SCIENCE
Teacher's Manual

Grade 5

Papua New Guinea
Department of Education

JICA

Issued free to schools by the Department of Education

First Edition

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Acknowledgements

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The Science curriculum officers, textbook writers, pilot teachers from NCD and Central Provinces and the Subject Curriculum Group (SCG) are acknowledged for their contribution in writing, piloting and validating this textbook.

The Curriculum Panel (CP) members, members of the Subject Advisory Committee (SAC) and the Basic Education Board of Studies (BEBoS) are also acknowledged for their advice, recommendation and endorsement of this Teacher's Manual.

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Table of Contents

Secretary's Message

Dear Teacher,

Teaching and learning of Science is a challenge. It is my pleasure to inform all Grade 5 Teachers in Primary Schools that a scoped and sequenced content-based curriculum resource material, the Teacher's Manual has been developed. The resource material will assist with the delivery of quality, effective and meaningful Science lessons to all grade 5 students in the country. The Teacher's Manual addresses areas of what to teach, how to teach and what to measure (assess). It is user friendly and reflects PNG contexts in daily situations to help students acquire key concepts.

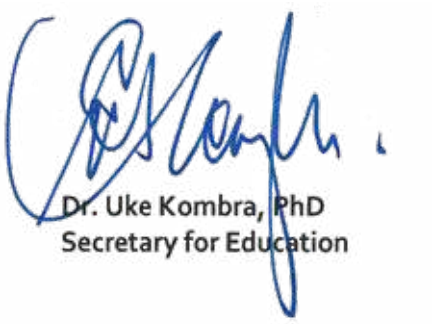
Science is a very interesting and enjoyable subject if taught well. This Grade 5 Teacher's Manual contains very interesting student activities with clear and precise step by step lesson flows for all lessons and teacher notes to assist teachers understand the science concepts for each lesson. These concepts are expanded from the Grades 3-5 Science syllabus to the textbook.

The Teacher's Manual is self-explanatory and provides suitable teaching and learning contents for teachers. It details the teaching and learning strategies, content, concepts and plans in order to achieve the intended purpose of the science lessons prescribed in the National Science Textbook. The lessons are aimed at preparing and shaping young scientists and equipping them with the relevant scientific skills for the 21st century.

This teacher resource was produced by the National Department of Education, in partnership with JICA our partners in global education. The development of these teacher and student materials took three years (2016-2019). I commend all personnel involved; science experts from Japan and the department's very own curriculum officers and textbook writers for the excellent work done.

Teachers are encouraged to use this Teacher's Manual as the main tool to effectively deliver the content of the textbook and other relevant resources such as science equipment recommended to generate creative teaching and interactive learning.

I approve this Grade 5 Science Teacher's Manual to be used in all primary schools throughout Papua New Guinea.



Dr. Uke Kombra, PhD
Secretary for Education

1. How to use the Teacher's Manual

Teacher's Manual has been developed for teachers to teach learning contents to their students more effectively with using the National Science Textbook. As for the features of this Teacher's Manual, its contents correspond to that in the textbook according to the Grades 3-5 Science Syllabus. The syllabus sets the national standards that are taught by teachers in the classroom that all students should acquire throughout the country, regardless of the context. These standards outlined in the syllabus are reflected in this teacher's manual. Therefore, information in this teacher's manual will help teachers to prepare lesson plans and to conduct lessons in line with the syllabus.

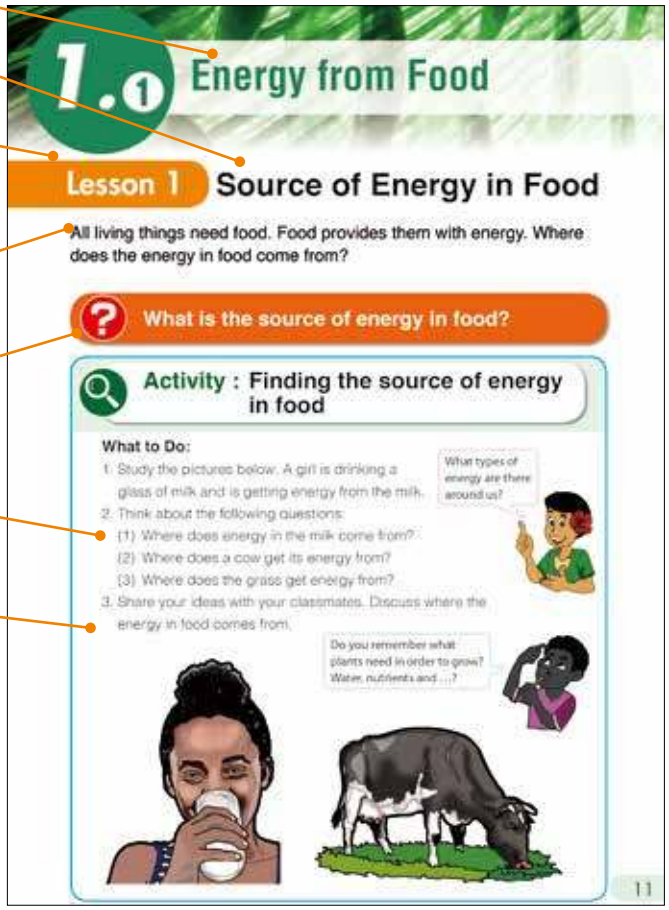
Firstly, the composition of the textbook is introduced, then, the components in this teacher's manual are introduced in the following section.

1.1 Composition of Science textbook

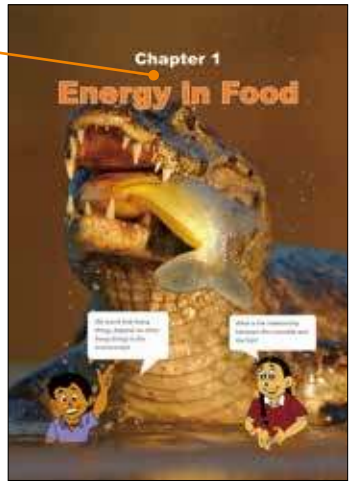
The Science Textbook is designed like this to have its components to repeatedly appear in each chapter, as shown in the top-right box ('structure in a chapter'). Each component is shown in the right.

The teacher's manual is designed according to the structure of the textbook in order to help the teacher to easily refer to the teacher's manual for preparation and implementation of a lesson.

Lesson



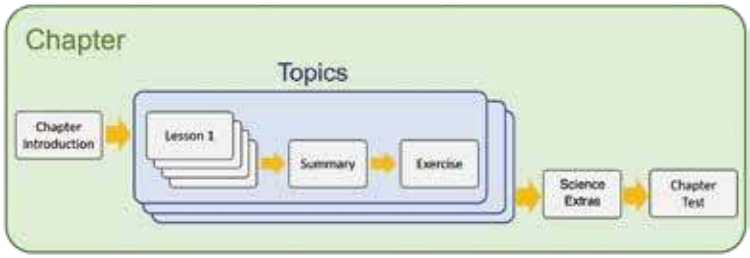
Chapter Introduction



Structure in a chapter

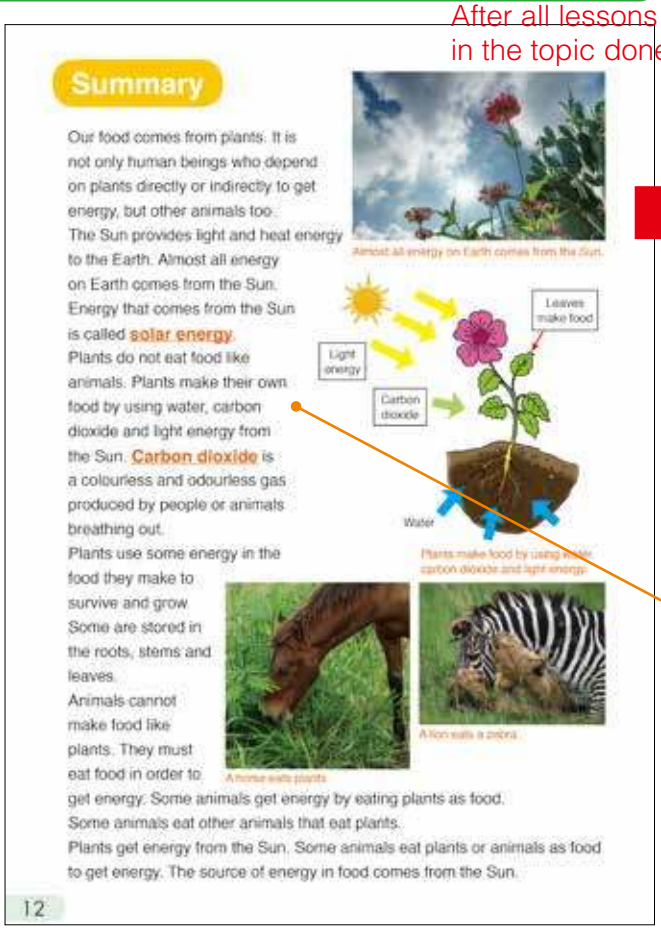
The Science Textbook consists of several chapters based on learning contents according to the syllabus. All chapters have regular components as shown in the diagram below.

1. Chapter Introduction
2. Main content pages
3. Summary
4. Exercise
5. Science Extras
6. Chapter test



(main content page)

After all lessons in the topic done...



Summary

Our food comes from plants. It is not only human beings who depend on plants directly or indirectly to get energy, but other animals too.
The Sun provides light and heat energy to the Earth. Almost all energy on Earth comes from the Sun.
Energy that comes from the Sun is called solar energy.
Plants do not eat food like animals. Plants make their own food by using water, carbon dioxide and light energy from the Sun. Carbon dioxide is a colourless and odourless gas produced by people or animals breathing out.
Plants use some energy in the food they make to survive and grow. Some are stored in the roots, stems and leaves.
Animals cannot make food like plants. They must eat food in order to get energy. Some animals get energy by eating plants as food. Some animals eat other animals that eat plants.
Plants get energy from the Sun. Some animals eat plants or animals as food to get energy. The source of energy in food comes from the Sun.

Almost all energy on Earth comes from the Sun.

Light energy
Carbon dioxide
Leaves make food
Water

Plants make food by using water, carbon dioxide and light energy.

A horse eats plants.

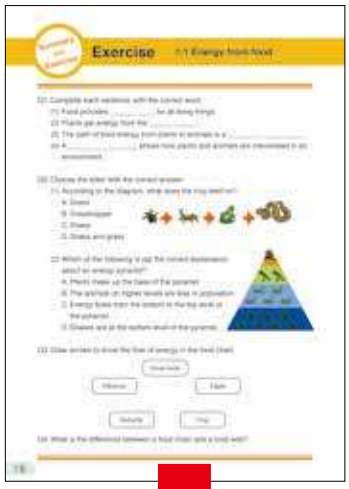
A lion eats a zebra.

12

Summary of the lesson

Summary

Exercise



Science Extras

What happens if an organism was removed from a food chain?

After all topics done...

Chapter test

1. Energy in Food

Go to next Chapter...

1.2 Main contents in the Teacher's Manual

The main content in this Teacher's Manual has eight components: Basic lesson information, Lesson objectives, Assessment, Preparation, Lesson flow, Teacher's note, Sample Blackboard Plan and a reduced textbook page.

Basic lesson information

Basic information such as name of the unit, chapter and topic for the lesson is shown. In addition, numbering (numerical code) and total number of lessons in the chapter are also shown to make teaching easier.

Textbook page of the lesson

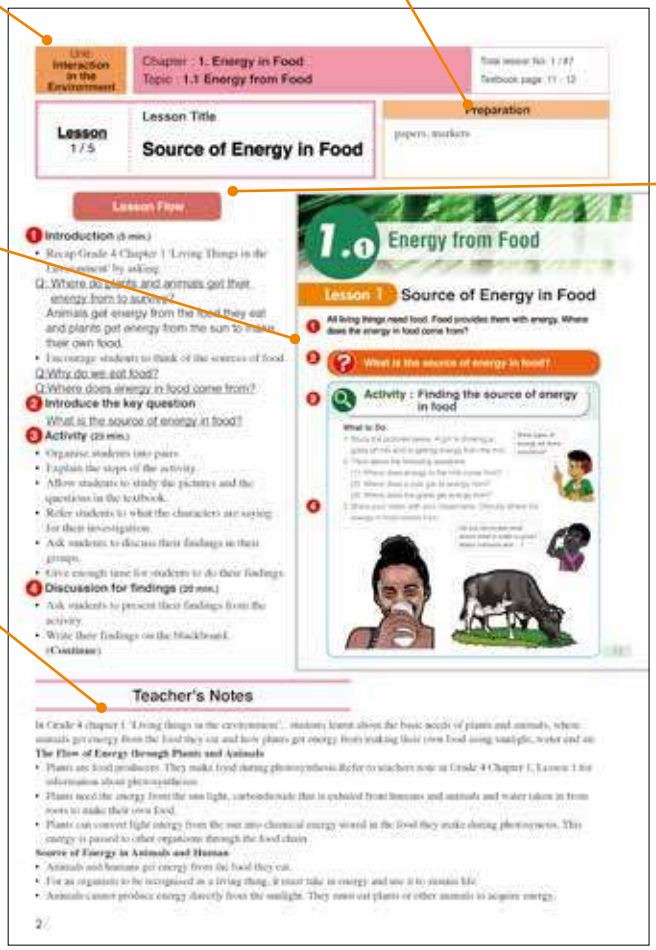
Corresponding textbook page number is shown at the center. The numbers in red circle on the page correspond to the 'Lesson Flow' to show where the content is in the lesson flow.

Teacher's Notes

Supplementary information useful for teaching, such as background knowledge and more detailed explanations, are introduced.
In case of materials or equipment not accessible nationwide, the alternatives are mentioned and instructions on how to improvise are provided.

Preparation

Materials and apparatuses recommended for use in the lesson are shown.



The lesson flow should be followed in line with the concept of the textbook:

❶ Introduction

In the introduction, teacher makes students review the previous lesson to connect the new lesson through the key question. An example of the introduction is shown in the lesson flow.

❷ Showing a key question

The key question is closely related to the core or main points of the lesson including the new knowledge, new concepts and new skills. The teacher delivers the key question by using the review of the previous lesson or a new phenomena at the beginning of a new lesson. In this particular lesson, students try to answer the key question by guessing or predicting based on their experiences.

❸ Activity

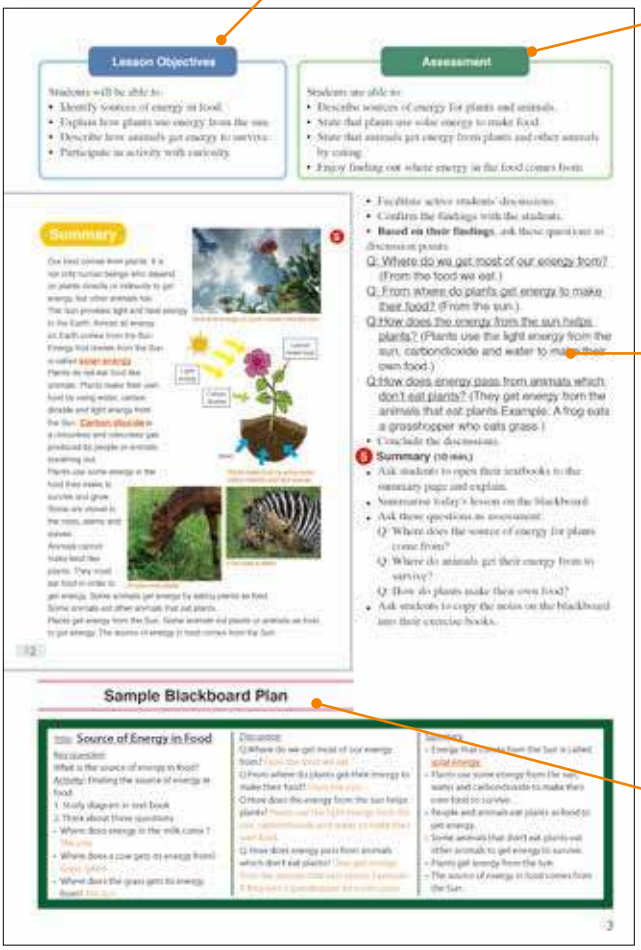
The activity is delivered to examine their guess and prediction to the key question. In some lessons, the teacher may deliver the activity without students' prediction or hypothesis. These two different ways are dependent on the lesson content. Activities are carried out by a group, individually or done by teacher's demonstration, which is dependent on the availability of the materials and contexts of the lesson topics. Teacher allows students to have enough time to do the activity.

Lesson Flow

A lesson flow includes several teaching points. The main components are:
❶. Introduction, ❷. Key question, ❸. Activity, ❹. Discussion and ❺. Summary.
Lesson flow in some lessons contains additional information like "Result" or "Challenge", according to the content of the lesson in the textbook.

Lesson Objectives

Objectives capturing the main knowledge and skills in the lesson are provided in the textbook.



Assessment

Teacher should reflect own lesson along this criteria through the lesson. The three components of knowledge, thinking skills, attitude & values are also indicated in the teacher's manual.

'Knowledge' means new concepts, new findings and their relationships.

'Thinking skills' means scientific process skills, which contain observing, measuring, inferring, classifying, predicting and communicating.

'Attitude and Value' means the interests, curiosities and respect for nature and recognition on the importance and usefulness of the content.

Refer to Teachers Guide for detail information.

Sample Blackboard Plan

A sample of blackboard of lesson notes writing is introduced. Contents of the blackboard sample are equivalent to the main teaching points of the lesson and can be utilised as a guide. In the sample blackboard plan, examples of the results in the activity and expected student's answers are written in coloured words.

❹ Discussion

In the discussion part, the teacher allows students to present their results or findings from the activity and to share with all other students. The teacher allows time to students to think and seek the answers for the key question by using the results or findings in the activity. The teacher must verify the results to the students to avoid misconceptions. In the case, for Grade 5, some of the results in the activity would be same as the conclusion of the lesson.

❺ Summary

The summary confirms the core points of the lesson. The teacher asks questions shown in the teacher's manuals as summative assessment to students in order to confirm if they have acquired the main knowledge and skills in the lesson. The summary points may be the students' findings or results in the discussion part of the textbook which the teacher would facilitate and direct students.

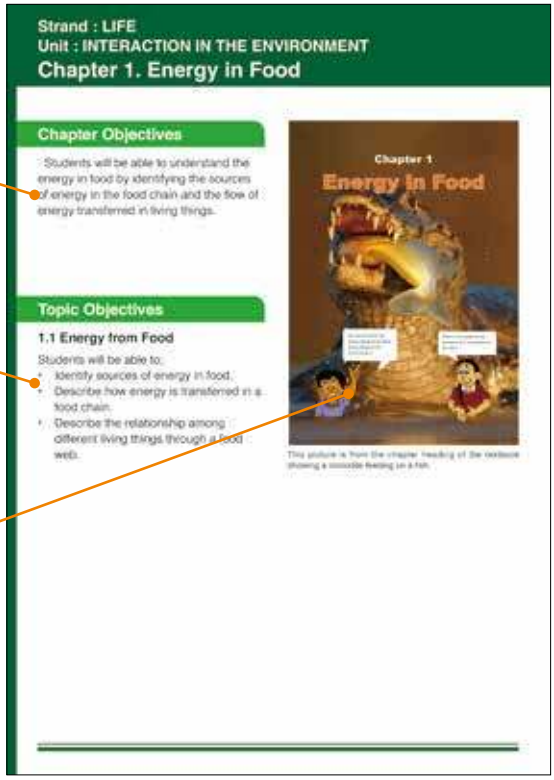
1.3 Chapter Introduction in Teacher's Manual

In the beginning of a chapter, the necessary information for the chapter such as chapter and topic objectives, linkages of the learning contents with other chapters and grades and a list of lessons are introduced. Student's prior knowledge learned in previous lesson or grade or experiences through their daily lives are also provided.

Chapter Objectives
The objectives to achieve the chapter are introduced.

Topic Objectives
The objectives to achieve each topic are introduced.

Chapter Heading
A picture of nature in Papua New Guinea or things in daily life related to the learning contents in the chapter is introduced with the list of lesson titles at each chapter heading in textbook.

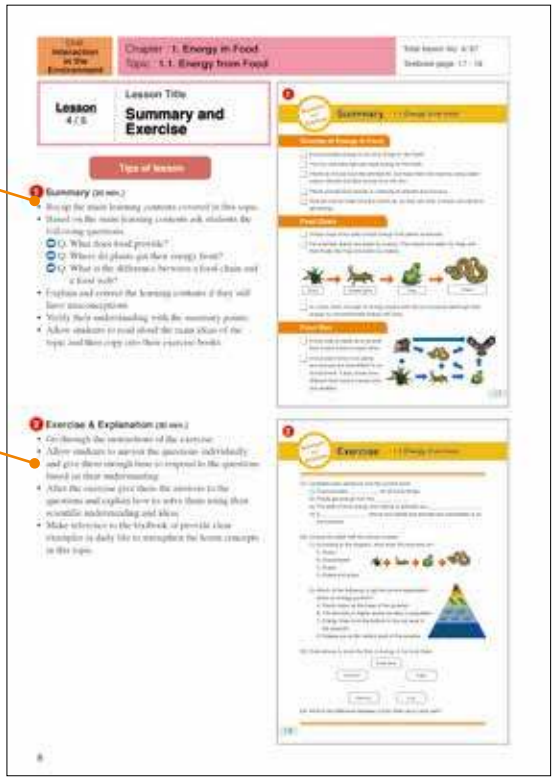


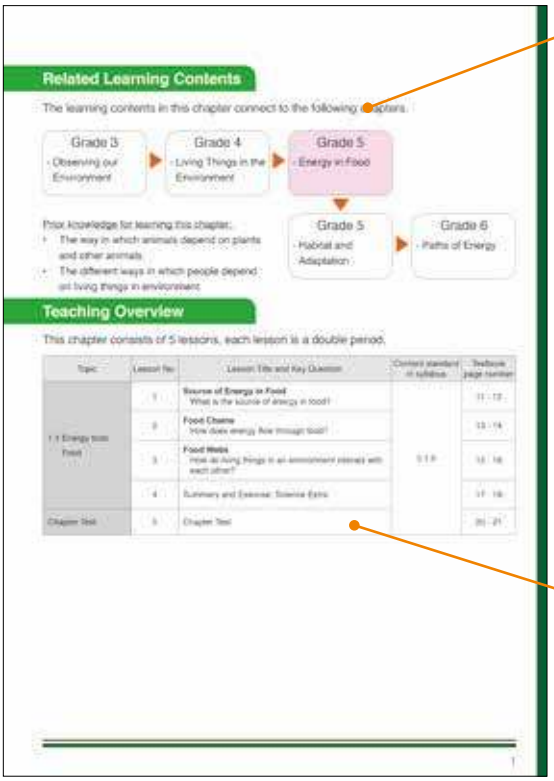
1.4 Summary and Exercise / Science Extras in Teacher's Manual

Summary and Exercise are inserted at the end of each topic, and column is inserted at the end of each chapter.

Summary of the Topic
The summary of the topic are shown with supplementary information.

Exercise of the Topic
Questions as student's exercise for learning contents in each topic are shown. To know students understanding, allow all students enough time to try solving the questions. After that, teacher must give the answer to students and teach how to solve each question.



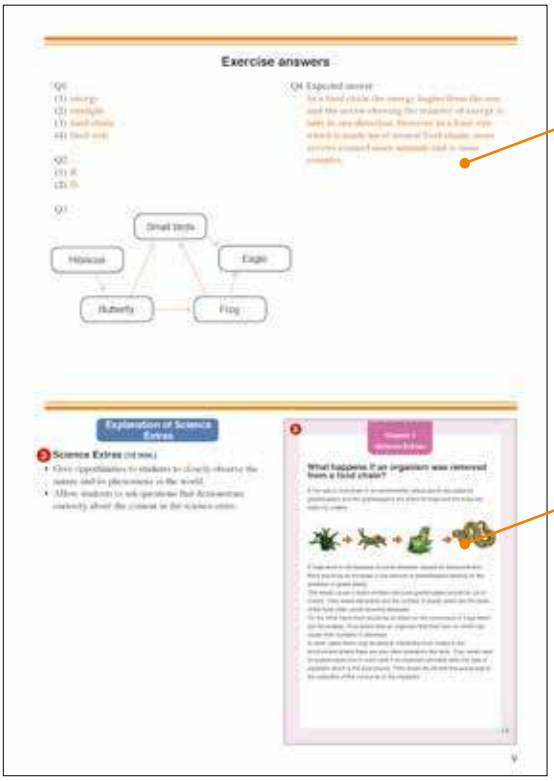


Related Learning Contents

In the Syllabus, key learning contents are scoped and sequenced across all grades, from elementary to grade 12. The main learning contents of a chapter links to that in other chapters including other grades from 3 to 6 are outlined as a concept map. Content in a chapter of a grade is necessary to be taught which links the contents to be learned in the same grade or the next grade. The concept map will help the teachers to visualise such a scope and sequence to teach in the classroom.

Teaching Overview

Topic, lesson titles and key questions, lesson number in the chapter, textbook page number and numerical code of related content standards written in the syllabus are introduced in this list.



Answer of Exercise Question

Answers of the questions in exercise are provided.

Science Extras

In the Science Extra page, interesting information related to the chapter contents are introduced to make students really interested in science.
Students are given time to read the Science Extra and discuss the content with classmates.

2. How to deliver a Science Lesson

Both the Textbook and the Teacher's Manual work hand in hand to deliver a meaningful and successful lesson. However, there are important things to consider before lessons are taught. Teacher should consider:

1. Having a Textbook and Teacher Manual on hand.
2. Knowing what was the previous and the next day's lesson contents before delivering the current lesson.
3. Preparing teaching materials prior to the lesson.
4. Reading the Lesson Objectives and understanding it very well.
5. Reading and understanding the Teacher's notes to have some background content knowledge of the lesson before teaching.
6. Following the sequence of the lesson carefully and consult the sample blackboard plan to confirm the lesson flow and notes.
7. Studying carefully the sample blackboard plan.

3. What to consider while presenting the lesson

Teacher should always consider the points mentioned above to help present the lesson effectively to the students. Everything that the teacher needs to know prior to the lesson is clearly written in the Teacher's Manual. Therefore, the teacher will have the manual while delivering the lesson because the reduced size of the textbook is inserted in the manual to help guide and follow with the class.

At the beginning of each lesson, all lessons have a key question that students are asked to think about ways on how to find out. Teachers will also realise that it encourages Problem Solving approach (Textbook pages 8 to 9) through the lesson. Teachers must be mindful that student's presentation of their findings is very rare and special. While doing problem solving, some findings presented may result in some misconceptions. However, when such arises consider those opinions or findings and always direct their attention back to the main focus of the lesson to flow with everyone in the class so that they learn and understand.

In several lessons, basic science instruments such as a thermometer, compass, tape measure and simple electric circuit are required. For Grade 5 students, teachers must assist them to master how to use the instruments to develop their manipulative skills.

Concept of problem solving approach in the layout of students textbook (pages 8 to 9)

4. What to do during Lesson Preparation

1. Yearly Overview (Page X to XI)

The Yearly overview for Grade 5 Science lessons provides the links to the syllabus. The annual overview shows strand, unit, chapter, topics and lesson titles. The time allocation for each lesson in Science is recognised as a double period of 60 minutes (30 minutes x 2 lessons).

2. Read Teacher's Manual

Information for teaching is introduced in the manual and teachers should read and understand the components of the teacher's manual as follows; lesson objectives, assessments, preparation, lesson flow, teacher's notes and sample blackboard.

3. Test the activity

Before the lesson, a teacher has to prepare the necessary materials and equipment written in the teacher's manual. In addition, it is essential for teachers to do a trial of the activity involving an experiment before the lesson. Conditions such as temperature, humidity, materials and equipment used in the lesson may vary. If teachers are able to find that the result obtained differ or is incorrect, then they should be aware of how to adjust the ways of presenting the activity. The success of the lesson depends entirely on how well a teacher prepares and facilitates students learning to be concrete and effective.

4. Prepare Blackboard Plan

After understanding the lesson contents, the teacher prepares the blackboard plans shown in the Teacher's Manual. The effective use of blackboard is important for student-friendly lessons because students can easily take notes.

5. How to use blackboard

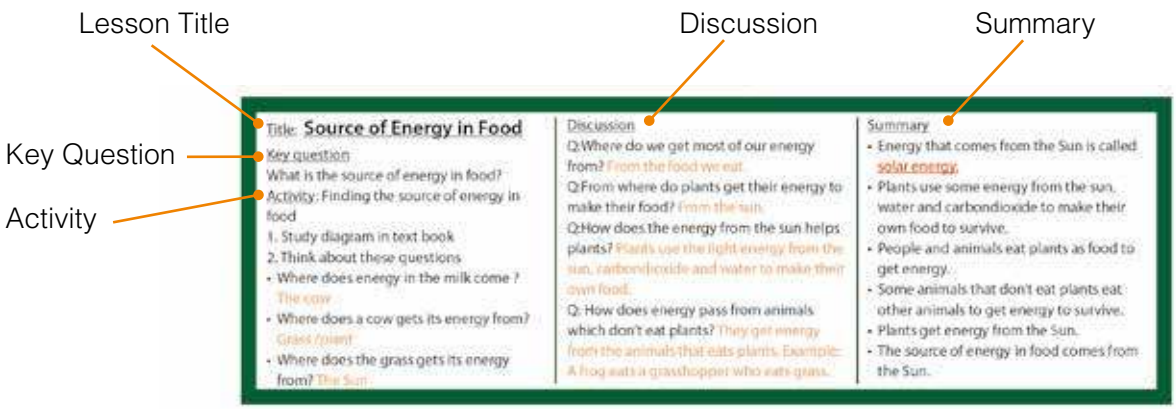
The common practice for the teachers utilising the blackboard is dividing it into sections for each subject. The Blackboard is an important teaching tool for teachers when utilised well. Therefore, in this Teacher's Manual it introduces the strategy for enhancing the effectiveness of blackboards for improving student learning.

1. To start a lesson, utilise the blackboard from the top left-hand corner of the blackboard to the right, top to the bottom chronologically as done in the Sample Blackboard Plan. The utilisation of the blackboard will accommodate the components of the blackboard plan below.

2. Encourage students to come out to the board to display their ideas and findings by writing and explaining what they have.

3. Allow students sufficient time to copy what you wrote before you erase it.

Sample Blackboard Plan



6. Yearly Overview

Yearly overview is designed purposely for the systematic flow of the grade content. It is helpful in the preparation of the yearly program to effectively plan for teaching. The strands, 'Life', 'Physical Science' and 'Earth and Space' are core strands of science in the syllabus.

STRAND	UNIT	Chapter	Topic	Term	No	LESSON in Chap.	Lesson Titles	Page Number
LIFE	INTERACTION IN THE ENVIRONMENT	1. Energy in Food	1.1 Energy from Food	TERM 1	1	1	Source of Energy in Food	2
					2	2	Food Chains	4
					3	3	Food Webs	6
					4	4	Summary and Exercise	8
					5	5	Chapter Test	10
PHYSICAL SCIENCE	FORCE AND MOTION	2. Force and Machine	2.1 Change in Motion		6	1	Change in Speed	14
					7	2	Change in Direction	16
					8	3	Summary and Exercise	18
			2.2 Regularity of Levers		9	4	Lifiting a Load Using a Lever 1	20
					10	5	Lifiting a Load Using a Lever 2	22
					11	6	Law of Lever to Balance	24
					12	7	Summary and Exercise	26
					13	8	Chapter Test	28
EARTH AND SPACE	WEATHER AND CLIMATE	3. Weather and Seasons	3.1 Observing Clouds		14	1	Types of Clouds	32
					15	2	Weather Forecast	34
					16	3	Summary and Exercise	36
			3.2 Seasons		17	4	Seasons	38
					18	5	Seasonal Changes and Living things	40
					19	6	Summary and Exercise	42
					20	7	Chapter Test	44
PHYSICAL SCIENCE	MATTER	4. New Matter	4.1 Common Chemical Changes	TERM 2	21	1	How to tell a Chemical Change	48
					22	2	Rusting	50
					23	3	Chemical Changes in Daily Life	52
					24	4	Summary and Exercise	54
					25	5	Chapter Test	56
PHYSICAL SCIENCE	MATTER	5. Three States of Matter	5.1 Properties of Three States of Matter		26	1	Shape of The Three States of Matter	60
					27	2	Volme of Three States of Matter	62
					28	3	Change in State of Matter 1: Solid and Liquid	64
					29	4	Change in State of Matter 2: Liquid and Gas	66
					30	5	Summary and Exercise	68
					31	6	Chapter Test	70
LIFE	ANIMALS	6. Reproduction and Heredity in Animals	6.1 Reproduction and Heredity		32	1	Reproduction in Fish	74
					33	2	Human Reproductive System	76
					34	3	Reproduction in Human	78
					35	4	From Parents to Young	80
					36	5	Summary and Exercise	82
					37	6	Chapter Test	84
PHYSICAL SCIENCE	ENERGY	7. Electricity 2	7.1 Electrical Circuit		38	1	Direction of Electric Current	88
					39	2	Series and Parallel Circuit	90
					40	3	Comparing Series and Palallel Circuits	92
					41	4	Circuit Components and their Symbols	94
					42	5	Daily Use of Electric Circuit	96
					43	6	Summary and Exercise	98
					44	7	Chapter Test	100

Chapters are arranged in sequential order from the first to the last. Each chapter contains one or more topics. The lesson number in the chapter is given to each lesson according to the students' textbook. Each lesson is recommended to be conducted as double periods (60 minutes). Finally, the page numbers are attached to each lesson to easily identify the lesson titles for planning and teaching.

STRAND	UNIT	Chapter	Topic	Term	No	LESSON in Chap.	Lesson Titles	Page Number
EARTH AND SPACE	OUR EARTH	8. Rocks, Minerals and Fossils	8.1 Rocks and Minerals	TERM 3	45	1	Rocks	104
					46	2	Minerals	106
					47	3	Types of Rock	108
					48	4	Uses of Rocks and Minerals	110
					49	5	Summary and Exercise	112
			8.2 Fossils		50	6	A Fossil	114
					51	7	Learning from Fossils	116
					52	8	Summary and Exercise	118
					53	9	Chapter Test	120
LIFE	INTERACTION IN THE ENVIRONMENT	9. Habitat and Adaptation	9.1 Habitats		54	1	Habitats	124
					55	2	Freshwater Habitat	126
					56	3	Ocean Habitat	128
					57	4	Rainforest Habitat	130
					58	5	Grassland Habitat	132
					59	6	Habitats Changes	134
					60	7	Summary and Exercise	136
			9.2 Adaptations		61	8	What is Adaptation?	138
					62	9	Adaptations to Habitats	140
					63	10	Camouflage	142
					64	11	Mimicry	144
					65	12	Behavioural Adaptation	146
					66	13	Summary and Exercise	148
					67	14	Chapter Test	150
LIFE	PLANTS	10. Plant Growth	10.1 Needs for Seed Germination	TERM 4	68	1	Inside of a Seed	154
					69	2	Conditions for Germination 1: Water	156
					70	3	Conditions for Germination 2: Air	158
					71	4	Conditions for Germination 3: Temperature	160
					72	5	Summary and Exercise	162
			10.2 Needs for Plant Growth		73	6	Conditions for Plant Growth 1: Water	164
					74	7	Conditions for Plant Growth 2: Light	166
					75	8	Conditions for Plant Growth 3: Fertiliser	168
					76	9	Summary and Exercise	170
					77	10	Chapter Test	172
PHYSICAL SCIENCE	ENERGY	11. Heat	11.1 Properties of Heat		78	1	What is Heat?	176
					79	2	Source of Heat	178
					80	3	Uses of Heat	180
					81	4	Temperature	182
					82	5	Summary and Exercise	184
			11.2 Heat Transfer		83	6	Heat Transfer 1: Conduction	186
					84	7	Heat Transfer 2: Convection	188
					85	8	Heat Transfer 3: Radiation	190
					86	9	Summary and Exercise	192
					87	10	Chapter Test	194

Strand : LIFE
Unit : INTERACTION IN THE ENVIRONMENT

Chapter 1. Energy in Food

Chapter Objectives

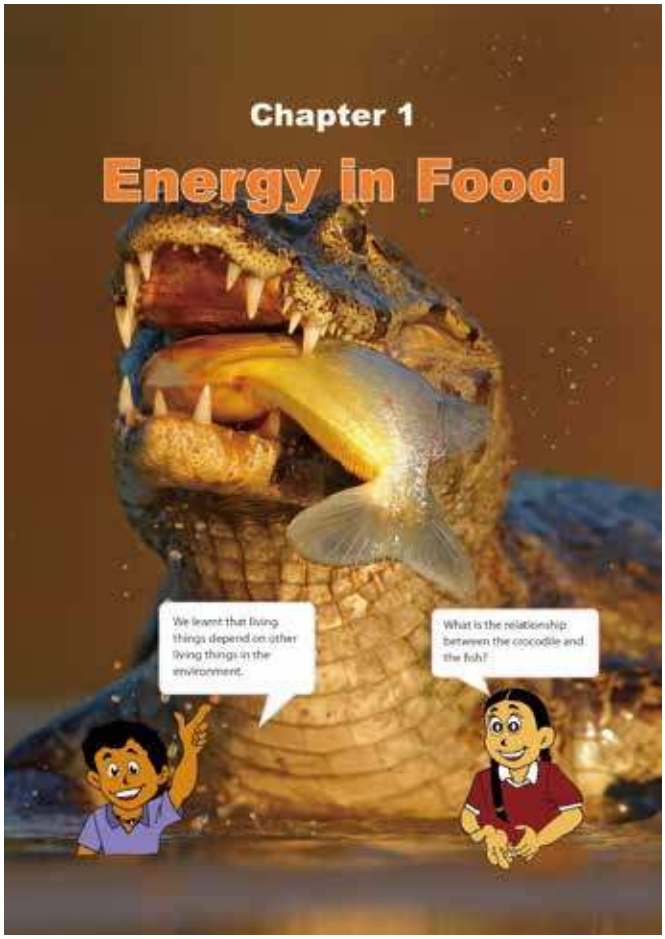
Students will be able to understand the energy in food by identifying the sources of energy in the food chain and the flow of energy transferred in living things.

Topic Objectives

1.1 Energy from Food

Students will be able to;

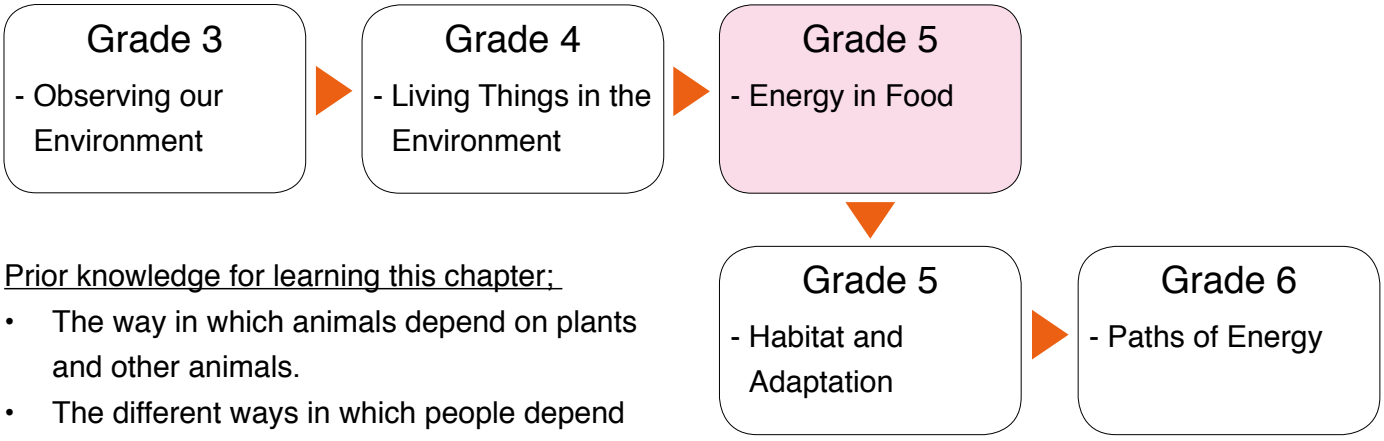
- Identify sources of energy in food.
- Describe how energy is transferred in a food chain.
- Describe the relationship among different living things through a food web.



This picture is from the chapter heading of the textbook showing a crocodile feeding on a fish.

Related Learning Contents

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



Prior knowledge for learning this chapter;

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

Teaching Overview

This chapter consists of 5 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
1.1 Energy from Food	1	**Source of Energy in Food** What is the source of energy in food?	5.1.5	11 - 12
	2	**Food Chains** How does energy flow through food?		13 - 14
	3	**Food Webs** How do living things in an environment interact with each other?		15 - 16
	4	Summary and Exercise, Science Extra		17 - 19
Chapter Test	5	Chapter Test		20 - 21

Unit: **Interaction in the Environment**	Chapter : **1. Energy in Food** Topic : **1.1 Energy from Food**	Total lesson No: 1 / 87 Textbook page: 11 - 12

Lesson 1 / 5

Lesson Title

Source of Energy in Food

Preparation

papers, markers

Lesson Flow

1 Introduction (5 min.)

- Recap Grade 4 Chapter 1 'Living Things in the Environment' by asking:

Q: Where do plants and animals get their energy from to survive?

Animals get energy from the food they eat and plants get energy from the sun to make their own food.

- Encourage students to think of the sources of food.

Q:Why do we eat food?

Q:Where does energy in food come from?

2 Introduce the key question

What is the source of energy in food?

3 Activity (25 min.)

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

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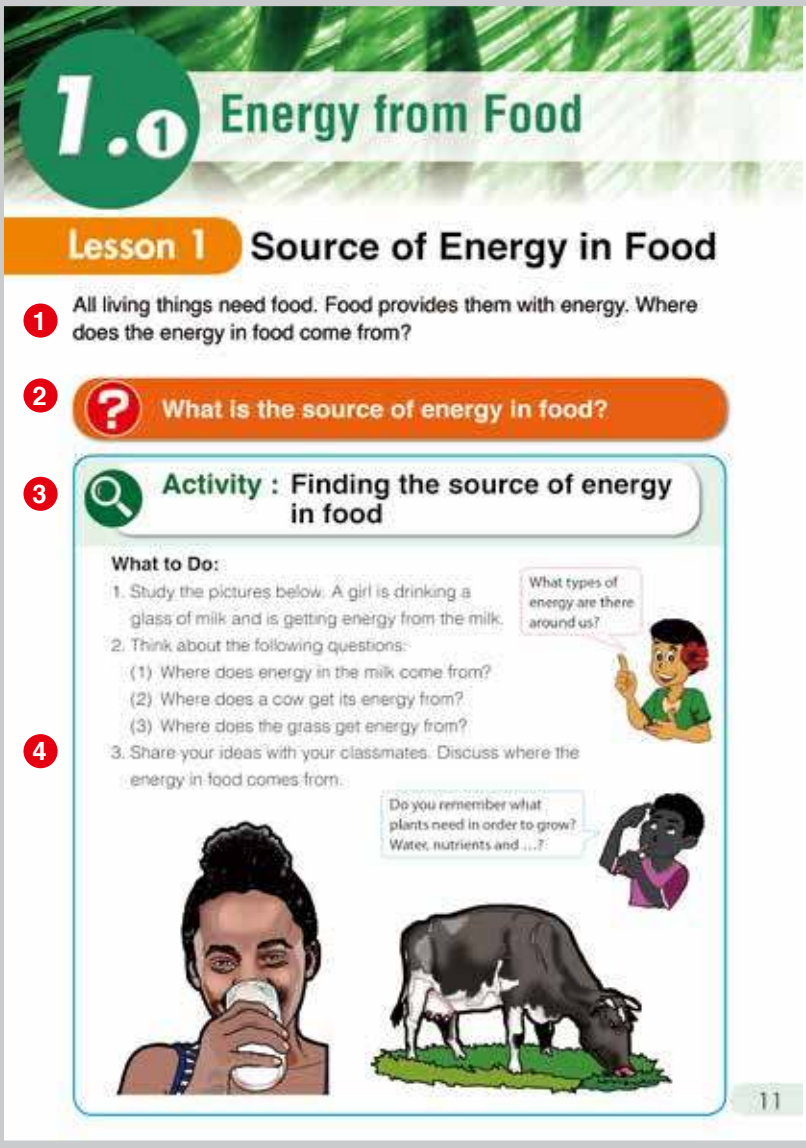

Teacher's Notes

In Grade 4 chapter 1 'Living things in the environment', students learnt about the basic needs of plants and animals, where animals get energy from the food they eat and how plants get energy from making their own food using sunlight, water and air.

The Flow of Energy through Plants and Animals

- Plants are food producers. They make food during photosynthesis.Refer to teachers note in Grade 4 Chapter 1, Lesson 1 for information about photosyntheisis.
- Plants need the energy from the sun light, carbondioxide that is exhaled from humans and animals and water taken in from roots to make their own food.
- Plants can convert light energy from the sun into chemical energy stored in the food they make during photosynesis. This energy is passed to other organisms through the food chain.

Source of Energy in Animals and Human

- Animals and humans get energy from the food they eat.
- For an organism to be recognised as a living thing, it must take in energy and use it to sustain life.
- Animals cannot produce energy directly from the sunlight. They must eat plants or other animals to acquire energy.

Lesson Objectives

Students will be able to:
- Identify sources of energy in food.
- Explain how plants use energy from the sun.
- Describe how animals get energy to survive.
- Participate in activity with curiosity.

Assessment

Students are able to:
- Describe sources of energy for plants and animals.
- State that plants use solar energy to make food.
- State that animals get energy from plants and other animals by eating.
- Enjoy finding out where energy in the food comes from.

Summary

Our food comes from plants. It is not only human beings who depend on plants directly or indirectly to get energy, but other animals too.
The Sun provides light and heat energy to the Earth. Almost all energy on Earth comes from the Sun.
Energy that comes from the Sun is called **solar energy**.
Plants do not eat food like animals. Plants make their own food by using water, carbon dioxide and light energy from the Sun. **Carbon dioxide** is a colourless and odourless gas produced by people or animals breathing out.
Plants use some energy in the food they make to survive and grow. Some are stored in the roots, stems and leaves.
Animals cannot make food like plants. They must eat food in order to get energy. Some animals get energy by eating plants as food. Some animals eat other animals that eat plants.
Plants get energy from the Sun. Some animals eat plants or animals as food to get energy. The source of energy in food comes from the Sun.

5

Almost all energy on Earth comes from the Sun.

Light energy
Carbon dioxide
Leaves make food
Water

Plants make food by using water, carbon dioxide and light energy

A horse eats plants.

A lion eats a zebra.

12

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

Q: Where do we get most of our energy from? (From the food we eat.)

Q: Where do plants get energy to make their food? (From the sun.)

Q:How does the energy from the sun helps plants? (Plants use the light energy from the sun, carbon dioxide and water to make their own food.)

Q:How does energy pass from animals which don't eat plants? (They get energy from the animals that eat plants.Example: A frog eats a grasshopper who eats grass.)

- 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: Where does the source of energy for plants come from?
  Q: Where do animals get their energy from to survive?
  Q: How do plants make their own food?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Source of Energy in Food**

Key question
What is the source of energy in food?
Activity: Finding the source of energy in food
1. Study diagram in text book
2. Think about these questions
- Where does energy in the milk come ? The cow
- Where does a cow gets its energy from? Grass /plant
- Where does the grass gets its energy from? The Sun

Discussion
Q:Where do we get most of our energy from? From the food we eat.
Q:From where do plants get their energy to make their food? From the sun.
Q:How does the energy from the sun helps plants? Plants use the light energy from the sun, carbon dioxide and water to make their own food.
Q: How does energy pass from animals which don't eat plants? They get energy from the animals that eats plants. Example: A frog eats a grasshopper who eats grass.

Summary
- Energy that comes from the Sun is called solar energy.
- Plants use some energy from the sun, water and carbon dioxide to make their own food to survive.
- People and animals eat plants as food to get energy.
- Some animals that don't eat plants eat other animals to get energy to survive.
- Plants get energy from the Sun.
- The source of energy in food comes from the Sun.

Unit: **Interaction in the Environment**	Chapter : **1. Energy in Food** Topic : **1.1 Energy from Food**	Total lesson No: 2 / 87 Textbook page: 13 - 14

Lesson 2 / 5

Lesson Title

Food Chains

Preparation

animal pictures, papers, markers

Lesson Flow

1 Introduction (5 min.)

- Recap previous lesson by asking:

Q: What do living things need to survive?
Q:Where does the source of energy for plants come from?
Q:Where do animals get their energy from?

- Encourage students to think of the flow of energy in food by asking:

Q:What do living things depend on to get energy?

2 Introduce the key question

How does energy flow through food?

3 Activity (25 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Allow students to study the picture in the textbook.
- Refer students to what the character is saying for their investigation.
- Ask students to do the activity.
- Give enough time to the students to find new ideas through the activity by themselves.
- 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.

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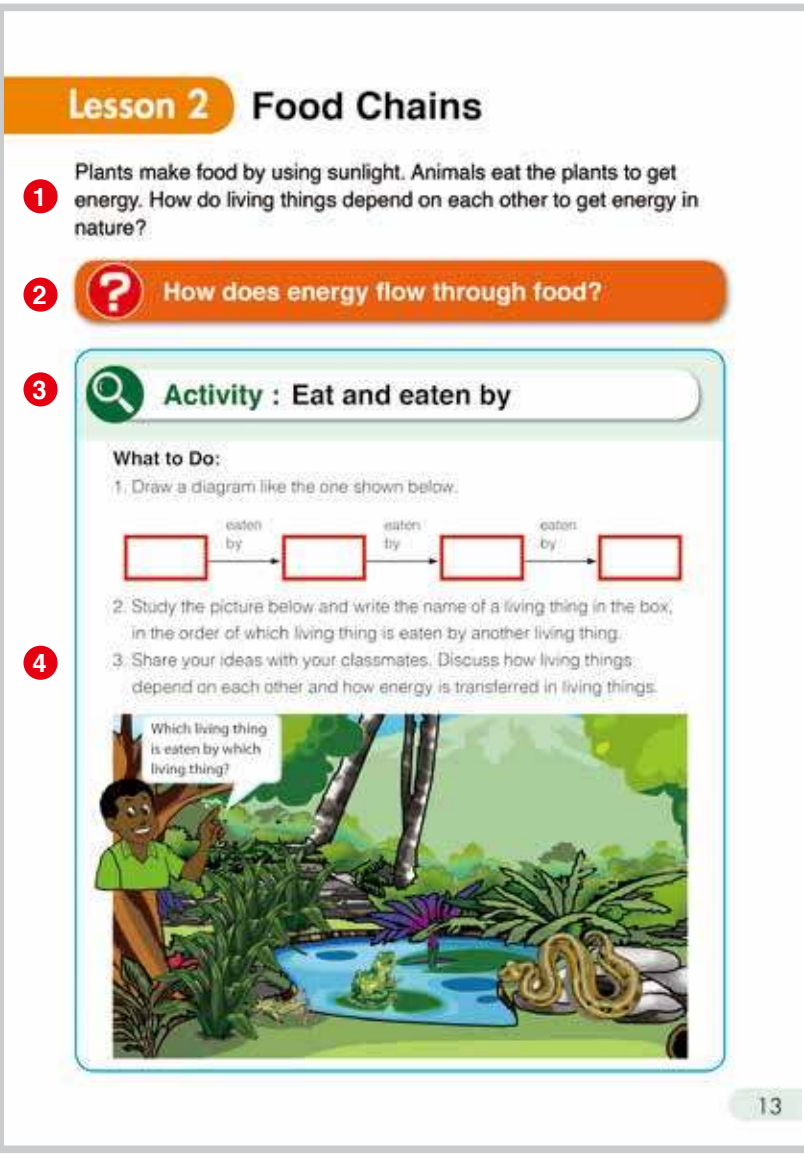


Teacher's Notes

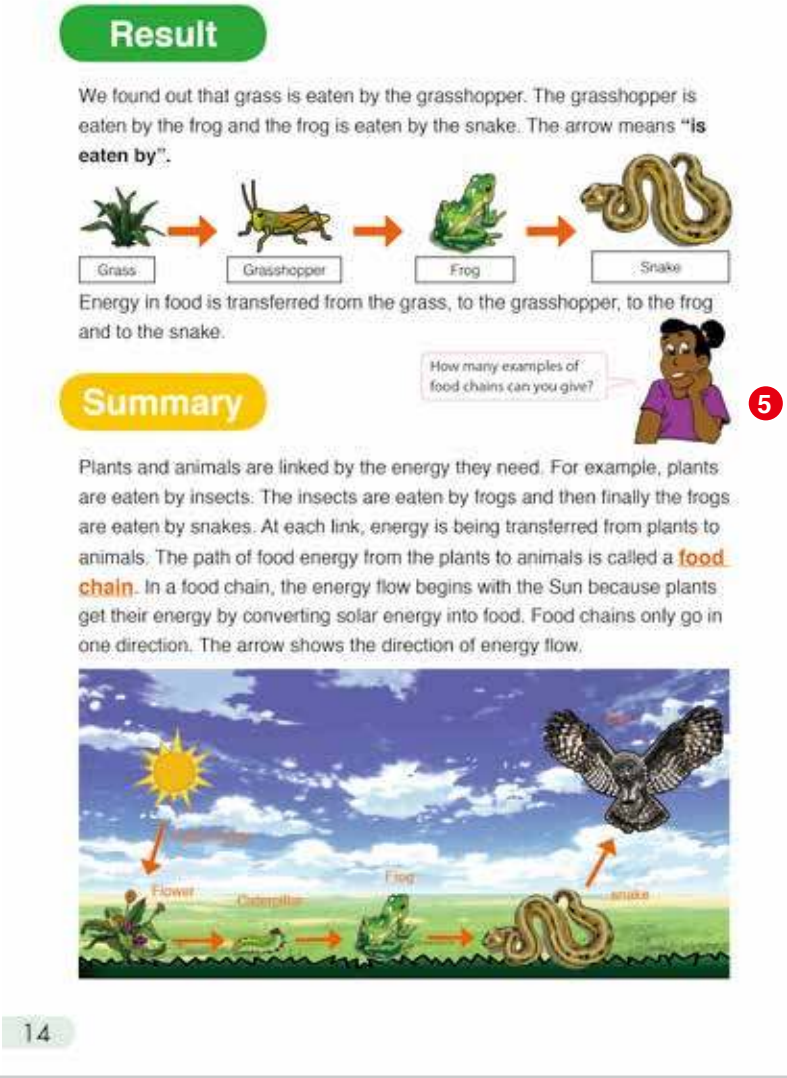
- A food chain will be taught in Grade 6 Chapter 1, lesson 2 'Food Chains in Different Environment'. In this lesson, students will identify food chains in different environment. In addition, students will learn about food web which is the combination of various food chains. This lesson is the foundation of Grade 6 Chapter 1, refer to these lessons prior to teaching this lesson.
- A food chain describes how different organisms eat each other, starting out with a plant and ending with an animal. Food chain in ecology is the sequence of transfers of matter and energy in the form of food from organism to organism. Food chains intertwine locally into a food web because most organisms consume more than one type of animal or plant. Plants, which convert solar energy to food by photosynthesis are the primary food source. In a predator chain, a plant-eating animal is eaten by a flesh-eating animal.
- Every living plant and animal must have energy to survive. Plants rely on the soil, water and the sun for energy. Animals rely on plants as well as other animals for energy.
- In an ecosystem, plants and animals all depend on each other to live. Scientists sometimes describe this dependence using a food chain or a food web.

Lesson Objectives

Students will be able to:
- Recognise how energy flows through food.
- Explain the meaning of a food chain.
- Appreciate the importance of living things in their environment.

Assessment

Students are able to:
- Draw the flow of energy from plants to animals in consideration of the relationship between 'eat' and 'be eaten by'
- State the definition of food chain.
- Express the importance of living things in their environment.



Result

We found out that grass is eaten by the grasshopper. The grasshopper is eaten by the frog and the frog is eaten by the snake. The arrow means **"is eaten by"**.

Grass → Grasshopper → Frog → Snake

Energy in food is transferred from the grass, to the grasshopper, to the frog and to the snake.

How many examples of food chains can you give?

Summary

Plants and animals are linked by the energy they need. For example, plants are eaten by insects. The insects are eaten by frogs and then finally the frogs are eaten by snakes. At each link, energy is being transferred from plants to animals. The path of food energy from the plants to animals is called a food chain. In a food chain, the energy flow begins with the Sun because plants get their energy by converting solar energy into food. Food chains only go in one direction. The arrow shows the direction of energy flow.

14

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

Q:Why does a grasshopper feed on plants/ grass? (To get food or energy to survive.)
Q:How do animals get energy? (By eating other animals and plants to get energy.)
Q:Where do plants get their energy from? (From the sun.)
Q:What do the arrows in the diagram represent? (It shows the relationship between 'eat' and 'eaten by'.)
Q:Why do the arrows in the food chain go in one direction? (Because it shows the natural way of living things feeding for survival and how energy flows.)
Q:How does the energy flow through food? (Energy in food flow from plants to other animals. Living things 'eat' or 'be eaten by' other living things, 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 is a food chain?
  Q:How does energy in food flow through?
  Q:What is the sources of energy in food chain?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Food Chains**

Key question
How does energy flow through food?

Activity: Eat and eaten

grass → grasshopper →
frog → snake

Discussion
Q: Why does a grasshopper feed on plants/ grass? To get food or energy to survive.
Q: How do animals get energy? By eating other animals and plants to get energy.
Q: Where do plants get their energy from? The sun.
Q: What do the arrows in the diagram represent? It shows the relationship between 'eat' and 'eaten by'.
Q: Why do the arrows in the food chain go in one direction? Because it shows the natural way of living things feeding for survival and how energy flows.
Q: How does the energy flow through food? Energy in food flow from plant to other animasl, living things 'eat' or 'be eaten by' other living things.

Summary
- A Food Chain is the path of food energy from the plants to animals.

The Sun → Flower
Caterpillar → Frog → Snake
Owl

- A food chain shows energy flow from the sun to plants and then to animals.
- A food chain only goes in one direction.

Unit: **Interaction in the Environment**	Chapter : **1. Energy in Food** Topic : **1.1 Energy from Food**	Total lesson No: 3 / 87 Textbook page: 15 - 16

Lesson 3 / 5

Lesson Title

Food Webs

Preparation

illustrated picture of food web

Lesson Flow

1 Introduction (5 min.)

- Recap previous lesson by asking:

Q:What is a food chain?

Q:How does energy flow from plants to animals?

Q:Why do the arrow in the food chain go in one direction?

- Provoke students thinking of food web by asking:

Q:What will happen to a food chain if a lot of living things live in an environment?

2 Introduce the key question

How do living things in an environment interact with each other?

3 Activity (20 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Ask students to study the picture and refer to what the character is saying for their investigation.
- 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 (25 min.)

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

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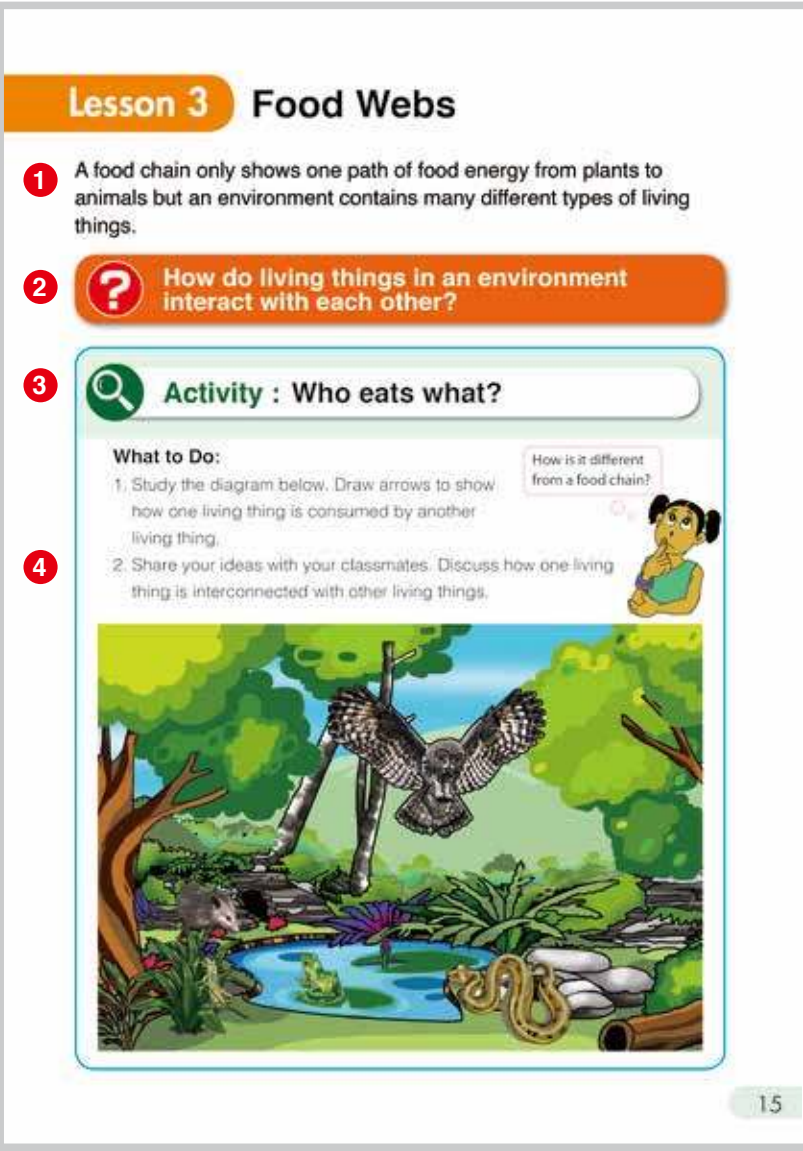

Lesson 3 Food Webs

1 A food chain only shows one path of food energy from plants to animals but an environment contains many different types of living things.

2 How do living things in an environment interact with each other?

3 Activity : Who eats what?

What to Do:

1. Study the diagram below. Draw arrows to show how one living thing is consumed by another living thing.
2. Share your ideas with your classmates. Discuss how one living thing is interconnected with other living things.

How is it different from a food chain?

4

15

Teacher's Notes

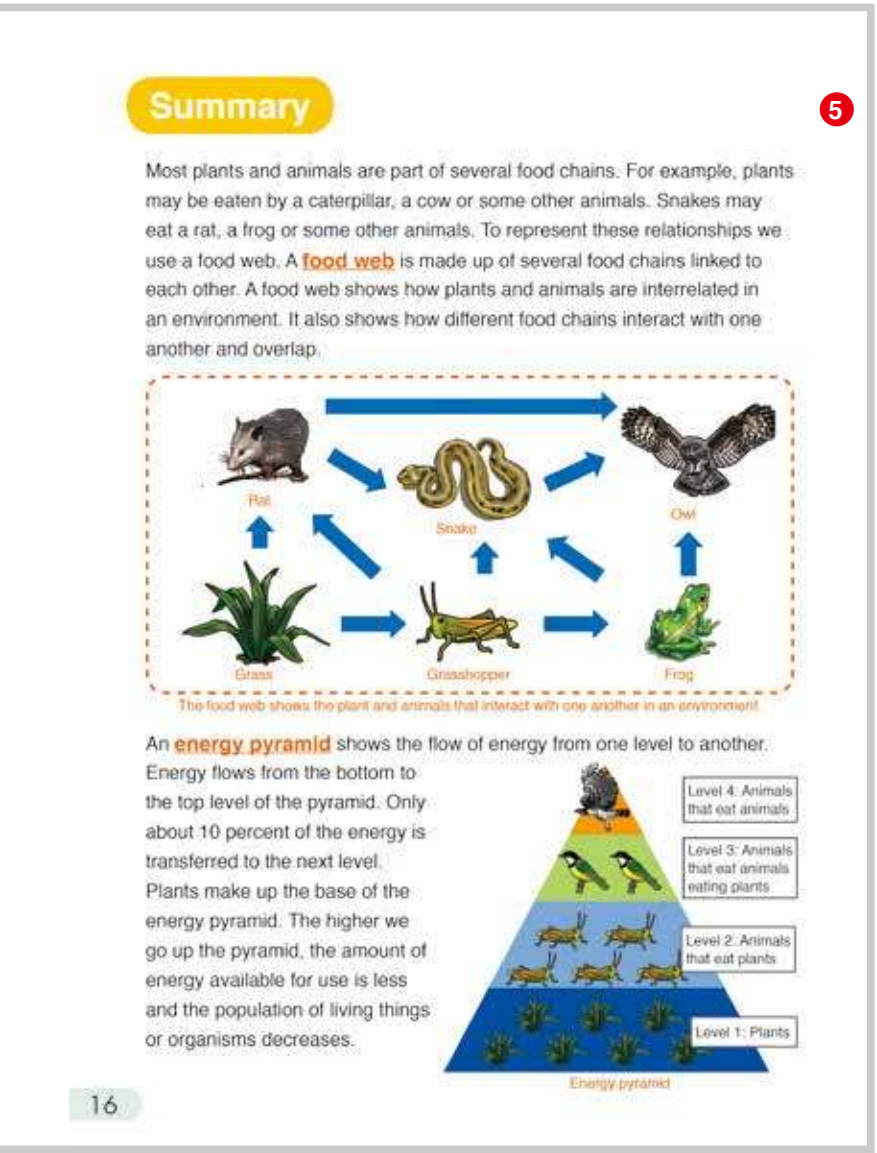
- A food web will be taught in Grade 6 Chapter 1, lesson 3 'Food Webs in Different Environment'. In this lesson, student will understand that a food web varies in different environments. Teachers are requested to refer to them prior to this lesson.
- A food web is the interconnection of food chains. We can find several food chains in a food web diagram in the textbook, for example:
  - Grass → Rat → Owl
  - Grass → Rat → Snake → Owl
  - Grass → Grassphopper → Frog → Owl
  - Grass → Grassphopper → Frog → Snake → Owl
  - Grass → Grassphopper → Rat → Snake → Owl
- An energy or trophic pyramid illustrates ecological relations among creatures. The first level (level 1) is plants, then herbivores (level 2), followed by primary prediators (level 3) and secondary prediators (level 4). Prediators are also called carnivores.

Lesson Objectives

Students will be able to:
- Understand what a food web is.
- Describe a food web.
- Explain what an energy pyramid is.

Assessment

Students are able to:
- State what a food web is by relating to food chains.
- Draw a food web to connect all living things in an environment.
- State the relationship between the amount of energy and the population of living things in an energy pyramid.



Summary

Most plants and animals are part of several food chains. For example, plants may be eaten by a caterpillar, a cow or some other animals. Snakes may eat a rat, a frog or some other animals. To represent these relationships we use a food web. A food web is made up of several food chains linked to each other. A food web shows how plants and animals are interrelated in an environment. It also shows how different food chains interact with one another and overlap.

The food web shows the plant and animals that interact with one another in an environment.

An energy pyramid shows the flow of energy from one level to another. Energy flows from the bottom to the top level of the pyramid. Only about 10 percent of the energy is transferred to the next level. Plants make up the base of the energy pyramid. The higher we go up the pyramid, the amount of energy available for use is less and the population of living things or organisms decreases.

Energy pyramid

16

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

Q:Which animals eat grass? (Rat and grasshopper.)
Q:What animals does a snake eat? (Rat, grasshopper and frog.)
Q:Which animal is eaten by an owl? (Rat, snake and frog.)
Q:How many food chains can you find in this picture? (More than 5 food chains.)
Q:Can you guess which living thing would have the most and least population in the environment? (Grass is the most, owl is the least.)

- Conclude the discussions.

5 Summary (10 min.)

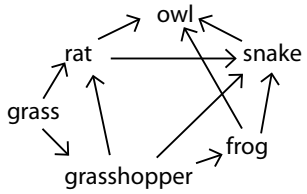
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q:What is a food web?
  Q:How are a food web and a food chain different?
  Q:What is an energy pyramid?
  Q:Explain the relationship between the amount of energy and the population of living things in an energy pyramid.
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Food Webs

Key question : How do living things in an environment interact with each other?
Activity: Who eats what.



Discussion

Q: Which animals eat grass? Rat and grasshopper.
Q:What animals does a snake eat? Rat, grasshopper and frog.
Q:Which animal is eaten by an owl? Rat, snake and frog.
Q:How many food chains can you find in this picture? More than 5 food chains.
Q:Can you guess which living thing would have the most and least population in the environment? Grass is the most, owl is the least.

Summary

- A food web is made up of several connected food chains together.
- A food web shows:
  How plant and animals are interrelated in an environment.
  How different food chains interact with one another and overlap.
- An energy pyramid shows the flow of energy from one level to another.
- The higher we go up the pyramid, the amount of energy available for use is less and the population of living things decreases.

Unit: **Interaction in the Environment**	Chapter : **1. Energy in Food** Topic : **1.1. Energy from Food**	Total lesson No: 4/ 87 Textbook page: 17 - 19

Lesson 4 / 5

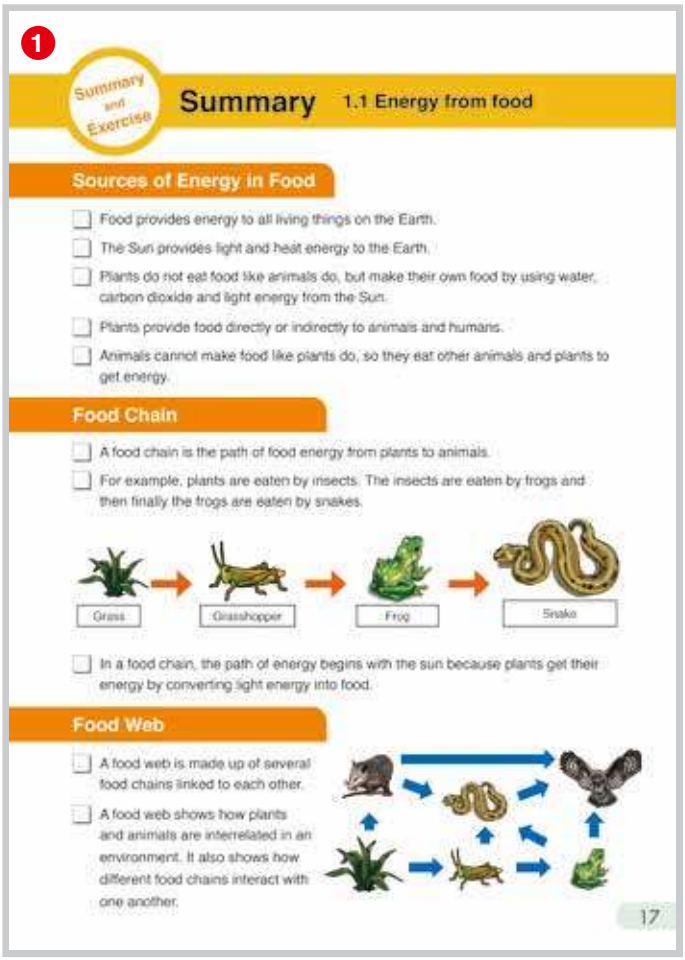
Lesson Title

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: What does food provide?
  - Q: Where do plants get their energy from?
  - Q: What is the difference between a food chain and a food web?
- 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.



1

Summary and Exercise

Summary 1.1 Energy from food

Sources of Energy in Food

- ☐ Food provides energy to all living things on the Earth.
- ☐ The Sun provides light and heat energy to the Earth.
- ☐ Plants do not eat food like animals do, but make their own food by using water, carbon dioxide and light energy from the Sun.
- ☐ Plants provide food directly or indirectly to animals and humans.
- ☐ Animals cannot make food like plants do, so they eat other animals and plants to get energy.

Food Chain

- ☐ A food chain is the path of food energy from plants to animals.
- ☐ For example, plants are eaten by insects. The insects are eaten by frogs and then finally the frogs are eaten by snakes.

- ☐ In a food chain, the path of energy begins with the sun because plants get their energy by converting light energy into food.

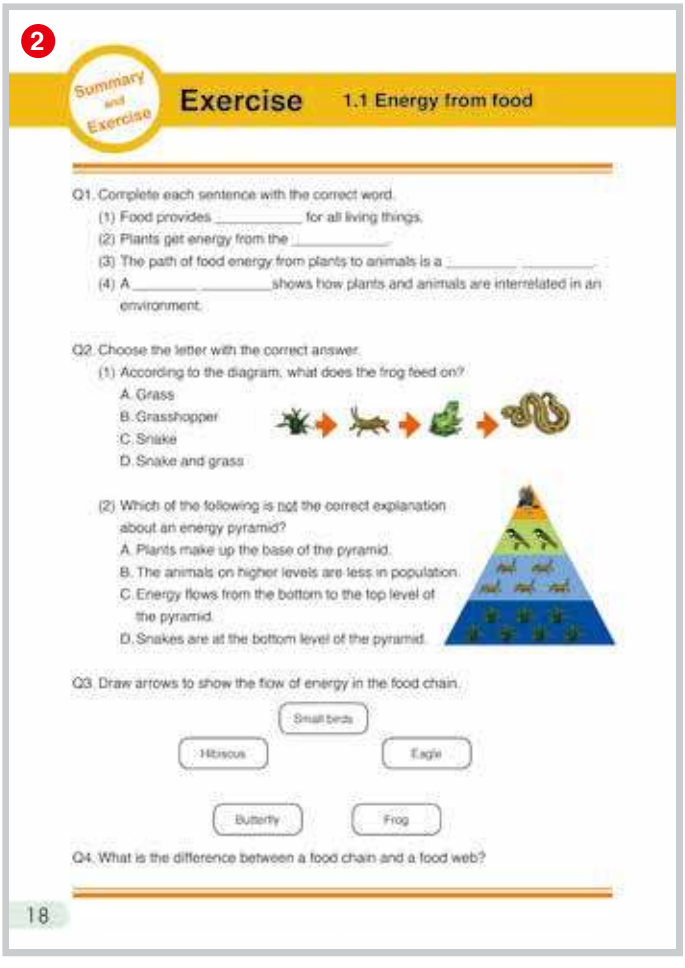
Food Web

- ☐ A food web is made up of several food chains linked to each other.
- ☐ A food web shows how plants and animals are interrelated in an environment. It also shows how different food chains interact with one another.

17

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.



2

Summary and Exercise

Exercise 1.1 Energy from food

Q1. Complete each sentence with the correct word.

(1) Food provides _____ for all living things.
(2) Plants get energy from the _____.
(3) The path of food energy from plants to animals is a _____.
(4) A _____ shows how plants and animals are interrelated in an environment.

Q2. Choose the letter with the correct answer.

(1) According to the diagram, what does the frog feed on?

A. Grass
B. Grasshopper
C. Snake
D. Snake and grass

(2) Which of the following is not the correct explanation about an energy pyramid?

A. Plants make up the base of the pyramid.
B. The animals on higher levels are less in population.
C. Energy flows from the bottom to the top level of the pyramid.
D. Snakes are at the bottom level of the pyramid.

Q3. Draw arrows to show the flow of energy in the food chain.

Q4. What is the difference between a food chain and a food web?

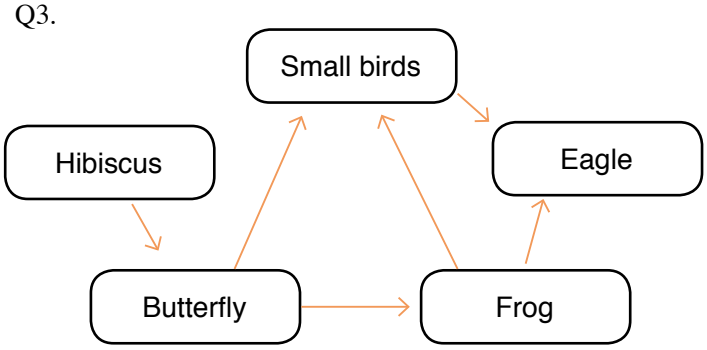
18

Exercise answers

Q1.
(1) **energy**
(2) **sunlight**
(3) **food chain**
(4) **food web**

Q2.
(1) **B**
(2) **D**

Q3.

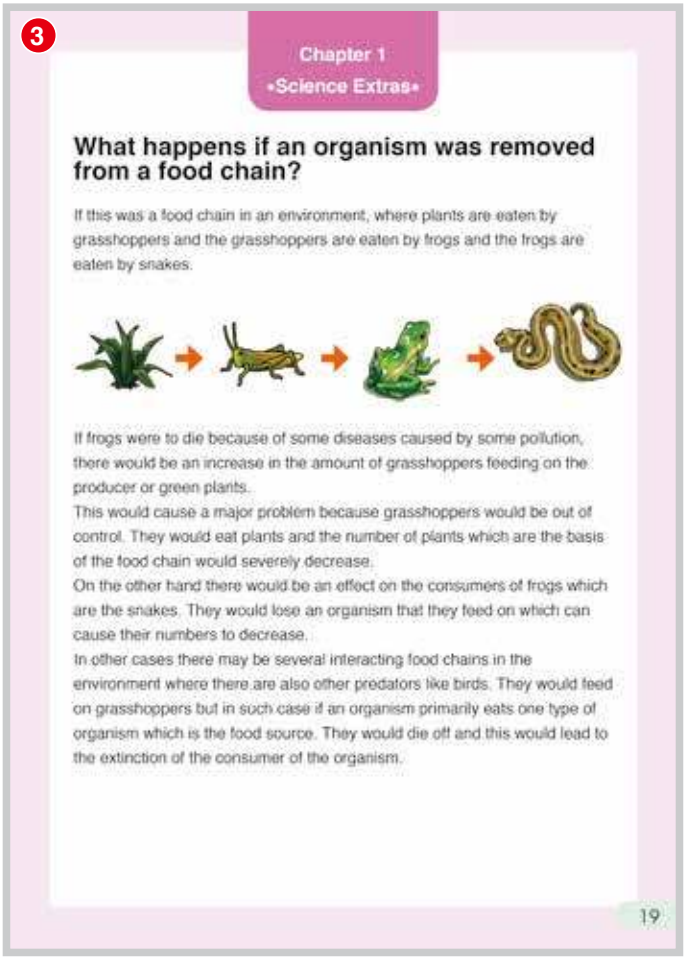


Q4. Expected answer
In a food chain the energy begins from the sun and the arrow showing the transfer of energy is only in one direction. However in a food web which is made up of several food chains more arrows connect more animals and is more complex.

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.



3

Chapter 1
•Science Extras•

What happens if an organism was removed from a food chain?

If this was a food chain in an environment, where plants are eaten by grasshoppers and the grasshoppers are eaten by frogs and the frogs are eaten by snakes.

If frogs were to die because of some diseases caused by some pollution, there would be an increase in the amount of grasshoppers feeding on the producer or green plants.
This would cause a major problem because grasshoppers would be out of control. They would eat plants and the number of plants which are the basis of the food chain would severely decrease.
On the other hand there would be an effect on the consumers of frogs which are the snakes. They would lose an organism that they feed on which can cause their numbers to decrease.
In other cases there may be several interacting food chains in the environment where there are also other predators like birds. They would feed on grasshoppers but in such case if an organism primarily eats one type of organism which is the food source. They would die off and this would lead to the extinction of the consumer of the organism.

19

Lesson 5 / 5

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

1. Energy in Food

Q1 Complete each sentence with the correct word.

(1) The Sun provides light and solar energy to Earth.

(2) Plants make their own food by using water, carbon dioxide and light energy from the Sun.

(3) The flow of energy from one level to another is shown as a energy pyramid in which the energy flows from the bottom to the top.

(4) A Food web is made up of several food chains linked to each other.

Q2 Choose the letter with the correct answer.

(1) In a food chain where do plants get the energy from?

(A) Solar energy
B. Animals
C. Insects
D. Other plants

(2) Study the pyramid on the right and identify which statement is true about it.

A. The energy flows from the top to the bottom level of the pyramid
(B) Only 10% of the energy is transferred to the next level.
C. Animals make up the base of the pyramid.
D. Plants make up the top of the pyramid.

(3) Which part of the plant makes food for the plant?

A. Root
B. Stem
(C) Leaves
D. Flower

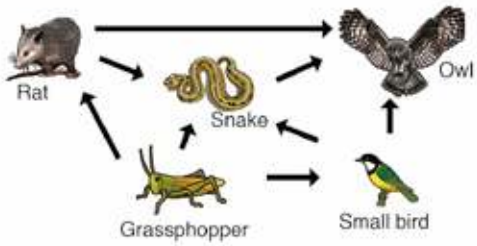
(4) Which of the following shows a correct food chain?

(A) peanut → rat → snake
B. grass → snake → eagle
C. peanut → eagle → grasshopper
D. grass → snake → grasshopper

20

Q3

Study the food web below and answer the following questions.



(1) Which organism eats the snake?
Owl

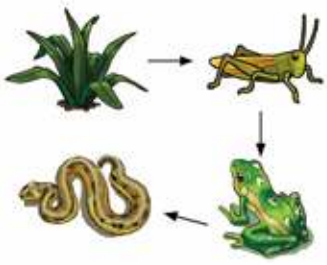
(2) Which organism in the picture would have the largest population?
Grasshopper

(3) Which organism in the picture would have the smallest population?
Owl

(4) If you are to represent the organisms in the picture as an energy pyramid, what organism would be at the top of the pyramid?
Owl

Q4

The picture on the right shows a food chain where a grasshopper feeds on the grass, a frog feeds on the grasshopper and a snake feeds on the frog.



What would happen to the population of grasshopper and snake if all the frogs in the area were killed by chemicals? Write the answer with your reason.

Grasshopper: (Expected answer) The population of grasshoppers will increase as there is no predator which is the frog to feed on it.

Snake: (Expected answer) The population of snakes will decrease as there is less food for snakes in the area.

Chapter 2. Force and Machine

Chapter Objectives

Students will be able to understand how force changes the speed and direction of an object through simple experiments. Students will also be able to understand how an object can be lifted with less effort by using a lever and the law of balancing a lever.

Topic Objectives

2.1 Change in Motion

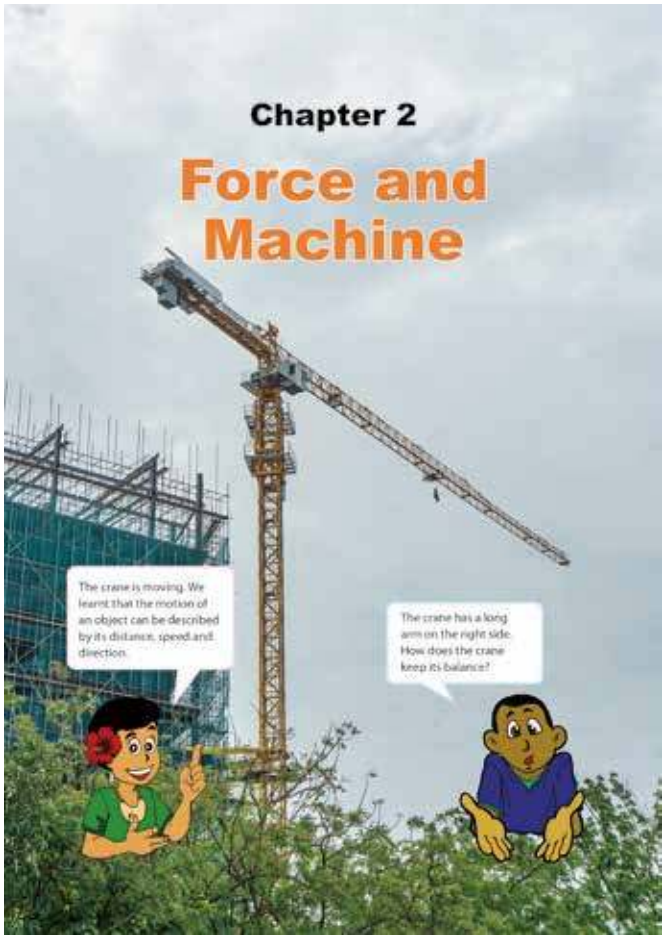
Students will be able to;

- Describe that a force can change the speed of an object to accelerate or decelerate.
- Explain gravity as the force that changes the direction of the ball thrown in the air.

