question**

Do seeds need water to germinate?

**3 Activity (20 min.)**

This lesson setup is done together for Lesson 3 Condition for Germination 2: Air and Lesson 4 Condition for Germination 3: Temperature

- Organise the students into groups.
- Explain the steps of the activity.
- Refer students to the experiment setups below the activity and the characters.
- Ask students to do the activity.
- Check students' activity and if necessary guide the students in setting up their experiment.
- Ask the students to observe the seed for the next 3-5 days and record their observations.

**4 Discussion for findings (20 min.)**

- Ask students to present their results from the activity.
  - Write their results on the blackboard.
- (Continue)

**Lesson 2** **Conditions for Germination 1: Water**

- 1** Plant life cycle starts from a seed. The seed sprouts and a seedling grows. The process of the seed growing into a seedling is called **germination**. What conditions do seeds need to germinate?

- 2** **?** Do seeds need water to germinate?

**3** **Activity : With and without water**

**What We Need:**

- bean seeds, water, tissue paper, two cups



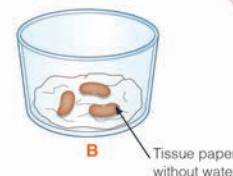
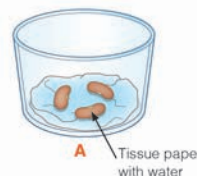
**What to Do:**

1. Fold the tissue paper so that it will fit inside the cups A and B as shown below.
2. Wet the paper in the cup labelled A until it is completely moist.
3. Place the bean seeds on top of the paper in each cup and put the two cups at the same location. Always keep Cup A moist.
4. Observe the seeds for a week. Record your observations in your exercise book.
5. Share your ideas with your classmates. Discuss which beans germinated and why.

What conditions are the same or different in this activity? Can you identify them?



How can we control the conditions?



**Teacher's Notes**

**SAFETY:** Emphasise the Safety Rules when using water to avoid slippery floor and wetting their clothes.

- Teach this lesson only up to the Activity and STOP.
- As soon as the seeds in cup A germinate (around after 2-4 days), then Discussion and Summary can be taught.
- Check every day that the tissue in cup A is moist and the tissue in cup B is dry.
- The cotyledon is the food storage area of the seed. The purpose of the seed coat is to protect the seed from physical, temperature-related, or water damage. The seed coat also ensures that the plant seed remain in a state of dormancy until conditions are right for the plant embryo to germinate, or sprout.
- When the seeds are immersed in water for some time the seed coat becomes soft allowing the seed to germinate.

## Lesson Objectives

Students will be able to:

- Identify the condition for seed germination through experiment.
- Understand what germination is.
- Show keenness to learn.

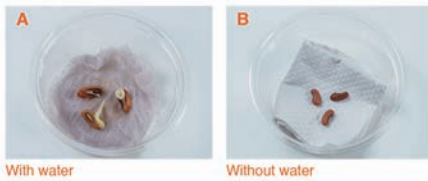
## Assessment

Students are able to:

- State that water is one of the important conditions for seed germination by controlling the different conditions.
- Explain the meaning of germination.
- Participate actively in the setups in Lessons 3 and 4.

### Result

We found out that the seeds placed on wet tissue paper germinated but the seeds placed on dry tissue paper did not germinate.



With water

Without water

What conditions were same or different?



#### Different conditions

The seeds were given water or not given water.

#### Same conditions

The seeds were exposed to air.  
The seeds were placed at the same location with the same amount of light and at the same temperature.

### Summary

The germination happens inside the seed. Seeds need the right conditions to germinate. Water is one of the important conditions for seed germination. Seeds need water to germinate.

Seeds are usually dry. They might have to wait for years to start growing. When a seed comes into contact with water, water allows the seed to swell up until the seed coat splits apart and the seed embryo absorbs water. Water makes the embryo 'wake up' from its hibernation and starts growing.

From this result, what did you find out? What does a seed need to germinate?



When a seed comes into contact with water, the seed coat will absorb water.



Once the seed coat splits, the embryo starts to grow.

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- Facilitate active students' discussions.
- Confirm the results with the students.
- **Based on their results**, ask these questions as discussion points.

**Q:** Compare the seeds in cups labelled A and B. What conditions were different? (Seeds in Cup A were in wet tissue while seeds in Cup B were in dry tissue.)

**Q:** What conditions are the same for seeds in cup A and B? (Same air, location, same light and same temperature)

**Q:** What do you think caused the seeds in cup labelled A to germinate? (The water in the tissue)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q:** What is germination?
  - Q:** What conditions are the same and different in cup A and B?
  - Q:** What condition does a seed need to germinate?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

**Title:** Conditions for Germination 1: Water

**Key question**

Do seeds need water to germinate?

**Activity:** With and without water

Day	Seed in tissue paper with water	Seed in tissue paper without water
1		
2	Write students' findings.	
3		
4		

**Discussion**

**Q:** Compare the seeds in cups labelled A and B. What was the difference?

Seeds in Cup A were in wet tissue while seeds in Cup B were in dry tissue.

**Q:** What conditions are the same for seeds in cup A and B?

Same air, location, same light and same temperature.

**Q:** What do you think caused the seeds in cup labelled A to germinate?

The water in the tissue.

**Summary**

- The process of the seed growing into a seedling is called **germination**.
- Seeds need the right condition for germination.
- **Water** is one of the important conditions for seed germination.

**Lesson Flow**

**1 Introduction (10 min.)**

- Review the last lesson.

Q:What is germination?

Q:What conditions are the same and different in cup A and B?

Q:What condition does a seed need to germinate?

- Encourage students to think about another conditions for germination by asking:

Q:Are there any conditions for seed germination?

**2 Introduce the key question**

**Do seeds need air to germinate?**

**3 Activity (20 min.)**

This set-up is done together with: Lesson 2 Conditions for Germination 1: Water and Lesson 4 Conditions for Germination 3: Temperature.

- Explain the steps of the activity.
- Refer the students to the experiment setups below the activity and the characters.
- Ask the students to do the activity.
- Check students' activity and if necessary guide the students in setting up their experiment.
- Ask the students to observe the seed for the next 3-5 days and record their observations.

**4 Discussion for findings (20 min.)**

- Ask students to present the findings from their activity.

(Continue)

**Lesson 3 Conditions for Germination 2: Air**

- 1** When a seed comes into contact with water, the seed germinates. Are there any other conditions for seed germination?

**2** **?** Do seeds need air to germinate?

**3** **Q** **Activity : With and without air**

**What We Need:**

- bean seeds, water, tissue paper, two cups

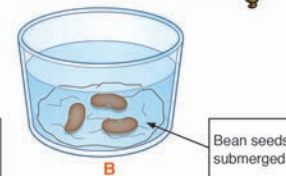
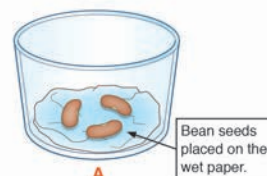


**What to Do:**

1. Fold the tissue paper so that it will fit inside the cup.
2. Place the paper in each cup and then place bean seeds on top of the paper.
3. Wet the paper in Cup A until it is completely moist. Pour water in Cup B until the bean seeds are submerged.
4. Place both cups at the same location.
5. Observe the seeds for a week. Record your observations in your exercise book.
6. Share your ideas with your classmates. Discuss which beans germinated and why.

To investigate how seeds grow with and without access to air, what conditions should we control?

We must place both cups at the same place so that all the conditions should be the same EXCEPT access to air.



**Teacher's Notes**

**Tips for the Lesson**

- Seeds cannot breathe in water because they don't have organs like gills for fish to do so. That is the reason as to why water is used as the condition to prevent oxygen from the air to reach the seeds.
- If other seeds other than bean seeds are used in this lesson, make sure you check that they do not float in cup B.
- In the dormant condition the seeds respiratory rate is very low and so oxygen is required in very small quantities. But for germination, oxygen is needed in large quantities. The seeds obtain oxygen that is dissolved in water and from the air contained in the soil. If soil conditions are too wet, an anaerobic condition persists and seeds may not be able to germinate. Oxygen is necessary for respiration which releases the energy needed for growth. Germinating seeds respire very actively and need sufficient oxygen. The germinating seeds obtain this oxygen from the air contained in the soil. For this reason that most seeds sown deeper in the soil or in water-logged soils (i.e. oxygen deficient) often fail to germinate due to lack of oxygen.

## Lesson Objectives

Students will be able to:

- Identify the condition for seed germination through the experiment.
- Explain how to control the condition to see if a seed needs air for germination or not.

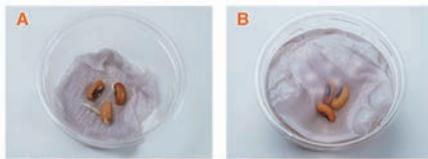
## Assessment

Students are able to:

- State that air is one of the important conditions for seed germination by controlling different conditions.
- Describe the way to setup the experiment to determine whether air is a condition for germination.
- Demonstrate keenness in setting up experiments.

## Result

We found out that the bean seeds placed on wet tissue paper germinated but the bean seeds that were submerged did not germinate.



Bean seeds placed on wet tissue paper

Bean seeds submerged

### Different conditions

The seeds were exposed to air or not exposed.

### Same conditions

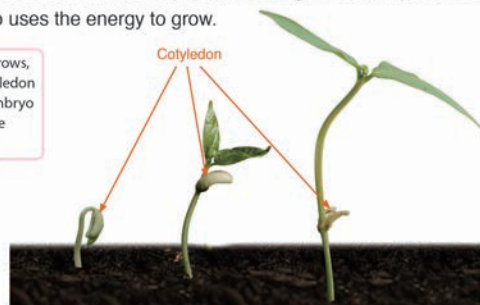
The seeds were given water.  
The seeds were placed at the same location with the same amount of light and at the same temperature.

## Summary

A bean seed placed on wet tissue paper is exposed to air. On the other hand, a bean seed submerged is not exposed to air because it is covered with water. From this result, we find that seeds need air to germinate.

Seeds need oxygen in the air for germination. Seeds cannot make food like adult plants do. Instead, they use the oxygen together with starch stored in seeds to make energy. When oxygen gets to the seeds, the oxygen helps the embryo burn the starch stored in the cotyledon. Burning the starch produces energy. The embryo uses the energy to grow.

The more an embryo grows, the more withered cotyledon is. This is because an embryo uses starch stored in the cotyledon to grow.



Stages of seed germination.

From this result, what does a seed need to germinate? A bean seed submerged, this means ...?



5

- Write their results on the blackboard.
- Facilitate active students' discussions.
- Confirm the result with the students.
- **Based on their results**, ask these questions as discussion points.

Q:What is the condition that is different for cup A and B? (Seeds in cup A are exposed to air and seeds in cup B are not exposed to air.)

Q:What are the conditions that are similar for cup A and B? (Seeds in both cups (A and B) have water, placed in the same location, same light and same temperature.)

Q:Which cup did the seed germinate? (Cup A)

Q:What condition does the seed need to germinate in cup B apart from water? (Air)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:  
Q: What conditions of seeds in cup A and B were the same and different?  
Q: Why did the seeds in cup A germinate?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title: **Conditions for Germination 2: Air**

Key question

Do seeds need air to germinate?

Activity : With and without air

Day	Seeds in tissue paper with water	Seeds fully submerged in water
1		
2	Write students' findings.	
3		
4		

Discussion

Q: What is the condition that is different for cup A and B?

Seeds in cup A are exposed to air and seeds in cup B are not exposed to air.

Q: What are the conditions that are similar for cup A and B?

Seeds in both cups (A and B) have water, placed in the same location, same light and same temperature.

Q:Which cup did the seed germinate?

Cup A

Q: What condition does a seed need to germinate in cup A apart from water? (Air)

Summary

- Seeds need oxygen from the air to germinate.
- Seeds use oxygen together with sugar to make energy.
- Seeds make energy for the embryo to grow using the sugar stored in cotyledon.

**Lesson Flow**

- 1 Introduction (10 min.)**
  - Review the last lesson.
  - Q: Why don't the submerged seeds germinate?
  - Encourage students to think about the relationship between temperature and germination by asking: Q: Does seed germination have a relationship with temperature?
- 2 Introduce the key question**  
Do seeds need proper temperature to germinate?
- 3 Activity (20 min.)**
  - This lesson setup is done together with those for Lesson 2 'Conditions for Germination 1: Water' and Lesson 3 'Conditions for Germination 2: Air.'
  - Explain the step of the activity.
  - Refer the students to the experiment setups below the activity and the characters.
  - Ask the students to do the activity.
  - Check students' activity and if necessary guide the students in setting up their experiment.
  - Ask the students to observe the seeds for the next 3-5 days and record their observations.
- 4 Discussion for findings (20 min.)**
  - Ask students to present their results from the activity.
  - Write their results on the blackboard.
  - Facilitate active students' discussions.

(Continue)

**Lesson 4** **Conditions for Germination 3: Temperature**

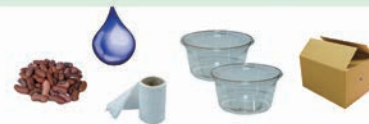
- 1** Seeds need water and air to germinate. How about temperature? Does seed germination have a relationship with temperature?

- 2** ? Do seeds need proper temperature to germinate?

**3** **Activity : Warm or cold temperature**

**What We Need:**

- bean seeds, water, tissue paper, two cups, cardboard box



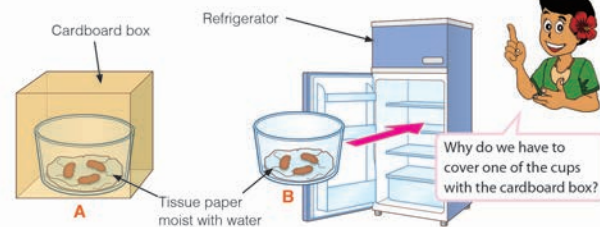
**What to Do:**

1. Fold the tissue paper so that it will fit inside the cup.
2. Place the paper in each cup and wet the paper in both cups until it is completely moist. Put the bean seeds on top of the paper in each cup.
3. Put one of the cups in a refrigerator. Place another cup in a classroom and cover it with the cardboard box.
4. Observe the seeds for a week. Record your observations in your exercise book.
5. Share your findings with your classmates. Discuss how temperature affects seed germination.

All the conditions for seeds should be the same EXCEPT the difference in temperature. What conditions should be the same?



**4**



Why do we have to cover one of the cups with the cardboard box?

**Teacher's Notes**

**Tips for the Lesson**

- This lesson's Discussion and Summary will be taught after 2-4 days when the seeds in the carton box germinate.
- Other lessons in the topic after this topic maybe taught while waiting for the seeds to germinate.
- Average temperatures in PNG normally permits germination to occur without other forms of heating, unlike the situation in cooler parts of the world.
- Seeds of tropical plants need tropical conditions to germinate. The soil temperature range in order for them to germinate should be around 27 - 32°C and there must not be much variation in this.
- Temperature is an important factor because: (1) overheating or drying by the sun can damage or kill germinating seeds quite easily; (2) conditions that are too cool, at higher elevations or in certain seasons, can slow germination and encourage diseases and some kinds of seeds require a fluctuation of temperature between day and night.

## Lesson Objectives

Students will be able to:

- Identify the condition for seed germination through the experiment.
- Explain how to control the condition to see if a seed needs proper temperature for germination or not.

## Assessment

Students are able to:

- State that temperature is one of the important conditions for seed germination by controlling different conditions.
- Describe the way to setup the experiment to determine whether proper temperature is a condition for germination.
- Assist each other to do setups.

### Result

It is dark inside a refrigerator, so we covered a bean seed placed in a classroom with a box in order to make it dark.



We found out that the bean seeds placed in a refrigerator did not germinate but the bean seeds placed in a classroom germinated.



At room temperature



At cold temperature

#### Different conditions

The seeds were placed at different temperatures.

#### Same conditions

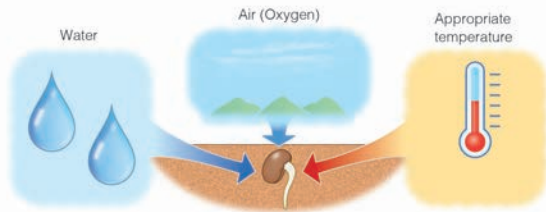
The seeds were given water.  
The seeds were exposed to air.  
The seeds were not exposed to light (dark place).

5

### Summary

The temperature in a classroom is warmer than that in a refrigerator. This means that seeds need an appropriate temperature for germination. Without the proper temperature, the seeds will not germinate. In general, most seeds will germinate at temperatures between 10°C and 35°C. Warmth speeds up and improves the process of germination. Seeds seem to have a system that makes them wait for warmer temperatures before sprouting. Through the three activities, we find that seeds need three conditions for germination: water, air (oxygen) and appropriate temperature.

From this result, what does a seed need to germinate?



Seeds need water, air and appropriate temperature to germinate.

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- Confirm the results with the students.
- **Based on their results**, ask these questions as discussion points.

Q: What condition is different between the seeds in Cup A and the seeds in Cup B? (Temperature)

Q: What conditions are the same between the seeds in Cup A and the seeds in Cup B? (The conditions of water, air; location and light brightness/dark are the same.)

Q: Why do we have to cover the seeds in a Cup A with a cardboard box? (It is dark inside a refrigerator, so the condition of brightness (darkness) should be the same.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: Which conditions of seeds in the refrigerator and in the classroom were the same and different?
  - Q: What condition does a seed need to germinate from today's activity?
  - Q: What are the three conditions for seeds to germinate?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title:

### Conditions for Germination 3: Temperature

Key question: Do seeds need proper temperature to germinate?

Activity: Warm or cold temperature

Day	Seeds in Cup A	Seeds in Cup B
1		
2	Write students' findings.	
3		
4		

Discussion

Q: What condition is different between the seeds in Cup A and the seeds in Cup B?

Temperature

Q: What conditions are the same between the seeds in Cup A and the seeds in Cup B?

The conditions of water, air; location and light brightness/dark are the same.

Q: Why do we have to cover the seeds in a Cup A with a cardboard box? It is dark inside a refrigerator, so the condition of brightness (darkness) should be the same.

Summary

- Seeds need **appropriate temperature** for germination.

- Most seeds germinate at temperatures between 10°C - 35°C.

- Warmth speeds up the process of germination in seeds

- Seeds need three conditions for germination:

1. water,
2. air (oxygen) and
3. appropriate temperature.



**Lesson**  
5 / 10

**Lesson Title**  
**Summary and Exercise**

**Tips of lesson**

**1 Summary (30 min.)**

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - ➔ What are three main parts of the seed?
  - ➔ How can we get the seeds to germinate?
  - ➔ How do water, air and temperature help the seed to germinate?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.

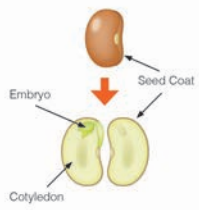
**2 Exercise & Explanation (30 min.)**

- Go through the instructions of the exercise.
- Allow students to answer the questions individually and give them enough time to respond to the questions based on their understanding.
- After the exercise give them the answers to the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strengthen the learnt concepts in this topic.

**1 Summary** 10.1 Needs for Seed Germination


**Inside of a Seed**

- There are three main parts of a seed: seed coat, embryo and cotyledon.
- The seed coat is the hard outer layer of the seed covering around the embryo and the cotyledon. It protects the embryo and the cotyledon.
- The embryo is the tiny plant inside the seed. It will develop into roots and leaves.
- The cotyledon is the part that stores food known as starch for the young plant.




**Conditions for Seed Germination 1: Water**

- Water is one of the important conditions for seed germination. Seeds need water to germinate.
- When a seed comes into contact with water, it allows the seed to swell up until the seed coat splits apart, and the seed embryo absorbs water.



**Conditions for Seed Germination 2: Air**

- Seeds need oxygen in the air for germination.
- When oxygen gets to the seeds, the oxygen helps the embryo to burn the food stored in the cotyledon. Burning the food produces energy to germinate and grow.



**Conditions for Seed Germination 3: Temperature**

- Seeds need proper temperature for germination.
- Warmth speeds up and improves the process of germination.
- Seeds seem to have a mechanism that makes them wait for warmer temperature before sprouting.

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**2 Exercise** 10.1 Needs for Seed Germination

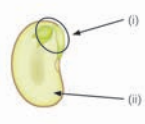
**Q1. Complete each sentence with the correct word.**

- The cotyledon and embryo are covered by the \_\_\_\_\_.
- The \_\_\_\_\_ causes the seed to swell up and split the seed coat apart allowing the embryo to come out.
- The \_\_\_\_\_ from the air helps embryo burn the food stored in cotyledon.
- Warm \_\_\_\_\_ speed up the process of germination.

**Q2. Choose the letter with the correct answer.**

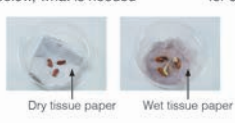
(1) What is the correct combination of the name of seed parts (i) and (ii)?

- (i) is pollen and (ii) is cotyledon.
- (i) is cotyledon and (ii) is embryo.
- (i) is seed coat and (ii) is embryo.
- (i) is embryo and (ii) is cotyledon.

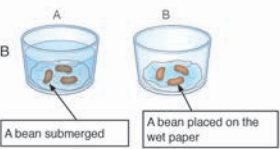


(2) According to the experiment shown below, what is needed for seed germination?

- Water
- Water and sunlight
- Air
- Darkness and air.



**Q3. Answer the question below.**  
What are the conditions in cup A and B that are same and different?



**Q4. Greg got some dry corn seeds and planted them in his garden. After five days, he did not see any plants growing from the spot he planted the seeds. What could be the two possible reasons for this?**

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## Exercise answers

Q1.

- (1) **seed coat**
- (2) **sater**
- (3) **oxygen**
- (4) **temperature**

Q2.

- (1) **D**
- (2) **A**

Q3. Expected answers:

- (1) Similar Conditions
  - **Seeds are given water**
  - **Seeds are exposed to light and brightness**
  - **Seeds are exposed to same temperature**
- (2) Different Conditions
  - **Seeds are exposed to air**
  - **Seeds are not exposed to air**

Q4. Expected answers:

- **Seeds germinate because they are exposed to water, air and proper temperature.**
  - **Seeds germinate because they are given water, air and left in good temperature.**
  - **Seeds can germinate because they have water, air and good temperature.**
- 
-

**Lesson Flow**

**1 Introduction (5 min.)**

- Begin by referring the students to the lesson on 'Seed Germination'.

Q:What conditions does a seed need to germinate?

- Encourage students to think about the conditions for plant growth by asking:

Q:What conditions are necessary for plant growth?

**2 Introduce the key question**

Do plants need water to grow?

**3 Activity (20 min.)**

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to the experiment setups below the activity and the talking character.
- Ask students to do the activity.
- Check students' activity and if necessary guide the students in setting up their experiment.
- Ask students to observe, describe and draw the plant in their table for the next five days.

**\*\*STOP THE LESSON HERE AND CONTINUE AFTER A WEEK**

**4 Discussion for findings (25 min.)**

- Ask students to present their results from the activity.
- Write their results on the blackboard.  
(Continue)

**10.2 Needs for Plant Growth**

**Lesson 1 Conditions for Plant Growth 1: Water**

**1** After germination, a seedling grows and changes into an adult plant. What does a plant need in order to grow well? What types of conditions are necessary for plant growth?

Seeds need water, air and appropriate temperature to germinate. How about young plants? What conditions do they need to grow? Let's predict!

**2** ? Do plants need water to grow?

**3** **Activity : With and without water**

**What We Need:**  
two same sized seedlings in plant pots, water

**What to Do:**

- Place seedlings A and B near the classroom window.
- Water seedling A every day, but do not water seedling B.
- Observe the seedlings for a week. Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss what happened to the seedling with or without water added and what it needs to grow.

What conditions should be the same or different in order to see if plants need water for growth?

Watering Seedling A Seedling B No watering

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**Teacher's Notes**

**Tips for the Lesson**

- The first part of this lesson will stop at the end of the activity. Allow for students to observe for a week (5-7 days). Take note that this lesson should continue after the plant is dying that is if the leaves have completely fallen off leaving only the stem. This may occur within 5, 6 or 7 days. Otherwise, after one week complete the entire lesson by covering the discussions of the result and finally the summary.
- In case the result does not turn out well within one week you can extend the time.
- If there is need to improvise with the materials used in the activity especially plant pot, you may do so.
- Below are the factors which teacher should focus the students attention to during daily observations with their descriptions;
  - Height of plant (i.e. measurement of the height)
  - Colour of the leaves (i.e. green, green-yellow, yellow-green, yellow, brown)
  - Shape of the plant (i.e. growing upright, bending and sloping)
  - Number of leaves

## Lesson Objectives

Students will be able to:

- Identify water as a condition for plant growth.
- Explain how to control the condition to see if a plant needs water for growth or not.

## Assessment

Students are able to:

- State that water is one of conditions for plant growth by controlling the different conditions.
- Describe the way to set up the experiment to determine whether water is a condition for growth.

### Result

We found out that the plant that was watered grew well but the plant that was not watered did not grow well.



Without water



With water

Why do we have to control conditions?



Different conditions

With and without water.

Same conditions

The same amount of light.

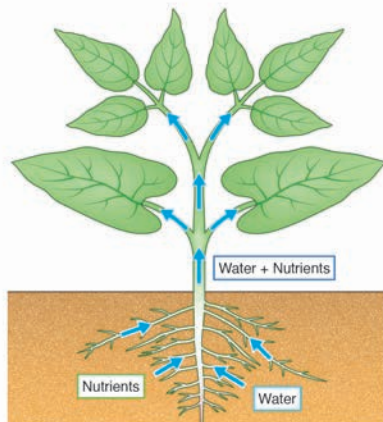
The same temperature.

### Summary

Plants need water to grow. Water is the main component in plants. Without water, plants cannot grow and survive. Water can be absorbed through the roots in the soil.

Water helps the plants to move nutrients from the soil up its stems and leaves. Water keeps the plant moist and flexible. Plants also use water to lower their temperature. Water also helps the plant to make its own food. The moving water inside the plant helps carry food to all parts of the plant.

From this result, what do plants need to grow?



5

- Facilitate active students' discussions.
- Confirm the results with the students.
- **Based on their results**, ask these questions as discussion points.

**Q:** How did you control the conditions in order to see if plant growth needs water or not? (We placed two plants at the same place to control brightness and temperature as the same conditions. We watered one plant but did not water the other plant to control water as the different condition.)

**Q:** From the result, what condition does a plant need to grow? (Water is important for plant growth.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

**Q:** What conditions should be the same or different in order to see if plants need water for growth?

**Q:** What condition is necessary for plant growth?

- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title:

### Conditions for Plant Growth 1: Water

Key question

Do plants need water to grow?

Activity : With and without water

Days	Plant with water		Plant without water	
	Descriptns	Drawings	Descriptns	Drawings
1				
2	Write students' findings.			
3				
...				

Discussion

**Q:** How did you control the conditions in order to see if plant growth needs water or not? **We place two plants at the same place to control brightness and temperature as the same conditions.**

**We watered one plant but did not water the other plant to control water as the different condition.**

**Q:** From the result, what condition does a plant need to grow? **Water is important to grow.**

Summary

- Plants need water to grow. Water is the main component in plants.
- Water helps plants in many ways:
- Water helps the plant move nutrients from the soil up its stems and leaves.
- Water keeps the plant moist and flexible.
- Plants use water to lower their temperature.
- Water helps the plant to make its own food.

**Lesson**  
7 / 10

**Lesson Title**  
**Conditions for Plant Growth 2: Light**

**Preparation**

same sized seedling, plant pot, water, cardboard box (big enough to cover the plant and pot)

**Lesson Flow**

**1 Introduction (5 min.)**

- Review the last lesson.

Q:What conditions should be the same or different in order to see if plants need water for growth?

Q:What condition is necessary for plant growth?

- Encourage students to think about the other conditions for plant growth by asking:

Q:Are there any other conditions apart from water that plants needed for growth?

**2 Introduce the key question**

Do plants need light to grow?

**3 Activity (20 min.)**

For this activity each group has to prepare and replant two seedlings from the germination experiment and use it.

- Organise the students into groups.
- Explain the steps of the activity.
- Refer students to the experiment setups below the activity and the characters.
- Ask students to do the activity.
- Check students' activity and if necessary guide the students in setting up their experiment.
- Ask students to observe, describe and draw the plant each day for 5-7 days.

**\*\*STOP THE LESSON HERE AND CONTINUE AFTER A WEEK**

(Continue)

**Lesson 2** **Conditions for Plant Growth 2: Light**

- 1** Plants need water to grow. Are there any other conditions for plants to grow?

- 2** **?** Do plants need light to grow?

**3** **Activity : With and without light**

**What We Need:**

- two same sized seedlings in plant pots, water, cardboard box



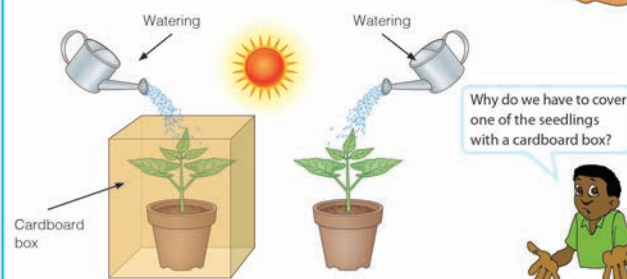
**What to Do:**

- Place both seedlings in a sunny place but cover one of the seedlings with a cardboard box.
- Water both seedlings every day.
- Observe the seedlings for a week. Record your observations in your exercise book.
- Share your ideas with your classmates. Discuss what happened to both seedlings and what plants need to grow.

To investigate whether plants need light for growth, how should we control the conditions? What conditions should be the same?