2.2 Regularity of Levers

Students will be able to;

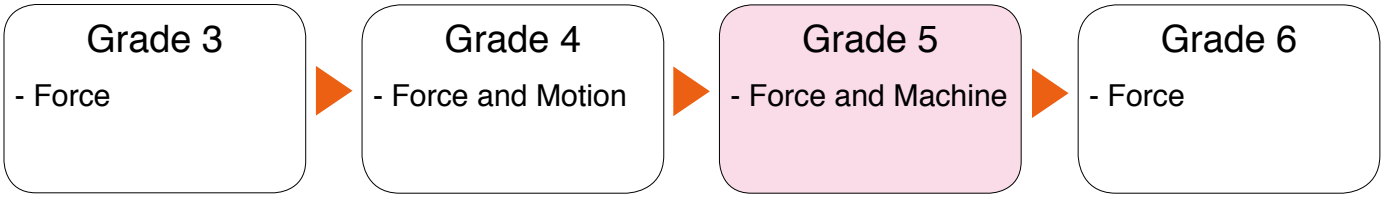
- Explain that lesser effort is needed to lift the load, when the effort is applied further away from the fulcrum.
- Explain that lesser effort is needed to lift the load, when the object is placed at a shorter distance from the fulcrum.
- Identify that a lever is balanced when the product of the weight and distance from the fulcrum on the left arm is the same as the one on the right arm.



This picture is from the chapter heading of the textbook showing a crane at a construction site. The crane has a weight on the left side to keep it balanced.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Motion of an object is described by its distance, speed and direction and can be measured.
- There are six types of simple machines that can make work easier such as: inclined plane, pulleys, wheel and axle, wedge, screw and lever.

Teaching Overview

This chapter consists of 8 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
2.1 Change in Motion	1	**Change in Speed** How does an applied force change the speed of an object?	5.2.3	23 - 24
	2	**Change in Direction** How does a force change the direction of a moving object?		25 - 26
	3	Summary and Exercise		27 - 28
2.2 Regularity of Levers	4	**Lifting a Load Using a Lever: 1** How can we lift an object using a lever with less force?		29 - 30
	5	**Lifting a Load Using a Lever: 2** How does the distance from a fulcrum to a load affect an effort?		31 - 32
	6	**Law of Lever to Balance** How can we balance a lever?		33 - 34
	7	Summary and Exercise, Science Extra		35 - 37
Chapter Test	8	Chapter Test		38 - 39

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.1 Change in Motion**	Total lesson No: 6 / 87 Textbook page: 23 - 24

Lesson 1 / 8

Lesson Title

Change in Speed

Preparation

2 m rain water gutter, marble, stopwatch, books, ruler

Lesson Flow

1 Introduction (5 min.)

- Review the learnt content on Force and Motion in Gr 4. Ask:

Q:What can force do to an object?

(Force can change the speed, direction, shape and size of an object.)

- Encourage the students to think about how a force can change the speed of an object.

2 Introduce the key question

How does an applied force change the speed of an object?

3 Activity (30 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask the students to conduct the activity and record their findings in the table.
- Explain how to calculate the average of distance and the speed of a marble.
- Ask students to calculate the average of distance and the speed.
- Give enough time for students to calculate the speed through activity.
- Ask students to discuss their findings with their groups.

4 Discussion for findings (15 min.)

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

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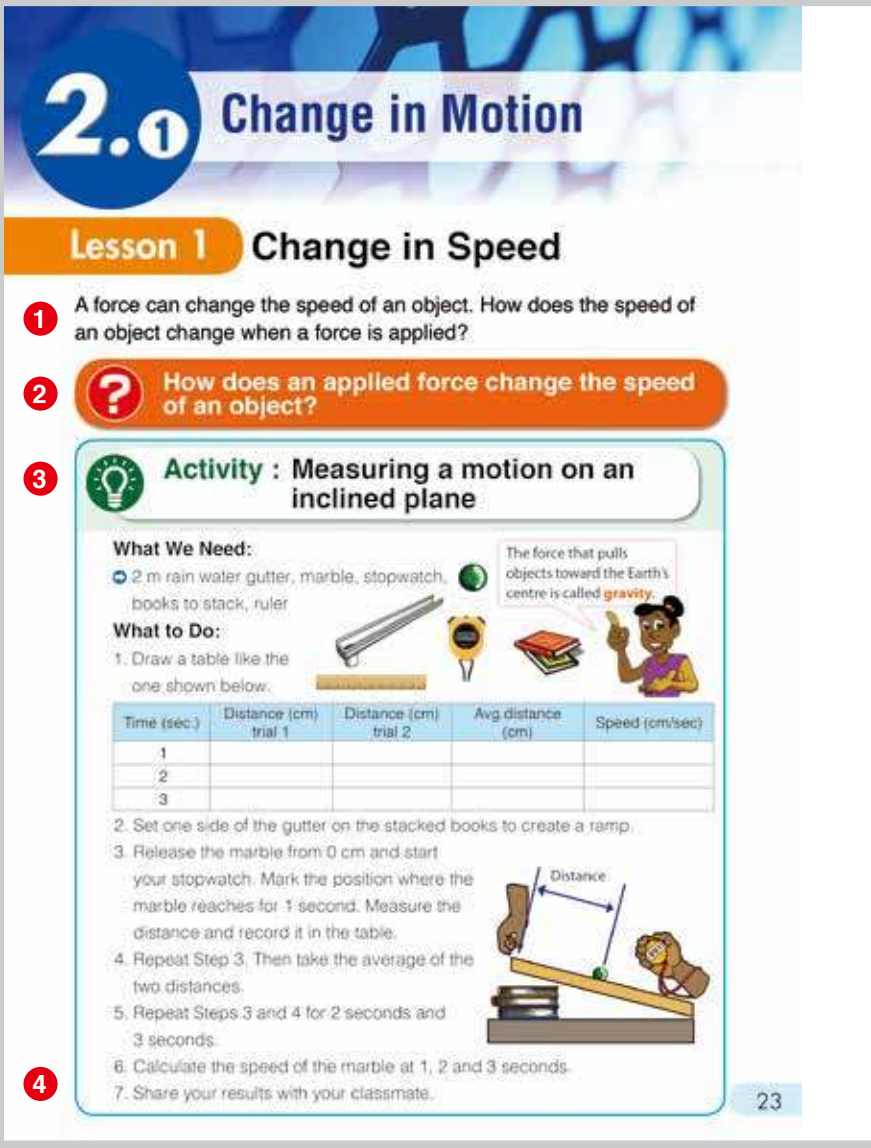


2.1 Change in Motion

Lesson 1 Change in Speed

1 A force can change the speed of an object. How does the speed of an object change when a force is applied?

2 How does an applied force change the speed of an object?

3 Activity : Measuring a motion on an inclined plane

What We Need:

2 m rain water gutter, marble, stopwatch, books to stack, ruler

The force that pulls objects toward the Earth's centre is called gravity.

What to Do:

1. Draw a table like the one shown below.

Time (sec.)	Distance (cm) trial 1	Distance (cm) trial 2	Avg distance (cm)	Speed (cm/sec)
1				
2				
3				

2. Set one side of the gutter on the stacked books to create a ramp.
3. Release the marble from 0 cm and start your stopwatch. Mark the position where the marble reaches for 1 second. Measure the distance and record it in the table.
4. Repeat Step 3. Then take the average of the two distances.
5. Repeat Steps 3 and 4 for 2 seconds and 3 seconds.
6. Calculate the speed of the marble at 1, 2 and 3 seconds.
7. Share your results with your classmate.

Distance

4

23

Teacher's Notes

Height (cm)	6	8	10
Time (s)	Distance (cm)		
0.5	4	5	6
1.0	10	20	25
1.5	34	45	56
2.0	60	80	100
2.5	94	125	156
3.0	135	180	225

- This is the reoccurrence of the very famous Galileo Galilei's experiment when he found the theory of free fall in the 17th century. It is recommended to set up the ramp with 6-10 cm height against 2 m long gutter for relevant observation.
- Table at left shows the relationship in theory between time and distance moved in a ramp with 6 cm, 8 cm and 10 cm height respectively. If the ramp is bent or the surface of the ramp is rough, the result may be significantly different from that in theory. Teachers are requested to check in advance if you can get similar values.
- If you cannot find a rainwater gutter, you can use a flat wooden plate instead. We recommend grooving the plate to make a track for the marble to roll down properly. Or you can use a cylinder shape object such as a spray can or a tin can instead of a marble so that you can keep the movement properly even on the flat surface.
- A tin can must have enough weight to roll down properly. In addition, a content of a can must be filled uniformly, as movement of contents inside of a can may disturb the rolling.

Lesson Objectives

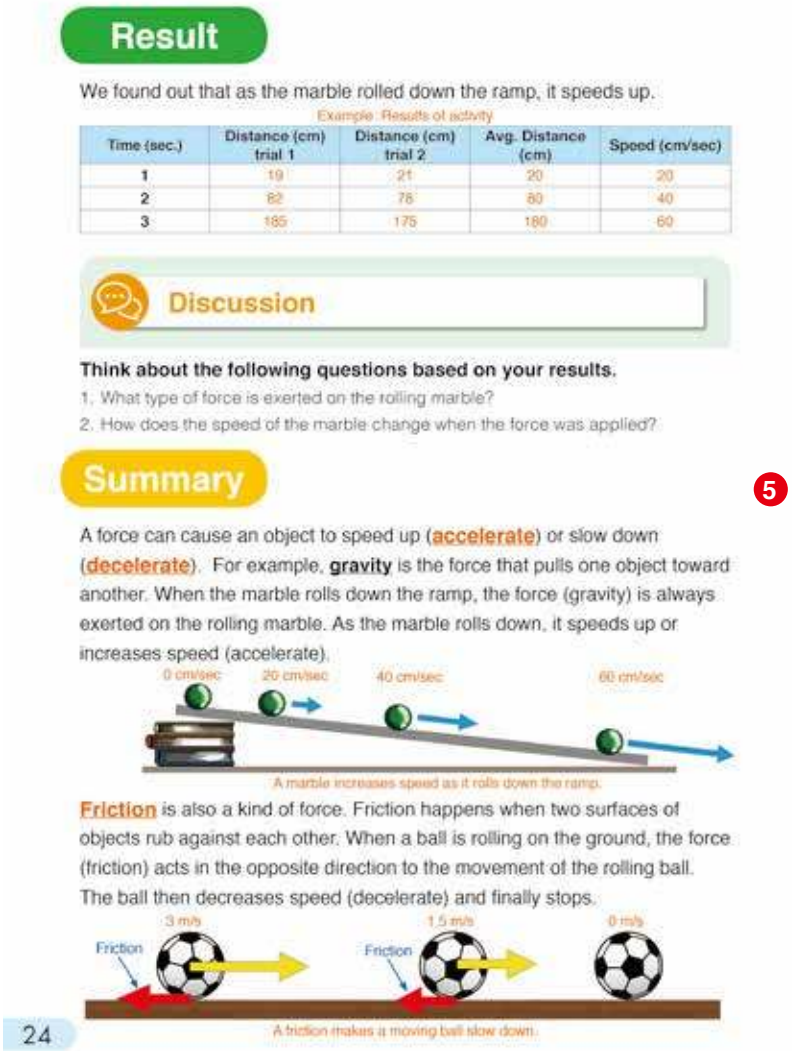
Students will be able to:

- Describe how the speed of an object changes when force is applied.
- Experiment the change in the speed of an object when force is applied.
- Set up the materials in the activity correctly.

Assessment

Students are able to:

- Explain how gravity and friction change the speed of an object.
- Find out how gravity changes the speed of a ball by analysing the results of the experiment.
- Show eagerness to participate in finding the change in speed caused by a force.



Result

We found out that as the marble rolled down the ramp, it speeds up.

Example: Results of activity

Time (sec.)	Distance (cm) trial 1	Distance (cm) trial 2	Avg. Distance (cm)	Speed (cm/sec)
1	19	21	20	20
2	82	78	80	40
3	185	175	180	60

Discussion

Think about the following questions based on your results.

1. What type of force is exerted on the rolling marble?
2. How does the speed of the marble change when the force was applied?

Summary

A force can cause an object to speed up (accelerate) or slow down (decelerate). For example, **gravity** is the force that pulls one object toward another. When the marble rolls down the ramp, the force (gravity) is always exerted on the rolling marble. As the marble rolls down, it speeds up or increases speed (accelerate).

A marble increases speed as it rolls down the ramp.

Friction is also a kind of force. Friction happens when two surfaces of objects rub against each other. When a ball is rolling on the ground, the force (friction) acts in the opposite direction to the movement of the rolling ball. The ball then decreases speed (decelerate) and finally stops.

A friction makes a moving ball slow down.

24

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

Q:What type of force is exerted on the rolling marble? (Gravity is the force exerted on the rolling marble.)

Q:How does the speed of the marble change when the gravity is applied to it? (The marble increases in speed during the roll down the ramp because the force of gravity is always pulling on it.)

Q:What is friction? (A force that makes an object slow down and stop when two surfaces of objects are rubbed against each other.)

Q:How does the speed of a ball change when a ball is rolling on the ground? (The speed of the ball decreases.)

- Conclude the discussions.

5 Summary (10 min.)

- Ask the student to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q:How does gravity change the speed of an object?
  Q: How does the friction force change the speed of a moving object?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Change in Speed

Key question

How does an applied force change the speed of an object?

Activity: Measuring a motion on an inclined plane.

Time	Distance trial 1	Distance trial 2	Average distance	Speed
1	19	21	20	20
2	82	78	80	40
3	185	175	180	60

Discussion

Q: What type of force is exerted on the rolling marble? Gravity is the force exerted on the rolling marble.

Q: How does the speed of the marble change when gravity is applied to it? The marble increases in speed during the roll down the ramp because the force of gravity is always pulling on it.

Q: What is friction? A force that makes an object slow and stop when two surfaces of objects are rubbed against each other.

Q: How does the speed of a ball change when a ball is rolling on the ground? The speed of the ball decreases.

Summary

- A force can cause an object to speed up (accelerate) or slow down (decelerate).

Example:

- Gravity increases the speed of an object moving downwards.
- Friction acts in the opposite direction of the moving object and slows it down.

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.1. Change in Motion**	Total lesson No: 7 / 87 Textbook page: 25 - 26

Lesson 2 / 8

Lesson Title

Change in Direction

Preparation

ball

Lesson Flow

1 Introduction (5 min.)

- Review the previous content. Ask:

Q:What can a force do to the speed of an object?

- Encourage the students to think about how a force can change the speed of an object by asking:

Q:What would happen to the direction of an object when force is applied?

2 Introduce the key question

How does a force change the direction of a moving object?

3 Activity (30 min.)

- Explain the steps of the activity.
- Let students to predict how the speed and the direction of a ball changes. Record their prediction in the table.
- Ask the students to conduct the activity and record their findings in the table.
- Give enough time for students to do their findings.
- Check each group during the activity by asking: 'How does the ball change direction?'
- Ask students to dicuss their results with their groups.

4 Discussion for findings (15 min.)

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

(Continue)

Lesson 2 Change in Direction

1 A force can cause an object to speed up or slow down. What would happen to the direction of a moving object when a force is applied to it?

2 How does a force change the direction of a moving object?

3 Activity : Throwing a ball up straight

What We Need:
- a ball

What to Do:

Let's observe the change in the direction of the ball when you throw it up straight.

1. Draw a table like the one shown below.

	How does it change?	
	Your prediction	Your observation
Speed		
Direction		

2. Predict how the speed and the direction of the ball change when you throw it up straight into the air.
3. Throw the ball up straight in the air. Observe how the speed and the direction of the ball changes. Record your observations in the table.
4. Share your observations with your classmate. Discuss how a force changes the direction of an object in motion.

4

What types of force are exerted on the ball?

25

Teacher's Notes

- As the theory of free fall discovered by Galileo Galilei explained, the light object and the heavy object fall in the same time theoretically if there is no air. If you can prepare balls of different sizes and weights, the variety will assist students to clearly understand the movement of object in midair.
- However, in real life, very light objects like balloons can be easily blown by the wind and it may confuse students to summarise the key learning concepts. Teachers should prepare balls with enough weight such as a soccer ball, a basketball and a cricket ball. Indoor is preferable to avoid the influence of the wind. Turn off indoor fans if you have.
- Noise caused by the ball when it hits the floor may disturb the activity. Ask students to catch the ball.
- An object slows down as it goes up because of the pull of gravity on it. At some point in midair it changes direction and increases in speed as it falls back to the ground (towards the center of the earth). Guide students to focus on the point where and when the ball changes direction from up to downward direction and its momentum (speed upwards and downwards).

Lesson Objectives

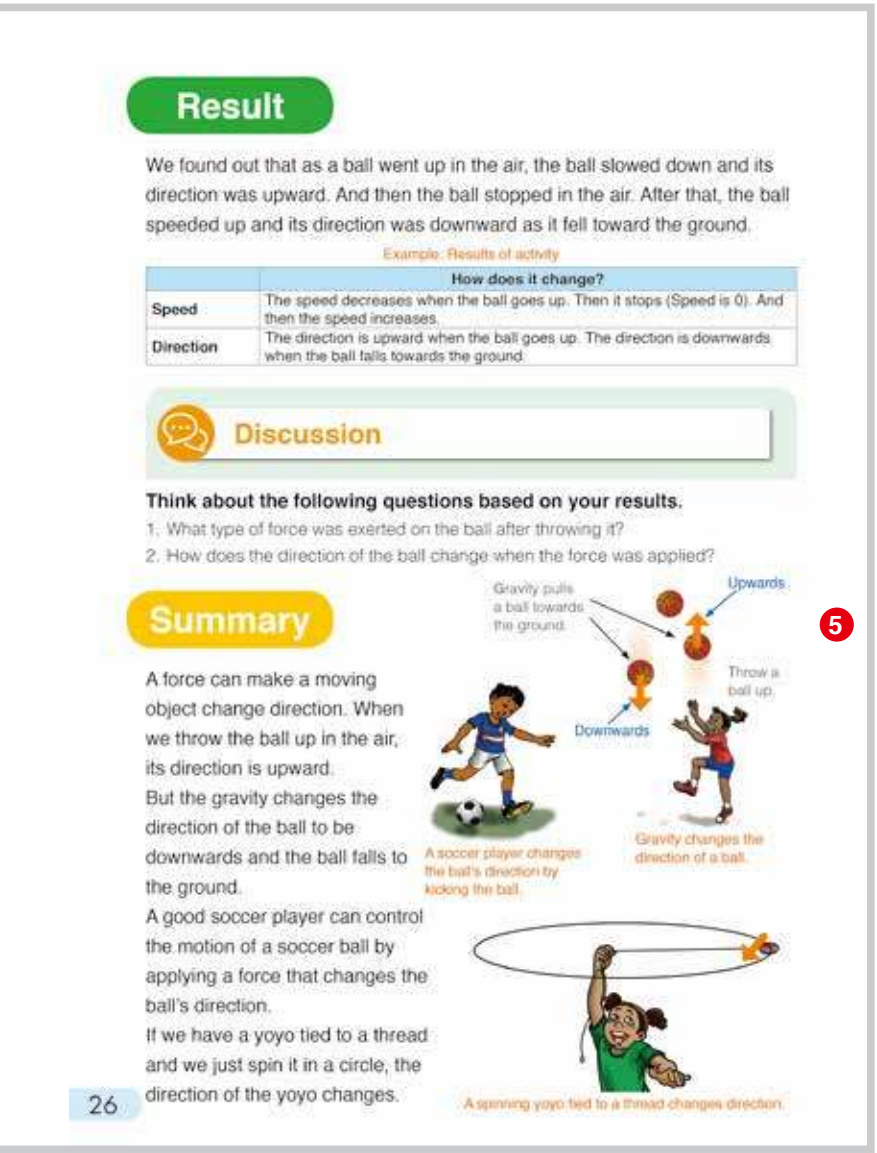
Students will be able to:

- Identify how a force changes the direction of an object.
- Observe the changes in the direction of an object when the force is applied.
- Experiment cooperatively in the activity.

Assessment

Students are able to:

- Explain how gravitational force changes the direction of an object.
- Find out how gravity changes the direction of a ball by observing the results of the activity.
- Cooperate with peers to identify the change in the direction caused by a force of gravity.



Result

We found out that as a ball went up in the air, the ball slowed down and its direction was upward. And then the ball stopped in the air. After that, the ball speeded up and its direction was downward as it fell toward the ground.

Example: Results of activity

	How does it change?
Speed	The speed decreases when the ball goes up. Then it stops (Speed is 0). And then the speed increases.
Direction	The direction is upward when the ball goes up. The direction is downwards when the ball falls towards the ground.

Discussion

Think about the following questions based on your results.

1. What type of force was exerted on the ball after throwing it?
2. How does the direction of the ball change when the force was applied?

Summary

A force can make a moving object change direction. When we throw the ball up in the air, its direction is upward. But the gravity changes the direction of the ball to be downwards and the ball falls to the ground.

A good soccer player can control the motion of a soccer ball by applying a force that changes the ball's direction.

If we have a yoyo tied to a thread and we just spin it in a circle, the direction of the yoyo changes.

26

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

Q:What type of force is exerted on the ball after throwing it? (The force of gravity.)

Q:How does the direction of the ball change when force is applied to it?
(The ball changes direction from upwards to downwards when the force of gravity pulls the ball downwards after it is being thrown into the air.)

Q:Can you give any examples that a force changes the direction of a moving object around us? (It depends on students' answers.)

- Conclude the discussions.

5 Summary (10 min.)

- Ask the 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 type of force changes the direction of a moving ball in the air?
  Q: How does gravity change the direction of an object from upward to downward direction?
- Ask students to copy the notes on the blackboard into their exercise books..

Sample Blackboard Plan

Title:

Change in Direction

Key question

How does a force change the direction of a moving object?

Activity: Throwing a ball up straight.

	How does it change	
	Your prediction	Your observation
Speed	(write student idea)	refer to textbook
Direction	(write student idea)	refer to textbook

Discussion

Q:What type of force is exerted on the ball after throwing it? The force of gravity.

Q:How does the direction of the ball change when force is applied to it?
The ball changes direction from upwards to downwards when the force of gravity pulls the ball downwards after it is being thrown into the air.

Q:Can you give any examples that a force changes the direction of a moving object around us? (It depends on students' answers.)

Summary

- A force can change the direction of the moving object.
- Gravity is the force that changes the directions of the moving object.

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.1. Change in Motion**	Total lesson No: 8 / 87 Textbook page: 27 - 28

Lesson 3 / 8

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: What kind of forces affect a moving object?
  - Q: How do these forces affect the moving object?
- 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.

1

Summary and Exercise

Summary 2.1 Change in Motion

Change in Speed

- A force can cause a moving object to speed up (accelerate) or slow down (decelerate).
- Gravity is a force that pulls one object towards another object.
- As an object rolls down a ramp, it increases speed due to gravity.
- Friction is a force that happens when two surfaces of two objects rub against each other.
- Friction always acts in the opposite direction of the moving object. When an object is rolling on the ground, the object decreases speed and finally stops due to friction.

Friction occurs and acts in the opposite direction of the moving ball.

Change in Direction

- A force can make a moving object change direction.
- Gravity changes the direction of the ball moving upward to downward.
- A soccer player can control the motion of the ball by applying a force that changes the ball's direction.

27

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.

2

Summary and Exercise

Exercise 2.1 Change in Motion

Q1. Complete each sentence with the correct word.
(1) The force that pulls one object towards another is called _____.
(2) Force that happens when two surfaces rub against each other is called _____.

Q2. Choose the letter with the correct answer.
(1) What happens when the marble rolls down a ramp?
A. It accelerates in speed.
B. It decelerates in speed.
C. Its speed remains the same.
D. It decreases the speed.
(2) Which sentence is true when we throw a ball into the air?
A. The ball does not change its direction when thrown in the air.
B. The ball decreases speed as it falls back to the ground.
C. The speed of the ball is the same when it was thrown in the air.
D. The ball changes direction when gravity acts on it and falls downwards.

Q3. Study the picture and answer the question.

The ball was rolling on the rough ground at position (i) and finally stopped its motion at position (iii). How can you describe the motion of the ball from position (i) to (iii)?

Q4. Mero measured the speed of a moving car every 5 seconds. Look at his record shown in the table on the right. Identify whether the car accelerated or decelerated and explain the reason of you answer.

Time (sec.)	Speed (m/s)
5	10
10	20
15	30

28

Exercise answers

Q1.
(1) **gravity**
(2) **friction**

Q2.
(1) **A**
Explain: The marble increases its speed or accelerates as it rolls down the ramp. The force of gravity also pulls the marble down the ramp. As it travels the distance it increases more in speed.
(2) **D**
Explain: When the ball is thrown (upward) into the air gravity still acts (pull) on it and slows down (decelerate) its speed as it goes up, eventually stopping the ball in mid-air. This changes the direction of the ball to fall back to the ground. The ball continues to fall and accelerates until it hits the ground and finally coming to a stop.

Q3. Expected answer
The ball decelerates or decreases the speed due to friction between surface of the ground and the ball.

Q4. Expected answer
The car accelerated because the speed of the car increased as the time went by on his record.

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.2. Regularity of Levers**	Total lesson No: 9 / 87 Textbook page: 29 - 30

Lesson 4 / 8

Lesson Title

Lifting a Load Using a Lever: 1

Preparation

pole (1.5 - 3m long), plastic bag with sand, a piece of wood, stool

Lesson Flow

1 Introduction (10 min.)

- Review Grade 4 topic 16.2 'Machine and Its Work' by asking:

Q:What are simple machines?

Q:Name the 6 types of simple machines.

- Encourage the students to think about how a lever lifts an object with less force, by asking:

Q:How can we lift a heavy object using a lever?

2 Introduce the key question

How can we lift an object by using a lever with less force?

3 Activity (20 min.)

- Explain the steps of the activity.
- Ask students to give their predictions and write their prediction on the blackboard.
- Ask students to do the activity.
- Allow enough time for students to record their findings in the table
- Check each group during the lesson by asking:

Q:Can you feel the difference when changing position of effort?

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)

Teacher's Notes

In Grade 4, Chapter 16 'Force and Motion', they learnt about levers as a simple machine. Review the lesson in advance. This lesson is the first part of the next lesson which is 'Lifting a load using a Lever: 2'. Students discover the easier way to lift a load. In the activity, a heavier load and a longer pole is better to us, so that the students can distinguish the feeling of large, medium or small force when applied to a given position on the lever. Check the next lesson prior to this lesson.

Tips of the Activity

- First, find the centre of the pole. Mark it with a tape then place the pole on the fulcrum as shown in the textbook.
- The recommended weight of the load should be about 10 kg. A pole of 3 meters which is strong enough to hold the weight of the load should be prepared to avoid an accident. The height of the fulcrum must be placed at 50 cm high.

SAFETY

Advice students not to let go the pole suddenly as it may injure your friends.

Pay close attention to the pole in case it breaks. Have student stand at a safe distance.

Lesson Objectives

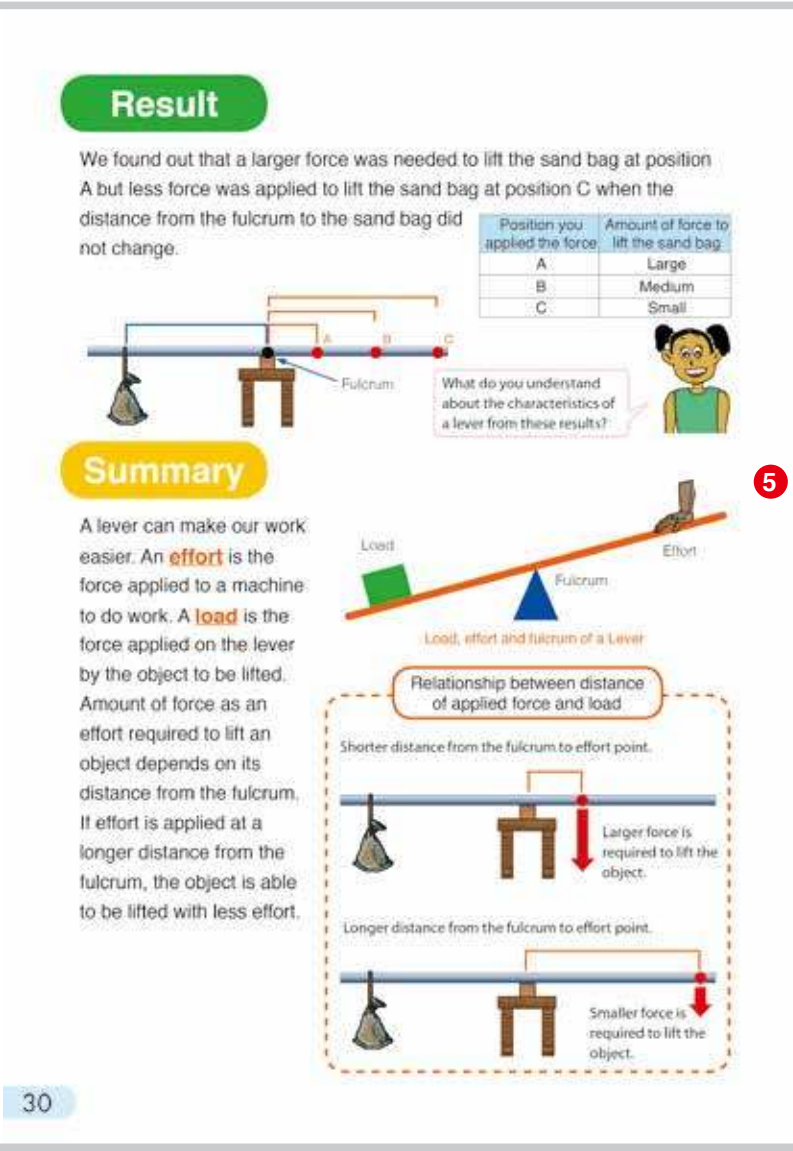
Students will be able to:

- Identify the way to lift a fixed sandbag on a pole easily by controlling the conditions.
- Distinguish the relationship between the amount of force required to lift an object and the distance from the fulcrum to the effort.

Assessment

Students are able to:

- Illustrate the easiest way to lift a fixed sandbag by changing the points to apply force to a pole.
- Explain that the further an effort is applied away from the fulcrum, the less effort is needed to lift a load.



Result

We found out that a larger force was needed to lift the sand bag at position A but less force was applied to lift the sand bag at position C when the distance from the fulcrum to the sand bag did not change.

Position you applied the force	Amount of force to lift the sand bag
A	Large
B	Medium
C	Small

Summary

A lever can make our work easier. An effort is the force applied to a machine to do work. A load is the force applied on the lever by the object to be lifted. Amount of force as an effort required to lift an object depends on its distance from the fulcrum. If effort is applied at a longer distance from the fulcrum, the object is able to be lifted with less effort.

30

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

Q:What condition did you change to find the way to lift a sand bag easily? (By changing the distance from a fulcrum.)

Q:How does an amount of force change at different positions: A, B and C? (The further you move away from the fulcrum the less force is needed.)

Q:What relationship did you find between the amount of force required to lift a sand bag and the distance from the fulcrum to the force you applied? (If we apply a force at the longer distance from the fulcrum, we need a less force to lift the sand bag.)

- 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:How do you make it easier to lift an object on a lever?

  Q:At which distance of the lever is difficult to lift an object?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Lifting a Load Using a Lever: 1

Key question How can we lift an object by using a lever with less force?

Activity:

Find ways to lift the sand bag easily using a lever

Effort	Prediction Small ,medium, large	Results
A	Small	Large
B	Large	Medium
C	Medium	Small

Discussion

Q: What condition did you change to find the way to lift a sand bag easily? By changing the distance from a fulcrum.

Q: How does an amount of force change at different positions: A, B and C? The further you move away from the fulcrum the less force is needed.

Q: What relationship did you find between the amount of force required to lift a sand bag and the distance from the fulcrum to the force you applied?

If we apply a force at the longer distance from the fulcrum, we need a less force to lift the sand bag.

Summary

- Using a lever makes a heavy object lift easier.
- An effort is the force applied to a machine to do work.
- A load is the force applied on the lever by the object to be lifted.
- When effort is applied further away from the fulcrum, the less effort is needed to lift the load.

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.2. Regularity of Levers**	Total lesson No: 10 / 87 Textbook page: 31 - 32

Lesson 5 / 8

Lesson Title

Lifting a Load Using a Lever: 2

Preparation

pole (1.5 - 3 m), plastic bag with sand, stool, a piece of wood

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson and ask:

Q:How do you make it easier to lift a load on a lever?

Q:At which distance of the lever is difficult to lift a load?

- Encourage students to think about the easy way to lift an object using a lever, by asking:

Q:What is another way to lift an object with less force?

2 Introduce the key question

How does the distance from a fulcrum to a load affect an effort?

3 Activity (20 min.)

- Explain the steps of the activity
- Tell the students to predict the results and write down their predictions in their exercise book
- Ask the students to conduct the activity and record their findings in the table
- Check each group during activity by asking:

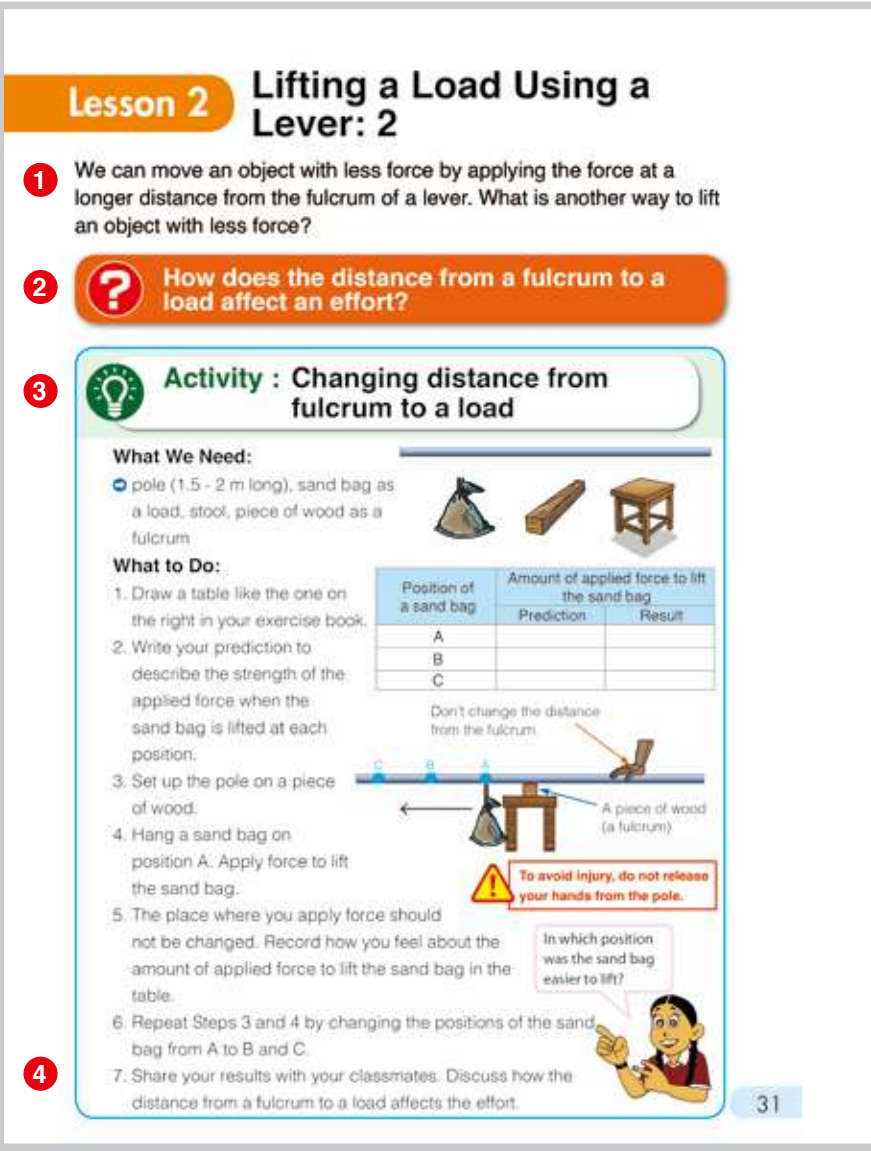
Q:Can you feel the difference when changing position of load?

- Give enough time for students to do their findings.

4 Discussion for findings (25 min.)

- Ask students to present their results from the activity.
- Write their findings on the blackboard.

(Continue)



Lesson 2 Lifting a Load Using a Lever: 2

1 We can move an object with less force by applying the force at a longer distance from the fulcrum of a lever. What is another way to lift an object with less force?

2 How does the distance from a fulcrum to a load affect an effort?

3 Activity : Changing distance from fulcrum to a load

What We Need:

pole (1.5 - 2 m long), sand bag as a load, stool, piece of wood as a fulcrum

What to Do:

1. Draw a table like the one on the right in your exercise book.
2. Write your prediction to describe the strength of the applied force when the sand bag is lifted at each position.
3. Set up the pole on a piece of wood.
4. Hang a sand bag on position A. Apply force to lift the sand bag.
5. The place where you apply force should not be changed. Record how you feel about the amount of applied force to lift the sand bag in the table.
6. Repeat Steps 3 and 4 by changing the positions of the sand bag from A to B and C.
7. Share your results with your classmates. Discuss how the distance from a fulcrum to a load affects the effort.

Position of a sand bag	Amount of applied force to lift the sand bag	
	Prediction	Result
A		
B		
C		

Don't change the distance from the fulcrum

C B A

A piece of wood (a fulcrum)

To avoid injury, do not release your hands from the pole.

In which position was the sand bag easier to lift?

4

31

Teacher's Notes

This lesson is the second part of the previous lesson. This focuses on the distance of the load from the fulcrum by changing the distance of the load on the lever, whilst maintaining the position of the fulcrum and effort (force applied by hand) to lift the load. However, in the first lesson the focus was on the distance of the effort from the fulcrum that is closer or further away.

Load - bag of sand, soil or gravel

Fulcrum - fulcrum is where the centre of the pole rests to form a lever

Effort – effort is the force applied (by hand) to lift the load. By applying force by the hand at difference position on the lever the variation in strength can be felt.

SAFETY

- Keep students at a safer distance when gathering around the setup.
- Remember not to let go of the pole suddenly as it can hurt you and your friends.

Lesson Objectives

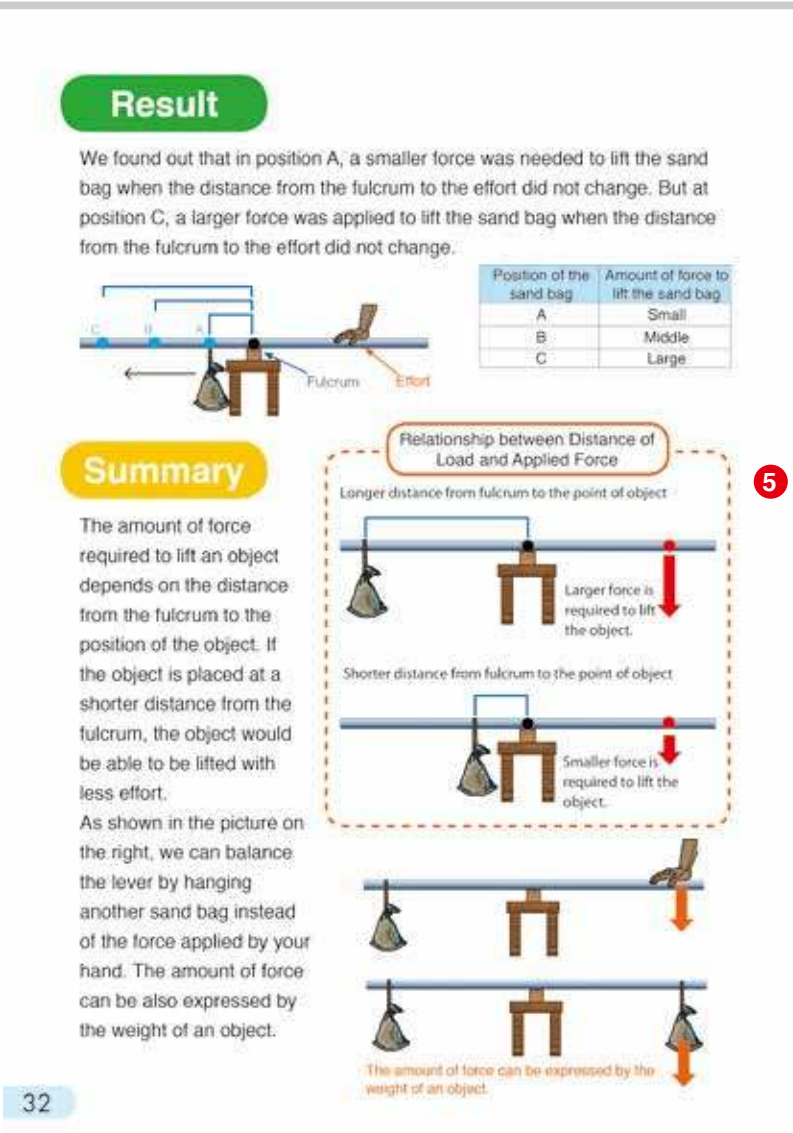
Students will be able to:

- Identify the relationship between the amount of force required to lift an object and the distance of the load from a fulcrum by controlling a condition.
- Demonstrate eagerness for investigation.

Assessment

Students are able to:

- Explain how the distance of a sandbag from a fulcrum affect the force required to lift by changing the positions of the sandbag from a fulcrum.
- Investigate to find out the regularity of a lever actively.



Result

We found out that in position A, a smaller force was needed to lift the sand bag when the distance from the fulcrum to the effort did not change. But at position C, a larger force was applied to lift the sand bag when the distance from the fulcrum to the effort did not change.

Position of the sand bag	Amount of force to lift the sand bag
A	Small
B	Middle
C	Large

Summary

The amount of force required to lift an object depends on the distance from the fulcrum to the position of the object. If the object is placed at a shorter distance from the fulcrum, the object would be able to be lifted with less effort.
As shown in the picture on the right, we can balance the lever by hanging another sand bag instead of the force applied by your hand. The amount of force can be also expressed by the weight of an object.

32

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

Q:What condition did you change to find the way to lift a sand bag easily? (By changing the distance from the fulcrum.)

Q:How does your effort change as you change the position of the load? (More force is needed as the sand bag is moved further away from the fulcrum. Less force is needed as the sand bag is moved closer to the fulcrum.)

Q:What relationship do you find between the amount of force required to lift a sand bag and the distance of the sand bag from a fulcrum? (If the sand bag is placed at a shorter distance from the fulcrum, we need less force to lift. If the sand bag is placed at a longer distance from the fulcrum, we need more force to lift.)

- 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:How do you make it easier to lift an object on a lever?

Q:At which distance of the lever is difficult to lift an object?

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

Sample Blackboard Plan

Title:

Lifting a Load Using a Lever: 2

Key question

How does the distance from a fulcrum to a load affect an effort?

Activity: Changing distance from fulcrum to a load

Load at different locations	Prediction Small ,medium, large	Results
A	Small	Small
B	Large	Middle
C	Middle	Large

Discussion

Q:What condition did you change to find the way to lift a sand bag easily? By changing the distance from the fulcrum.

Q:How does your effort change as you change the position of the load? More force is needed as the sand bag is moved further away from the fulcrum. Less force is needed as the sand bag is moved closer to the fulcrum.

Q:What relationship do you find between the amount of force required to lift a sand bag and the distance of the sand bag from a fulcrum? If the sand bag is placed at a shorter distance from the fulcrum, we need less force to lift. If the sand bag is placed at a longer distance from the fulcrum, we need more force to lift.

Summary

- The amount of force required to lift an object depends on the distance from the fulcrum to the position of the object.
- If the object is placed at a shorter distance from the fulcrum, the less effort is needed to lift it.

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.2. Regularity of Levers**	Total lesson No: 11 / 87 Textbook page: 33 - 34

Lesson 6 / 8

Lesson Title

Law of Lever to Balance

Preparation

30 cm ruler, 7 bulldog clips (double clip), 2 paper clips, 8 one kina coins, pen

Lesson Flow

1 Introduction (5 min.)

- Review the previous lessons. Ask:

Q:What is the relationship between the amount of force required to lift an object and the distance of the load from a fulcrum?

Q:How much force is needed to lift an object if the object is closer to the fulcrum?

- Ask students to look at the picture of a balanced lever and ask:

Q:What will happen if the position of the weights changes?

2 Introduce the key question

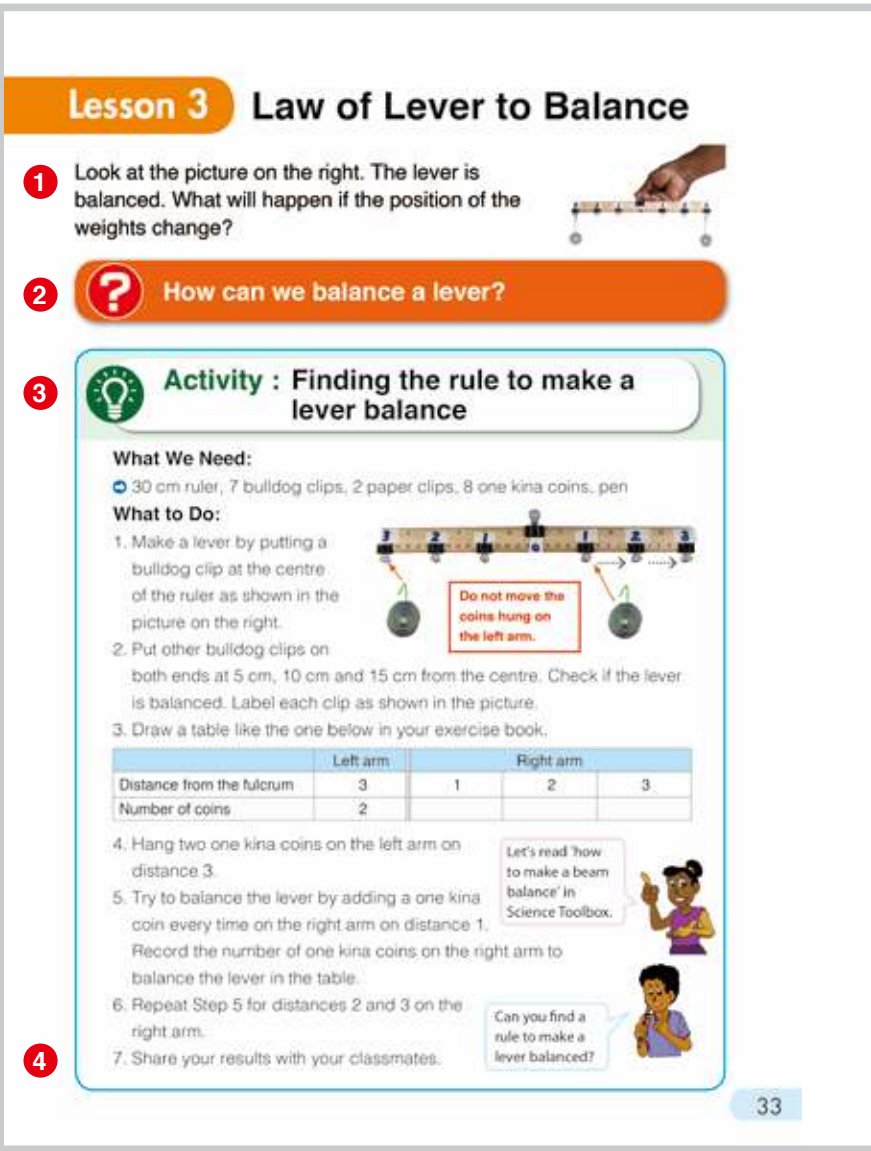
How can we balance a lever?

3 Activity (20 min.)

- Advice students to use each type of material (refer to teacher's note).
- Explain the steps of the activity.
- Have the students make a beam balance using a ruler. Help them to balance the lever if necessary.
- Have the students do the activity and record their results in the table.
- Check students' activity and if neccessary guide them towards their findings.
- Ask students to discuss their results with their groups.

4 Discussion for findings (25 min.)

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



Lesson 3 Law of Lever to Balance

1 Look at the picture on the right. The lever is balanced. What will happen if the position of the weights change?

2 How can we balance a lever?

3 Activity : Finding the rule to make a lever balance

What We Need:

30 cm ruler, 7 bulldog clips, 2 paper clips, 8 one kina coins, pen

What to Do:

1. Make a lever by putting a bulldog clip at the centre of the ruler as shown in the picture on the right.
2. Put other bulldog clips on both ends at 5 cm, 10 cm and 15 cm from the centre. Check if the lever is balanced. Label each clip as shown in the picture.
3. Draw a table like the one below in your exercise book.

Do not move the coins hung on the left arm.

	Left arm	Right arm		
Distance from the fulcrum	3	1	2	3
Number of coins	2			

4. Hang two one kina coins on the left arm on distance 3.
5. Try to balance the lever by adding a one kina coin every time on the right arm on distance 1. Record the number of one kina coins on the right arm to balance the lever in the table.
6. Repeat Step 5 for distances 2 and 3 on the right arm.
7. Share your results with your classmates.

Let's read 'how to make a beam balance' in Science Toolbox.

Can you find a rule to make a lever balanced?

4

33

Teacher's Notes

Tips for the Activity

- Construct a beam balance as a sample. Refer to Science Tool box 'How to make a balance'.
- Try it out prior to the lesson to be familiar with steps of construction and how to balance the lever.
- If there are not enough rulers, use a straight strip of wood required for each group.
- Follow the steps to find the centre of the wood or ruler first. Then check if it is balanced.
- Paper clips can be used as hooks. Secure the paper clips to stop it from sliding off the ruler.
- In place of one kina coins, use same size bolt washer or bolt nuts.

Balancing the arms of a lever

- If a distance cannot be balanced by a coin put a dash through the box.

SAFETY

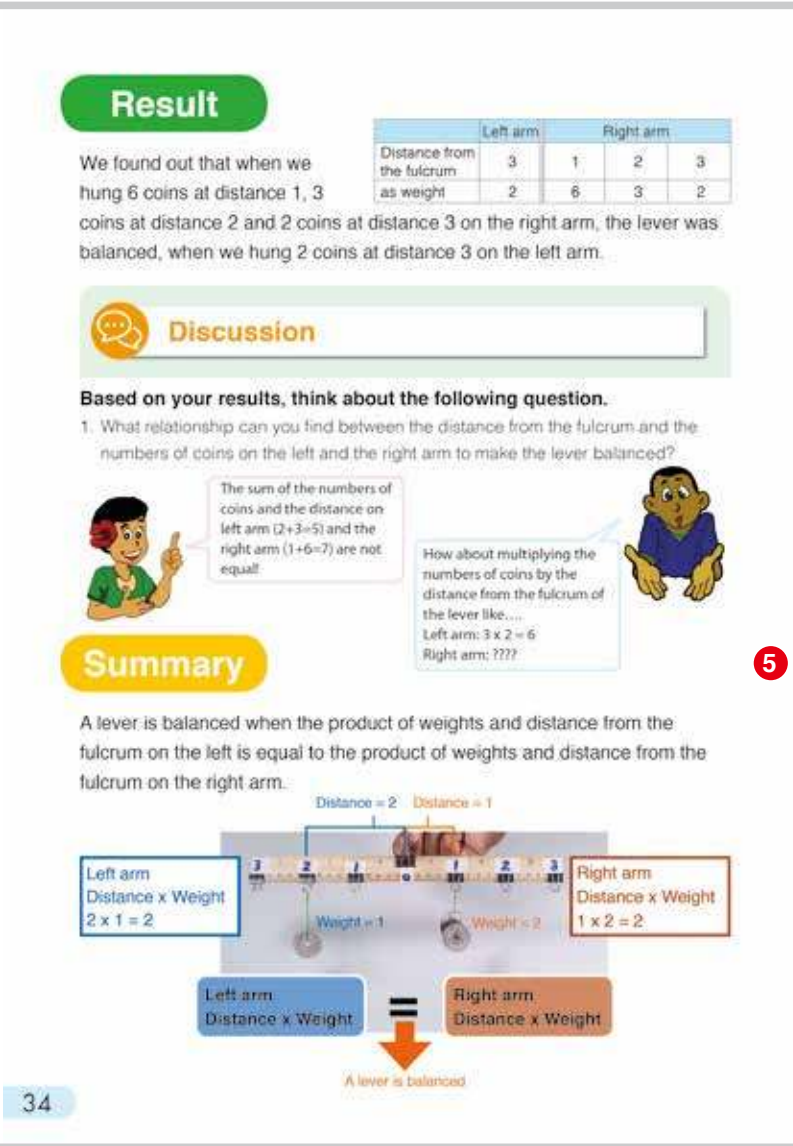
- Do not put or hold paper clips or other small objects in the mouth when making the balance.
- Be careful when using tools to cut. Example scissors. Do not pull tools from others. Wait till others are finished.

Lesson Objectives

Students will be able to:
- Identify the law of a lever to balance through the activity.
- Investigate the law of a lever with interest.

Assessment

Students are able to:
- Explain how to balance a lever by relating to the numbers of weights and the distance from the fulcrum on both arms of a lever.
- Show eagerness to find out the law of a lever to balance.



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

Q:What relationship can you find from the results? Let students state opinions freely.

- Ask students to calculate the sum of the numbers of coins and the distance on both left and right arms in the table.

Q:What is the sum on the left arm? (3+2=5)
Q:What are the sums on the right arm? (1+6=7, 2+3=5, and 3+2=5)
Q:Can you find the relationship between the sum on the left and the right arms? (No.)

- Ask students to calculate the product of the numbers of coins and the distance on both left and right arms in the table.

Q:What is the product on the left arm? (3×2=6)
Q:What are the products on the right arm? (1×6=6, 2×3=6, and 3×2=6)
Q:Can you find the relationship between the product on the left and on the right arms? (Yes. The product of distance and the number of coins on both arms are the same.)

- 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 question as assessment:
  Q:What is the law of a lever to balance?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:
Law of Lever to Balance

Key question
How can we balance a lever?

Activity:
Finding the rule to make a lever balance

Results

	Left arm	Right arm		
Distance from the fulcrum	3	1	2	3
Number of coins	2	6	3	2

Discussion
Q: What relationship can you find from the results? (Write freely students' ideas)
Q: What is the sum on the left arm? 3+2=5
Q: What are the sums on the right arm? 1+6=7, 2+3=5, and 3+2=5
Q: Can you find the relationship between the sums on the left and right arms? No.
Q: What is the product on the left arm? 3×2=6
Q: What are the products on the right arm? 1×6=6, 2×3=6, and 3×2=6

Summary
- A lever is balanced when the product of weights and the distance from the fulcrum on the left arm is equal to that of the right arm.

• Law of a Lever to balance	
Left arm	Right arm
Weight x distance = Weight x distance	

Lesson 7 / 8

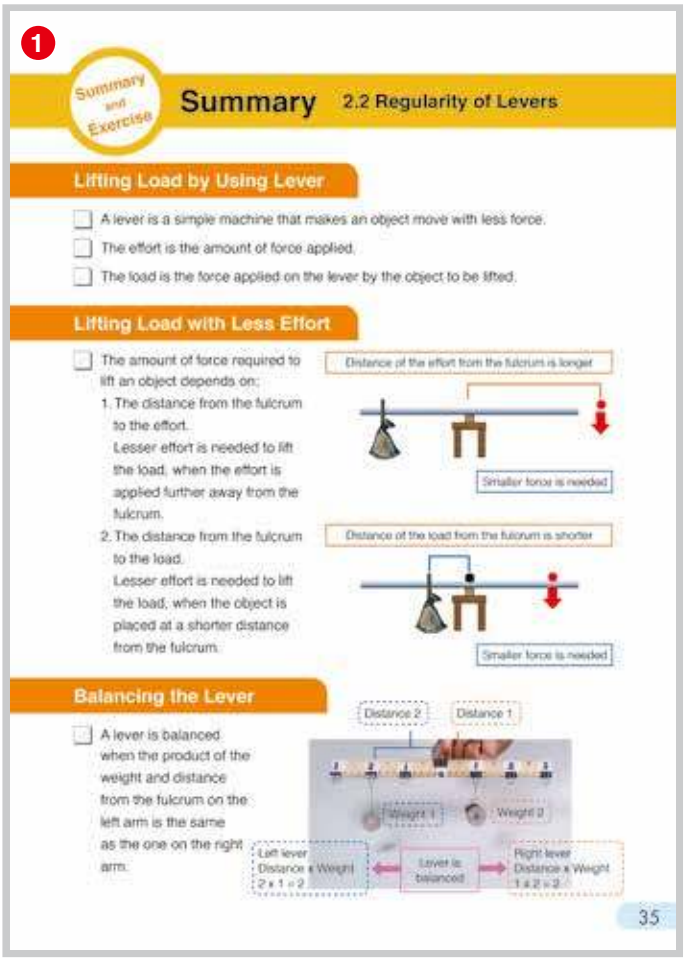
Lesson Title

Summary and Exercise

Tips of lesson

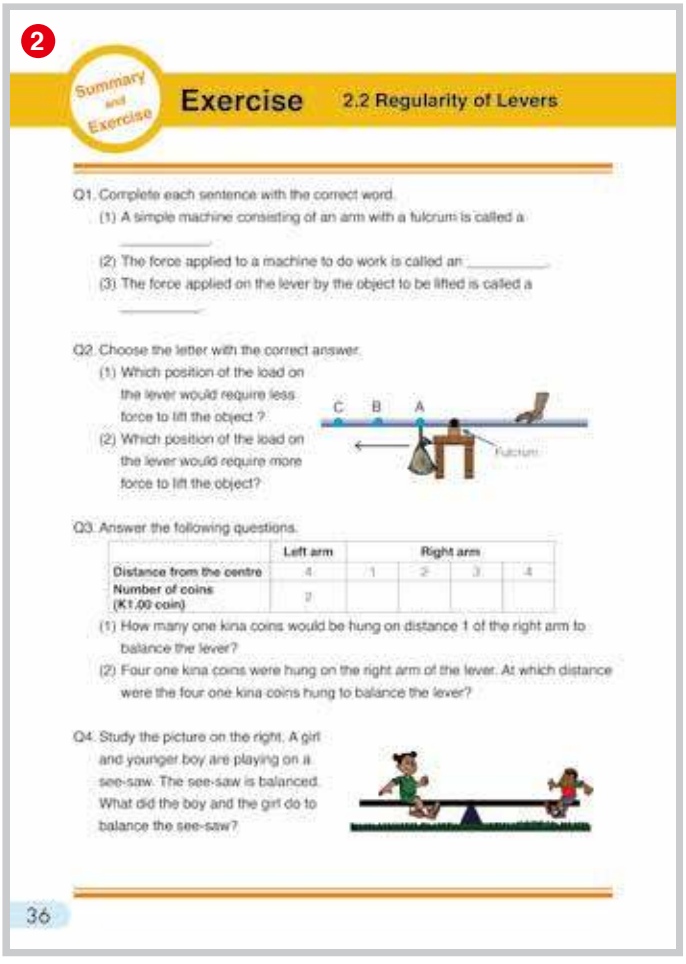
1 Summary (20 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - Q: What is the regularity of levers?
  - Q: How do you balance a lever?
- 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.



Exercise answers

Q1.
(1) **lever**
(2) **effort**
(3) **load**

Q2.
(1) **A**
(2) **C**

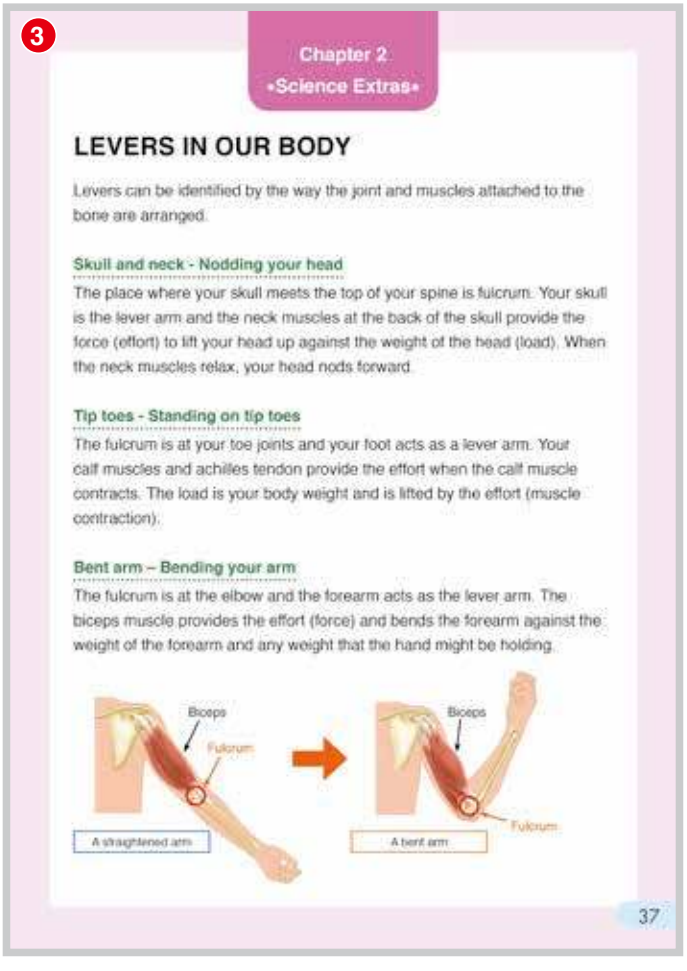
Q3.
(1) **8 one kina coins**
(2) **Distance 2.**

Q4. Expected Answer
By the girl moving to sit closer to the fulcrum and the boy sits at the far end of the see-saw.

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.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Chapter 2
•Science Extras•

LEVERS IN OUR BODY

Levers can be identified by the way the joint and muscles attached to the bone are arranged.

Skull and neck - Nodding your head

The place where your skull meets the top of your spine is fulcrum. Your skull is the lever arm and the neck muscles at the back of the skull provide the force (effort) to lift your head up against the weight of the head (load). When the neck muscles relax, your head nods forward.

Tip toes - Standing on tip toes

The fulcrum is at your toe joints and your foot acts as a lever arm. Your calf muscles and achilles tendon provide the effort when the calf muscle contracts. The load is your body weight and is lifted by the effort (muscle contraction).

Bent arm – Bending your arm

The fulcrum is at the elbow and the forearm acts as the lever arm. The biceps muscle provides the effort (force) and bends the forearm against the weight of the forearm and any weight that the hand might be holding.

37

Lesson 8 / 8

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

2. Force and Machine

Q1 Complete each sentence with the correct word.

(1) A force can cause an object to speed up or slow down.

(2) A force can make a moving object change its speed and direction.

(3) A force that slows down the movement of an object between two surfaces that touch each other is called friction.

(4) To accelerate means that the motion of an object speeds up.

Q2 Choose the letter with the correct answer.

(1) What happens to the speed of an object as it rolls down a slope?
The speed of the object

A. remains the same.
B. increases.
C. decreases.
D. decreases then speeds up.

(2) The lever shown below is balanced. The distance from load A to the fulcrum and the distance from load B to the fulcrum are same. Which of the following is true about the diagram?

A. A is heavier than B.
B. A is lighter than B.
C. A and B have different weights.
D. A and B have the same weights.

(3) What is the best reason to explain why a ball comes to a stop after rolling for some time?

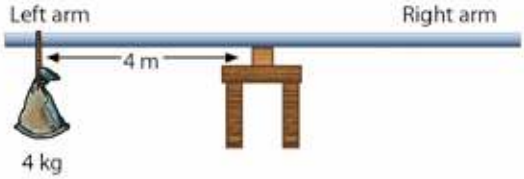
A. Because there is no force acting on the ball.
B. Because the ball ran out of force to continue rolling.
C. Because the force of gravity is pulling the ball backwards.
D. Because of the friction force acting between the ball and the ground.

38

Q3

(1) Study the diagram below.
The ball is moving in the direction to the right. It is decelerating due to friction and will come to a stop. In which direction is the friction force acting on the rolling ball?
Left

(2) If a 4 kg weight was placed on the left arm at a distance of 4 m from the fulcrum:



(i) What is the product of the weight and distance on the left arm of the lever? (Ignore its units)
16

(ii) The lever is balanced when the other weight is hanging on the right arm at the distance of 2 m from the fulcrum. Calculate what would be the amount of weight on the right arm?
Your calculation: (Left arm) 4 x 4 = 16,
(Right arm) 2 x 8 = 16
Answer: 8 kg

Q4

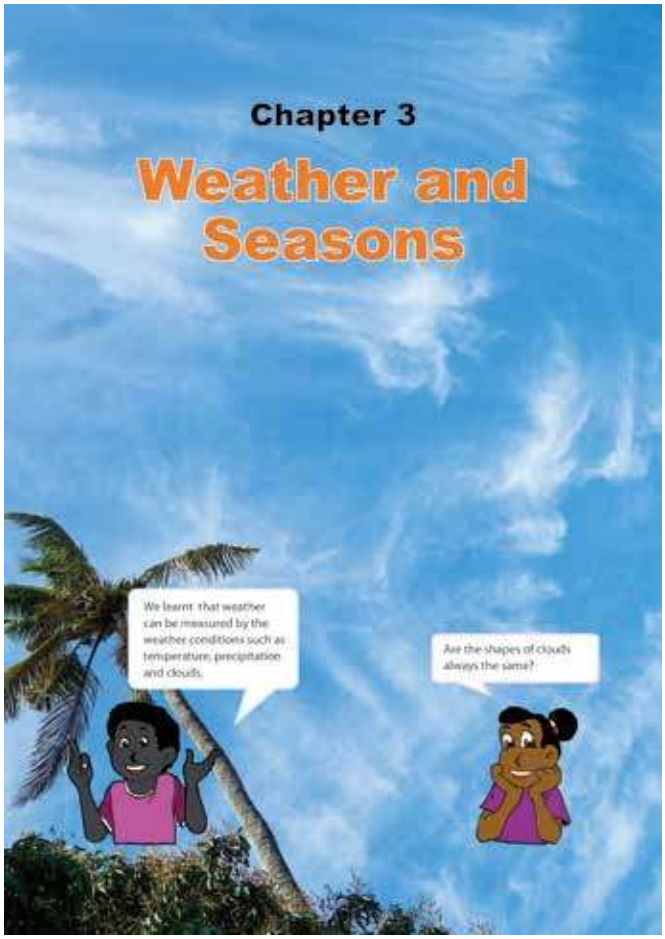
Kolo wanted to carry a bag of fruits but he struggled to balance the bag on the pole on his shoulder. What must he do to be able to carry the bag on the pole on his shoulder?

(Expected answers)
- He can move the bag with the pole forward to make the distance between the bag and his shoulder shorter.
- He can hold the pole infront and further away from the shoulder making the distance longer.

Chapter 3. Weather and Seasons

Chapter Objectives

Students will be able to identify different types of clouds, how weather is forecasted and how seasonal changes affect plants and animals.



This picture is from the chapter heading of the textbook showing cirrus clouds in the sky. Clouds are classified according to their characteristics.

Topic Objectives

3.1 Observing Clouds

Students will be able to;

- Identify the different types of clouds and their characteristics.
- Identify the relationship between types of clouds and weather.

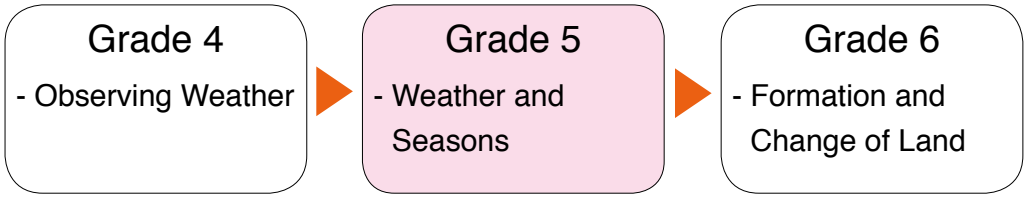
3.2 Seasons

Students will be able to;

- Identify seasons experienced in Papua New Guinea and in other parts of the world.
- Explain how plants and animals change with the seasons.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Weather changes from day to day.
- Clouds, temperature, precipitation and wind are used to measure weather.

Teaching Overview

This chapter consists of 7 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
3.1 Observing Clouds	1	**Types of Clouds** What types of clouds can be observed?	5.3.2	41 - 42
	2	**Weather Forecast** How can we forecast weather?		43 - 44
	3	Summary and Exercise		45 - 46
3.2 Seasons	4	**Seasons** What is a season?		47 - 48
	5	**Seasonal Changes and Living Things** How do living things change with seasons?		49 - 50
	6	Summary and Exercise, Science Extra		51 - 53
Chapter Test	7	Chapter Test		54 - 55

Unit: **Weather and Climate**	Chapter : **3. Weather and Seasons** Topic : **3.1. Observing Clouds**	Total lesson No: 14 / 87 Textbook page: 41 - 42

Lesson 1 / 7

Lesson Title

Types of Clouds

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Ask students to stand outside and observe what they can see in the sky.

Q:What can you see in the sky?

- Encourage students to focus on the clouds and describe the clouds.

2 Introduce the key question

What types of clouds can be observed?

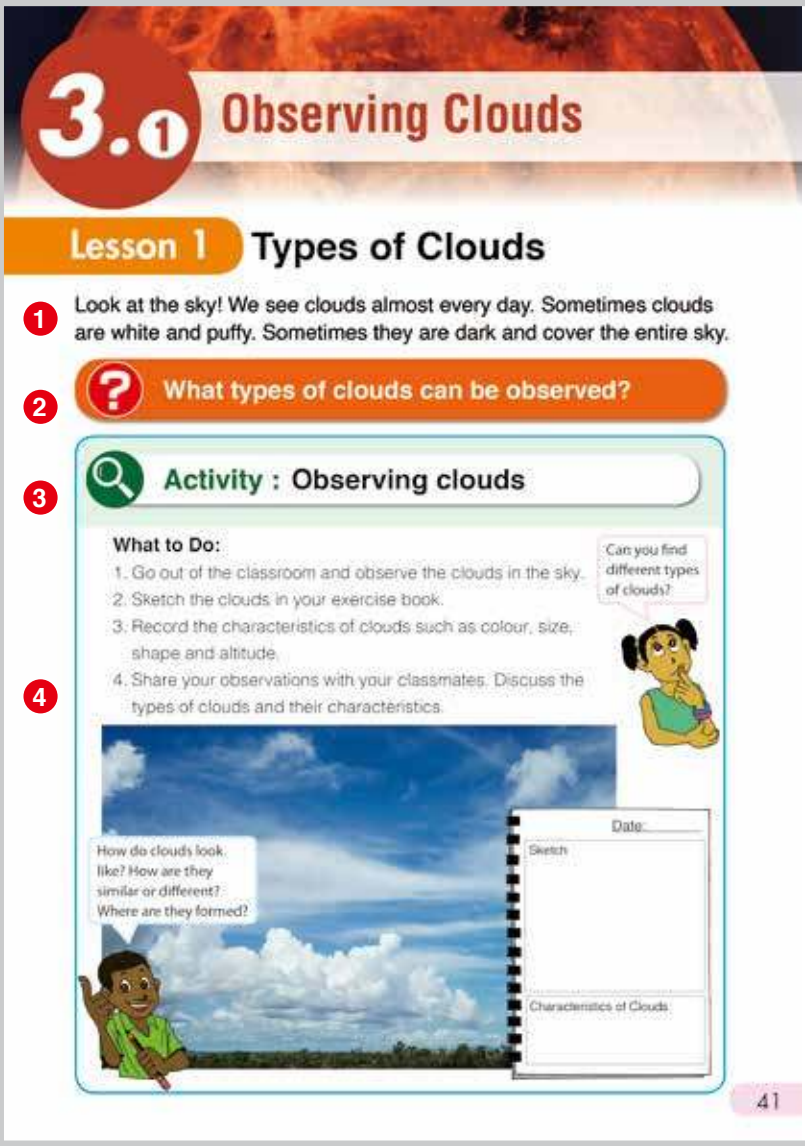
3 Activity (25 min.)

- Organise students into pairs and remind them of the safety rules.
- Explain the steps of the activity.
- Refer students to what the characters are saying for their observation.
- Let students sketch the clouds freely then record their characteristics based on colours, size, shape and altitude.
- Ask students to discuss their findings with their groups.
- Give enough time for students to do their findings.
- Make sure students record their observations in their exercise books.

4 Discussion for findings (20 min.)

- Ask students to present their findings and sketches from the activity.
- Write their findings on the blackboard.

(Continue)



Teacher's Notes

SAFETY: Remind the students not to look at the sun directly.

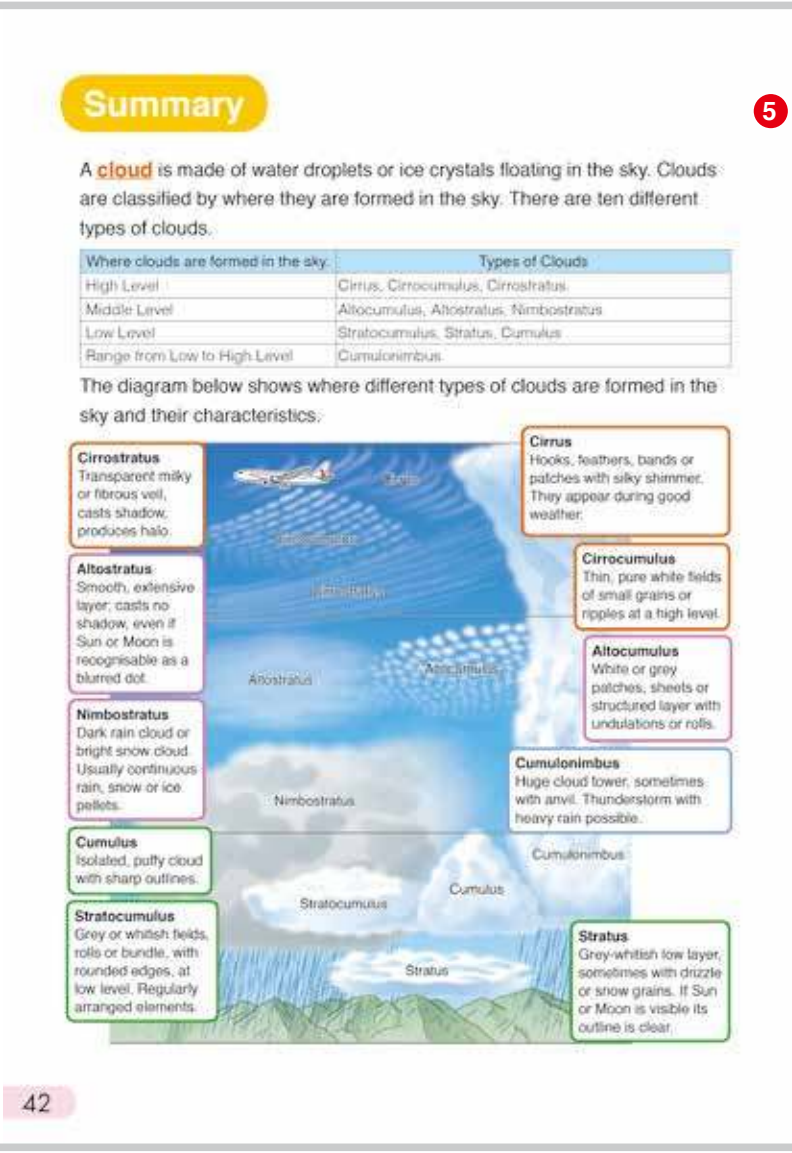
- Altitude is the height or point above sea level or ground level.
- Clouds are given different names based on their shape and their height in the sky. Some clouds are near the ground. Others are almost as high as jet planes fly.Some are puffy like cotton. Others are grey and uniform.
- Cumulonimbus cloud is also known as The King of Clouds. It exists through the entire height of the troposphere, usually characterised by its icy, anvil-shaped top. More commonly known as thunderclouds, cumulonimbus is the only cloud type that can produce hail, thunder and lighting. The base of the cloud is often flat, with a very dark wall-like feature hanging underneath, and may only lie a 200 to 4000 m above the Earth's surface.
- World Meteorological Organisation (WMO) currently recognises ten cloud genera (basic classifications), which describe where in the sky they form and their approximate appearance:
  - High clouds (CH): Cirrus, Cirrocumulus, Cirrostratus;
  - Middle clouds (CM): Altocumulus, Altostratus, Nimbostratus
  - Low clouds (CL): Stratocumulus, Stratus, Cumulus,
  - Cumulonimbus

Lesson Objectives

Students will be able to:
- Observe the different types of clouds.
- Identify the different types of clouds and their characteristics.
- Communicate their findings with others.

Assessment

Students are able to:
- Sketch the different types of clouds based on theirs colours, size, shape and altitude.
- Distinguish the types of cloud in a diagram based on their characteristics.
- Express their ideas actively.



Summary

A cloud is made of water droplets or ice crystals floating in the sky. Clouds are classified by where they are formed in the sky. There are ten different types of clouds.

Where clouds are formed in the sky	Types of Clouds
High Level	Cirrus, Cirrocumulus, Cirrostratus
Middle Level	Altocumulus, Altostratus, Nimbostratus
Low Level	Stratocumulus, Stratus, Cumulus
Range from Low to High Level	Cumulonimbus

The diagram below shows where different types of clouds are formed in the sky and their characteristics.

42

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

Q:What characteristics are similar and different in the clouds you have sketched?
Similarities- Some clouds are big and white.
Differences- Some clouds cover the entire sky and some don't.

- Explain that there are different types of clouds seen every day or throughout the day.

Q:Which clouds do you think are very high in the sky at mid- level and the lowest level?
(It depends on students' answers. For example, clouds look like feathers and patches appear in high level, clouds look like grey rolls or bundle appear in low level. Refer to textbook.)

Q:How many types of clouds can you find? (It depends on students)

- 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: How can clouds be classified?
  Q: How many types of clouds are there?
- Ask students to copy the notes on the blackboard into their exercise books.

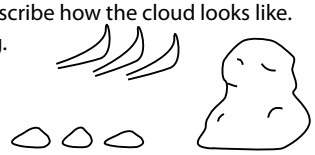
Sample Blackboard Plan

Title:

Types of Clouds

Key question
What types of clouds can be observed?
Activity:Observing Clouds

Sketch the clouds: Beside each cloud describe how the cloud looks like.
E.g.



Discussion
Q: What characteristics are similar and different in the clouds you have sketched?

Similarity	Difference
- White and big - Clouds are in layers - Clouds move	- Some clouds are grey - Different shapes and sizes - Clouds have different height

Which clouds do you think are very high in the sky at mid- level and the lowest level?
Highest clouds: Cirrus, cirrocumulus
Mid- level: Altocumulus, altostratus
Lowest clouds: Stratus, cumulus, stratocumulus
Q: How many types of clouds can you find?
(It depends on students and sky conditions)

Summary
- A cloud is made of water drops or ice crystals floating in the sky.
- Clouds can be classified by where they are formed in the sky.
- There are ten (10) types of clouds.
- Clouds can be described by their shape, size, colour and altitude.

Unit: **Weather and Climate**	Chapter : **3. Weather and Seasons** Topic : **3.1. Observing Clouds**	Total lesson No: 15 / 87 Textbook page: 43 - 44

Lesson 2 / 7

Lesson Title

Weather Forecast

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- Recap the previous lesson on 'Types of Clouds'.

Q:What types of cloud are there?

Q:How can clouds be classified?

- Ask students to look outside the classroom and identify the type of clouds and what the current weather is like.

2 Introduce the key question

How can we forecast weather?

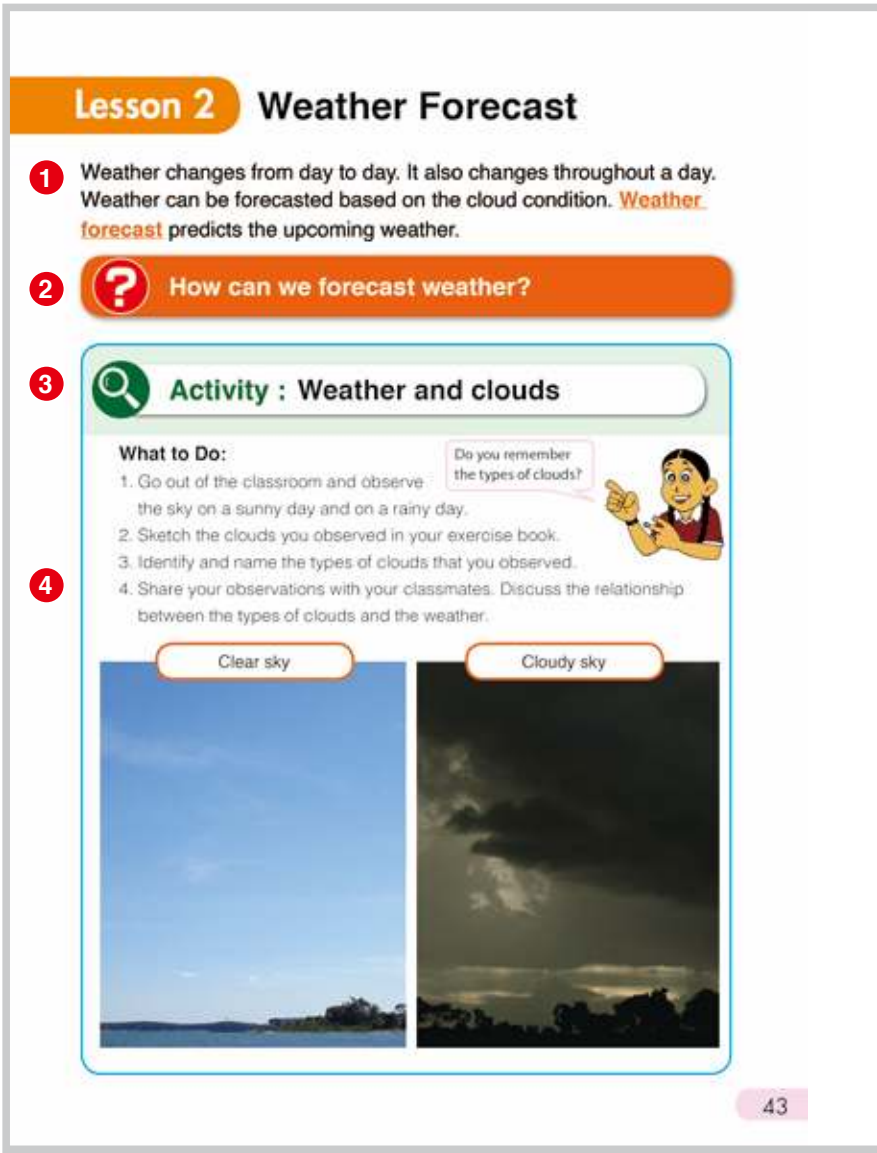
3 Activity (20 min.)