**4**



**Teacher's Notes**

**Tips for the lesson**

- Students can use the seedlings from the germination experiment, replant it into a plant pot and use it in the experiment.
- Consider that this lesson is quite similar to the previous lesson However the conditions are different.
- If there is a need to improvise with the materials used in the activity especially plant pot, you may do so.
- In case the result may not turn out well within one week so if you wish to extend the time do so.
- Below are the factors the students should pay attention to during the daily observations with their descriptions.
  - Height of the plant (measurement of the plant height).
  - Colour of the leaves (dark green, light green, pale green, yellowish green, yellow, yellowish brown).
  - Shape of plant (growing upright, bending, sloping).

## Lesson Objectives

Students will be able to:

- Identify light as a condition for plant growth.
- Explain how to control the condition to see if a plant needs light for growth or not.

## Assessment

Students are able to:

- State that light is one of conditions for plant growth by controlling the different conditions.
- Describe the way to set up the experiment to determine whether light is a condition for plant growth.
- Show eagerness to participate in the lesson.

### Result

If the plant is covered with the cardboard box, it is dark inside the box. Why is it dark inside the box?

We found out that the plant covered with the cardboard box did not grow well but the plant that was not covered with the cardboard box grew well.



A plant covered with a box.



A plant without a box.

Different conditions

With and without light.

Same conditions

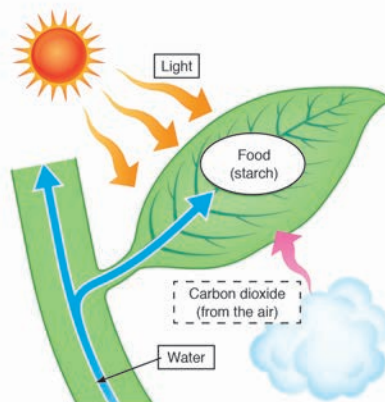
With water.  
The same temperature.

### Summary

From this result, what do plants need to grow?

Light is very important for plants to grow. Plants are able to make some of their own food by using light. Plants use the food as the energy for their growth.

Plants need not only water and light but also air (carbon dioxide) to make their own food for their growth. The process by which plants make their own food (starch) from carbon dioxide and water by using light is called **photosynthesis**. Photosynthesis usually takes place in the leaves.



Process of photosynthesis

### 4 Discussion for findings (25 min.)

- Ask the students to present their findings from the activity.
- Write students' findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the results with the students.
- **Based on their results**, ask these questions as discussion points.

Q: What are the different conditions of the two plants in the experiments? (With and without light.)

Q: What conditions are the same for the two plants? (Temperature and water)

Q: Which plant grew well? (The plant without the box.)

Q: What condition does a plant need to grow well? (Light)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

Q: What conditions should be the same or different in order to see if plants need light for growth?

Q: What condition is necessary for plant growth from this lesson?

Q: What is photosynthesis?

- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title:

### Conditions for Plant Growth 2: light

Key question

Do plants need light to grow?

Activity: With and without light

Days	Plant with light		Plant without light	
	Descriptn	Drawings	Descriptn	Drawings
1				
2				
3				
...				

Discussion

Q: What are the different conditions of the two plants in the experiments?  
**With and without light.**

Q: What conditions are the same for the two plants? **Temperature and water**

Q: Which plant grew well? **The plant without a box.**

Q: What condition does a plant need to grow well? **Light**

Summary

- Light is very important for plants to grow
- Plants use light to make their own food
- The process in which plants make their food from carbon dioxide and water by using light is called **Photosynthesis**

**Lesson**  
8 / 10

**Lesson Title**  
**Conditions for Plant Growth 3: Fertiliser**

**Preparation**

two same sized seedling in plant pot, water, fertiliser (chicken manure, compost, food peelings)

**Lesson Flow**

**1 Introduction (5 min.)**

- Review the last lesson.

Q:What conditions should be the same or different in order to see if plants needs light for growth?

Q:What condition is necessary for plant growth from this lesson?

Q:What is photosynthesis?

- Encourage students to think about how to grow plant well, by asking:

Q:How can plants grow well?

**2 Introduce the key question**

Do plants need fertiliser to grow well?

**3 Activity (20 min.)**

For this activity each group has to prepare and replant two seedlings from the germination experiment and use it.

- Organise students into groups
- Explain the steps of the activity.
- Refer students to the experiment setups below the activity and the character.
- Ask the students to do the activity.
- Check students' activity and if necessary guide the students in setting up their experiment, their predictions and the plan for their investigation. (i.e. Lab write-up format)
- Ask students to observe, describe and draw in their table each day of observation.

**\* STOP THE LESSON HERE AND CONTINUE AFTER A WEEK.**

**Lesson 3** **Conditions for Plant Growth 3: Fertiliser**

- 1** Plants need water and light to grow. How can we make plants grow well? Can fertilisers work on plant growth?

- 2** **?** Do plants need fertiliser to grow well?

**3** **Activity : With and without fertiliser**

**What We Need:**

- two same sized seedlings in plant pots, water, fertiliser



**What to Do:**

- Form a group with your classmates and predict:
  - What conditions should be different or same in order to see if plants need fertilisers to grow well?
  - How can you investigate whether your predictions are correct or not?
- Based on your predictions, make a plan for your investigation and try it out.
- Observe the seedlings for a week and record your observations in your exercise book.
- Share your ideas with your classmates. Discuss the conditions you controlled, your investigation plan and the results of your investigation.

Where should we place the seedlings? All the conditions should be the same EXCEPT for access to fertilisers.



**Teacher's Notes**

**Tips for the lesson**

- Teacher considers that this lesson is quite similar to the previous lesson, therefore follow the same procedure however conditions are different.
- Food and vegetable peelings can be used as compost or animal manure can substitute fertilizers from shops.
- In the garden these minerals are supplied by the soil and by adding fertilizers such as manure, compost, and fertilizer salts. The essential elements needed in large quantities are nitrogen, phosphorus, potassium, calcium, magnesium, and sulphur. The most important nutrients for plants growing needs are nitrogen (N), phosphorus (P) and potassium (K). Nitrogen is necessary for making green leaves; phosphorus is needed for making big flowers and strong flower.
- Below are the factors the students should pay attention to during the daily observations with their descriptions.
  - Height of the plant (measurement of the plant height).
  - Colour of the leaves (dark green, light green. Pale green, yellowish green, yellow, yellowish brown).
  - Size of plant stems (measurement of the diameter).
  - Number of leaves

## Lesson Objectives

Students will be able to:

- Identify fertiliser as one of the conditions for plant growth.
- Explain how to control the condition to see if a plant needs fertiliser for growth or not.

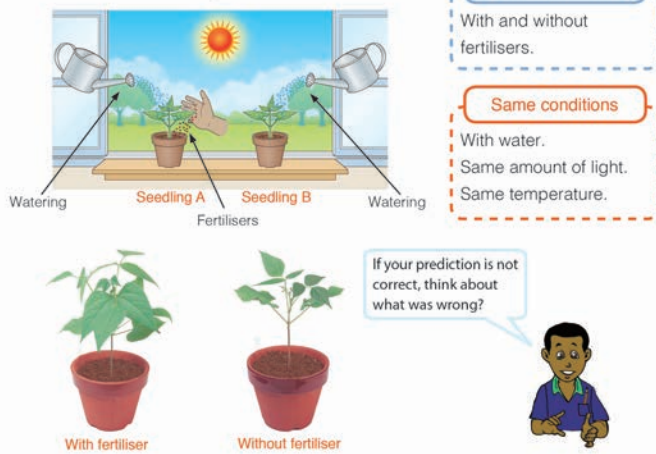
## Assessment

Students are able to:

- State that fertiliser is one of conditions for plant growth well by controlling the different conditions.
- Describe the way to set up the experiment to determine whether fertiliser is a condition for plant growth.
- Participate in groups actively.

## Result

We found out that both seedlings were put in the same place and had access to water, light and temperature. Seedling A had fertiliser and Seedling B did not. The seedling with fertiliser grew very well. On the other hand the seedling without fertiliser did not grow well.



## Summary

Fertilisers help plants grow well. They provide nutrients such as nitrogen and potassium to plants to help boost their growth. Plants need nutrients to maintain their growth. The nutrients are necessary for producing green leaves, big flowers and strong roots. From the three experiments we found out that plants need **water**, **air (carbon dioxide)** and **light** to grow. The **nutrients** also help plants grow well.

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## 4 Discussion for findings (25 min.)

- Ask students to present the findings from their activity.
- Write students' findings on the blackboard.
- Facilitate active students' discussions.
- Confirm that plants grew well and bigger with the fertiliser than the one without the fertiliser.
- **Based on their results**, ask the following questions as discussion points.

Q: How did you control the conditions to see if plants need fertiliser to grow well? (One plant is with fertiliser and another is without fertiliser, but we control water, brightness and temperature as the same conditions.)

Q: Which plants grow well? (The plant with fertiliser)

Q: From this experiment, what helped plants grow well? (Fertiliser)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

Q: What conditions should be the same if you want to investigate whether plants need fertiliser to grow well or not?

Q: What is necessary for plants to grow well in this experiment?

- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title:

### Conditions for Plant Growth 3: Fertiliser

Key question

Do plants need fertilizer to grow well?

Activity: With and without fertiliser

Weeks	Plant with fertiliser		Plant without fertiliser	
	Dscriptn	Drawing	Dscriptn	Drawing
1				
2				
3				
...				

Discussion

Q: How did you control the conditions to see if plants need fertiliser to grow well?

*One plant is with fertiliser and another is without fertiliser, but we control water, brightness and temperature as the same conditions.*

Q: Which plants grow well?

*The plant with fertiliser.*

Q: From this experiment, what helps plants grow well?

*Fertiliser*

Summary

- Fertilisers help plants grow well.
- Fertilisers provide nutrients such as nitrogen and potassium to plants to help speed up their growth.
- From the three experiments, plants need: **water**, **air (carbon dioxide)** and **light** to grow.
- The nutrients also help plants grow well.



Tips of lesson

**1 Summary (20 min.)**

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - How can the nutrients reach all parts of the plant?
  - How do plants make their own food?
  - What are three ways that show that the nutrients from fertilizer aids plant growth?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.

**2 Exercise & Explanation (30 min.)**

- Go through the instructions of the exercise.
- Allow students to answer the questions individually and give them enough time to respond to the questions based on their understanding.
- After the exercise give them the answers to the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strengthen the learnt concepts in this topic.

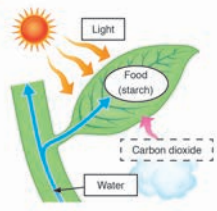
**1 Summary and Exercise** **Summary** 10.2 Needs for Plant Growth

**Conditions for Plant Growth: Water**

- Without water plants cannot grow and survive.
- Water can be absorbed through the roots from the soil and helps to move nutrients from the soil up its stems and leaves.
- Water keeps the plant moist, flexible and lowers its temperature.
- Water also helps the plant make its own food.
- The moving water inside the plant helps carry food to all parts of the plant.


**Conditions for Plant Growth: Light**

- Light is important for plants to grow.
- Plants are able to make their own food by using light.
- Photosynthesis is the process by which plants make their own food (starch) from carbon dioxide and water by using light.



**Conditions for Plant Growth: Fertiliser**

- Fertilisers help plants grow well.
- Fertilisers provide nutrients to plants and give plants an additional growth boost.
- Plants need nutrients to maintain their growth. The nutrients are necessary for making green leaves, big flowers and strong roots.



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**2 Summary and Exercise** **Exercise** 10.2 Needs for Plant Growth

Q1. Complete each sentence with the correct word.

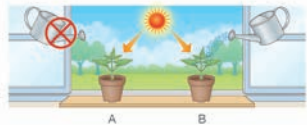
- Water helps the plant move \_\_\_\_\_ from the soil up its stems and leaves.
- Plants can get nutrients from \_\_\_\_\_ for growth.
- Plants use \_\_\_\_\_ to keep itself moist and flexible.
- Plants need water, \_\_\_\_\_, light and nutrients to grow.
- The process by which plants make their own food from carbon dioxide and water by using light is called \_\_\_\_\_.

Q2. Choose the letter with the correct answer.

- Which of the following sentences is **not** correct about the ways that plants use water? Plants use water to
  - move nutrients from the soil to its parts.
  - make their own food by using sunlight.
  - keep them growing big and tall in a short time.
  - keep them cool in hot temperature.
- What do plants make as their own food in the process of photosynthesis?
  - Water
  - Starch
  - Carbon dioxide
  - Sunlight

Q3. Answer the question below.

What are the conditions in plants A and B that are similar and different?



Q4. Explain what the nutrients from the fertiliser would do to the plant when applied?

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## Exercise answers

Q1.

- (1) **nutrients**
- (2) **fertiliser**
- (3) **water**
- (4) **sunlight**
- (5) **photosynthesis**

Q2.

- (1) **C**
- (2) **B**

Q3. Expected answers:

- (1) Similar Conditions
  - **light and brightness**
  - **air**
  - **temperature**
  - **fertiliser (soil)**
- (2) Different Conditions
  - **Water**

Q4. Expected answers:

- **The nutrient from the fertiliser makes the plant leaves green, the flowers big, and the roots strong.**
- **Nutrients from fertiliser makes plant leaves green, big flowers and strong roots.**

### Explanation of Science Extras

#### 3 Science Extras (10 min.)

- Give opportunities to students to closely observe the nature and its phenomena in the world.
- Allow students to ask questions that demonstrate curiosity about the content in the science extra.

3Chapter 10  
•Science Extras•


### How long does it take to germinate and grow Mango from a seed? What are things that affect its growth?

The pulp of the seed of a mature mango fruit must be removed. Store the seed in an open container of water at room temperature and place it in a warm place. The water must be changed every two days during this time.

After 7 to 14 days the seed will start to germinate. Once the seed begins to produce shoots, it must be planted in a pot of compost. If the seed does not sprout within this time, plant the seed in a 10 cm pot of compost and seal the pot in a plastic bag. The plant must be watered frequently and keep it sealed in a warm place for up to 60 days or until shoots appear.

After planting, it takes mango trees about one year to reach 90 to 120 cm tall. It must be transplanted. Between two to four years mango tree will produce fruit. Once the fruit appears, it takes 3 to 6 months to mature.

Mature mango trees can reach heights and spreads of more than 12 m. Temperature is the main factor in a mango tree's growth. Warmth makes them grow faster and mature more quickly. The varieties of mangoes also have certain influences. If the pulp is removed from the mango seed, it may take the seed up to 7 weeks to germinate.



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Chapter Test

10. Plant Growth

Q1

Complete each sentence with the correct word.

- (1) The process of the seed growing into a seedling is germination.
- (2) The embryo of the seed will develop into roots and leaves.
- (3) Plants need nutrients to maintain their growth.

Q2

Choose the letter with the correct answer.

- (1) Water and fertiliser were given to both plants shown below. Which condition was not given to the plant on the right?

- A. Salt
- B. Sunlight
- C. Oil
- D. Electricity



- (2) What conditions do seeds need to germinate?

- A. Water, air and appropriate temperature.
- B. Water, light and air.
- C. Water, soil and appropriate temperature.
- D. Air, appropriate temperature and light.

- (3) Which of the following statements does not describe a function of water in plants? Water helps the plant

- A. make its own food.
- B. get rid of the nutrients into soil.
- C. moves the nutrients to all parts of the plant.
- D. keep moist and flexible.

- (4) Which of the following is the correct explanation about cotyledon?

- A. Cotyledons make the plant body cool.
- B. Cotyledons provide light to make food.
- C. Cotyledons develop into the leaves.
- D. Cotyledons store and provide food to the seed.



**Q3**

(1) After germination, what three conditions do plants need in order to grow well?

1. Water
2. Light
3. Fertiliser

(2) What is the process by which plants make their own food from carbon dioxide and water by using sunlight?

Photosynthesis

(3) What is the name of the food that the plant makes in the process (2)?

Starch

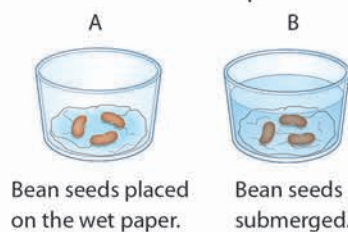
(4) A seed has a hard covering that covers its inside parts. What could be the reason for the seed coat to be hard?

The seed coat protects the embryo and the cotyledon from damage.

**Q4**

(1) Irene prepared two set-ups as shown on the right in order to investigate the condition of seed germination. Bean seeds are placed on wet paper in setup A while bean seeds in set-up B are submerged in the water. Explain why she prepared the two set-ups in the experiment.

(Expected answer) The different conditions between setup A and B is whether the seeds are exposed to air or not. Based on the observation, she can identify if air is one of the conditions for germination.



(2) Ambai observed that the seeds that were moistened and placed in an appropriate temperature and exposed air germinated. If he wants to keep the remaining seeds for the following year, how should he store the seeds? Write two ways to prevent the seeds from germinating.

(Expected answer) 1) He should store the seeds in a dry place. 2) He should store the seeds in a cold place. 3) He should store the seeds in a plastic bag to avoid exposure air.

Strand : PHYSICAL SCIENCE  
Unit : ENERGY  
Chapter 11. Heat

### Chapter Objectives

Students will be able to identify the properties of heat and how heat is transferred in solids, liquids and gases.

### Topic Objectives

#### 11.1 Properties of Heat

Students will be able to;

- Investigate how objects become hot or cold.
- Explain how different sources produce heat.
- Describe ways heat energy is used in our daily lives and manufacturing.
- Explain the relationship between hot, cold and temperature.

#### 11.2 Heat Transfer

Students will be able to;

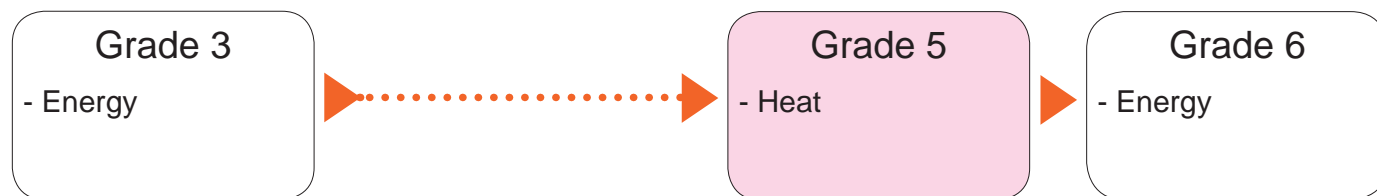
- Describe how heat is transferred through conduction.
- Explain how convection occurs in liquids and gases.
- Differentiate radiation, conduction and convection in a certain situation.



This picture is from the chapter heading of the textbook showing the image taken by a thermography camera which is a device that can visualise the surface temperature of objects.

## Related Learning Contents

The learning contents in this chapter connect to the following chapters.



Prior knowledge for learning this chapter;

- Heat is a type of energy.
- How to use thermometer.

## Teaching Overview

This chapter consists of 10 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
11.1 Properties of Heat	1	<b>What is Heat</b> What makes objects hot or cold?	5.1.1	185 - 186
	2	<b>Sources of Heat</b> What are the sources that produce heat?		187 - 188
	3	<b>Uses of Heat</b> What is heat used for?		189 - 190
	4	<b>Temperature</b> What is temperature?		191 - 192
	5	Summary and Exercise		193 - 194
11.2 Heat Transfer	6	<b>Heat transfer 1: Conduction</b> How does heat transfer?		195 - 196
	7	<b>Heat transfer 2: Convection</b> How does heat transfer in liquids and gases?		197 - 198
	8	<b>Heat transfer 3: Radiation</b> What is another way of heat transfer?		199 - 200
	9	Summary and Exercise, Science Extra		201 - 203
Chapter Test	10	Chapter Test		

**Lesson Flow**

**1 Introduction (5 min.)**

- Review Grade 3 Chapter 5 'Energy' by asking:  
Q:What is energy?  
Q:What kinds of energy do you know?
- Encourage the students to think about how objects become hot or cold, by asking:  
Q:When you are outside and the cold winds make your body cold, what would you do to keep warm?

**2 Introduce the key question**

What makes objects hot or cold?

**3 Activity (20 min.)**

- Organise students to stand around their table and prepare the equipment for the activity.
- Ask students to do the activity.
- Monitor how students hold the cold and warm substance and caution them on the safe way of holding the cup of warm water.
- Make sure the students record their findings.
- Ask the students to share their findings.
- Allow enough time for the students to conduct activity.

**4 Discussion for findings (20 min.)**

- Ask students to present their results of the activity.
- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the results with the students.  
**(Continue)**

# 11.1 Properties of Heat

## Lesson 1 What is Heat?

- 1 When we are outside, cold wind makes our body cold. Then we might make a fire so that the fire will make our body warm.
- 2 ? What makes objects hot or cold?
- 3 🔍 **Activity : Making something hot or cold**

**What We Need:**  
• cup of warm water, ice cubes

**What to Do:**

  1. Draw a table like the one shown below.

	How do you feel?	Does your palm become warm or cold?
Place an ice cube on your palm		
Hold a cup of warm water		

  2. Place an ice cube on your palm. Record in the table how your palm feels and whether your palm becomes hot or cold.
  3. Hold the cup of warm water in both palms. Record in the table how you feel and whether your palms become hot or cold.
  4. Share your findings with your classmates.







Why does your palm feel cold when you hold an ice cube?

 Do not use hot water.

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## Teacher's Notes

- This is a build-up content from Grade 3 which defines the characteristics of heat. This lesson is more on understanding that heat is an energy that moves from warmer to cooler places. Therefore, through the activity you should lead them to explain the movement of heat is one characteristic of heat.
- Difference between temperature and heat**  
Heat is the flow of energy from a higher temperature to a lower temperature, in other words heat moves from warmer areas to cooler areas.
- Our own bodies produce heat. The activity of holding ice in your hands demonstrates that heat in our bodies is transferred to the ice causing it to melt.
- Warm air around the hand and ice cube also contributes to melt the ice.
- Be cautious in this lesson when using hot water.
  1. Use a ceramic cup or bowl. Something that can withstand hot water. Avoid using soft plastic and glass ware.
  2. Then wrap hands around the cup or bowl.

## Lesson Objectives

Students will be able to:

- Understand what heat is.
- Experiment how heat is transferred
- Participate cooperatively in the activity.

## Assessment

Students are able to:

- Explain that heat is energy.
- Conclude that heat moves from warmer objects to cooler objects.
- Investigate the properties of heat in collaboration with classmates.

### Result



Your palm becomes cold when you place an ice cube on it.



Your palms become warm when you hold a cup of warm water.

### Summary

**Heat** is a form of energy. We feel heat energy as heat. Heat always moves from warmer objects to cooler objects. For example, we feel warm when we are close to a fire because heat comes from the fire to us. Why does our palm become cold when we hold an ice cube? This is because heat moves from our palm to the ice cube. In other words, your palm loses heat, while the ice cube gains the heat. On the other hand, our palm becomes warm when we hold a cup of hot water. This is because heat moves from the cup of hot water to our palms.

Why doesn't your palms become warm when you hold an ice cube?



5



Heat moves from the cup of warm water to our palms.

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- **Based on their results**, ask these questions as discussion points.

Q: Was your palm warm or cold before holding the ice cube? (Warm)

Q: What happened when you held the ice cube? (It began melting and my palms became cold.)

Q: Why did the ice melt? (Ice melted because the warmth or heat from the palm caused it to melt.)

Q: Why did your hand become much warmer from the cup of warm water? (Because the heat from the cup was transferred to the palm of the hand or the palm was cooler than the cup of warm water.)

Q: How is heat transferred? (From hotter objects to colder objects.)

- Conclude the discussions

### 5 Summary (10 min.)

- Ask students to open textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

Q: What is heat?

Q: How does heat move?

- Ask the students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

**Title:** What is Heat?

**Key question**

What makes objects hot or cold?

**Activity:** Make something hot or cold

	How does your palm feel?	Does Your palm become warm or cool?
Hold an ice cube on your palm	Cool/ cold	Cool/ cold
Hold a cup of warm water	Warm/ hot	Warm/hot

**Discussion**

Q: Was your palm warm or cold before holding the ice cube?

Warm

Q: What happened when you held the ice cube?

It began melting and my palms became cold.

Q: Why did the ice melt? Ice melted because the warmth or heat from the palm caused it to melt.

Q: Why did your hand become much warmer from the warm cup of water?

Because the heat from the cup was transferred to the palm of the hand or the palm was cooler than the warm cup of water.

Q: How is heat transferred? From hotter objects to colder objects.

**Summary**

- Heat energy moves from warmer places to cooler places.
- Heat energy never travels from cool objects to warm objects.



**Lesson Flow**

**1 Introduction (5 min.)**

- Review the previous lessons by asking:  
Q:Why doesn't your palm become warm when you hold an ice cube?  
Q:What is heat?  
Q:How does heat move?
- Encourage students to think about the sources of heat around us by asking:  
Q:Where does heat come from?

**2 Introduce the key question**

What are the sources that produce heat?

**3 Activity (20 min.)**

- Organise students into groups.
- Explain the steps of the activity.
- Allow students to study picture and what the characters are saying for the activity
- Ask students to do their activity.
- Give enough time for the students to do their activity and record their findings into their exercise books.
- Ask students to share their findings in their groups.

**4 Discussion for findings (20 min.)**

- Ask students to present their findings from the activity.
  - Write down their findings on the blackboard.
  - Facilitate active students' discussions.
  - Confirm the findings with the students.
- (Continue)**

**Lesson 2 Sources of Heat**

**1** Burning wood gives off heat that makes our body warm.

**2** **?** What are the sources that produce heat?

**3** **🔍** **Activity : Find sources and the ways they produce heat**

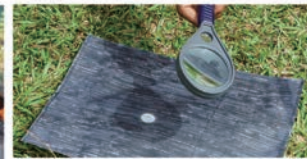
**What to Do:**

1. Draw a table like the one shown below.

Sources that produce heat	The ways that produce heat
wood	burning the wood

2. Write the names of things that produce heat and how they produce heat.

**4** 3. Share your ideas with your classmates. Discuss the sources of heat and the ways they produce heat.



Do you remember how you made fire by using the magnifying lens?



You eat food every day to get energy and keep your body warm. How does your body use food?

**Teacher's Notes**

- Prior to the lesson, make your own list of sources that produce heat and the ways they produce heat.
- Be open minded to the students answers as some sources listed may require more clarification in the ways they produce heat. Below is a list of possible answers that need more clarifications.

Electronic devices	Mobile phones, desktop computers, laptops, television screens, DVD players, hair trimmers etc.
Electrical appliances	Electric jug, cookers, ovens, stoves, vacuums, fans etc.
Others	Gas stoves, vehicles or machine engines, outboard motors, lawn mowers etc.

- Heat sources change some form of energy into heat energy. Electrical energy is changed into heat by an electrical appliance. Chemical energy in food is changed to heat energy in our body or light energy from the sun is changed into heat using a hand lens.

## Lesson Objectives

Students will be able to:

- Identify the different sources that produce heat.
- Explain how different sources produce heat.

## Assessment

Students are able to:

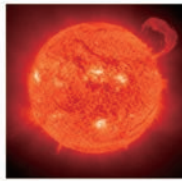
- List the different sources of heat in a table.
- State the relationship between the sources of heat and the ways they produce heat.

## Summary

There are many kinds of sources of heat such as; the Sun, electrical appliance and fire wood. These heat sources basically change energy such as electrical energy and chemical energy into heat energy. The following are some examples of sources of heat.

### The Sun

We feel warm or hot when we stand in a sunny place. This is because the Sun gives off heat energy.



### Electrical Appliance

When we cook food we might use an electrical cooker. It can produce heat by changing electrical energy into heat energy.



### Rubbing Your Hands Together

When we rub our hands together they get warm. This is because friction between the two hands produce heat energy.



### Burning Wood

When wood is burnt, the chemical energy stored in the wood changes to heat energy.



### Eating Food

Our body temperature is normally kept between 36 °C to 37°C. It means our body is also producing heat. How can our body produce heat? Our body changes food we eat into heat energy.



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- **Based on their findings**, ask these questions as discussion points.

From the pictures:

**Q:** What form of energy is changed to produce heat by using a hand lens? (Light energy from the Sun.)

**Q:** What form of energy is in food that changes to produce heat when food is eaten? (The chemical energy in the food changes to heat energy in our body.)

**Q:** What form of energy is in the wood that changes to heat when it is burnt? (The chemical energy in the wood changes to heat when burnt.)

**Q:** Do you have any ideas of other sources of heat around us? (Electrical appliance, rubbing somethings together, stove etc.)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open the textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What are some sources that produce heat?
  - Q: What form of energy changes to heat energy by using a hand lens?
  - Q: What causes friction to produce heat energy?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title:

### Sources of Heat

**Key question :** What sources can you find that produce heat?

**Activity:** Find sources and the ways they produce heat

Sources that produce heat	Ways that produce heat
wood	burning the wood
lens	gathering light
food	eating

Discussion

Q: What form of energy is changed to produce heat by using a hand lens? **Light energy from the Sun.**

Q: What form of energy is in the food that changes to produce heat when the food is eaten? **The chemical energy in the food changes to heat energy in our body.**

Q: What form of energy is in the wood that changes to heat when it is burnt? **The chemical energy in the wood changes to heat when burnt.**

Q: Do you have any ideas of other sources of heat around us?

**Electrical appliance, rubbing somethings together, stove, etc.**

**Summary**

- Some sources of heat energy are:
  - The Sun, electrical appliances, wood, food and rubbing (friction)
- Heat energy is changed by other forms of energy or force. Example:
  - Sunlight changed to heat
  - Electricity changed to heat
  - Chemicals in the food and wood changed to heat.
- Friction produces heat.

**Lesson Flow**

**1 Introduction (5 min.)**

- Review the previous lesson by asking:  
Q:What are some sources that produce heat?  
Q:What form of energy changes to heat energy by using a hand lens?
- Encourage the students to think about the ways heat is used.  
Q:How do we use heat in our daily lives?

**2 Introduce the key question**

What is heat used for?