- Organise students to work in pairs.
- Explain the steps of the activity.
- Ask students to observe the sky on a sunny day and later on a rainy day to identify the different types of clouds.
- Ask students to discuss their findings with their groups.
- Give enough time for the students to do their findings.
- Ask the students to record their observations in the table.

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)



Teacher's Notes

Tips for the Activity

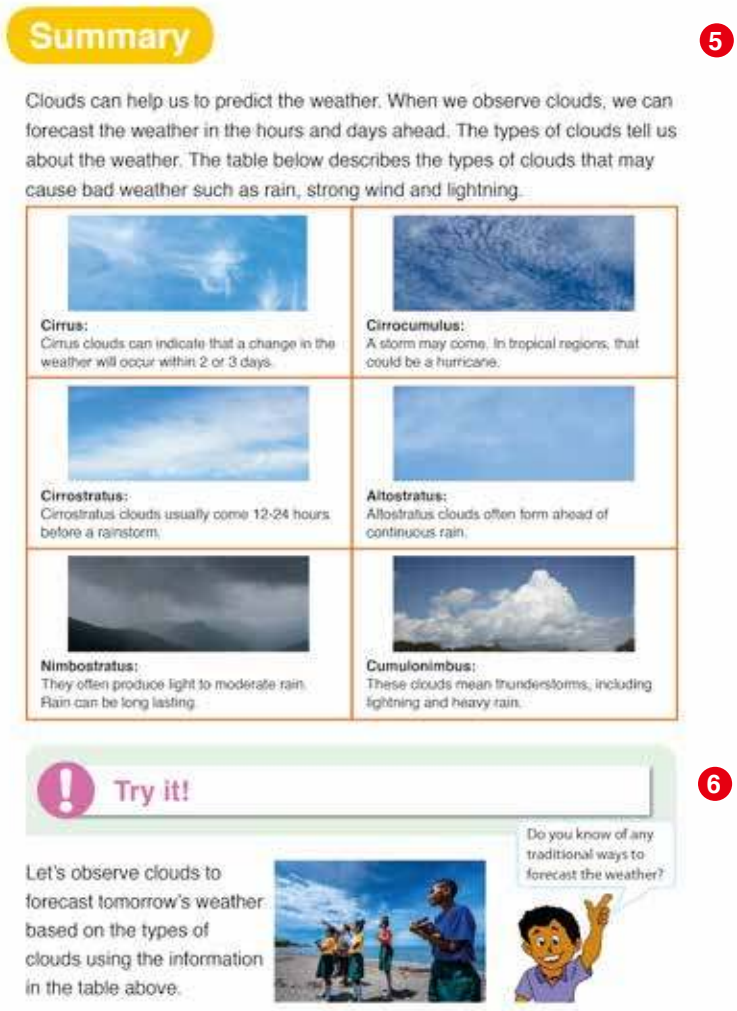
- This activity can be done two times, on a sunny day and on a rainy day, before the discussion. The weather condition varies and the result shown in the blackboard plan is just an example. Thus, the lesson need to be facilitated based on the condition in your place when it is conducted. Refer to the previous lesson to identify the clouds in your sky.
- The appearance of a cloud is best described in terms of the height, shape, structure, texture, luminance and colour of the cloud. These factors will be considered for each of the characteristic cloud forms. Thus, teachers need to encourage students to pay attention on these factors. Putting some descriptions on the sketch such as 'hairy shape' and 'puffy' 'shape' is very nice idea, as students cannot draw everything in this limited time.
- Differences in luminance exist between clouds composed of water droplets and ice crystals. Ice crystal clouds appear in higher altitude because the higher sky is very cold. They are usually more hairy, transparent and shiny than water droplet clouds owing to their thinness and to the sparseness of the ice particles. On the contrary, water droplet clouds tend to be produced in lower attitude and whity. Dark clouds – usually water droplet clouds - are originally white, but such cloud block off the sunlight because of its thickness, it looks dark as the result.

Lesson Objectives

Students will be able to:
- Identify the relationship between types of clouds and weather.
- Infer weather based on the types of clouds.
- Participate in activity with interest.

Assessment

Students are able to:
- Distinguish the types of clouds that may cause bad weather.
- Forecast tomorrow's weather by observing the types of clouds.
- Appreciate that clouds help to predict weather.



Summary 5

Clouds can help us to predict the weather. When we observe clouds, we can forecast the weather in the hours and days ahead. The types of clouds tell us about the weather. The table below describes the types of clouds that may cause bad weather such as rain, strong wind and lightning.

Cirrus: Cirrus clouds can indicate that a change in the weather will occur within 2 or 3 days.	**Cirrocumulus:** A storm may come. In tropical regions, that could be a hurricane.
Cirrostratus: Cirrostratus clouds usually come 12-24 hours before a rainstorm.	**Altostratus:** Altostratus clouds often form ahead of continuous rain.
Nimbostratus: They often produce light to moderate rain. Rain can be long lasting.	**Cumulonimbus:** These clouds mean thunderstorms, including lightning and heavy rain.

Try it! 6

Let's observe clouds to forecast tomorrow's weather based on the types of clouds using the information in the table above.

Do you know of any traditional ways to forecast the weather?

44

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

Q:What kinds of clouds do you observe on a sunny day? (Cirrus, Cirrocumulus, etc)

Q:What types of clouds do you observe on a cloudy or rainy day? (Nimbostratus, cumulonimbus, etc)

Q:What relationships are there between the types of clouds and weather? (The types of clouds tell us about the weather.)

Q:How can people predict weather? (By observing the types of clouds.)

- 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 do clouds tell us about?
- Ask students to copy the notes on the blackboard into their exercise books.

6 Try it!

- Let students discuss the traditional weather forecasts.
- Go out of classroom with the students.
- Ask them to forecast tomorrow's weather based on the type of clouds and the traditional ways.

Sample Blackboard Plan

Title:

Weather Forecast

Key question

How can we forecast weather?

Activity: Weather and Clouds

Sketch the clouds and identify the type of cloud.Example:

Sunny day	Rainy day
Cirrus- hairy	Cumulonimbus- puffy.

Discussion

Q: What kinds of clouds do you observe on a sunny day?

Cirrus, Cirrocumulus, etc

Q: What types of clouds do you observe on a cloudy or rainy day?

Nimbostratus, cumulonimbus, etc

Q: What relationships are there between the types of clouds and weather?

The types of clouds tell us about the weather.

Q: How can people predict weather?

By observing the types of clouds.

Summary

- Clouds can help us to predict weather.
- The types of clouds tell us about the weather.
- Some types of clouds may cause bad weather such as rain, strong wind and lightning.

Try it!

Q: What are the traditional ways for weather forecast?

It depends on the location.

Your tomorrow's weather forecast:

Sunny day:20°C, Cloudy: 10°C, Rainy:7°C

Lesson 3 / 7

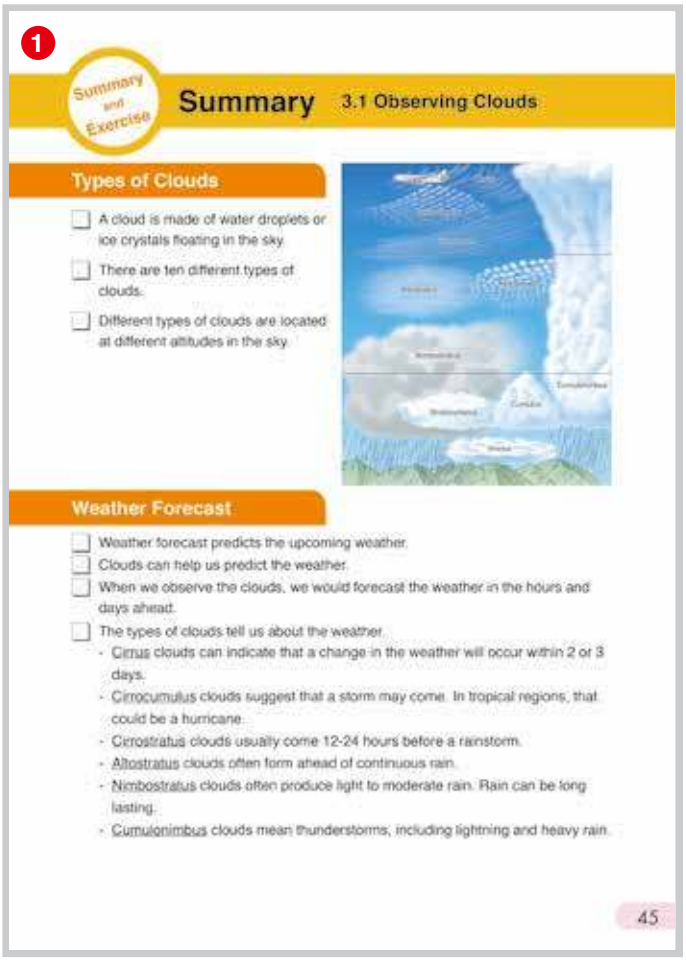
Lesson Title

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.
  - Q: What is a cloud made up of?
  - Q: What are the highest clouds, mid-level clouds and the lowest clouds?
  - Q: What do clouds tell us about?
- 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.



1

Summary and Exercise

Summary 3.1 Observing Clouds

Types of Clouds

- ☐ A cloud is made of water droplets or ice crystals floating in the sky.
- ☐ There are ten different types of clouds.
- ☐ Different types of clouds are located at different altitudes in the sky.

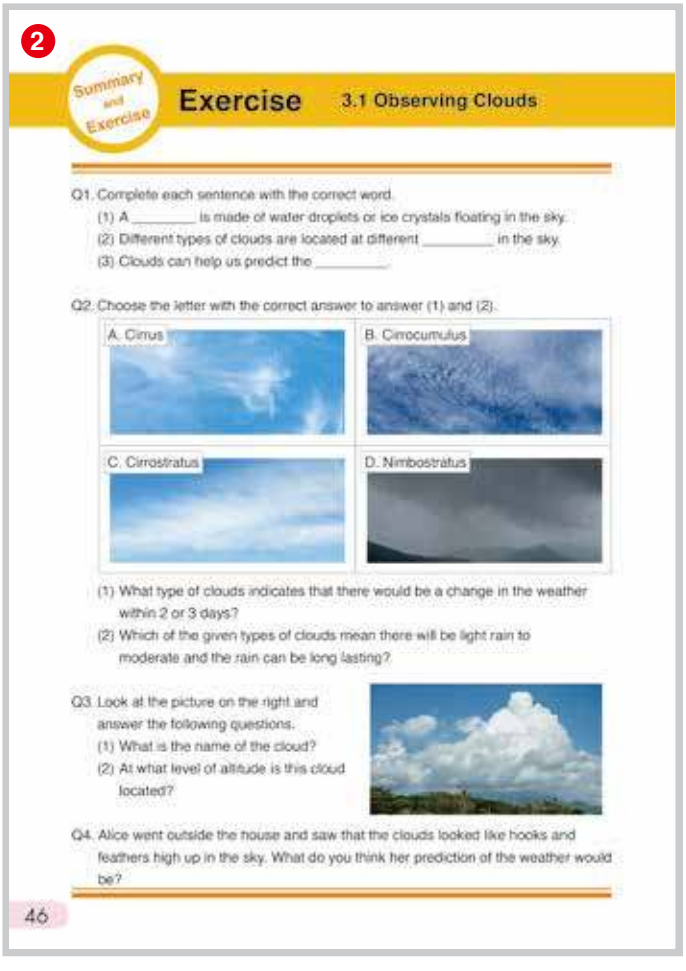
Weather Forecast

- ☐ Weather forecast predicts the upcoming weather.
- ☐ Clouds can help us predict the weather.
- ☐ When we observe the clouds, we would forecast the weather in the hours and days ahead.
- ☐ The types of clouds tell us about the weather.
  - Cirrus clouds can indicate that a change in the weather will occur within 2 or 3 days.
  - Cirrocumulus clouds suggest that a storm may come. In tropical regions, that could be a hurricane.
  - Cirrostratus clouds usually come 12-24 hours before a rainstorm.
  - Altostratus clouds often form ahead of continuous rain.
  - Nimbostratus clouds often produce light to moderate rain. Rain can be long lasting.
  - Cumulonimbus clouds mean thunderstorms, including lightning and heavy rain.

45

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.



2

Summary and Exercise

Exercise 3.1 Observing Clouds

Q1. Complete each sentence with the correct word.
(1) A _____ is made of water droplets or ice crystals floating in the sky.
(2) Different types of clouds are located at different _____ in the sky.
(3) Clouds can help us predict the _____.

Q2. Choose the letter with the correct answer to answer (1) and (2).

A. Cirrus

B. Cirrocumulus

C. Cirrostratus

D. Nimbostratus

(1) What type of clouds indicates that there would be a change in the weather within 2 or 3 days?
(2) Which of the given types of clouds mean there will be light rain to moderate and the rain can be long lasting?

Q3. Look at the picture on the right and answer the following questions.
(1) What is the name of the cloud?
(2) At what level of altitude is this cloud located?

Q4. Alice went outside the house and saw that the clouds looked like hooks and feathers high up in the sky. What do you think her prediction of the weather would be?

46

Exercise answers

Q1.
(1) **cloud**
(2) **altitude (height)**
(3) **weather**

(1) A cloud is made of water drops or ice crystals in the sky.
(2) Different types of clouds are located at different altitude in the sky.
(3) We can predict the types of weather by looking at the clouds.

Q2.
(1) **A**
(2) **D**

(1) Cirrus clouds can indicate that a change in the weather will occur within 2 or 3 days.
(2) Nimbostratus often produces light rain to moderate. Rain can be long lasting.

Q3.
(1) **Cumulonimbus**
(2) **It ranges from low level to high level altitude.**

Q4. Expected answer
Her prediction would be bad weather with precipitation or rain.

This type of cloud is called cumulonimbus; it can develop thunderstorms including lightning, hail, heavy rain and even tornadoes.

Unit: **Weather and Climate**	Chapter : **3. Weather and Seasons** Topic : **3.2. Seasons**	Total lesson No: 17 / 87 Textbook page: 47 - 48

Lesson 4 / 7

Lesson Title

Seasons

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- This is a new topic for the students but they might have heard of seasons.

Q:Have you ever heard of the word season before?

- Based on their knowledge ask them to compare season and weather which was learnt in Grade 4.

Q:Is season similar to or different from weather?

2 Introduce the key question

What is a season?

3 Activity (20 min.)

- Students can work in pairs.
- Ask students to guess if the temperature and the rainfall are the same all year round.
- Refer students to the graph in the activity and explain how to read the line graph and bar graph.
- Have students carefully analyse the graph to answer the given questions.
- Encourage students to record their findings in their exercise books.
- Ask students to discuss their findings in pairs or in groups.

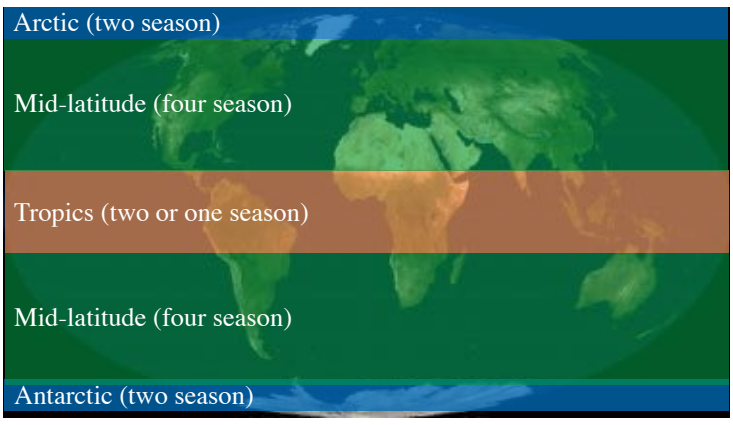
4 Discussion for findings (20 min.)

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

(Continue)

Teacher's Notes

This map shows the seasons experienced in different parts of the world



Papua New Guinea is in the Tropics where we experience two seasons which are wet and dry seasons.

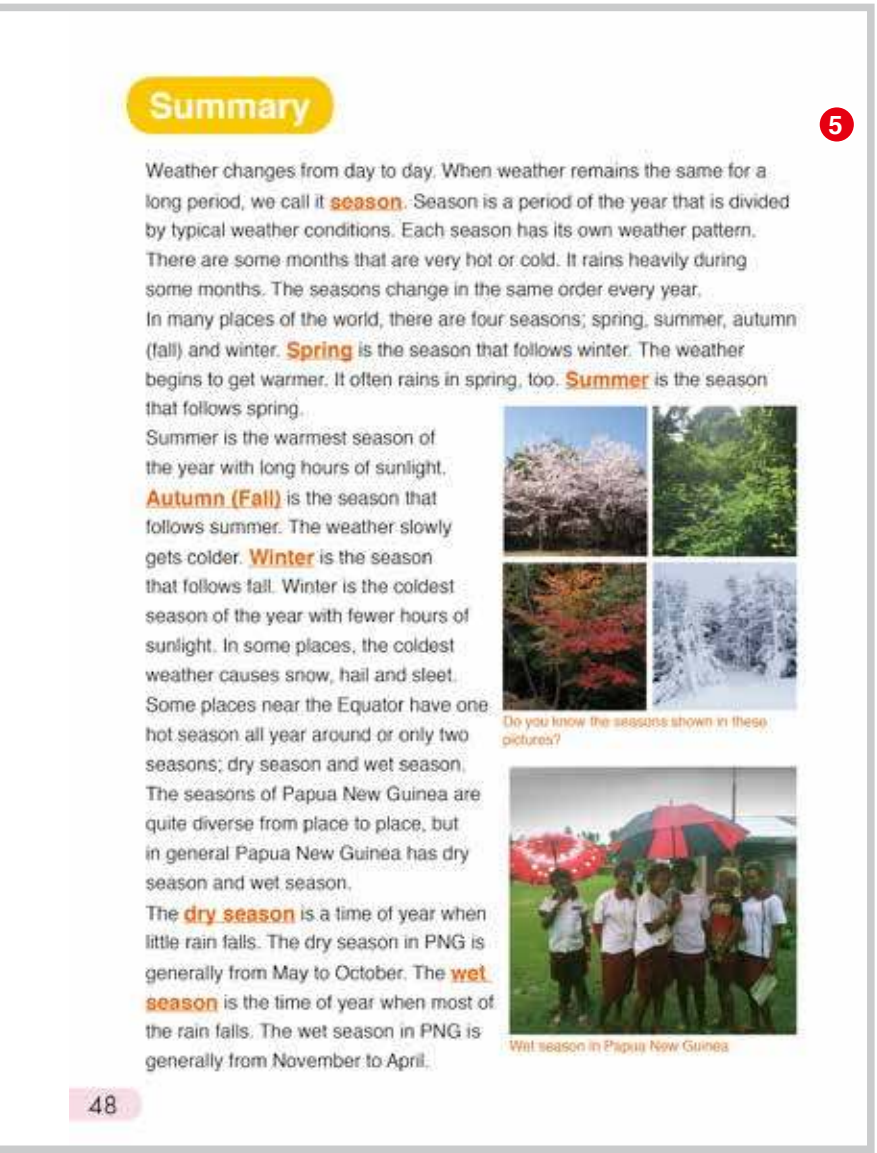
Note: Explain that the graph used in the activity is made up of two graphs put together as one. There's the line graph that shows the temperature (which the temperature is read from the dots on the line) and bar graph that shows the amount of rainfall (the amount of rainfall is read from where the bar stops at the top).

Lesson Objectives

Students will be able to:
- Define the word season.
- Identify seasons experienced in Papua New Guinea and in other parts of the world.
- Interpret the graph on how the seasons in Papua New Guinea change every year.

Assessment

Students are able to:
- Explain the definition of season compared with weather.
- State the types of seasons in Papua New Guinea and those in other parts of the world.
- Identify the pattern of seasons in Papua New Guinea by focusing on rainfall and temperature from the graph.
- Appreciate that seasons are not the same all throughout the year.



Summary

Weather changes from day to day. When weather remains the same for a long period, we call it **season**. Season is a period of the year that is divided by typical weather conditions. Each season has its own weather pattern. There are some months that are very hot or cold. It rains heavily during some months. The seasons change in the same order every year.

In many places of the world, there are four seasons; spring, summer, autumn (fall) and winter. **Spring** is the season that follows winter. The weather begins to get warmer. It often rains in spring, too. **Summer** is the season that follows spring.

Summer is the warmest season of the year with long hours of sunlight. **Autumn (Fall)** is the season that follows summer. The weather slowly gets colder. **Winter** is the season that follows fall. Winter is the coldest season of the year with fewer hours of sunlight. In some places, the coldest weather causes snow, hail and sleet.

Some places near the Equator have one hot season all year around or only two seasons; dry season and wet season.

The seasons of Papua New Guinea are quite diverse from place to place, but in general Papua New Guinea has dry season and wet season.

The **dry season** is a time of year when little rain falls. The dry season in PNG is generally from May to October. The **wet season** is the time of year when most of the rain falls. The wet season in PNG is generally from November to April.

Do you know the seasons shown in these pictures?

Wet season in Papua New Guinea

48

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

Q:In which part of the year do we experience less rain and more rainfalls?
Less rainfall- in the middle of the year
More rainfall- At the beginning and towards the end of the year

Q:What about the temperature? Warmer at the beginning and towards the end of the year but cooler in the middle of the year

- Explain that when weather remains the same for a long period this is call a season. A season is a period of the year that is divided by typical weather conditions.

Q:What seasons does Papua New Guinea have? Dry and wet season

Q:What about in other places of the world?

- 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 a season?
  Q: How many seasons are there in other parts of the world? (Name them)
  Q: How many seasons do we have in PNG? What are they?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Seasons**

Key question: What is a season?

Activity: Seasons in Papua New Guinea

1. Is the temperature the same all year round? No
2. Which months are warmer with temperatures at 25°C and over? Jan to May and from Oct to Dec
3. Which months are cooler with temperatures below 25°C? Jun to Sep
4. Does the rainfall occur all year round? No Drier months are from June to September, the other months are wetter.
5. Which months are drier with less than 200 mm of rainfall? Jun to Sep
6. How many months are wetter with more than 200 mm of rainfall?

Discussion

Q: In which part of the year do we experience less rain and more rainfalls? Less rainfall- in the middle of the year
More rainfall- At the beginning and towards the end of the year

Q: What about the temperature? Warmer at the beginning and towards the end of the year but cooler in the middle of the year.

Q: What patterns of rainfalls and temperature are there in PNG? In the middle of the year: Less rainfall and cooler. At the beginning and the end of the year: More rainfalls and warmer.

Q: What seasons does PNG have? Dry and wet season

Summary

- A season is a period of the year that is divided by typical weather conditions.
- In other places of the world there are four seasons: spring, summer, autumn and winter.
- In PNG there are two seasons: dry and wet season.

Unit: **Weather and Climate**	Chapter : **3. Weather and Seasons** Topic : **3.2. Seasons**	Total lesson No: 18 / 87 Textbook page: 49 - 50

Lesson 5 / 7

Lesson Title

Seasonal Changes and Living Things

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Recap on the previous lesson on seasons.

Q:What seasons do we have in Papua New Guinea?

Q:What are the four seasons experienced in other parts of the world?

2 Introduce the key question

How do living things change with seasons?

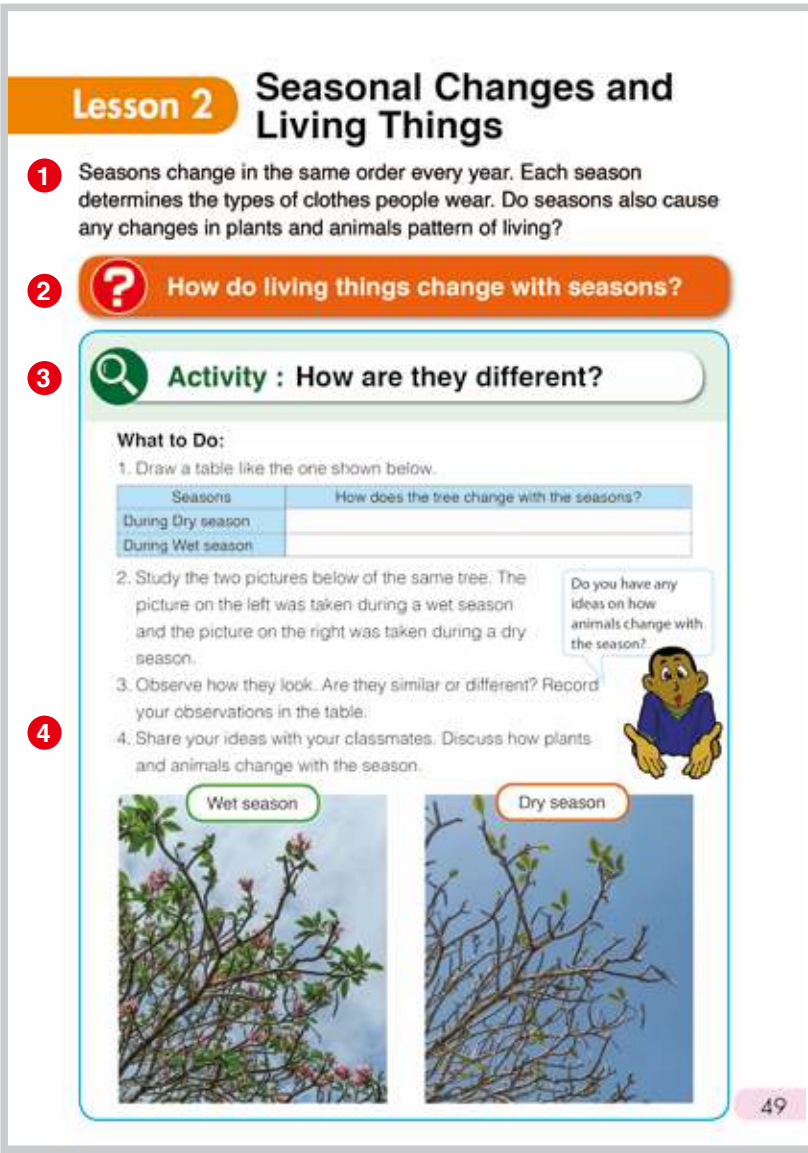
3 Activity (25 min.)

- Organise students in pairs or in groups to work.
- Ask the students to guess how plants and animals can adjust to change in seasons.
- Explain the steps of the activity.
- Advice students to study the pictures of tree and the characters in the activity.
- Ask students to make a list of their findings in the table.
- Check students' activity and if neccessary guide them towards their findings.
- Ask students to discuss their findings in their groups.
- 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.

(Continue)



Lesson 2 Seasonal Changes and Living Things

1 Seasons change in the same order every year. Each season determines the types of clothes people wear. Do seasons also cause any changes in plants and animals pattern of living?

2 How do living things change with seasons?

3 Activity : How are they different?

What to Do:

1. Draw a table like the one shown below.

Seasons	How does the tree change with the seasons?
During Dry season	
During Wet season	

2. Study the two pictures below of the same tree. The picture on the left was taken during a wet season and the picture on the right was taken during a dry season.
3. Observe how they look. Are they similar or different? Record your observations in the table.
4. Share your ideas with your classmates. Discuss how plants and animals change with the season.

Do you have any ideas on how animals change with the season?

4

Wet season

Dry season

49

Teacher's Notes

How do seasonal changes affect plants and animals?

- Animals and plants change throughout the seasons of spring, summer, autumn (fall), and winter.
- Animal adaptations are triggered by weather and seasonal changes. During the spring, the warm weather and abundant food supplies encourage the growth of both plants and animals. This growth continues throughout the summer. During autumn (fall), the weather cools, the amount of sunlight decreases, and food becomes scarce (not plenty). Some plants become dormant and some animals undergo changes to prepare for the winter. Some animals collect food to store during the winter months and others hibernate (go into a long sleep), migrate, or grow thicker fur.
- Plants can sense changes in the seasons. Leaves change colour and drop each autumn in some climates. Leaves changing colour is a response to the shortened length of the day in autumn. In the spring, the winter buds on the trees break open, and the leaves start to grow.

Note: This can be discussed with the students based on the second question in the discussion.

Lesson Objectives

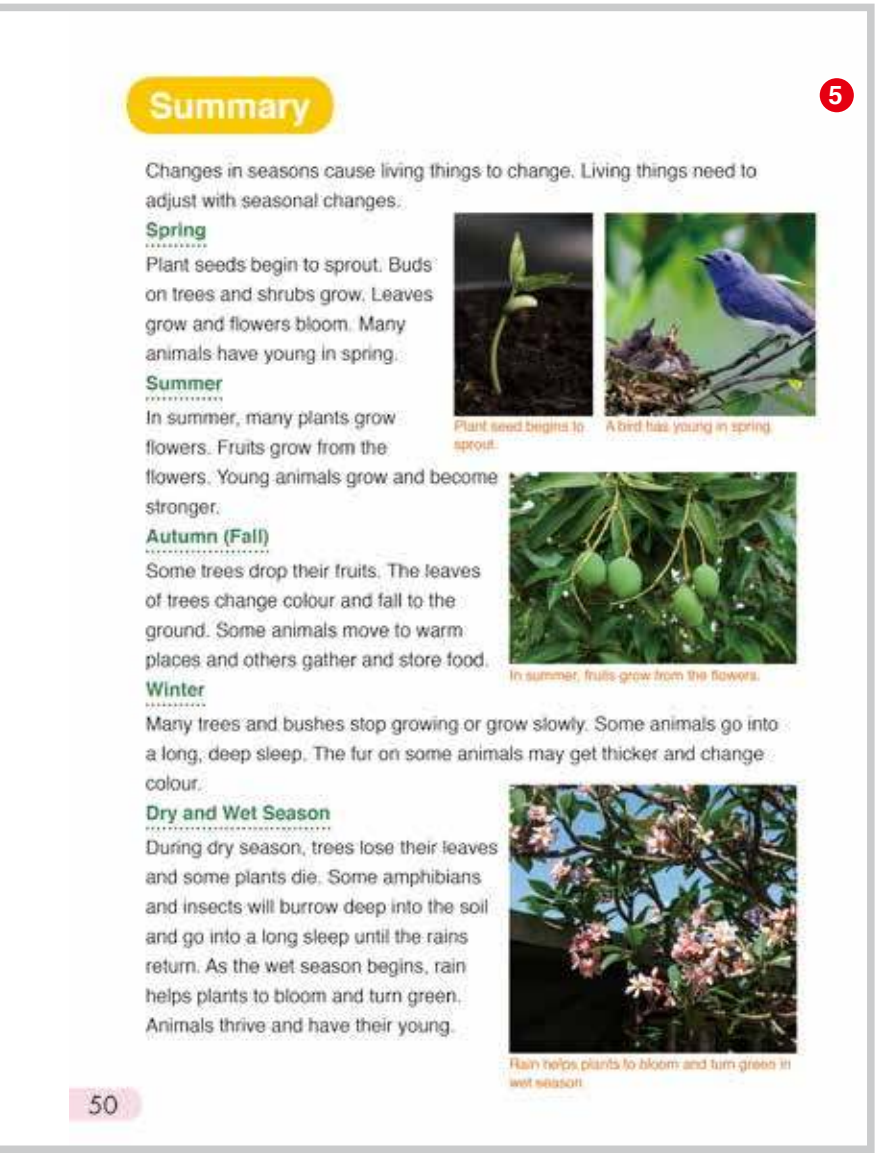
Students will be able to:

- Observe how the tree changes with the season.
- Identify how living things change with the seasons.

Assessment

Students are able to:

- Record how a tree changes with wet and dry season in a table.
- Explain how living things change with seasons.
- Appreciate that plants and animals are able to change with seasons.



Summary

Changes in seasons cause living things to change. Living things need to adjust with seasonal changes.

Spring

Plant seeds begin to sprout. Buds on trees and shrubs grow. Leaves grow and flowers bloom. Many animals have young in spring.

Summer

In summer, many plants grow flowers. Fruits grow from the flowers. Young animals grow and become stronger.

Autumn (Fall)

Some trees drop their fruits. The leaves of trees change colour and fall to the ground. Some animals move to warm places and others gather and store food.

Winter

Many trees and bushes stop growing or grow slowly. Some animals go into a long, deep sleep. The fur on some animals may get thicker and change colour.

Dry and Wet Season

During dry season, trees lose their leaves and some plants die. Some amphibians and insects will burrow deep into the soil and go into a long sleep until the rains return. As the wet season begins, rain helps plants to bloom and turn green. Animals thrive and have their young.

Plant seed begins to sprout.

A bird has young in spring.

In summer, fruits grow from the flowers.

Rain helps plants to bloom and turn green in wet season.

50

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

Q:How do plants change during dry and wet season?

During dry season:

- Some plants change the colour of leaves, leaves drop, etc.

During wet season:

- Leaves start to grow, some make flowers, etc.

Q:How do animals change during dry and wet season?

During dry season:

- Some animals go into a long sleep, other migrate to places where there is food

During wet season:

- They thrive and have their young

- Conclude the discussions.

5 Summary (10 min.)

- Ask the 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 happens when seasons change?
  Q: How do plants and animals change with the seasonal changes?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Seasonal Changes and Living Things

Key question

How do living things change with seasons?

Activity: How are they different?

Season	How does the tree change with the seasons?
During Dry Season	Tree loses its leaves, now flowers, etc.
During Wet Season	Tree blooms and turn green, leaves grow, etc.

Discussion

Q: How do animals change during dry and wet season?

During dry season: Some plants change the colour of leaves, leaves drop, etc.

During wet season: Leaves start to grow, some make flowers, etc.

Q: How do animals change during dry and wet season? During dry season: Some animals go into a long sleep, other migrate to places where there is food.

During wet season: They thrive and have their young.

Summary

- Changes in seasons cause living things to change.
- Living things need to adjust with seasonal changes.
- Many animals have young in spring.

↓

- Many plants grow flowers in summer.

↓

- Some leaves of trees change colour and fall off to the ground in autumn.

↓

- Some animals go into a long sleep in winter.

Unit: **Weather and Climate**	Chapter : **3. Weather and Seasons** Topic : **3.2. Seasons**	Total lesson No: 19 / 87 Textbook page: 51 - 53

Lesson 6 / 7

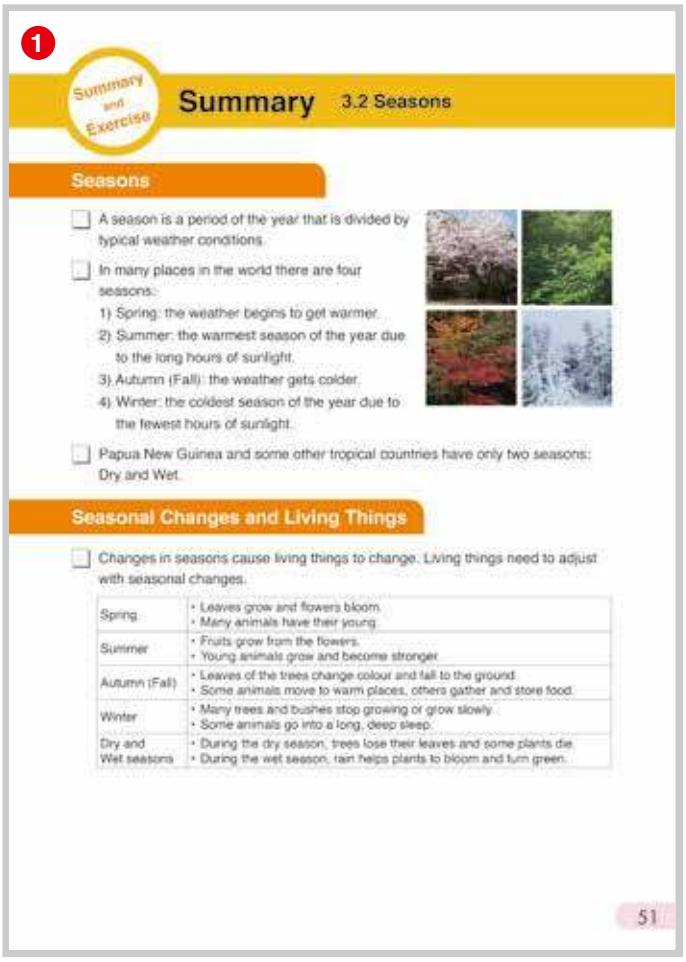
Lesson Title

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: What is season?
  - Q: What seasons do we experience in Papua New Guinea?
  - Q: What are the other seasons experienced in other parts of the world?
  - Q: How do plants and animals adapt to seasonal changes?
- 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.



1

Summary and Exercise

Summary 3.2 Seasons

Seasons

- A season is a period of the year that is divided by typical weather conditions.
- In many places in the world there are four seasons:
  1) Spring: the weather begins to get warmer.
  2) Summer: the warmest season of the year due to the long hours of sunlight.
  3) Autumn (Fall): the weather gets colder.
  4) Winter: the coldest season of the year due to the fewest hours of sunlight.
- Papua New Guinea and some other tropical countries have only two seasons: Dry and Wet.

Seasonal Changes and Living Things

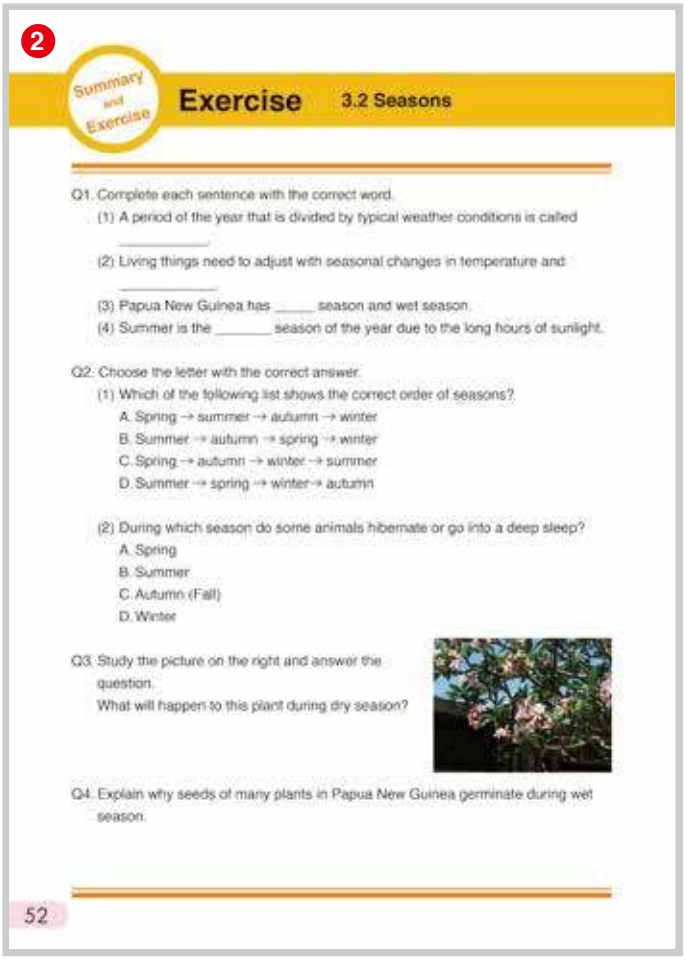
- Changes in seasons cause living things to change. Living things need to adjust with seasonal changes.

Spring	• Leaves grow and flowers bloom. • Many animals have their young.
Summer	• Fruits grow from the flowers. • Young animals grow and become stronger.
Autumn (Fall)	• Leaves of the trees change colour and fall to the ground. • Some animals move to warm places, others gather and store food.
Winter	• Many trees and bushes stop growing or grow slowly. • Some animals go into a long, deep sleep.
Dry and Wet seasons	• During the dry season, trees lose their leaves and some plants die. • During the wet season, rain helps plants to bloom and turn green.

51

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.



2

Summary and Exercise

Exercise 3.2 Seasons

Q1. Complete each sentence with the correct word.

(1) A period of the year that is divided by typical weather conditions is called _____.

(2) Living things need to adjust with seasonal changes in temperature and _____.

(3) Papua New Guinea has _____ season and wet season.

(4) Summer is the _____ season of the year due to the long hours of sunlight.

Q2. Choose the letter with the correct answer.

(1) Which of the following list shows the correct order of seasons?

A. Spring → summer → autumn → winter
B. Summer → autumn → spring → winter
C. Spring → autumn → winter → summer
D. Summer → spring → winter → autumn

(2) During which season do some animals hibernate or go into a deep sleep?

A. Spring
B. Summer
C. Autumn (Fall)
D. Winter

Q3. Study the picture on the right and answer the question.
What will happen to this plant during dry season?

Q4. Explain why seeds of many plants in Papua New Guinea germinate during wet season.

52

Exercise answers

Q1.
(1) **season**
(2) **rainfall**
(3) **dry**
(4) **warmest (hottest)**

(2) Changes in seasons cause living things to change. Living things need to adjust with seasonal changes in temperature and rainfall.
(3) Papua New Guinea has dry season and wet seasons. The dry season is a time of year when little rain falls.

Q2.
(1) **A**
(2) **D**

(1) The correct order of the 4 seasons experienced in other parts of the world is spring, summer, autumn, winter.
(2) Some animals go into a deep sleep during winter, this is called hibernation.

Q3. **The leaves turn brown and drop to the ground.**

Q4. Expected answer
The seeds get enough water to germinate and grow well in the wet season.

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.


3

Chapter 3
•Science Extras•

Why do animals go into a very long sleep during winter?

You are probably aware that some animals fall into a very long sleep during winter, this is called Hibernation. Hibernation is an adaptation that helps many animals conserve energy by remaining inactive and reducing their body temperature for days, weeks or even months at a time.
Typically, animals hibernate in order to survive long periods when food is scarce. Hibernating animals will generally eat a lot of food before hibernation and then survive off the energy stored in their fat.
Hibernating animals can sense seasonal changes. The moment they sense autumn (fall) approaching, they get busy preparing by eating more than usual, the animal builds up extra layers of fat. During hibernation, the animal's body will feed on this fat to keep itself alive. Extra fat also helps the animal to stay warm when they are asleep. They then find a shelter where they will be safe while they are asleep if they want to survive.
Only warm-blooded animals can truly hibernate because cold-blooded animals cannot regulate their own body temperatures. Bears, ground squirrels, woodchucks and groundhogs all hibernate during winter.

This animal has gone into a deep sleep during winter.

53

Lesson 7 / 7

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

3. Weather and Seasons

Q1 Complete each sentence with the correct word.

(1) Different types of clouds are located at different altitude (height) of the sky.

(2) The types of clouds tell us about the upcoming weather.

(3) Some places near the equator have one hot season all year round or only two seasons, dry and wet.

Q2 Choose the letter with the correct answer.

(1) Papua New Guinea has two seasons, what are they?

A. rainy and winter
B. wet and dry
C. spring and dry
D. summer and winter

(2) Which cloud is formed at a range from low to high level altitude and like a huge cloud tower?

A. cirrocumulus
B. cumulonimbus
C. cirrostratus
D. cumulus

(3) What can clouds tell us about? They can tell us about

A. what the upcoming weather will be like.
B. when it will be full moon.
C. what time the sun rises.
D. how many seasons there are.

(4) In which season do leaves of trees start to change their colours and drop to the ground and the nights begin to get colder?

A. Spring
B. Summer
C. Autumn
D. Winter

54

Q3

(1) What would be the expected weather when the clouds are thin, pure white fields of small grains or ripples at a high alttitude as shown in the picture on the right?

Storm may come. In tropical regions, that could be a hurricane.

(2) How are plants different in wet and dry season?

During dry seasons, trees lose their leaves and some plants die. As the wet season begins rain helps plants to bloom and turn green.

(3) The graph on the right shows monthly rainfall in a city. Is it dry season or wet season from July to October?

Day season

Q4

(1) What do animals do in Autumn (Fall) to get ready for winter?

(Expected answer) Animals move to warmer places./ Animals gather and store food for winter.

(2) Farahlyn observed the sky one day and saw that the clouds looked like hooks, feathers and patches with silky shimmer.

(i) What type of cloud did she see?

Cirrus

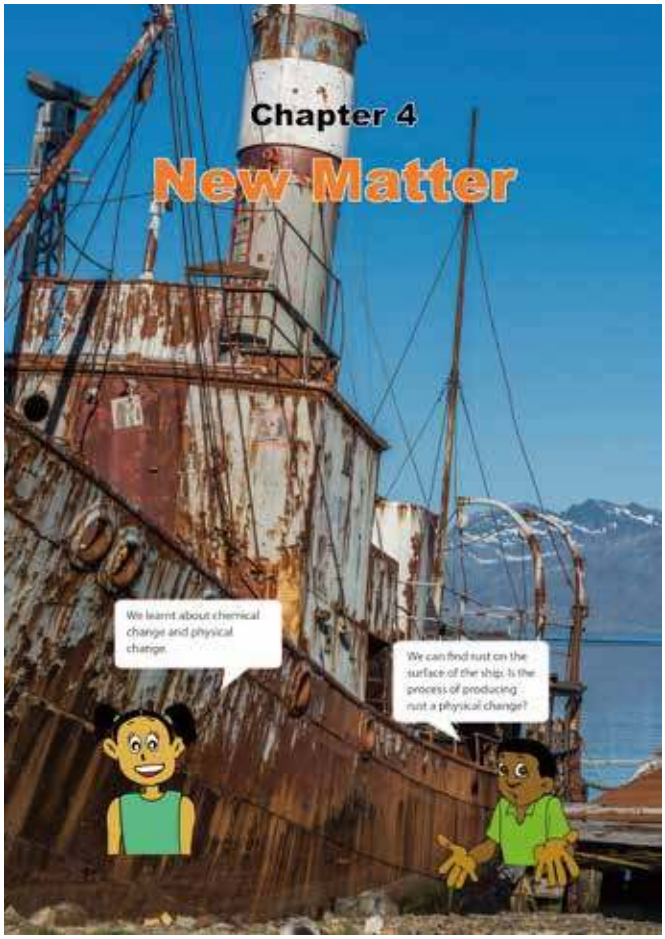
(ii) What do you think the weather would be like by looking at those clouds?

Weather would be fine but might change within 2 or 3 days.

Chapter 4. New Matter

Chapter Objectives

Students will be able to understand and explain the process of a chemical change and identify the types of common chemical changes that occur in daily life.



This picture is from the chapter heading of the textbook showing a ship which the surface is covered by dark brown rust over some years.

Topic Objectives

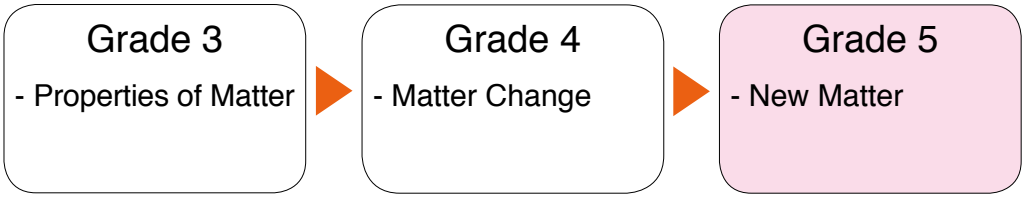
4.1 Common Chemical Changes

Students will be able to;

- Recognise and explain a chemical change has taken place in matter.
- Explain that a chemical change occurs in matter when it produces a new matter with new properties.
- State that rusting is a kind of chemical change that occurs on the surface of iron or steel.
- Explain that rusting occurs when iron or steel comes in contact with water and oxygen in the air.
- Recognise that iron and rust are different kinds of matter.
- Identify common chemical changes in daily life.

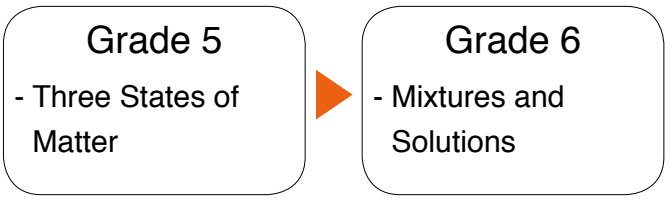
Related Learning Contents

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



Prior knowledge for learning this chapter;

- Matter can change its physical properties such as shape, size and colour.
- Matter can change chemically. A chemical change in matter is where a new kind of matter is formed.



Teaching Overview

This chapter consists of 5 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
4.1 Common Chemical Changes	1	**How to tell a Chemical Change** How can we tell if a chemical change has taken place?	5.2.4	57 - 58
	2	**Rusting** Is rusting a chemical change?		59 - 60
	3	**Chemical Changes in Daily Life** How does a chemical change take place in daily life?		61 - 62
	4	Summary and Exercise, Science Extra		63 - 65
Chapter Test	5	Chapter Test		66 - 67

Unit: **Matter**	Chapter : **4. New Matter** Topic : **4.1. Common Chemical Changes**	Total lesson No: 21 / 87 Textbook page: 57 - 58

Lesson 1 / 5

Lesson Title

How to Tell a Chemical Change

Preparation

2 sugar cubes, table spoon, candle, match, hammer, aluminium foil

Lesson Flow

1 Introduction (5 min.)

- Draw students' attention to Grade 4 Topic 12.1, 'Physical and Chemical Changes in Matter'.

Q:How do matter change?

Q:Give an example of a physical and a chemical change in matter.

- Encourage students to think about chemical changes in matter by asking:

Q:What happens when a matter change chemically?

2 Introduce the key question

How can we tell if a chemical change has taken place?

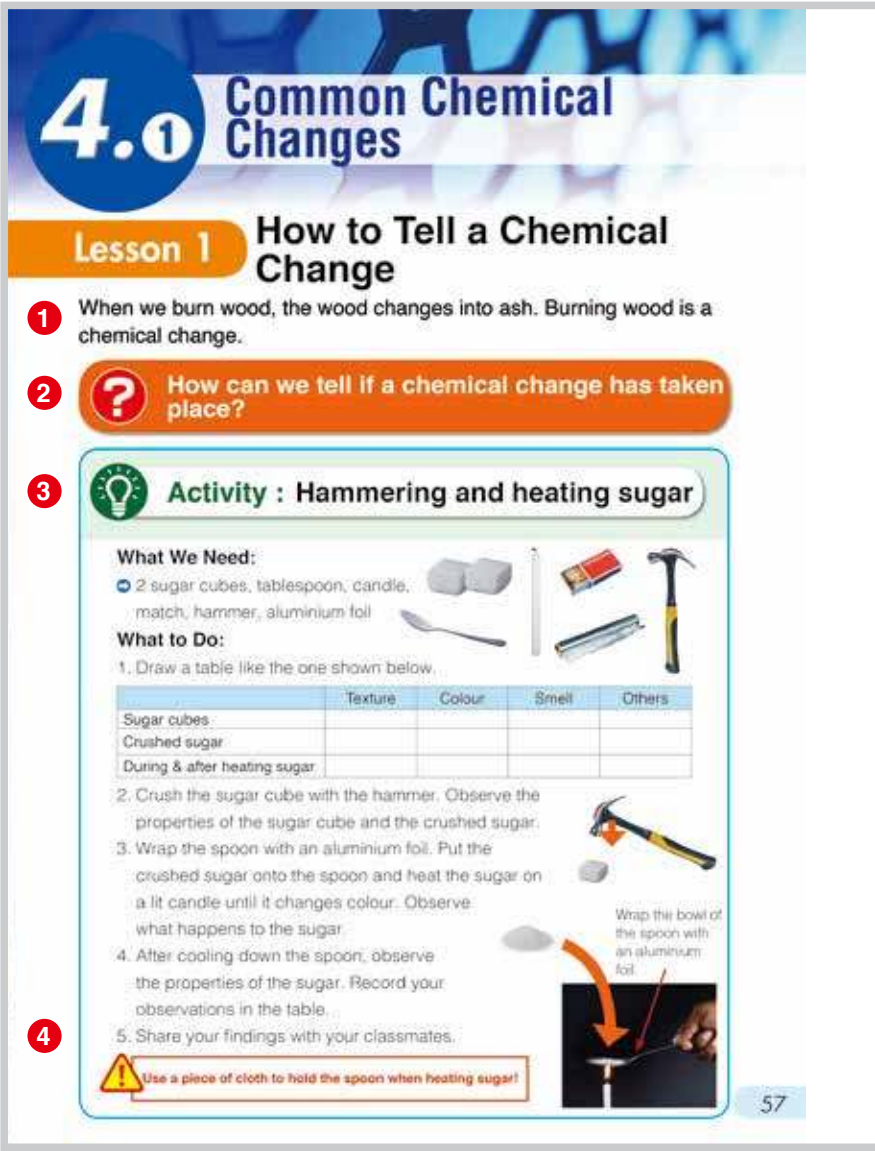
3 Activity (25 min.)

- Organise students into small groups.
- Explain the steps of the activity.
- Before the activity, remind students of the important safety rules required.
- Have students carryout the investigation.
- Assist students to crush the suagr cube with the hammer and light the candle.
- Advise students to closely observe the properties of the sugar.
- Give enough time for students to do their findings.

4 Discussion for findings (20 min.)

- Ask students to present their findings from the activity.

(Continue)



Teacher's Notes

- In Grade 4 Chapter 12 'Matter Change', students learnt about Physical and Chemical changes in Matter. They learnt that matter can change in different ways that is physically and chemically. For this lesson students will identify ways of how to tell if a chemical change has taken place through the activity.

Tips of the Activity

Note: In the case, that there is no sugar, you can improvise by following the tips below.

1. Pour 2 cups of sugar into a bowl.
2. Add 2 teaspoons of water and stir with a fork until well blended.
3. Press sugar firmly into moulds to smooth away loose sugar.
4. Pour sugar into a flat surfaced square and press down firmly to make it intact.
5. Use a small fine blade / knife and cut into cubes.
6. Leave it to stay for an hour or overnight and then gently remove the cubes.
7. Place them on a dry surface and leave to dry completely. Once it is hard to handle, it is ready to use.

Ingredients: bowl, cup, 250g sugar, water

Lesson Objectives

Students will be able to:

- Recognise how to distinguish a chemical change from a physical change.
- Distinguish a chemical change from a physical change through the activity.
- Carry out the experiment correctly and carefully.

Assessment

Students are able to:

- Explain that a chemical change is different from a physical change as it produces a new matter.
- Describe sugar as a chemical change based on its properties.
- Follow instructions to carry out the experiment correctly.

Discussion

How do we tell a physical change from a chemical change?

1. Think about the following questions based on your results.
   (1) Do the sugar cube and the crushed sugar have the same or different properties?
   (2) Is the crushed sugar a physical or a chemical change?
   (3) Does the sugar after heating have the same properties as the sugar cube?
   (4) Is the heated sugar a physical change or a chemical change? Why do you think so?
2. Talk about how we can tell if a chemical change has taken place.

A physical change is a change in the physical properties of matter!

Summary

A chemical change produces new kinds of matter. A physical change does not produce new matter. New matter has different properties. For example, burning is a chemical change. After burning wood, the wood changes into ash. The wood and ash have different properties. Burning wood produces new kind of matter such as ash. Ash is no longer wood.
A chemical change produces gas, odour, heat, light, and changes in colour and state. For example, when sugar is heated, odour is produced, its colour and state changes. Therefore, heating sugar is a chemical change.

Burning wood is a chemical change. It produces ash.

Heating sugar produces melted sugar (caramel) and the colour changes.

58

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

Q:Do the sugar cube and the crushed sugar have the same or different properties? (Both have the same properties.)

Q:Is the crushed sugar a physical or a chemical change? (A physical change)

Q:Does the sugar after heating have same properties as the sugar cube? (No, their properties are different.)

Q:Is heating sugar a physical change or a chemical change? (A chemical change)

Q:Why do you think so? (Because its properties had changed when heated.)

- 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: How can we tell a chemical change apart from a physical change?
  Q: What are some examples of chemical properties of matter?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

How to Tell a Chemical Change

Key question : How can we tell if a chemical change has taken place?

Activity: Hammering and heating sugar

	Texture	Colour	Smell	Others
Sugar Cube	Rough	White	No	.....
Crushed sugar	Rough	White	No	.....
During heating and after heating	Smooth	Brown	Sweet scent	.....

Discussion

Q: Do the sugar cube and the crushed sugar have the same or different properties? Both have the same properties.

Q: Is the crushed sugar a physical or a chemical change? A physical change

Q: Does the sugar after heating have same properties as the sugar cube? No, their properties are different.

Q: Is heating sugar a physical change or a chemical change? A chemical change

Q: Why do you think so? Because its properties had changed when heated.

Summary

- Chemical change produces a new matter
- The new matter produced has different properties.
- A chemical change includes production of gas, odour, heat or light and changes in colour and state.
- Examples of chemical change are; burning a wood or paper and heating sugar etc.

Unit: **Matter**	Chapter : **4. New Matter** Topic : **4.1. Common Chemical Changes**	Total lesson No: 22 / 87 Textbook page: 59 - 60

Lesson 2 / 5

Lesson Title

Rusting

Preparation

A piece of dry steel wool, piece of steel wool dipped in salt water for a week, small plate, scissors, hand lens, magnet, A4 paper

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:How does a chemical change occur in matter?

Q:What are some examples of chemical properties of matter?

- Encourage students to think about other types of chemical changes by asking:

Q:Do you think there are other kinds of chemical change?

2 Introduce the key question

Is rusting a chemical change?

3 Activity (25 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Before the activity, remind students about the safety rules required.
- Refer students to what the character is saying for their investigation.
- Have students carry out the investigation.
- Check students' activity and if neccessary guide them towards their findings.
- Ask students to record their results in the table and to discuss their results with their groups.

4 Discussion for findings (20 min.)

- Ask students to present their findings from the activity.

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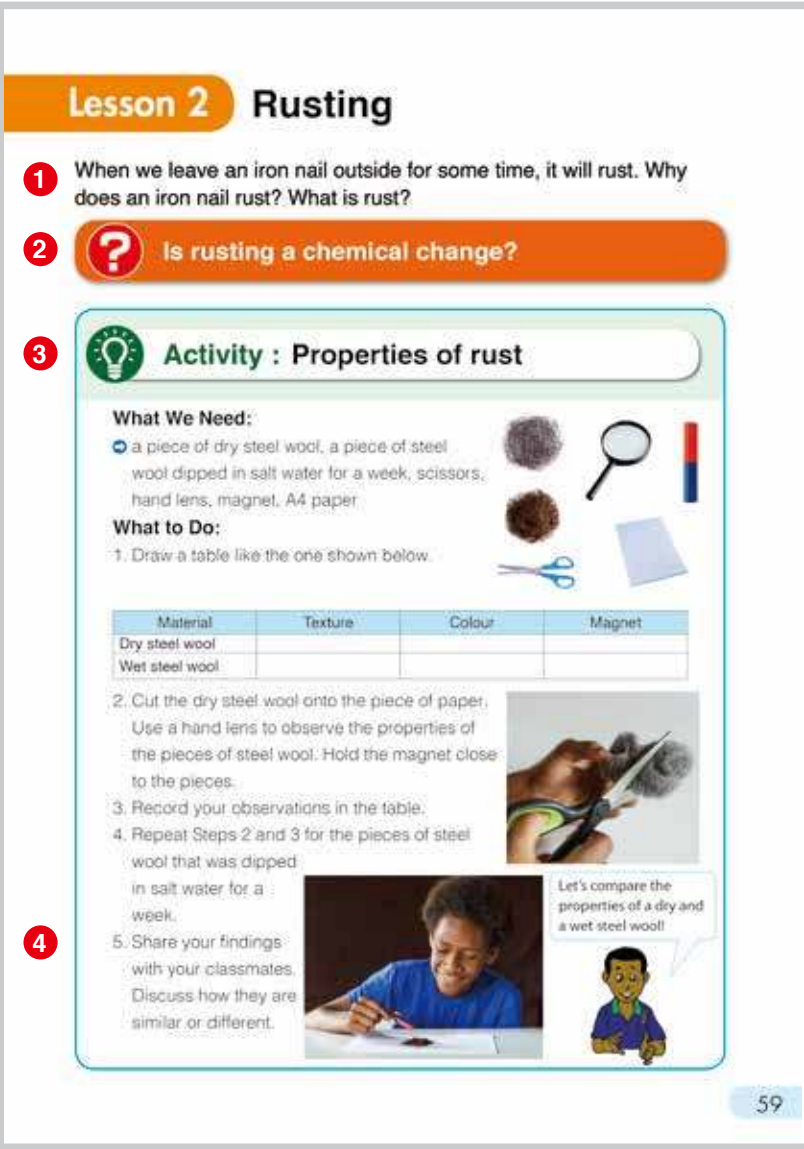


Lesson 2 Rusting

1 When we leave an iron nail outside for some time, it will rust. Why does an iron nail rust? What is rust?

2 Is rusting a chemical change?

3 Activity : Properties of rust

What We Need:

a piece of dry steel wool, a piece of steel wool dipped in salt water for a week, scissors, hand lens, magnet, A4 paper

What to Do:

1. Draw a table like the one shown below.

Material	Texture	Colour	Magnet
Dry steel wool			
Wet steel wool			

2. Cut the dry steel wool onto the piece of paper. Use a hand lens to observe the properties of the pieces of steel wool. Hold the magnet close to the pieces.
3. Record your observations in the table.
4. Repeat Steps 2 and 3 for the pieces of steel wool that was dipped in salt water for a week.
5. Share your findings with your classmates. Discuss how they are similar or different.

4

Let's compare the properties of a dry and a wet steel wool!

59

Teacher's Notes

- In Grade 4 chapter 12 'Matter Change', students learnt that burning wood, cooking food, ripening fruits and rusting are some examples of chemical change in matter. In this lesson, students will further learn about what causes rusting to be a chemical change.

Tips for the Lesson

- Prior to the lesson, add a few pinch of salt into a jar and soak the steel wool for a week. The salt acts as an agent in making the steel wool to change or rust faster.
- Theoretically, it is true that magnetism and electric conductivity will be lost because of rust. However it does not happen in reality because full chemical change does not occur in real situation.
- Remove the steel wool from the salt water and let it to be exposed to the air to allow rust to occur immediately.

SAFETY

- Remember not to drop the magnet or place it closer to mobile phones or computers.

Additional Information on Rust

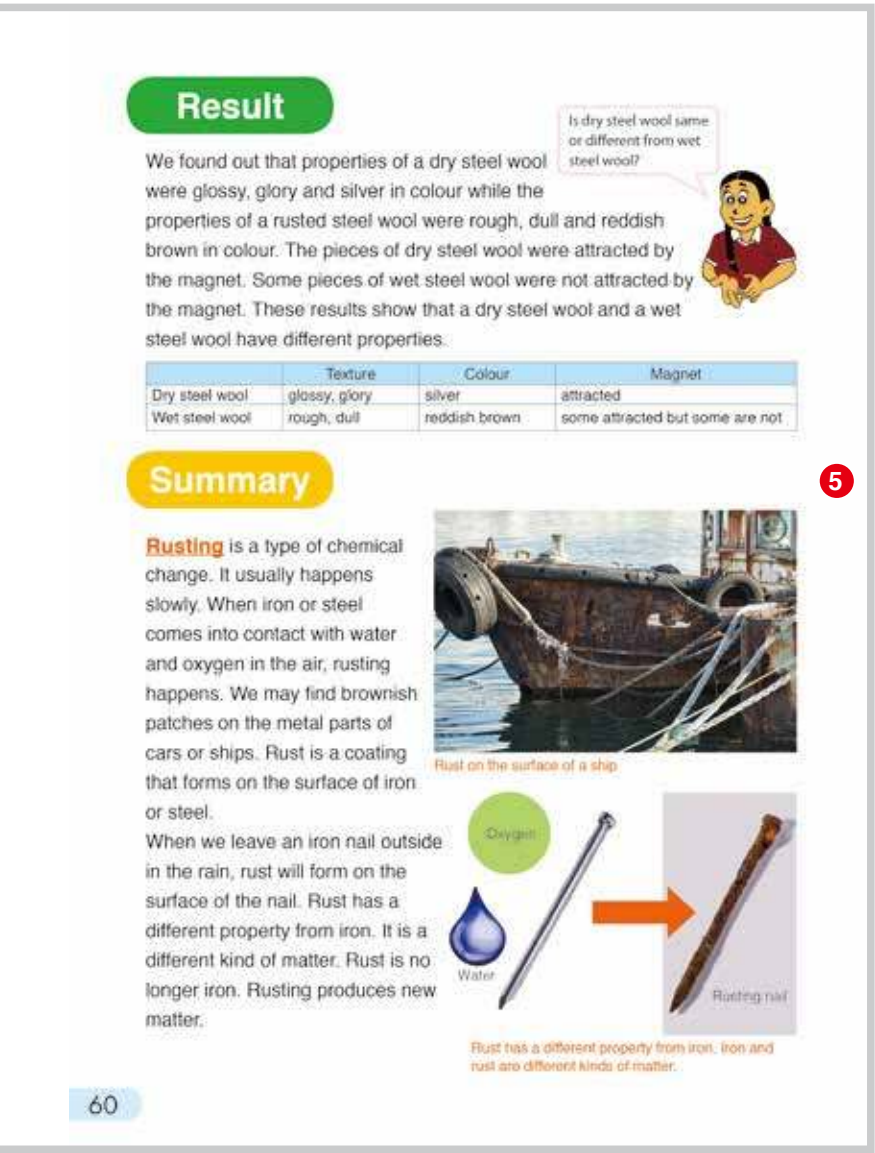
- One of the properties of rust is it becomes an insulator that it cannot conduct electricity just as not been attracted to a magnet.
- Not all metals rust. For example, aluminium doesn't rust because it has a protective layer of aluminium oxide on its surface. This stops the metal coming into direct contact with water (or moisture in the air) and oxygen. On the other hand, iron rusts because it has no protective layer on its surface when it comes into contact with water (or moisture in the air) and oxygen.

Lesson Objectives

Students will be able to:
- Explain what rusting is.
- Recognise that iron and rust are different kinds of matter.
- Show curiosity towards observing properties of iron and rust.

Assessment

Students are able to:
- State that rusting is a kind of chemical change.
- Explain how iron and rust are different kinds of matter based on their properties.
- Examine the properties of iron and rust with curiosity.



Result

We found out that properties of a dry steel wool were glossy, glory and silver in colour while the properties of a rusted steel wool were rough, dull and reddish brown in colour. The pieces of dry steel wool were attracted by the magnet. Some pieces of wet steel wool were not attracted by the magnet. These results show that a dry steel wool and a wet steel wool have different properties.

Is dry steel wool same or different from wet steel wool?

	Texture	Colour	Magnet
Dry steel wool	glossy, glory	silver	attracted
Wet steel wool	rough, dull	reddish brown	some attracted but some are not

Summary

5

Rusting is a type of chemical change. It usually happens slowly. When iron or steel comes into contact with water and oxygen in the air, rusting happens. We may find brownish patches on the metal parts of cars or ships. Rust is a coating that forms on the surface of iron or steel.
When we leave an iron nail outside in the rain, rust will form on the surface of the nail. Rust has a different property from iron. It is a different kind of matter. Rust is no longer iron. Rusting produces new matter.

Rust on the surface of a ship

Oxygen
Water
Rusting nail

Rust has a different property from iron. Iron and rust are different kinds of matter.

60

- Write their 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:Are the dry steel wool and the wet steel wool same or different matter? (They are different matter.)

Q:Why do you think so? (Because their properties are different.)

Q:Which type of steel wool showed a clear sign of rusting? (The wet steel wool.)

Q:Which property shows that rusting is a chemical change? (Colour changes from silver to reddish brown, and a magnet can attract dry steel wool, but it cannot attract some rust, 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 is rusting?
  Q: How does rusting happen?
  Q: What properties are difference between the wet steel wool and a dry steel wool?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Rusting

Key question :
Is rusting a chemical change?
Activity : Properties of rust
Result:

	Texture	Colour	magnet
Dry s/ wool	Glossy	Silver	Attracted
Wet s/ wool	Rough and dull	Reddish brown	Not attracted

Discussion

Q: Are the dry steel wool and the wet steel same or different matter? They are different matter.
Q: Why do you think so? Because their properties are different.
Q: Which type of steel wool showed a clear sign of rusting? The wet steel wool.
Q: Which property shows that rusting is a sign chemical change? Colour changes from silver to reddish brown, and a magnet can attract dry steel wool, but it cannot attract some rust, etc.

Summary

- Rusting is a type of chemical change that usually forms on the surface of iron or steel.
- Rusting occurs when iron or steel comes into contact with water and oxygen in the air.
- Rust and iron are different kinds of matter because they have different properties.

Unit: **Matter**	Chapter : **4. New Matter** Topic : **4.1. Common Chemical Changes**	Total lesson No: 23 / 87 Textbook page: 61 - 62

Lesson 3 / 5

Lesson Title

Chemical Changes in Daily Life

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:What is rust?

Q:How does rusting happen?

- Encourage students to think about what happens when matter goes through a chemical change.

2 Introduce the key question

How does a chemical change take place in daily life?

3 Activity (20 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to the pictures below the activity for their investigation.
- Have students carry out the activity and record their findings in the exercise books.
- Check students' activity and if neccessry guide them towards their findings.
- Ask students to discuss their findings in their groups.
- Give enough time for students to do their findings.

4 Discussion for findings (25 min.)

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

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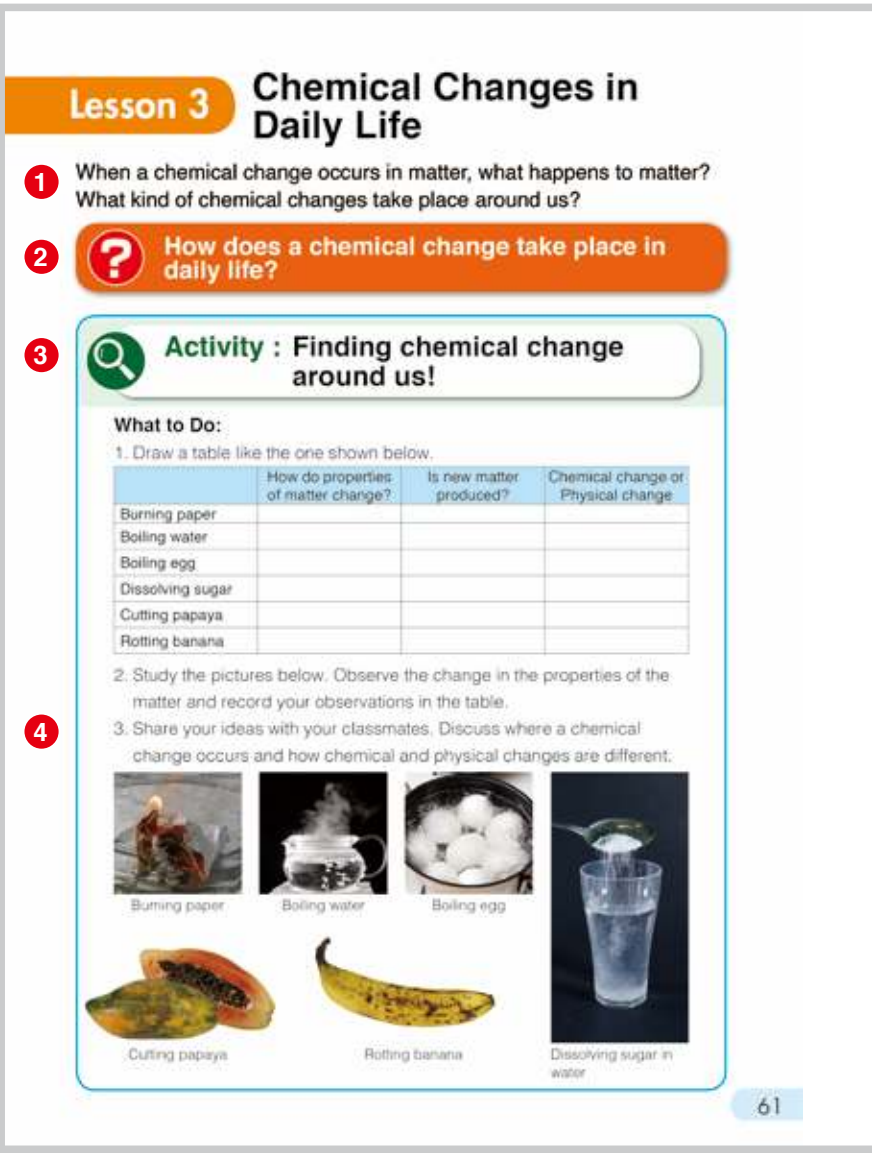


Lesson 3 Chemical Changes in Daily Life

1 When a chemical change occurs in matter, what happens to matter? What kind of chemical changes take place around us?

2 How does a chemical change take place in daily life?

3 Activity : Finding chemical change around us!

What to Do:

1. Draw a table like the one shown below.

	How do properties of matter change?	Is new matter produced?	Chemical change or Physical change
Burning paper			
Boiling water			
Boiling egg			
Dissolving sugar			
Cutting papaya			
Rotting banana			

2. Study the pictures below. Observe the change in the properties of the matter and record your observations in the table.

4 3. Share your ideas with your classmates. Discuss where a chemical change occurs and how chemical and physical changes are different.

Burning paper · Boiling water · Boiling egg · Cutting papaya · Rotting banana · Dissolving sugar in water

61

Teacher's Notes

What is a Chemical Change?

- A chemical change takes place when one or more substances react to form a new substance, or a substance breaks down to form one or more substances. A chemical change is also called a chemical reaction.
- It is sometimes accompanied by the emission (give off) or absorption (take in) of energy. The ones that are accompanied by the emission of heat are known as exothermic reactions; while the ones in which heat is absorbed, are known as endothermic reactions.

Other Examples of Chemical Changes in Daily Life

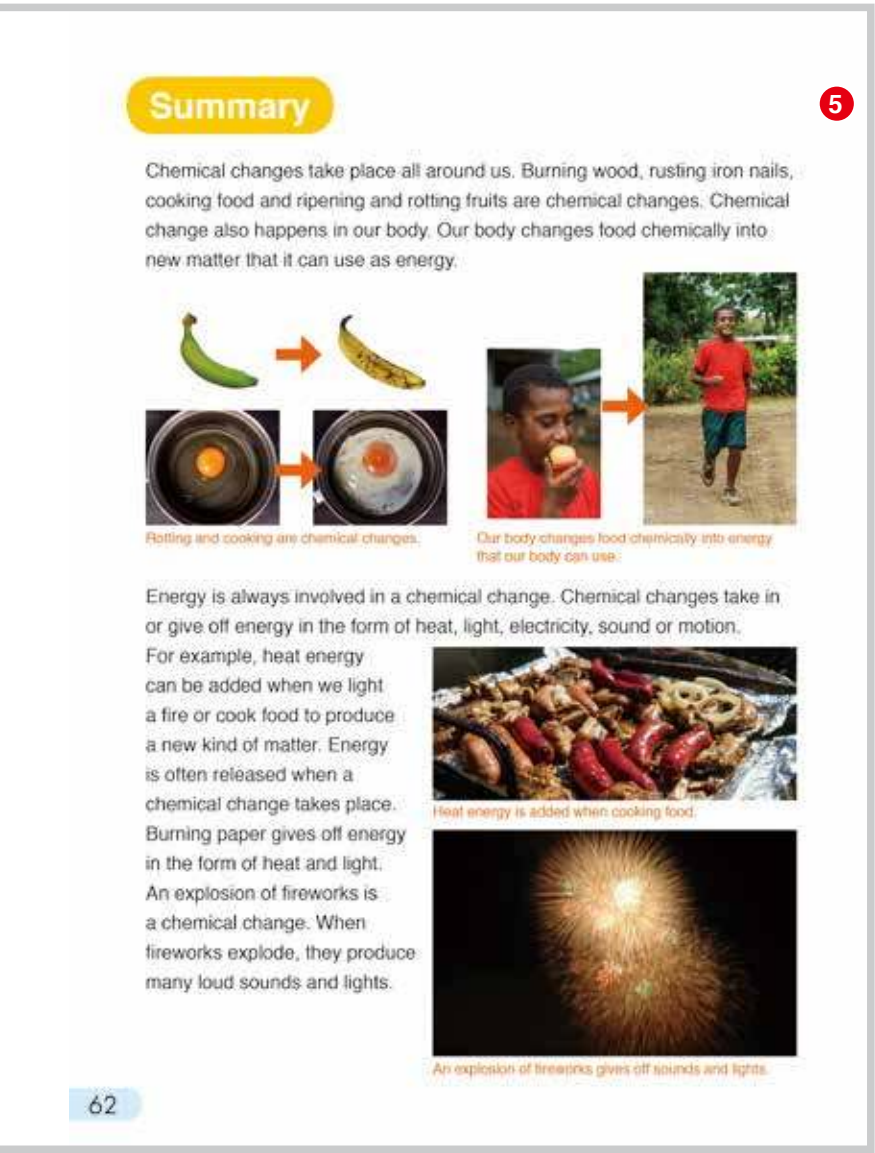
1. Digestion of Food
2. Washing detergents used in washing dirt from clothes, dishes and our bodies etc.
3. Effect of Medicine in our body taken when ill with different kinds of sickness and diseases.
4. Changing of colour of falling leaves. For instance, leaf of an almond tree (talis or okari tree).

Lesson Objectives

Students will be able to:
- Recognise that chemical changes take place all around us.
- Identify forms of energy involved in a chemical change.

Assessment

Students are able to:
- List examples of chemical changes that occur in daily life.
- State the forms of energy that are involved in a chemical change that occur in daily life.
- Show eagerness in discovering how chemical changes occur in daily life.



Summary

Chemical changes take place all around us. Burning wood, rusting iron nails, cooking food and ripening and rotting fruits are chemical changes. Chemical change also happens in our body. Our body changes food chemically into new matter that it can use as energy.

Rotting and cooking are chemical changes.

Our body changes food chemically into energy that our body can use.

Energy is always involved in a chemical change. Chemical changes take in or give off energy in the form of heat, light, electricity, sound or motion. For example, heat energy can be added when we light a fire or cook food to produce a new kind of matter. Energy is often released when a chemical change takes place. Burning paper gives off energy in the form of heat and light. An explosion of fireworks is a chemical change. When fireworks explode, they produce many loud sounds and lights.

Heat energy is added when cooking food.

An explosion of fireworks gives off sounds and lights.

62

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

Q:What are some types of chemical changes that happened around us? (Burning paper, rotting banana and a boiling egg.)

Q:How is the burning paper different from a mango being cut?(When paper is burning, a new kind of matter called the ash is created whereas in the mango being cut, its physical properties such as the size and the shape changed but the mango still remain as it is.)

Q:What energy is necessary to burn paper and cook food? (Heat energy)

Q:What energy is given off when paper is burning? (Heat energy, light energy)

Q:What is involved in chemical change? (Energy)

- 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: List examples of chemical changes that occur in daily life.
  Q: What forms of energy are involved in a chemical change?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Chemical Changes in Daily Life

Key question : How does a chemical change take place in daily life?

Activity: Finding chemical change around us.

	How...	New matter...	Chemical…
Burning paper			
Boiling water			
Boiling egg			
...			

Discussion

Q: What are some types of chemical changes that happened around us? Burning paper, rotting banana and a boiling egg, etc.

Q: How is the burning paper different from a mango being cut?When paper is burning, a new kind of matter called the ash is created whereas in the mango being cut, its physical properties such as the size and the shape changed but the mango still remain as it is.

Q: What energy is necessary to burn paper and cook food? Heat energy

Q: What energy is given off when paper is burning? Heat energy, light energy.

Q: What is involved in chemical change? (Energy)

Summary

- Chemical changes take place all around us.
- Burning wood, rusting iron nails, cooking food and ripening and rotting fruits are chemical changes.
- Chemical change also happens in our body.
- Energy is always involved in a chemical change.

Unit: **Matter**	Chapter : **4. New Matter** Topic : **4.1. Common Chemical Changes**	Total lesson No: 24 / 87 Textbook page: 63 - 65

Lesson 4 / 5

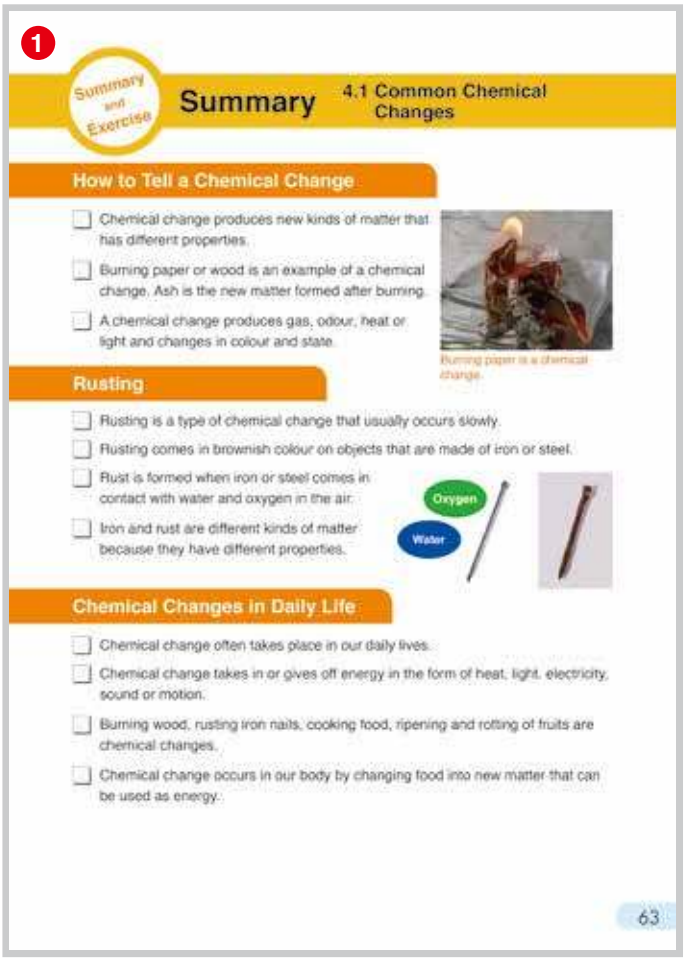
Lesson Title

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 chemical changes occur in matter?
  - Q: What are some examples of chemical changes?
- Explain and correct the learning contents again 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.



1

Summary and Exercise

Summary 4.1 Common Chemical Changes

How to Tell a Chemical Change

- Chemical change produces new kinds of matter that has different properties.
- Burning paper or wood is an example of a chemical change. Ash is the new matter formed after burning.
- A chemical change produces gas, odour, heat or light and changes in colour and state.

Burning paper is a chemical change.

Rusting

- Rusting is a type of chemical change that usually occurs slowly.
- Rusting comes in brownish colour on objects that are made of iron or steel.
- Rust is formed when iron or steel comes in contact with water and oxygen in the air.
- Iron and rust are different kinds of matter because they have different properties.

Oxygen

Water

Chemical Changes in Daily Life

- Chemical change often takes place in our daily lives.
- Chemical change takes in or gives off energy in the form of heat, light, electricity, sound or motion.
- Burning wood, rusting iron nails, cooking food, ripening and rotting of fruits are chemical changes.
- Chemical change occurs in our body by changing food into new matter that can be used as energy.

63

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 streghten the learnt concepts in this topic.

2

Summary and Exercise

Exercise 4.1 Common Chemical Changes

Q1. Complete each sentence with the correct word.

(1) Energy is always involved in a _____ change.
(2) The new matter formed after burning wood is _____.
(3) Chemical change produces _____ kind of matter.
(4) Iron and rust have different _____ such as colour and texture.

Q2. Choose the letter with the correct answer.

(1) Which of the following is a chemical change?
A. Boiling water.
B. Tearing of a paper.
C. Sharpening a pencil.
D. Rotting banana.

(2) What happens to an iron nail when it is left outside in the rain for a while?
A. Rust would form on the surface of the nail.
B. The iron nail would not change but remain as iron nail.
C. The nail would go missing.
D. The surface of the nail would become shinny.

Q3. Answer the following questions.

(1) Which of these pictures shown on the right is a chemical change?
(2) What things were produced when the sugar was burnt?
(3) Explain why it is a chemical change.

A

B

Crushing a sugar cube

Burning sugar

Q4. Plants take in water and gas called carbon dioxide and absorb sunlight. Then plants make sugar as their own food and give off oxygen gas. What can you conclude about the kind of changes that take place inside a plant to produce sugar and oxygen? Explain your answer.

64

Exercise answers

Q1.
(1) **chemical**
(2) **ash**
(3) **different**
(4) **properties**

Q2.
(1) **D**
(2) **A**

(2) Explain:
An iron nail is made of iron. When it is left outside in the rain, iron comes in contact with water and oxygen and as result rust occurs on the surface of the nail.

Q3.
(1) **The burning sugar**
(2) **Caramel**
(3) **Heating sugar produces a caramel that has different properties as a new kind of matter.**

Q4. Expected answer
The chemical change takes place inside the plants because new matter is produced.

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.

3

Chapter 4
•Science Extras•

Change of leaf colours during autumn

In many places of the world there are four seasons; spring, summer, autumn (fall) and winter. During autumn, falling temperatures prompts trees to prepare for winter. In these preparations, some kinds of trees change colour of their leaves dramatically.

Most leaves of trees look green because of the pigment they contain which is the chlorophyll. Chlorophyll absorbs sunlight and the light energy is converted to chemical energy through the process of photosynthesis. In addition to the chlorophyll, there are other pigments present in the leaves, which are carotene and anthocyanin. While carotene is yellow, anthocyanin is red. The change in temperature during autumn(fall) causes the trees to cut off supply of water to the leaves. In the absence of water, photosynthesis stops, and the chlorophyll breaks down through chemical change. Therefore, the leaves take the colour of the other pigments, and we can see a change in colour from green to red and yellow.

Leaves change their colour during autumn

Chemical change takes place in leaves of trees

65

Lesson 5 / 5

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

4. New Matter

Q1 Complete each sentence with the correct word.

(1) Cooking food, rotting banana, burning paper, and rusting iron are some chemical changes in daily life.

(2) Rust is a coating that forms on the surface of iron or steel.

(3) Heat energy is added when cooking food.

(4) A new solid matter produced after burning paper is callled ash.

Q2 Choose the letter with the correct answer.

(1) Which list contains chemical changes only?

A. baking cake, boiling water, tearing paper, cutting mango
B. rotting banana, burning wood, rusting iron, cooking food
C. breaking glass, burning paper, slicing bread, popping pop corn
D. crushed can, squeezing a paper, spoilt milk, rotting mango

(2) Which of the following statements is not true about rust?

A. Rust occurs when iron or steel comes in contact with water and oxygen.
B. Rust has the same property as iron.
C. Rust is a kind of chemical change.
D. Rust comes in brownish colour.

(3) A pair of metal scissors left outdoor was rusted. What evidence shows that a chemical change has taken place?

A. It had a deep scratch.
B. The sunlight has warmed it.
C. The soil has stuck on its surface.
D. It changed to a brownish colour.

66

Q3

(1) Sandy wants to experiment with some sugar cubes. What should she do to change the sugar cube chemically?

She should burn the sugar.

(2) An explosion of fireworks is a chemical change. What three forms of energy does it produce when it explodes?

(i) heat (ii) light (iii) sound

(3) Think about how an egg changes when it is cooked. Is this a physical change or a chemical change? Explain your answer.

(Expected answer) Cooking an egg is a chemical change because the egg completely changes into a new substance with new properties being formed after being cooked.

Q4

(1) A silver spoon that has turned black can be made shiny again by rubbing off the black tarnish with silver polish. Is polishing a physical change or a chemical change? Explain your answer.

It is physical change. (Expected answer) The black tarnish is removed from the surface of silver spoon by polishing. In the process, there is no new substance produced.

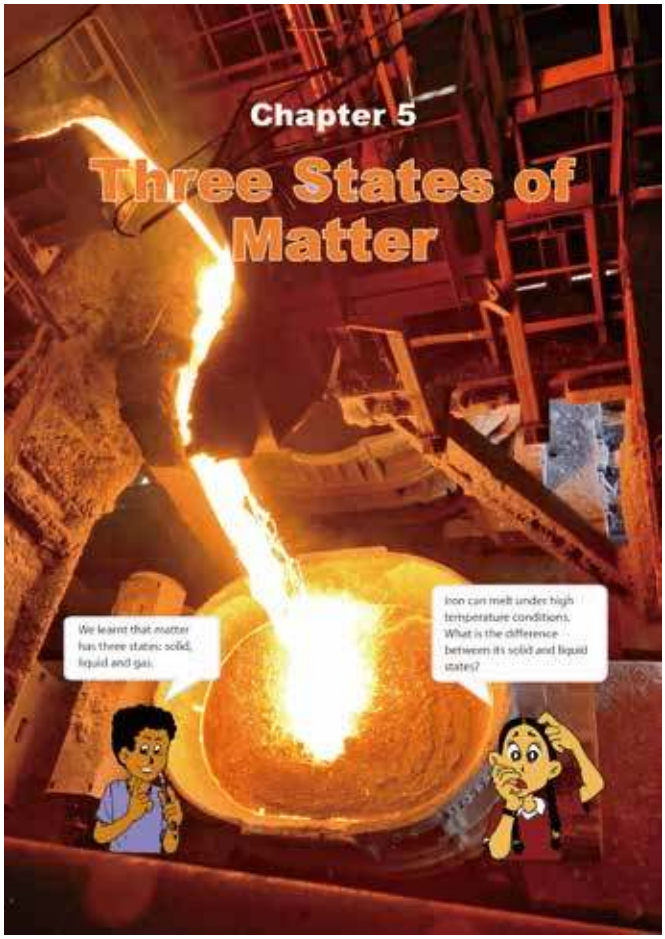
(2) Explain why the melting ice is not a chemical change.

(Expected answer) The only thing that changes is the physical state of water from ice to water. The water still remains as water and new substance does not produce.

Chapter 5. Three States of Matter

Chapter Objectives

Students will be able to understand the differences between the properties of the three states of matter in terms of shape, volume and temperature.



This picture is from the chapter heading of the textbook showing melting iron at a factory. The temperature of the liquid iron is over 1 500°C that is melting point of iron.

Topic Objectives

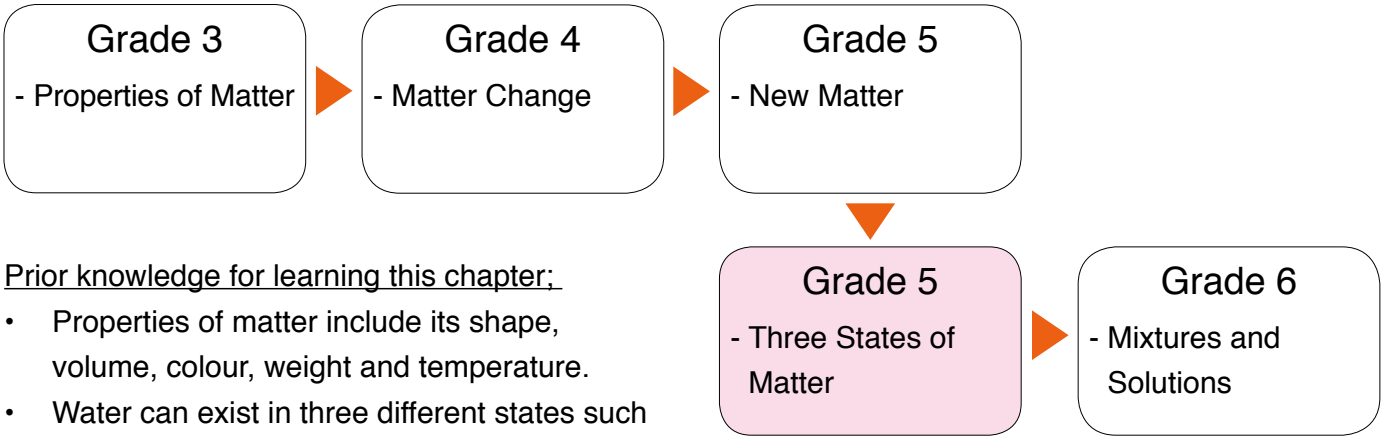
5.1 Properties of Three States of Matter

Students will be able to;

- Describe the shape of the three states of matter.
- Explain that solid, liquid and gas expand when heated and contract when cooled.
- Explain the terms of melting and freezing point in relation to change in state of matter.
- Explain the terms of boiling point in relation to change in state of matter.
- Describe that matter can change from one state to another by heating and cooling.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Properties of matter include its shape, volume, colour, weight and temperature.
- Water can exist in three different states such as solid, liquid and gas.

Teaching Overview

This chapter consists of 6 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
5.1 Properties of Three States of Matter	1	**Shape of The Three States of Matter** How is the shape of the three states of matter similar or different?	5.2.4	69 - 70
	2	**Volume of Three States of Matter** What characteristics of volume do the three states of matter have?		71 - 72
	3	**Change in State of Matter 1: Solid and Liquid** How does matter change its state from a solid to a liquid?		73 - 74
	4	**Change in State of Matter 2: Liquid and Gas** How does a matter change its state from a liquid to a gas?		75 - 76
	5	Summary and Exercise, Science Extra		77 - 79
Chapter Test	6	Chapter Test		80 - 81

Unit: **Matter**	Chapter : **5. Three States of Matter** Topic : **5.1. Properties of Three States of Matter**	Total lesson No: 26 / 87 Textbook page: 69 - 70

Lesson 1 / 6

Lesson Title

Shape of The Three States of Matter

Preparation

stone, water, three balloons

Lesson Flow

1 Introduction (5 min.)

- Refer students to Gr 4, Topic 12.2 'States of Water' to recall the three state of water (Ice, water and steam).
- Tell the students that like water, matter can exist in three states, solid, liquid and gas.

Q:What are the differences between solid, liquid and gas?

- Ask students to imagine ice, water and steam and encourage students to think about shape as one of the properties of matter. In terms of the shape of the air, recall what happened when they catch the air in Gr 4 Topic 5.1 'Characteristics of Air (Gas)'.

2 Introduce the key question

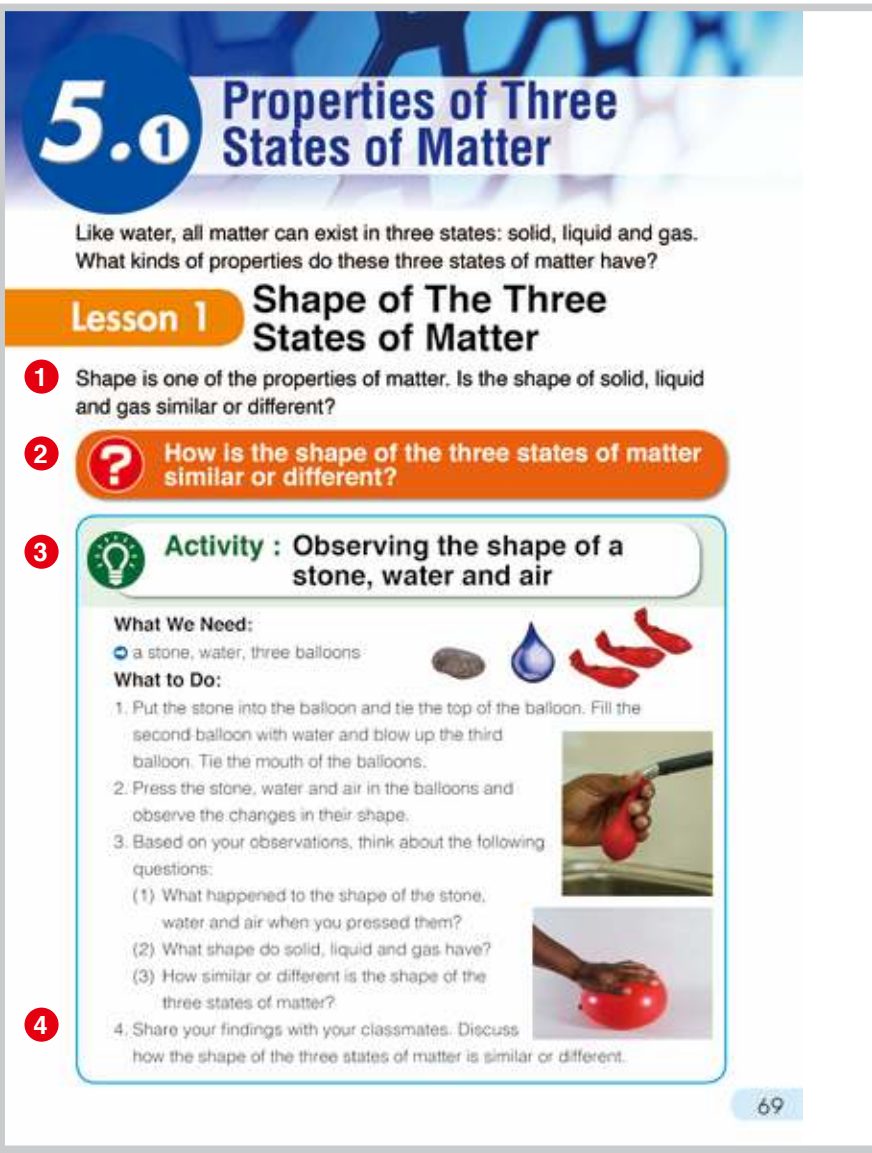
How is the shape of the three states of matter similar or different?

3 Activity (25 min.)

- Organise students into small groups.
- Explain the steps of the activity.
- Advise students on safety rules when carrying out the investigation.
- Ask students to draw a table into their exercise books.
- Facilitate their findings using the three questions in the textbook and allow them to share their ideas about their investigation.

4 Discussion for findings (20 min.)

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



5.1 Properties of Three States of Matter

Like water, all matter can exist in three states: solid, liquid and gas. What kinds of properties do these three states of matter have?

Lesson 1 Shape of The Three States of Matter

1 Shape is one of the properties of matter. Is the shape of solid, liquid and gas similar or different?

2 How is the shape of the three states of matter similar or different?

3 Activity : Observing the shape of a stone, water and air

What We Need:
a stone, water, three balloons

What to Do:
1. Put the stone into the balloon and tie the top of the balloon. Fill the second balloon with water and blow up the third balloon. Tie the mouth of the balloons.
2. Press the stone, water and air in the balloons and observe the changes in their shape.
3. Based on your observations, think about the following questions:
(1) What happened to the shape of the stone, water and air when you pressed them?
(2) What shape do solid, liquid and gas have?
(3) How similar or different is the shape of the three states of matter?
4. Share your findings with your classmates. Discuss how the shape of the three states of matter is similar or different.

4

69

Teacher's Notes

Facilitation Note

- Students will be using three different balloons in the activity.
  - 1st balloon for the stone as in solid state.
  - 2nd balloon for the water as in liquid state.
  - 3rd balloon for blown air as in gas state.
- The three balloons have to be pressed separately in order to observe change in their shapes.
- Check to make sure the 2nd and 3rd balloons do not have any pricked holes prior to the activity.

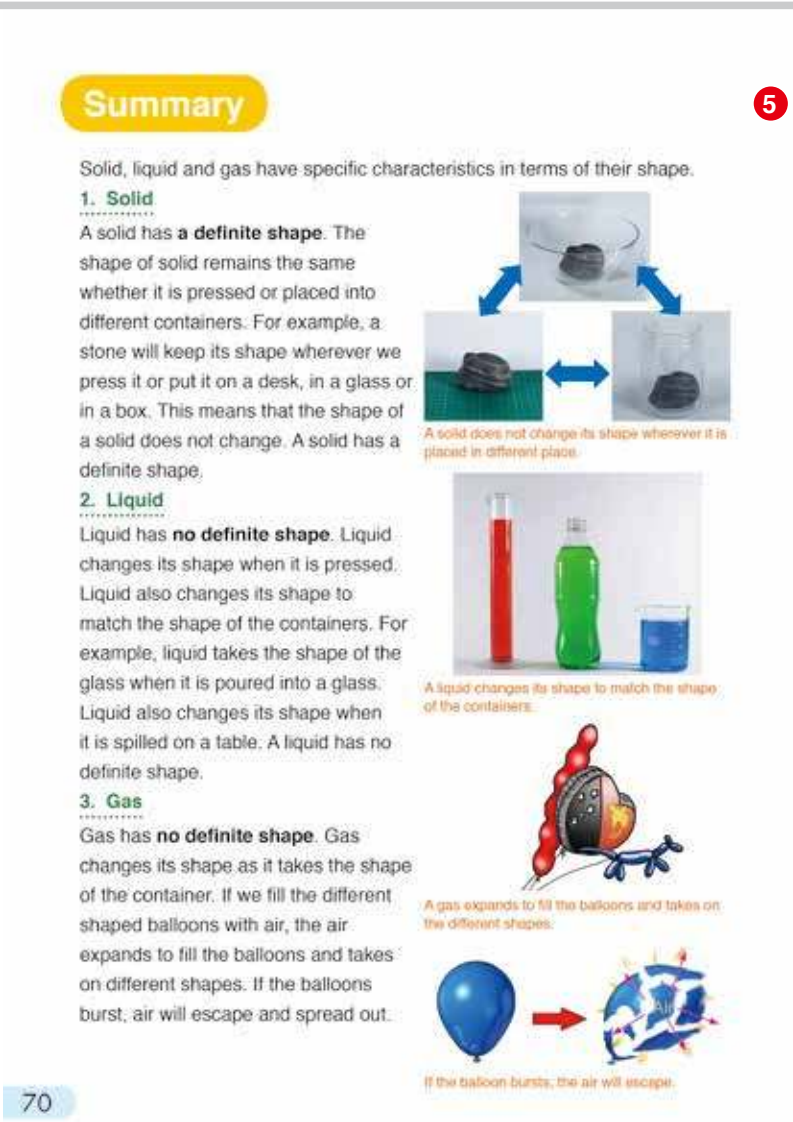
SOLID	LIQUID	GAS
		
Has fixed shape.	No fixed shape Takes shape of the container.	No fixed shape Takes shape of the container.

Lesson Objectives

Students will be able to:
- Describe the characteristics of the three states of matter in terms of shape.
- Show interest in observing the shape of the three states of matter.

Assessment

Students are able to:
- State how the shape of solid, liquid and gas are similar or different.
- Participate in the activity with interest.



Summary

Solid, liquid and gas have specific characteristics in terms of their shape.

1. Solid

A solid has **a definite shape**. The shape of solid remains the same whether it is pressed or placed into different containers. For example, a stone will keep its shape wherever we press it or put it on a desk, in a glass or in a box. This means that the shape of a solid does not change. A solid has a definite shape.

A solid does not change its shape wherever it is placed in different place.

2. Liquid

Liquid has **no definite shape**. Liquid changes its shape when it is pressed. Liquid also changes its shape to match the shape of the containers. For example, liquid takes the shape of the glass when it is poured into a glass. Liquid also changes its shape when it is spilled on a table. A liquid has no definite shape.

A liquid changes its shape to match the shape of the containers.

3. Gas

Gas has **no definite shape**. Gas changes its shape as it takes the shape of the container. If we fill the different shaped balloons with air, the air expands to fill the balloons and takes on different shapes. If the balloons burst, air will escape and spread out.

A gas expands to fill the balloons and takes on the different shapes.

If the balloon bursts, the air will escape.

70

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

Q:What happened to the shape of the stone, water and the gas when pressed? (The shape of the stone did not change. The shape of the water in the balloon changed when pressed. The shape of the air in the balloon changed when pressed.)

Q:What shape do solid, liquid and gas have? (Solid has a definite shape, liquid and gas do not have a definite shape.)

Q:How is the shape of solid, liquid and gas alike or different? (The shape of a solid is different from that of liquid and gas, whereas the shape of liquids and gases are similar.)

- 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 shape do solids, liquids and gases have?
  Q: What are the similarities and differences between the shapes of the three states of matter?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Shape of Three States of Matter

Key question : How is the shape of the three states of matter similar or different?

Activity: Observing the shape of a stone, water and air.

Result:

	What is happening to the shape of:
Stone	The shape of the stone stayed the same.
Water	The shape of the water in the balloon changed when pressed.
Air	The shape of the air in the balloon change when it was pressed.

Discussion

Q: What happened to the shape of the stone, water and gas when pressed? The shape of the stone did not change.The shape of the water in the balloon changed when pressed.The shape of the air in the balloon changed when pressed.

Q: What shape do solid, liquid and gas have? Solid has a definite shape, liquid and gas do not have a definite shape.

Q: How is the shape of solid, liquid and gas alike or different? The shape of a solid is different from that of liquid and gas, whereas the shape of liquids and gases are similar.

Summary
- Solid, liquid and gas have their specific characteristics in terms of shape.
- Solid has a definite shape.
- Liquid has no definite shape.
- Gas has no definite shape.

Unit: **Matter**	Chapter : **5. Three States of Matter** Topic : **5.1. Properties of Three States of Matter**	Total lesson No: 27/ 87 Textbook page: 71 - 72

Lesson 2 / 6

Lesson Title

Volume of Three States of Matter

Preparation

cold water, hot water, plastic bottle with its cap, straw, balloon, two bowls, removable adhesive

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:What are the similarities and differences of the shapes of three states of matter?

- Encourage students to think about volume of the three states of matter by asking:

Q:How are the volume of the three states of matter similar or different?

2 Introduce the key question

What characteristics of volume do the three states of matter have?

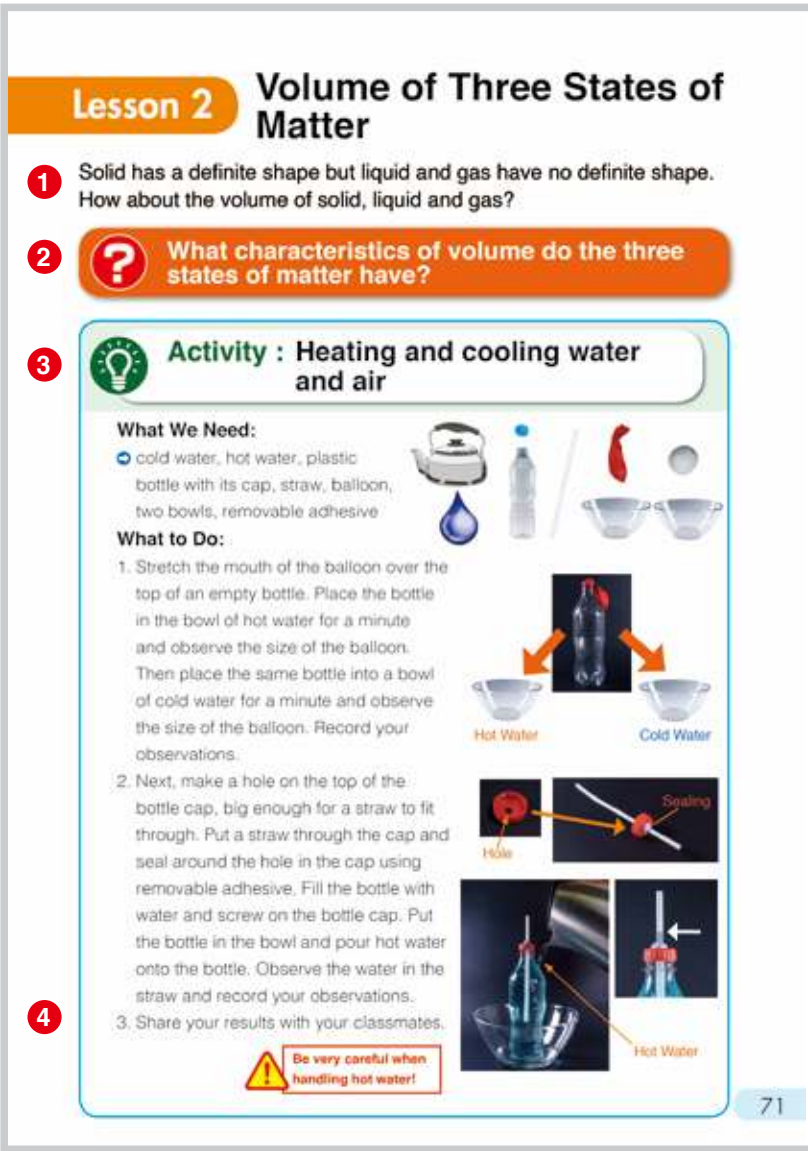
3 Activity (20 min.)

- Organise the students into groups.
- Remind the students of the important safety rules prior the activity.
- Explain the steps of the activity.
- Ask students to use a chart to record their observation.
- Have students carry out the activity.
- Assist each group with their findings and facilitate where necessary.
- Ask students to discuss their results with their groups.
- Give enough time for students to do their findings

4 Discussion for findings (25 min.)

- Ask students to present their results from the activity.

(Continue)



Teacher's Notes

Additional Notes 'Expansion and Contraction'

- When we heat any substance, the particles get more energy and begin to move faster.
- This movement causes the particles to move further apart so that the substance expands.
- If we cool a hot substance we take energy away from the particles. They start to move more slowly and get closer together so the substance contracts.
- All states of matter expand when heated and contract when cooled.
- Gases expand most when heated and solids the least because gas particles are already far apart and are much freer to move.

Expansion and Contraction in Everyday Life

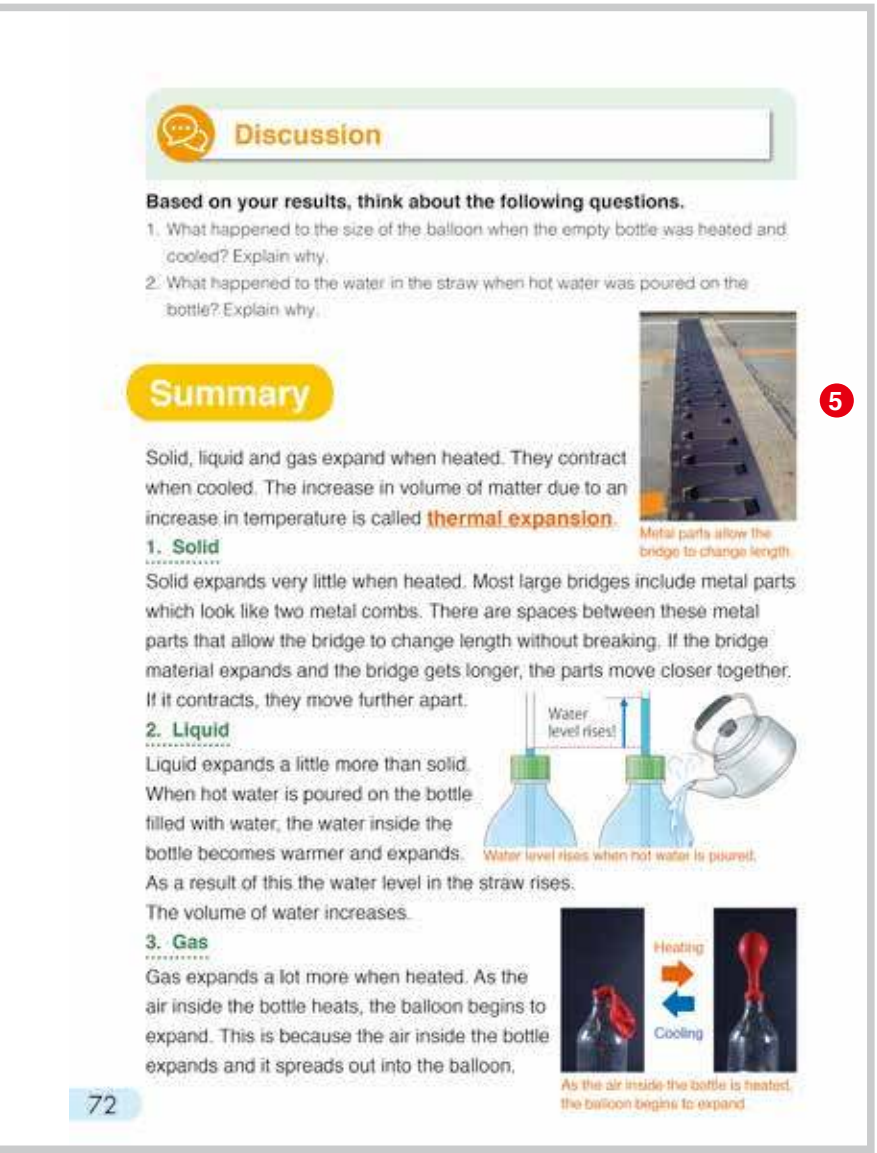
- Gaps are left between sections of railway line to allow expansion in hot day.
- Telephone wires are deliberately left loose to allow for contraction in winter.
- Central heating systems have an expansion pipe to allow the heated water to expand without bursting out the system.
- Soft drinks like Coca cola need to allow space when filling up their bottles or cans. No allowance will cause the bottles or cans to burst.

Lesson Objectives

Students will be able to:
- Describe how the volume of solid, liquid and gas change.
- Observe the changes in volume of liquid and gas.
- Cooperate with others.

Assessment

Students are able to:
- State the change in the volume of three states of matter by relating to the change in their temperature.
- Identify the characteristics of the change in the volume of liquid and gas based on the results of observation.
- Take part in the investigation in a cooperative manner.



Discussion

Based on your results, think about the following questions.

1. What happened to the size of the balloon when the empty bottle was heated and cooled? Explain why.
2. What happened to the water in the straw when hot water was poured on the bottle? Explain why.

Summary

Solid, liquid and gas expand when heated. They contract when cooled. The increase in volume of matter due to an increase in temperature is called thermal expansion.

1. Solid

Solid expands very little when heated. Most large bridges include metal parts which look like two metal combs. There are spaces between these metal parts that allow the bridge to change length without breaking. If the bridge material expands and the bridge gets longer, the parts move closer together. If it contracts, they move further apart.

Metal parts allow the bridge to change length.

2. Liquid

Liquid expands a little more than solid. When hot water is poured on the bottle filled with water, the water inside the bottle becomes warmer and expands. As a result of this the water level in the straw rises. The volume of water increases.

Water level rises!

Water level rises when hot water is poured.

3. Gas

Gas expands a lot more when heated. As the air inside the bottle heats, the balloon begins to expand. This is because the air inside the bottle expands and it spreads out into the balloon.

Heating

Cooling

As the air inside the bottle is heated, the balloon begins to expand.

72

5

- 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:What happened to the size of the balloon when the empty bottle was heated and cooled? (When heated, the size of the balloon expanded. When cooled, the size of the balloon contracted or shrank.)

Q:Why? (This is because the air inside the balloon expanded when heated and shrank or contracted when cooled.)

Q:What happened to the water in the straw when hot water was poured on the bottle? (The level of water rose when heated.)

Q:Why? (Because the water in the bottle expanded when heated.)

- 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 the questions as assessment:
  Q: What happens to the volume of solid, liquid and gas when heated?
  Q: What happens to the volume of solid, liquid and gas when cooled?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Volume of Three States of Matter**

Key question

What characteristics of volume do the three states of matter have?

Activity: Heating and cooling water and air.

Situation	Your observation
Empty bottle with balloon in hot water	Balloon expands in size.
Empty bottle with balloon in cold water	Balloon contracts in size.
Pouring hot water on the bottle filled with water.	Water level in the straw rise.

Discussion

Q: What happened to the size of the balloon when the empty bottle was heated and cooled? When heated, the size of the balloon expanded.
When cooled, the size of the balloon shrank.

Q: Why? This is because the air inside the balloon expanded when heated and shrunk when cooled.

Q: What happened to the water in the straw when hot water was poured on the bottle? The level of the water rose when heated.

Q: Why? Because the water in the bottle expanded when heated.

Summary

- Solid, liquid and gas expand when heated and contract when cooled. The increase in volume of matter due to an increase in temperature is called thermal expansion.
- The volume of solid change very little when heated and cooled.
- Liquid expands or contracts a little more than solid when heated or cooled.
- Gas expands and contracts a great deal when heated or cooled.

Unit: **Matter**	Chapter : **5. Three States of Matter** Topic : **5.1. Properties of Three States of Matter**	Total lesson No: 28 / 87 Textbook page: 73 - 74

Lesson 3 / 6

Lesson Title

Change in State of Matter 1: Solid and Liquid

Preparation

thermometer, candle, stove,
empty tin-can, bowl with water

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:What happens to the volume of solid, liquid and gas when heated?

Q:What happens to the volume of solid, liquid and gas when cooled?

- Ask students to recall the change in the states of water from one state to another as covered in Topic 12.2 in Grade 4 and motivate students to think about changes in states of matter with the question:

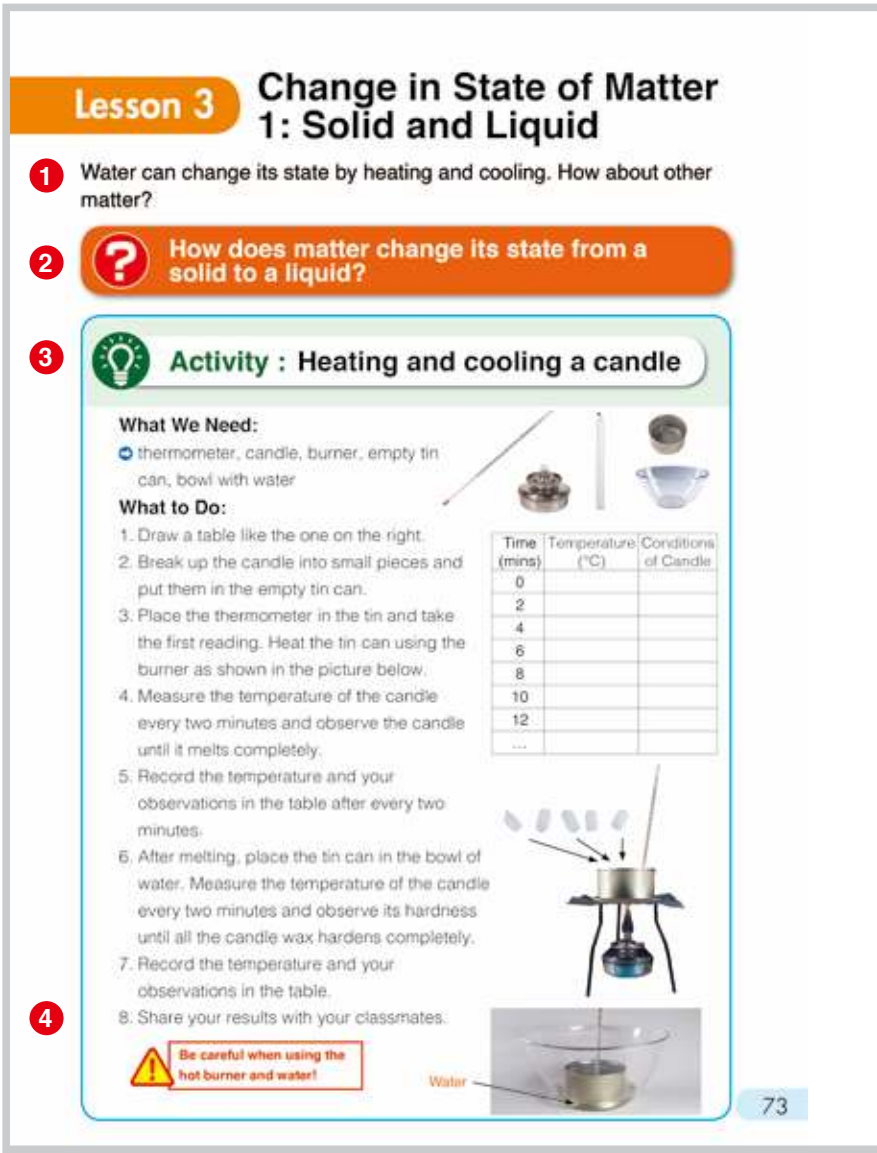
Q:How about other matter? Do you think they can also change their states like water?

2 Introduce the key question

How does matter change its state from a solid to a liquid?

3 Activity (25 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Remind students of the safety rules when using heat.
- Have students carry out the activity and record their result in the table.
- Assist each group to set the thermometer in the can of candle and and read the scale.
- Ask students to discuss their results with their groups.
- Give enough time for students to do their findings.



Lesson 3 Change in State of Matter 1: Solid and Liquid

1 Water can change its state by heating and cooling. How about other matter?

2 How does matter change its state from a solid to a liquid?

3 Activity : Heating and cooling a candle

What We Need:
- thermometer, candle, burner, empty tin can, bowl with water

What to Do:
1. Draw a table like the one on the right.
2. Break up the candle into small pieces and put them in the empty tin can.
3. Place the thermometer in the tin and take the first reading. Heat the tin can using the burner as shown in the picture below.
4. Measure the temperature of the candle every two minutes and observe the candle until it melts completely.
5. Record the temperature and your observations in the table after every two minutes.
6. After melting, place the tin can in the bowl of water. Measure the temperature of the candle every two minutes and observe its hardness until all the candle wax hardens completely.
7. Record the temperature and your observations in the table.
8. Share your results with your classmates.

Time (mins)	Temperature (°C)	Conditions of Candle
0		
2		
4		
6		
8		
10		
12		
...		

4 Be careful when using the hot burner and water!

Water

73

Teacher's Notes

In Grade 4 Chapter 12 'Matter Change', students learnt about how ice changes its form when it melts. When ice is heated, it starts to melt and becomes water. This process of solid changing into liquid is called melting. For this lesson, the activity will be focused on other matters such as a candle.

SAFETY

- Be very careful when using a match to light the stove.
- Teacher should pay closer attention to students when lighting their stoves.
- Always use a piece of cloth or tong to hold the heated tinned can.

Tips for the Activity

- Set up the source of heat (stove, fire etc.) in an open space where students can freely observe.
- For Steps 3-5, refer to Grade 4 Chapter 12 Topic 12.2, lesson 4, for similar process used in the activity.

- Energy is involved in a change of state. To change from one state to another, energy must be added or taken away. When you heat a solid, heat is added to it. We say that the solid is gaining heat energy. When you cool a liquid, heat energy is taken away. If you cool a liquid enough, it will freeze into a solid. We say that heat energy is lost from the liquid.
- Materials have different melting and freezing points. In other words, the difference characterises materials.
- Other substances including metals which are solid at room temperature have very high melting points.

Lesson Objectives

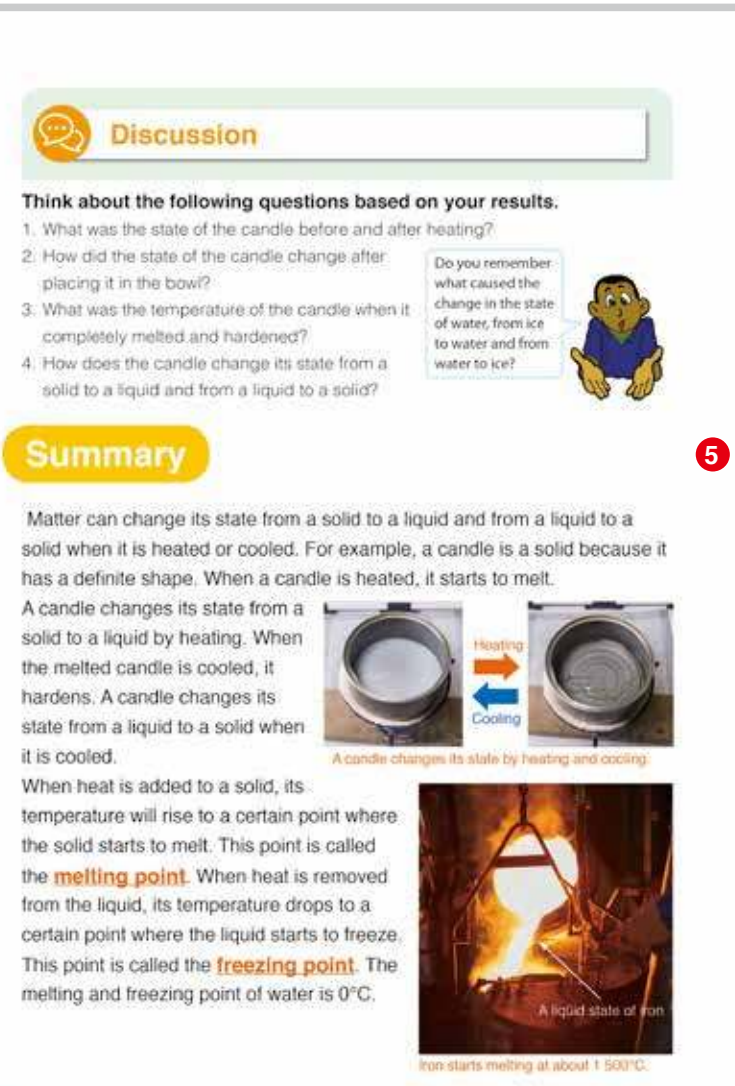
Students will be able to:

- Describe how matter changes from solid to liquid and from liquid to solid.
- Recognise that solid and liquid change their state when their temperature reaches a certain point.
- Use a thermometer properly.

Assessment

Students are able to:

- Explain that matter can change its state from a solid to a liquid and from a liquid to a solid by heating and cooling.
- Explain the terms of melting and freezing point in relation to change in state of matter.
- Measure the temperature of matter using a thermometer.



Discussion

Think about the following questions based on your results.

1. What was the state of the candle before and after heating?
2. How did the state of the candle change after placing it in the bowl?
3. What was the temperature of the candle when it completely melted and hardened?
4. How does the candle change its state from a solid to a liquid and from a liquid to a solid?

Do you remember what caused the change in the state of water, from ice to water and from water to ice?

Summary

Matter can change its state from a solid to a liquid and from a liquid to a solid when it is heated or cooled. For example, a candle is a solid because it has a definite shape. When a candle is heated, it starts to melt.

A candle changes its state from a solid to a liquid by heating. When the melted candle is cooled, it hardens. A candle changes its state from a liquid to a solid when it is cooled.

Heating

Cooling

A candle changes its state by heating and cooling.

When heat is added to a solid, its temperature will rise to a certain point where the solid starts to melt. This point is called the melting point. When heat is removed from the liquid, its temperature drops to a certain point where the liquid starts to freeze. This point is called the freezing point. The melting and freezing point of water is 0°C.

A liquid state of iron

Iron starts melting at about 1 500°C.

74

5

4 Discussion for findings (20 min.)

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

Q:What was the state of the candle before and after heating? (Before heating, the candle was in a solid state. After heating, the candle was in a liquid state.)

Q:After placing the can in the bowl of water, how did the state of the candle change? (The candle changed from liquid to solid state.)

Q:What temperature did the candle completely melted and hardened? (Around 50~60oC.)

Q:How does a candle change its state from a solid to a liquid and from a liquid to a solid? (It changed its state by heating and cooling.)

- 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: How does matter change its state from solid to liquid and from liquid to solid?
  Q: What is melting point?
  Q: What is freezing point?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Change in State of Matter 1: Solid and Liquid

Key question : How does matter change its state from a solid to a liquid?

Activity : Heating and cooling a candle

Time (mins)	Temperature (°C)	Conditions of candle
0		
2	Write the results presented by	
4	students.	
...		

Discussion

Q: What was the state of the candle before and after heating? Before heating, the candle was solid state. After heating the candle was in a liquid state.

Q: After placing the can in the bowl of water, how did the state of the candle change? The candle changed from liquid to solid state.

Q: What temperature did the candle completely melted and hardened? Write the answers from the students (Around 50~60°C).

Q: How does a candle change its state from a solid to a liquid and from a liquid to a solid? It changed its state by heating and cooling.

Summary

- Matter can change from solid to liquid and liquid to solid by heating and cooling.
- The temperature of a solid rises to a certain point when heat is added .This is called the melting point.
- The temperature of a liquid drops to a certain point when heat is removed. This is called the freezing point.

Unit: **Matter**	Chapter : **5. Three States of Matter** Topic : **5.1. Properties of Three States of Matter**	Total lesson No: 29 / 87 Textbook page: 75 - 76

Lesson 4 / 6

Lesson Title

Change in State of Matter 2: Liquid and Gas

Preparation

ethanol, zip lock bag, tray, hot and cold water

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson.

Q:How does matter change its state from solid to liquid and from liquid to solid?

Q:What is melting and freezing point?

- Encourage students to think about the change in state of matter from liquid to gas.

Q:Does matter go through a similar process of change from liquid to gas?

2 Introduce the key question

How does a matter change its state from a liquid to a gas?

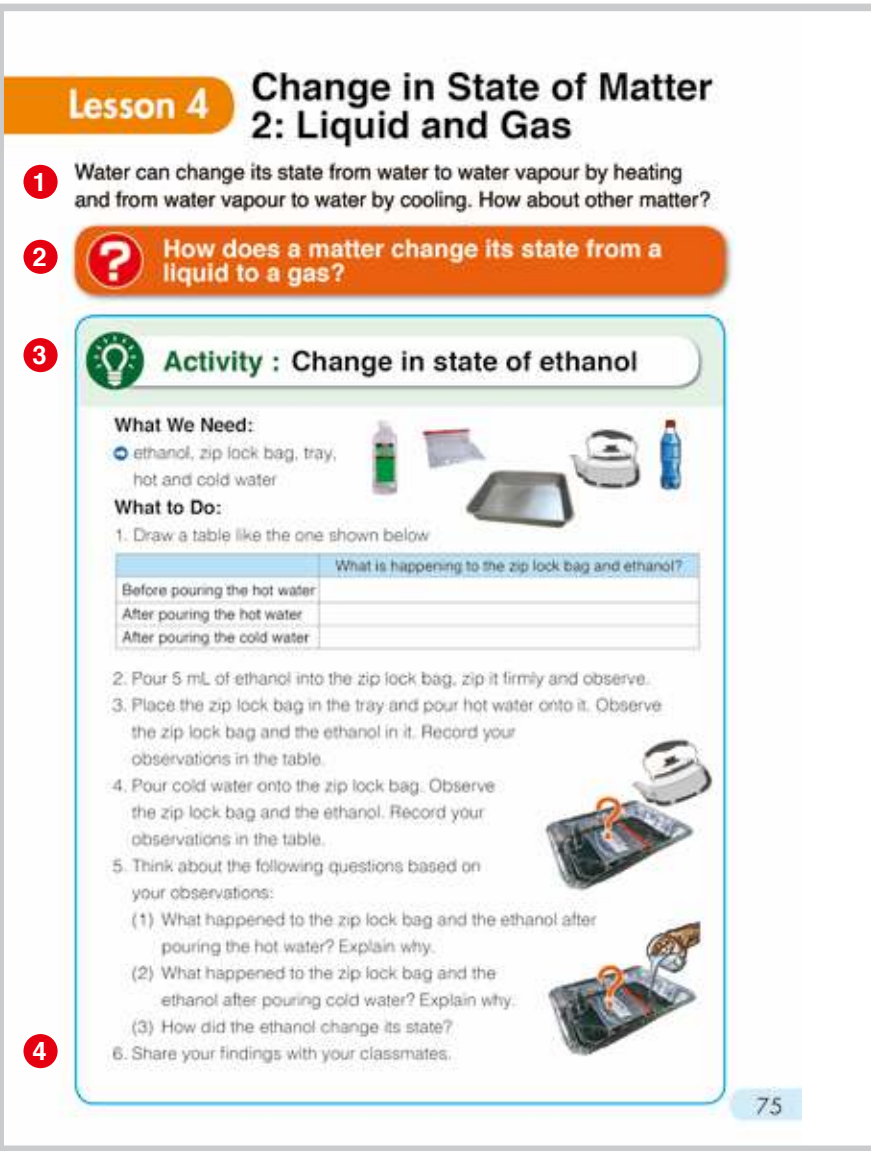
3 Activity (25 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Remind students of the safety rules for using hot water.
- Assist students to carry out the activity.
- Check students' activity and if necessary guide them towards their findings using the questions below the activity table if neccessary.
- Give enough time for students to do their findings.

4 Discussion for findings (20 min.)

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

(Continue)



Lesson 4 Change in State of Matter 2: Liquid and Gas

1 Water can change its state from water to water vapour by heating and from water vapour to water by cooling. How about other matter?

2 How does a matter change its state from a liquid to a gas?

3 Activity : Change in state of ethanol

What We Need:

ethanol, zip lock bag, tray, hot and cold water

What to Do:

1. Draw a table like the one shown below

	What is happening to the zip lock bag and ethanol?
Before pouring the hot water	
After pouring the hot water	
After pouring the cold water	

2. Pour 5 mL of ethanol into the zip lock bag, zip it firmly and observe.
3. Place the zip lock bag in the tray and pour hot water onto it. Observe the zip lock bag and the ethanol in it. Record your observations in the table.
4. Pour cold water onto the zip lock bag. Observe the zip lock bag and the ethanol. Record your observations in the table.
5. Think about the following questions based on your observations:
   (1) What happened to the zip lock bag and the ethanol after pouring the hot water? Explain why.
   (2) What happened to the zip lock bag and the ethanol after pouring cold water? Explain why.
   (3) How did the ethanol change its state?
6. Share your findings with your classmates.

4

75

Teacher's Notes

In Grade 4 Chapter 12 'Matter Change', students learnt about how water changes its form when heated. When water is heated, its temperature increases and the steam rises from the surface causing the water to boil and eventually evaporate. This process of liquid changing into gas is called evaporation.

SAFETY

- Use a piece of cloth to handle the teapot or tray to avoid being burned.
- Pay closer attention to students while pouring the ethanol or methylated spirit into the zip lock as it is a dangerous substance. Likewise, for the hot water as children might burn themselves.
- The methanol is harmful substances therefore do not try to drink.

Tips of the Lesson

- A methylated spirit can substitute the ethanol if unavailable. BUT, be very careful as it is poisonous which can lead to serious health problems or even death when they drink. Keep out of reach after the lesson.
- A deeper and wider tray or dish is good to use as it can accommodate a lot of water when poured inside.
- The hot water has to be poured around the zip lock in order to clearly observe how the zip lock will expand.
- Try as much as possible to allow all the air in the zip lock out before tying with a rope or rubber band.
- Make sure to use the same tray or dish to pour the water at room temperature to observe the next change.

Lesson Objectives

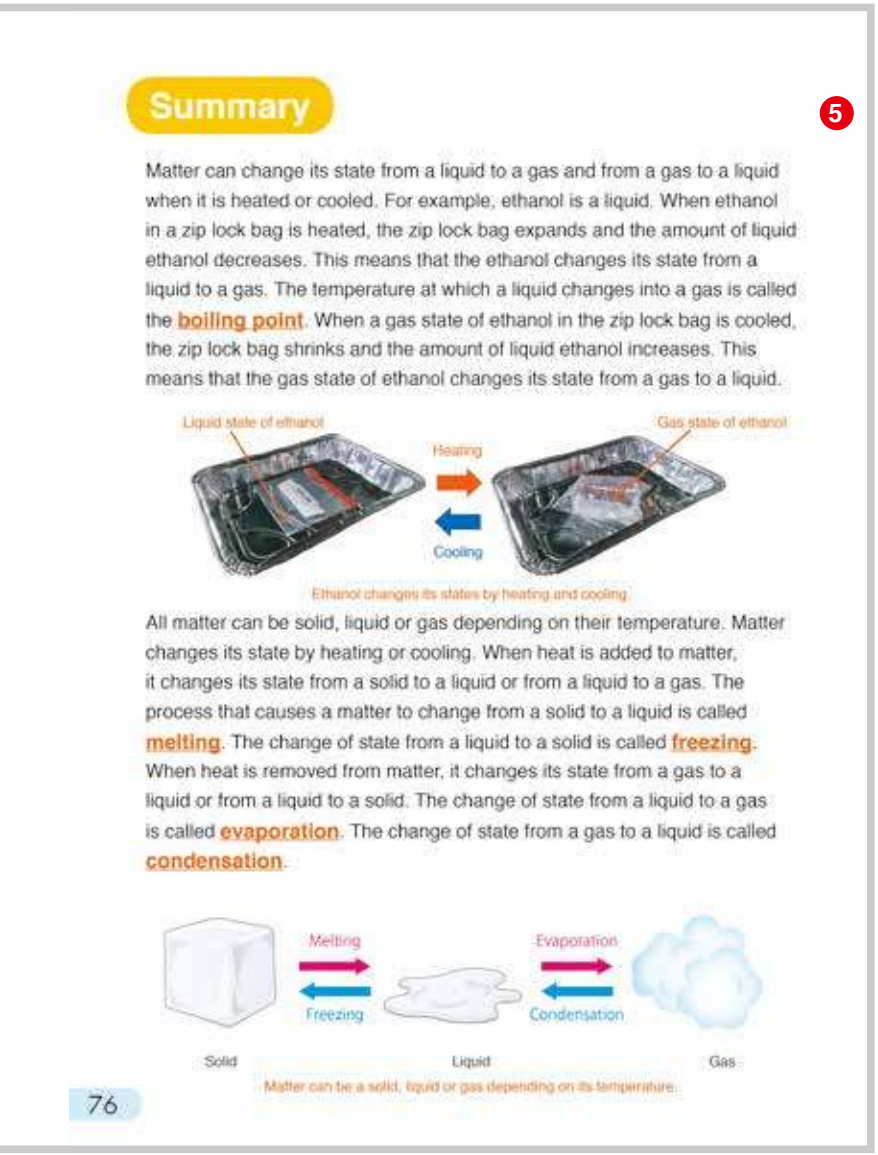
Students will be able to:

- Explain how matter can change its state from liquid to gas and from gas to liquid.
- Identify the processes of the change in the three states of matter.

Assessment

Students are able to:

- State the change in states of matter from liquid to gas and from gas to liquid by heating and cooling.
- Explain melting, freezing, evaporation and condensation as the process of the change in three states of matter.
- Actively participate in observing the changes in states of matter from liquid to gas and from gas to liquid.



Summary

Matter can change its state from a liquid to a gas and from a gas to a liquid when it is heated or cooled. For example, ethanol is a liquid. When ethanol in a zip lock bag is heated, the zip lock bag expands and the amount of liquid ethanol decreases. This means that the ethanol changes its state from a liquid to a gas. The temperature at which a liquid changes into a gas is called the **boiling point**. When a gas state of ethanol in the zip lock bag is cooled, the zip lock bag shrinks and the amount of liquid ethanol increases. This means that the gas state of ethanol changes its state from a gas to a liquid.

Ethanol changes its states by heating and cooling

All matter can be solid, liquid or gas depending on their temperature. Matter changes its state by heating or cooling. When heat is added to matter, it changes its state from a solid to a liquid or from a liquid to a gas. The process that causes a matter to change from a solid to a liquid is called **melting**. The change of state from a liquid to a solid is called **freezing**. When heat is removed from matter, it changes its state from a gas to a liquid or from a liquid to a solid. The change of state from a liquid to a gas is called **evaporation**. The change of state from a gas to a liquid is called **condensation**.

Matter can be a solid, liquid or gas depending on its temperature.

76

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

Q:What happened to the zip lock and ethanol after pouring the hot water? (It expanded in size. The amount of ethanol decreased.)

Q:Why? (The ethanol changed from liquid to gas when heated. The amount of gas in zip lock increased and it expanded.)

Q:What happened to the zip lock and ethanol after pouring cold water? (It shrank in size. The amount of ethanol increased.)

Q:Why? (The ethanol changed from gas to liquid when cooled. The amount of gas in zip lock decreased and it shrunk.)

Q:How did the ethanol change its state? (It change from liquid to gas when heated, It change from gas to liquid when cooled.)

- 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 the questions as assessment:
  Q: How does matter change its state from liquid to gas and from gas to liquid?
  Q: What kinds of processes are involved in the changes in states of matter?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Change in State of Matter 2: Liquid and Gas**

Key question : How does matter change its state from a liquid to a gas?

Activity: Change in state of ethanol

	What is happening to the zip lock and ethanol
Before	Ethanol was in its liquid state
After pouring hot water	Zip lock expanded. The amount of ethanol decreasesd. State change: Liquid to Gas
After pouring cold water	Zip lock shrank in size and the amount of ethanol increased State change: Gas to Liquid

Discussion

Q: What happened to the zip lock and ethanol after pouring hot water? It expands in size. The amount of ethanol decreased.

Q: Why? The ethanol changed from liquid to gas when heated. The amount of gas in zip lock increased and it expanded.

Q: What happened to the zip lock and ethanol after pouring cold water? It shrank in size. The amount of ethanol increased.

Q: Why? The ethanol changed from gas to liquid when cooled. The amount of gas in zip lock decreased and it shrunk.

Q: How did the ethanol change its state? It changes from liquid to gas when heated, It changes from gas to liquid when cooled.

Summary

- Matter can be solid, liquid or gas depending on its temperature.
- The process of a change of state includes: Melting, freezing, evaporation and condensation.

Unit: **Matter**	Chapter : **5. Three States of Matter** Topic : **5.1. Properties of Three States of Matter**	Total lesson No: 30 / 87 Textbook page: 77 - 79

Lesson 5 / 6

Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (20 min.)

- Recap the main learning contents in this topic.
- Based on the main learning contents ask students the following questions
  - Q: What are two common properties of the three states of matter?
  - Q: How do matter change from one state to another?
- Explain and correct the learning contents again 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.

1

Summary and Exercise

Summary 5.1 Properties of Three States of Matter

Shape of the Three States of Matter

Solid has a definite shape which does not change even if it is pressed or placed anywhere.

Liquid has no definite shape. It changes its shape when pressed or placed in different kinds of container.

Gas has no definite shape. It changes its shape as it takes the shape of the container.

Volume of Three States of Matter

- Solid, liquid and gas expand when heated and contract when cooled.
- Thermal expansion is the increase in volume of matter due to the increase in its temperature.

Volume of Matter when Heated		
Solid	Liquid	Gas
Solid expands very little.	Liquid expands a little more than solid.	Gas expands greater than liquid and solid.

Changes in States of Matter: Solid and Liquid, Liquid and Gas

- Matter can change from one state to another by heating and cooling.
- All matter can be solid, liquid or gas depending on their temperature.

- The melting point is the point in which solid starts to melt when the temperature rises.
- The freezing point is the point in which liquid starts to freeze when the temperature drops.
- The melting and freezing point of water is 0°C.
- The boiling point is the temperature at which a liquid changes into a gas.

77

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 streghten the learnt concepts in this topic.

2

Summary and Exercise

Exercise 5.1 Properties of Three States of Matter

Q1. Complete each sentence with the correct word.

(1) The three _____ of matter are solid, liquid and gas.
(2) Unlike liquid and gas, _____ has a definite shape.
(3) Gas changes its _____ as it takes the shape of different kind of containers.
(4) The melting and freezing point of water is _____ °C.

Q2. Choose the letter with the correct answer.

(1) Solid, liquid and gas _____ when they are heated.
A. contract
B. expand
C. disappear
D. burst

(2) Which of the following is a property of liquid?
A. All liquids have colour.
B. Liquid never expand when it is heated.
C. Liquid has a definite shape.
D. Liquid increase its volume when its temperature increases.

Q3. Answer the following question.
What process of change in the state of matter is marked **X**?

Q4. Benny wanted to open the top of a cough mixture bottle but it was too difficult to open. The top is made of metal and the bottle is made of glass. He poured some hot water over the bottle top and then he was able to open it. What made it easier for him to open the top of the cough mixture bottle?

78

Exercise answers

Q1.
(1) **states**
(2) **solid**
(3) **shape**
(4) **0**

Q2.
(1) **B**
(2) **D**

Q3.
X: **Condensation**

Q4. Expected Answer
The hot water that was poured over the top of the bottle made the bottle expand and he was able to open the bottle easily.

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.

3

Chapter 5
•Science Extras•

Do all substances change their state from solid to liquid and liquid to gas?

All substances mainly have three different states at various temperatures. The change from solid state to gas state requires the change of solid state to liquid state and liquid state to gas state.
If solids have enough vapour pressure at a particular temperature then they can change directly into air. The direct change of state from solid to gas is called **sublimation**.

Sublimation
Solid
Gas

Examples of Sublimation

One of the example of sublimation is dry ice. It is a solid form of carbon dioxide. Its temperature is less than -78°C. When dry ice gets exposed to air, it directly changes its state from solid to gas. When dry ice is placed in water, sublimation is accelerated and smoke like fog is created. The most common use of dry ice is to preserve food to keep it cool. This is because the temperature of dry ice is lower than ice and it does not make the food wet due to its sublimation process.
Another well-known example of sublimation is a substance known as naphthalene. Naphthalene is usually found in pesticides such as mothball. When mothballs sublime, they give off a pleasant fragrance which is also irritating to pests like cockroaches. For this reason they are used in drawers, shelves, wardrobes and suitcases in homes.

Solid state of carbon dioxide

Sublimation of carbon dioxide

79

Lesson 6 / 6

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

5. Three States of Matter

Q1 Complete each sentence with the correct word.

(1) Solid, liquid and gas increase its volume when heated.
(2) A solid has a definite shape.
(3) The point at which solid starts to melt is called melting point.
(4) A change of state from a liquid to a gas is called evaporation.
(5) Gas expands much more than solid and liquid.

Q2 Choose the letter with the correct answer.

(1) What happens when hot water is poured on a bottle filled with water?
A. The volume of the water will decrease.
B. The water in the bottle becomes warmer and expands.
C. The water in the bottle cools and contracts.
D. All water in the bottle evaporates.

(2) Which of the following matter has no definite shape?
A. Oxygen and candle
B. Stone and water
C. Sand and sugar
D. Air and water

(3) Which term best describes the process of change from solid to liquid?
A. Freezing
B. Evaporation
C. Melting
D. Condensation

(4) Which of the following is the correct statement about the volume of matter?
A. The volume of liquid increases when it is heated.
B. The volume of solid decreases when it is heated.
C. Gas never expands when it is heated.
D. All matter do not change their volume when heated.

80

Q3

(1) Danny observed and sketched the state of the candle as shown in the picture on the right. Classify the state of the candle near the flame as a solid, liquid or gas.

Liquid because it is melting.

A burning candle

(2) Study the diagram below.

What will happen to the balloon when the bottle is placed into the bowl of hot water?

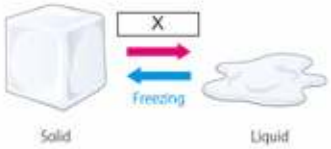
The balloon will expand.

(3) Explain your answer for (2).

As the air inside the bottle is heated, the air inside the balloon expands and spreads out inside the balloon.

(4) Study the diagram shown on the right. What process is marked 'X'?

Melting.



Q4

Kim placed a cup of water in a warm place. One week later, there was no water left in the cup. What happened to the water in the cup?

The water in the cup evaporated and changed from liquid to a gas state due to the heat.

Chapter 6. Reproduction and Heredity in Animals

Chapter Objectives

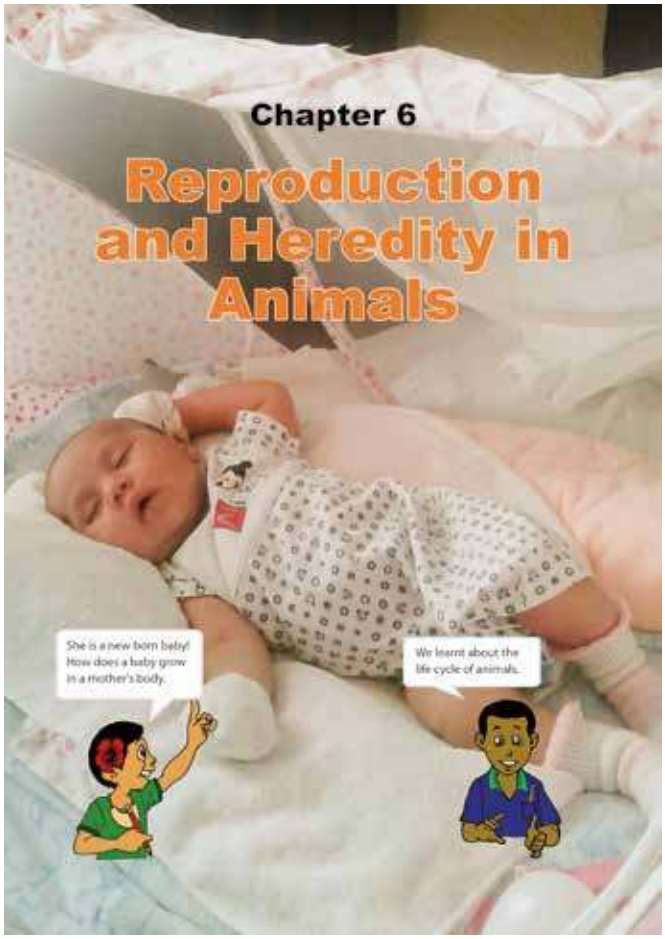
Students will be able to understand the reproduction of animals by comparing the reproductive process as in fish and human. Students will also able be to understand traits from parents to their children by heredity.

Topic Objectives

6.1 Reproduction and Heredity

Students will be able to;

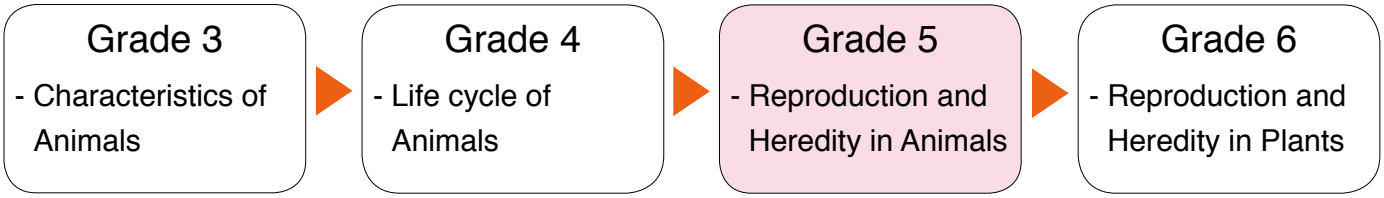
- Describe the process of development in each stage in the fish egg.
- Explain the male and female reproductive system.
- Identify the different processes involved in the reproduction of humans.
- Describe similarities and differences by traits from parents.



This picture is from the chapter heading of the textbook showing traits from a parent to child.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Characteristics of animals
- Life cycle of insects, fish, amphibians, reptiles, birds and mammals.

Teaching Overview

This chapter consists of 6 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
6.1 Reproduction and Heredity	1	**Reproduction in Fish** How does the life of a fish begin with eggs?	5.1.2	83 - 84
	2	**Human Reproductive System** Which body parts are used for human reproduction?		85 - 86
	3	**Reproduction in Human** How does human life begin?		87 - 88
	4	**From Parents to Young** Why do young animals look like their parents?		89 - 90
	5	Summary and Exercise, Science Extra		91 - 93
Chapter Test	6	Chapter Test		94 - 95

Unit: **Animals**	Chapter : **6. Reproduction and Heredity in Animals** Topic : **6.1. Reproduction and Heredity**	Total lesson No: 32 / 87 Textbook page: 83 - 84

Lesson 1 / 6

Lesson Title

Reproduction in Fish

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- This is a new chapter. Begin by defining the word 'Reproduction'.

Q:What is reproduction? The process of producing young/ off springs.

- Focus the students on animals that lay eggs and ask:

Q:Name some animals that lay eggs?

- Encourage students that this lesson will focus on the growth of fish in an egg.

2 Introduce the key question

How does the life of a fish begin with eggs?

3 Activity (25 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Ask students to do the activity and refer them to what the characters are saying.
- Students study picture in the text book.
- Check students' activity and if necessasry guide them towards their findings.
- Students will share ideas with each other about how fish grows in an egg.
- 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.

(Continue)

Teacher's Notes

- 'Life cycle of fish' is taught in Grade 4, Chapter 10 'Life cycle of fish and Amphibians'. Teachers are requested to refer it prior to this lesson. This lesson focuses on 'life cycle inside an egg'. Teachers need to help students to change their views from macro to micro level. It develops scientific skills to observe the world which cannot be seen by naked eyes.
- In the activity students are to sketch from the first stage to the last stage of development when the young fish hatches.

How fertilisation takes place in fish

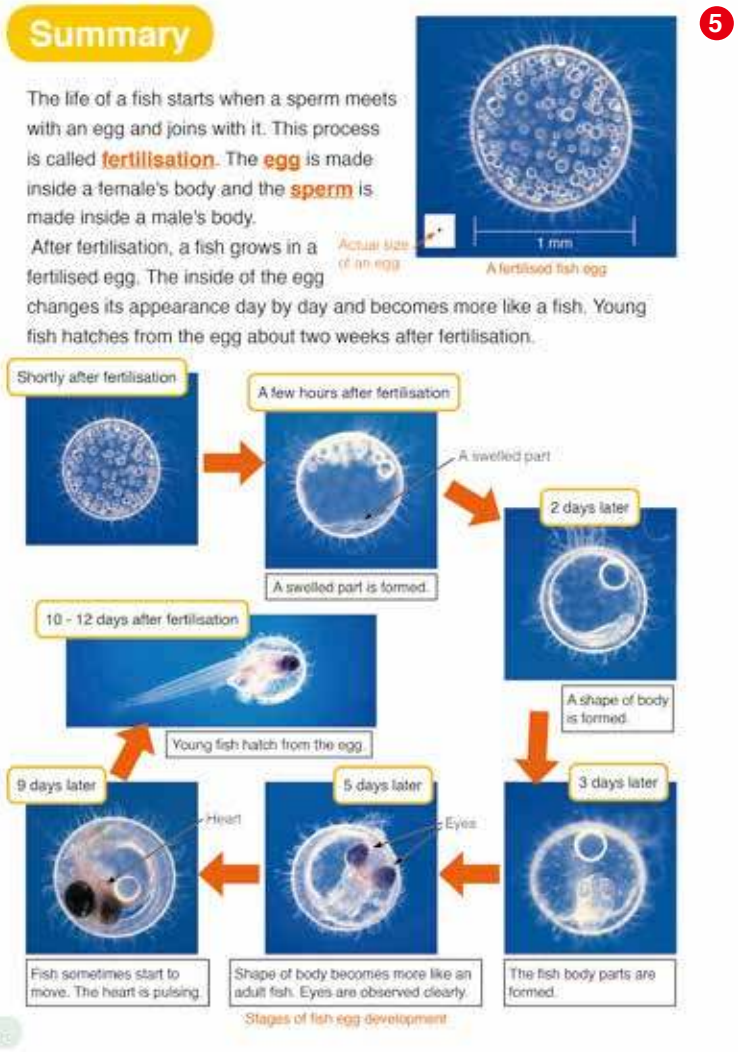
- Egg lying is one way that fish use for reproduction and it involves the eggs growing until they hatch into fry after seven to ten days. Different fish use different methods when it comes to fertilising the eggs. There are many methods and these are some;
  1. Scattering method- the female fish scatter its eggs in different areas, and the male follows behind it to fertilise them.
  2. Substrate spawners reproduce by using saliva as 'glue' to attach their eggs to various surfaces like rocks, aquarium glass, plants, or wood. The females leave the eggs there, and the male come to fertilise them. Catfish mostly favors this method of reproduction
  3. Bubble nest- the male fish blows bubbles for the female to lay its eggs next to the surface of the water where there is a source of food and maximum oxygen.
  4. Mouthbrooders- the eggs are laid by the females and fertilised by the males. During the incubation period, either of the parents will take the eggs and keep them in their mouth until they hatch.

Lesson Objectives

Students will be able to:
- Define what fertilisation is.
- Explain how in fish reproduce.
- Observe the growth of fish in an egg.
- Participate in discussion actively.

Assessment

Students are able to:
- State the definition of fertilisation.
- Describe the process of development in each stage in the egg.
- Sketch the growth of fish in an egg from the picture.
- Express their opinions during discussion.



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

Q:What body part of fish can you find at the beginning? (shape of fish)
Q:After that, what body part of fish can you see? (Eyes and hearts.)
Q:How does the size of an egg change as fish in the egg grows? (The size of egg doesn't change, same size, etc...)
Q:How does the fish look like after hatching from the egg? (It is similar to adult fish.)
Q:How does a fish grow and develop in an egg? (Explain the growth and development of the fish in an egg by referring to textbook.)

- 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 fertilisation?
  Q:In which body are egg and sperm made, female or male?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Reproduction in Fish

Key question:
How does the life of a fish begin with eggs?
Activity The growth of fish in an egg

Stage After fertilisation	Diagram	Description (eye,tail, colour, size)
Few hours	Students' drawing	
2 days		

Discussion
Q: What body part of fish can you find at the beginning? shape of fish
Q: After that, what body part of fish can you see? Eyes and hearts
Q: How does the size of an egg change as fish in the egg grows? The size of egg does not change, same size, etc
Q: How does the fish look like after hatching from the egg? It is similar to adult fish.
Q: How does a fish grow and develop in an egg? Explain the growth and development of the fish in an egg by referring to textbook

Summary
- Reproduction is a process where living things produce young ones similar to themselves.
- Fertilisation is the process when the sperm joins with an egg.
- The inside of the egg changes its appearance day by day and becomes similar to a fish.

Unit: **Animals**	Chapter : **6. Reproduction and Heredity in Animals** Topic : **6.1. Reproduction and Heredity**	Total lesson No: 33 / 87 Textbook page: 85 - 86

Lesson 2 / 6

Lesson Title

Human Reproductive System

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- Advice students that this is a sentive lesson. All students must repect others views and opinions.
- Review previous lesson by asking:

Q:What is fertilisation?

Q:How does a fish develop in an egg?

- Encourage students to think about human reproductive system by asking:

Q: How do human reproduce?

2 Introduce the key question

Which body parts are used for human reproduction?

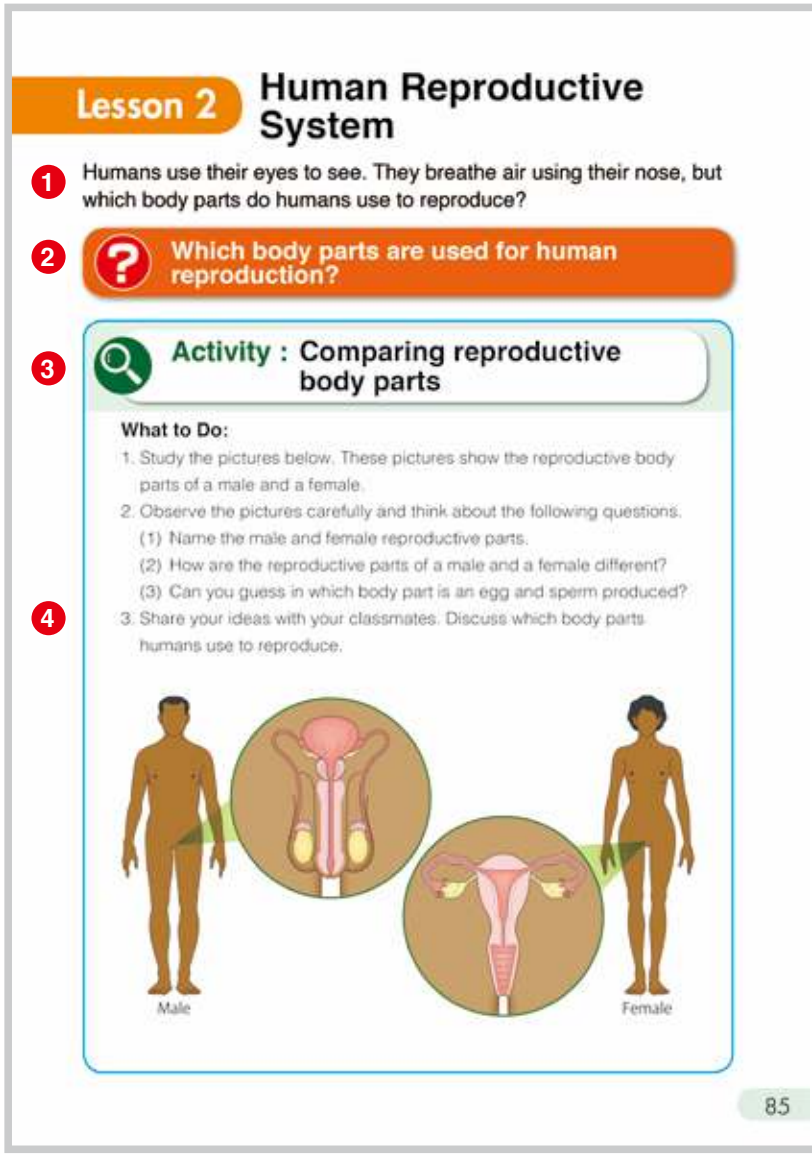
3 Activity (20 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Allow students to study picture and questions in textbook.
- Ask students to do the activity based on the questions in the activity.
- Ask students to discuss their findings in their groups.
- 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.

(Continue)



Lesson 2 Human Reproductive System

1 Humans use their eyes to see. They breathe air using their nose, but which body parts do humans use to reproduce?

2 Which body parts are used for human reproduction?

3 Activity : Comparing reproductive body parts

What to Do:

1. Study the pictures below. These pictures show the reproductive body parts of a male and a female.
2. Observe the pictures carefully and think about the following questions.
   (1) Name the male and female reproductive parts.
   (2) How are the reproductive parts of a male and a female different?
   (3) Can you guess in which body part is an egg and sperm produced?
3. Share your ideas with your classmates. Discuss which body parts humans use to reproduce.

4

85

Teacher's Notes

- This lesson is a very sensitive lesson and would cause embarrassment to either boys or girls so before teaching these lessons encourage students to respect each other's views and opinions.

  Suggested options to teach this lesson

  (1) This lesson can be taught by teaching separately the boys from the girls.

  (2) Arrange and prepare a teacher of the same gender to teach this lesson if it is against your traditional customs.
- Encourage students to identify reproductive parts from what they know and not reading content on the summary page.
- Let students know that there are other reproductive organs that will be looked at in higher grades.

Male	Female
1. The reproductive system of the male is located outside the body and around the pelvis region, to maintain the temperature required by the sperm to stay healthy. 2. Produce sperm. 3. To provide sperm to the ovum for fertilisation.	1. The female reproductive system is located entirely inside the body, with entry and exit points at the vulva, and separate openings for urination and menstruation. Produce ovum. 2. Receive and fertilise the male sperm. 3. Support the development of the growing embryo. 4.To provide nourishment to the infants (newborn) by secreting milk in the mammary glands (breast).

Lesson Objectives

Students will be able to:

- Identify which body parts are used for human reproduction.
- Explain the function of male and female reproductive organs.
- Recognise the importance of life.

Assessment

Students are able to:

- List male reproductive parts as penis and testes and female reproductive parts as ovaries, womb and vagina.
- State how testes, penis, ovary, womb and vagina work in the reproductive system.
- Value the importance of the reproductive organs.

Summary

5

The reproductive system is the group of the body parts that work together for the purpose of reproduction. Males and females have different reproductive systems.

1. Female Reproductive System

The female reproductive system is made up of the ovaries, womb and vagina. The ovary is a body part that contains thousands of eggs. Two ovaries are located inside the female body. The womb is the place where a baby grows until its birth. The vagina is a muscular tube that connects the womb to the outside of the body. It is the opening at the end of the path that the baby takes to leave a female body during birth.

Female Reproductive System

2. Male Reproductive System

The male reproductive system includes the testes and penis. The testes and penis are located outside of the body. The testes produce millions of sperms. There are two testes that are contained in a bag of skin. The penis is a body part that passes semen out of the man's body. Semen is a mixture of sperm and fluids.

Male Reproductive System

86

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

Q:Which body parts of the male and the female reproductive system do you know? (It depends on students' knowledge.)

- Explain the male and female reproductive organs.

Q:How are the reproductive parts of a male and a female different? (The male reproductive parts are located outside the body, the female reproductive parts are located inside the body, the shapes of the body parts are different, etc.)

Q:Can you guess which productive body parts produces eggs and sperms? (The eggs are produced in ovaries, and the sperms are produced in the testes.)

- 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 body parts are used for human reproduction?
  Q: What is the difference between a male and female reproductive system?
  Q: Where are eggs made?
  Q: Where are sperms made?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Reproduction system in Human

Key question : Which body parts are used for human reproduction?

Activity: Comparing reproductive Body parts

Questions:

1. Name the male and female reproductive parts.
2. How are the male and female reproductive parts different?
3. Can you guess which body parts are the eggs and sperm produced?

Discussion

Q:Which body parts of the male and the female reproductive system do you know? It depends on students' knowledge.

Q:How are the reproductive parts of a male and a female different? The male reproductive parts are located outside body, the female reproductive parts are located inside body, the shapes of the body parts are different, etc...

Q:Can you guess which reproductive body parts produces eggs and sperms? The eggs are produced in ovaries, and the sperms are produced in the testes.

Summary

- The reproductive system is the group of the body parts that work together for the purpose of reproduction.
- Female reproductive system includes ovaries, womb and vagina.
- The ovary contains thousands of eggs. There are two ovaries.
- The womb is the place where a baby grows until its birth.
- Male reproductive system includes penis and testes.
- The testes produce millions of sperm.

Unit: **Animals**	Chapter : **6. Reproduction and Heredity in Animals** Topic : **6.1. Reproduction and Heredity**	Total lesson No: 34 / 87 Textbook page: 87 - 88

Lesson 3 / 6

Lesson Title

Reproduction in Human

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- Review the previous lesson and Lesson 1 'Reproduction in Fish' by asking:

Q:Which body parts are used for human reproduction?

Q:How does a fish develop in an egg?

- Encourage students to think about the reproduction in human by asking:

Q:How is human reproduction similar to or different from fish?

2 Introduce the key question

How does human life begin?

3 Activity (20 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Allow students to study picture and questions in textbook and refer them to what the character is saying for their activity.
- Ask students to do the activity based on the questions in 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' discussions.
- Confirm the findings with the students.