**3 Activity (20 min.)**

- Organise students into groups.
- Explain the steps of the activity.
- Allow students to study the pictures and what the character is saying for the activity.
- Ask students to do their activity.
- Give enough time to the students to find new ideas through activity by themselves.
- Ask students to share their findings in their groups.

**4 Discussion for findings (25 min.)**

- Ask students to present their findings from the activity.
- Write down their findings on the blackboard.
- Discuss active students' discussions.
- Confirm the findings with the students.  
(Continue)

**Lesson 3 Uses of Heat**

**1** We use heat in many ways. How do we use heat in our daily lives?

**2** **?** What is heat used for?

**3** **Q** **Activity : What can heat do?**

**What to Do:**

1. Draw a table like the one shown below in your excise book.

What is heat used for in your daily life?	What is heat used for in factory and thermal power plant?

2. List what heat can do in our daily lives.  
3. Refer to the pictures below and list how heat is used in factories and plants to make our daily lives convenient.  
4. Share your ideas with your classmates.

Let's guess what heat can do in factories and plants.



**Teacher's Notes**

- If possible, prepare more pictures about various manufacturing examples in magazines and newspapers apart from the textbook to draw various ideas during the lesson.
- Manufacturing simply means to produce something industrially: to 'make, create, build-up' something into a finished product using raw materials, especially on a large industrial scale.
- Heat is used in the following places like factories for production of food stuff, textiles (manufacturing of clothing), metal and non-metal products (plastics, rubber, ceramic, clothes) and in constructions areas.

**Examples**

Factories	Food	To bake biscuits, bread, cakes etc
	Clothing	Use heat to wash, dye cloth and dry before packing
	Metal	Melt the metals and make different shapes of metal for different purposes
Constructions	Road constructions	Heat is used to make sealed roads- track marker or steam roller, tar laying
	Building construction	Cut or join metal etc...welding

## Lesson Objectives

Students will be able to:

- Understand how people use heat.
- Communicate their findings with others.

## Assessment

Students are able to:

- List the examples of the ways heat is used in daily life.
- State their findings to classmates actively.

### Summary

We use heat for many purposes in daily lives.

#### Making things warm

Heat is used to warm your body on a cold morning. Heat can make things warm.

#### Causing a change in matter

Heat is used to cook food such as boiling water and frying eggs. When a lot of heat is added, even metal will melt. In a car factory, heat is used to melt metal so that it can be shaped to build cars.

#### Generating electricity

At a thermal power plant, heat is used to generate electricity which is used in our daily lives.

Heat used for making things warm



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Heat is used for cooking



Heat is used for boiling water



Heat used for generating electricity



Heat is used for melting steel



### ! Try it!

How does a refrigerator work to keep food cold?



Does 'coldness' move to food?

We studied that 'heat' can move from a warm place to a cold place.



Refrigerator can take heat away from food. The food inside the refrigerator loses its heat so that it can keep cold. Where does the heat go? The heat goes away from the refrigerator into the air.

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- **Based on their findings**, ask these questions as discussion points.

**Q:** How do we use heat in our daily life?

(We use heat to warm our body, to cook food, to dry our wet clothes, etc.)

**Q:** How do we use heat in factory or thermal power plant?

(We use heat to melt metal and make many things such as car, to produce electricity by burning something at a thermal power plant.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open textbooks to the summary page and explain .

- Summarise today's lesson on the blackboard.

- Ask these questions as assessment:

Q: How can we use heat in our daily life and in factories or plants?

- Ask the students to copy the notes on the blackboard into their exercise books

### 6 Try it!

- Let students think of the question:

Q: How does a refrigerator work to keep food cold?

- Ask students to present their findings.

- Explain how a refrigerator work and conclude this discussions.

## Sample Blackboard Plan

Title:

### Uses of heat

Key question

What is heat used for?

Activity: What can heat do?

Results:

What heat can do in your daily life?	What is heat use for in factory and thermal power plant?
To warm our body	To melt metal
To cook food	To make many things such as cars

Discussion

Q: How do we use heat in our daily life?

We use heat to warm our body, to cook food, to dry our wet clothes, etc.

Q: How do we use heat in factory or thermal power plant?

We use heat to melt metal and make many things such as car, to produce electricity by burning something at a thermal power plant.

Summary

We use heat for many purposes in daily lives.

1. Making things warm

- Heat is used to warm your body.

2. Causing a change in matter

- Heat is used to cook food.

- Heat is used to melt metal so that it can be shaped to build cars.

3. Generating electricity

- Heat is used to generate electricity which is used in our daily lives.

**Lesson Flow**

**1 Introduction (5 min.)**

- Review the previous lesson. Ask:  
Q:How can we use heat in our daily life and in factories or thermal power plants?
- Remind students of Grade 3 Chapter 6 'The Sun' by asking:  
Q: What do we use to measure the temperature of the ground?  
Q:Do you remember how to use a thermometer?
- Encourage students to think about temperature and heat by asking:  
Q:Are temperature and heat the same or different?

**2 Introduce the key question**

What is temperature?

**3 Activity (25 min.)**

- Explain the steps of the activity.
- Remind students of how to use a thermometer and read the scale.
- Caution the students when using glass materials and hot water.
- Let them make their prediction.
- Have the students to do the activity and record their findings.
- Give enough time for the students to do their experiments
- Ask students to share their results in their groups.

**Lesson 4 Temperature**

- 1** We shiver when it is cold and sweat when it is hot. What is the temperature outside? How can we measure the temperature?

**2** **?** What is temperature?

**3** **Activity : Measuring temperature**

**What We Need:**

- thermometer, warm water, cold water

Do you remember how to use a thermometer?

**What to Do:**

1. Draw a table like the one shown below.

	Your prediction (°C)	Temperature (°C)
Warm water		
Cold water		
Mixture of cold and warm water		

2. Predict the temperatures of warm water, cold water and record your predictions in the table.  
3. Place the thermometer in warm water. Observe how the liquid in the thermometer changes and measure the temperature.  
4. Repeat Step 3 using cold water.  
5. Mix warm and cold water. Predict the temperature of the mixture and repeat Step 3.  
6. Based on your results, think about the following questions:  
(1) How does the liquid in the thermometer change?  
(2) What is the relationship between hotness, coldness and temperature?  
7. Share your ideas with your classmates.



**Teacher's Notes**

- In Grade 3, Chapter 6 'The Sun' and in Grade 4, Chapter 12 'Matter Change', they learnt about the use of the thermometer.
- Refer to the 'science tool box' at the end of the textbook. It explains how to use a thermometer.

**Tips for the Activity**

- Provide the equipment for each group in a tray or a box if there are sufficient materials prior to the lesson.
- Warm water should be used for the activity. Cold water provided should be refrigerated water. When warm and cold water are mixed the result should show a big difference in the temperature. Then the students can clearly identify the difference in the result
- Provide rags to wipe off spills of water and a bucket of water.
- If the experiment does not show the expected result, the teacher must conduct the experiment again for the whole class to confirm and get a better result.**

## Lesson Objectives

Students will be able to:

- Measure the temperature of warm and cold water with a thermometer .
- Understand what temperature is.

## Assessment

Students are able to:

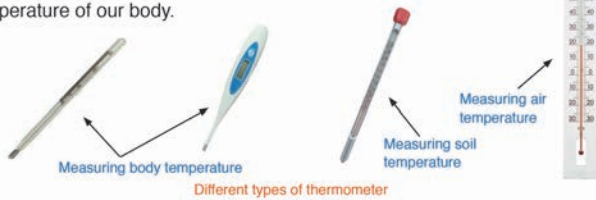
- Read the temperature of warm and cold water on the scale using the unit of degrees Celsius ( $^{\circ}\text{C}$ ).
- Explain what temperature is in relations to heat.

## Summary

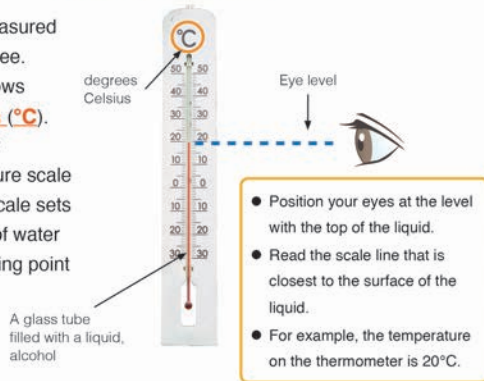
Temperature and heat are related to each other but they are different. Heat is the form of energy that is transferred from hot area to cold area.

**Temperature** is a measure of how hot or cold matter is. In other words, it is a measure of heat.

Temperature can be measured using a **thermometer**. A thermometer consists of a glass tube filled with a liquid, usually alcohol or mercury. The hotter the temperature, the higher the liquid rises in the tube. When it is cold, it moves down. There are several kinds of thermometers. Some thermometers measure the temperature of air and some measure the temperature of our body.



Temperature is measured in units called degree. A thermometer shows **degrees Celsius ( $^{\circ}\text{C}$ )**. Celsius is the most common temperature scale in the world. The scale sets the freezing point of water at  $0^{\circ}\text{C}$  and the boiling point of water at  $100^{\circ}\text{C}$ .



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## 4 Discussion for findings (20 min.)

- Ask students to present their results of the activity.
- Write down their results on the blackboard.
- Facilitate active students' discussions.
- Confirm the results with the students.
- **Based on their findings**, asks these questions as discussion points.

**Q:**How does the liquid in the thermometer **change**? (When the temperature is higher, the level of the liquid goes up. When the temperature is lower, the level goes down.)

**Q:**What is the **relationship between hot, cold and temperature**? (Temperature is the degree of hotness or coldness of an object.)

**Q:**What do you think **temperature is**? (Temperature is the measure of how hot or cold something is.)

- Conclude the discussions.

## 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q:** What is temperature?
  - Q:** What instrument is used to measure temperature?
  - Q:** What is the unit for measuring temperature?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

**Title:** Temperature

**Key question**

What is temperature?

**Activity:** Measuring temperature

	Your prediction ( $^{\circ}\text{C}$ )	Temperature ( $^{\circ}\text{C}$ )
Warm water		
Cold water	Write answers from	
Mixture of cold and warm water	students.	

**Discussion**

**Q:** How does the liquid in the thermometer change? **When the temperature is higher, the level of the liquid goes up. When the temperature is lower, the level goes down.**

**Q:** What is the relationship between hot, cold and temperature?

**Temperature is the degree of hotness or coldness of an object.**

**Q:** What do you think temperature is?

**Temperature is the measure of how hot or cold something is.**

**Summary**

- Temperature and heat are related to each other but they are different.
- Heat is the form of energy that is transferred from hot area to cold area.
- **Temperature** is the measure of how hot or cold an object is.
- Temperature can be measured using a **thermometer**.
- Temperature is measured in units called degree Celsius. A thermometer shows degrees Celsius ( $^{\circ}\text{C}$ ).

Tips of lesson

**1 Summary (30 min.)**

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - Q: What are some properties of heat?
  - Q: What forms of energy can be changed to produce heat energy?
  - Q: How can you describe temperature and heat?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.


**2 Exercise & Explanation (30 min.)**

- Go through the instructions of the exercise.
- Allow students to answer the questions individually and give them enough time to respond to the questions based on their understanding.
- After the exercise give them the answers to the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strengthen the learnt concepts in this topic.

**1 Summary and Exercise** **Summary** 11.1 Properties of Heat

**Properties of Heat**

- Heat energy moves from warmer places to cooler places.
- Heat energy never travels from cool objects to warm objects.



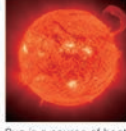
Heat moves from the cup to the palms

**Source of Heat**

- Examples of sources of heat energy are the Sun, electrical appliances, burning wood, eating food and friction.
- Some forms of energy can be changed to produce heat energy.

Example:


- Sunlight is changed to heat energy.
- Electricity is changed to heat energy.
- Chemicals in food and wood are changed to heat.
- Rubbing of two objects cause friction to produce heat energy.



Sun is a source of heat

**Use of Heat**

- Heat is used to make things warm, to boil water and fry eggs and to melt metal to build cars.
- Heat is used to generate electricity at a thermal power plant for our daily lives.



Heat used to melt steel

**Temperature**

- Temperature is the measure of how hot or cold matter is.
- Temperature is measured in units called degrees Celsius (°C).
- Thermometer is the instrument used to measure temperature.
- Thermometer consists of a glass tube filled with a liquid alcohol or mercury.

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**2 Summary and Exercise** **Exercise** 11.1 Properties of Heat

Q1. Complete each sentence with the correct word.

- A form of energy that moves from warm to cool places is \_\_\_\_\_.
- A measure of how hot or cold something is called \_\_\_\_\_.
- The boiling point of water is \_\_\_\_\_ degrees Celsius.

Q2. Choose the letter with the correct answer.

- Which sentence is **not** true about heat energy?
  - Heat can only move from warm to cool place.
  - Heat energy can be felt as warmness.
  - Heat moves from cool to warm place.
  - Heat can change states of matter.
- What does a thermal power plant provide for our daily use? It provides
  - light energy.
  - sound energy.
  - heat energy.
  - electricity.

Q3. Answer the following questions.

- What is the instrument used to measure how hot or cold an object is?
- How is fire used in daily life? Give two examples of how fire is used as heat energy.
- Give two sources of heat energy.

Q4. Our hands become cold when we hold a cold drink, ice block or an ice cube. Why do our hands become cold when we hold cold things for sometime?

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## Exercise answers

Q1.

- (1) **Heat**
- (2) **Temperature**
- (3) **100 °C (degree Celsius)**

Q2.

- (1) **A**
- (2) **D**

Q3.

- (1) **Thermometer**
- (2) Expected answer  
**Fire can be used to keep us warm at night or during cold weather. / to cook our food / to generate electricity at thermal power plant.**

- (3) **Fire, the Sun, electrical appliances, burning wood, etc.**

Q4. Expected answer

**Our hands become cold because heat in the hands is transferred to the cold ice cubes.**

Explanation: Heat always moves from warm to cool places. Therefore, heat from our body or hands moves to cool places or objects.



**Lesson Flow**

**1 Introduction (5 min.)**

- This is a very new concept for the students so begin by asking:

Q:Do you think heat can be transferred?

Q:How can heat be transferred?

- Allow students to give answers freely and then tell them that in this lesson we will learn about how heat can be transferred.

**2 Introduce the key question**

How does heat transfer?

**3 Activity (25 min.)**

- Organise students into groups and remind them of the safety tips.
- Explain the steps of the activity.
- Ask them to predict what will happen to the three pats of margarine at three spots on the spoon.
- Give enough time for students to do the experiment and record their results
- Ask them to discuss the results in their groups.

**4 Discussion for findings (20 min.)**

- Ask students to present the results from the activity.
- Write their results on the blackboard.
- Facilitate active students' discussions.
- Confirm the results with the students.  
(Continue)

**11.2 Heat Transfer**

**Lesson 1 Heat Transfer 1: Conduction**

**1** Heat moves from warmer to cooler places. When you cook food using a frying pan with the burner, the food gets hot. How does the heat from the burner transfer to the food on the frying pan?

**2** **?** How does heat transfer?

**3** **Activity : Melting margarine on a spoon**

**What We Need:**  
• a metal spoon, margarine, a cup of hot water (~60°C)

**What to Do:**

- Place three small pats of margarine on the spoon handle at equal distances.
- Predict what will happen to three pats of margarine at these three spots. Record your predictions in your exercise book.
- Place the metal spoon into hot water and observe the three pats of margarine.
- Record your observations in your exercise book.
- Share your results with your classmates.

How is the heat from hot water transferred?

**4**

**!** Be careful when you touch the spoon in the cup of hot water because it will be hot.

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**Teacher's Notes**

**Tips for the Activity**

- Heat can be transferred with hot water quickly, but it should not be too high (~60 °C) to avoid burns.
- When touching the spoon after 3 minutes, remind students to feel from the part that was dipped in the hot water and slowly move to the other parts to feel the warmth of each part.

**Background information**

Conduction occurs when two objects at different temperatures are in contact with each other. Heat flows from the warmer to the cooler object until they are both at the same temperature. Some substances conduct heat more easily than others. Solids are better conductors than liquids and liquids are better conductors than gases. Metals are very good conductors of heat, while air is a very poor conductor of heat. You experience heat transfer by conduction wherever you touch something that is hotter or colder than your skin, for example, when you wash your hands in warm or cold water.

**SAFETY**

- Be careful when touching the part dipped in hot water because it would be hot.
- Hot water should be carefully poured into the cup to avoid it from spilling or getting burnt.

## Lesson Objectives

Students will be able to:

- Understand what conduction is.
- Infer how heat is transferred through matter.
- Experiment with interest.

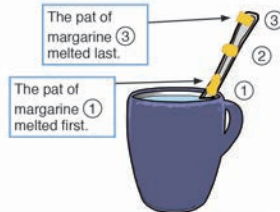
## Assessment

Students are able to:

- Explain the meaning of conduction.
- Describe that heat is transferred from the hotter place to the cooler place based on the results of the activity.
- Participate in the experiment actively.

### Result

We found out that the pats of margarine on a spoon handle melted in the order of ①, ② and ③.



### Discussion

Think about the following questions based on your results.

1. What is the source of heat in this activity?
2. Which pat of margarine is closest to or furthest from the source of heat?
3. Why did the pats of margarine on the spoon handle melted in the order of ①, ② and ③?

How did heat move through the spoon?



### Summary

The transfer of heat from one place to another through matter is called **conduction**. Conduction occurs mainly in solids. Heat is transferred from warmer places to colder places through conduction until they are both at the same temperature.

For example, in the activity, heat from the hot water is transferred to one end of the spoon by conduction and the heat is gradually transferred to the cold end of the spoon. The spoon in a cup of hot water becomes warmer. When we cook food, heat from the burner is transferred to the bottom of the pan through conduction. The heat is transferred throughout the pan and into the food. So, the pan and the food become warmer and hotter.

1. Heat in hot water is transferred to the spoon by conduction.



Conduction



Cooking is an example of conduction.

- **Based on their findings**, ask these questions as discussion points.

Q: What is the source of the heat in this activity? (Hot water)

Q: Which pat of margarine is closest to or furthest from the source of heat? (The closest to heat is ① and the furthest from heat is ③.)

Q: Which part of the spoon became hot fast? (The bowl of the spoon)

Q: Why did the pats of margarine on the spoon handle melt in the order of ①, ② and ③? (Because heat moves from the source of heat (hot water) to the bowl of a spoon, ①, ②, ③ gradually.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:  
Q: What is conduction?  
Q: How is heat transferred through conduction?
- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

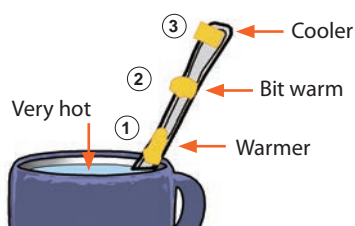
Title:

### Heat Transfer 1: Conduction

Key question: How does heat transfer?

Activity: Melting margarine on a spoon

Result:



Discussion

Q: What is the source of heat in this activity?

Hot water

Q: Which pat of margarine is closest to or furthest from the source of heat? The closest to heat is ①, and the furthest from heat is ③.

Q: Which part of the spoon became hot fast? The bowl of a spoon

Q: Why did the pats of margarine on the spoon handle melt in the order of ①, ②, and ③? Because heat moves from the source of heat (hot water) to the bowl of a spoon, ①, ②, ③, gradually.

Summary

- The transfer of heat from one place to another through matter is called **conduction**.
- Conduction occurs mainly in solids.
- Heat is transferred from warmer place to colder place through conduction.

**Lesson**  
7 / 10

**Lesson Title**  
**Heat Transfer 2:  
Convection**

**Preparation**

transparent plastic cup, water,  
dye (dark colour), candle, dropper or  
straw

**Lesson Flow**

**1 Introduction (5 min.)**

- Recap on the previous lesson on 'Conduction' by asking:

Q:What is conduction?

- Focus students' attention on how heat is transferred in liquid and gas.

Q:How does the water in the pot get warm?

(Allow students to give answers freely and tell them that in this lesson they will learn about convection)

**2 Introduce the key question**

How does heat transfer in liquids and gases?

**3 Activity (25 min.)**

- Organise students into groups.
- Explain the steps of the activity and remind students of the safety tips.
- Allow students to predict how heat is transferred in water and record their predictions in their exercise books.
- Advise students to study the pictures below the activity and the character for their experiment.
- Give enough time for students to do the experiment and sketch how the dye moves inside the cup.
- Ask students to discuss their findings in groups.

**4 Discussion for findings (20 min.)**

- Ask students to present the result from the activity. (Continue)

**Lesson 2 Heat Transfer 2:  
Convection**

- 1** Conduction occurs mainly in solids. How about liquids and gases? What type of heat transfer would occur in liquids and gasses?

**2** **?** How does heat transfer in liquids and gases?

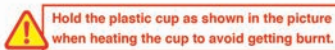

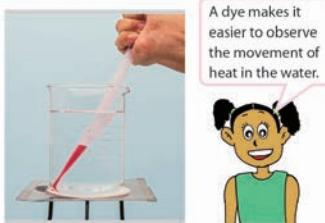

**3** **Activity : Observing how warmed water moves**

**What We Need:**

- transparent plastic cup, water, dye, candle, dropper or straw



**What to Do:**

- Predict how heat is transferred in water and record your predictions in your exercise book. 
- Put some drops of dye at the bottom of water in a plastic cup using a dropper or a straw as shown in the picture on the right. 
- Bring the cup close to a flame and heat the cup of water at the spot where you put some drops of dye. Keep it more than 3 cm away from the top of the flame. 
- Observe and sketch how the dye moves inside the cup. 
- Share your results with your classmates. Discuss how heat is transferred in water.

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**Teacher's Notes**

**Tips for the Activity**

- Make sure the water is steady before putting in the dye.
- If a straw or dropper is to be used get a small amount of dye and make sure to place it gently to avoid the water from moving.
- Wait for the dye to settle properly at the base of the cup on one side before putting it over the candle flame.
- When putting the cup over the candle flame, slowly move the cup over the candle flame and avoid water from moving.

**Note:** Teacher should light the candles for the students and there should be close supervision.

- Convection occurs when heat is transferred through a gas or liquid by the hotter material moving into a cooler area.
- Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Liquids and gases expand when they are heated. This is because the particles in liquids and gases move faster when they are heated than they do when they are cold.

**SAFETY**

- Make sure to place the cup more than 3 cm above the flame.
- Hold the cup at the top of it to avoid getting burnt.
- Blow the candle off after the experiment.

## Lesson Objectives

Students will be able to:

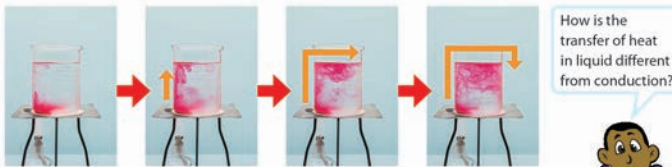
- Infer how heat is transferred in liquids.
- Understand what convection is.
- Experiment with interest.

## Assessment

Students are able to:

- Describe how heat is transferred through water based on the results of the activity.
- Explain the meaning of convection.
- Participate in the experiment actively.

### Result



We found out that when we heated water, the warmed part of water rises upward. Water near the surface of water went down. This process continues until all the water in the cup was heated.

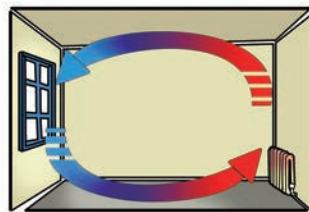


### Summary

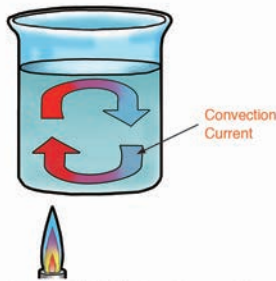
The transfer of heat through liquids and gases such as water and air is called **convection**. Convection occurs when heat is transferred by the movement of liquids or gases.

For example, the picture on the right shows the convection of air. Air is warmed by the stove and the warm air rises. As the air cools, it goes down. The cool air is warmed by the stove again and rises. This process continues until all the air in the room has been heated.

The movement of water or air created by the process of convection is called **convection current**.



Convection of air



Convection Current

Heat is transferred in liquids through convection.

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- Write their results on the blackboard.
- Facilitate active students' discussions.
- Confirm the results with the students.
- **Based on their results**, ask these questions as discussion points.

**Q: Why was dye used instead of just water?**

(Because a dye makes it easier to observe the movement of water.)

**Q: In which directions did the dye in the water move when it was heated?**

(It rises upwards, goes upper to the top part of the water, and goes down.)

**Q: How is the heat transferred through water?**

(The heat is transferred by the movement of water.)

- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:

Q: What is **convection**?

Q: How is **convection** different from **conduction**?

- Ask students to copy the notes on the blackboard into their exercise books.

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## Sample Blackboard Plan

Title:

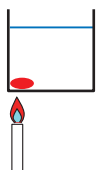
### Heat Transfer 2: Convection

Key question

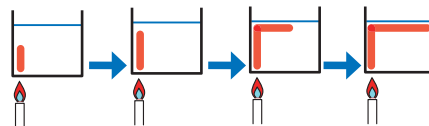
How does heat transfer in liquids and gases?

Activity: Observing how warmed water moves

Sketch



Result:



Discussion

Q: Why was dye used instead of just water?

Because a dye makes it easier to observe the movement of water.

Q: In which directions did the dye in the water move when it was heated? It rises upwards, goes upper to the top part of the water, and goes down.

How is the heat transferred through water?

The heat is transferred by the movement of water

Summary

- **Convection** is the transfer of heat through liquids and gas such as water and air.
- Convection occurs when heat is transferred by the movement of liquids or gases.
- The current of water or air created by the process of convection is called **convection current**.

**Lesson Flow**

**1 Introduction (10 min.)**

- Recap on how heat is transferred by conduction and convection.
- Make students wonder about heat transfer in daily life situation. Ask:

Q:When you place your hand close to a light bulb, what do you feel?

Q:How did the heat transfer from the light bulb to your hand?

**2 Introduce the key question**

What is another way of heat transfer?

**3 Activity (15 min.)**

- Let the students look at the two pictures at the bottom and ask:
- Q.What do you see? What is the source of heat?
- Explain the steps of the activity.
  - Ask students to infer and choose the best way of how heat is transferred in each situation (1) and (2).
  - Make students focus on thinking about the reasons based on previously learnt knowledge.
  - Give enough time for them to consider and record their answers and the reason for choosing the answer.
  - Ask students to discuss in their groups the reasons for their answers.

**Lesson 3 Heat Transfer 3: Radiation**

- 1** When we stand in the sunlight, we feel the warmth of the Sun. Why are we warmed by the Sun even though it is millions of kilometres away in space?

- 2** ? What is another way of heat transfer?

**3** **Activity : Inferring how heat transfers**

**What to Do:**

1. Draw the table below:

Situation	Is heat transferred?	Why did you choose the option?
(1) Heat from a fire to people		
(2) Heat from the Sun to the Earth		

2. Study the pictures below in situations (1) and (2).

3. Think about how heat is transferred from a heat source and choose the best choice from the options: a) conduction, b) convection and c) other ways.

4. Write down your choice in the table with your reasons.

Do you remember how heat is transferred by conduction and convection?



- 4** 5. Share your ideas with your classmates. Discuss how heat is transferred in each situation.



(1) Heat from a fire to the people.



(2) Heat from the Sun to the Earth.

**Teacher's Notes**

**Tips for the activity**

- In the activity, heat from the heat source is transferred through radiation in both situation (i) and (ii).
- 'Radiation' is a new knowledge for students so let students select one of the ways from the options; (1 conduction, 2 convection and 3 other ways). Then, assists students to put logical reason to their answers based on previous knowledge on conduction and convection.

**Radiation**

- All heat sources emit radiation in the transfer in energy in the form of light ray called electromagnetic wave (learning content in higher Grade). Some electromagnetic waves such as infrared and ultraviolet ray cannot be seen by human's eyes.
- 'Mumu' is a traditional cooking style in Papua New Guinea. Heated stones even not bright emits infrared ray that penetrates into the food.

## Lesson Objectives

Students will be able to:

- Understand what radiation is.
- Differentiate radiation from conduction and convection.
- Participate in the activity with care.

## Assessment

Students are able to:

- Explain how the heat is transferred by radiation.
- Identify the different features among radiation, conduction and convection.
- Show curiosity of how heat is transferred through conduction, convection and radiation.

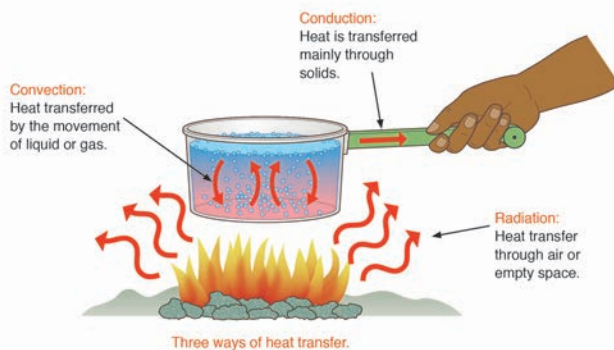
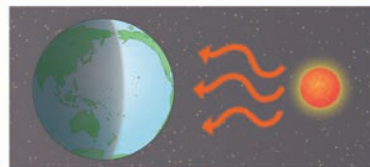
### Summary

The transfer of heat in the form of waves through air or empty space is called **radiation**. When we are near a fire, we receive and absorb radiation from the fire. Then we feel the warmth.

Both conduction and convection need matter such as solids, liquids and gases to transfer energy but radiation does not require matter.

There is no air in the space. The Space is an empty space. The Sun give off heat. The heat is transferred through space to the Earth by radiation.

Heat can be transferred in three ways: conduction, convection and radiation. The following diagram shows an example of the three ways in which heat is transferred.



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### 4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.
- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm the findings with the students.
- **Based on their finding**, ask these questions as discussion points on scientific facts in order.