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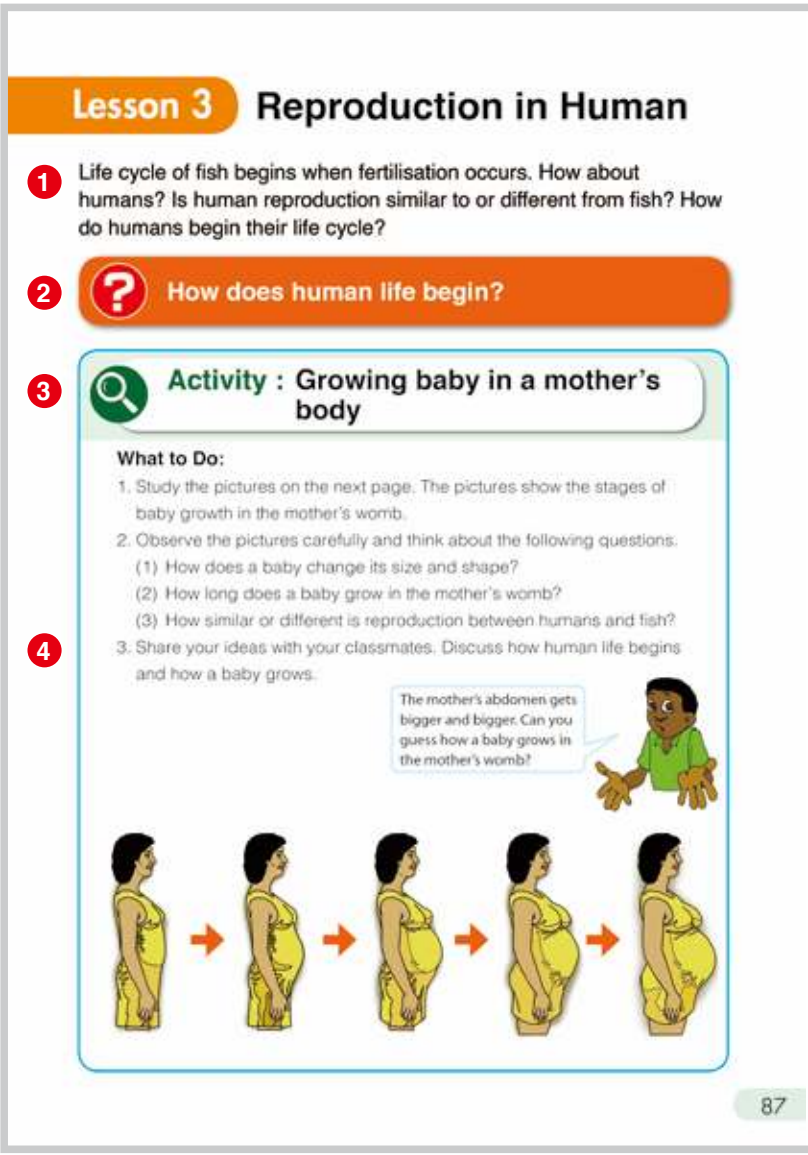


Lesson 3 Reproduction in Human

1 Life cycle of fish begins when fertilisation occurs. How about humans? Is human reproduction similar to or different from fish? How do humans begin their life cycle?

2 How does human life begin?

3 Activity : Growing baby in a mother's body

What to Do:

1. Study the pictures on the next page. The pictures show the stages of baby growth in the mother's womb.
2. Observe the pictures carefully and think about the following questions.
   (1) How does a baby change its size and shape?
   (2) How long does a baby grow in the mother's womb?
   (3) How similar or different is reproduction between humans and fish?
3. Share your ideas with your classmates. Discuss how human life begins and how a baby grows.

4

The mother's abdomen gets bigger and bigger. Can you guess how a baby grows in the mother's womb?

87

Teacher's Notes

- 'Life cycle of mammals' is taught in Grade 4, Chapter 10. That lesson describes life after birth whereas this lesson focuses on the life before birth. Refer to the lesson in Grade 4 prior to this lesson so you can effectively link these two topics to explain whole life cycle of humans.
- Human Reproduction is a process where a male sperm and a female egg provide the information (chromosomes) required to produce another human being. Conception occurs when the sperm meeets the egg and fertilises it. Pregnancy begins once the fertilised egg is implanted in the uterus.

Reminder:
Advice students to respect themselves and all other students.
Arrange other teachers to teach the lesson if against your customs.

Additional Information - Terms used in the process of birth of a baby

1. Zygote is a fertilised egg. This occurs when an egg joins with a sperm in a female body (this stage is not in the textbook above, but it is similar the fertilisation of fish which is the first lesson of this topic).
2. Embryo is an early stage of development of an organism that develops from a zygote (fertilised egg).
3. Foetus is an unborn offspring of a mammal at the later stages of its development, especially a human from eight weeks after fertilisation to its birth. In a foetus, all major body organs are present.
4. Baby is a general word used to describe a human from birth until about age 1 or 2 years old. From birth until to 3 months of age, a baby can be called a new born.

Lesson Objectives

Students will be able to:
- Explain the processes of reproduction in humans.
- Compare the similarities and differences between human and fish.
- Recognize the importance of the life.

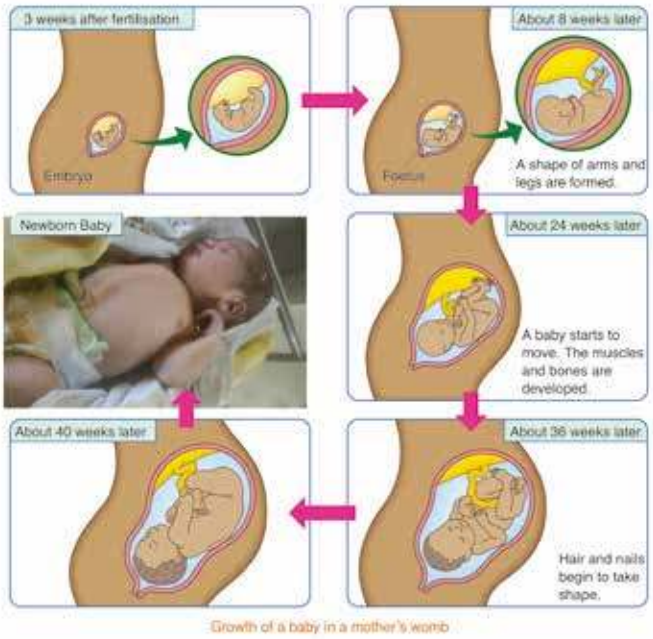
Assessment

Students are able to:
- State the steps of how a baby grows in a body of mother.
- List the differences and similarities in the reproduction processes in human and fish.
- Value the importance of the human life.

Summary

5

When a sperm meets with an egg, the egg becomes a fertilised egg. Human life begins with a fertilised egg. In humans, fertilisation takes place inside the body of the female, unlike fish. The fertilised egg develops and grows in the mother's womb (uterus) and becomes an embryo. The embryo gradually turns into the shape of a human being eight weeks after fertilisation. This is called the foetus. As the foetus grows into a baby, organs such as the spine and heart, hair and nails begin to take shape. After about thirty-seven to forty weeks in the mother's womb, the baby is born.



Growth of a baby in a mother's womb

88

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

Q:How does the baby change its size and shape? (The fertilised egg develops and grows bigger in the mother's womb. It changes its shape by forming the different parts of the body such as the arms and legs. The muscles and the bones also develop including the hair and the nails.)

Q:How long does a baby grow in the body of the mother? (For about thirty-seven to forty weeks.)

Q:How is reproduction in fish and humans similar or different?

Similarities: Female produces eggs, Fertilisation takes place and life begins with fertilised egg.

Differences: Fertilisation takes place inside the body of a woman; fertilisation takes place outside the body of a female fish, it takes 40 weeks to develop fully for human and it takes 2 weeks for fish to develop before it is hatched.

- 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 does a human life begin from?
  Q: How does a baby grow?
  Q: What is the difference between the reproduction process of a fish and human being?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Reproduction in Human**

Key question: How does human life begin?

Activity: Growing baby in a mother's body.

Questions:
1. How does a baby change its size and shape?
2. How long does a baby grow in the body of a mother?
3. How is the reproduction similar or different between humans and fish?

Discussion

1. How does the baby change its size and shape? The fertilised egg develops and grows in the mother's womb. It changes it shape by forming the different parts of the body such as the arms and legs. The muscles and the bones also develop including the hair and the nails.

Q: How long does a baby grow in the body of the mother? For thirty-seven to forty weeks.

Q: How is reproduction in fish and humans similar or different ? Similarities: Female produces eggs, Fertilisation takes place and life begins with fertilised egg. Differences: Fertilisation takes place inside the body of a woman; fertilisation takes place outside the body of a female fish, it takes 40 weeks to develop fully for human and it takes 2 weeks for fish to develop before it is hatched.

Summary
- The fertilised egg that develops and grows in the mother's womb is called an embryo.
- When the embryo turns into a shape of the human body eight weeks after fertilisation is called a foetus.
- The foetus grows into a baby and is ready to be born after about nine months.

Unit: **Animals**	Chapter : **6. Reproduction and Heredity in Animals** Topic : **6.1. Reproduction and Heredity**	Total lesson No: 35 / 87 Textbook page: 89 - 90

Lesson 4 / 6

Lesson Title

From Parents to Young

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson and Lesson 1 'Reproduction in Fish' by asking:

Q:How does a baby grow?

Q:Does a young fish look like its parents?

- Encourage students to think about heredity by asking:

Q:Most animals look like their parents. Why do they look like their parents?

2 Introduce the key question

Why do young animals look like their parents?

3 Activity (25 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Allow students to study the diagram and questions in the activity.
- Refer students to what the character is saying for their activity.
- Ask students to do the activity based on the questions in the activity.
- Ask students to discuss their findings in their groups.
- Give enough time for students to do their findings.

4 Discussion for findings (20 min.)

- Ask students to present their findings from the activity.

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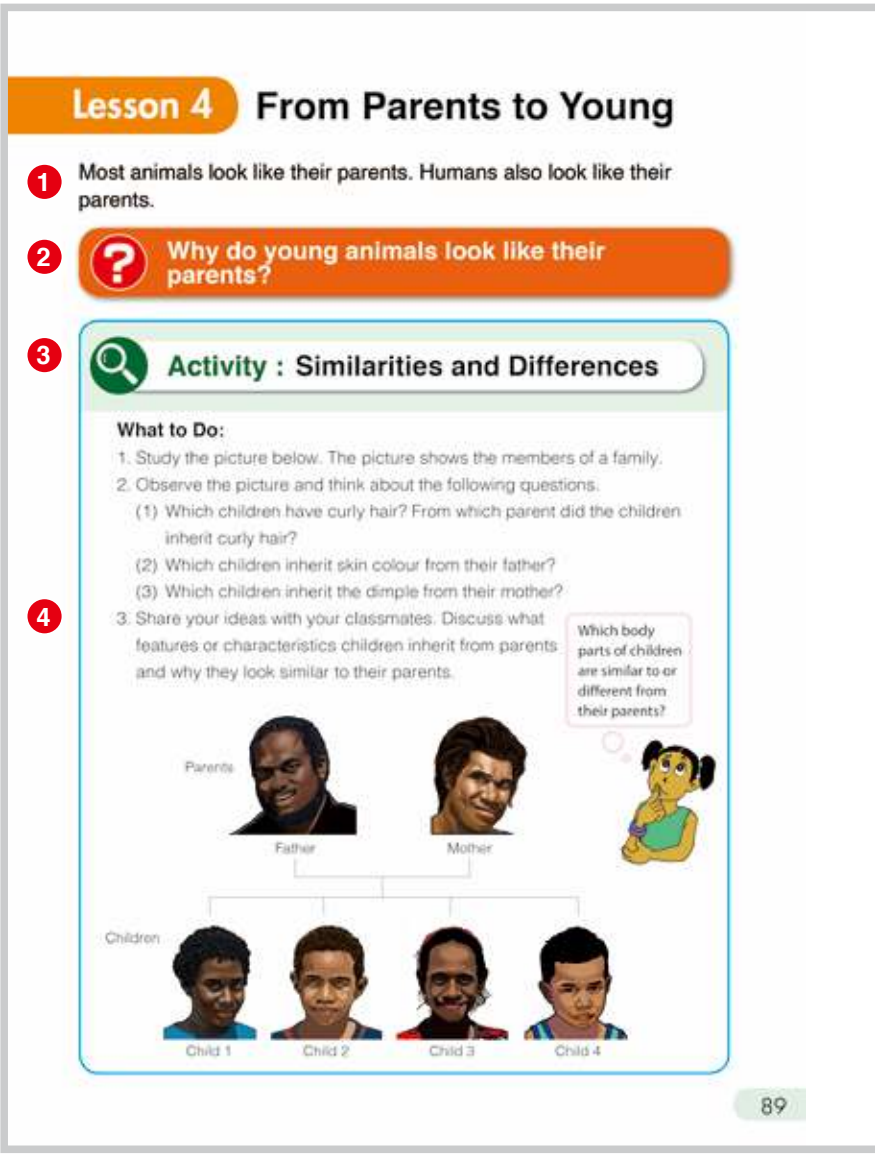


Teacher's Notes

- 'Hereditity in Plants' is taught in Grade 6, Chapter 5, lesson 4. The teacher's note explains the famous rule of heredity called Mendelian inheritance. Referring to the note in advance to this lesson may help your effective facilitation of this lesson.

Additional Information about Heredity and Traits

- **What is heredity?** The passing of traits from parents to children either through asexual or sexual reproduction , the offspring cells or organisms acquire the genetic information of their parents. 'Inheritance' is the same concept but used in more scientific context.
- **What is Trait?** A Trait is a noticeable feature or quality in a person. Each of us has different combination of traits that make us unique.Traits are passed from generation to generation. We inherit traits from our parents and pass them to our children.
- **What is genetic?** It is the scientific study of heredity.
- Not all young animals look like their parents.A baby ladybird and a tadpole are some examples of animals which do not look like their parents.

Lesson Objectives

Students will be able to:
- Understand what heredity is.
- Describe what traits animals inherit.
- Value others' effort and opinions.

Assessment

Students are able to:
- Explain the reason why the youngs looks like their adults.
- State the different types of the traits of animals.
- Listen to other's opinions carefully.

Summary

Young animals look like their parents because parents pass traits to their children when they reproduce. This process is called heredity. A trait is a feature or characteristic of a living thing. The eye colour, hair colour, blood type and the shape of the nose and ears are examples of the traits of humans that are inherited by the children from their parents. Traits of animals include the colour of fur and the shape of their ears or beaks.

Examples of Human Traits

Curly hair | Straight hair | Dimples | No Dimples | Cross right thumb over left | Cross left thumb over right

Widow's peak hairline | Straight hairline | Can roll tongue | Cannot roll tongue | Detached earlobe | Attached earlobe

Young animals inherit many traits from both parents. For example, a child with curly hair has a parent or parents with curly hair. A child may have long nose if their father or mother has long nose. A kitten with striped pattern of fur usually has a parent with striped fur. If puppies have floppy ears, their parents may also have floppy ears.

A puppy and its parent have floppy ears.

Children have traits similar to their mother or father.

90

- 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:What characteristics do children inherit from their parents? (The shape of ear and nose, colour of hair, hair type etc...)

Q:Why do they look similar to their parents? (Because they inherited their traits from their parents.)

- Elaborate more by explaining to students that they also have some features that makes them to look similar to their parents and pose a question .

Q:What characteristics do you inherit from your parents? (Let students to state their opinions freely.)

- 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 children look like their parents?
  Q: What are traits?
  Q: What traits do the youngs inherit from their parents?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

From Parents to young

Key question : Why do young animals look like their parents.

Activity: Similarities and differences.

1. Which children have curly hair? From which parents did the children inherit?
   From father: Child 1,2 and 4
2. Which children inherit skin colour from their father? Child 1 and 3
3. Which children inherit the dimple from their mother? Child 3

Discussion

Q:What characteristics do children inherit from their parents?
The shape of ear and nose,colour of hair, hair type , etc...

Q:Why do they look similar to their parents?
Because they inherit their traits from their parents.

Q: What characteristics do you inherit from your parents?
(Write down the ideas from students.)

Summary

- Young animals look like their parents because parents pass traits to their children when they reproduce.
- Heredity is passing of traits from parents to children during reproduction.
- Trait is a feature or characteristic of a living thing.
- Examples of Traits:
  Eye colour, hair/fur colour, blood type, the shape of the nose and ears, hair type, etc...

Unit: **Animals**	Chapter : **6. Reproduction and Heredity in Animals** Topic : **6.1. Reproduction and Heredity**	Total lesson No: 36 / 87 Textbook page: 91 - 93

Lesson 5 / 6

Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (20 min.)

- Recap the main learning content in the topic.
- Based on the main learning contents ask student the following questions.
  - Q: What is reproduction?
  - Q: How does a human life begin?
  - Q: Why do children look like their parents?
- 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.

1

Summary and Exercise

Summary 6.1 Reproduction and Heredity

Reproduction

- Reproduction is the process by which living things produce young ones similar to themselves.
- Fertilisation is the process by which joins a sperm with an egg.
- An egg is produced inside a female's body and the sperm is produced inside the male's body.

Reproduction in Fish

Shape of body becomes more like adult fish in the egg

- After fertilisation, fish grows in the fertilised egg.
- The inside of the egg becomes more like a fish.
- Young fish hatch from the egg after about a few weeks.

Reproduction in Humans

- Sexual reproduction takes place in humans between a male and a female.
- Male reproductive organs are the testes and penis.
- Female reproductive organs are the ovaries, womb and vagina.
- A fertilised egg develops and grows in the mother's womb and becomes an embryo.
- The embryo turns into the shape of the human body eight weeks after fertilisation and becomes a foetus.
- A foetus grows into a baby and after about thirty-seven to forty weeks the baby is born.

The fertilised egg develops and grows in the mother's womb and becomes a foetus

From Parents to Young

- Heredity is the process of parents passing traits to their children.
- A trait is a feature or characteristic of a living thing.
- Some examples of human traits are: eye colour, hair colour, blood type, the shape of the nose and ears.
- Young animals also inherit many traits from both parents.

91

2 Exercise & Explanation (30 min.)

- Go through the instructions of the exercise.
- Allow students to answer 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.

2

Summary and Exercise

Exercise 6.1 Reproduction and Heredity

Q1. Complete each sentence with the correct word.

(1) The process that all living things produce young ones similar to themselves is called _____.

(2) The process of sperm joining with the eggs is _____.

(3) In human, a fertilised egg develops in the mother's _____.

(4) The passing of traits from parents to young is called _____.

Q2. Choose the letter with the correct answer.

(1) The picture shows a stage in the reproduction of a fish, where the egg starts to swell up. When does the swelling part of the egg form?

A. Before the egg is about to hatch.
B. After the egg is already fertilised.
C. Before the egg is ready to be fertilised.
D. When the egg is in the male fish body.

(2) In the life cycle of a fish, where does fertilisation take place?

A. In the female fish body.
B. In the male fish body.
C. Outside in the water.
D. On the land.

Q3. Answer the following questions.

(1) What makes children look like their parents?

(2) Write any two examples of human traits.

Q4. In humans, how does fertilisation occur?

92

Exercise answers

Q1.
(1) **reproduction**
(2) **fertilisation**
(3) **womb**
(4) **heredity**

Q2.
(1) **B**
(2) **C**

Q3.
(1) **Heredity**
(2) **Eye colour, hair colour, blood type, shape of nose, types of hair (curly or straight), etc.**

Q4. Expected Answer
When a sperm meets with an egg, the egg becomes a fertilised egg. Human life begins with a fertilised egg. In human, fertilisation takes place inside the body of the female.

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.

3

Chapter 6
•Science Extras•

How do Birds of Paradise reproduce

It is believed that Birds of Paradise are independent birds and some species defend territories. Female birds of paradise reach sexual maturity at around one year old and males at around two to three years old. Females enter the males' territories when they are interested to breed and choose the most suitable mate. After the female chooses her mate, she will lay between one depending on the species she admires.

Males build large, elaborate displays for females, perform acrobatic dances or sing long and complicated songs. The males take part in various dance rituals where they will display their additional coloured feathers. They may do this type of dance for many hours before they give up if a female isn't responsive to them. If a female does respond they will mate and then the male quickly runs off. He will try to find several other females he can mate with before the season ends.

Once mating has occurred the female will lay 2-3 eggs. They are small and brownish orange in colour. She will do her best to hide them from predators. She will only fly away from them when she has to get food. They will hatch after about 20 days of development.

Most eggs will hatch within two to four weeks. The newly hatched chicks develop quickly and will begin to learn to fly at around one month old.

93

Lesson 6 / 6

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

6. Reproduction and Heredity in Animals

Q1 Complete each sentence with the correct word.

(1) The womb, ovaries and vagina are organs found in the female reproductive system.

(2) Young fish hatch from the egg about two weeks after fertilisation.

(3) Eye colour, hair colour, blood type and the shape of the nose are some examples of the traits of human that are inherited.

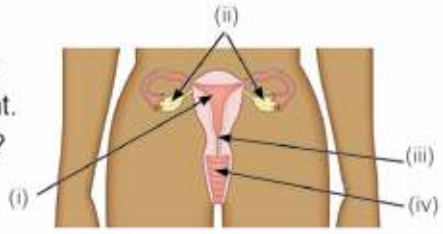
(4) The female body part that contains thousands of eggs is called ovary.

Q2 Choose the letter with the correct answer.

(1) Which of the following is not part of a male reproductive system?

A. Testes
B. Uterus
C. Penis
D. Sperm

(2) Study the picture of the female reproductive organs on the right. Where are the eggs produced?

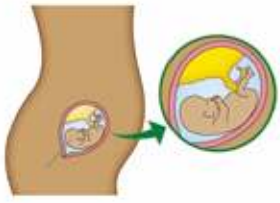


A. (i) B. (ii)
C. (iii) D. (iv)

(3) Which of the following is not a trait inherited from parents?

A. Scratches
B. Spots on fur
C. Shape of beak
D. Eye colour

(4) Study the picture of a foetus in a female's body. The foetus's arms and legs have been formed. How old is the baby?



A. 3 days
B. 1 week
C. 8 weeks
D. 36 weeks

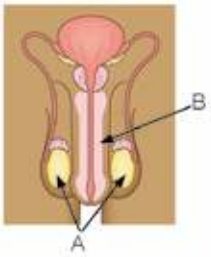
94

Q3

(1) Explain the work of the parts labeled A and B of the male reproductive system?

A. The testes produce millions of sperms.

B. The penis is a body part that passes semen out of the man's body.



(2) What is the difference between the ovary and the testes?

The ovary is found in the female body that contains thousands of eggs and the testes is found in the male body which produces millions of sperms.

(3) Where are the testes located?

The testes are contained in a bag of skin.

(4) What is the name of the process in which a sperm joins with an egg?

Fertilisation

Q4

(1) Explain the process of heredity.

(Expected answer) Heredity makes young children to look like their parents because parents pass traits to their children when they reproduce.

(2) Study the two pictures on the right. Explain how the growths of fertilised eggs are different between fish and human.

(Expected answer) The fertilised egg of fish develops in the water, while the fertilised egg of human develops and grows in the mother's womb (uterus).

Fertilised eggs of fish

Foetus of human

Chapter 7. Electricity 2

Chapter Objectives

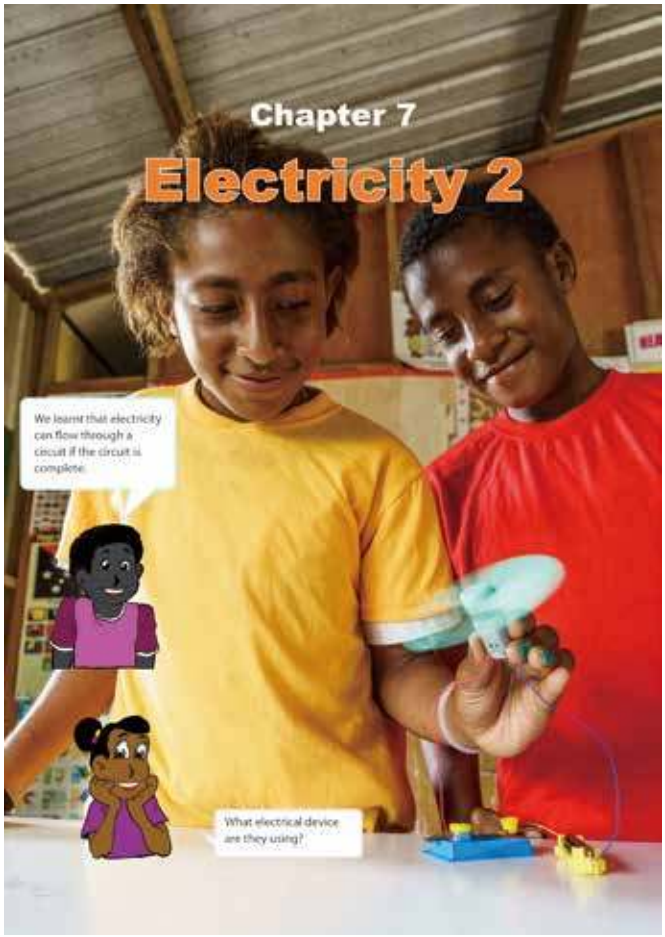
Students will be able to understand how electric current flows in a circuit and the properties of series and parallel circuits through experiments using batteries, motor, propeller, switch and wires.

Topic Objectives

7.1 Electrical Circuit

Students will be able to;

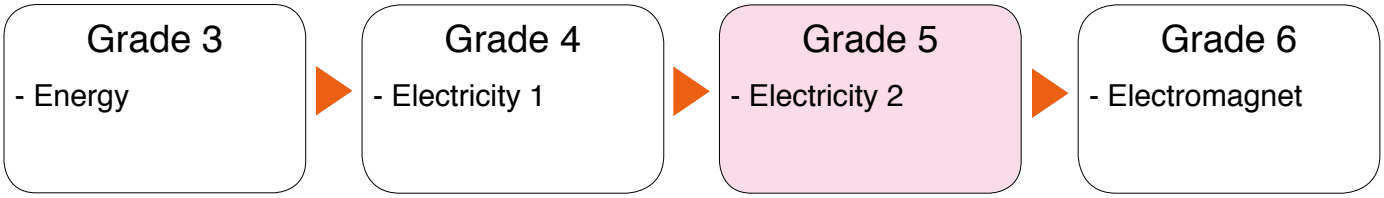
- Describe how the electric current flows in the circuit.
- Identify the two ways of connection where the electric current flows in the circuit.
- Describe the flow of electric current in a series and parallel circuit.
- Describe a circuit diagram from actual circuits.
- State the connections of electric circuits in appliances used in daily life.



This picture is from the chapter heading of the textbook showing two Grade 5 students turning a propeller using electric components that are connected in a circuit.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Electric current flows through the closed circuit.
- Characteristics of conductors and insulators.

Teaching Overview

This chapter consists of 7 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
7.1 Electric Circuit	1	**Direction of Electric Current** How does electric current work in a circuit?	5.2.2	97 - 98
	2	**Series and Parallel Circuit** How can we connect two dry cells to make a motor rotate?		99 - 100
	3	**Comparing Series and Parallel Circuits** How is the amount of electric current different between series and parallel connection of two dry cells?		101 - 102
	4	**Circuit Components and their Symbols** How can an electric circuit be represented?		103 - 104
	5	**Daily Use of Electric Circuit** Where are electric circuits used in our daily lives?		105 - 106
	6	Summary and Exercise, Science Extra		107 - 109
Chapter Test	7	Chapter Test		110 - 111

Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 38 / 87 Textbook page: 97 - 98

Lesson 1 / 7

Lesson Title

Direction of Electric Current

Preparation

motor, propeller, dry cell, switch, cell holder and pieces of electric wire

Lesson Flow

1 Introduction (5 min.)

- Review Grade 4 Chapter 8 Topic 8.2: 'Function of Electricity', by asking:

Q:How can we light a bulb with a dry cell?

Q:How does electricity flow through an electric circuit?

- Explain what a motor is and encourage students to think about the direction of electric current by asking:

Q:What else can electric current do apart from lighting up a bulb?

2 Introduce the key question

How does electric current work in a circuit?

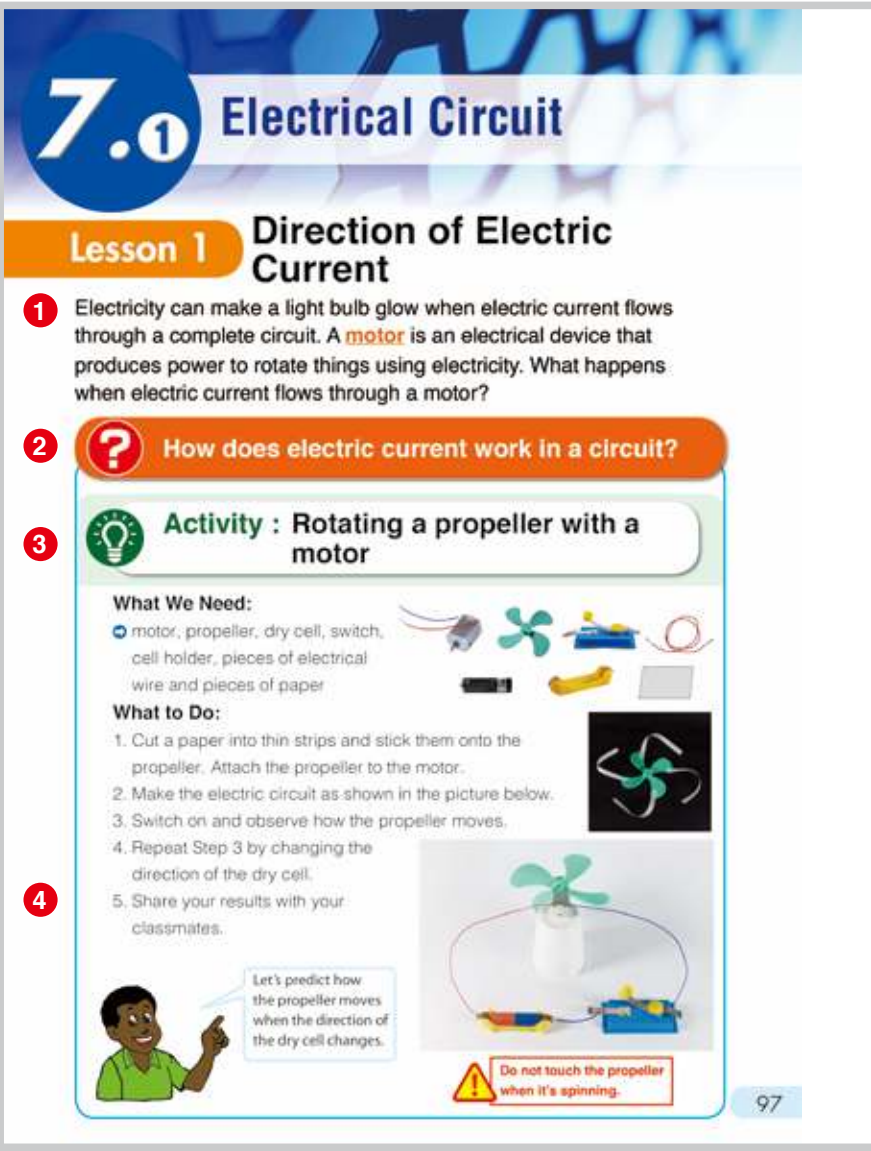
3 Activity (30 min.)

- Organise students into groups and remind them of the safety rules.
- Refer students to what the character is saying for their investigations.
- Explain the steps of the activity.
- Let students predict how the propeller moves when the direction of the dry cell changes.
- Assist students to make a circuit correctly.
- Have students do the activity and record their observations in their exercise books.
- Ask students to discuss their results in their groups

4 Discussion for findings (20 min.)

- Ask students to present their result from the activity.

(Continue)



Teacher's Notes

In Grade 4, Chapter 8 'Electricity 1' students have already learnt about how to make a simple circuit. Give opportunity for students to recall how to make a simple circuit using the given materials in the activity.

Tips of 'How to set up'

1. Place the dry cell in the cell holder.
2. Since the motor has two wires attached to it, connect one of the wires to the cell holder and the other to the switch.
3. Connect an extra wire at least 15cm long to the switch and the cell holder.
4. Attach the propeller to the motor.
5. Place the motor on a container or cup that is low enough to rest on.

Background information

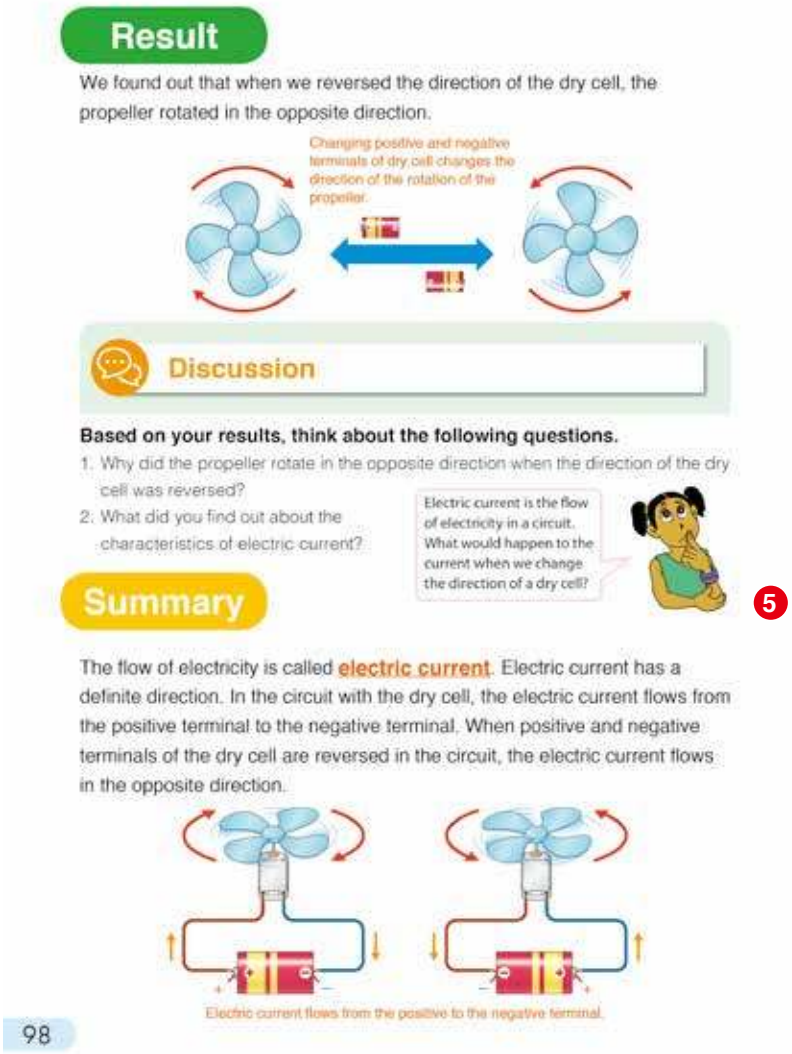
How does electric current flow in a circuit? The direction of an electric current is by law the direction in which a positive charge would move. Thus, the current in the external circuit is directed away from the positive terminal and towards the negative terminal of the battery. Electrons would actually move through the wires in the opposite direction.

Lesson Objectives

Students will be able to:
- Recognize that electric current has a definite direction through an experiment.
- Explain how electric current flows through a circuit from a dry cell.
- Show curiosity in investigation.

Assessment

Students are able to:
- Identify the direction of electric current in a circuit by relating to the change in the direction of a propeller rotation.
- State that electric current flows from the positive terminal to the negative terminal in a circuit.
- Participate in the activity with curiosity.



- 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 did the propeller rotate in the opposite direction when the direction of the dry cell was reversed? (Because the direction of electric current also changed.)

Q:What did you find about the characteristics of electric current? (The electric current has a definite direction, the electric current flows from one terminal to another of a dry cell, the electric current change the direction of a propeller rotation when the direction of a dry cell changes, etc.)

- Demonstrate again to clarify that changing positive and negative terminals of dry cell changes the direction of rotation of the propeller.
- 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: From which terminal of the dry cell does the electric current flows through a circuit?
  Q: What would happen to the electric current when we change the direction of the dry cell?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Direction of Electric Current

Key question:
How does electric current work in a circuit?
Activity: Rotating a propeller with a motor
Prediction:
How will the propeller move when the direction of the dry cell changes?
Write down the predictions for the students.
Result:
When you reversed the direction of the dry cell, the propeller rotated in the opposite direction.

Changing positive and negative terminal of the dry cell changes the direction of the rotation of the propeller

Discussion
Q: Why did the propeller rotate in the opposite direction when the direction of the dry cell was reversed? Because the direction of electric current aslo changed.
Q:What did you find about the characteristics of electric current?

The electric current has a definite direction, the electric current flows from one terminal to another of a dry cell, the electric current change the direction of a propeller rotation when the direction of a dry cell changes.

Summary
- The electric current has a definite direction. It flows from positive terminal of the dry cell to the negative terminal in the circuit.
- When positive and negative terminals of the dry cell are reversed in the circuit, the electric current flows in the opposite direction.

Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 39 / 87 Textbook page: 99 - 100

Lesson 2 / 7

Lesson Title

Series and Parallel Circuit

Preparation

2 dry cells, switch, motor, propeller, electrical wire

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson on electric current by asking this question:

Q:How can you change the rotating direction of the motor? By changing the positive and negative terminal of the dry cell.

- Provoke students to think by asking;

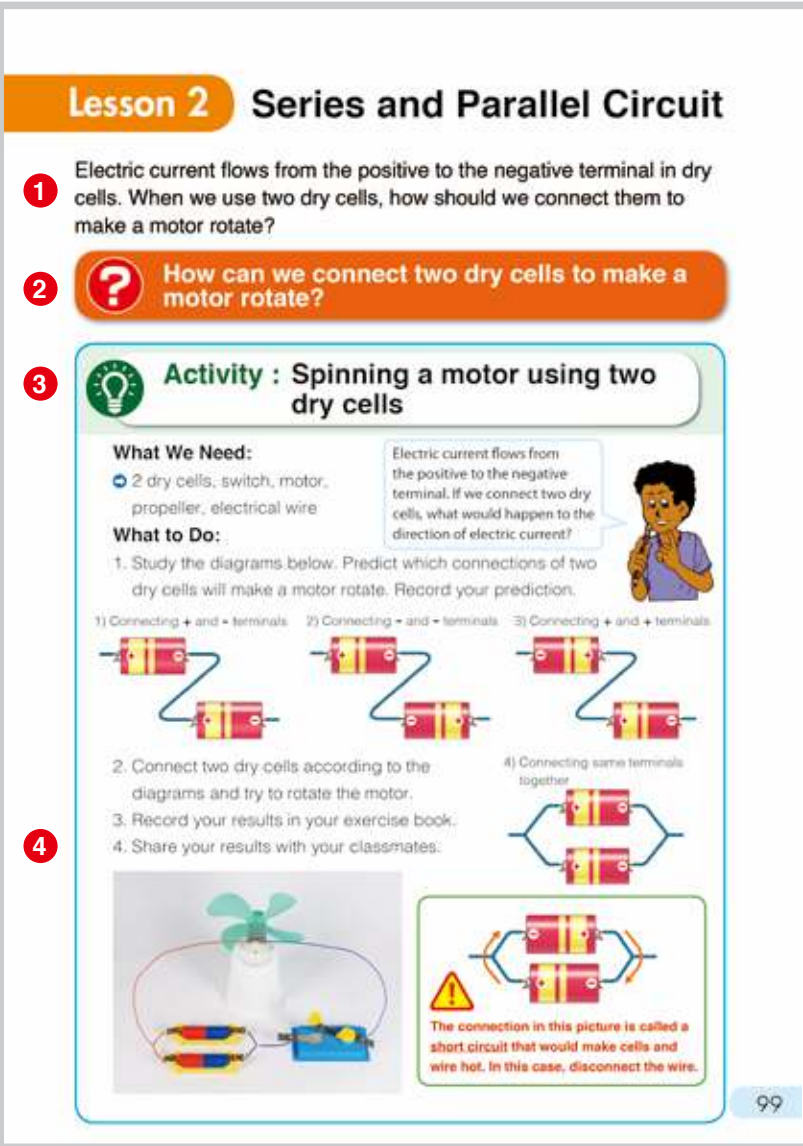
Q:How should we connect two dry cells to make a motor rotate?

2 Introduce the key question

How can we connect two dry cells to make a motor rotate?

3 Activity (30 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Remind them of the safety tips.
- Refer students to study the diagrams and the character.
- Ask students to predict which ways make a motor rotate.
- Direct students to do the activity according to the diagrams.
- Assist students with the connections.
- Ask the students to record their results in their exercise books.
- Ask students to discuss their results in their groups.



Lesson 2 Series and Parallel Circuit

1 Electric current flows from the positive to the negative terminal in dry cells. When we use two dry cells, how should we connect them to make a motor rotate?

2 How can we connect two dry cells to make a motor rotate?

3 Activity : Spinning a motor using two dry cells

What We Need:
- 2 dry cells, switch, motor, propeller, electrical wire

What to Do:

1. Study the diagrams below. Predict which connections of two dry cells will make a motor rotate. Record your prediction.

Electric current flows from the positive to the negative terminal. If we connect two dry cells, what would happen to the direction of electric current?

1) Connecting + and - terminals 2) Connecting - and - terminals 3) Connecting + and + terminals

4 2. Connect two dry cells according to the diagrams and try to rotate the motor.
3. Record your results in your exercise book.
4. Share your results with your classmates.

4) Connecting same terminals together

The connection in this picture is called a short circuit that would make cells and wire hot. In this case, disconnect the wire.

99

Teacher's Notes

Tips for the Activity

1. Follow the same connections as in the previous lesson.
2. Connect two dry cells with extra wires to make the circuits (series and parallel circuits).
3. If the motor doesn't rotate then check the connections again especially the wires.
4. If the wires are coated, make sure to remove the coating before connecting.
5. For parallel circuit make sure the wires are properly connected.

SAFETY

1. Do not touch the propeller when it is spinning.
2. Do not put the dry cell in your mouth.
3. Try not to make a short circuit because the wire might get hot.

Background information

- A series circuit is one with all the loads in a row. There is only ONE path for the electricity to flow. If this circuit was a string of light bulbs, and one blew out, the remaining bulbs would turn off.
- A parallel circuit is one that has two or more paths for the electricity to flow; the loads are parallel to each other. If the loads in this circuit were light bulbs and one blew out, there is still current flowing to the others because they are still in a direct path from the negative to positive terminals of the battery.

Lesson Objectives

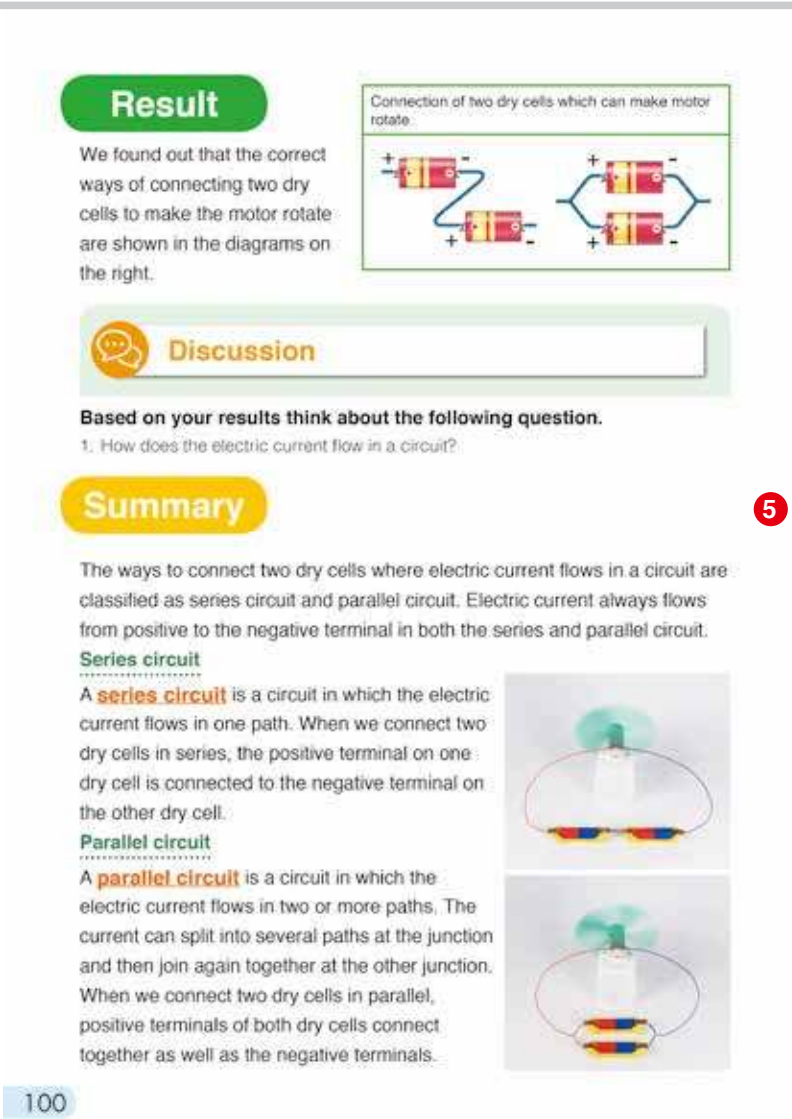
Students will be able to:

- Realise the two ways of connection where electric current flows in the circuit.
- Experiment the ways to connect two dry cells that makes a motor rotate.
- Develop curiosity of investigation.

Assessment

Students are able to:

- Identify a series and parallel circuit as ways where electric current flows in the circuit.
- Explain the direction of two dry cells in a circuit to make a motor rotate.
- Investigate the ways to connect two dry cells actively.



Result

We found out that the correct ways of connecting two dry cells to make the motor rotate are shown in the diagrams on the right.

Connection of two dry cells which can make motor rotate

Discussion

Based on your results think about the following question.

1. How does the electric current flow in a circuit?

Summary

The ways to connect two dry cells where electric current flows in a circuit are classified as series circuit and parallel circuit. Electric current always flows from positive to the negative terminal in both the series and parallel circuit.

Series circuit

A series circuit is a circuit in which the electric current flows in one path. When we connect two dry cells in series, the positive terminal on one dry cell is connected to the negative terminal on the other dry cell.

Parallel circuit

A parallel circuit is a circuit in which the electric current flows in two or more paths. The current can split into several paths at the junction and then join again together at the other junction. When we connect two dry cells in parallel, positive terminals of both dry cells connect together as well as the negative terminals.

100

4 Discussion for findings (20 min.)

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

Q:How do we connect two dry cells in series to make a motor rotate? (We connect positive to negative or negative to positive terminal, etc.)

Q:In which direction does electric current flow in a circuit? (From positive to negative terminal of a dry cell, etc.)

Q:How does the electric current flow in a circuit when two dry cells are connected as shown in the diagram in the 'Result'? In the circuit on the left, the electric current flows in one pathway. In the circuit on the right, the electric current flows in two pathways.

- 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 are the two types of connection?
  Q: How does electric current flow in a series and a parallel circuit?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

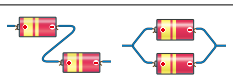
Title:

Series and Parallel Circuit

Key question : How can we connect two dry cells to make a motor rotate?
Activity: Spinning a motor using two dry cells
Predictions: (Place a tick)
Which connections can make the motor rotate?
Diagram 1: Yes
Diagram 2: No
Diagram 3: No
Diagram 4: Yes

Result:

Connections of two dry cells which can make motor rotate.



Discussion

Q: How do we connect two dry cells in series to make a motor rotate? We connect positive to negative or negative to positive terminal.
Q: In which direction does electric current flow in a circuit? From positive to negative terminal of a dry cell, etc...

How does the electric current flow in a circuit when two dry cells are connected as shown on the diagram in the 'Result'? In the circuit on the left, the electric current flows in one pathway. In the circuit on the right, the electric current flows in two pathways

Summary

- The ways of connection where the electric current flow in the circuit are classified in two types.
  1. Series circuit- electric current flows in one path.
  2. Parallel circuit- electric current flows in two or more paths.

Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 40 / 87 Textbook page: 101 - 102

Lesson 3 / 7

Lesson Title

Comparing Series and Parallel Circuits

Preparation

2 light bulbs, 4 dry cells, 4 cell holders
2 switches, electric wire

Lesson Flow

1 Introduction (5 min.)

- Revise the previous lesson. Ask:

Q:What connection of two dry cells can make the motor rotate?

- Provoke students to think of the brightness of the bulbs in both circuits.

Q:What can you say about the brightness of the bulbs in a series and parallel circuit?

2 Introduce the key question

How is the amount of electric current different between series and parallel connection of two dry cells?

3 Activity (30 min.)

- Organise students into groups and remind them of the safety tips.
- Explain the steps of the activity.
- Encourage students to compare two connections at a time.
- Give enough time for them to do the experiments.
- Ask them to record their results in the table.
- Ask students to discuss their results in their groups.

4 Discussion for findings (20 min.)

- Ask students to present their observation results from the activity.
- Write their observation results on the blackboard.
- Facilitate active students' discussions.
- Confirm the results with the students.

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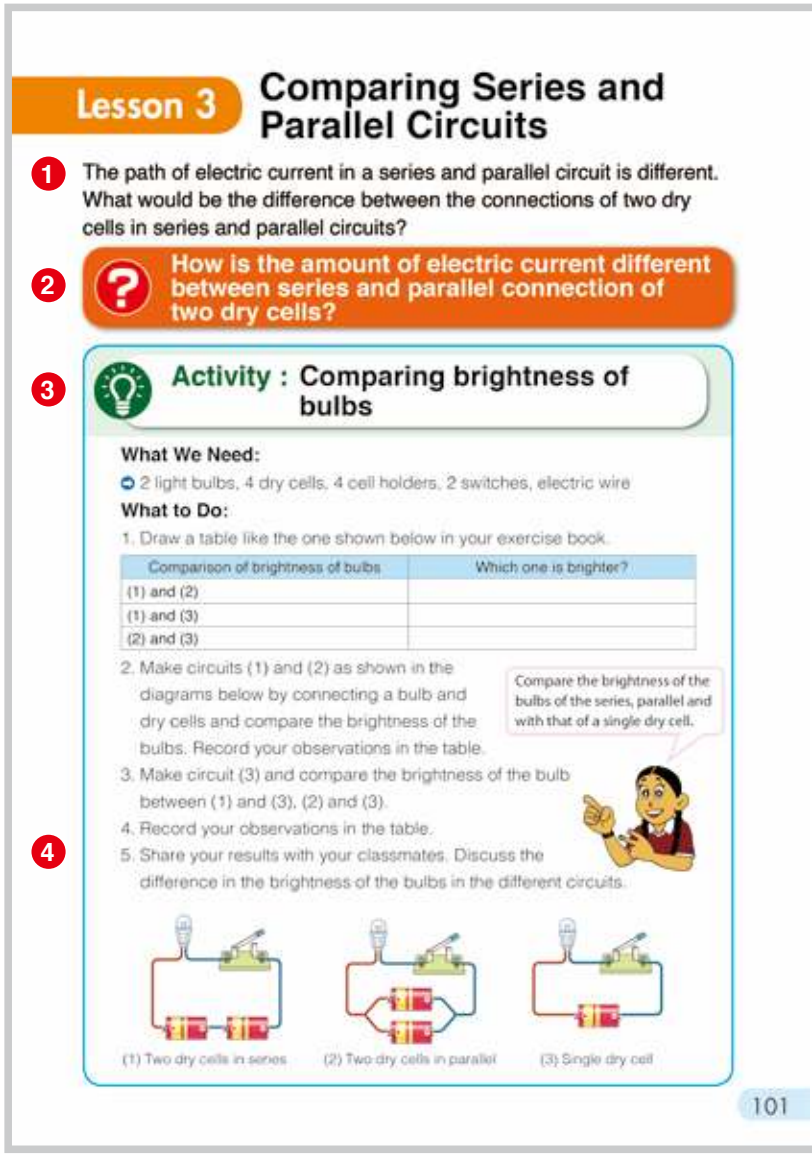


Lesson 3 Comparing Series and Parallel Circuits

1 The path of electric current in a series and parallel circuit is different. What would be the difference between the connections of two dry cells in series and parallel circuits?

2 How is the amount of electric current different between series and parallel connection of two dry cells?

3 Activity : Comparing brightness of bulbs

What We Need:
2 light bulbs, 4 dry cells, 4 cell holders, 2 switches, electric wire

What to Do:
1. Draw a table like the one shown below in your exercise book.

Comparison of brightness of bulbs	Which one is brighter?
(1) and (2)	
(1) and (3)	
(2) and (3)	

2. Make circuits (1) and (2) as shown in the diagrams below by connecting a bulb and dry cells and compare the brightness of the bulbs. Record your observations in the table.
3. Make circuit (3) and compare the brightness of the bulb between (1) and (3), (2) and (3).
4. Record your observations in the table.
5. Share your results with your classmates. Discuss the difference in the brightness of the bulbs in the different circuits.

Compare the brightness of the bulbs of the series, parallel and with that of a single dry cell.

4

(1) Two dry cells in series (2) Two dry cells in parallel (3) Single dry cell

101

Teacher's Notes

SAFETY: The safety tips for the previous lessons apply to this lesson as well.

Tips for the Activity

1. The same connection for experiments in the previous lessons is used but for this lesson bulb is connected and also use new dry cells.
2. There will be three connections, a single dry cell circuit, a series circuit and a parallel circuit.
3. If there are limited materials, the materials can be improvised such as a switch or cell box/ holder (Refer to Grade 4 Electricity 1) or a connection can be done one at a time.
4. If the experiment doesn't work, always make sure to check the connections properly.

Background information

- Which circuit lasts longer series or parallel? When batteries are hooked up in series, the voltage is increased. For example, two - 6 Volt batteries connected in series produce 12 Volts. When batteries are hooked up in parallel, the voltage remains the same (6 volt), but the power (or available current) is increased. This means that the batteries would last longer.

Lesson Objectives

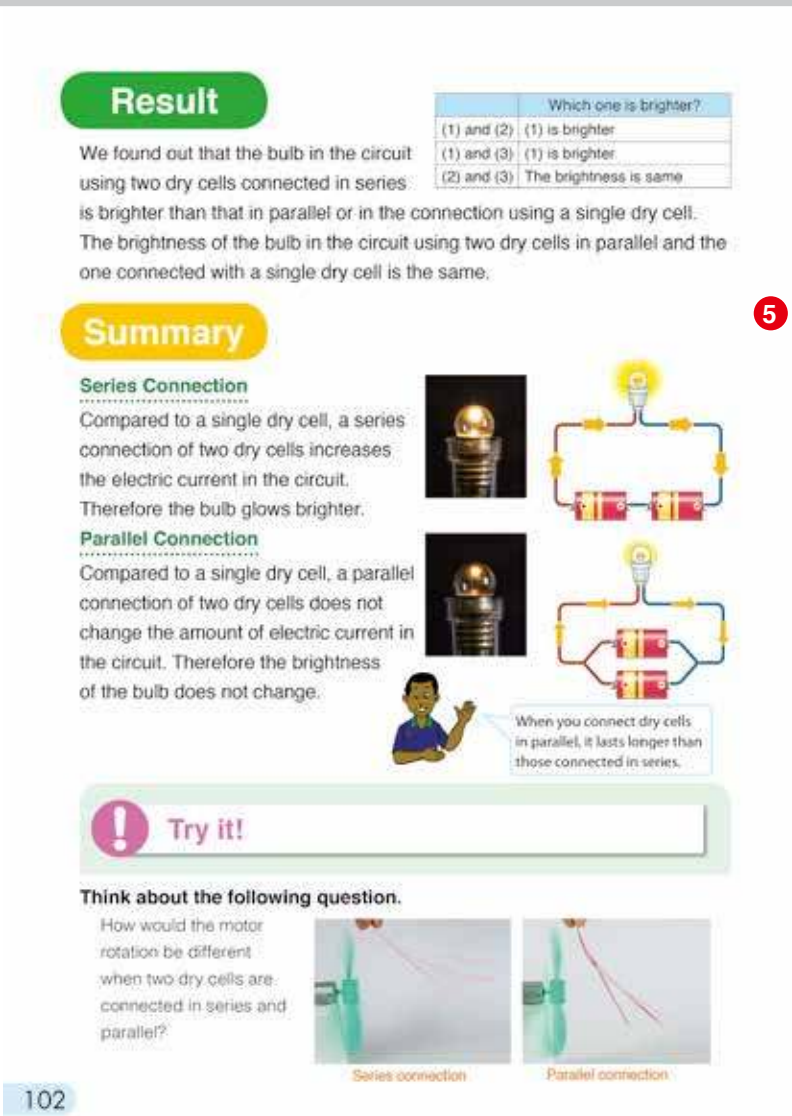
Students will be able to:

- Discover the ways to connect two dry cells that make a bulb brighter through activity.
- Relate the connection of two dry cells to the brightness of a bulb and the strength of electric current in a circuit.
- Show curiosity of how the results vary.

Assessment

Students are able to:

- Explain that a series connection of two dry cells makes a bulb brighter based on the result of the activity.
- Explain the relationship between a series connection and a parallel connection of two dry cells with the strength of electric current by comparing the brightness of bulbs.
- Participate in the investigation with interest.



Result

We found out that the bulb in the circuit using two dry cells connected in series is brighter than that in parallel or in the connection using a single dry cell. The brightness of the bulb in the circuit using two dry cells in parallel and the one connected with a single dry cell is the same.

	Which one is brighter?
(1) and (2)	(1) is brighter
(1) and (3)	(1) is brighter
(2) and (3)	The brightness is same

Summary

Series Connection

Compared to a single dry cell, a series connection of two dry cells increases the electric current in the circuit. Therefore the bulb glows brighter.

Parallel Connection

Compared to a single dry cell, a parallel connection of two dry cells does not change the amount of electric current in the circuit. Therefore the brightness of the bulb does not change.

When you connect dry cells in parallel, it lasts longer than those connected in series.

Try it!

Think about the following question.

How would the motor rotation be different when two dry cells are connected in series and parallel?

Series connection

Parallel connection

102

5

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

Q:What is the difference between the circuits of (1) and (2)? (Connection of cells is different.)

Q:How should we connect two dry cells to make a bulb brighter? (Two dry cells should be connected in series, etc.)

Q:What is the difference between the circuits of (1) and (3)? (The number of cells is different.)

Q:What relationship is there between the number of cells and the brightness of a bulb when two cells are connected in series? (If the number of dry cells increases, the bulb becomes brighter.)

Q:What is the difference between the circuits of (2) and (3)? (The number of cells is different.)

Q:What relationship is there between the number of cells and the brightness of a bulb when two cells are connected in parallel? (Even if the number of dry cells increases, the brightness doesn't change.)

- 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:How can we make a bulb brighter?
  Q:How does the strength of electric current change when two dry cells are connected in series and parallel?
- Ask students to copy the notes on the blackboard into their exercise books.
- Facilitate 'Try it!'

Sample Blackboard Plan

Title: **Comparing Series and Parallel Circuits**

Key question
How is the amount of electric current different between series and parallel connection of two dry cells?

Activity : Comparing brightness of bulbs

Comparison of brightness of bulbs	Which one is brighter?
(1)and (2)	(1) is brighter
(1)and (3)	(1) is brighter
(2)and (3)	Same brightness

Discussion

Q:What is the difference between the circuits of (1) and (2)? (Refer to lesson flow.)
Q:How should we connect two dry cells to make a bulb brighter? (Refer to lesson flow.)
Q:What is the difference between the circuits of (1) and (3)? (Refer to lesson flow.)
Q:What relationship is there between the number of cells and the brightness of a bulb when two cells are connected in series? (Refer to lesson flow.)
Q:What is the difference between the circuits of (2) and (3)? (Refer to lesson flow.)
Q: What relationship is there between the number of cells and the brightness of a bulb when two cells are connected in parallel? (Refer to lesson flow.)

Summary Comparing with a single dry cell:

1. Series connection:
   - Electric current increases as the number of the dry cells increase.
   - Bulb light up brighter.
2. Parallel connection
   - Electric current doesn't change even if more dry cells are added.
   - Brightness of bulb does not change.

Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 41 / 87 Textbook page: 103 - 104

Lesson 4 / 7

Lesson Title

Circuit Components and their Symbols

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- Review the previous lesson on comparing series and parallel circuits.

Q:Which circuit made the motor rotate faster and made the bulb brighter?

- Encourage students to think of how to draw a circuit diagram by asking:

Q:Is it easy to draw a circuit?

Q:How can we draw a circuit easily?

2 Introduce the key question

How can an electric circuit be represented?

3 Discussion (20 min.)

- Discuss 1. Symbols of circuit components with students.
- Ask students to study 'Component, Symbol and Examples' in the table.

Q:How are circuit components described by symbols? (It depends on students.)

- Explain the use and the characteristics of each symbol on the blackboard or on a chart.
- Ask students to draw the symbols in their exercise books.
- Provoke students to think about this question:

Q:Why are symbols used to represent each circuit components? (It makes us draw a circuit simply within a shorter time.)

- Confirm the symbols with the students.

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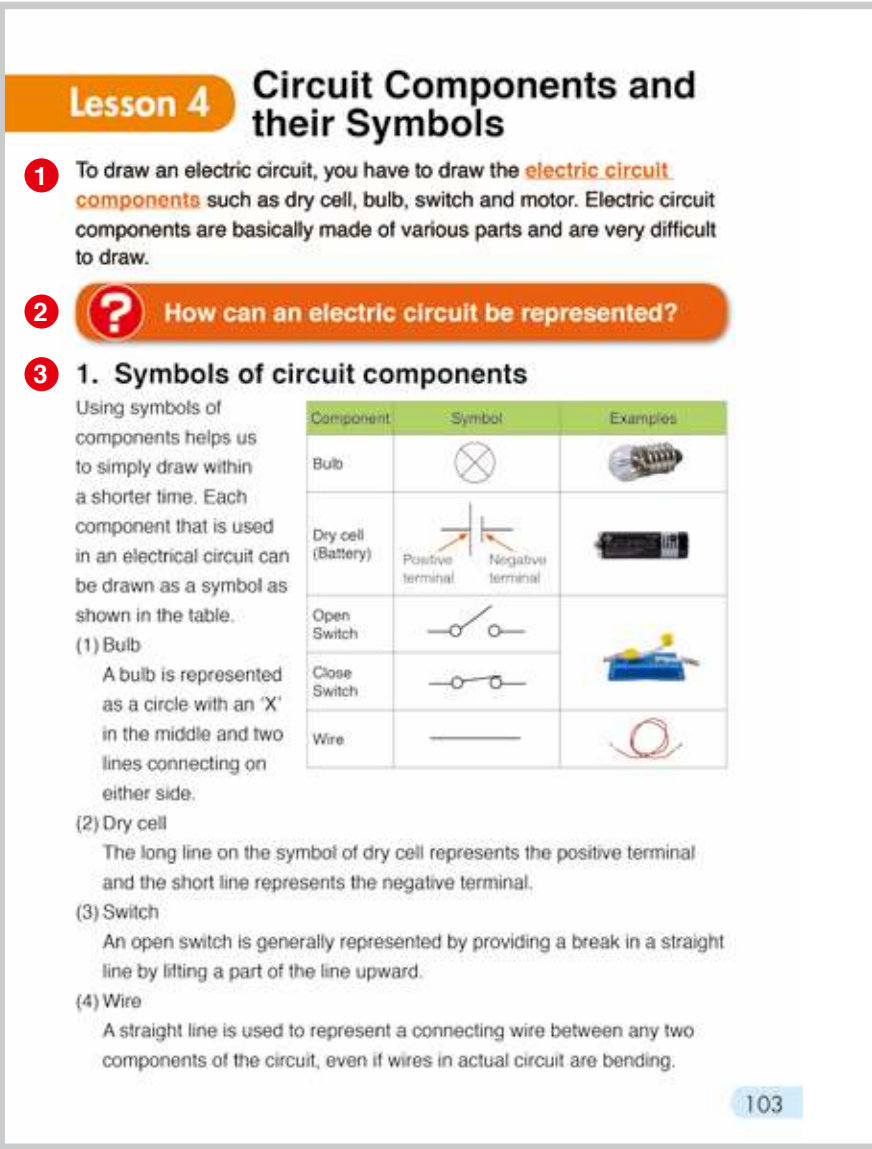


Lesson 4 Circuit Components and their Symbols

1 To draw an electric circuit, you have to draw the electric circuit components such as dry cell, bulb, switch and motor. Electric circuit components are basically made of various parts and are very difficult to draw.

2 ? How can an electric circuit be represented?

3 1. Symbols of circuit components

Using symbols of components helps us to simply draw within a shorter time. Each component that is used in an electrical circuit can be drawn as a symbol as shown in the table.

Component	Symbol	Examples
Bulb		
Dry cell (Battery)	Positive terminal / Negative terminal	
Open Switch		
Close Switch		
Wire		

(1) Bulb
A bulb is represented as a circle with an 'X' in the middle and two lines connecting on either side.

(2) Dry cell
The long line on the symbol of dry cell represents the positive terminal and the short line represents the negative terminal.

(3) Switch
An open switch is generally represented by providing a break in a straight line by lifting a part of the line upward.

(4) Wire
A straight line is used to represent a connecting wire between any two components of the circuit, even if wires in actual circuit are bending.

103

Teacher's Notes

Why do we use symbols to draw circuit diagrams?

- The idea of a circuit diagram is to use circuit symbols instead of drawing each component in the circuit. Always try to make the wires straight lines, and don't be tempted to make them wiggly. If you have to draw wires to join circuit symbols that are already shown, use a ruler and don't let the wires cross each other.

Why do we use circuit diagrams?

- Circuit diagrams are a pictorial way of showing circuits. Electricians and engineers draw circuit diagrams to help them design the actual circuits.

Note:

- This is a special lesson where the layout is a bit different and in this lesson new knowledge is learnt before the activity. The flow of the lesson starts with a discussion and then students do the activity. The learning contents should be put up on the blackboard. Try not to refer students to the textbook until towards the end of the summary.
- There are two learning contents in this lesson. Go through each content thoroughly to ensure that students understand and grasp the idea before doing the activity.

Lesson Objectives

Students will be able to:
- Describe a circuit diagram from the actual circuits.
- Explain how to draw a circuit diagram.

Assessment

Students are able to:
- Draw a simple series and parallel circuits using the symbols of circuit components.
- State the rules and the process for drawing a circuit diagram.

2. How to draw a circuit diagram

4

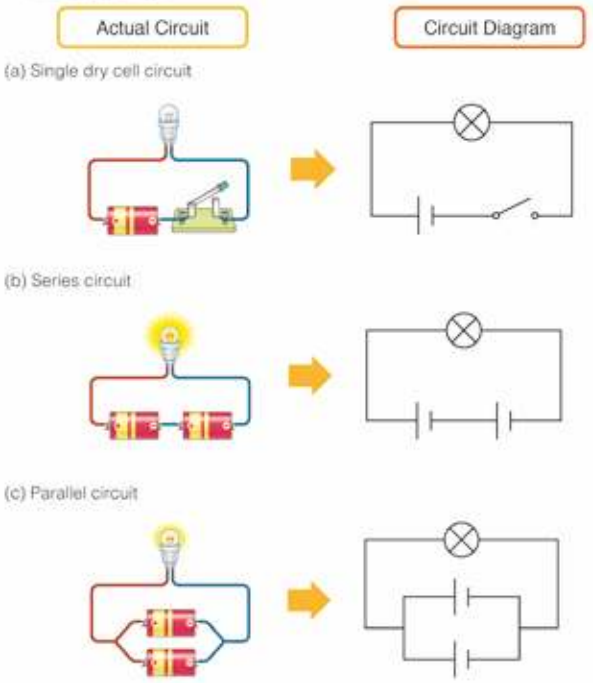
A diagram representing an electrical circuit drawn with symbols is called a **circuit diagram**. The following are some tips to draw a circuit diagram.

(1) All components in an actual circuit such as a dry cell, a switch and a light bulb are shown in a circuit diagram.

(2) Check the direction of the dry cells. It should be the same as the actual circuit.

(3) Corners in a circuit diagram are drawn as right angles.

(4) Number of junctions in a circuit diagram should be the same as the one in the actual circuit.



104

4 Discussion (20 min.)

- Discuss 2. How to draw a circuit diagram with students.
- Explain a circuit diagram and the four points to consider when a circuit diagram is drawn.
- Ask students to study the diagrams of 'Actual circuit' and 'Circuit diagram'.
- Draw the first actual circuit on the blackboard. Then, demonstrate how to draw a circuit diagram on the blackboard while explaining.
- Draw the next two actual circuits on the blackboard and ask the students to draw the circuit diagram in their exercise books.
- Allow enough time for them to complete their diagram.
- Ask the students to present their diagrams and teacher make corrections where necessary.

5 Summary (10 min.)

- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: How can an electric circuit be described simply?
  Q: What is a circuit diagram?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Circuit Components and their Symbols**

Key question : How can an electric circuit be represented?

Symbols of circuit components

Component	Symbols	Examples
Bulb		
Dry cell (Battery)		
Switch (open)		
Switch (closed)		
Wire		

How to draw a circuit diagram

Actual circuit	Circuit diagram

Actual circuit	Circuit diagram

Summary
- Circuit diagram
  - A diagram representing an electrical circuit drawn with symbols.
- An electric circuit be described simply:
  - By using symbols of circuit component.
  - By drawing circuit diagrams using symbols.

Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 42 / 87 Textbook page: 105 - 106

Lesson 5 / 7

Lesson Title

Daily Use of Electric Circuit

Preparation

flashlight

Lesson Flow

1 Introduction (10 min.)

- Review the previous lesson. Ask:

Q:How can an electric circuit be described simply? By the circuit diagrams with symbols of the components

- Based on their daily life, ask the question:

Q:Where can you find electric circuit in your daily life? Electric appliances such as radio, rice cooker, TV and so on

2 Introduce the key question

Where are electric circuits used in our daily lives?

3 Activity (20 min.)

- Students can work in pairs or in groups.
- Refer students to what the characters are saying for investigation.
- Ask students to predict the components and a circuit of a flashlight.
- Remind students of the safety tips.
- Have students remove the pieces from a flashlight and observe how each component connects based on the three questions in the activity.
- Ask students to discuss their results in pairs or in their groups.

4 Discussion for findings (20 min.)

- Ask students to present their investigation results from the activity.
- Write their results on the blackboard.

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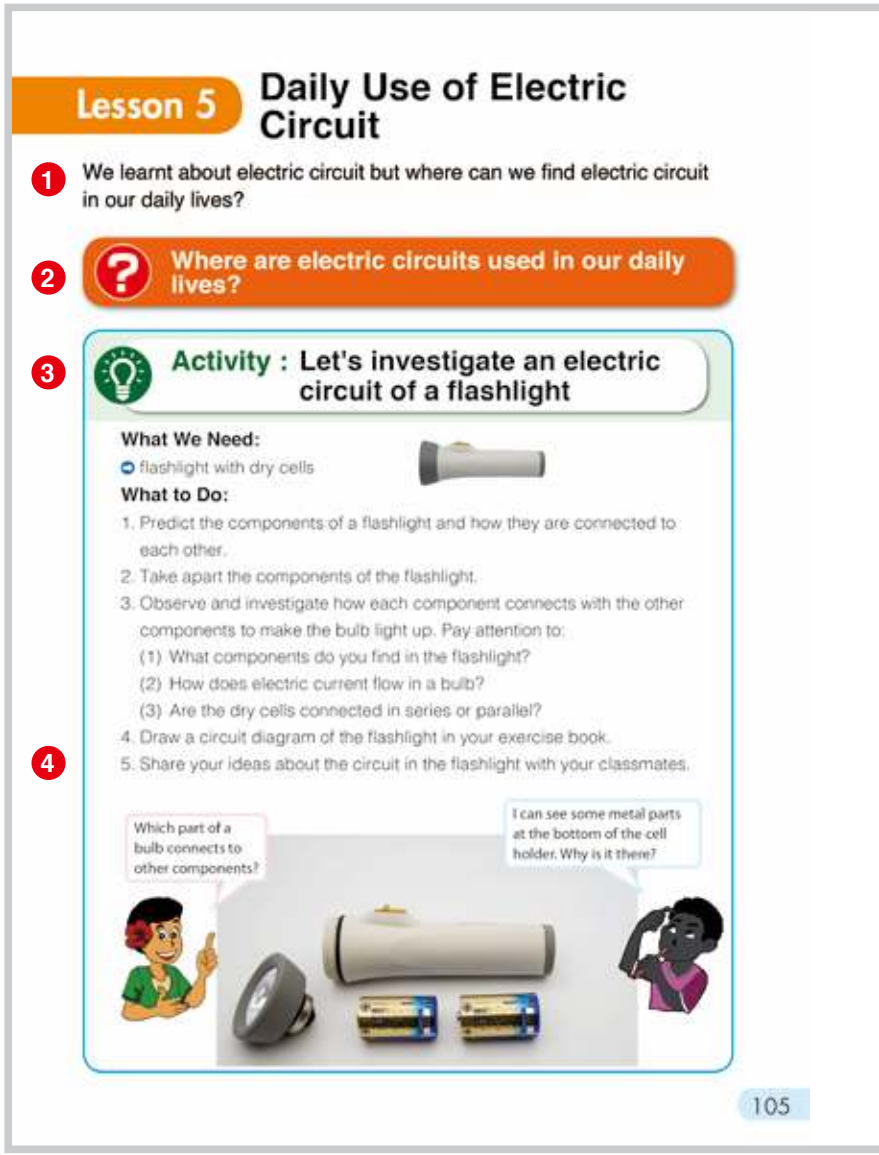


Lesson 5 Daily Use of Electric Circuit

1 We learnt about electric circuit but where can we find electric circuit in our daily lives?

2 Where are electric circuits used in our daily lives?

3 Activity : Let's investigate an electric circuit of a flashlight

What We Need:

- flashlight with dry cells

What to Do:

1. Predict the components of a flashlight and how they are connected to each other.
2. Take apart the components of the flashlight.
3. Observe and investigate how each component connects with the other components to make the bulb light up. Pay attention to:
   (1) What components do you find in the flashlight?
   (2) How does electric current flow in a bulb?
   (3) Are the dry cells connected in series or parallel?
4. Draw a circuit diagram of the flashlight in your exercise book.
5. Share your ideas about the circuit in the flashlight with your classmates.

4

105

Teacher's Notes

SAFETY

1. Gently remove the pieces from the flashlight.
2. Try not to put the dry cell in your mouth.
3. Do not take apart pieces of a flashlight in which a rechargeable battery is used.

What type of circuit is used in a home?

- There are two types of circuits used for wiring up houses and electrical appliances. Series circuits have all the components in a line, with current flowing through all the appliances one after the other. In parallel circuits, the current splits up and flows through separate paths through each component.

What are the uses of electric circuit in daily life?

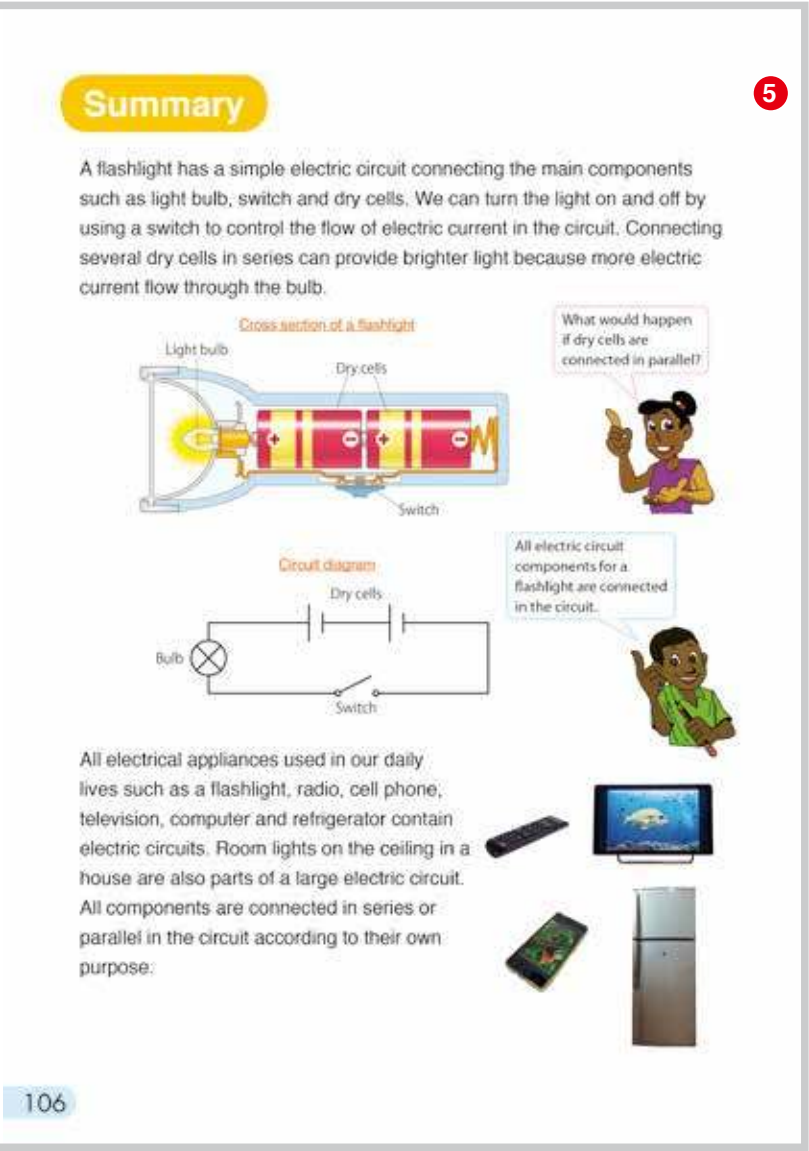
- An electric circuit can be used to transport electrical power to provide electric lighting, to run electric motors, to recharge storage batteries, to provide heat for heating, for cooking, for melting metals, to monitor conditions such as in alarm systems, to store data to run diagnostic medical equipment and so on.

Lesson Objectives

Students will be able to:
- State the uses of electric circuits in daily life.
- Observe the components of a flashlight.
- Predict an electric circuit of a flashlight.

Assessment

Students are able to:
- State how electric circuits are used for electric appliances in daily life.
- Explain that a flashlight consists of a light bulb, switch and dry cells.
- Design a circuit diagram of a flashlight based on observation.



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

Q:What will happen to the flashlight if one component is removed? (The bulb would not light.)

Q:Why do you think so? (The electric current cannot flow through a circuit if there is a gap in a circuit, etc.)

- Put the picture card of the cross section of a flashlight on the blackboard and explain the structure and components of the flashlight.
- Ask the question:

Q:How does electric current flow through a flashlight? (From two dry cells in series to bulb, to switch, to the dry cells.)

- Let students draw a circuit diagram of a flashlight based on the picture card of cross section of a flashlight.
- Ask students to present their circuit diagrams and confirm them with students.
- 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 do all electric appliances contain in order for them to work?
  Q: What circuit are the appliances connected in?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Daily Use of Electric Circuit

Key question

Where are electric circuits used in our daily lives?

Activity: Let's investigate an electric circuit of a flashlight

Predictions:

1. What are the components of a light torch?
2. How do the components connect to each other?

Results:

1. What components can you find in the torch that will make the bulb light? Bulbs, dry cells, wires, switch.
2. How does electric current flow in a bulb? Electric current flows from the dry cells to the bulb when the switch is on.
3. Do the dry cells connect in series or parallel? In series

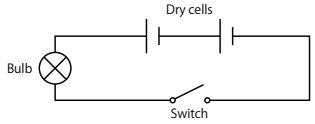
Discussion

Q: What will happen to the flashlight if one component is removed? (Refer to lesson flow.)

Q: Why do you think so? (Refer to lesson flow.)

The electric current cannot flow through a circuit there is a gap in a circuit, etc.

Let's draw a circuit diagram of a flashlight



Summary

- All electrical appliances used in daily life contain electric circuit.
- Some appliances are connected in series circuit while others are connected in parallel circuits.

Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 43 / 87 Textbook page: 107 - 109

Lesson 6 / 7

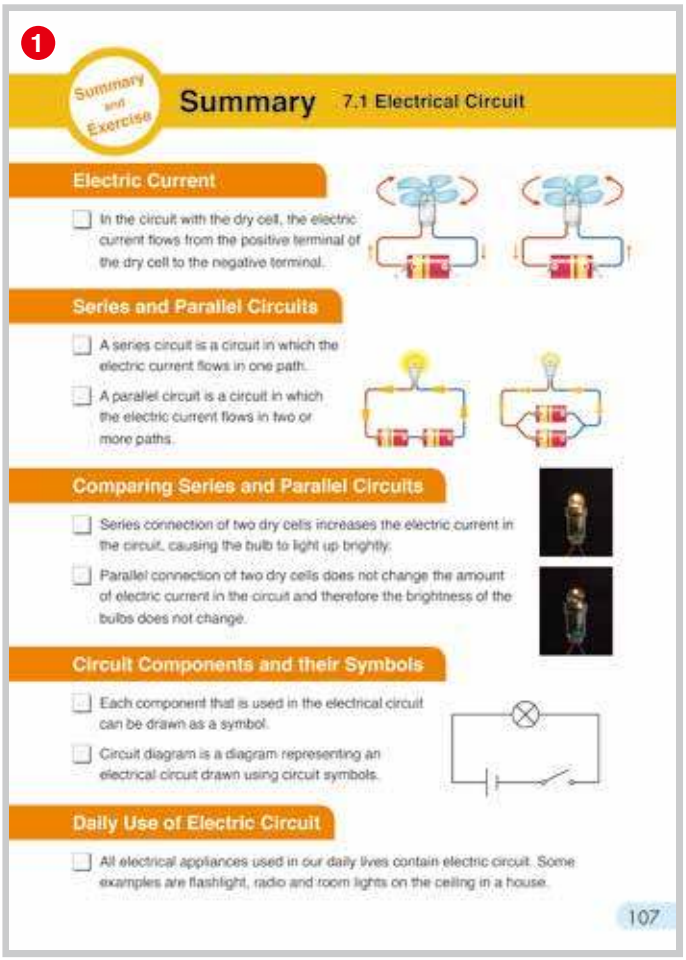
Lesson Title

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: From which terminal of the dry cell does the electric current flow?
  - Q: How does the electric current flow in a series and a parallel circuit?
  - Q: Which type of connection would have the bulb light up brighter?
- 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.



1

Summary and Exercise

Summary 7.1 Electrical Circuit

Electric Current

- In the circuit with the dry cell, the electric current flows from the positive terminal of the dry cell to the negative terminal.

Series and Parallel Circuits

- A series circuit is a circuit in which the electric current flows in one path.
- A parallel circuit is a circuit in which the electric current flows in two or more paths.

Comparing Series and Parallel Circuits

- Series connection of two dry cells increases the electric current in the circuit, causing the bulb to light up brightly.
- Parallel connection of two dry cells does not change the amount of electric current in the circuit and therefore the brightness of the bulbs does not change.

Circuit Components and their Symbols

- Each component that is used in the electrical circuit can be drawn as a symbol.
- Circuit diagram is a diagram representing an electrical circuit drawn using circuit symbols.