#### Situation 1

Q: Is the fire touching the people? (No)

Q: Is there air around the fire? (Yes). Do their body get warm by convection? (No, because the heated air goes upward by convection so it doesn't warm their body.)

#### Situation 2

Q: Is the sun touching the Earth? (No)

Q: Is there air around the Sun? (No, there is no air in space.)

Q: Is the heat transferred by conduction or convection? (No)

- Explain what radiation is.
- Conclude the discussions.

### 5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summary today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What is radiation?
  - Q: How many ways is heat transferred?
  - Q: How are conduction, convection and radiation different?
- Ask students to copy the notes on the blackboard into their exercise books.

## Sample Blackboard Plan

Title: **Heat Transfer 3: Radiation**

Key question: What is another way of heat transfer?

Activity: Inferring how heat transfers

Situation	Is heat transferred?	Why did you choose the option?
1) Heat from a fire to people	Yes, -Other way -Convection	Both does not touch each other There is air between fire and people

2) Heat from the Sun to the Earth

Yes,  
- Other way

These are not touching.  
No air in the space.

#### Discussion

Situation 1)

Q: Is the fire touching the people?

No. Conduction doesn't occur

Q: Is there air around the fire? Yes

Q: Do their body get warm by convection?

No, because the heated air goes upward by convection so it doesn't warm their body.

Situation 2)

Q. Is the Sun touching the Earth?

No. Conduction doesn't occur.

Q. Is there air around the Sun?

No. Because there is no air in space.

Convection doesn't occur.

Q: Is the heat transferred by conduction or convection? No

#### Summary

**Radiation** is the transfer of heat in the form of waves through air or empty space.

Three ways of heat transfer: conduction, convection and radiation.

Tips of lesson

**1 Summary (20 min.)**

- Recap the main learning contents covered in this topic.
- Base on the main learning contents ask students the following questions.
  - Q: What are the three ways of heat transfer?
  - Q: Which heat transfer occurs in solids?
  - Q: Which heat transfer occurs in liquids and gases?
  - Q: Can you explain how radiation occurs?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.

**2 Exercise & Explanation (30 min.)**

- Go through the instructions of the exercise.
- Allow students to answer the questions individually and give them enough time to respond to the questions based on their understanding.
- After the exercise give them the answers to the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strengthen the learnt concepts in this topic.

**1 Summary and Exercise** **Summary** 11.2 Heat Transfer


**Heat Transfer**

Three ways of heat transfer to receive or give off heat are; conduction, convection and radiation.

**(1) Conduction**

Conduction is the transfer of heat from one place to another through matter.

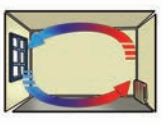
Heat is transferred from warmer places to colder places through conduction until they are both at the same temperature.  
Example: Heat from the burner is transferred to the pan. The heat is transferred throughout the pan and into the food.



**(2) Convection**


Convection is transfer of heat through liquids and gases such as water and air.

Convection occurs when heat is transferred by the movement of liquids or gas  
Example: Air is warmed by the stove and the warm air rises and as the air cools it moves down. The cool air is warmed again by the stove and rises. This process continues until all the air in the room has been heated.



**(3) Radiation**

Radiation is the transfer of heat in the form of waves through air or empty space.  
Example: We receive and absorb radiation when we are near the fire. This makes us feel warm.



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**2 Summary and Exercise** **Exercise** 11.2 Heat Transfer

Q1. Complete each sentence with the correct word.


- The transfer of heat through liquids and gases is called \_\_\_\_\_.
- Heat from the Sun travels through space and reaches the Earth by \_\_\_\_\_.
- The transfer of heat from one place to another through matter is called \_\_\_\_\_.

Q2. Choose the letter with the correct answer.


- When you put a metal spoon into the hot water, the spoon gradually becomes warm. Which type of heat transfer is occurring?
  - Conduction
  - Absorption
  - Radiation
  - Convection

Q3. Answer the following.

- When you sit near a fire you can feel the heat. What type of heat transfer is this?
- Study the picture on the right. Water in the pot is heated by the fire. Draw an arrow on the picture to show how the heated water moves by convection.



Q4. Study the picture of the frying pan on the right. Infer the reason why the pan has a handle, using the word 'conduction'.



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## Exercise answers

Q1.

- (1) convection
- (2) radiation
- (3) conduction

Q2.

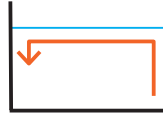
- (1) A

Q3.

- (1) Radiation

Explain that heat from the fire is transferred through radiation because our body is not touching the fire directly but absorbs the heat through the space between the fire and us. Whereas in solids and liquids heat is transferred through them when they are touching.

(2)



The arrow indicates that heat moves from the heated point or area and moves outwards and spreads because liquids do not have fixed shape and move freely.

Q4. Expected answer

- (1) There is no conduction of heat directly from the fire.
- (2) There is no conduction of heat because the handle does not touch the fire.

### Explanation of Science Extras

#### 3 Science Extras (10 min.)

- Give opportunities to students to closely observe the nature and its phenomena in the world.
- Allow students to ask questions that demonstrate curiosity about the content in the science extra.

3Chapter 11  
•Science Extras•


### How is heat produced? Can heat be absorbed?

What do you notice when lighting a candle? The beginning energy causes oxygen and wax to react which produces carbon dioxide, water and heat. When you put a laundry detergent powder in your hand and add water you can feel the heat. This type of change gives off heat.

There are changes that give off heat while other changes take in or absorb heat. Changes that release energy into the environment in the form of heat cause the reaction products and its surroundings to become hotter. It feels warm or hot or may even explode. Some examples of heat been given off are; lighting a match and burning wood.



Heat can also be taken in or absorbed. It is a change in which heat energy is absorbed from its environment. The absorbed energy provides the beginning energy for the change to occur. An example of heat taken in includes dissolving salt. When salt is dissolving into water, the temperature of the water decreases. Other examples include melting ice cubes and evaporating liquid water.

An example of change in which heat is given off.



A burning candle

Examples of change in which heat is taken in.



Dissolving salt      Melting ice cube

203



## Chapter Test

# 11. Heat

**Q1**

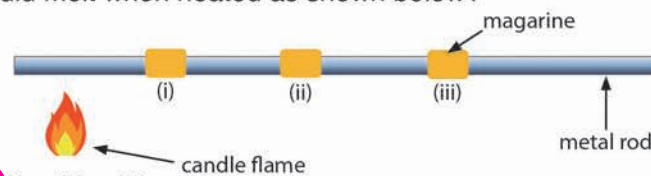
Complete each sentence with the correct word.

- (1) We feel warm when we are near a fire because heat energy from the fire is transferred to us.
- (2) The transfer of heat mostly in liquids and gases is called convection.
- (3) The transfer of heat by conduction occurs mainly in solids.
- (4) The measure of how cold or hot an object is called temperature.

**Q2**

Choose the letter with the correct answer.

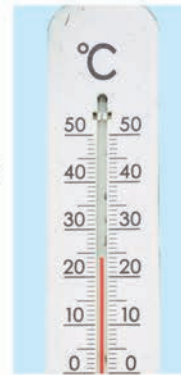
- (1) Which is not a source of heat energy?
  - A. A lit kerosene lamp
  - B. Cooling a metal with water
  - C. Burning a wood
  - D. Burning newspapers
  
- (2) What is radiation? It is the transfer of heat
  - A. in a form of waves through air or an empty space.
  - B. by movement of liquid and gases.
  - C. through one solid to another that are touching.
  - D. that occurs in solid only.
  
- (3) Placed at different parts of the metal rod were pats of margarine at (i), (ii) and (iii). What is the correct order of the pats of margarine that would melt when heated as shown below?




- A. (i) → (ii) → (iii)
- B. (ii) → (iii) → (i)
- C. (iii) → (i) → (ii)
- D. All places at the same time

**Q3**

- (1) Study the diagram on the right.
- (i) What is this instrument? Thermometer
- (ii) What is the unit used in this instrument?  
degree Celsius (°C)
- (iii) What is the reading shown on the instrument?  
24°C



- (2) Study the diagram below. The hot cup of tea is held by hand and cold metal spoon dipped in the tea.
- (i) Identify the object losing heat and gaining heat in the picture.

Example	Object that is losing heat	Object that is gaining heat
 <p>Hot cup of tea</p>	<u>Cup of tea</u>	<u>Hand</u> <u>Spoon</u>

- (ii) How does the heat move from one part of the object to another in the picture?  
(Expected answer) Heat moves from the warm part to the cooler part of the object by conduction.

**Q4**

- Moses says that ice cube cools a drink because the cold from the ice gets into the drink. Evaluate his statement and explain your idea.  
(Expected answer) His statement is wrong. Ice makes the drink cool because heat in the drink has transferred to the ice which also melts the ice.

# 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 make a Beam balance

5. How to read a Graph



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

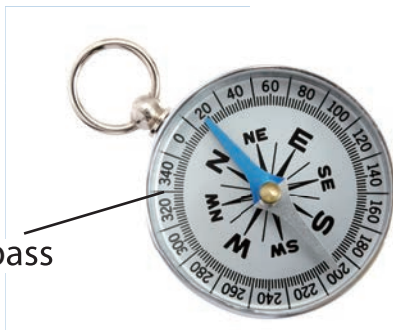
Tape measure



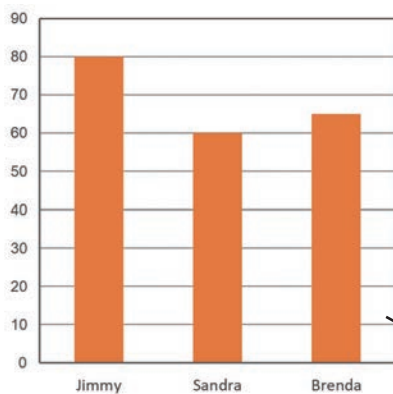
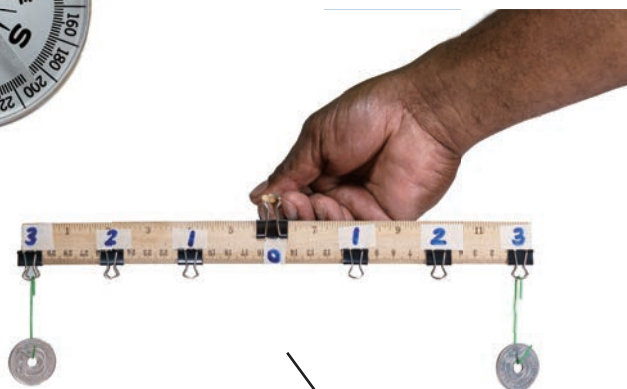
Thermometer



Compass



Beam balance



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 [ $^{\circ}\text{C}$ ].



### 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:

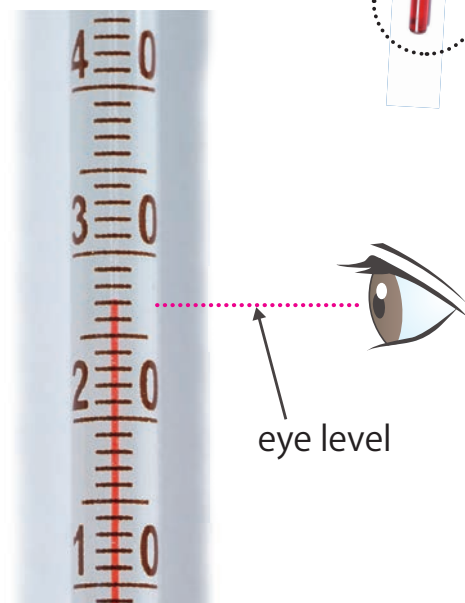
Wait for a few minutes until the liquid in the tube stops moving. Position your eyes at the same level with the top of the liquid in the tube.

#### STEP 3:

Read the scale line that is closest to the top of the liquid. The thermometer as shown on the right shows  $27^{\circ}\text{C}$ .

Thermometer

bulb



## How to use a Compass

### 1. What is a compass?

A compass is an instrument used 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:

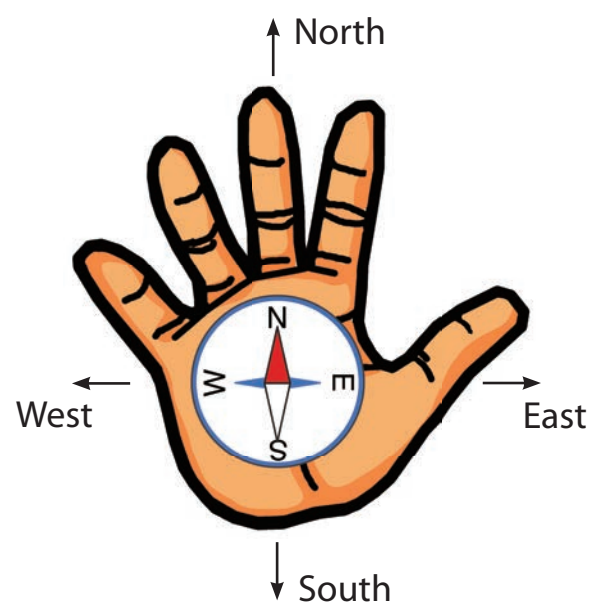
When you want to face North, place the compass flat on your palm and hold your palm in front of your chest as shown in the picture on the right.

#### 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 make a Beam Balance

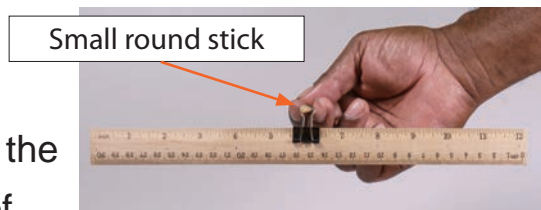
## 1. What is a Beam Balance?

A beam balance is a type of lever that can be used to compare weights of two objects. It has an arm or bar with a centre point, called a fulcrum. If one side of the lever is pushed down, the other side is pushed up.

## 2. Making a Beam Balance

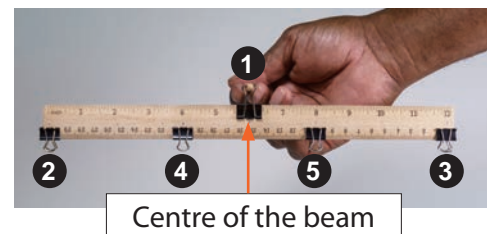
### STEP 1:

Use a 30 cm ruler as the beam balance. Put the 1<sup>st</sup> bull dog clip approximately in the centre of the ruler. Put a round stick through the clip to check if the beam is balanced properly. If it is not balanced, adjust the position of the 1<sup>st</sup> bull dog clip to the left or right sides.



### STEP 2:

- (1) From the centre on the beam, measure and mark every 5 cm to the right end and to the left end. On the opposite edge of the 1<sup>st</sup> clip, put the 2<sup>nd</sup> and the 3<sup>rd</sup> clips at both ends of the ruler with their centres on the marks. Check if the beam is balanced.
- (2) On the marks on either sides of the centre, put the 4<sup>th</sup> clip and the 5<sup>th</sup> clip with their centres on the marks and also on the same edge as the 2<sup>nd</sup> and 3<sup>rd</sup> clips. Check if the beam is balanced.
- (3) Between the two clips on the right side and on the left side, put the 6<sup>th</sup> clip and the 7<sup>th</sup> clip with their centres on the marks and on the same edge as the 2<sup>nd</sup>, 3<sup>rd</sup>, 4<sup>th</sup> and 5<sup>th</sup> clip. Check if the beam is balanced.



### STEP 3:

Label the centre clip '0' with a sticker. From '0', label the clips on the left side and right side of the beam as '1', '2' and '3' with stickers.



### STEP 4:

Use paper clips as 'hooks' to hang and balance 1 Kina coins on distance 3 on both the left side and right side of the beam.



# How to read a Bar Graph

## 1. What is a Bar Graph?

A bar graph helps to compare data. The bar graph below shows the weight of three students.

## 2. Reading a Bar Graph

### STEP 1:

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

### STEP 2:

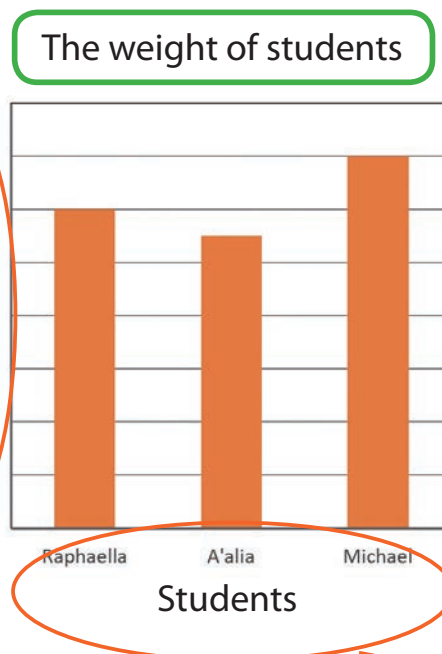
Study the bottom part of the graph called the horizontal axis labeled 'Student' that shows the name of students; Michael, Raphaella and A'alia.

### 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.

Vertical axis

Weight (kg)



Horizontal axis

(2) The highest represented number is 80 kg. Between any two numbers example between 30 and 40 the interval amount is 10 kg.

### STEP 4:

(1) Study the bar graph. Look at the bar on label 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.



## Glossary

<b>Accelerate</b> is to increase in speed. ....	24
<b>Adaptation</b> is the use of body part or a behaviour that helps an organism survive in its environment or a new environment. ....	148
<b>Alloy</b> is a mixture of two or more metals. ....	120
<b>Autumn (fall)</b> is the season that follows summer. The weather slowly gets colder. ....	48
<b>Behaviour</b> is the way organisms act in a certain situation. ....	148
<b>Boiling point</b> is the temperature at which a liquid changes into a gas. ....	76
<b>Camouflage</b> is a type of animal adaptation that use the colours, patterns or shape of body parts of an animal that allows it to blend in with its surroundings.....	152
<b>Carbon dioxide</b> is a colourless and odourless gas produced by people or animals when they breathe out. ....	12
<b>Cast</b> is the opposite of its mould. ....	124
<b>Chemical change</b> is a change that produces new kinds of matter.....	58
<b>Circuit diagram</b> is a diagram representing an electrical circuit drawn using symbols. ....	104
<b>Cloud</b> is made of water droplets or ice crystals floating in the sky. ....	42
<b>Condensation</b> is the process that causes a matter to change from gas to liquid. ....	76
<b>Conduction</b> is the transfer of heat from one place to another through matter. ....	196
<b>Convection</b> is the transfer of heat through liquids and gases such as water and air.....	198
<b>Convection current</b> is the movement or flow of water or air created by the process of convection. ....	198
<b>Core</b> is the hottest, innermost layer of the Earth. ....	114
<b>Cotyledon</b> is the part of a plant that stores food. ....	164
<b>Crust</b> is the thinnest outer layer of the Earth. ....	114
<b>Decelerate</b> is to reduce in speed or slow down. ....	24
<b>Degrees Celsius</b> is the unit of measurement used to measure temperature. ....	192
<b>Desert</b> is a large, hot, dry area of land with very little water and very few plants. ...	150
<b>Dry season</b> is a time of year when little rain falls. ....	48
<b>Effort</b> is the force applied to a machine to do work. ....	30
<b>Egg</b> is the female reproductive cell. ....	84
<b>Electric current</b> is the flow of electricity. ....	98
<b>Electric circuit components</b> are basically the various parts of circuit such as dry cells, bulb, switch and motor.....	103

<b>Embryo in animals</b> is an early developmental stage of an animal while it is within the mother's womb (uterus) or in the egg. ....	88
<b>Embryo in plants</b> is the tiny plant inside the seed. ....	164
<b>Energy pyramid</b> is a representation of the flow of energy from one energy level to another. ....	16
<b>Evaporation</b> is the process that causes a matter to change from liquid to a gas. ....	76
<b>Fertilisation</b> is the process where the egg meets the sperm and joins it. ....	84
<b>Foetus</b> is the unborn offspring of an animal that develops from an embryo. ....	88
<b>Food chain</b> is the path of food energy from the plants to animals. ....	14
<b>Food web</b> consists of several food chains linked to each other. ....	16
<b>Fossil</b> is the remains of once a living thing. ....	124
<b>Freezing</b> is the process that causes a matter to change from a liquid to a solid. ....	76
<b>Freezing point</b> is the temperature at a certain point where liquids start to change to solid. ....	74
<b>Freshwater habitats</b> are natural water sources that do not contain salt. ....	136
<b>Friction</b> is the force that occurs when two surface of objects rub against each other from opposite directions. ....	24
<b>Germination</b> is the process of the seed growing into a seedling. ....	165
<b>Grassland</b> is an area mostly covered by grasses with few or no trees. ....	142
<b>Habitat</b> is the part of a natural environment where a plant or an animal lives. ....	134
<b>Heat</b> is a form of energy. ....	186
<b>Heredity</b> is the way in which traits are passed on from parents to young organisms.....	90
<b>Hibernation</b> is the state of inactivity where animals go to a deep sleep. ....	156
<b>Igneous rock</b> is a rock formed when melted rock from inside the Earth cools and hardens. ....	118
<b>Lever</b> is a type of simple machine that makes an object move with less force.....	29
<b>Load</b> is the force applied on the lever by the object to be lifted. ....	30
<b>Magma</b> is melted rock form in the Earth or a result of volcanic eruption. ....	118
<b>Mantle</b> is the thick, hot layer of the Earth. ....	114
<b>Melting</b> is the process that causes a matter to change from a solid to a liquid. ....	76
<b>Melting point</b> is the temperature at a certain point where solids start to melt. ....	74
<b>Metamorphic rock</b> is a rock formed when a rock inside the Earth has been changed by heat and pressure. ....	118
<b>Migration</b> is the movement of fish, bird and other animals from one place to another. ....	156

## Glossary

<b>Mimicry</b> is a type of animal adaptation that allows an animal to look like another kind of animal. ....	154
<b>Mineral</b> is a valuable or useful substance that is dug out of the ground. ....	114
<b>Motor</b> is an electrical device that produces power to rotate things using electricity. ....	97
<b>Mould</b> is the shape of a dead living thing found in a rock. ....	124
<b>Ocean habitat</b> is the area with salty water. ....	138
<b>Organism</b> is any living thing such as plant, animal and other living things. ....	144
<b>Ovary</b> is the female body part that contains thousands of eggs. ....	86
<b>Parallel circuit</b> is a circuit in which the electric current flows in two or more paths. ....	100
<b>Penis</b> is the male body part that passes semen out of the man's body. ....	86
<b>Photosynthesis</b> is the process by which plants make their own food (starch) from carbon dioxide and water by using light. ....	176
<b>Radiation</b> is the transfer of heat in the form of waves through air or empty space. ....	200
<b>Rainforest habitat</b> is an area with a lot of rain, warm climate and tall trees. ....	140
<b>Reproduction</b> is the process where living things produce young ones similar to themselves. ....	83
<b>Reproductive system</b> is the group of the body parts that work together for the purpose of reproduction. ....	86
<b>Rock</b> is a naturally formed, non-living material as part of the Earth crust. ....	114
<b>Rusting</b> is the red or orange coating that forms on the surface of metal due to chemical change between metal surface and the environment. ....	60
<b>Season</b> is a period of the year that is divided by typical weather conditions. ....	48
<b>Sediment</b> is a collection of sand particles of rock and small bits of soil piled up over time. ....	118
<b>Sedimentary rock</b> is a rock formed when sediments are glued together and become hard. ....	118
<b>Seed coat</b> is the hard outer layer of the seed covering the embryo and the cotyledon. ....	164
<b>Semen</b> is a mixture of sperm and fluids. ....	86
<b>Series circuit</b> is a circuit in which the electric current flows in one path. ....	100
<b>Sleet</b> is a mixture of snow and rain. ....	48
<b>Solar energy</b> is the energy that comes from the Sun. ....	12
<b>Sperm</b> is the male reproductive cell. ....	84
<b>Spring</b> is the season that follows winter. The weather begins to get warmer. ....	48
<b>Sublimation</b> is the direct change of state from solid to gas. ....	79

<b>Starch</b> is a substance made by plants to store energy in foods such as rice, bread, kaukau and potato. ....	164
<b>Summer</b> is the season that follows spring. It is warmest season of the year with long hours of sunlight.....	48
<b>Temperature</b> is a measure of how hot or cold a matter is. ....	192
<b>Testes</b> is the male body part that produces millions of sperm. ....	86
<b>Thermal expansion</b> is the increase in volume of matter due to an increase in temperature. ....	72
<b>Thermometer</b> is an instrument that is used to measure temperature in degrees Celsius.....	192
<b>Trait</b> is a feature or characteristic of a living thing. ....	90
<b>Vagina</b> is a muscular tube that connects the womb to the outside of a female's body. ....	86
<b>Weather forecast</b> is to predict the upcoming weather. ....	43
<b>Wet season</b> is the time of year when most of the rain falls. ....	48
<b>Winter</b> is the season that follows autumn (fall). Winter is the coldest season of the year with fewer hours of sunlight. ....	48
<b>Womb</b> is the place where a baby grows until its birth. ....	86

## Glossary

### Page number corresponds to Grade 4 Textbook

<b>Anther</b> is the part of a male flower which contains pollen. ....	72
<b>Battery</b> is a device that makes it easy to carry electricity any where you go. ....	78
<b>Chemical property</b> is the ability to change into new matter that has different properties. ....	138
<b>Compost</b> is a mixture of naturally decaying matter such as plants and animals. ...	34
<b>Conductor</b> is a material that electric current easily flows through. ....	86
<b>Direction</b> is the path that an object takes. Direction is expected by comparing its current position to its past position. ....	212
<b>Distance</b> is a measure of how far an object has travelled from its starting point. ...	212
<b>Electric circuit</b> is the circle of a pathway that electricity flows. ....	82
<b>Fruit</b> comes from flowers and they contain seeds. ....	96
<b>Inclined plane</b> is one of the simple machines that uses slanted surface to move objects from a lower position to a higher position with less force. ....	218
<b>Insulator</b> is a material that electric current does not flow through easily. ....	86
<b>Metal</b> is a material such as iron, copper and gold. ....	86
<b>Motion</b> is the change in the position of an object. An object in motion moves from one place to another. ....	210
<b>Muscle</b> is under our skin and covers our bones. We use our muscles when we move our body parts. ....	188
<b>Oxygen</b> is one of the gases in the air. ....	12
<b>Petal</b> is the bright colourful parts of a flower. ....	72
<b>Phases of the moon</b> mean a series of changing shapes of the bright part of the moon that we can see. ....	202
<b>Physical change</b> is a change in physical properties of matter. It may make the matter look different, but it does not change the material itself. ....	136
<b>Physical property</b> is a characteristic of matter that can be measured or observed with our five senses. ....	134
<b>Pistil</b> is a female part of a flower. ....	72
<b>Pollen</b> is a fine powder produced by flowers, which is carried by the wind or by insects to other flowers. ....	72

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### Page number corresponds to Grade 4 Textbook

<b>Position</b> is the place or location of an object. ....	210
<b>Precipitation</b> is any form of water that falls from clouds such as rain, snow and hail. ....	62,166
<b>Pulley</b> is a wheel to lift or lower an object easily.....	218
<b>Screw</b> is a simple machine made up of an inclined plane wrapped around a cylinder or cone to change a weak force to a strong downward or upward force. ....	218,230
<b>Seed</b> is a part produced by plants from which a new plant grows. ....	24
<b>Seedling</b> is a young plant that grows from a seed. ....	42
<b>Shelter</b> is a place where animals can be safe. ....	12
<b>Simple machine</b> is a tool or device that can make work easier. ....	218
<b>Speed</b> is a measure of how fast an object is moving. ....	212,214
<b>Stamen</b> is a male part of a flower.....	72
<b>Steam</b> are the visible tiny water droplets floating in the air. ....	148
<b>Stigma</b> is the top of the centre part of a flower that receives pollen. ....	72
<b>Vibration</b> is a quick movement back and forth. ....	120
<b>Volume</b> is the amount of a space in a container. ....	48
<b>Water cycle</b> is the movement of water between the air and the Earth as water changes its state. ....	166
<b>Water vapour</b> is gaseous state of water. ....	148
<b>Weather</b> is the conditions of the air and the sky at a particular time and place. ...	60
<b>Wedge</b> is a simple machine made up of two inclined planes back to back to form a sharp edges. ....	218,228
<b>Wheel and axle</b> is one of the simple machines to make work easier by increasing the strength of the force. ....	228,226
<b>Wind</b> is moving air. ....	46,62
<b>Work</b> in science means the movement of an object by using force. ....	218

# Basic Science Instruments

Basic science instruments introduced in the textbook are listed below.



1



2



3



4



5



6



7

- 1 Magnifying lens
- 2 Stopwatch
- 3 Measuring tape
- 4 Beaker
- 5 Thermometer
- 6 Dropper
- 7 Burner
- 8 Beam balance
- 9 Bulb
- 10 Bulb holder
- 11 Motor
- 12 Cell holder
- 13 Switch
- 14 Propeller
- 15 Wire



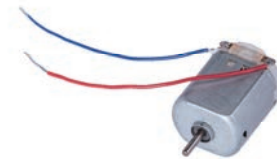
8



9



10



11



12



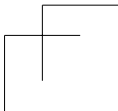
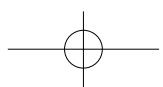
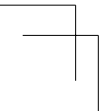
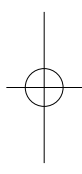
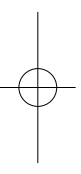
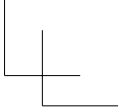
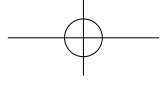
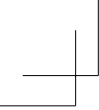
13



14



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## Science Grade 5 Teacher's Manual Development Committees

The Science Teacher's Manual 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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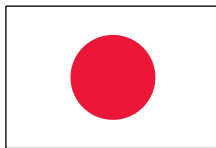
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