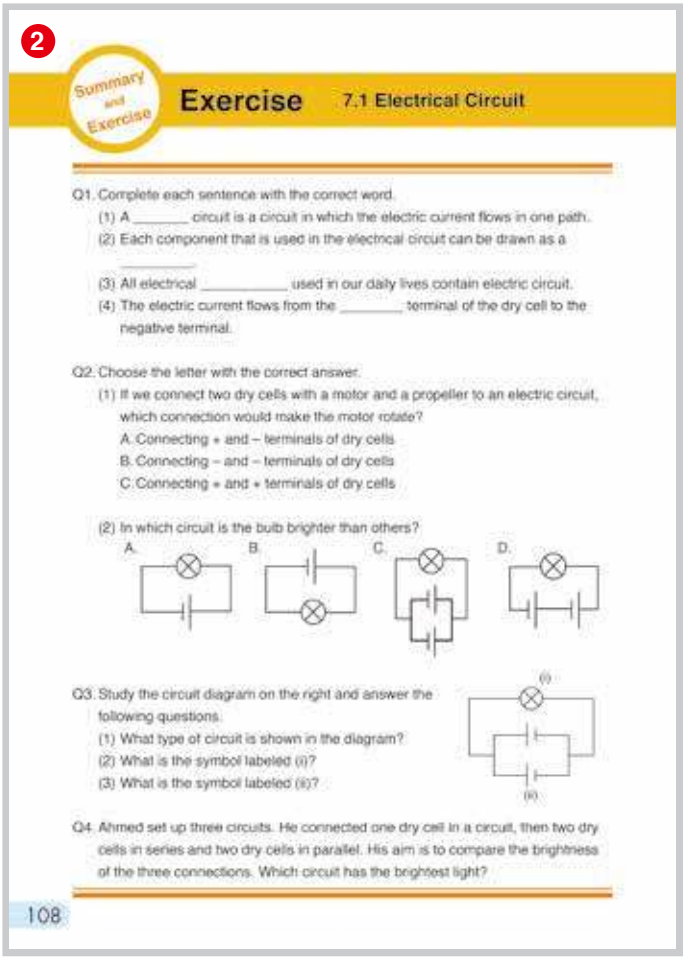
Daily Use of Electric Circuit

- All electrical appliances used in our daily lives contain electric circuit. Some examples are flashlight, radio and room lights on the ceiling in a house.

107

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.



2

Summary and Exercise

Exercise 7.1 Electrical Circuit

Q1. Complete each sentence with the correct word.

(1) A _____ circuit is a circuit in which the electric current flows in one path.

(2) Each component that is used in the electrical circuit can be drawn as a _____.

(3) All electrical _____ used in our daily lives contain electric circuit.

(4) The electric current flows from the _____ terminal of the dry cell to the negative terminal.

Q2. Choose the letter with the correct answer.

(1) If we connect two dry cells with a motor and a propeller to an electric circuit, which connection would make the motor rotate?

A. Connecting + and – terminals of dry cells

B. Connecting – and – terminals of dry cells

C. Connecting + and + terminals of dry cells

(2) In which circuit is the bulb brighter than others?

A. B. C. D.

Q3. Study the circuit diagram on the right and answer the following questions.

(1) What type of circuit is shown in the diagram?

(2) What is the symbol labeled (i)?

(3) What is the symbol labeled (ii)?

Q4. Ahmed set up three circuits. He connected one dry cell in a circuit, then two dry cells in series and two dry cells in parallel. His aim is to compare the brightness of the three connections. Which circuit has the brightest light?

108

Exercise answers

Q1.
(1) **series**
(2) **symbol**
(3) **appliances**
(4) **positive**

Q2.
(1) **A**
(2) **D**

(1) The correct way to make the motor rotate and for the electric current to flow is when positive terminal on one dry cell is connected to negative terminal on another dry cell.
(2) Electrical cord is not an electric appliance that contains a circuit, it only contains one of the electric components which is the wire.

Q3.
(1) **parallel circuit**
(2) **bulb**
(3) **dry cell/ battery**

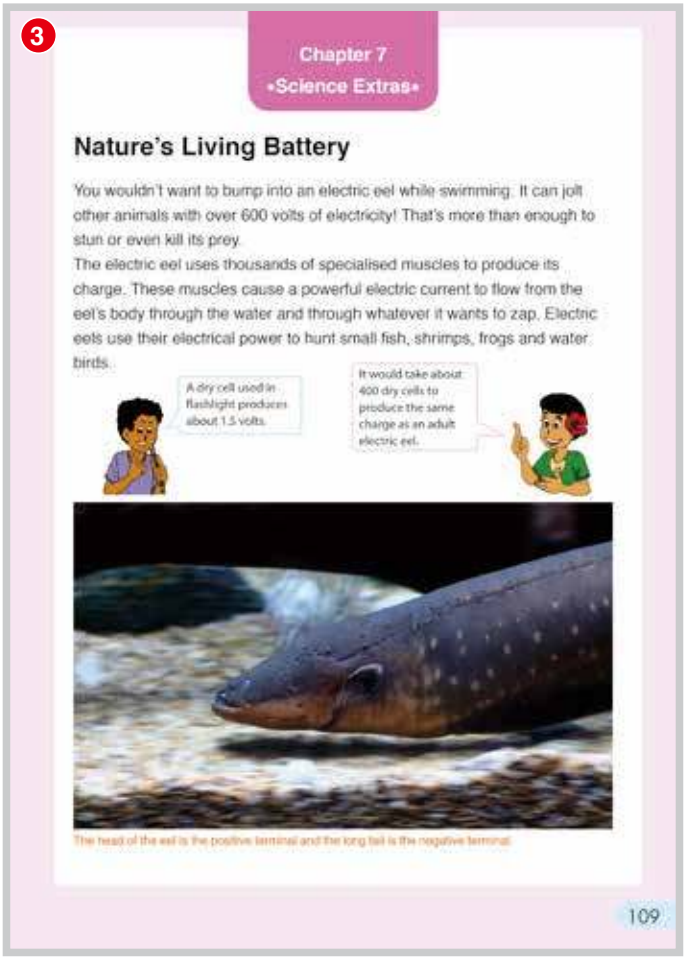
Q4.Expected answer.
Series connection has the brightest light while the parallel and the single dry cell the brightness of the bulbs were the same.

Comparing the 3 connections:
- Series connection of two dry cells increases an electric current in the circuit so the bulb lights up brighter.
- Parallel connection of two dry cells doesn't change an amount of electric current in a circuit so the brightness of the bulb does not change, it is the same with a single dry cell.

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.


3

Chapter 7
•Science Extras•

Nature's Living Battery

You wouldn't want to bump into an electric eel while swimming. It can jolt other animals with over 600 volts of electricity! That's more than enough to stun or even kill its prey.
The electric eel uses thousands of specialised muscles to produce its charge. These muscles cause a powerful electric current to flow from the eel's body through the water and through whatever it wants to zap. Electric eels use their electrical power to hunt small fish, shrimps, frogs and water birds.

A dry cell used in flashlight produces about 1.5 volts.

It would take about 400 dry cells to produce the same charge as an adult electric eel.

The head of the eel is the positive terminal and the long tail is the negative terminal.

109

Lesson 7 / 7

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

7. Electricity 2

Q1 Complete each sentence with the correct word.

(1) Electric current flows from the positive to the negative terminal of the battery.

(2) Electric circuits can be classified as series and parallel circuits.

(3) A straight line is used to represent a connecting wire in a circuit diagram.

(4) A flashlight generally has a simple electric circuit.

Q2 Choose the letter with the correct answer.

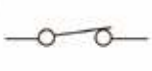
(1) From which direction does the electric current flow?

A. Negative to positive terminal
B. Negative to negative terminal
C. Positive to negative terminal
D. Positive to positive terminal

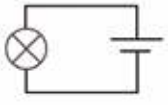
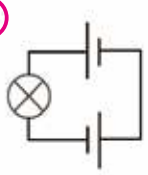
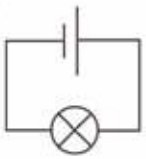
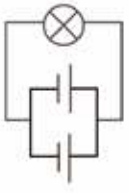
(2) How would a motor's rotation be different when connected in series and parallel with two dry cells? The motor in

A. series will be faster than the one in parallel.
B. series will be slower than the one in parallel.
C. parallel will be faster than the one in series.
D. both connections will turn with the same speed.

(3) Which of the following symbol represents a bulb?

A.  B.  C.  D.

(4) Which of the following connection has a much brighter light bulb?

A.  B.  C.  D. 

110

Q3

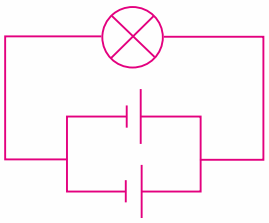
(1) Stefan took apart a flashlight to investigate how the electric circuit components are connected in it. What are the four components he would find in the flashlight?

The components were a light bulb, dry cells, switch and wires.

(2) Why are symbols and circuit diagrams used?

(Expected answer) Symbols and circuit diagrams are used to show electric circuits simply and draw it in a short time instead of drawing the actual circuits.

(3) Study the picture on the right.
Draw the circuit diagram of the electrical circuit below.



Q4

(1) What is the difference between a series and a parallel circuit?

(Expected answer) A series circuit is a circuit in which the electric current flows in one path, while a parallel circuit is a circuit in which the electric current flows in two or more paths.

(2) What happens when more dry cells are added in a series circuit?

(Expected answer) If more dry cells are added in a series circuit, the amount of electric current flowing in the circuit will increase.

Chapter 8. Rocks, Minerals and Fossils

Chapter Objectives

Students will be able to understand the composition of rocks and minerals with their uses and identify rocks as sedimentary, metamorphic and igneous. Students will be able to understand the basic process of fossil formation and the importance of studying fossils.

Topic Objectives

8.1 Rocks and Minerals

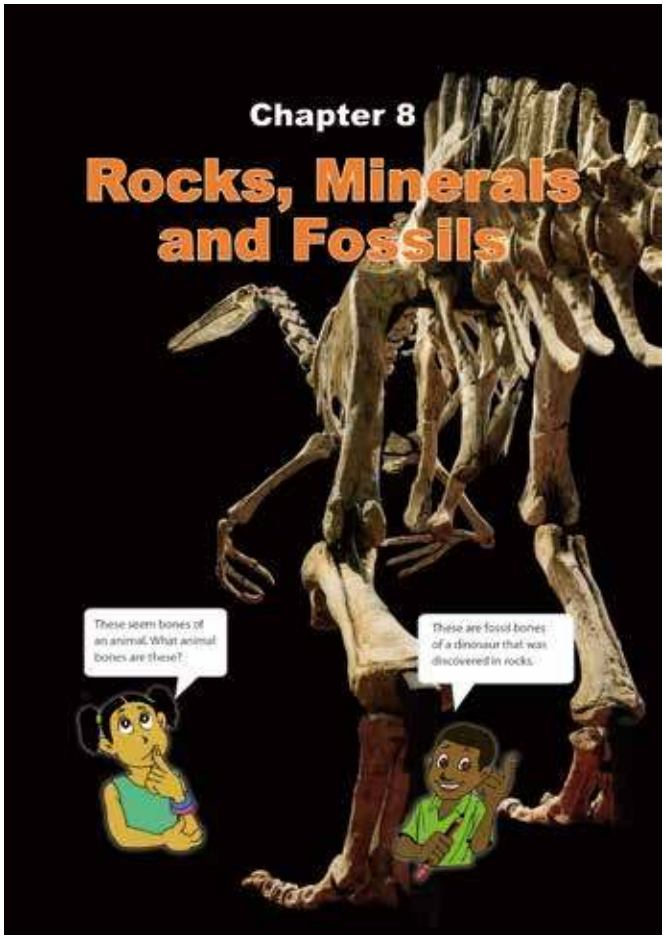
Students will be able to;

- Define rocks.
- Identify different types of minerals in rocks.
- Define sedimentary, metamorphic and igneous rocks.
- Explain the uses of rocks and minerals.

8.2 Fossils

Students will be able to;

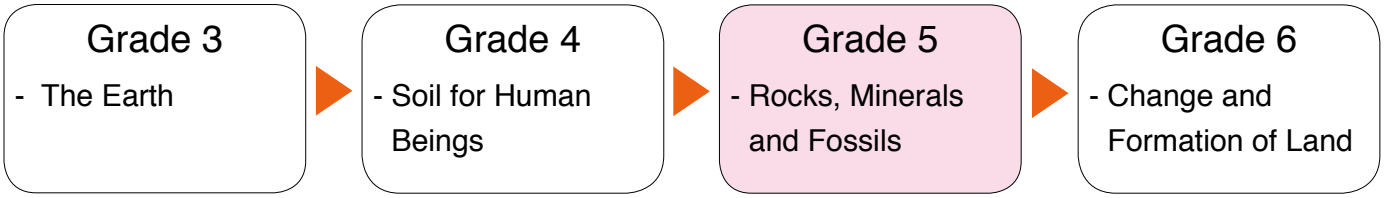
- Explain that fossils are the remains of once a living thing.
- Describe how fossils can help people learn about living things.



This picture is from the chapter heading of the textbook showing fossil bones of a dinosaur that lived hundred million years ago.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- The Earth's surface is covered by water and land.
- Properties of soil such as colour, particle size and texture.
- Causes and effects of soil pollution and ways to prevent soil pollution.

Teaching Overview

This chapter consists of 9 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
8.1 Rocks and Minerals	1	**Rocks** What is a rock?	5.3.1	113- 114
	2	**Minerals** How can we classify minerals?		115 - 116
	3	**Types of Rock** What types of rocks are there?		117 - 118
	4	**Uses of Rocks and Minerals** How do we use rocks and minerals in daily life?		119 - 120
	5	Summary and Exercise		121 - 122
8.2 Fossils	6	**A Fossil** What is a fossil?		123 - 124
	7	**Learning from Fossils** What do fossils tell us?		125 - 126
	8	Summary and Exercise, Science Extra		127 - 129
Chapter Test	9	Chapter Test		130 - 131

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.1. Rocks and Minerals**	Total lesson No: 45 / 87 Textbook page: 113 - 114

Lesson 1 / 9

Lesson Title

Rocks

Preparation

hand lens, different types of rocks, markers

Lesson Flow

1 Introduction (10 min.)

- Recall what was learned about rocks and minerals in Grade 3 and motivate students to think about different kinds of rocks and minerals that are found around them by asking:

Q:Why do rocks look different?
Q:What are rocks made up of?

2 Introduce the key question

What is a rock?

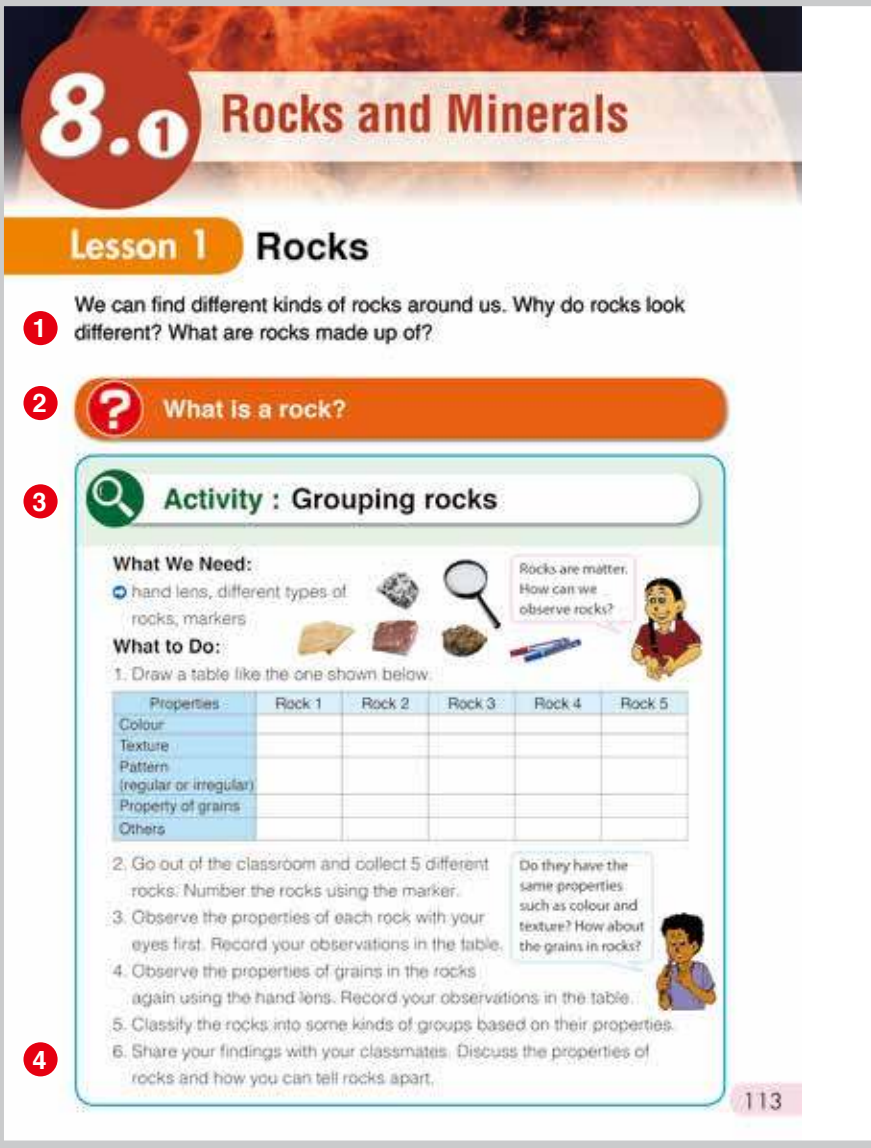
3 Activity (20 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask the students to do the activity.
- Refer students to what the characters are saying for their investigations.
- Check students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- 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.
- Facilitate active students' discussions.
- Confirm the findings with the students.

(Continue)



Teacher's Notes

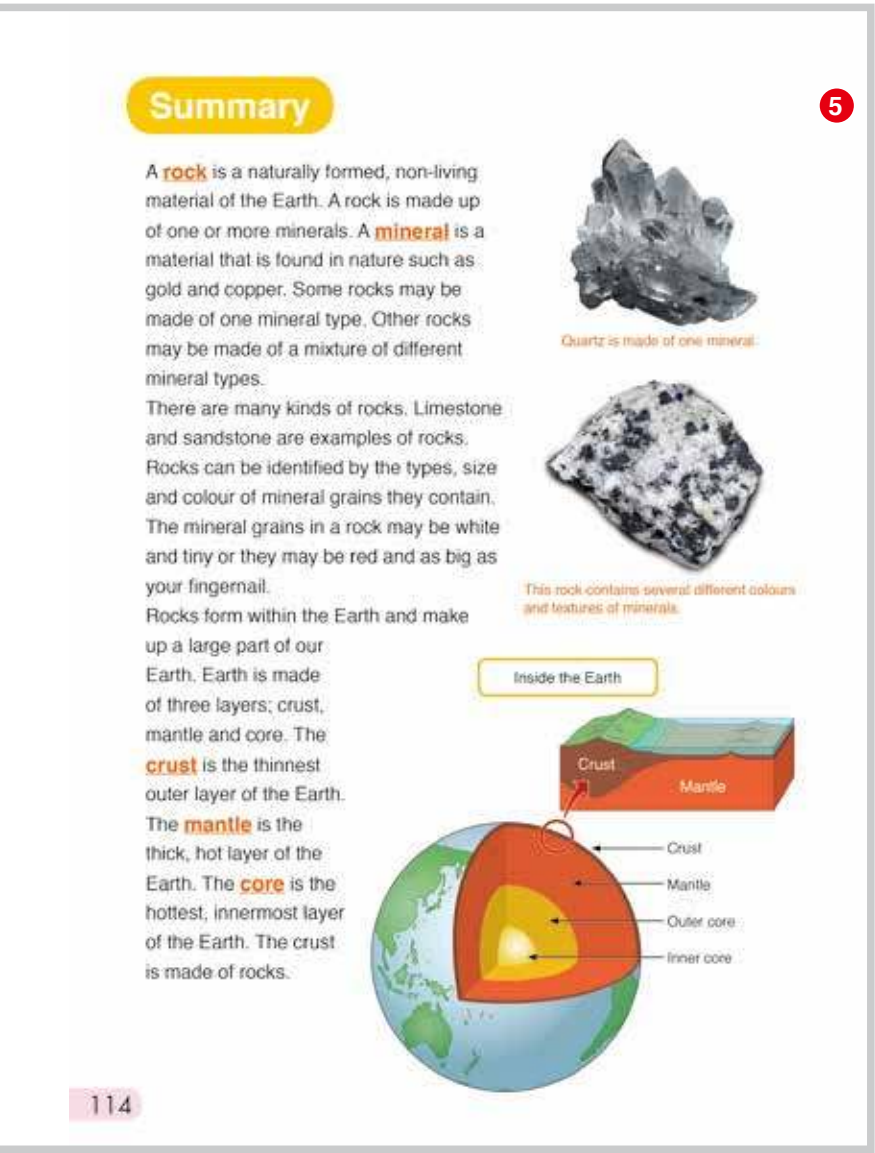
- 'Rocks' is taught in Grade 3 Chapter 10. In that lesson, students are asked to describe the characteristics of rocks. In this lesson, students explain the characteristics in more scientific manner. Refer to the prior lesson to encourage students to talk scientifically.
- A rock is a naturally occurring solid mass made of one or more minerals that we find in nature. For example;
  1. Limestone is composed of only one mineral – Calcite
  2. Basalt is commonly composed of three minerals – feldspar, pyroxene and olivine
  3. Granite is composed of five minerals – two kinds of feldspar, mica, amphibole and quartz.
- Geologists group rocks into three categories based on how they were formed; Igneous, Sedimentary and Metamorphic. They will be taught in lesson 3 in this chapter. (Sedimentary rock is again taught in 'Formation of Sedimentary Rocks' in Grade 6 Chapter 2, lesson 8.)
- Minerals are solid substances that are present in nature and can be made of one or more elements combined together (chemical compounds). Gold, silver and carbon are elements that form minerals on their own.

Lesson Objectives

Students will be able to:
- Define the words rock and mineral.
- Observe the different types of rocks.
- Identify the three layers of the Earth.
- Communicate their findings with others.

Assessment

Students are able to:
- State the definition of rock and mineral.
- Classify rocks according to their colour, texture, pattern and the properties of grain.
- Name three layers of the Earth as crust, mantle and core.
- Express their findings actively.



Summary

A rock is a naturally formed, non-living material of the Earth. A rock is made up of one or more minerals. A mineral is a material that is found in nature such as gold and copper. Some rocks may be made of one mineral type. Other rocks may be made of a mixture of different mineral types.

There are many kinds of rocks. Limestone and sandstone are examples of rocks. Rocks can be identified by the types, size and colour of mineral grains they contain. The mineral grains in a rock may be white and tiny or they may be red and as big as your fingernail.

Rocks form within the Earth and make up a large part of our Earth. Earth is made of three layers; crust, mantle and core. The crust is the thinnest outer layer of the Earth. The mantle is the thick, hot layer of the Earth. The core is the hottest, innermost layer of the Earth. The crust is made of rocks.

Quartz is made of one mineral.

This rock contains several different colours and textures of minerals.

Inside the Earth

Crust
Mantle
Crust
Mantle
Outer core
Inner core

114

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

Q:What kinds of properties do rocks have? (Because they were made of different components.)

Q:How can we classify rocks? (They can be classified by their properties such as colours, texture, etc.)

Q:Why do rocks look different? (Because they have different properties, etc.)

Q:Can you guess how the Earth is structured? (It depends on students' ideas.)

Q:Can you guess in which part of the Earth rocks can be found? (It depends on students' ideas.)

- 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 a rock?
  Q: What makes up a rock?
  Q: What is a mineral?
  Q: How can we classify rocks?
  Q: What are the three layers of the earth?
  Q: Which layer of the Earth is made of rocks?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Rocks

Key question : What is a rock?

Activity: Grouping rocks

Properties	Rock 1	Rock 2	Rock 3	...
Colour				
Texture				
Pattern	Write students' findings			
Grains				
Others				

Discussion

Q: What kinds of properties do rocks have? Because they were made of different components.

Q: How can we classify rocks? They can be classified by their properties such as colours, texture, etc.

Q: Why do rocks look different? Because they have different properties, etc.

Q: Can you guess how the Earth is structured? (It depends on students)

Q: Can you guess which part of the Earth rocks can be found?(Depends on students)

Summary

- A rock is a naturally formed, non-living material.
- A rock is made up of one or minerals.
- A mineral is a material that is found in nature such as gold and cooper.
- The three layers of the Earth are, crust, mantle and core.
  - Crust: The thinnest outer layer.
  - Mantle: The thick, hot layer.
  - Core: The hottest, innermost layer.
- Crust is made of rocks.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.1. Rocks and Minerals**	Total lesson No: 46 / 87 Textbook page: 115 - 116

Lesson 2 / 9

Lesson Title

Minerals

Preparation

rocks that include different types of minerals, hand lens, steel nail

Lesson Flow

1 Introduction (10 min.)

- Review the previous lesson.

Q:What is a rock?

Q:What makes up a rock?

- Motivate students to think about the types and properties of minerals by asking:

Q:What types of minerals are found in rocks?

Q:What properties do minerals have?

2 Introduce the key question

How can we classify minerals?

3 Activity (20 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to study the pictures in the activity and the characters.
- Ask the students to do the activity.
- Check students' activity and if necessary guide them towards their findings.
- Ask students to discuss their findings with their groups.
- 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.

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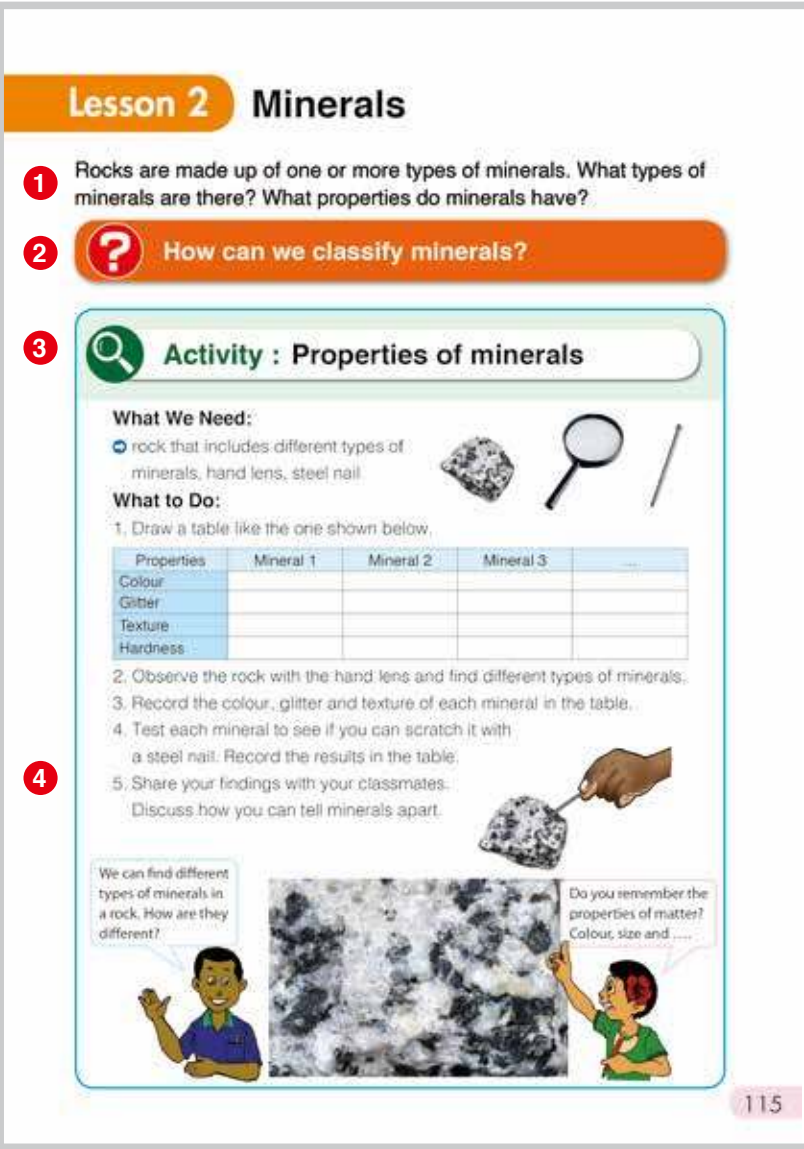


Teacher's Notes

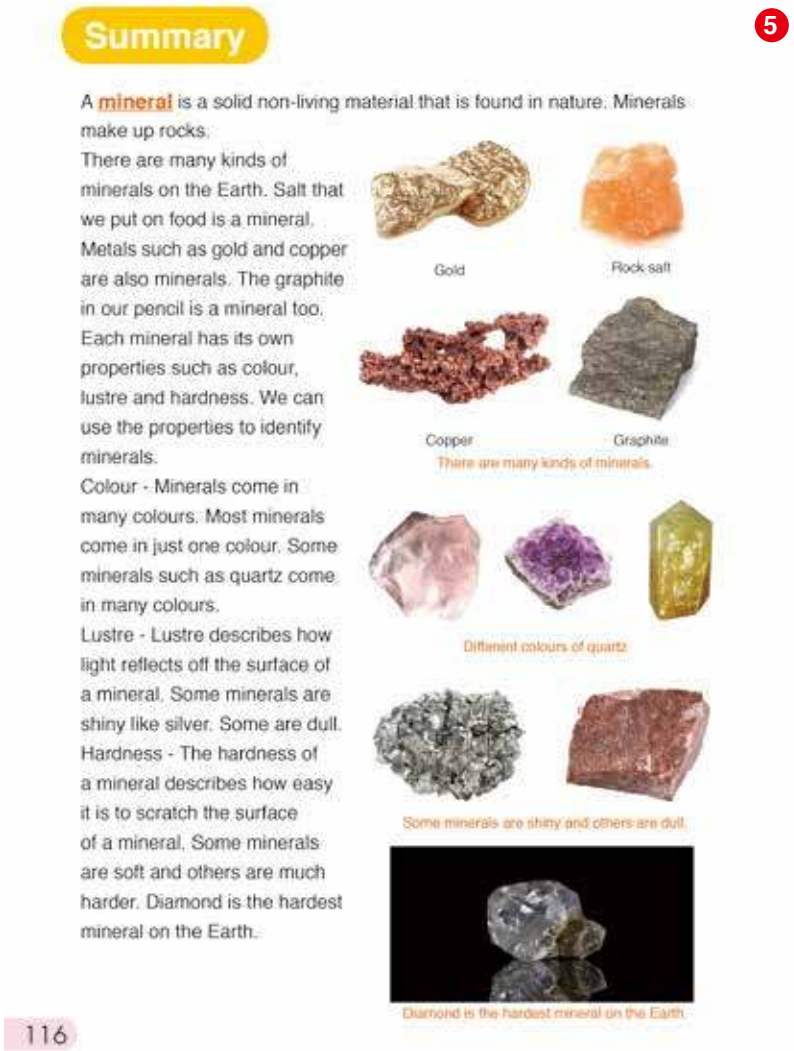
- To meet the definition of 'mineral' used by most geologists, a substance must meet five requirements: Naturally occurring, inorganic, solid, definite chemical composition and ordered internal structure.
  1. 'Naturally occurring' means that people did not make it. Steel is not a mineral because it is an alloy produced by people.
  2. 'Inorganic' means that the substance is not made by an organism. Wood and pearls are made by organisms and thus are not minerals.
  3. 'Solid' means that it is not a liquid or a gas at standard temperature and pressure.
  4. 'Definite chemical composition' means that all occurrences of that mineral have a chemical composition that varies within a specific limited range. For example: the mineral halite (known as 'rock salt' when it is mined) has a chemical composition of NaCl. It is made up of an equal number of atoms of sodium and chlorine.
  5. 'Ordered internal structure' means that the atoms in a mineral are arranged in a systematic and repeating pattern.
- So minerals are solid substances that are present in nature and are made of one or more elements combined together. For example, salt is an example of a mineral and is a combination of element Sodium and Chlorine.
- These are all properties of a mineral- Its crystal shape, hardness, colour and lustre all depend on which chemical elements it is made of and how the atoms of these elements are arranged inside it.

Lesson Objectives

Students will be able to:
- Define the word mineral.
- Identify the properties of minerals in rocks.
- Participate in the investigation with interest.

Assessment

Students are able to:
- State the definition of mineral.
- Record the properties of different minerals in the table based on colour, glitter, texture and hardness.
- Test some minerals to confirm their properties.
- Enjoy exploring minerals.



Summary

A mineral is a solid non-living material that is found in nature. Minerals make up rocks.
There are many kinds of minerals on the Earth. Salt that we put on food is a mineral. Metals such as gold and copper are also minerals. The graphite in our pencil is a mineral too.
Each mineral has its own properties such as colour, lustre and hardness. We can use the properties to identify minerals.
Colour - Minerals come in many colours. Most minerals come in just one colour. Some minerals such as quartz come in many colours.
Lustre - Lustre describes how light reflects off the surface of a mineral. Some minerals are shiny like silver. Some are dull.
Hardness - The hardness of a mineral describes how easy it is to scratch the surface of a mineral. Some minerals are soft and others are much harder. Diamond is the hardest mineral on the Earth.

Gold
Rock salt
Copper
Graphite
There are many kinds of minerals.
Different colours of quartz
Some minerals are shiny and others are dull.
Diamond is the hardest mineral on the Earth.

116

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

Q:What properties do minerals have? (Colour, glitter, texture, hardness, etc)
Q:What colours of minerals did you find? (Black, white, etc.)
Q:How is the glitter of minerals different? (Some shiny, some dull, etc)
Q:How is the hardness different? (Some hard, some soft)
Q:How can we identify minerals? (By comparing the properties.)
Q:What are some examples of minerals that you know of? (Gold, cooper, diamond and nickel 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 kind of properties do minerals have?
  Q: How can we identify minerals?
  Q: What is a mineral, an element and a substance?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Minerals

Key question

How can we classify minerals?

Activity

Properties of minerals

Properties	Mineral 1	Mineral 2	Mineral 3
Colour			
Glitter	Write students' findings		
Texture			
Hardness			

Discussion

Q. What properties do minerals have? Colour, glitter, texture, hardness, etc
Q: What colours of minerals did you find? Black, white, etc.
Q: How is the glitter of minerals different? Some shiny, some dull, etc
Q: How is the hardness different? Some hard, some soft.
Q: How can we identify minerals? By comparing the properties.
Q . What are some examples of minerals that you know of? Gold, cooper, etc.

Summary

- A mineral is a solid, non-living material that is found in nature.
- Minerals are made up of different kinds of elements.
- An element is a substance that cannot be broken down into other substance.
- A mineral had its own properties such as, colour, texture, glitter and hardness.
- Some examples of minerals are gold, cooper, salt and graphite from pencils.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.1. Rocks and Minerals**	Total lesson No: 47 / 87 Textbook page: 117 - 118

Lesson 3 / 9

Lesson Title

Types of Rock

Preparation

three different colours of crayons, cutter, foil, mug, boiling water.

Lesson Flow

1 Introduction (5 min.)

- Review the Lesson 1 'Rocks' by asking:

Q:What is a rock?

Q:How are rocks different?

- Motivate students to think about types of rock and their classification by asking:

Q:What types of rocks are there on Earth?

Q:How can we tell them apart?

2 Introduce the key question

What types of rocks are there?

3 Activity (25 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Remind them of the safety for the use of cutter and hot water.
- Refer students to study the pictures and the character in the textbook.
- Ask students to predict how rocks are formed.
- Ask the students to do the activity.
- Check students' activity and if necessary guide them towards their findings.
- Ask students to discuss their findings with their groups.
- 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.

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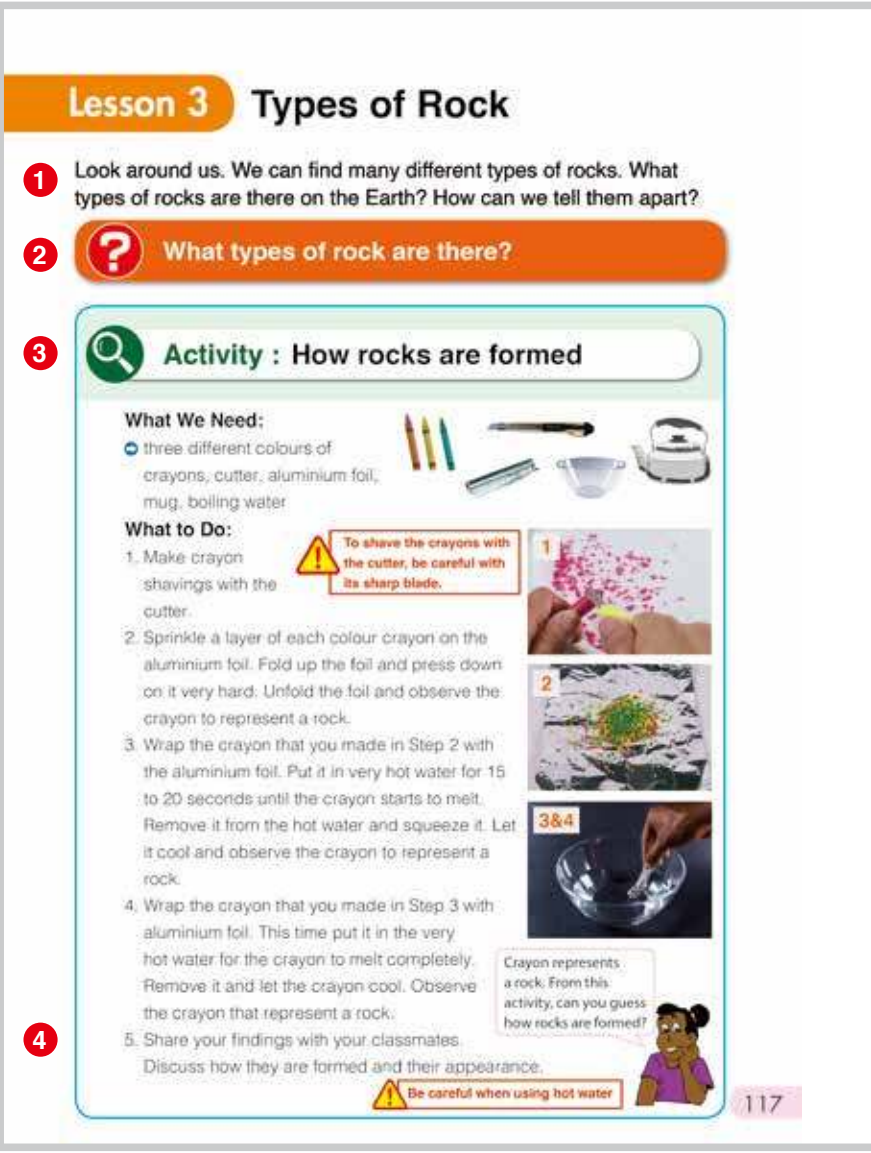


Teacher's Notes

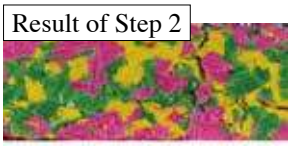
Results from the Activity

- Step 2: The crayons got squeezed together by pressure and got cemented. Not much change was done to the crayons. This represents how **sedimentary rocks** are formed in nature.
- Step 3: The crayons that got cemented were put into hot water for few seconds and were changed by heat and pressure. This represents the formation of **metamorphic rock.**
- Step 4: The crayons that symbolise metamorphic rock changed and gave a different appearance when extreme heat was applied, allowing the crayons to completely melt. And left to be cooled off and became hard. This represents how **igneous rocks** are formed in nature.

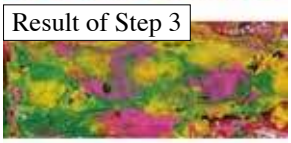
Tips for the Activity

- For step 4 in the activity, 1 minute should be given to allow the crayons to melt completely in hot water.
- Safety for this lesson is important. Students should be reminded to use the cutter carefully and avoid spilling hot water.

Result of Step 2



Result of Step 3



Result of Step 4

Lesson Objectives

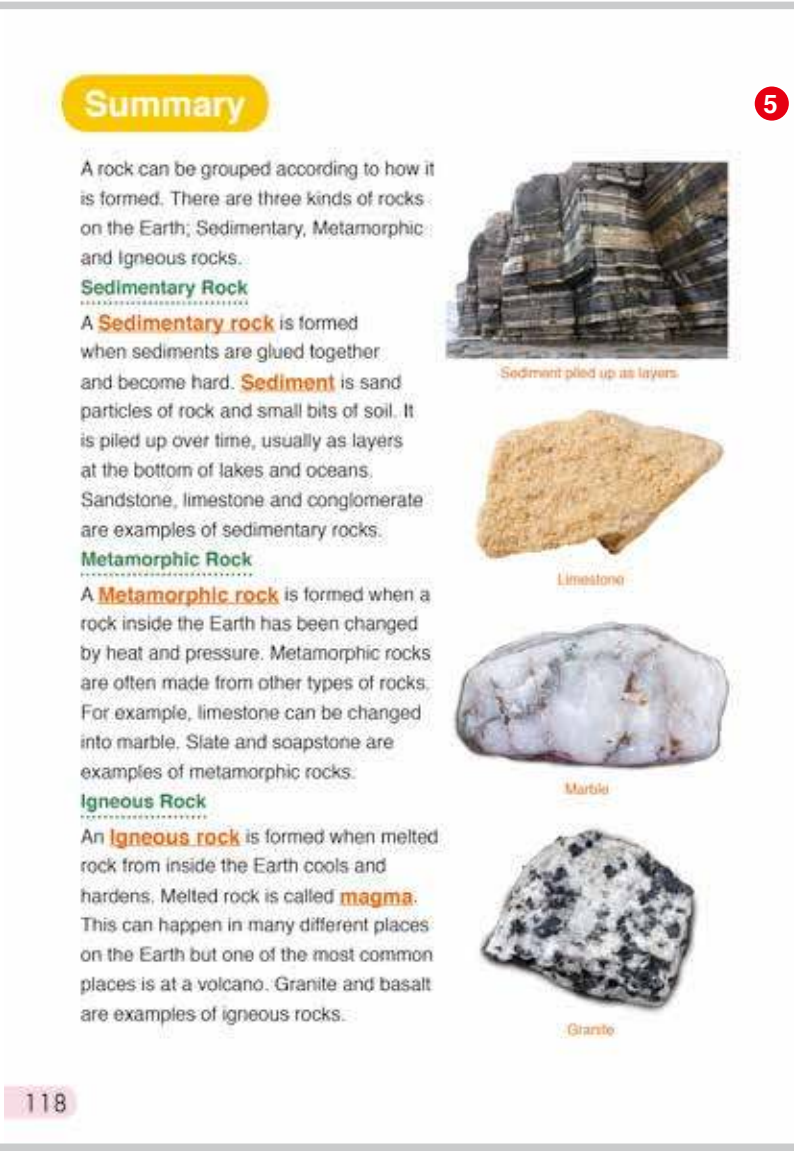
Students will be able to:

- Explain how the formation of igneous, sedimentary and metamorphic rocks are different.
- Infer how rocks are formed through the activity.
- Communicate their ideas with others.

Assessment

Students are able to:

- State the meaning of sedimentary, metamorphic and igneous rocks.
- Form igneous, sedimentary and metamorphic rocks using crayons.
- Differentiate the types of rocks formed.
- Listen for and remember the names of newly introduced rocks.



Summary

A rock can be grouped according to how it is formed. There are three kinds of rocks on the Earth; Sedimentary, Metamorphic and Igneous rocks.

Sedimentary Rock

A **Sedimentary rock** is formed when sediments are glued together and become hard. **Sediment** is sand particles of rock and small bits of soil. It is piled up over time, usually as layers at the bottom of lakes and oceans. Sandstone, limestone and conglomerate are examples of sedimentary rocks.

Metamorphic Rock

A **Metamorphic rock** is formed when a rock inside the Earth has been changed by heat and pressure. Metamorphic rocks are often made from other types of rocks. For example, limestone can be changed into marble. Slate and soapstone are examples of metamorphic rocks.

Igneous Rock

An **Igneous rock** is formed when melted rock from inside the Earth cools and hardens. Melted rock is called **magma**. This can happen in many different places on the Earth but one of the most common places is at a volcano. Granite and basalt are examples of igneous rocks.

Sediment piled up as layers

Limestone

Marble

Granite

118

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

Q:The crayon in Step 2, 3 and 4 is modelled into a rock. What was done in each step to form a rock? Step 2 - Pressure was applied to and it became hard.
Step 3 - Heat and pressure were applied to Step 2 that caused the crayon to melt and become hard again.
Step 4 - Strong heat was applied to Step 3 that caused the crayon to melt completely, cooled and then became hard.)

Q:What affects the formation of rocks? (Pressure and heat)

Q:How many types of rocks are there? (Three types of rocks)

- Conclude the discussions.

5 Summary (10 min.)

- Ask students to open their textbook to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: How are sedimentary, metamorphic and igneous rocks formed?
  Q: What are some examples of sedimentary, metamorphic and igneous rocks?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Types of Rocks

Key question
What types of rocks are there?
Activity:
How are rocks formed
Results:
Step 2: The size of crayon doesn't change. They got hard.
Step 3: The hard crayons melt. The crayon grain disappears. Striped colour.
Step 4: All crayon grains mixed. It is monotone colours.

Discussion
Q: The crayon in Step 2, 3 and 4 is modelled into a rock. What was done in each step to form a rock? Step 2 - Pressure was applied to and it became hard.
Step 3 - Heat and pressure were applied to Step 2 that caused the crayon to melt and become hard again.
Step 4 - Strong heat was applied to Step3 that caused the crayon to melt completely, cooled and then became hard.
Q: What affects the formation of rocks?
Pressure and heat.

Q: How many types of rocks are there?
Three types of rocks.
Summary
- A rock is grouped according to how it is formed.
- The three kinds of rocks are Sedimentary, Metamorphic and Igneous rocks.
- Sedimentary rock is formed when pieces of rocks glued together due to pressure.
- Metamorphic rock is formed when heat and pressure is applied.
- Igneous rock is formed when melted rock (magma) cools and hardens.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.1. Rocks and Minerals**	Total lesson No: 48 / 87 Textbook page: 119 - 120

Lesson 4 / 9

Lesson Title

Uses of Rocks and Minerals

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- Review previous lesson.

Q:What are the three major rocks called?

Q:How are sedimentary, metamorphic and igneous rocks formed?

- Motivate students to think about the uses of rocks and minerals by asking:

Q:How are rocks and minerals useful to our life?

2 Introduce the key question

How do we use rocks and minerals in daily life?

3 Activity (20 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to study the pictures in the activity and the characters.
- Ask the students to do the activity.
- Check students' activity and if necessary guide them towards their findings.
- Ask students to discuss their findings with their groups.
- 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.

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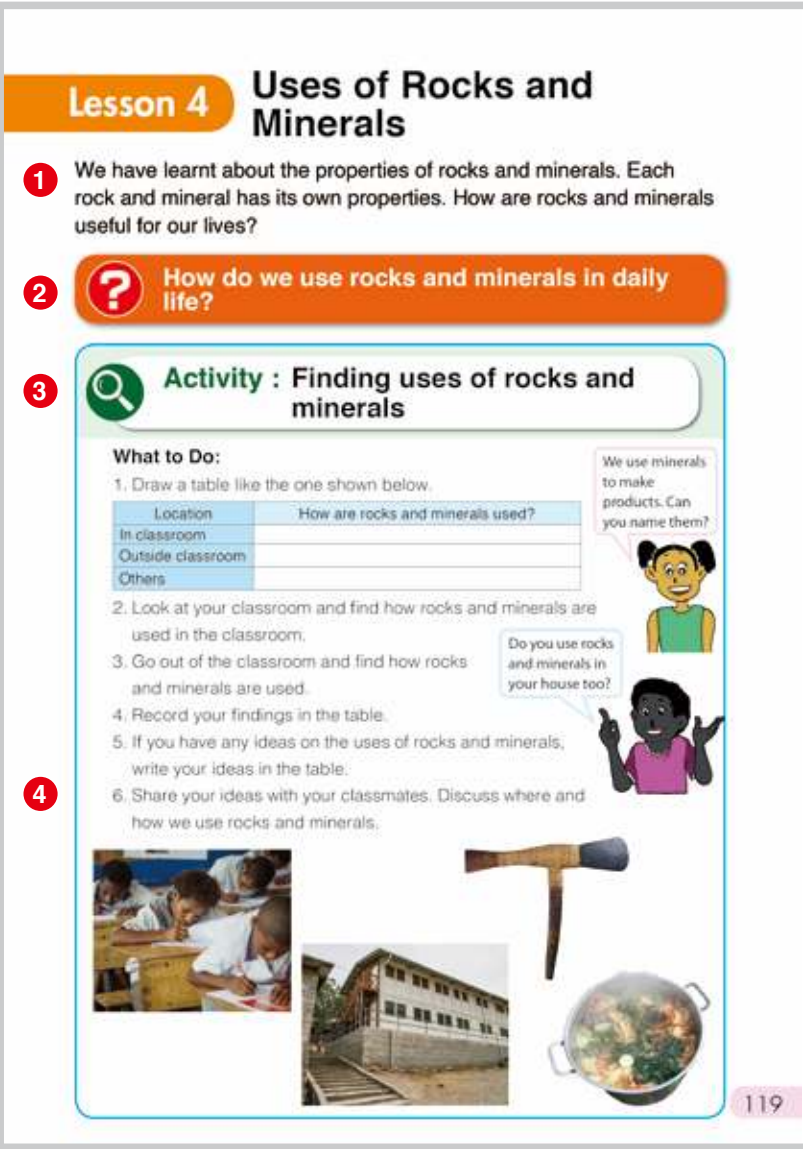


Lesson 4 Uses of Rocks and Minerals

1 We have learnt about the properties of rocks and minerals. Each rock and mineral has its own properties. How are rocks and minerals useful for our lives?

2 How do we use rocks and minerals in daily life?

3 Activity : Finding uses of rocks and minerals

What to Do:

1. Draw a table like the one shown below.

Location	How are rocks and minerals used?
In classroom	
Outside classroom	
Others	

2. Look at your classroom and find how rocks and minerals are used in the classroom.
3. Go out of the classroom and find how rocks and minerals are used.
4. Record your findings in the table.
5. If you have any ideas on the uses of rocks and minerals, write your ideas in the table.
6. Share your ideas with your classmates. Discuss where and how we use rocks and minerals.

4

We use minerals to make products. Can you name them?

Do you use rocks and minerals in your house too?

119

Teacher's Notes

1. **Minerals** are valued for everything because of their beauty, rarity and hardness as precious gemstones to their useful practicality in the pharmaceutical, manufacturing, construction, petroleum and high-tech industries.
2. **Rocks** house these minerals and also provide for many uses: as the foundation from which soil is produced; as the foundations of naturally occurring mountains; as building blocks for most of the great monuments of human history; and as the decorative stones of current architecture and design.

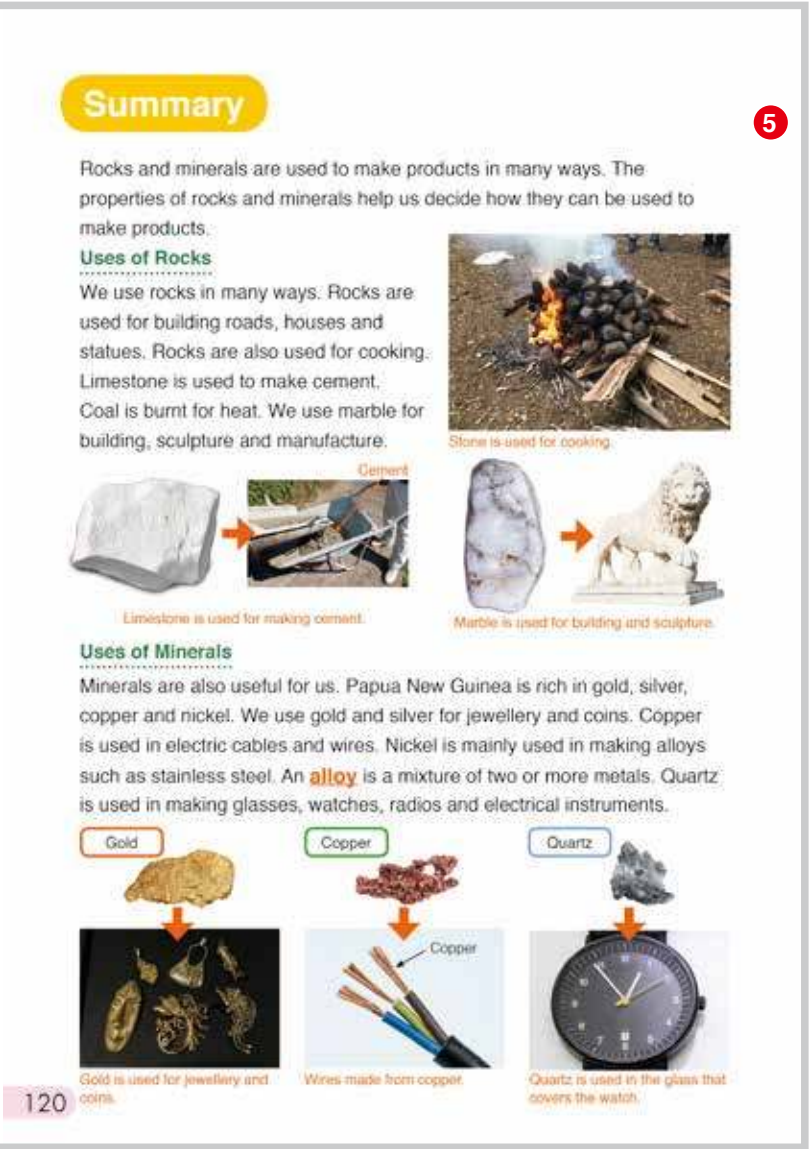
Name	Type of rock / Mineral	Use
Basalt	Igneous	in road building
Calcite	Mineral	in cement and mortars and production of lime
Granite	Igneous	for buildings, monuments and tombstones
Marble	Metamorphic	in building floor, tile in bathrooms
Obsidian	Igneous	in making arrow heads and knife
Quartz	Mineral	in making glass and optical lenses
Sandstone	Sedimentary	in building materials
Chalk	Sedimentary	in writing

Lesson Objectives

Students will be able to:
- Explain how rocks and minerals are used in daily life.
- Investigate the uses of rocks and minerals with interest.

Assessment

Students are able to:
- Give examples of the uses of common rocks and minerals in daily life.
- List the uses of rocks and minerals in a table.
- Value the use of rocks and minerals in their daily lives.



Summary

Rocks and minerals are used to make products in many ways. The properties of rocks and minerals help us decide how they can be used to make products.

Uses of Rocks

We use rocks in many ways. Rocks are used for building roads, houses and statues. Rocks are also used for cooking. Limestone is used to make cement. Coal is burnt for heat. We use marble for building, sculpture and manufacture.

Stone is used for cooking.

Cement

Limestone is used for making cement.

Marble is used for building and sculpture.

Uses of Minerals

Minerals are also useful for us. Papua New Guinea is rich in gold, silver, copper and nickel. We use gold and silver for jewellery and coins. Copper is used in electric cables and wires. Nickel is mainly used in making alloys such as stainless steel. An alloy is a mixture of two or more metals. Quartz is used in making glasses, watches, radios and electrical instruments.

Gold

Copper

Quartz

Copper

Gold is used for jewellery and coins.

Wires made from copper.

Quartz is used in the glass that covers the watch.

120

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

Q:How are rocks useful? (Rocks are used for building roads, houses, statues, cooking food and making cement. etc.)

Q:How are minerals useful? (Minerals are used for jewellery, in electric cables and wires, used to make stainless steel, watches, radios and glass etc.)

Q:Can you guess why gold and silver are often used for jewellery? (Because their colour looks beautiful, they are shining, etc)

- Explain that the properties of rocks and minerals help us decide how they can be used.
- 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 type of rock is used for making cement?
  Q: What type of rock is used for building and sculpture?
  Q: What is Gold used for?
  Q: What is Copper used for?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Uses of Rocks and Minerals

Key question : How do we use rocks and minerals in daily life?

Activity: Finding uses of rocks and minerals.

Places	How are rocks and minerals used?
In classroom	floor, chalk etc.
Outside classroom	road, house, mumu stone etc.

Discussion

Q: How are rocks useful? Rocks are used for building roads, houses, statues, cooking food and to make cement.

Q: How are minerals useful? Minerals are used for jewellery, in electric cables and wires, used to make stainless steel, watches, radios and glass.

Q: Why gold and silver are often used for jewellery? Because their colour looks beautiful, they are shining, etc.

Summary

- Rocks and minerals are used to make products in many ways.
- The properties of rocks and minerals help us decide how they can be used.
- Rocks are useful in building roads, buildings, statues and for cooking.
- Minerals such as,
  1. Gold is used to make jewellery.
  2. Copper is used for electric cables.
  3. Nickel is used to make stainless steel.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.1. Rocks and Minerals**	Total lesson No: 49 / 87 Textbook page: 121- 122

Lesson 5 / 9

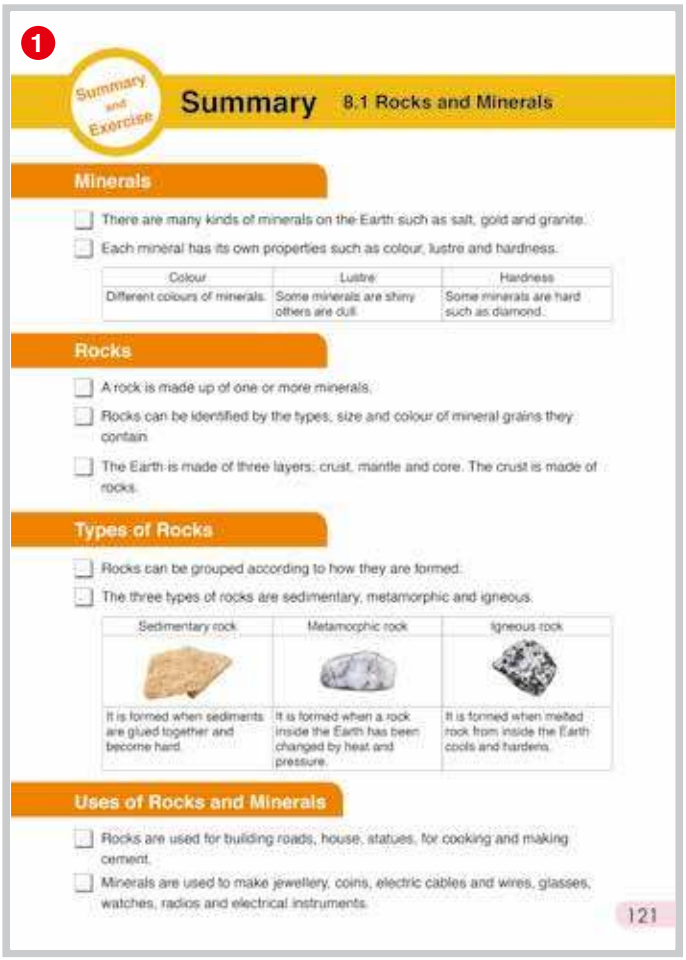
Lesson Title

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.
  - Q: What are rocks made of?
  - Q: How can we group minerals?
  - Q: What are the three layers of the Earth?
- 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.



1

Summary and Exercise

Summary 8.1 Rocks and Minerals

Minerals

- There are many kinds of minerals on the Earth such as salt, gold and granite.
- Each mineral has its own properties such as colour, lustre and hardness.

Colour	Lustre	Hardness
Different colours of minerals.	Some minerals are shiny, others are dull.	Some minerals are hard such as diamond.

Rocks

- A rock is made up of one or more minerals.
- Rocks can be identified by the types, size and colour of mineral grains they contain.
- The Earth is made of three layers: crust, mantle and core. The crust is made of rocks.

Types of Rocks

- Rocks can be grouped according to how they are formed.
- The three types of rocks are sedimentary, metamorphic and igneous.

Sedimentary rock	Metamorphic rock	Igneous rock
It is formed when sediments are glued together and become hard.	It is formed when a rock inside the Earth has been changed by heat and pressure.	It is formed when melted rock from inside the Earth cools and hardens.

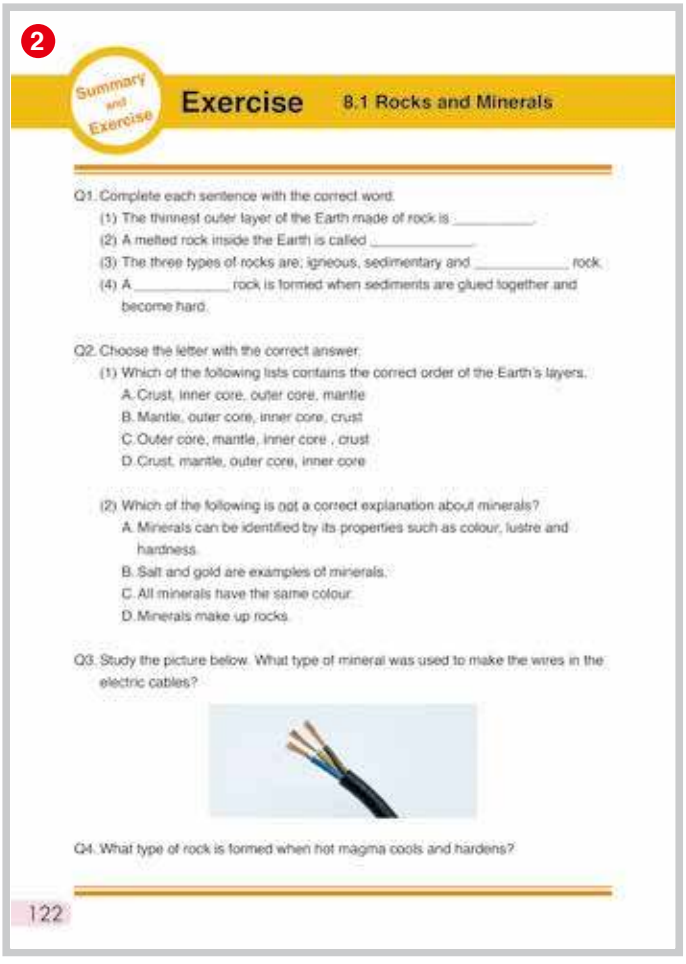
Uses of Rocks and Minerals

- Rocks are used for building roads, house, statues, for cooking and making cement.
- Minerals are used to make jewellery, coins, electric cables and wires, glasses, watches, radios and electrical instruments.

121

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.



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Summary and Exercise

Exercise 8.1 Rocks and Minerals

Q1. Complete each sentence with the correct word.

(1) The thinnest outer layer of the Earth made of rock is _____.

(2) A melted rock inside the Earth is called _____.

(3) The three types of rocks are: igneous, sedimentary and _____ rock.

(4) A _____ rock is formed when sediments are glued together and become hard.

Q2. Choose the letter with the correct answer.

(1) Which of the following lists contains the correct order of the Earth's layers.

A. Crust, inner core, outer core, mantle

B. Mantle, outer core, inner core, crust

C. Outer core, mantle, inner core , crust

D. Crust, mantle, outer core, inner core

(2) Which of the following is not a correct explanation about minerals?

A. Minerals can be identified by its properties such as colour, lustre and hardness.

B. Salt and gold are examples of minerals.

C. All minerals have the same colour.

D. Minerals make up rocks.

Q3. Study the picture below. What type of mineral was used to make the wires in the electric cables?

Q4. What type of rock is formed when hot magma cools and hardens?

122

Exercise answers

Q1.
(1) **crust**
(2) **magma**
(3) **metamorphic**
(4) **sedimentary**

Q2.
(1) **D**
The Earth is made up of three layers; the crust, mantle and core. The core consists of the outer and the inner core. The crust is the thinnest outer layer of the Earth. The mantle is the thin, hot layer of the Earth. The core is the hottest, innermost layer of the Earth. The crust is made of rocks.
(2) **C**
Minerals come in many colours. Most minerals come in just one colour. Some minerals such as quartz come in many colours.

Q3. Expected Answer
The mineral used to make electrical wires is copper.

Q4. Expected Answer
Igneous rock is formed when melted rock in the earth cools and hardens.
Examples of Igneous rocks are basalt and granite.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.2. Fossils**	Total lesson No: 50 / 87 Textbook page: 123 - 124

Lesson 6 / 9

Lesson Title

A Fossil

Preparation

clay, plate, objects such as shells, candle, tin-can

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson.

Q:How are rocks and minerals useful?

- Show to students a picture of a fossil.

Q:What does it look like?

Q:What do you think it is called? Introduce the word fossil to them. Avoid giving the definition. Then lead them to the key question.

2 Introduce the key question

What is a fossil?

3 Activity (25 min.)

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

4 Discussion for findings (20 min.)

- Ask students to present the different fossils they have made and let them say anything about similarities or differences from the fossils.
- Facilitate active students' discussions.
- Confirm the findings with the students.

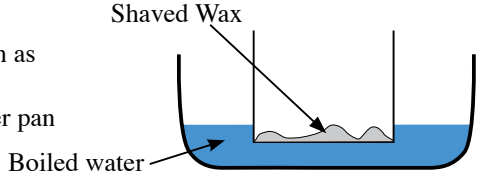
(Continue)

Teacher's Notes

- A fossil is any preserved remains, impression, or trace of any once-living thing from a past geological age. Examples include bones, shells, exoskeletons, stone imprints of animals or microbes, objects preserved in amber, hair, petrified wood, oil, coal, and DNA remnants.
- The two fossils formed during the activity are:
  1. Mould fossils – Is the empty shape of a living thing found in a rock.
  2. Casts fossils – Are formed when sediments fill the empty space (mould).
  (A cast made in this experiment is shown in the picture on the right)

How to melt candle wax using a double boiler?

- Direct heating for candle wax is not so safe. Indirectly heating using 'Double boiler' is a better method to melt candle wax.
- Prepare two pans, one should be enough small enough to be put in another pan as shown in the figure on the right.
- Put shaved candle wax in the smaller pan and pour boiled water into the bigger pan so that the wax slowly melts.

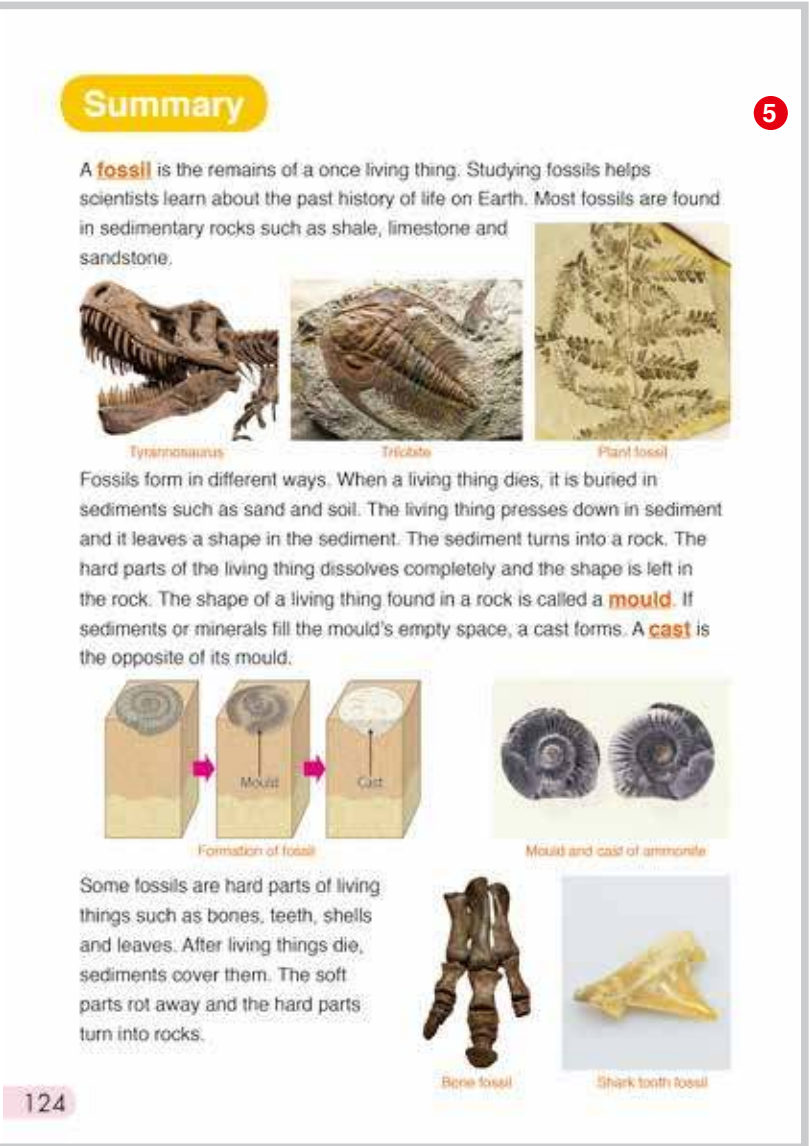


Lesson Objectives

Students will be able to:
- Define the term fossil.
- Demonstrate on how fossils are made.
- Show curiosity in exploring the formation of fossils.

Assessment

Students are able to:
- State the definition of fossil.
- Explain how fossils are formed by observing a model of fossil.
- Make a model of a fossil with interest.



Summary

5

A fossil is the remains of a once living thing. Studying fossils helps scientists learn about the past history of life on Earth. Most fossils are found in sedimentary rocks such as shale, limestone and sandstone.

Tyrannosaurus Trilobite Plant fossil

Fossils form in different ways. When a living thing dies, it is buried in sediments such as sand and soil. The living thing presses down in sediment and it leaves a shape in the sediment. The sediment turns into a rock. The hard parts of the living thing dissolves completely and the shape is left in the rock. The shape of a living thing found in a rock is called a mould. If sediments or minerals fill the mould's empty space, a cast forms. A cast is the opposite of its mould.

Mould Cast

Formation of fossil

Mould and cast of ammonite

Some fossils are hard parts of living things such as bones, teeth, shells and leaves. After living things die, sediments cover them. The soft parts rot away and the hard parts turn into rocks.

Bone fossil Shark tooth fossil

124

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

Q:What was formed in steps 1 and 2? (An empty shape (imprint) of an object was formed.)

- Explain that the empty shape of a living thing found in rocks is called a mould

Q:What was formed in steps 3 and 4? (Candle wax filled the empty shape (mould) and created an image.)

- Explain that this image is called a cast.

Q:Can you guess what filled the mould in nature? (soil, sediments, etc)

Q:Can you guess how a fossil is formed? (Refer to 'Summary' in textbook.)

- 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 a fossil?
  Q: What is a mould and a cast?
  Q: Why is it important to study fossils?
  Q: Which body parts become a fossil easily?
  Q: How are fossils formed?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

A Fossil

Key question
What is a Fossil?
Activity: Make a fossil
How are the imprint in the clay and the fossil similar or different?
Similarity:
Write students' findings

Differences:
Write students' findings

Discussion
Q: What was formed in steps 1 and 2? An empty shape of an object was formed.
Q: What was formed in steps 3 and 4? Candle wax filled the empty shape (mould)) and created an image.
Q: Can you guess what filled the mould in nature? soil, sediments, etc.
Q: Can you guess how a fossil is formed? Write students' ideas here.

Summary
- A fossil is the remains of a once-living thing.
- Fossils are formed when living things die and are buried in soil. The hard part of the living thing leaves an empty shape (mould) in the rock. Sediments feel the empty space forming a cast.
- Mould and cast are fossils.
- Some fossils are hard parts of living things such as bones, teeth, shells and leaves.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.2. Fossils**	Total lesson No: 51 / 87 Textbook page: 125 - 126

Lesson 7 / 9

Lesson Title

Learning from Fossils

Preparation

nil

Lesson Flow

1 Introduction (10 min.)

- Review previous lesson.

Q:What is a fossil?

Q:What type of rock contains fossils?

- Motivate students to think about the importance of studying fossils by asking:

Q:What do we learn from fossils?

2 Introduce the key question

What do fossils tell us?

3 Activity (20 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to study the pictures in the activity and the talking character.
- Ask the students to do the activity and to record their ideas in the table.
- Check students' activity and if necessary guide them towards their findings.
- Ask students to discuss their findings with their groups.
- 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.

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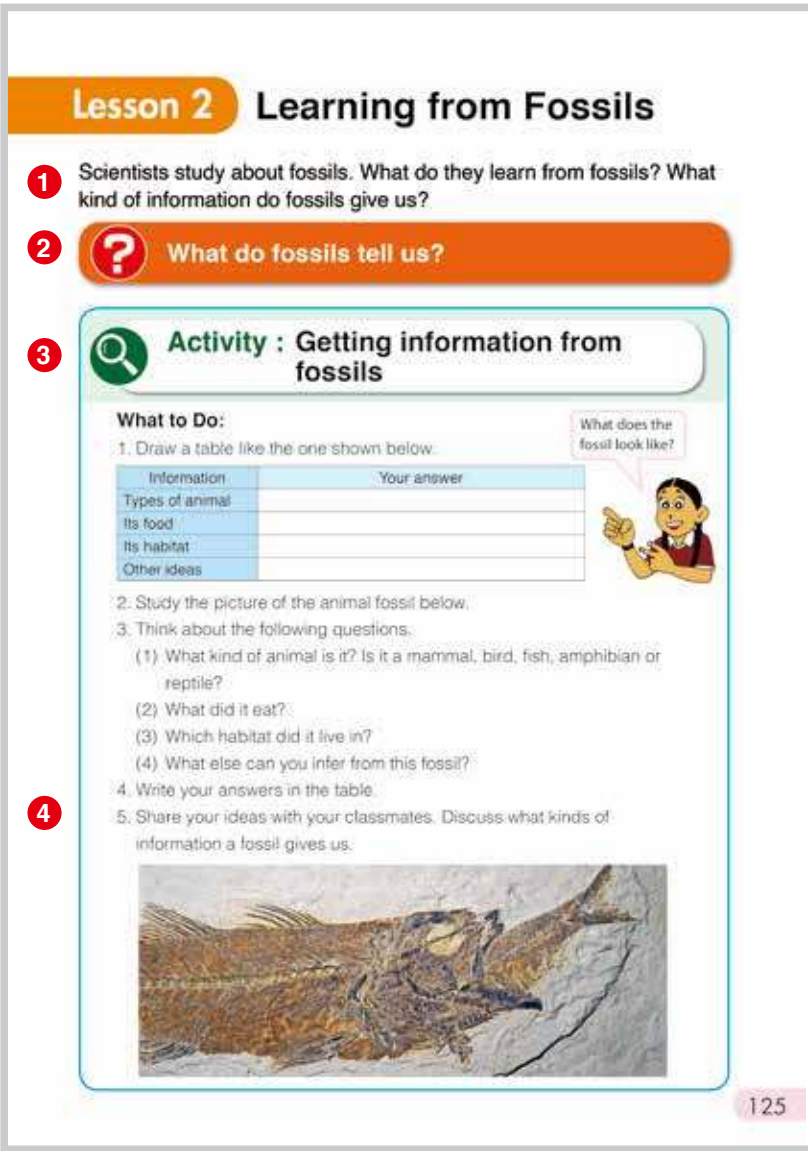


Lesson 2 Learning from Fossils

1 Scientists study about fossils. What do they learn from fossils? What kind of information do fossils give us?

2 What do fossils tell us?

3 Activity : Getting information from fossils

What to Do:

1. Draw a table like the one shown below.

Information	Your answer
Types of animal	
Its food	
Its habitat	
Other ideas	

What does the fossil look like?

2. Study the picture of the animal fossil below.
3. Think about the following questions.
   (1) What kind of animal is it? Is it a mammal, bird, fish, amphibian or reptile?
   (2) What did it eat?
   (3) Which habitat did it live in?
   (4) What else can you infer from this fossil?
4. Write your answers in the table.
5. Share your ideas with your classmates. Discuss what kinds of information a fossil gives us.

4

125

Teacher's Notes

- By studying the fossil record we can tell how long life has existed on Earth and how different plants and animals are relate to each other. Often we can work out how and where they lived and use that information to find out about ancient environments.
- Climate is one of the factors that determine where different species of plants and animals **can** live, so paleontologists look for clues to a location's ancient climate in the types of **fossil** plants and animals they find there.
- Fossils of human remains and of plants and animals provide insight into how people of the past lived. Plant and animal fossils from near the remains of old human settlements show what people ate, their tools they used and their culture.

Tips for the Lesson

- Teacher can also provide other pictures of fossils with guided questions so students can also compare other fossil's habitats and type of food eaten.

Lesson Objectives

Students will be able to:
- Identify what fossils tell us.
- Infer the past history of life and environment on the Earth from fossils.
- Show curiosity in exploring the fossils.

Assessment

Students are able to:
- Explain what kinds of information fossils give us.
- Describe the type, habitat, food and size of ancient organisms by observing a fossil.
- Express their ideas actively.

Summary

Fossils give us so many clues. Studying fossils helps us to learn about the past history of life and environments on Earth. Fossils give us information about organisms that lived long ago. Moulds and casts show what kinds of plants and animals might have lived and how they looked. Some fossils look like animals and plants that are living today. Most of them such as dinosaurs no longer live on the Earth. Fossil bones tell us about how large animals were. Fossil teeth show what they ate.

Some animals no longer live on the Earth.

Some fossils are similar to ferns alive today.

The body size of tyrannosaurus was bigger than humans. Look at the shape of its teeth. Can you guess what food it ate?

Fossils also tell us about the environments in which they lived. For example, an ammonite lived in the sea. When a fossil of an ammonite is found in the mountains, we can infer that the mountains were once covered by the sea.

Long Ago

Now

Ammonite is found in the Himalaya Mountains.

The mountains were once covered by the sea.

126

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

Q:What kind of information does a fossil give us? (It gives us the information about the kinds of living things that lived long ago, what they ate, where they lived, their sizes, etc.)

Q:How can you tell that this animal fossil is a fish? (It looks like the present fish.)

Q:How can you tell that the habitat of this ancient fish was water? (Present fish lives in water, oceans, rivers, etc.)

Q:How can you tell the size of this ancient fish? (From the size of the fossil)

Q:The animal fossil is found in a mountain. How has the environment where the ancient fish lived changed from past to present? (The environment was once under sea, river or lake. Now it becomes a mountain.)

- 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 information do fossils give us?
  Q: Which part of the fossil tells us about the size of an animal?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Learning from Fossils**

Key question: What do fossils tell us?

Activity: Getting information from fossils

	Answer
Type of animal	Fish
Its food	Small fish
Its habitat	Water, Ocean, river, lake, etc
Other ideas -Size -Colour	 -Large, Big, etc. - Brown, no ideas, etc.

Discussion

Q: What kind of information does a fossil gives us? Kinds of living things that lived long ago, what they ate, where they lived, their size, etc.

Q: How can you tell that this animal fossil is a fish? It looks like the present fish.

Q: How can you tell that the habitat of this ancient fish was water? Present fish lives in water, oceans, river, etc.

Q: How can you tell the size of this ancient fish? From the size of the fossil

Q: How has the environment where the ancient fish lived changed from past to present?

The environment was once sea, river or lake. Now it becomes a mountain.

Summary

- Fossils give us information about living things that lived long ago.
- Moulds and casts show what kind of plants and animals might have lived and how they looked.
- Fossil bones tell us about how large or small animals are.
- Fossil teeth show what they eat.
- Fossils also tell us about the environment which the animal once lived in.

Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.2. Fossils**	Total lesson No: 52 / 87 Textbook page: 127- 129

Lesson 8 / 9

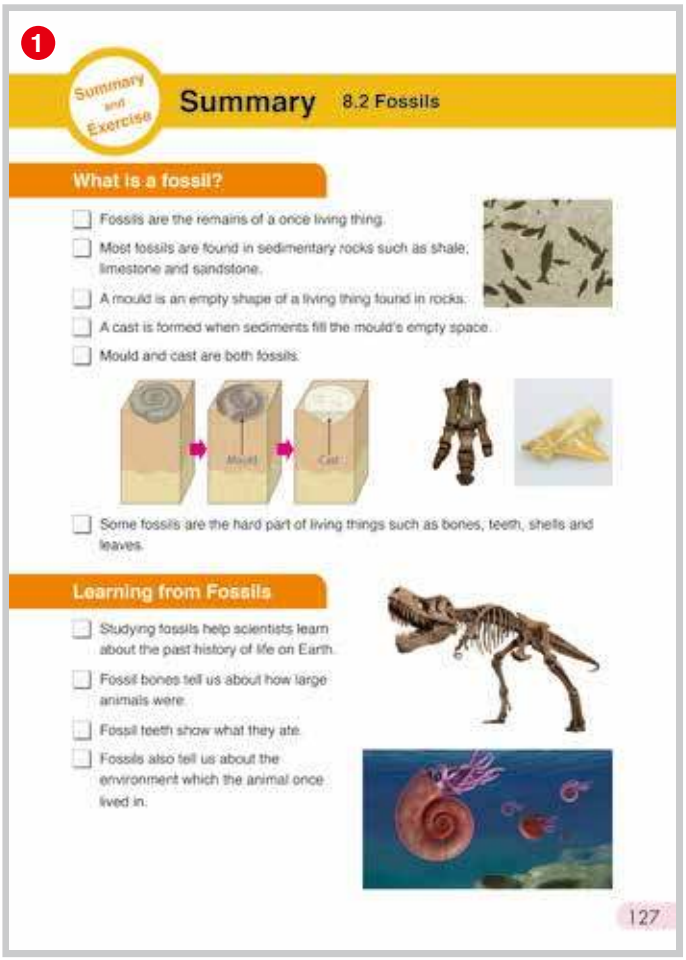
Lesson Title

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: What is a fossil?
  - Q: Why is it important to study fossils?
  - Q: What type of rock contains fossils?
  - Q: What is a mould and a cast?
- 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.



1

Summary and Exercise

Summary 8.2 Fossils

What is a fossil?

- Fossils are the remains of a once living thing.
- Most fossils are found in sedimentary rocks such as shale, limestone and sandstone.
- A mould is an empty shape of a living thing found in rocks.
- A cast is formed when sediments fill the mould's empty space.
- Mould and cast are both fossils.

- Some fossils are the hard part of living things such as bones, teeth, shells and leaves.

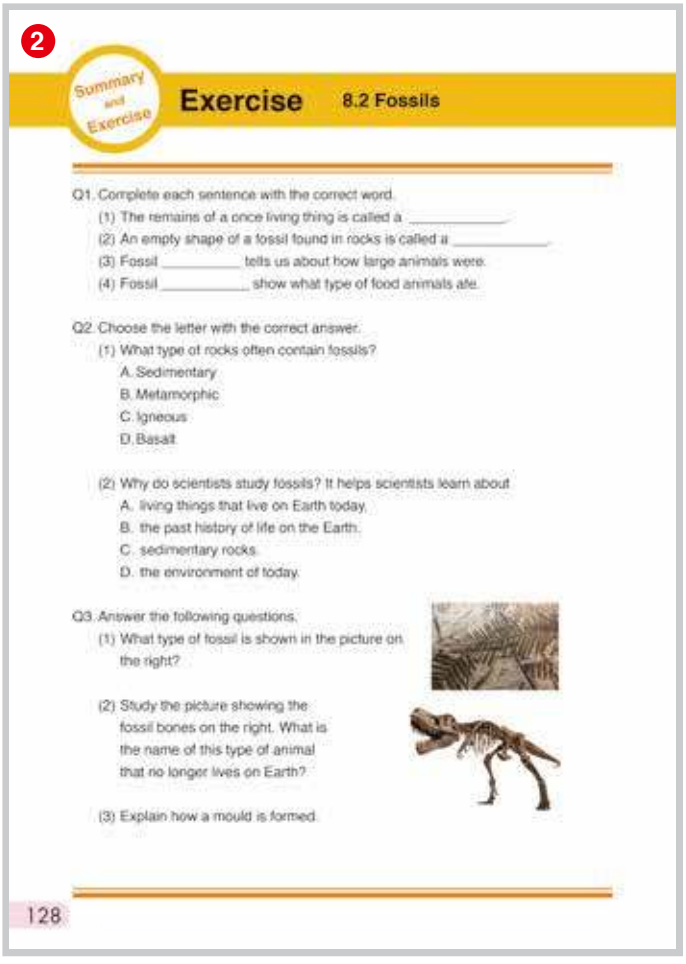
Learning from Fossils

- Studying fossils help scientists learn about the past history of life on Earth.
- Fossil bones tell us about how large animals were.
- Fossil teeth show what they ate.
- Fossils also tell us about the environment which the animal once lived in.

127

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.



2

Summary and Exercise

Exercise 8.2 Fossils

Q1. Complete each sentence with the correct word.

(1) The remains of a once living thing is called a _____.
(2) An empty shape of a fossil found in rocks is called a _____.
(3) Fossil _____ tells us about how large animals were.
(4) Fossil _____ show what type of food animals ate.

Q2. Choose the letter with the correct answer.

(1) What type of rocks often contain fossils?
A. Sedimentary
B. Metamorphic
C. Igneous
D. Basalt

(2) Why do scientists study fossils? It helps scientists learn about
A. living things that live on Earth today.
B. the past history of life on the Earth.
C. sedimentary rocks.
D. the environment of today.

Q3. Answer the following questions.

(1) What type of fossil is shown in the picture on the right?

(2) Study the picture showing the fossil bones on the right. What is the name of this type of animal that no longer lives on Earth?

(3) Explain how a mould is formed.

128

Exercise answers

Q1.
(1) **fossil**
(2) **mould**
(3) **bones**
(4) **teeth**

Q2.
(1) **A**
Most fossils are found in sedimentary rocks such as shale, limestone and sandstone. When a living thing dies, it is buried in layers of sediments such as sand and soil.
(2) **B**
Fossils give us so many clues. Studying fossils helps us learn about the past history of life and environments on the Earth.

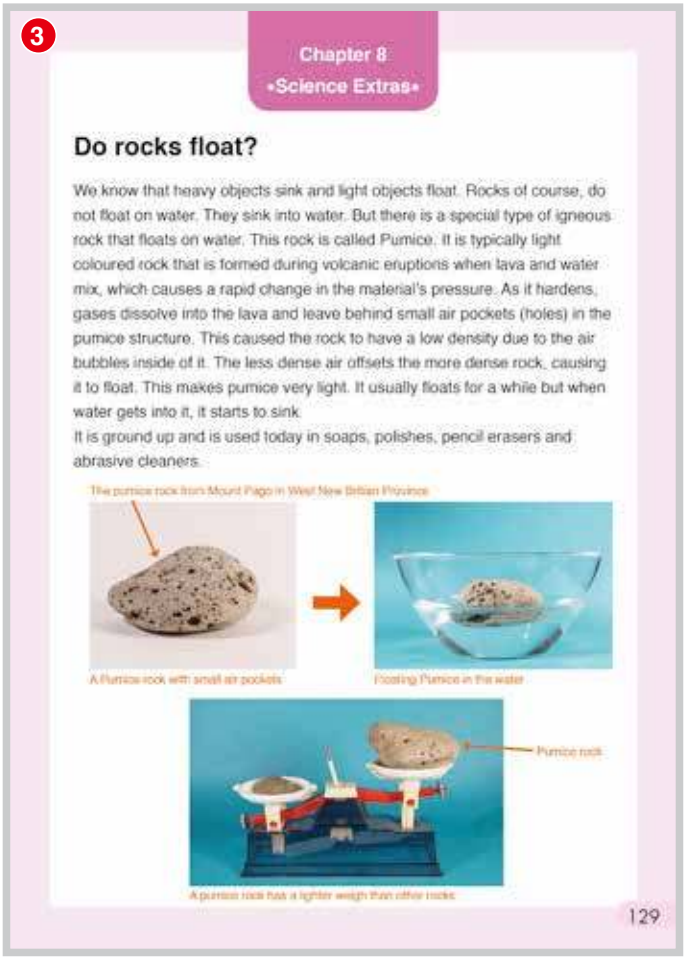
Q3. Expected answer
(1) **Plant fossil**
Some fossils are hard parts of living things such as bones, teeth, shells and leaves. After living things die, sediments covered them. The soft parts rot away and the hard parts turned to rock.

(2) **Dinosaur (Tyrannosaurus)**
(3) **When a living thing dies, it is buried in sediments. The sediments turn into a rock. The hard parts of the living thing dissolve completely and the shape is left in the rock. The shape of a living thing found in a rock is called a mould.**

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.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Chapter 8
•Science Extras•

Do rocks float?

We know that heavy objects sink and light objects float. Rocks of course, do not float on water. They sink into water. But there is a special type of igneous rock that floats on water. This rock is called Pumice. It is typically light coloured rock that is formed during volcanic eruptions when lava and water mix, which causes a rapid change in the material's pressure. As it hardens, gases dissolve into the lava and leave behind small air pockets (holes) in the pumice structure. This caused the rock to have a low density due to the air bubbles inside of it. The less dense air offsets the more dense rock, causing it to float. This makes pumice very light. It usually floats for a while but when water gets into it, it starts to sink.
It is ground up and is used today in soaps, polishes, pencil erasers and abrasive cleaners.

The pumice rock from Mount Pago in West New Britain Province

A Pumice rock with small air pockets

Floating Pumice in the water

Pumice rock

A pumice rock has a lighter weigh than other rocks

129

Lesson
9 / 9

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

8. Rocks, Minerals and Fossils

Q1 Complete each sentence with the correct word.

(1) A rock that is formed inside the Earth that has been changed by heat and pressure is called metamorphic rock.

(2) Granite and basalt are examples of igneous rock.

(3) The remains of a once living thing is called a fossil.

(4) The rock that is used for building and making sculpture is called marble.

Q2 Choose the letter with the correct answer.

(1) Which type of rocks are formed when sediments are pressed and cemented together?

A. Igneous
B. Metamorphic
C. Sedimentary
D. Fossils

(2) Which of these is not a mineral property?

A. Colour
B. Lustre
C. Temperature
D. Hardness

(3) Which of the following is formed when a fossil mould is filled?

A. Bones
B. Fossil cast
C. Tar pit
D. Plants

(4) Which of the following animal parts would most likely form a fossil?

A. Blood
B. Fur
C. Bones
D. Skin

130

Q3

Study the diagram on the right.

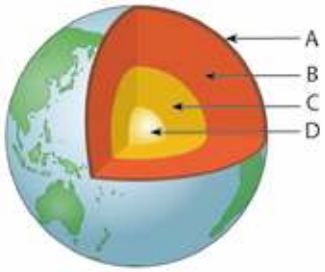
(1) Write the letter A, B, C or D for the correct layer of the Earth in the space provided.

Mantle ___B___

Inner core ___D___

Crust ___A___

Outer core ___C___



(2) Which part of the Earth layers is made of rocks?

Crust

Q4

(1) Scientists found fossils of shellfish in rocks on the land. What can we infer about the place?

The place was long ago in the sea (under the water).


Shellfish

(2) A group of students oberved five rocks samples with magnifying hand lens. Study the table below and answer the following questions.

Sample	Lustre	Hardness	Colour	State	Grain
1	Shiny	Hard	White	Solid	Cannot be seen
2	Shiny	Hard	Gold	Soild	Cannot be seen
3	Dull	Hard	Several colours	Solid	Can be seen with different colour
4	Shiny	Hard	Transparent	Solid	Cannot be seen
5	Dull	Hard	White	Solid	Cannot be seen

Which of the above samples would not be classified as minerals? Explain your answer.

Samples 3 would not be classified as minerals. Sample 3 is a rock that contains several kinds of minerals because different colours of grains are observed on it.

Chapter 9. Habitat and Adaptation

Chapter Objectives

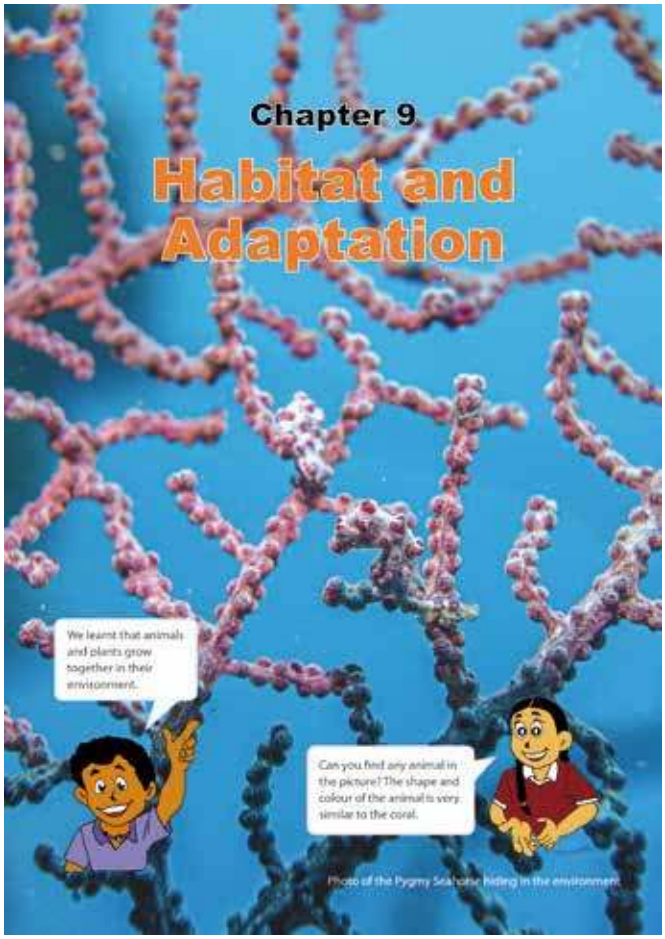
Students will be able to understand the characteristics of the different habitats, their conditions, the different needs provided for plants and animals that live in them. Students will also be able to understand the ways the animals adapt to their habitats to survive.

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.

Grade 3	Grade 4	Grade 5	Grade 6
- Observing our Environment	- Living Things in the Environment	- Habitat & Adaptation	- Paths of Energy

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	**Habitats** What kinds of environments do living things live in?	5.1.4	133 - 134
	2	**Freshwater Habitat** What is a fresh water habitat?		135 - 136
	3	**Ocean Habitat** What is an ocean habitat?		137 - 138
	4	**Rainforest Habitat** What is a rainforest habitat?		139 - 140
	5	**Grassland Habitat** What is a grassland habitat?		141 - 142
	6	**Habitat Changes** What happens to living things when habitats change?		143 - 144
	7	Summary and Exercise		145 - 146
9.2 Adaptations	8	**What is Adaptation?** How do adaptations help organisms?		147 - 148
	9	**Adaptation to Habitats** How do organisms adapt to their habitats?		149 - 150
	10	**Camouflage** What is camouflage?		151 - 152
	11	**Mimicry** What is mimicry?		153 - 154
	12	**Behavioural Adaptation** 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

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 54 / 87 Textbook page: 133 - 134

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.
- Advice 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)

Teacher's Notes

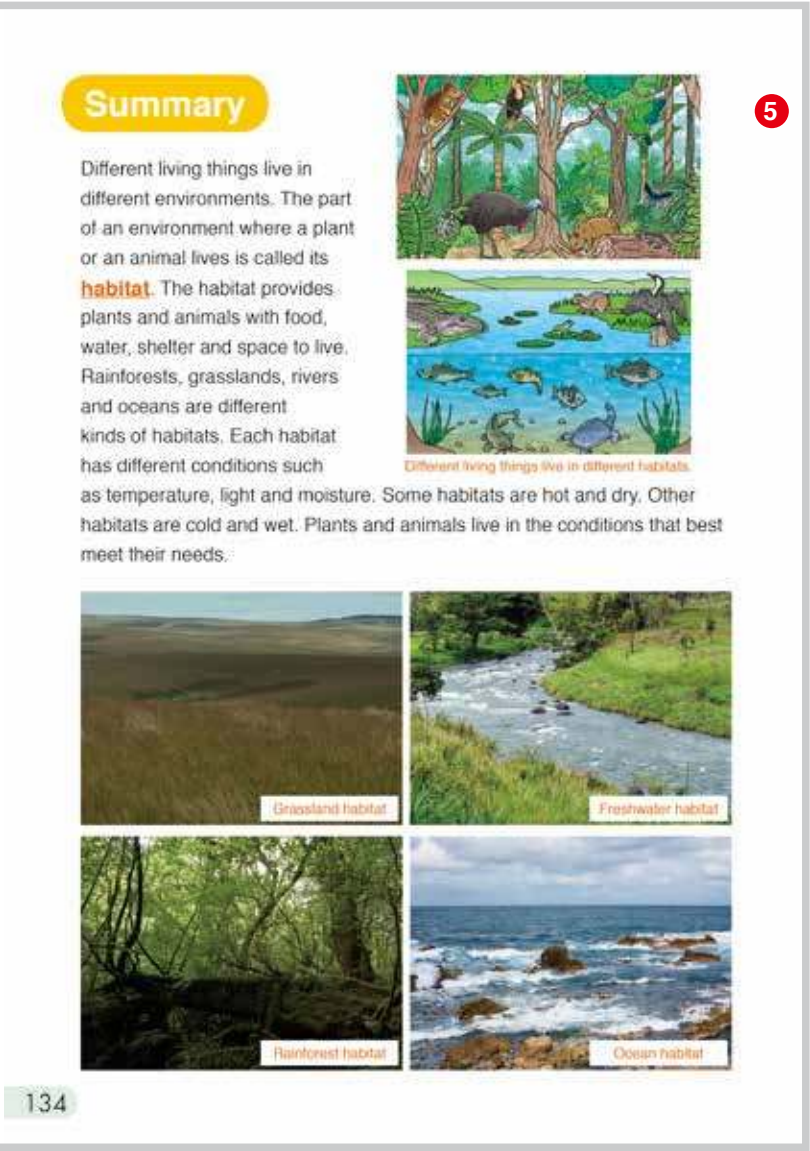
- Students have learnt about the relationship between living things and environments in 'Observing Our Environment' in Grade 3 Chapter 1 and 'Living Things in the Environment' in Grade 4 Chapter 1. In this chapter, students will learn the relationship between living things in a particular environment 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

134

- 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 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 sea are different from those of 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.

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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 55 / 87 Textbook page: 135 - 136

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)

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]).

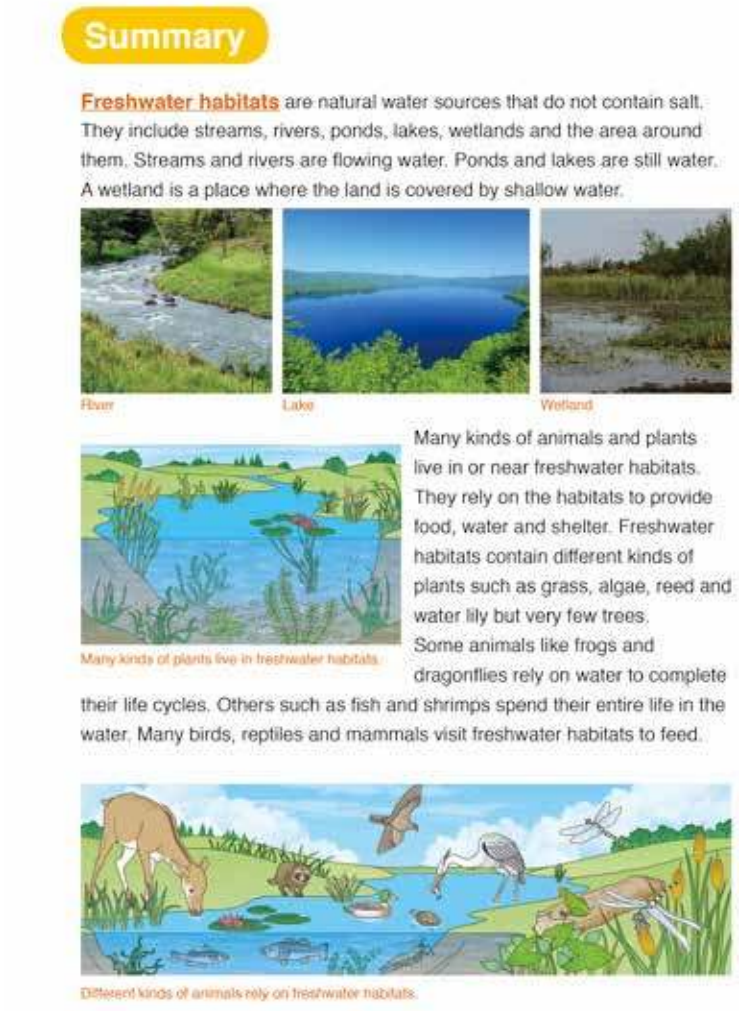
- **The two major sources of freshwater are:**
  i. Ground water - water found in shallow aquifers beneath the earth's surface. This water is generally found at depths up to around 2 000 feet.
  ii. Surface water - water found in streams, rivers, lakes, and reservoirs and glaciers.
- **Water lilies, 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.

136

- 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.

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
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 ...

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 56 / 87 Textbook page: 137 - 138

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.

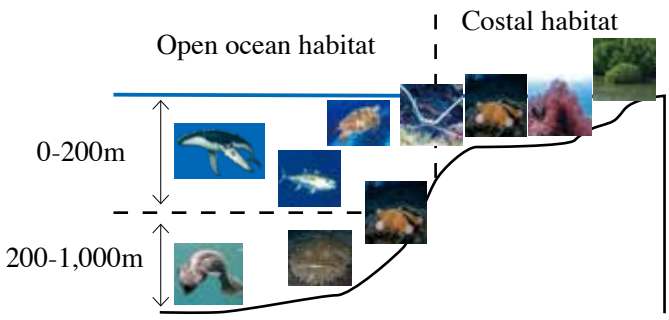
4 Discussion for findings (25 min.)

- Ask students to present the findings from their activity.

(Continue)

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

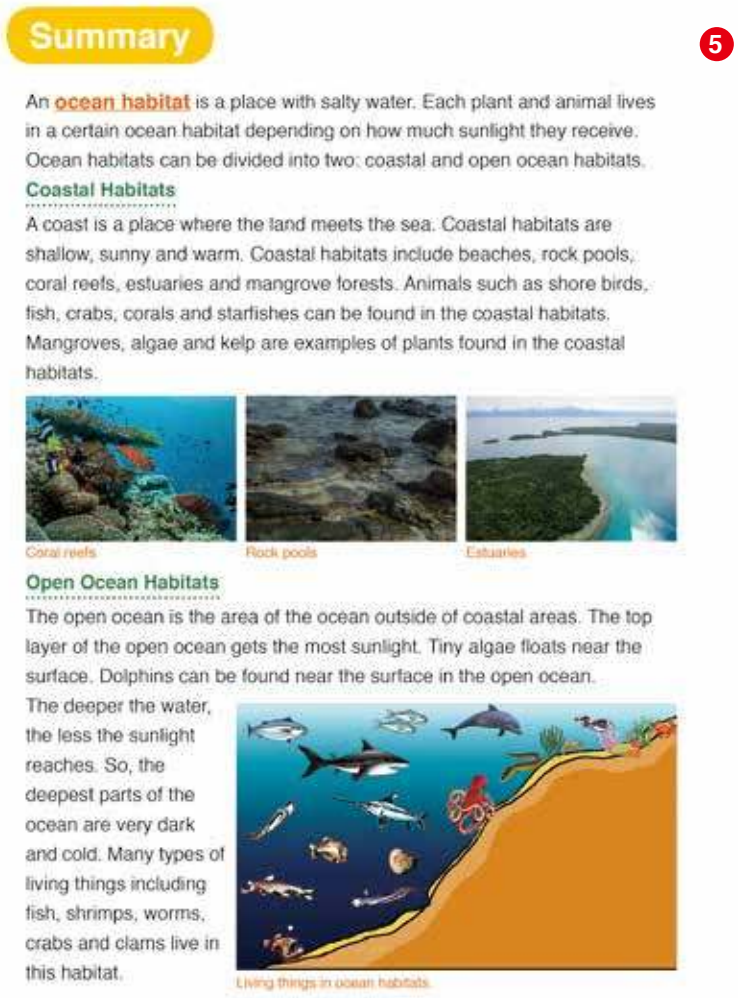
- Frill shark has an eel-like shape with 6 pairs of very large gill slits that enables maximum absorption of oxygen from the deep ocean waters.
- Most of them have developed very sensitive eyes to sense the bioluminescent animals and the environmental light coming from the surface. The eyes are tubular, 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

5

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

138

- 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 mangroves 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 costal 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.

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 mangroves grow in the coastal habitat? The condition of coast helps mangroves 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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 57 / 87 Textbook page: 139 - 140

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 coastal 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:
   (1) What kinds of animals live in a rainforest?
   (2) How do different kinds of plants grow in a rainforest?
   (3) Where do different kinds of animals live in a rainforest?
   (4) 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?

4

139

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 togheter.
3. Where do differrent 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.

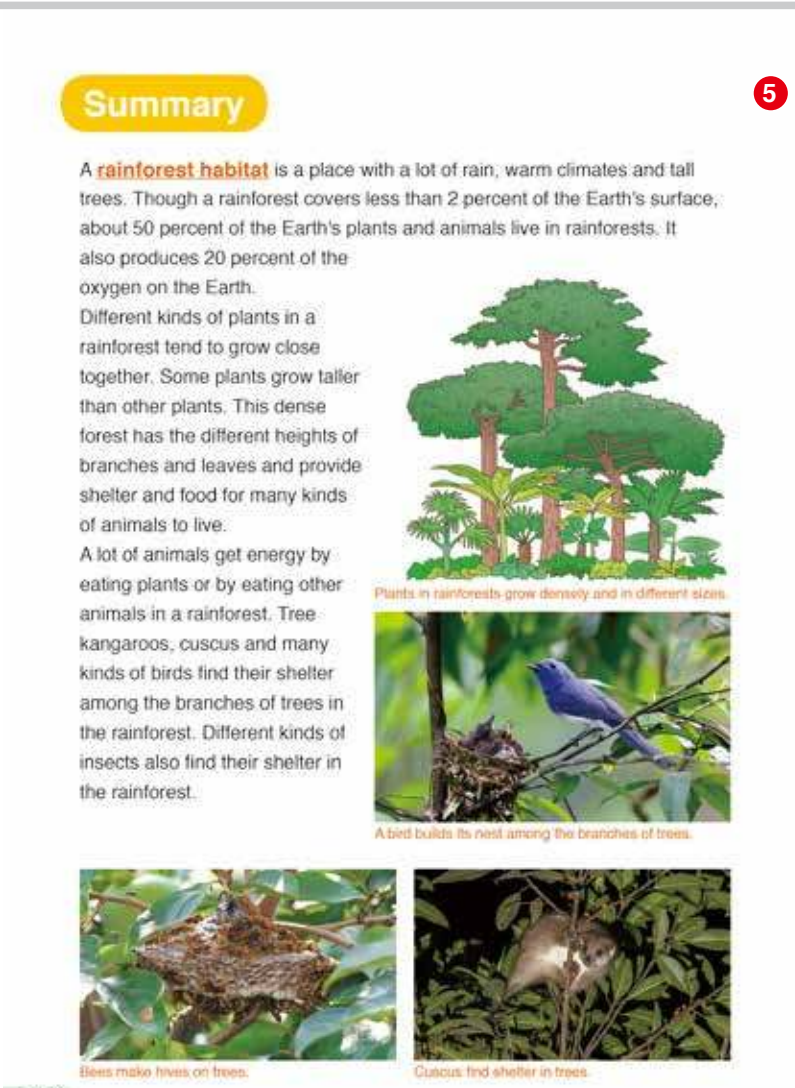
- The largest rainforests are in the Amazon River Basin (South America) and the Congo River Basin (Western Africa).
- Smaller rainforests are located in Central America, Madagascar, Australia and Papua New Guinea.
- Rainforests are populated with insects (like butterflies and beetles), arachnids (like 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

5

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.

- 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?
Write down the answers of students.
2. How do different kinds of plants grow in a rainforest?
Write down the answers of students.
3. Where do differrent 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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 58 / 87 Textbook page: 141 - 142

Lesson 5 / 14

Lesson Title

Grassland Habitat

Preparation

pictures of grassland plants and animals, A3 papers, 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

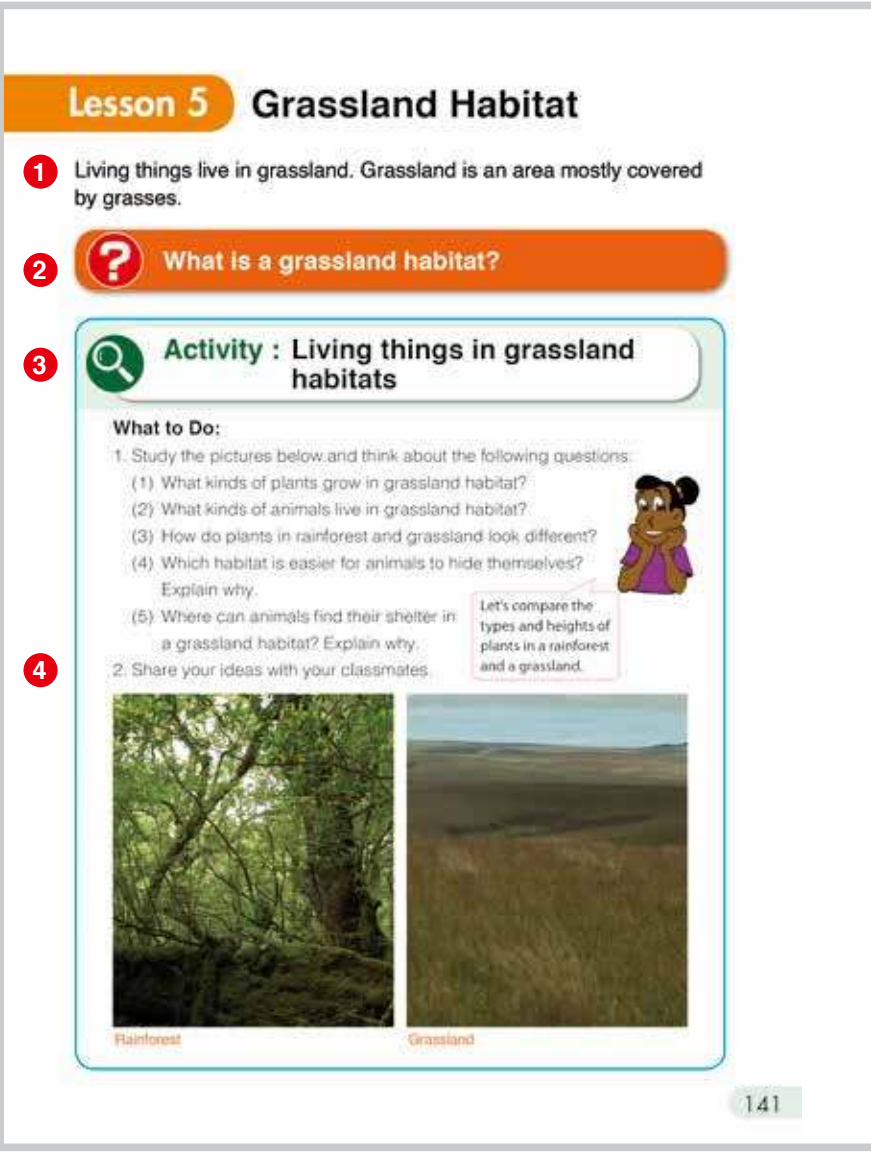
What is a grassland habitat?

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:

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

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

4

Rainforest

Grassland

141

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

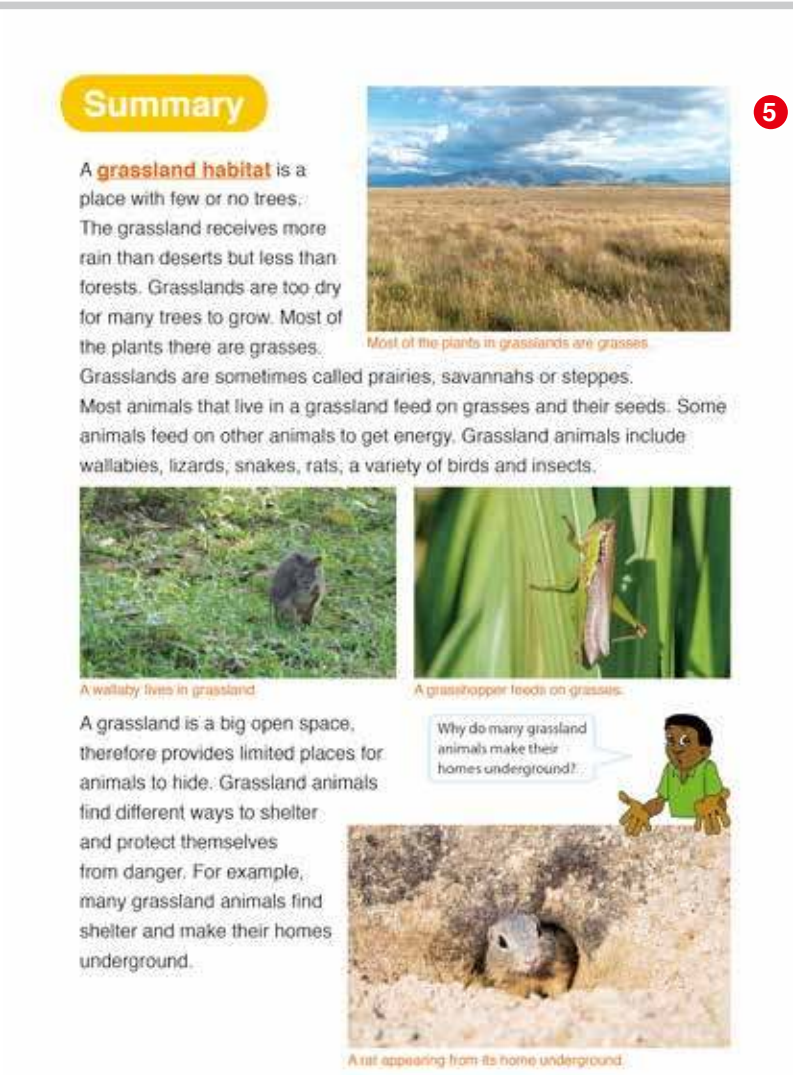
Students will be able to:

- 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.

142

- 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.

Sample Blackboard Plan

Title: **Grassland Habitat**

Key question What is a grassland habitat?

Activity : Living things in grassland habitats

Results:

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

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 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.

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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 59 / 87 Textbook page: 143 - 144

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?

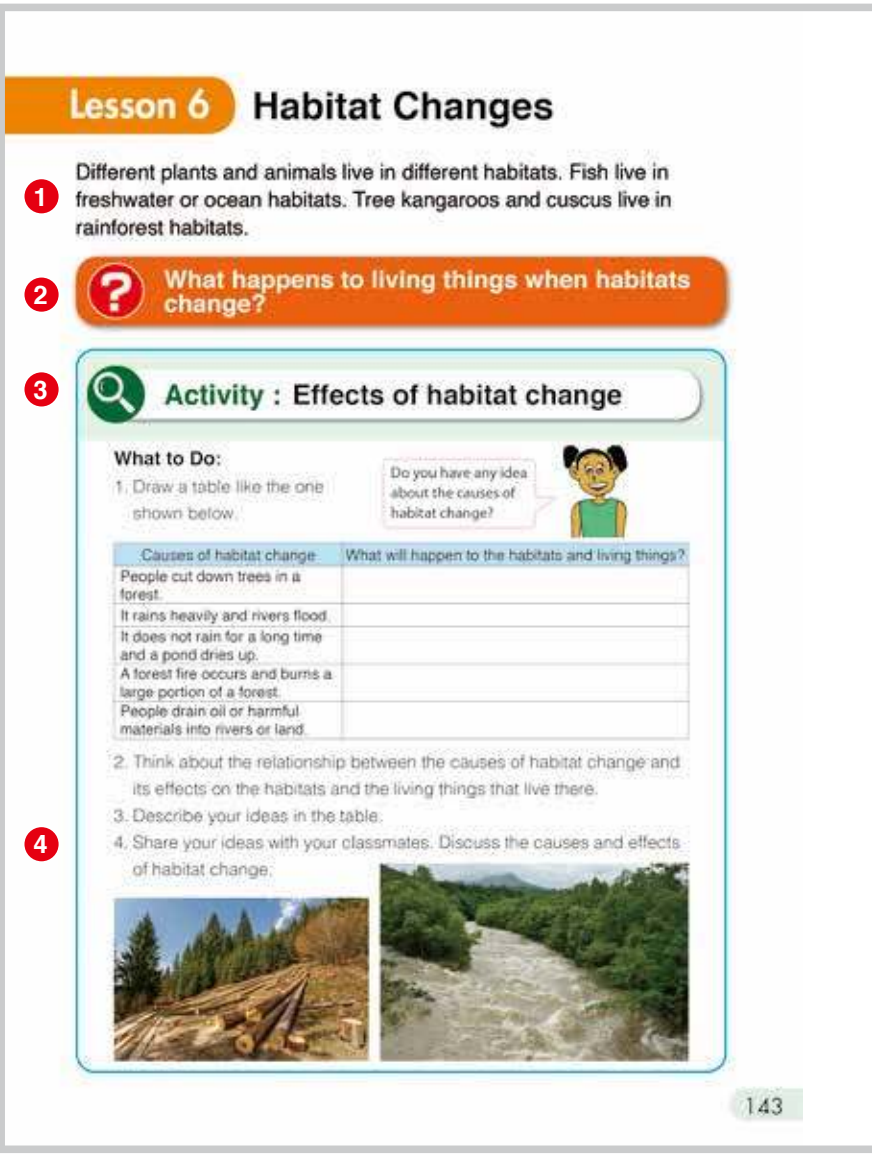
3 Activity (20 min.)

- 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

143

Teacher's Notes

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

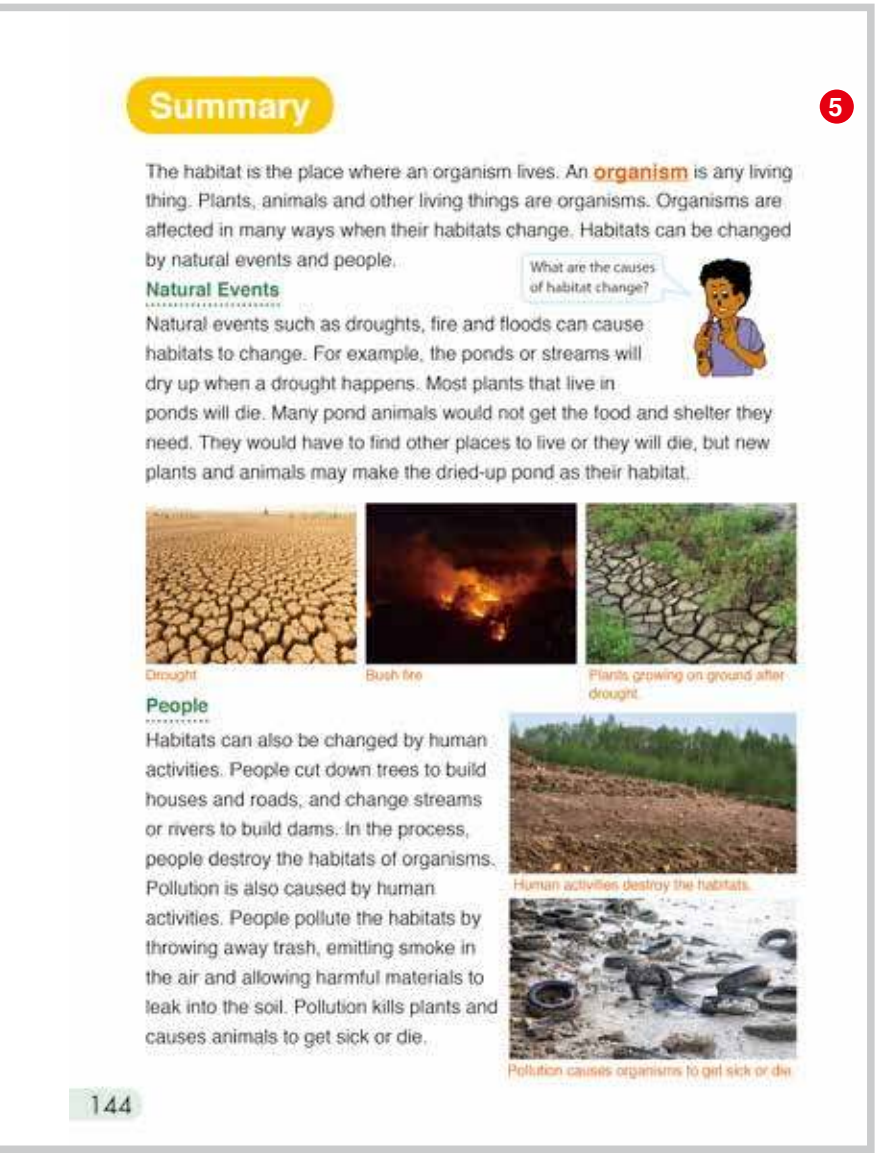
- Habitat change can occur naturally through droughts, disease, fire, hurricanes, mudslides, volcanoes, earthquakes, slight increases or decreases in seasonal temperature or precipitation, etc.
- Habitat change can also be induced by human activities such as land use change and physical modification 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.

What are the causes of habitat change?

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.

144

- 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.

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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.1. Habitats**	Total lesson No: 60 / 87 Textbook page: 145 - 146

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.

1

Summary and Exercise

Summary 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.

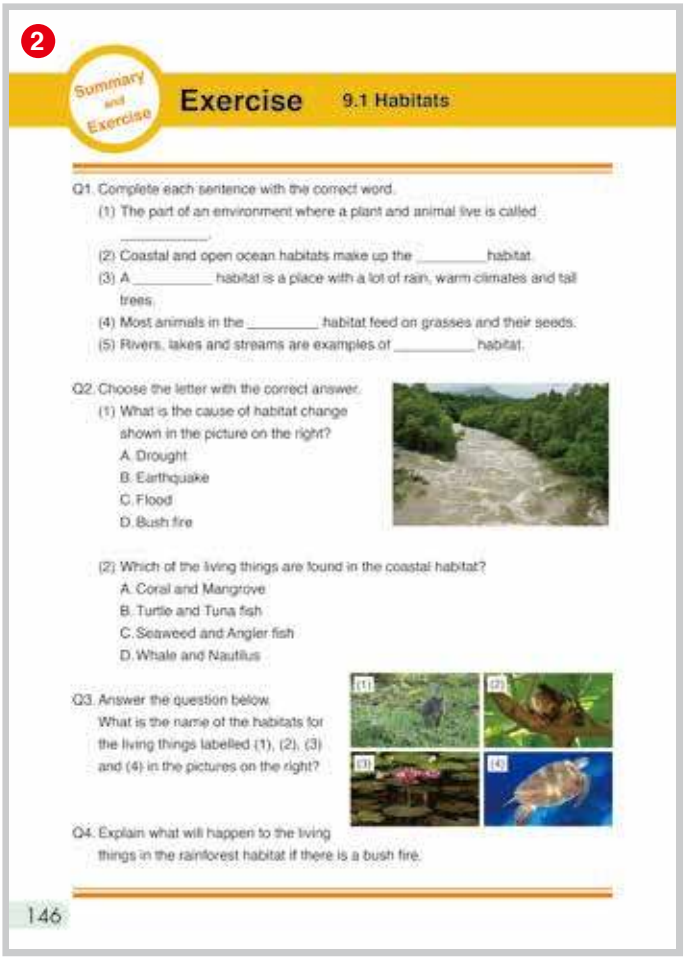
Habitat Changes

- 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.

145

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 strenghten the learnt concepts in this topic.



2

Summary and Exercise

Exercise 9.1 Habitats

Q1. Complete each sentence with the correct word.

(1) The part of an environment where a plant and animal live is called _____.

(2) Coastal and open ocean habitats make up the _____ habitat.

(3) A _____ habitat is a place with a lot of rain, warm climates and tall trees.

(4) Most animals in the _____ habitat feed on grasses and their seeds.

(5) Rivers, lakes and streams are examples of _____ habitat.

Q2. Choose the letter with the correct answer.

(1) What is the cause of habitat change shown in the picture on the right?

A. Drought
B. Earthquake
C. Flood
D. Bush fire

(2) Which of the living things are found in the coastal habitat?

A. Coral and Mangrove
B. Turtle and Tuna fish
C. Seaweed and Angler fish
D. 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.

146

Exercise answers

Q1.
(1) **habitat**
(2) **ocean**
(3) **rainforest**
(4) **grassland**
(5) **freshwater**

Q2.
(1) **C**
(2) **A**

Q3.
(1) **grassland**
(2) **rainforest**
(3) **freshwater**
(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.**

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.2. Adaptations**	Total lesson No: 61 / 87 Textbook page: 147 - 148

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.

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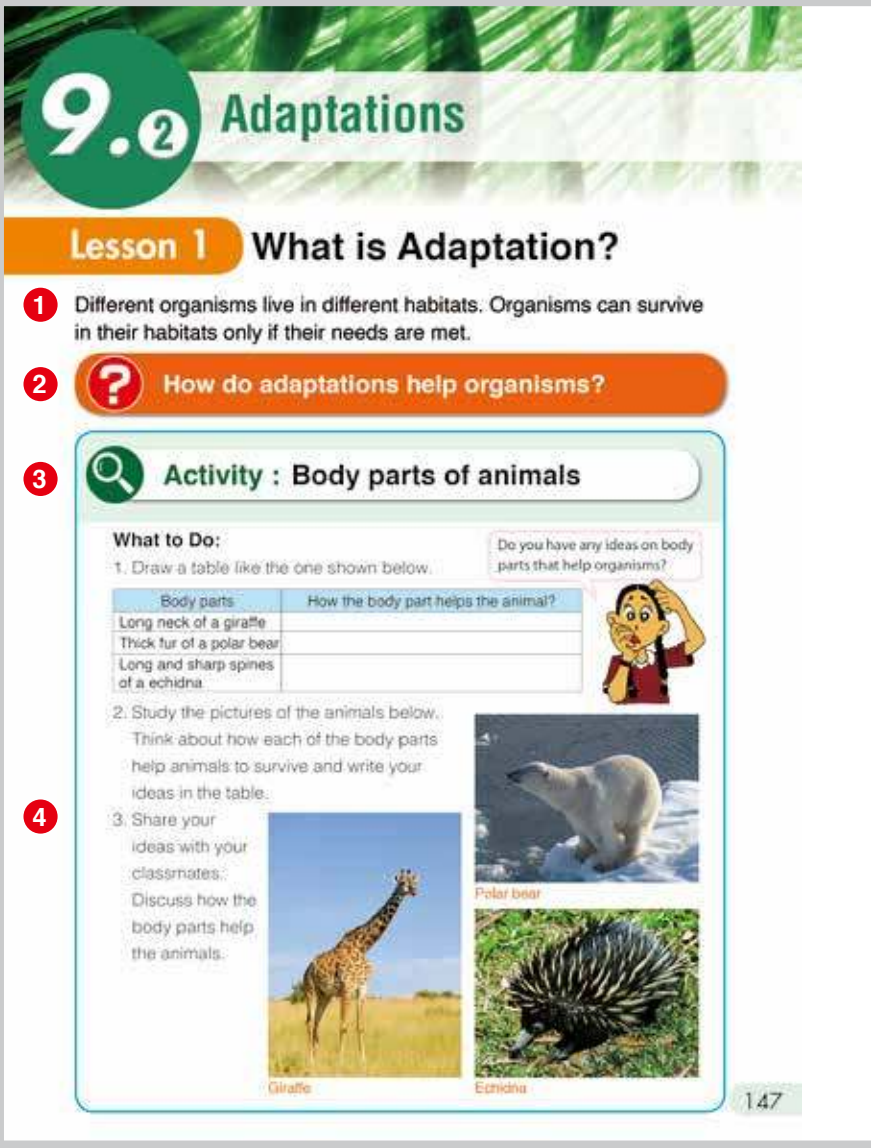


Teacher's Notes

- 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:

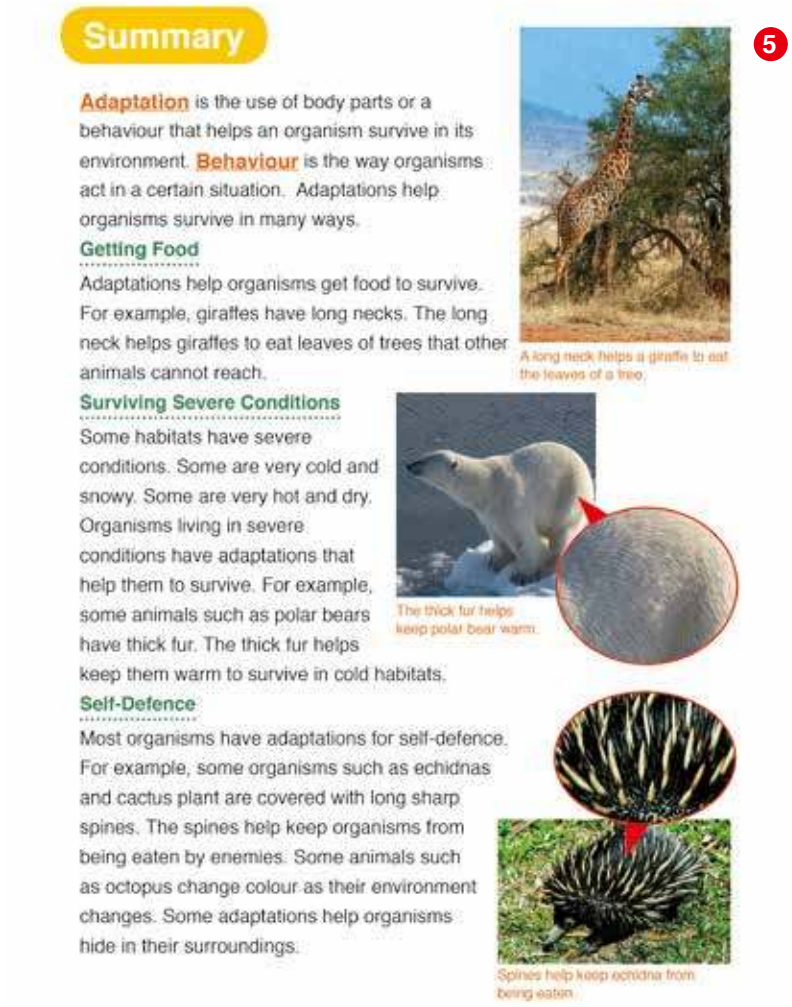
- Behavioural - responses made by an organism that help it to survive/reproduce.
- Physiological - a body process that helps an organism to survive/reproduce.
- Structural - a feature of an organism's body that helps it to survive/reproduce.

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.

148

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

Q:If a giraffe didn't have a lond 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.

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 tempreature
Hedgehog Long and sharp spines	For protection from its enemies

Discussion

Q:If a giraffe didn't have a lond 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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.2. Adaptations**	Total lesson No: 62 / 87 Textbook page: 149 - 150

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.

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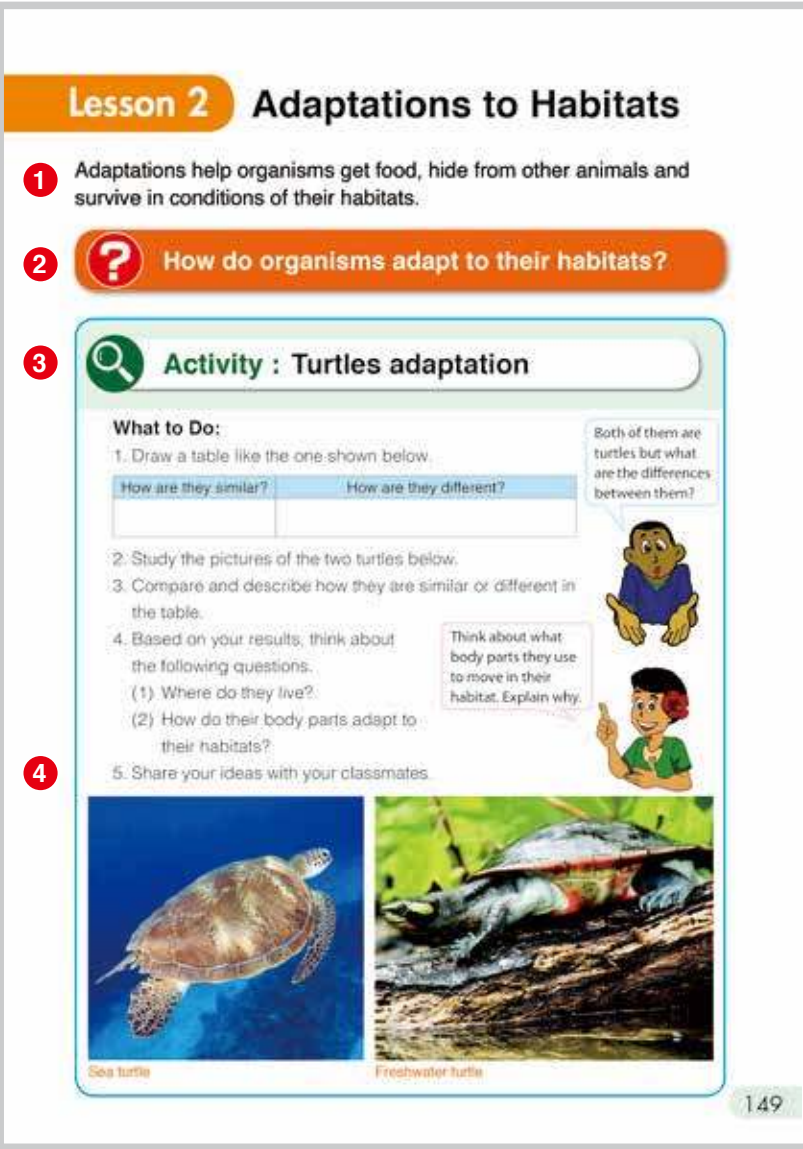

Lesson 2 Adaptations to Habitats

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?

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?
5. Share your ideas with your classmates.

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

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

4

Sea turtle

Freshwater turtle

149

Teacher's Notes

- The name of the freshwater turtle in the acitvity 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.

150

- **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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.2. Adaptations**	Total lesson No: 63 / 87 Textbook page: 151 - 152

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.

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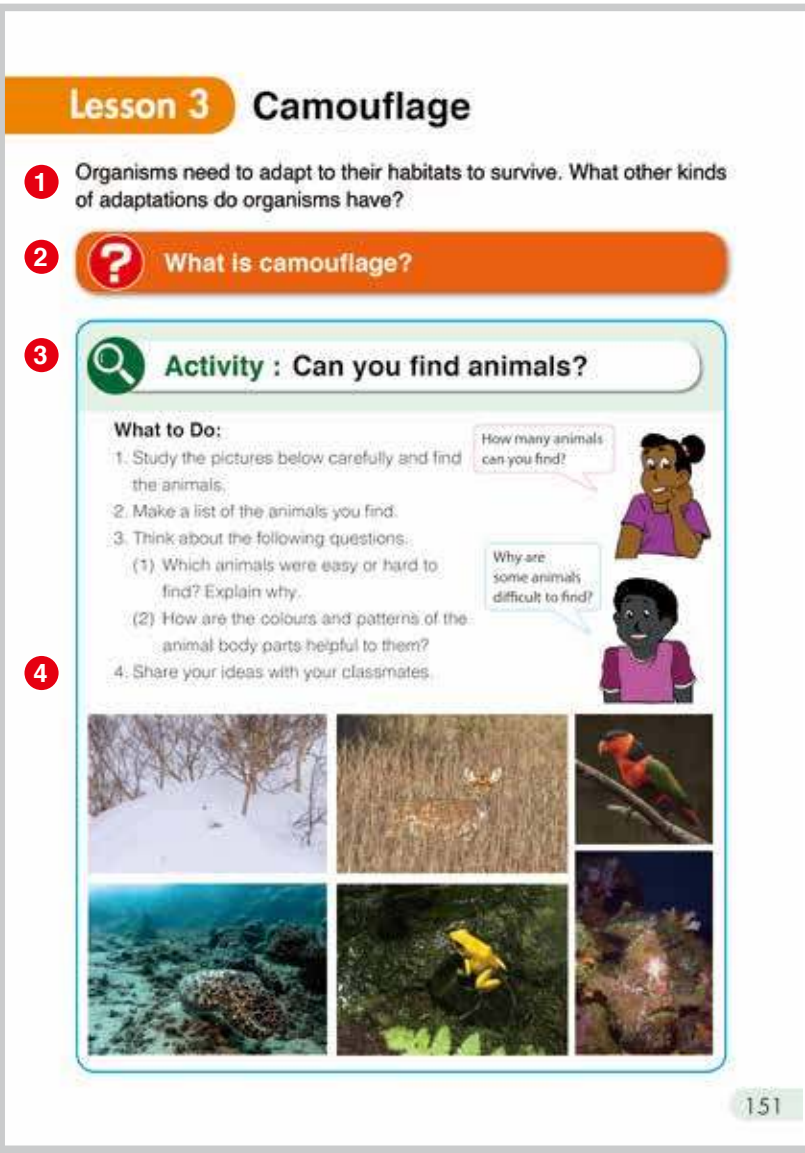

Lesson 3 Camouflage

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

2 What is camouflage?

3 Activity : Can you find animals?

What to Do:

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

How many animals can you find?

Why are some animals difficult to find?

151

Teacher's Notes

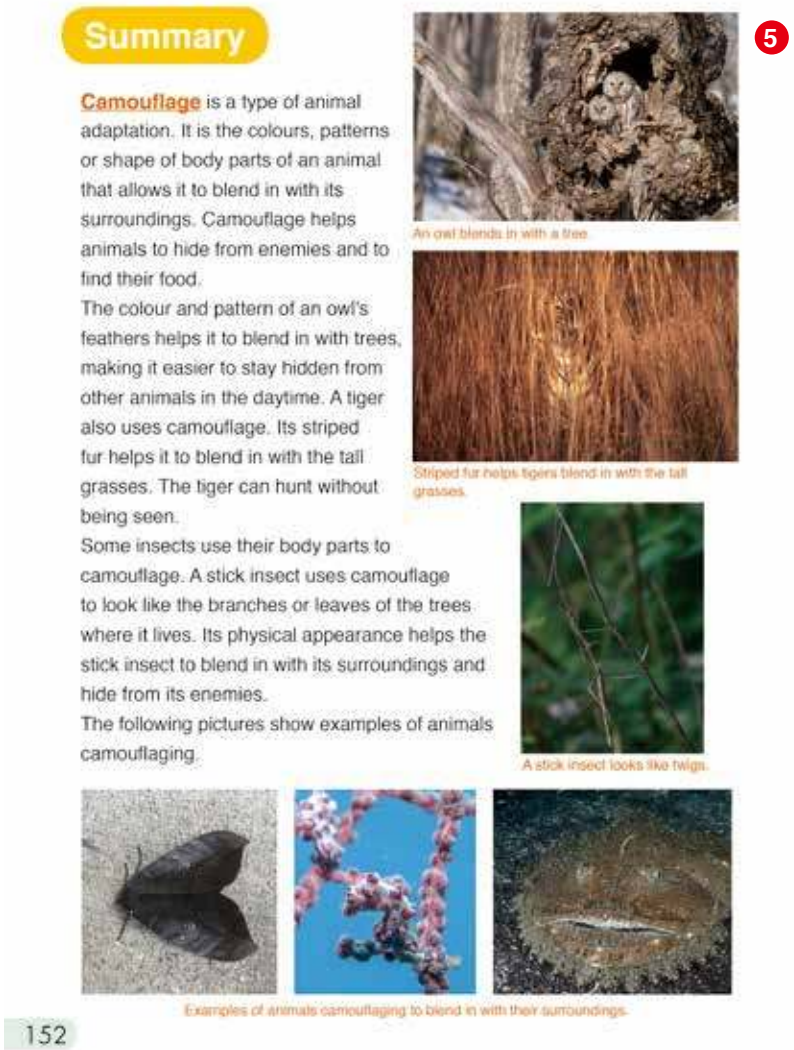
- Camouflage is one example of adaption that help animals to survive in their environment. Animals utilise camouflage to avoid detection by both predator and prey species.
- The animals that are hunted are called prey. Prey animals often use camouflage to hide from predators. Camouflage is a way of hiding 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

- 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 colours are similar to the colour of their environment. Easy to find: bird and frog. Because their colours are 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 colours are similar to the colour of their environment. Easy to find: bird and frog. Because their colours are 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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.2. Adaptations**	Total lesson No: 64 / 87 Textbook page: 153 - 154

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.

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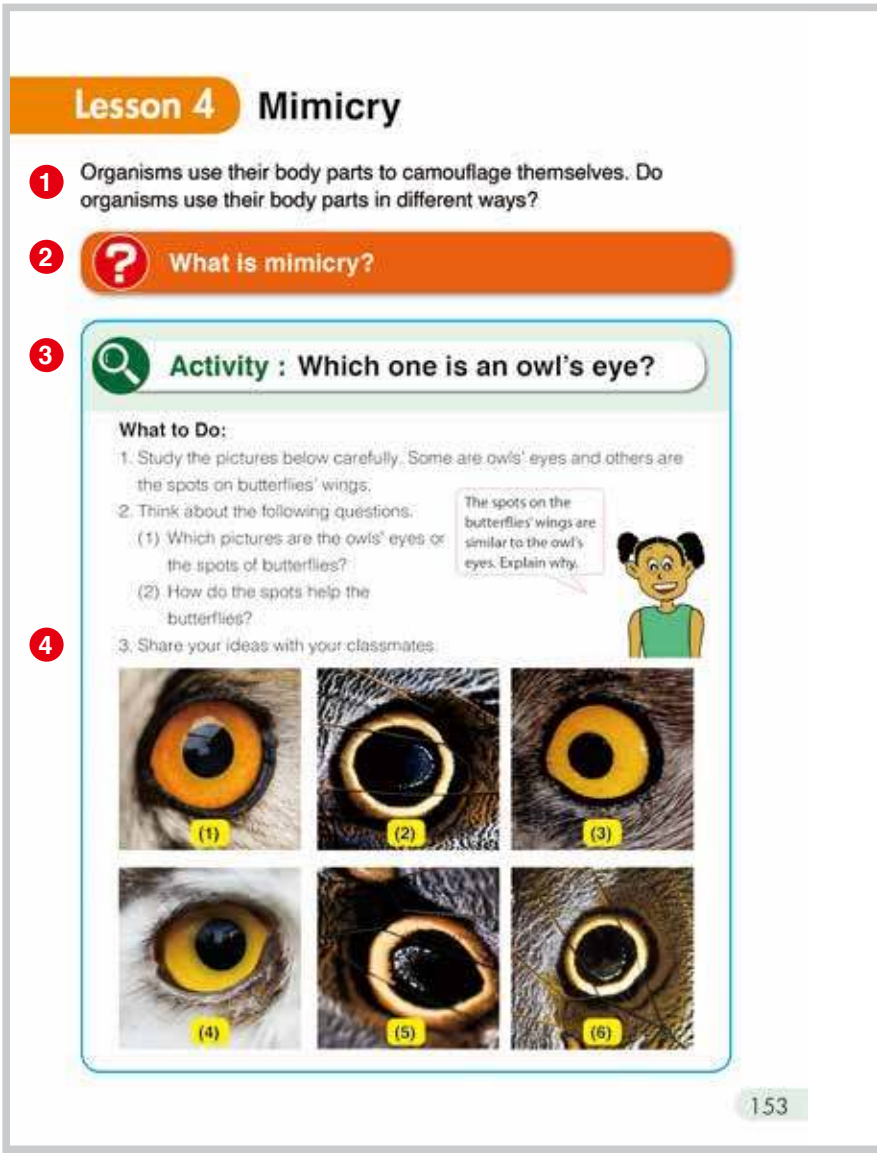


Lesson 4 Mimicry

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.

4

(1) (2) (3) (4) (5) (6)

153

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

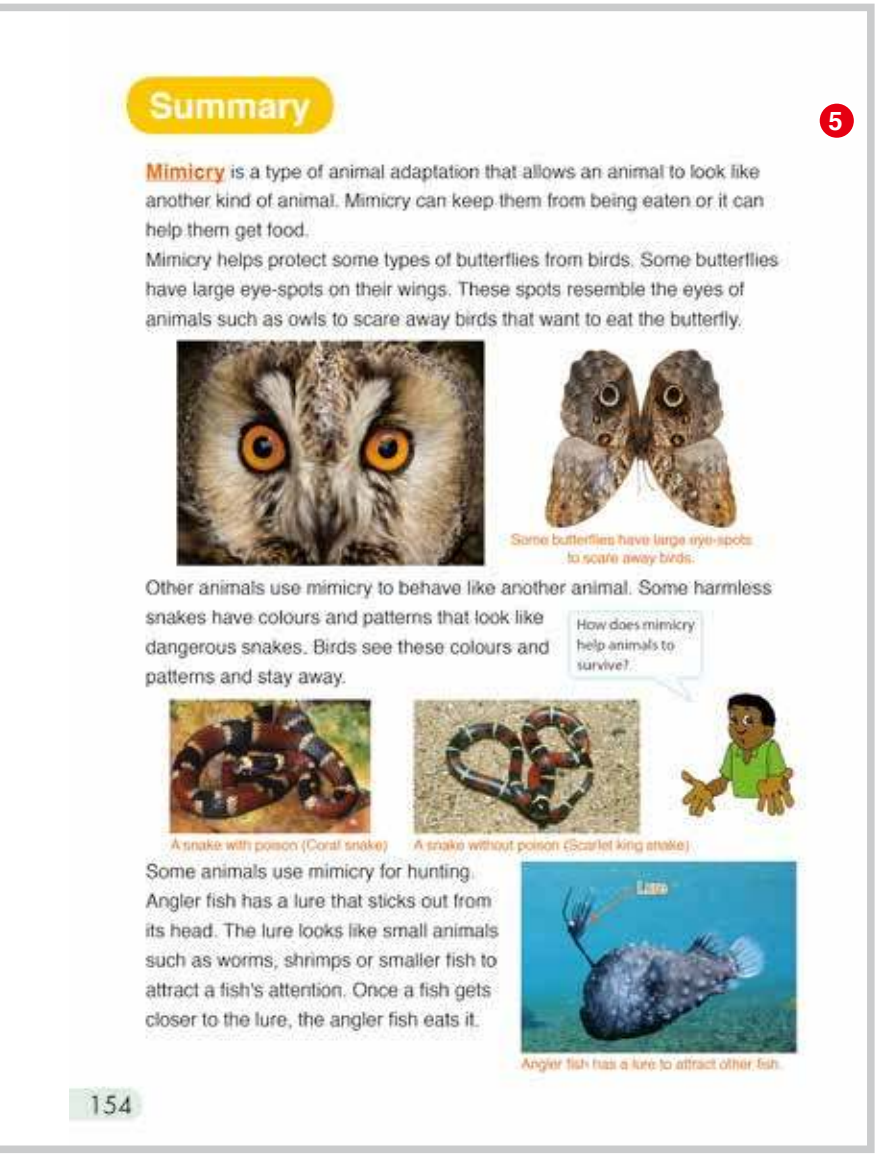
- Pictures 1, 3 and 4 are owls' eyes and the spot on the butterfly's wing are pictures 2, 5 and 6.

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.

How does mimicry help animals to survive?

A snake with poison (Coral snake)

A snake without poison (Scarlet king snake)

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.

Lure

Angler fish has a lure to attract other fish.

154

- **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? (The spots on the butterfly's wing look like the owls' eyes, because 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.

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? The spots on the butterfly's wing look like the owls' eyes, because 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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.2. Adaptations**	Total lesson No: 65 / 87 Textbook page: 155 - 156

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?

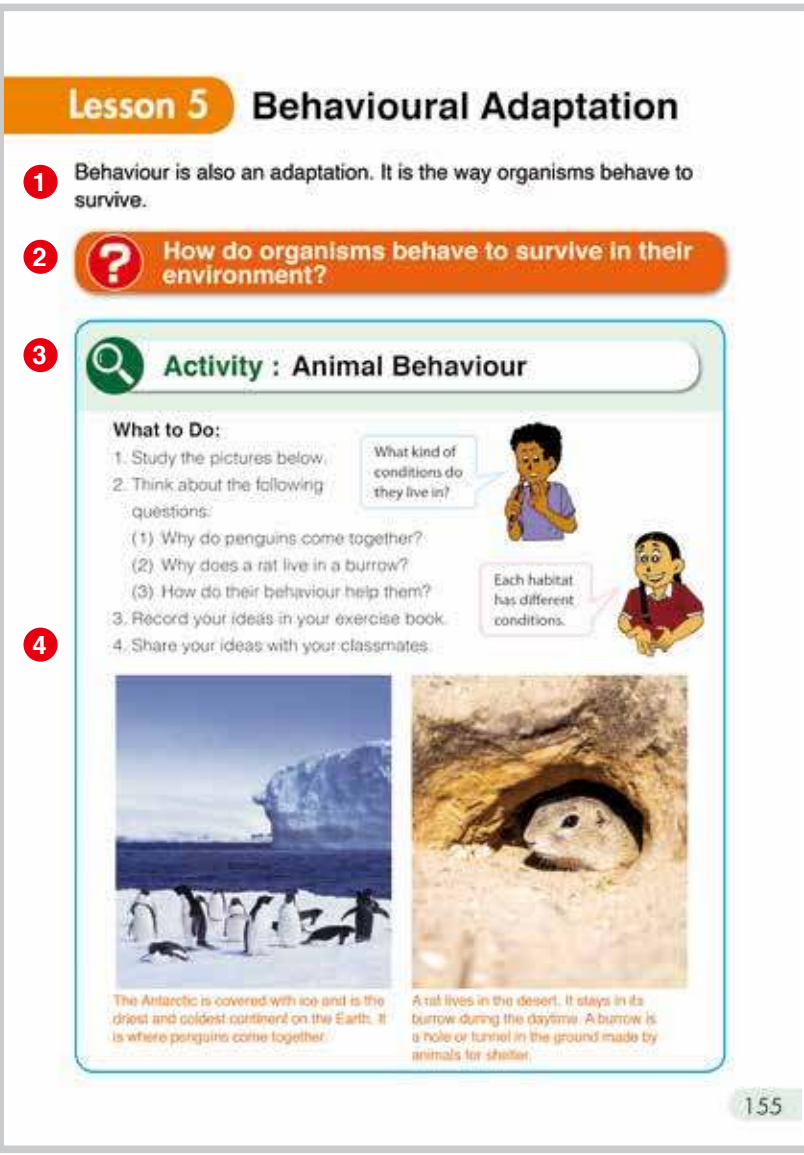
3 Activity (20 min.)

- 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 Activity : Animal Behaviour

What to Do:

1. Study the pictures below.
2. 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?
3. Record your ideas in your exercise book.
4. Share your ideas with your classmates.

4

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.

155

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

5

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.

156

- 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.

Unit: **Interaction in the Environment**	Chapter : **9. Habitat and Adaptation** Topic : **9.2. Adaptations**	Total lesson No: 66 / 87 Textbook page: 157 - 159

Lesson 13 / 14

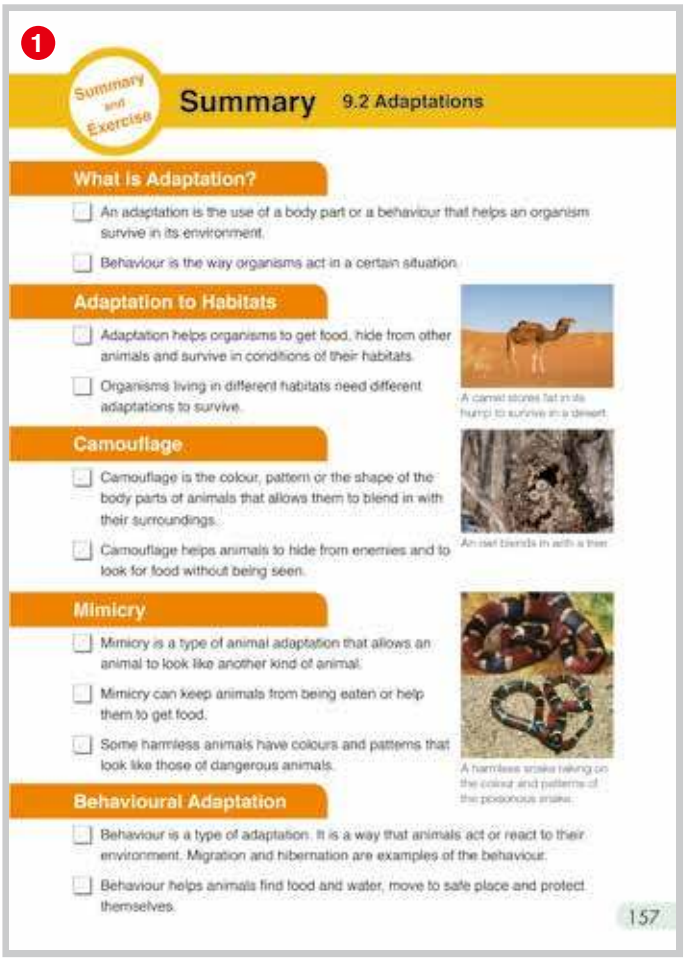
Lesson Title

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.



1

Summary and Exercise

Summary 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.

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

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.

An owl blends in with a tree.

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.

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

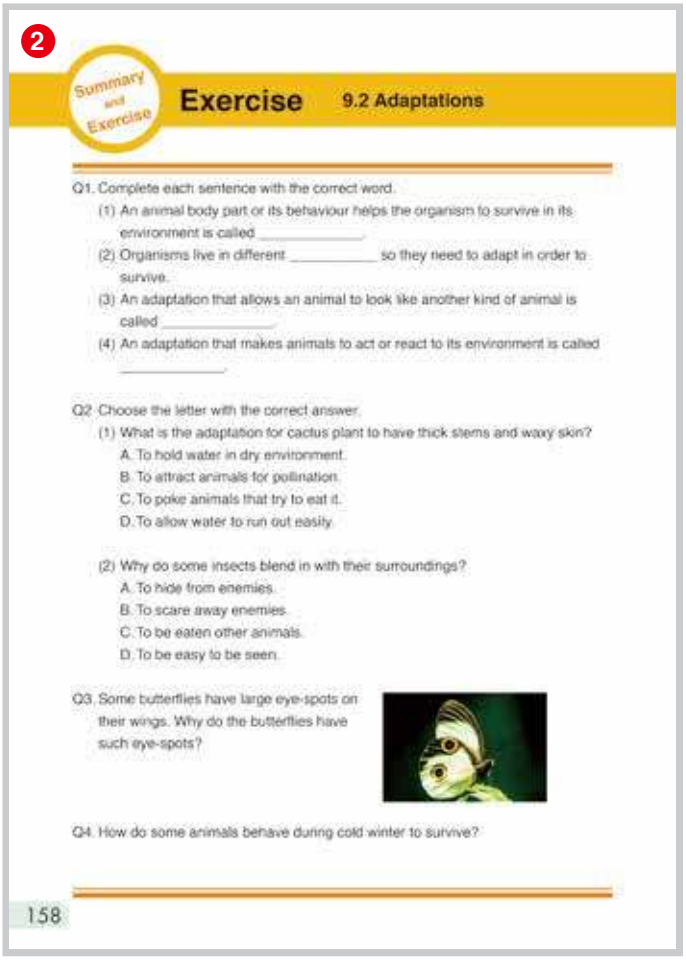
Behavioural Adaptation

- 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.

157

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.



2

Summary and Exercise

Exercise 9.2 Adaptations

Q1. Complete each sentence with the correct word.

(1) An animal body part or its behaviour helps the organism to survive in its environment is called _____.

(2) Organisms live in different _____ so they need to adapt in order to survive.

(3) An adaptation that allows an animal to look like another kind of animal is called _____.

(4) An adaptation that makes animals to act or react to its environment is called _____.

Q2. Choose the letter with the correct answer.

(1) What is the adaptation for cactus plant to have thick stems and waxy skin?

A. To hold water in dry environment.
B. To attract animals for pollination.
C. To poke animals that try to eat it.
D. To allow water to run out easily.

(2) Why do some insects blend in with their surroundings?

A. To hide from enemies.
B. To scare away enemies.
C. To be eaten other animals.
D. 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?

158

Exercise answers

Q1.
(1) **adaptation**
(2) **habitat/environment**
(3) **mimicry**
(4) **behaviour**

Q2.
(1) **A**
(2) **A**

Q3.
To scare away birds that want to eat them.

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.

3

Chapter 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 blends in the rock

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 can change the colour and patterns of its skin

159

Lesson 14 / 14

Lesson Title

Chapter Test

Answers of the Chapter Test

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

160

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?

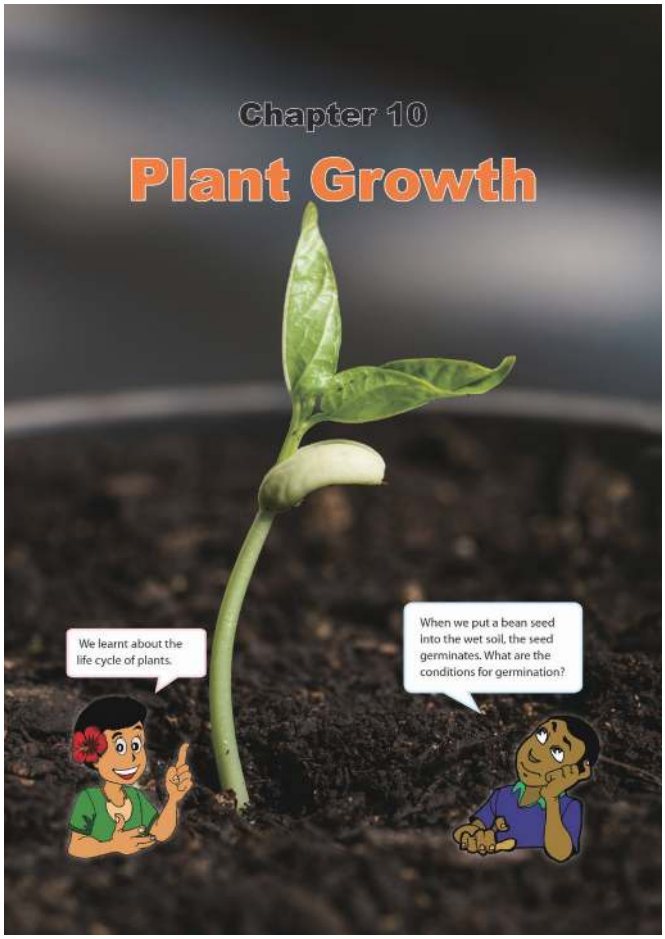
(Expected answer) The giraffe is adapted to the environment by having a very long neck that enables it to reach the leaves at the top of the tree.

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.



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

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.

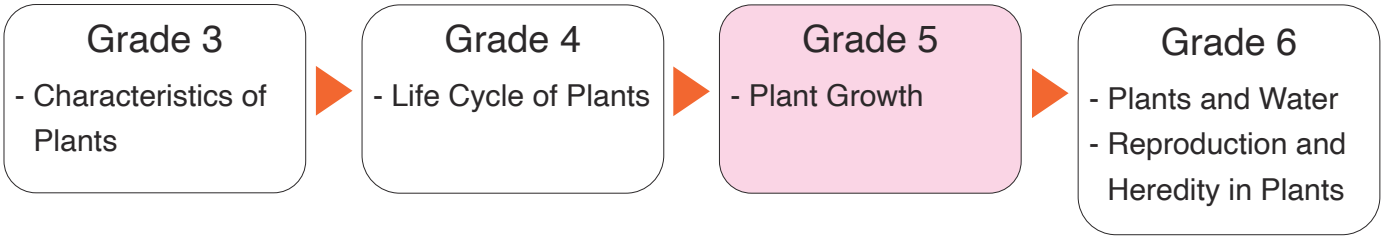
10.2 Needs for Plant Growth

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.

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	**Inside of a Seed** What is the structure of a seed?	5.2.1	163 - 164
	2	**Conditions for Germination 1: Water** Do seeds need water to germinate?		165 - 166
	3	**Conditions for Germination 2: Air** Do seeds need air to germinate?		167 - 168
	4	**Conditions for Germination 3: Temperature** Do seeds need proper temperature to germinate?		169 - 170
	5	Summary and Exercise		171 - 172
10.2 Needs for Plant Growth	6	**Conditions for Plant Growth 1: Water** Do plants need water to grow?		173 - 174
	7	**Conditions for Plant Growth 2: Light** Do plants need light to grow?		175 - 176
	8	**Conditions for Plant Growth 3: Fertiliser** Do plants need fertiliser to grow well?		177 - 178
	9	Summary and Exercise, Science Extra		179 - 181
Chapter Test	10	Chapter Test		182 - 183

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.1. Needs for Seed Germination**	Total lesson No: 68 / 87 Textbook page: 163 - 164

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)

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.	Monocotyledon Single cotyledon when it germinates.

Bean Tomato

Corn

SAFETY

Keep their fingers away from the knife cutting edge.

Lesson Objectives

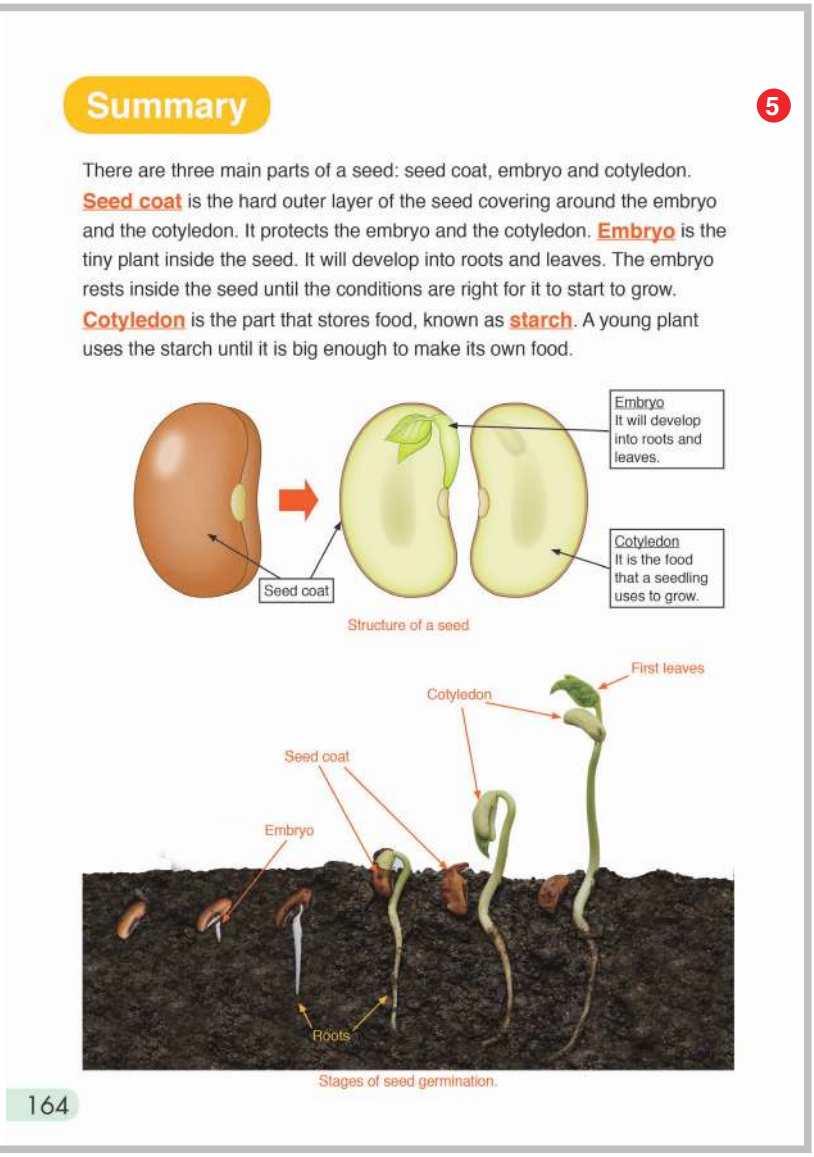
Students will be able to:

- 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

5

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.

Structure of a seed

Stages of seed germination.

164

- 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 textboks 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 a seed coat work?
  Q: Where does the leaf and root grow from?
  Q: Where does the seed gets 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

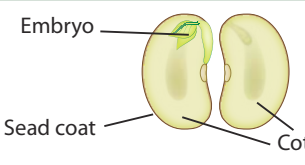
Q: What part of the seed covers the embryo and the cotyledon of the seed? Seed Coat

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 its 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.

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.1. Needs for Seed Germination**	Total lesson No: 69 / 87 Textbook page: 165 - 166

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.)

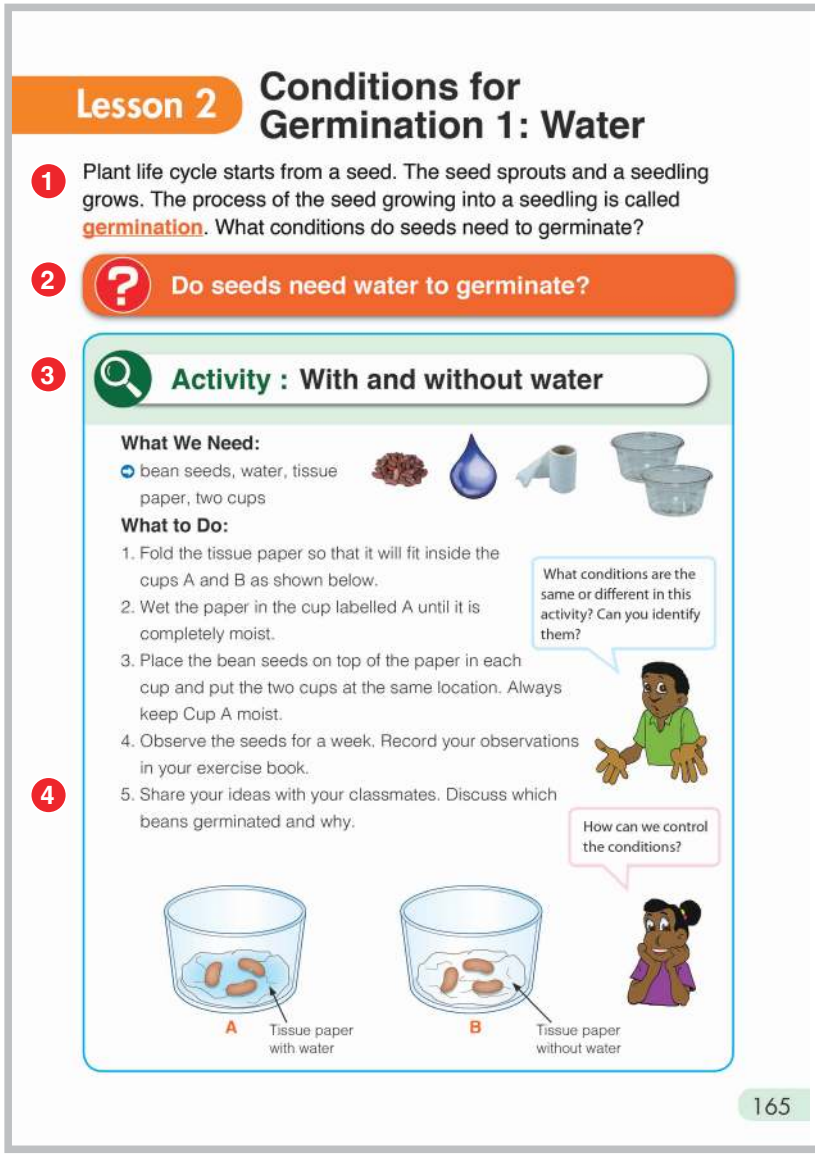
This lesson setup is done together for Lesson 3 Condition for Germination 2: Air and Lesson 4 Condition for Germination 3: Temperature

- 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?

A Tissue paper with water

B Tissue paper without water

165

Teacher's Notes

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

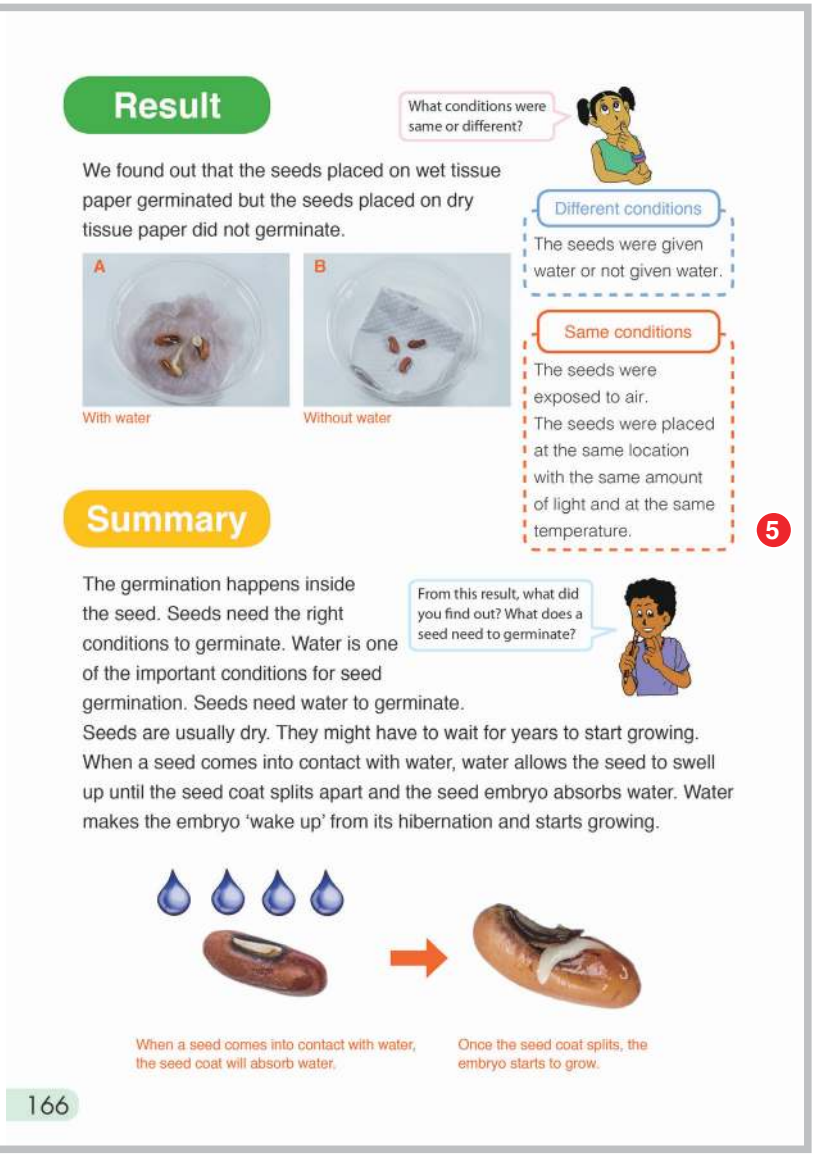
- Teach this lesson only up to the Activity and STOP.
- As soon as the seeds in cup A germinate (around after 2-4 days), then Discussion and Summary can be taught.
- Check every day that the tissue in cup A is moist and the tissue in cup B is dry.
- The cotyledon is the food storage area of the seed. 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.

What conditions were same or different?

A

With water

B

Without water

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.

166

- 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.

Unit	Chapter : **10. Plant Growth**	Total lesson No: 70 / 87
Plants	Topic : **10.1. Needs for Seed Germination**	Textbook page: 167 - 168

Lesson 3 / 10

Lesson Title

Conditions for Germination 2: Air

Preparation

pet bottles or improvised cups

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.

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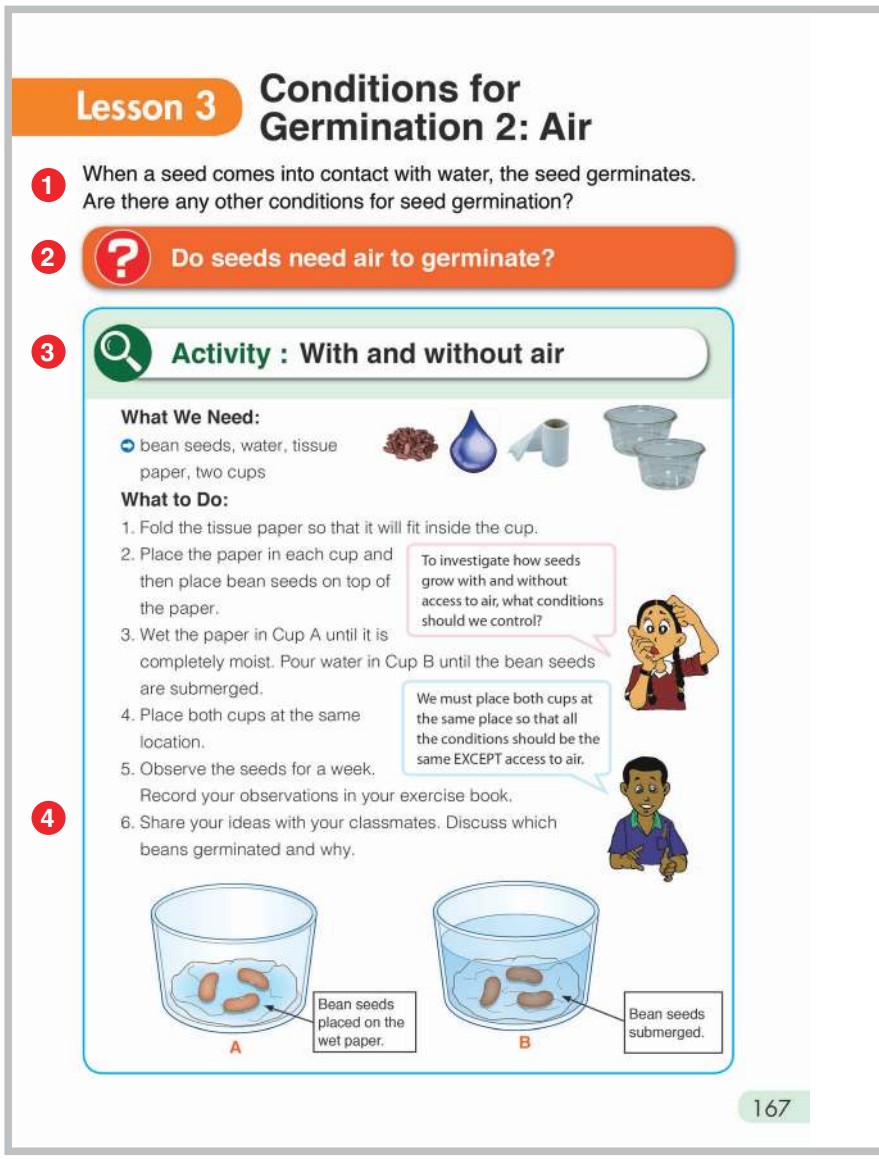


Lesson 3 Conditions for Germination 2: Air

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 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.

4

Bean seeds placed on the wet paper.

Bean seeds submerged.

A B

167

Teacher's Notes

Tips for the Lesson

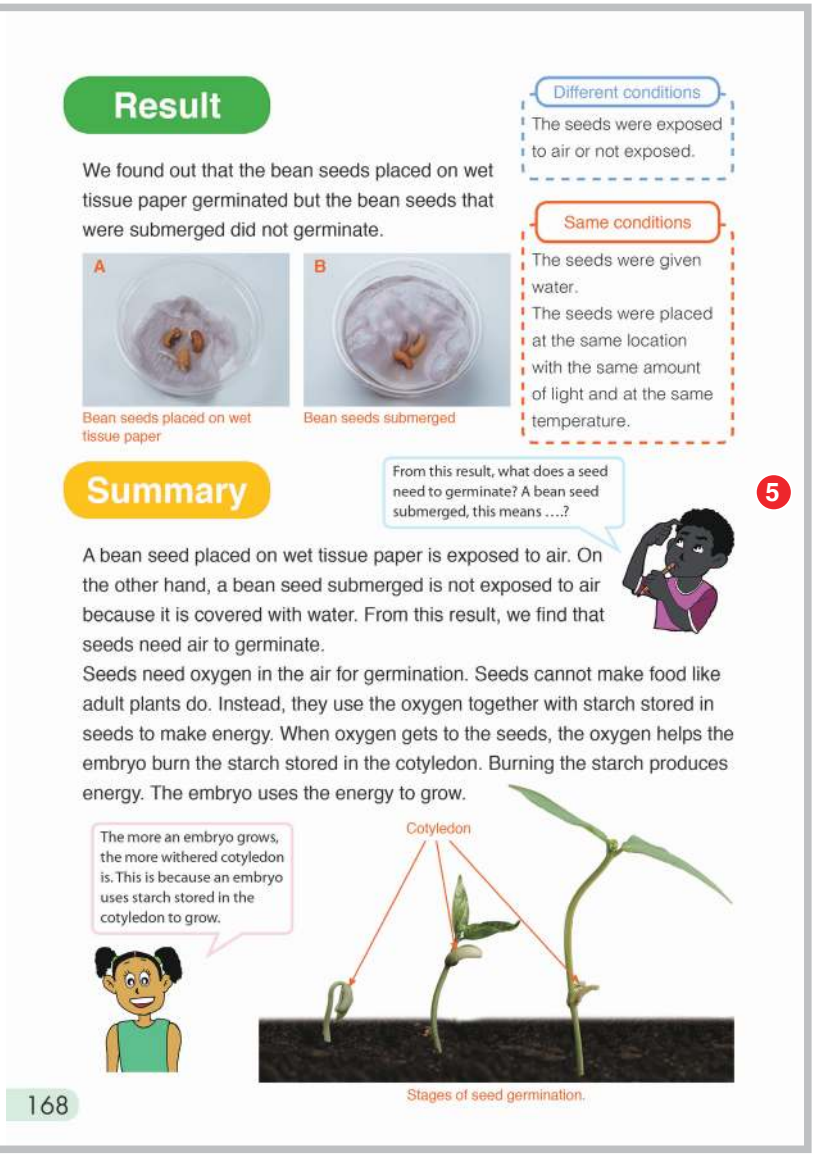
- Seeds cannot breathe in water because they don't have organs like gills for fish to do so. That is the reason as to why water is used as the condition to prevent oxygen from the air to reach the seeds.
- If other seeds other than bean seeds are used in this lesson, make sure you check that they do 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.

A

Bean seeds placed on wet tissue paper

B

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

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

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.

168

- 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.

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.

Unit	Chapter : **10. Plant Growth**	Total lesson No: 71 / 87
Plants	Topic : **10.1. Needs for Seed Germination**	Textbook page: 169 - 170

Lesson 4 / 10

Lesson Title

Conditions for Germination 3: Temperature

Preparation

pet bottles or improvised cups

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 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.

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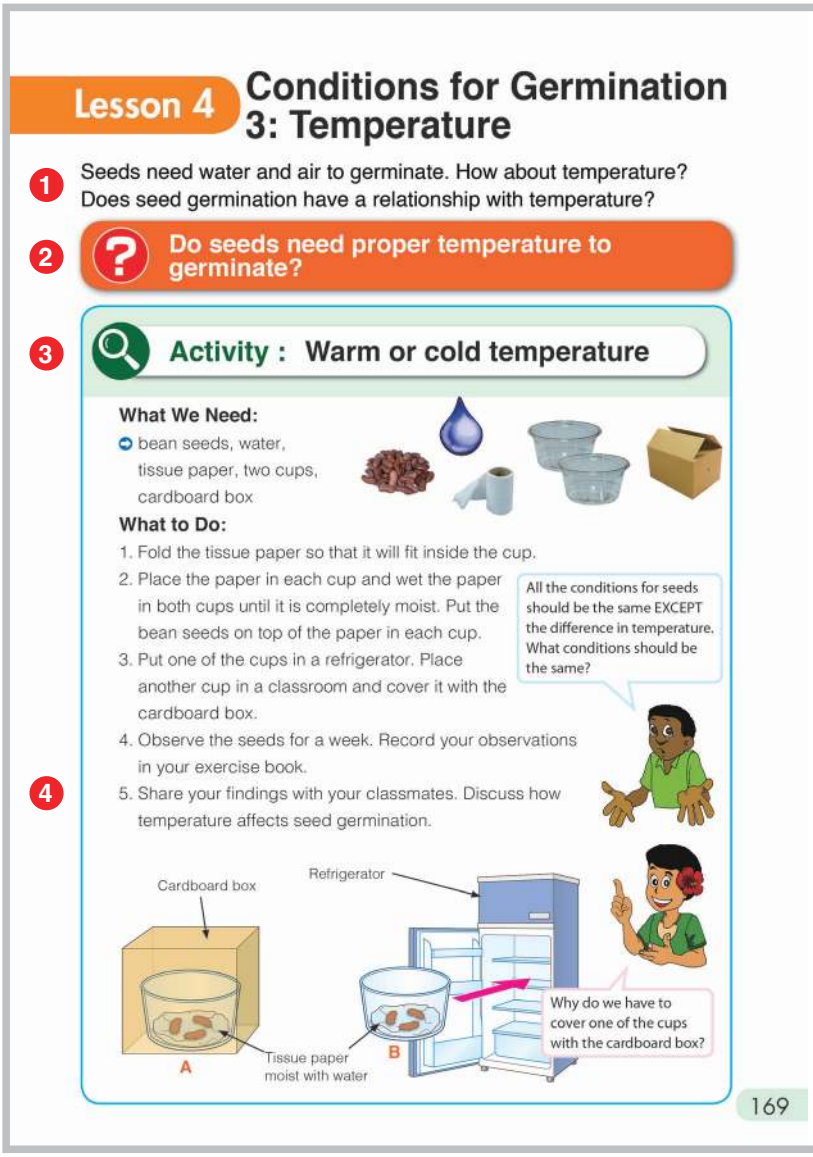


Teacher's Notes

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

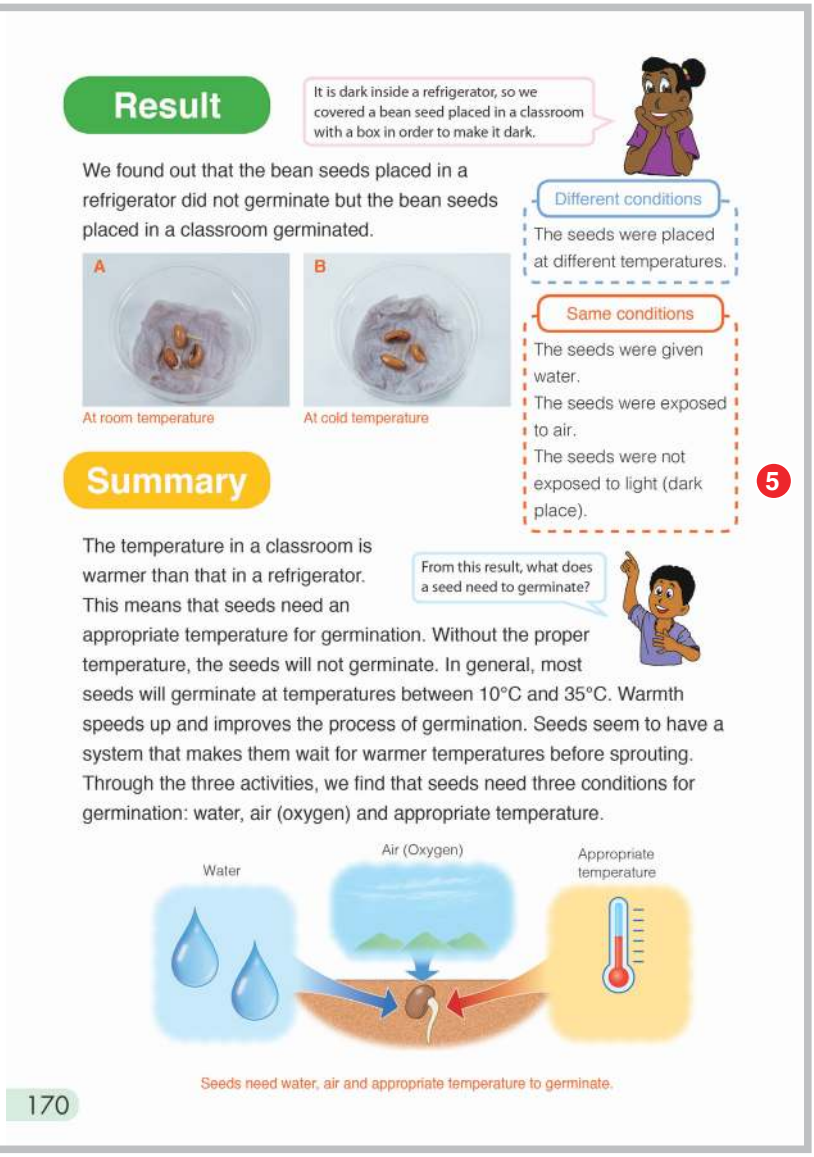
Students will be able to:

- 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 temperture 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.



- 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.

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.1. Needs for Seed Germination**	Total lesson No: 72 / 87 Textbook page: 171 - 172

Lesson 5 / 10

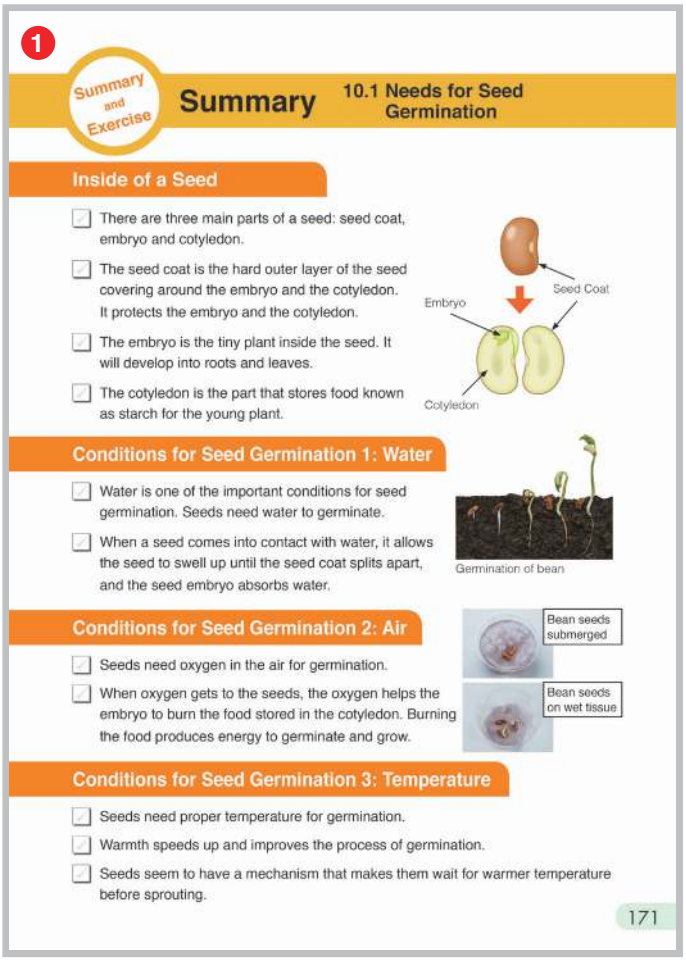
Lesson Title

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.



1

Summary and Exercise

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.

Germination of bean

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.

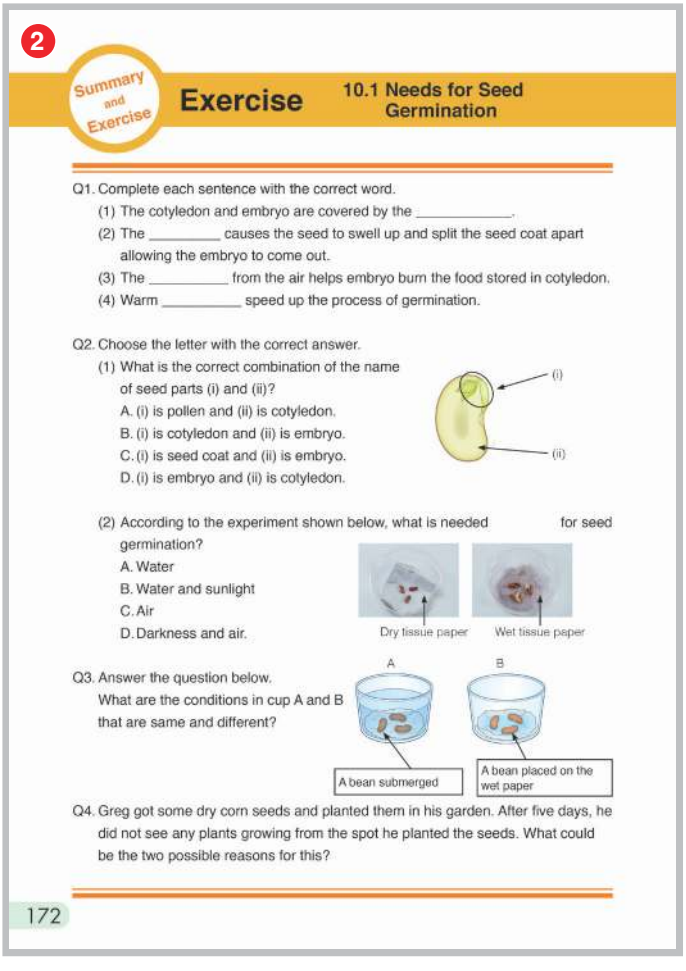
Conditions for Seed Germination 3: Temperature

- 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.

171

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.



2

Summary and Exercise

Exercise 10.1 Needs for Seed Germination

Q1. Complete each sentence with the correct word.

(1) The cotyledon and embryo are covered by the _____.

(2) The _____ causes the seed to swell up and split the seed coat apart allowing the embryo to come out.

(3) The _____ from the air helps embryo burn the food stored in cotyledon.

(4) 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)?

A. (i) is pollen and (ii) is cotyledon.
B. (i) is cotyledon and (ii) is embryo.
C. (i) is seed coat and (ii) is embryo.
D. (i) is embryo and (ii) is cotyledon.

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

A. Water
B. Water and sunlight
C. Air
D. 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?

172

Exercise answers

Q1.
(1) **seed coat**
(2) **water**
(3) **oxygen**
(4) **temperature**

Q2.
(1) **D**
(2) **A**

Q3. Expected answers:
(1) Same Conditions
- **Seeds are given water**
- **Seeds are exposed to light and brightness**
- **Seeds are exposed to same temperature**

(2) Different Conditions
- **A. Seeds are not exposed to air**
- **B. Seeds are exposed to air**

Q4. Expected answers:
- **Seeds didn't germinate because they are not exposed to water, air and proper temperature.**

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.2. Needs for Plant Growth**	Total lesson No: 73 / 87 Textbook page: 173 - 174

Lesson 6 / 10

Lesson Title

Conditions for Plant Growth 1: Water

Preparation

two same sized seedling, two plant pot, water

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.

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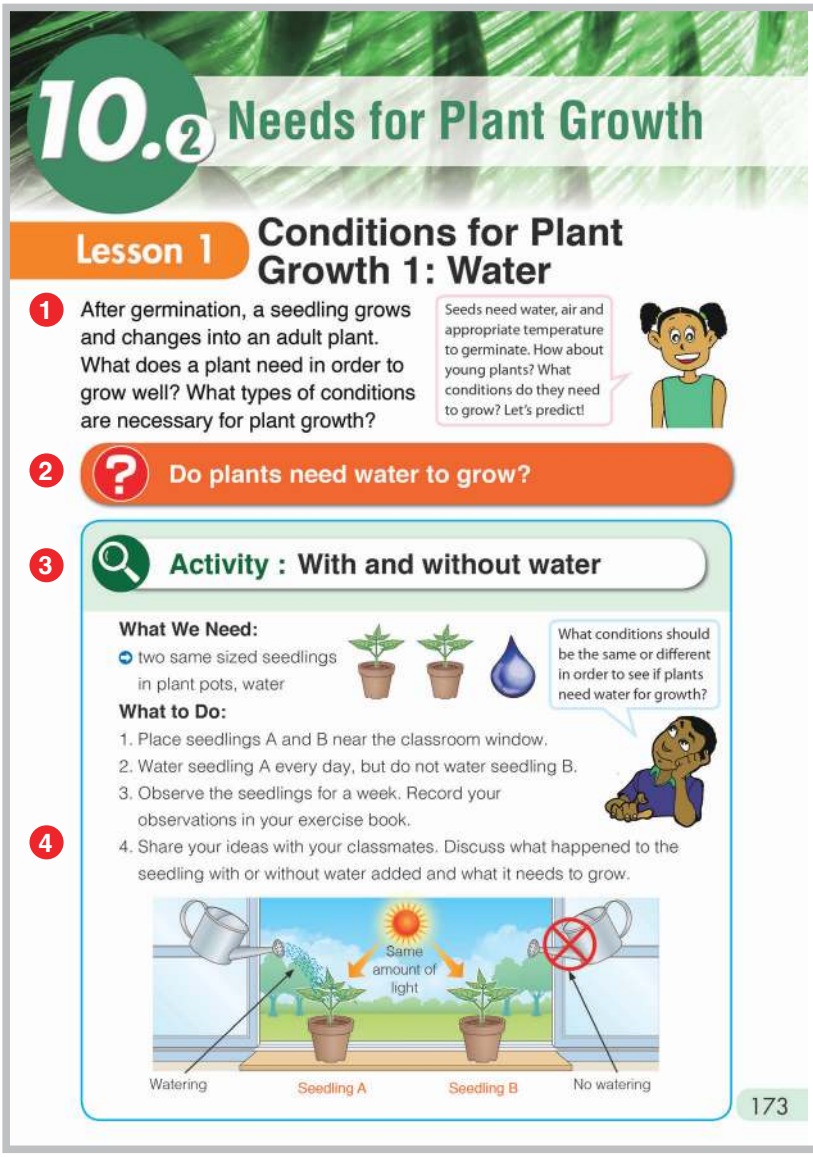


Teacher's Notes

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 is 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 observationsd with their descriptions;
  1. Height of plant (i.e. measurement of the height)
  2. Colour of the leaves (i.e. green, green-yellow, yellow-green, yellow, brown)
  3. Shape of the plant (i.e. growing upright, bending and sloping)
  4. Number of leaves

Lesson Objectives

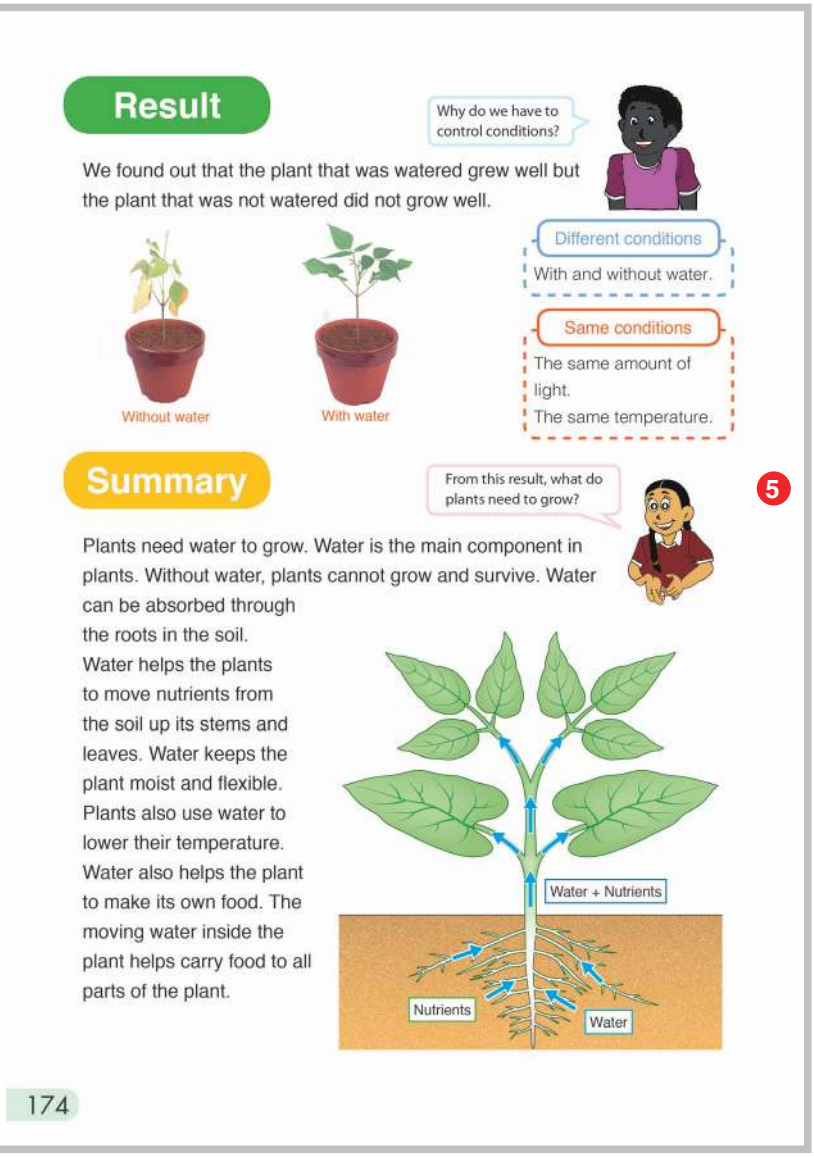
Students will be able to:

- 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

Why do we have to control conditions?

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

Different conditions

With and without water.

Same conditions

The same amount of light.

The same temperature.

Summary

From this result, what do plants need to grow?

5

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.

Water + Nutrients

Nutrients

Water

174

- 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 needs water for growth?
  Q: What condition is necessary for plant growth?
- Ask students to copy the notes on the blackboard into their exercise books.

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.

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.2. Needs for Plant Growth**	Total lesson No: 74 / 87 Textbook page: 175 - 176

Lesson 7 / 10

Lesson Title

Conditions for Plant Growth 2: Light

Preparation

same sized seedling, plant pot, water, card board 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?

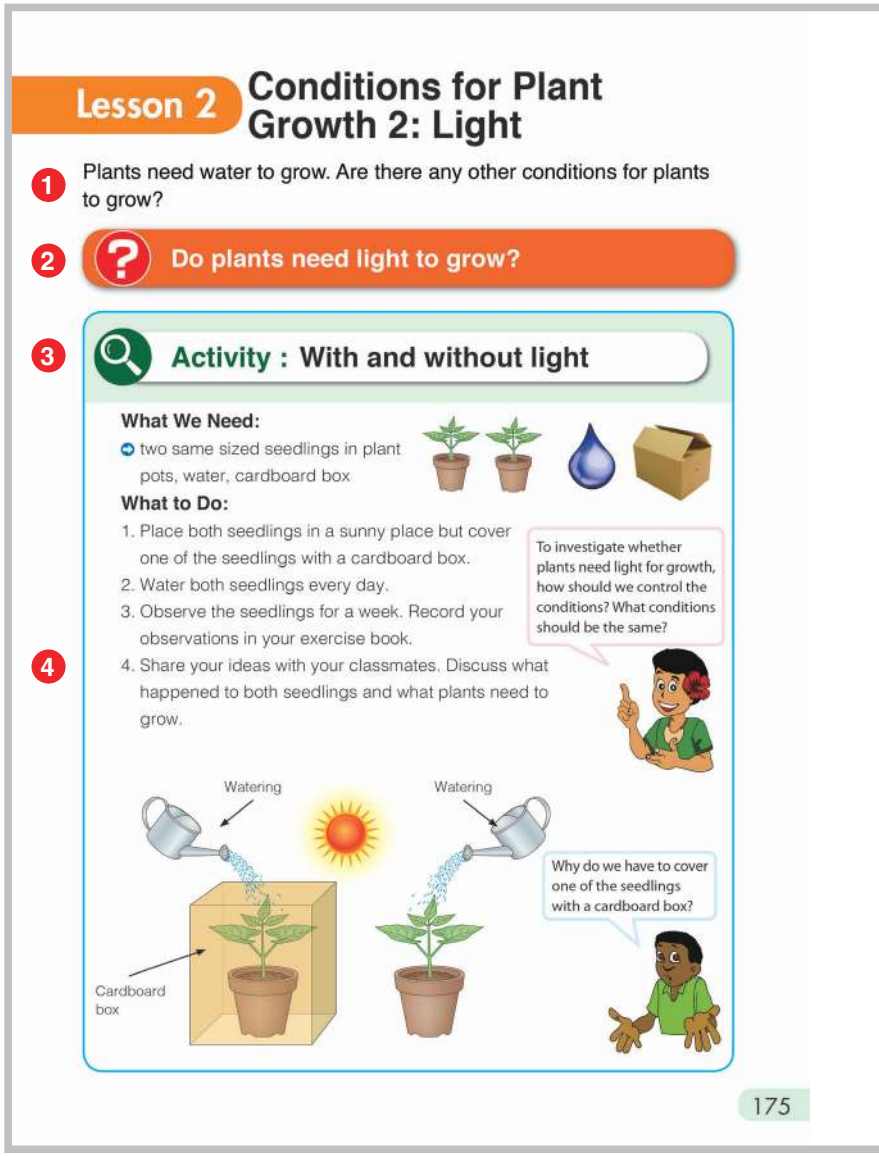
3 Activity (20 min.)

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)



Teacher's Notes

Tips for the lesson

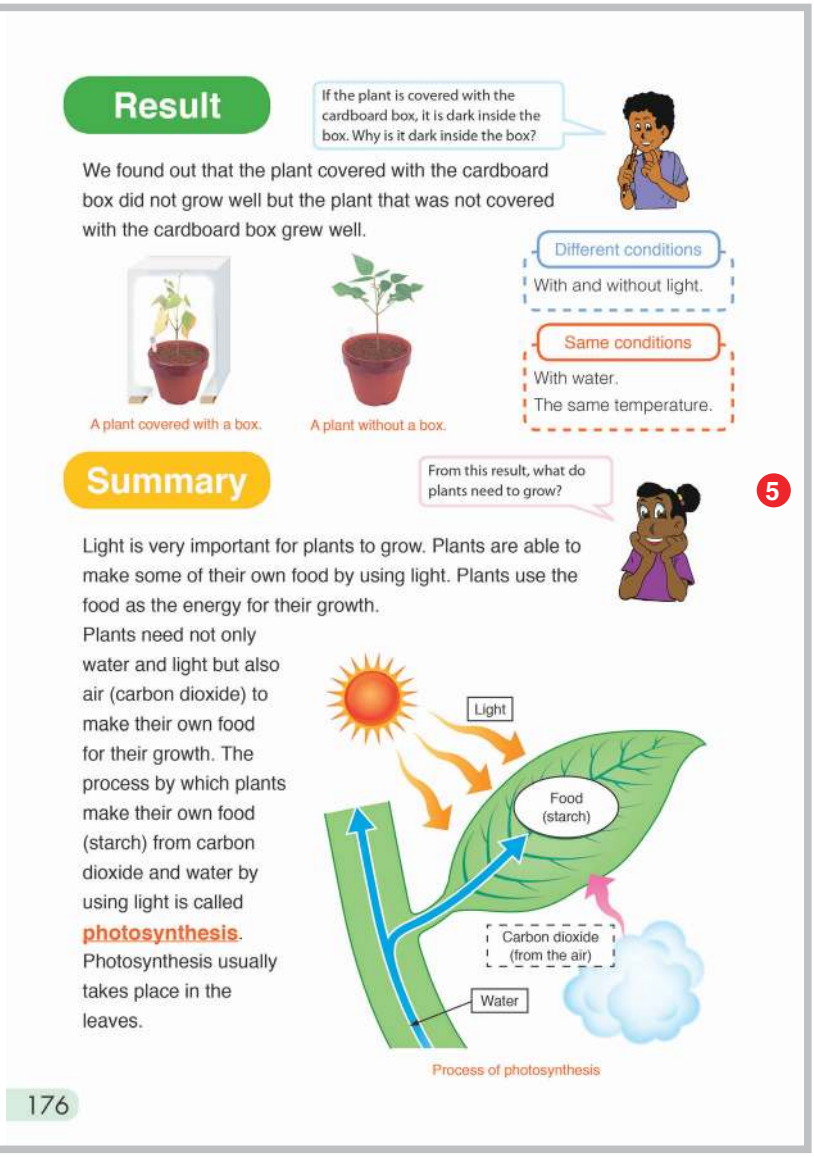
- Students can use the seedlings from the germination experiment, replant it into a plant pot and use it in the experiment.
- Consider that this lesson is quite similar to the previous lesson However the conditions are different.
- If there is a need to improvise with the materials used in the activity 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.
  1. Height of the plant (measurement of the plant height).
  2. Colour of the leaves (dark green, light green, pale green, yellowish green, yellow, yellowish brown).
  3. 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 eargerness to participate in the lesson.



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 needs 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.

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

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.2. Needs for Plant Growth**	Total lesson No: 75 / 87 Textbook page: 177 - 178

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

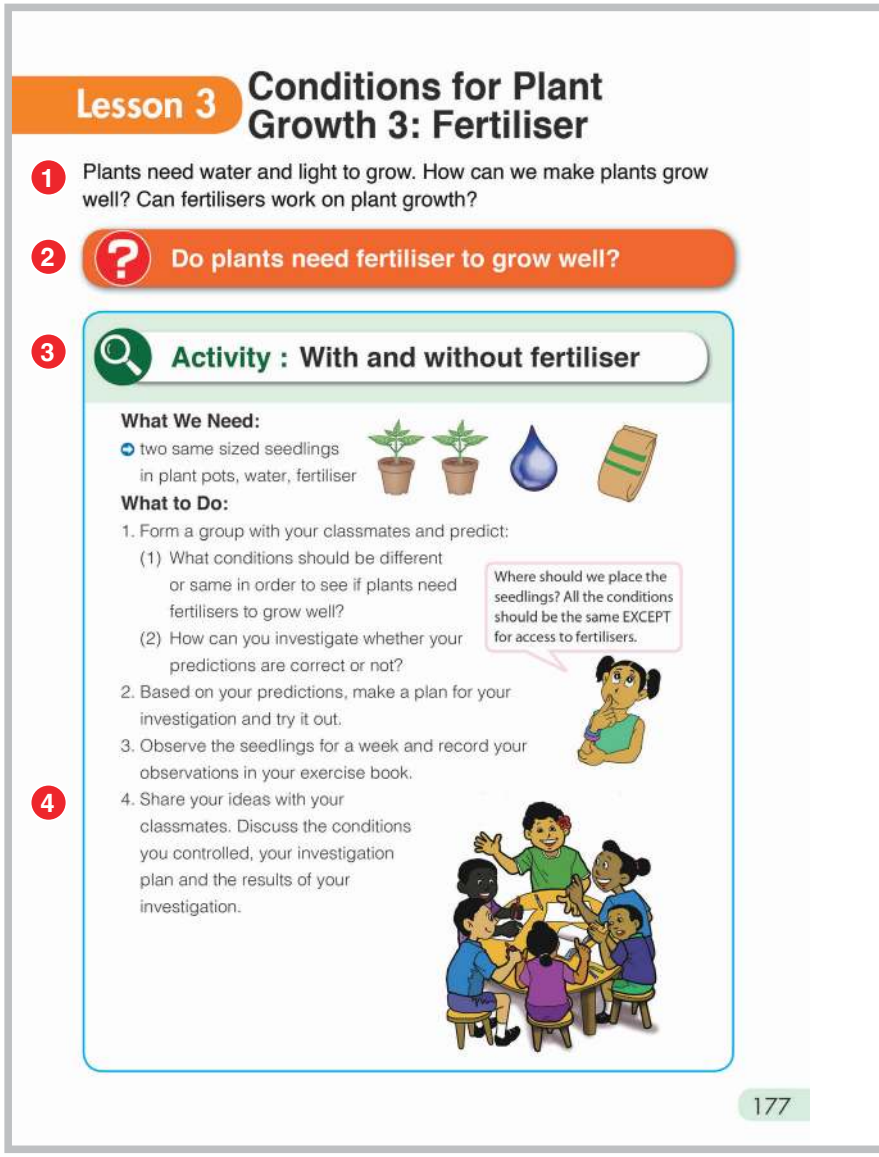
Do plants need fertiliser to grow well?

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:
1. Form a group with your classmates and predict:
(1) What conditions should be different or same in order to see if plants need fertilisers to grow well?
(2) How can you investigate whether your predictions are correct or not?
2. Based on your predictions, make a plan for your investigation and try it out.
3. Observe the seedlings for a week and record your observations in your exercise book.
4. 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.

177

Teacher's Notes

Tips for the lesson

- Consider 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.
  1. Height of the plant (measurement of the plant height).
  2. Colour of the leaves (dark green, light green. Pale green, yellowish green, yellow, yellowish brown).
  3. Size of plant stems (measurement of the diameter).
  4. Number of leaves

Lesson Objectives

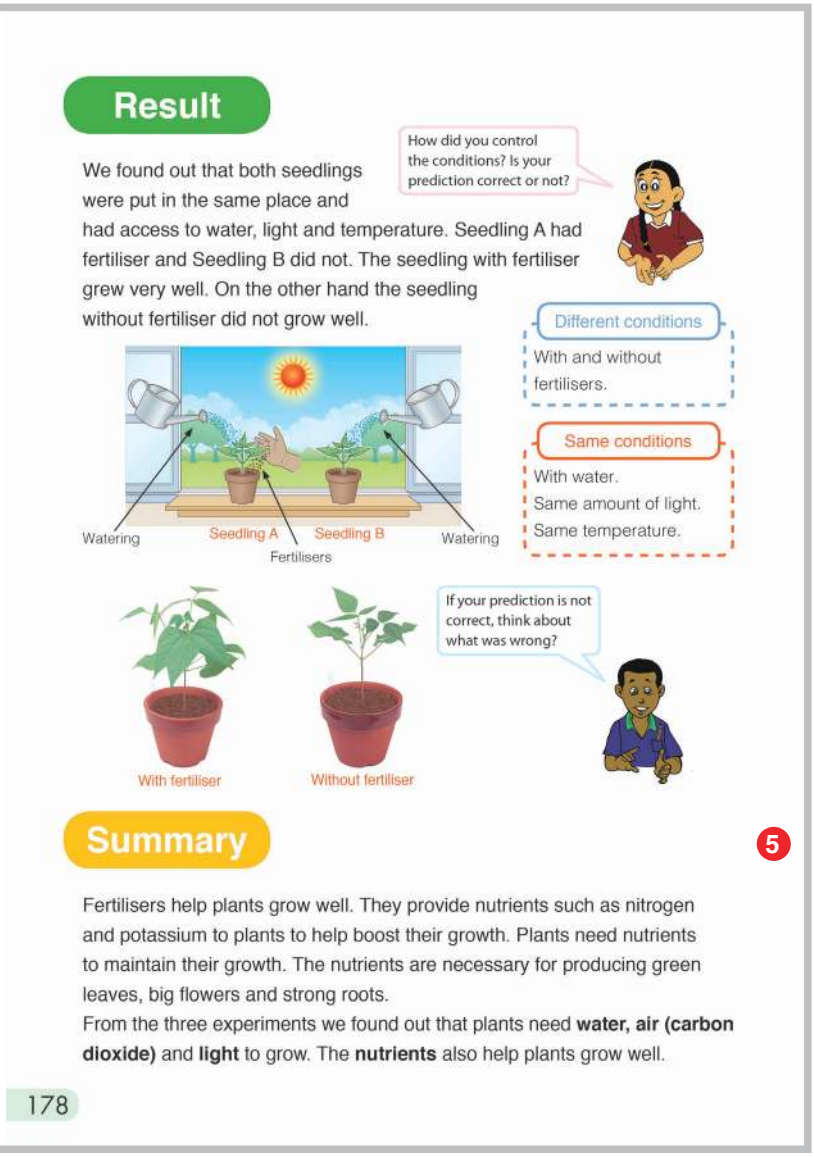
Students will be able to:

- 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

5

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.

178

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 fertiliser 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.

Unit: **Plants**	Chapter : **10. Plant Growth** Topic : **10.2. Needs for Plant Growth**	Total lesson No: 76 / 87 Textbook page: 179 - 181

Lesson 9 / 10

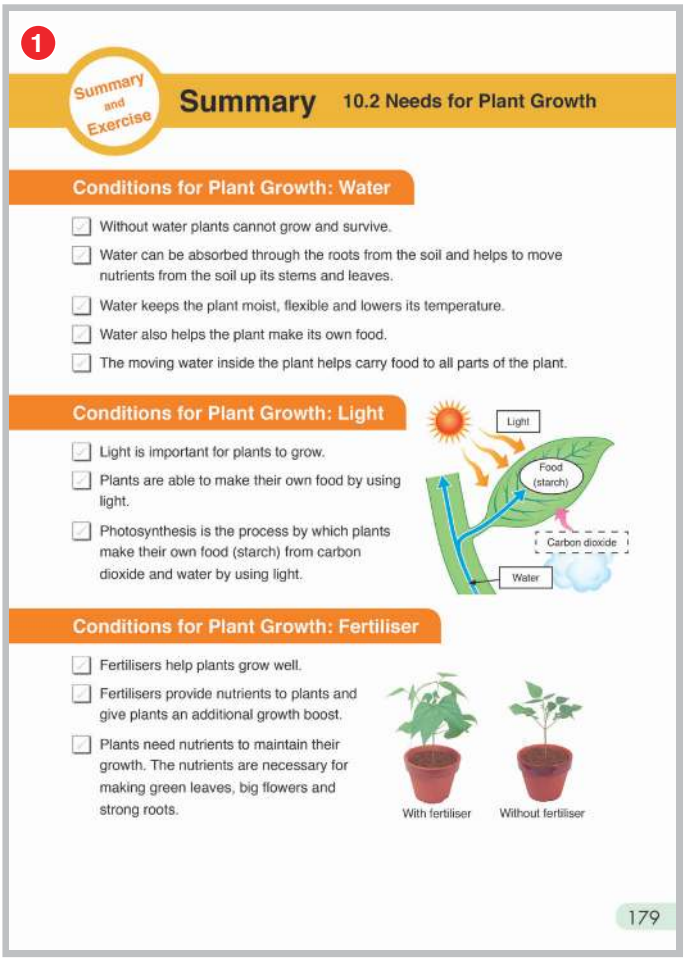
Lesson Title

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.
  - 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 fertiliser 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.



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.

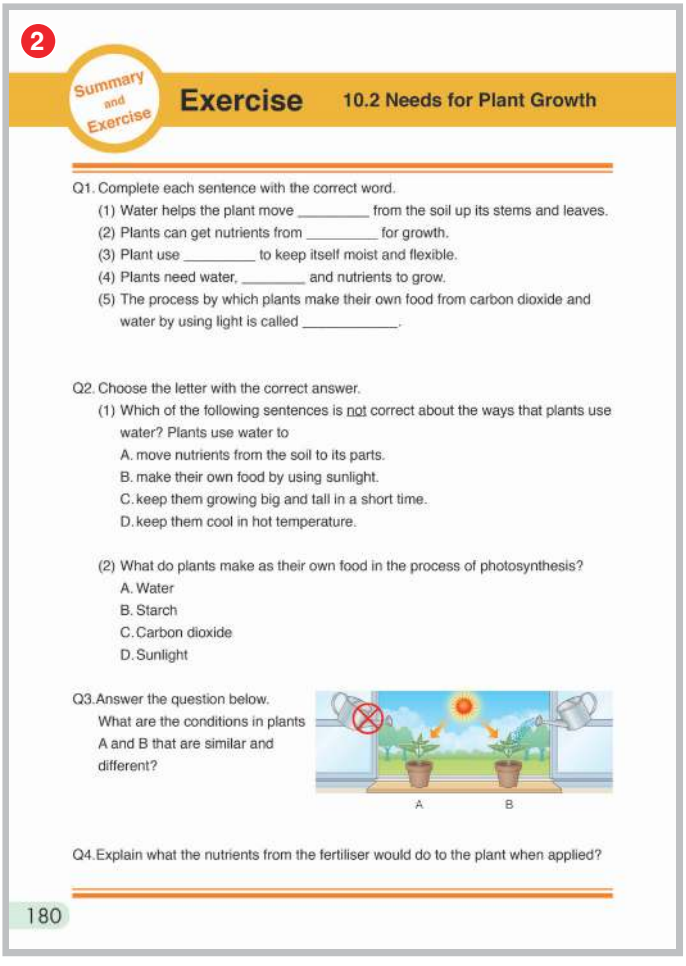
Conditions for Plant Growth: Fertiliser

- 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.

179

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.



2

Summary and Exercise

Exercise 10.2 Needs for Plant Growth

Q1. Complete each sentence with the correct word.

(1) Water helps the plant move _____ from the soil up its stems and leaves.
(2) Plants can get nutrients from _____ for growth.
(3) Plant use _____ to keep itself moist and flexible.
(4) Plants need water, _____ and nutrients to grow.
(5) 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.

(1) Which of the following sentences is not correct about the ways that plants use water? Plants use water to
A. move nutrients from the soil to its parts.
B. make their own food by using sunlight.
C. keep them growing big and tall in a short time.
D. keep them cool in hot temperature.

(2) What do plants make as their own food in the process of photosynthesis?
A. Water
B. Starch
C. Carbon dioxide
D. 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?

180

Exercise answers

Q1.
(1) **nutrients**
(2) **fertiliser**
(3) **water**
(4) **sunlight**
(5) **photosynthesis**

Q2.
(1) **C**
(2) **B**

Q3. Expected answers:
(1) Same 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.

3

Chapter 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 variaties 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.

181

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.

182

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.

Bean seeds placed on the wet paper.

Bean seeds submerged.

(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.

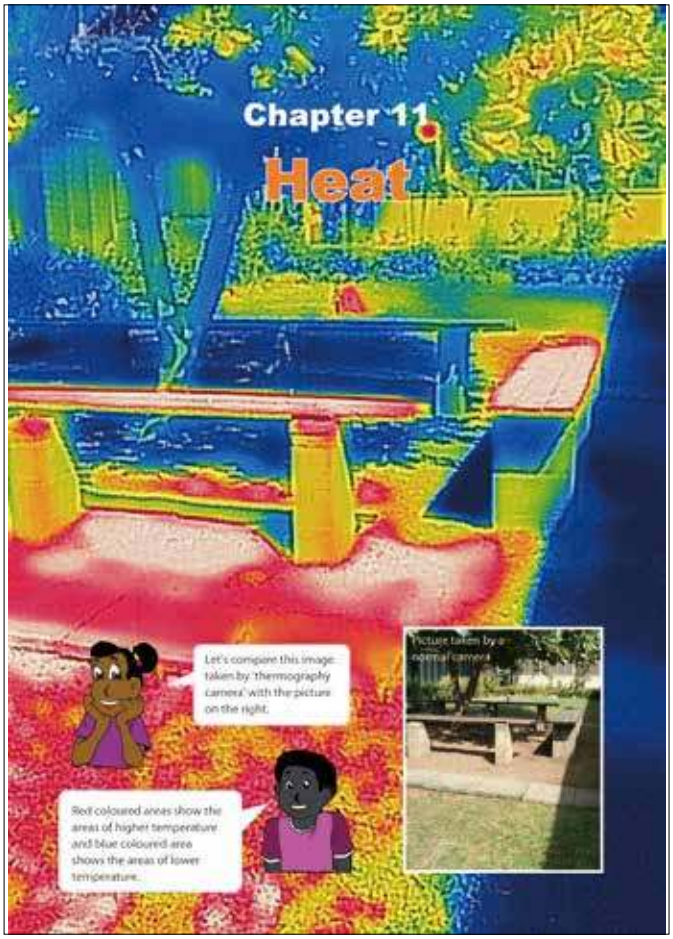
(2) Ambai observed that the seeds that were moisted and placed in an appropriate temperature and exposed air germinated. If she wants to keep the remaining seeds for the following year, how should she store the seeds? Write two ways to prevent the seeds from germinating.

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

Chapter 11. Heat

Chapter Objectives

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



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.

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.

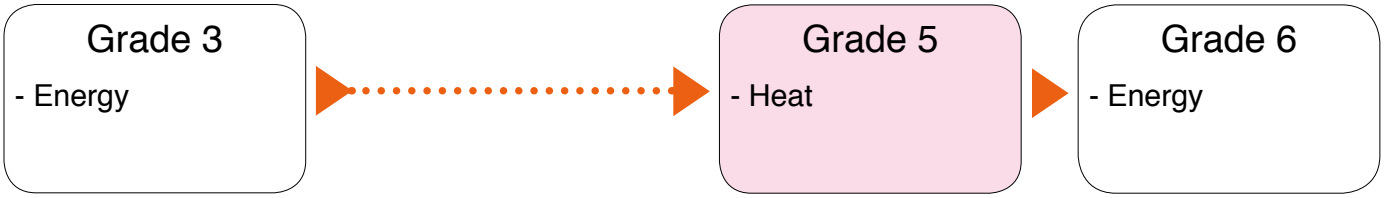
11.2 Heat Transfer

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.

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	**What is Heat** What makes objects hot or cold?	5.1.1	185 - 186
	2	**Sources of Heat** What are the sources that produce heat?		187 - 188
	3	**Uses of Heat** What is heat used for?		189 - 190
	4	**Temperature** What is temperature?		191 - 192
	5	Summary and Exercise		193 - 194
11.2 Heat Transfer	6	**Heat transfer 1: Conduction** How does heat transfer?		195 - 196
	7	**Heat transfer 2: Convection** How does heat transfer in liquids and gases?		197 - 198
	8	**Heat transfer 3: Radiation** What is another way of heat transfer?		199 - 200
	9	Summary and Exercise, Science Extra		201 - 203
Chapter Test	10	Chapter Test		204 - 205

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.1. Properties of Heat**	Total lesson No: 78 / 87 Textbook page: 185 - 186

Lesson 1 / 10

Lesson Title

What is Heat?

Preparation

cup of warm water, ice cube

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.
- Faciliate active students' discussions.
- Confirm the results with the students.

(Continue)

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 transfered
- 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.

- **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 transfered? (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 transfered? 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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.1. Properties of Heat**	Total lesson No: 79 / 87 Textbook page: 187 - 188

Lesson 2 / 10

Lesson Title

Sources of Heat

Preparation

nil

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?

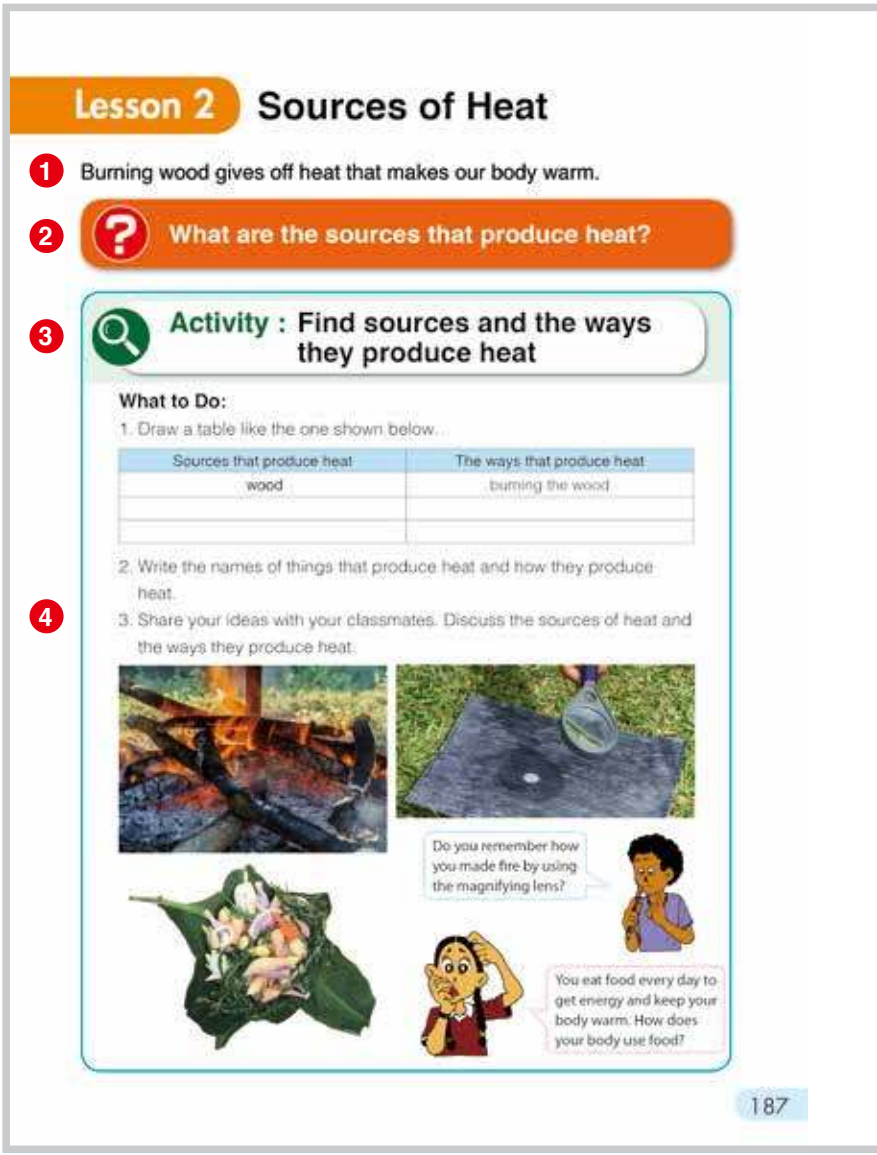
3 Activity (20 min.)

- 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)



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

5

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.

188

- **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 are the sources 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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.1. Properties of Heat**	Total lesson No: 80 / 87 Textbook page: 189 - 190

Lesson 3 / 10

Lesson Title

Uses of Heat

Preparation

nil

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?

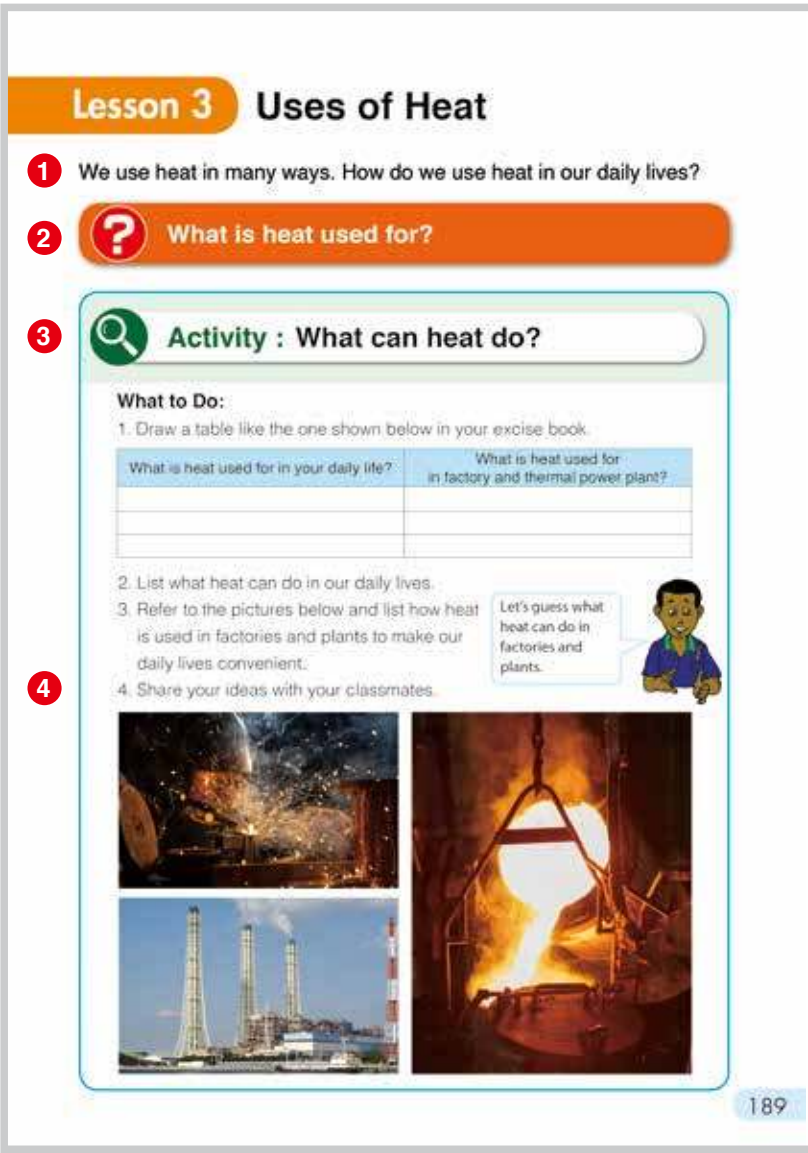
3 Activity (20 min.)

- 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)



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

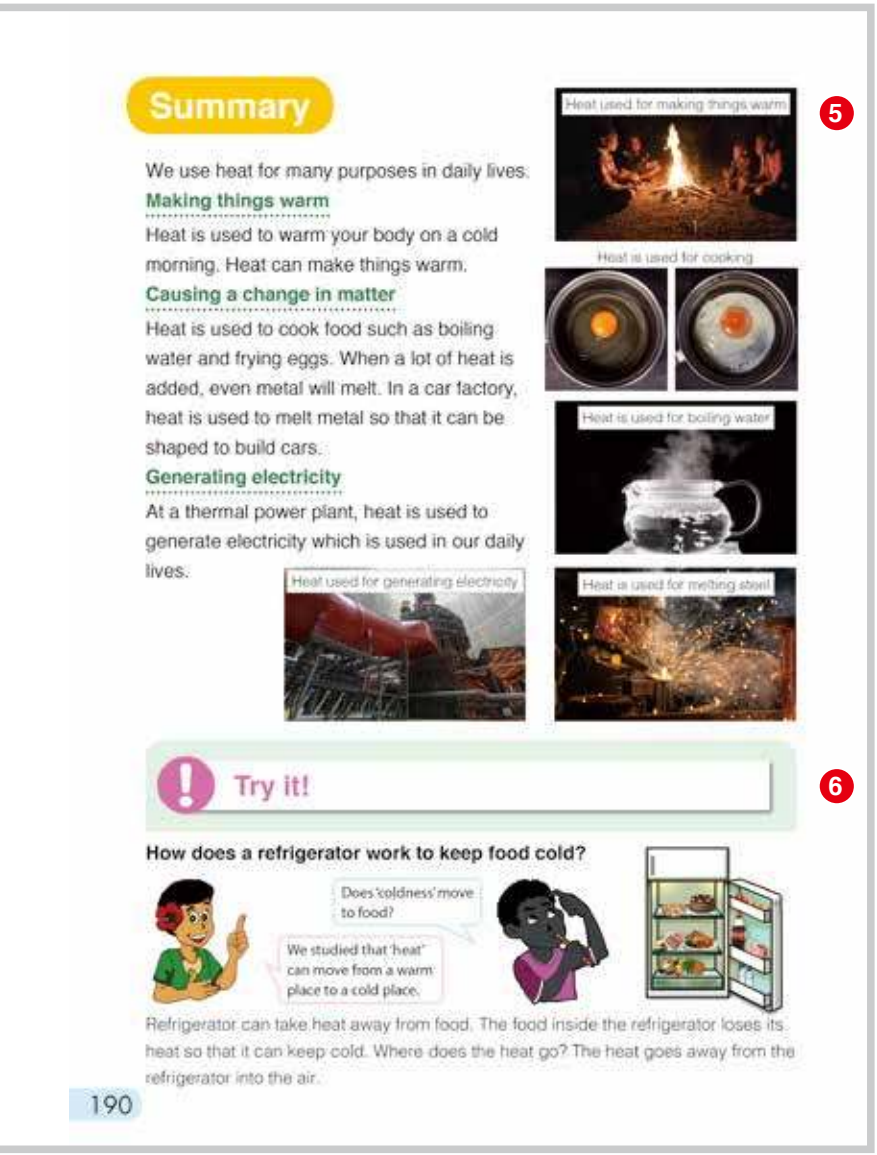
Factories	Food	To bake biscuits, bread, cakes etc
	Clothing	Use heat to wash, dye cloth and dry before packing
	Metal	Melt the metals and make different shapes of metal for different purposes
Constructions	Road constructions	Heat is used to make sealed roads- track marker or steam roller, tar laying
	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.

5

Try it!

6

How does a refrigerator work to keep food cold?

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.

190

- **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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.1. Properties of Heat**	Total lesson No: 81 / 87 Textbook page: 191 - 192

Lesson 4 / 10

Lesson Title

Temperature

Preparation

thermometer, warm water, cold water

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:

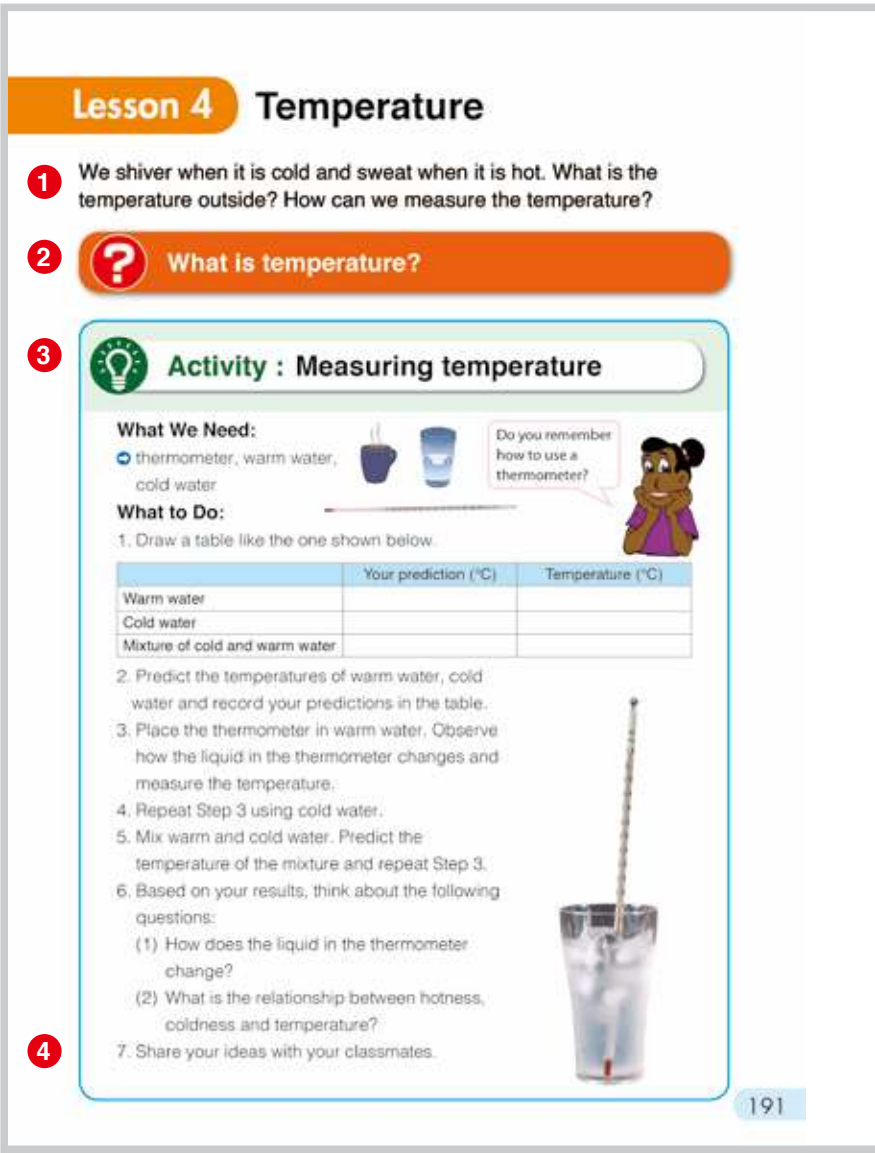
Q:Are temperature and heat the same or different?

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 experiements
- 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.

4

191

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

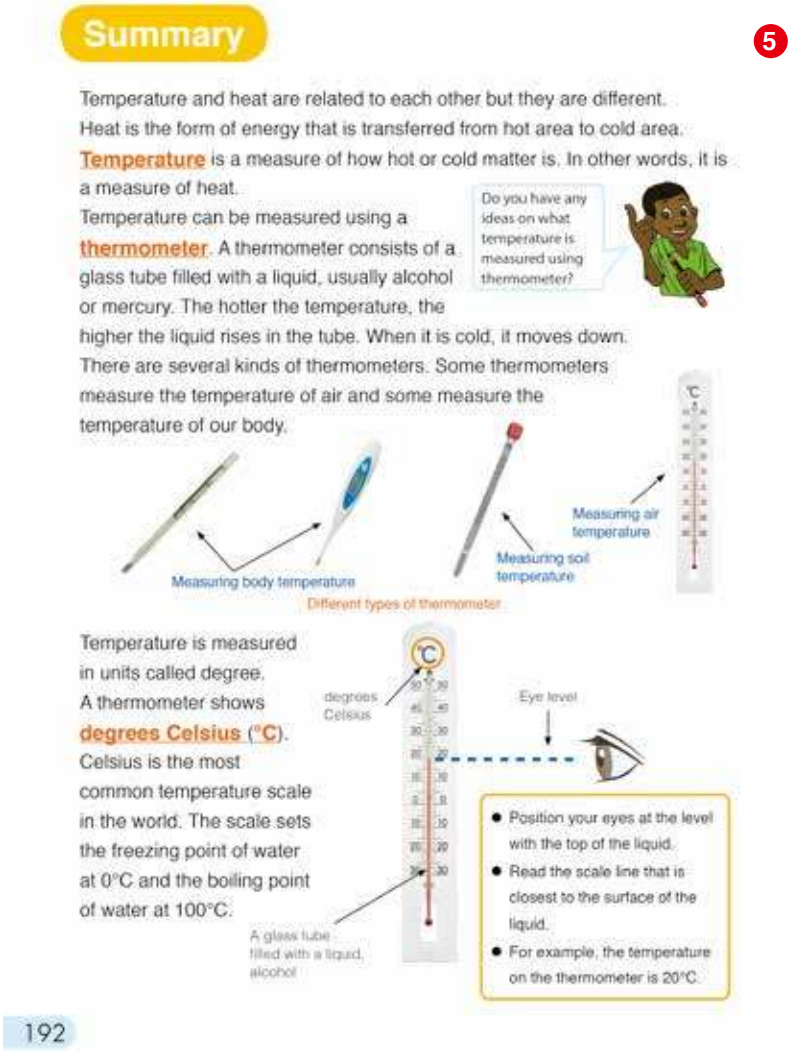
- Provide the equipment for each group in a tray or a box if there are sufficient materials prior to the lesson.
- Warm water should be used for the activity. Cold water provided should be refrigerated water. When warm and cold water are mixed the result should show a big difference in the temperature. 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 (°C).
- Explain what temperature is in relations to heat.



Summary

5

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.

Do you have any ideas on what temperature is measured using thermometer?

Measuring body temperature

Measuring soil temperature

Measuring air temperature

Different types of thermometer

Temperature is measured in units called degree. A thermometer shows degrees Celsius (°C). Celsius is the most common temperature scale in the world. The scale sets the freezing point of water at 0°C and the boiling point of water at 100°C.

degrees Celsius

Eye level

- Position your eyes at the level with the top of the liquid.
- Read the scale line that is closest to the surface of the liquid.
- For example, the temperature on the thermometer is 20°C.

A glass tube filled with a liquid, alcohol

192

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 (°C)	Temperature (°C)
Warm water		
Cold water	Write answers from students.	
Mixture of cold and warm water		

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 (°C).

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.1. Properties of Heat**	Total lesson No: 82 / 87 Textbook page: 193 - 194

Lesson 5 / 10

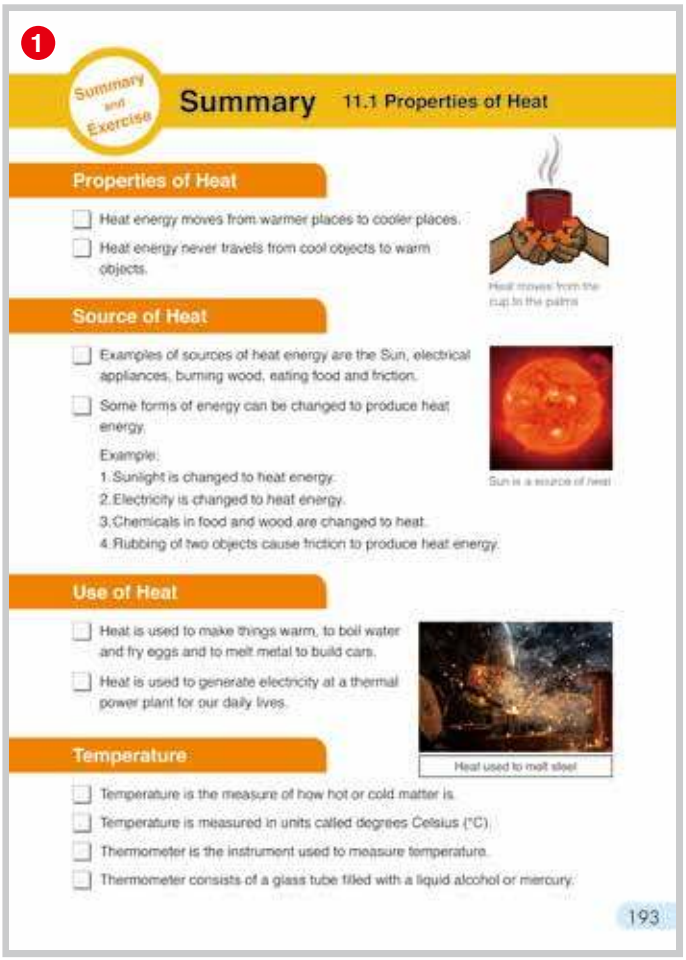
Lesson Title

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.
  - 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.



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:
1. Sunlight is changed to heat energy.
2. Electricity is changed to heat energy.
3. Chemicals in food and wood are changed to heat.
4. 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

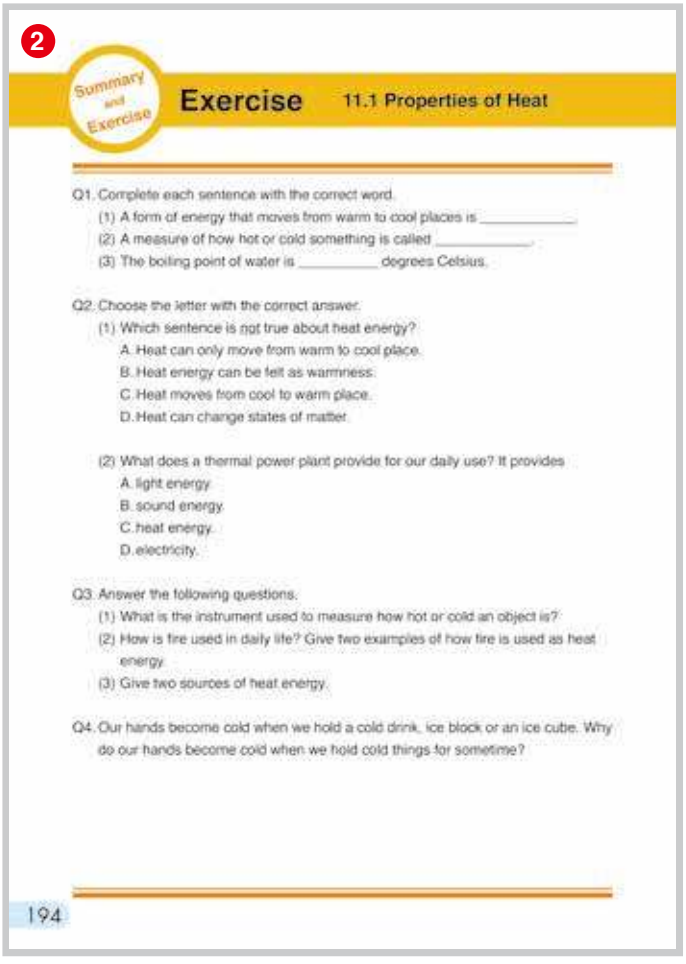
Temperature

- 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.

193

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.



2

Summary and Exercise

Exercise 11.1 Properties of Heat

Q1. Complete each sentence with the correct word.
(1) A form of energy that moves from warm to cool places is _____.
(2) A measure of how hot or cold something is called _____.
(3) The boiling point of water is _____ degrees Celsius.

Q2. Choose the letter with the correct answer.
(1) Which sentence is not true about heat energy?
A. Heat can only move from warm to cool place.
B. Heat energy can be felt as warmness.
C. Heat moves from cool to warm place.
D. Heat can change states of matter.

(2) What does a thermal power plant provide for our daily use? It provides
A. light energy.
B. sound energy.
C. heat energy.
D. electricity.

Q3. Answer the following questions.
(1) What is the instrument used to measure how hot or cold an object is?
(2) How is fire used in daily life? Give two examples of how fire is used as heat energy.
(3) 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?

194

Exercise answers

Q1.
(1) **heat**
(2) **temperature**
(3) **100 °C (degree Celsius)**

Q2.
(1) **C**
(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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.2. Heat Transfer**	Total lesson No: 83 / 87 Textbook page: 195 - 196

Lesson 6 / 10

Lesson Title

Heat Transfer 1: Conduction

Preparation

metal spoon, margarine
a cup of hot water (~60 °C)

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 studnets' discussions.
- Confirm the results with the students.

(Continue)

Teacher's Notes

Tips for the Activity

1. Heat can be transferred with hot water quickly, but it should not be too high (~60 °C) to avoid burns.
2. 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 warmness of each part.

SAFETY

1. Be careful when touching the part dipped in hot water because it would be hot.
2. Hot water should be carefully poured into the cup to avoid it from spilling or getting burnt.

Background information

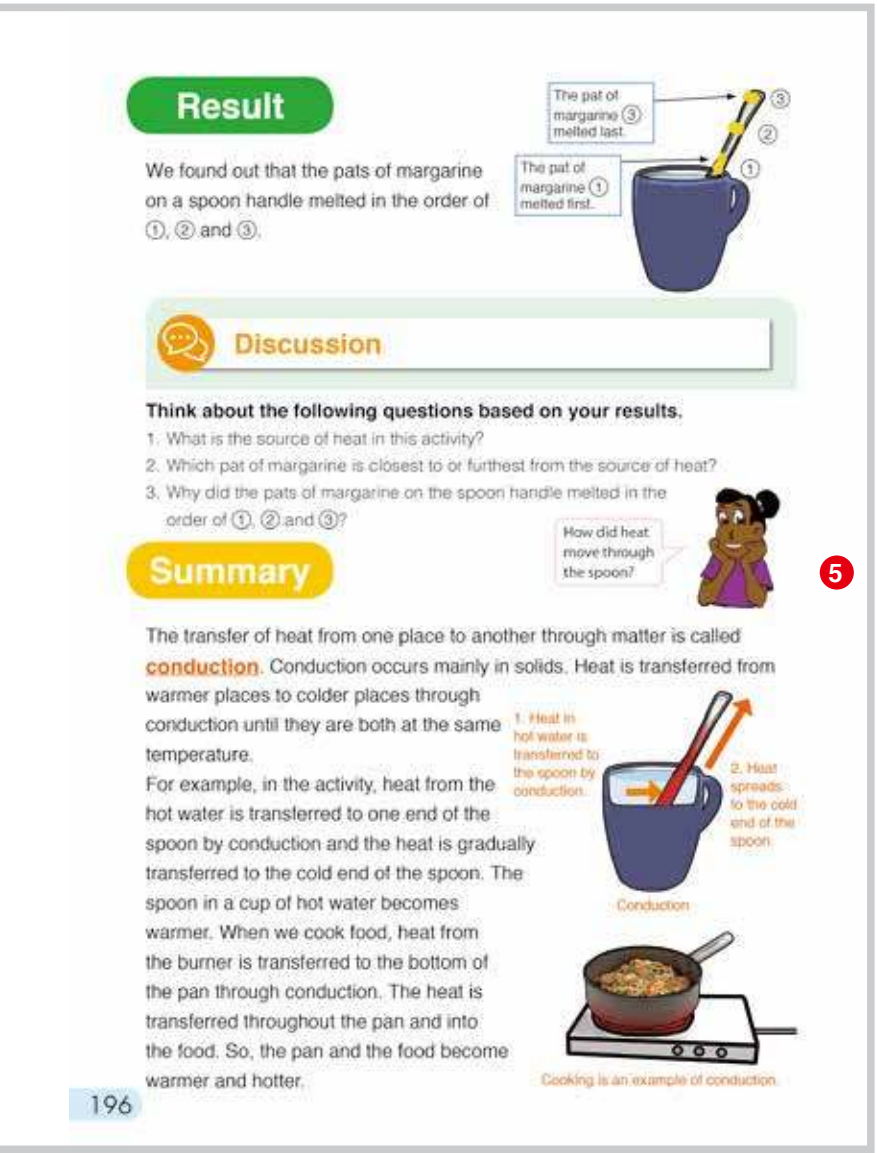
Conduction occurs when two objects at different temperatures are in contact with each other. Heat flows from the warmer to the cooler object until they are both at the same temperature. Some substances conduct heat more easily than others. Solids are better conductors than liquids and liquids are better 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.

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?

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.

Conduction

Cooking is an example of conduction.

196

- **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 ①and 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.)

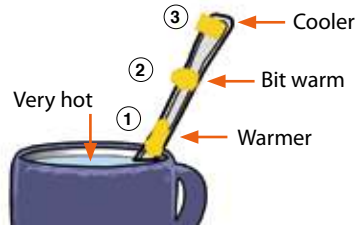
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is conduction?
  Q: How is heat transferred through conduction?
- Ask students to copy the notes on the blackboard into their exercise books.

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 become 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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.2. Heat Transfer**	Total lesson No: 84 / 87 Textbook page: 197 - 198

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

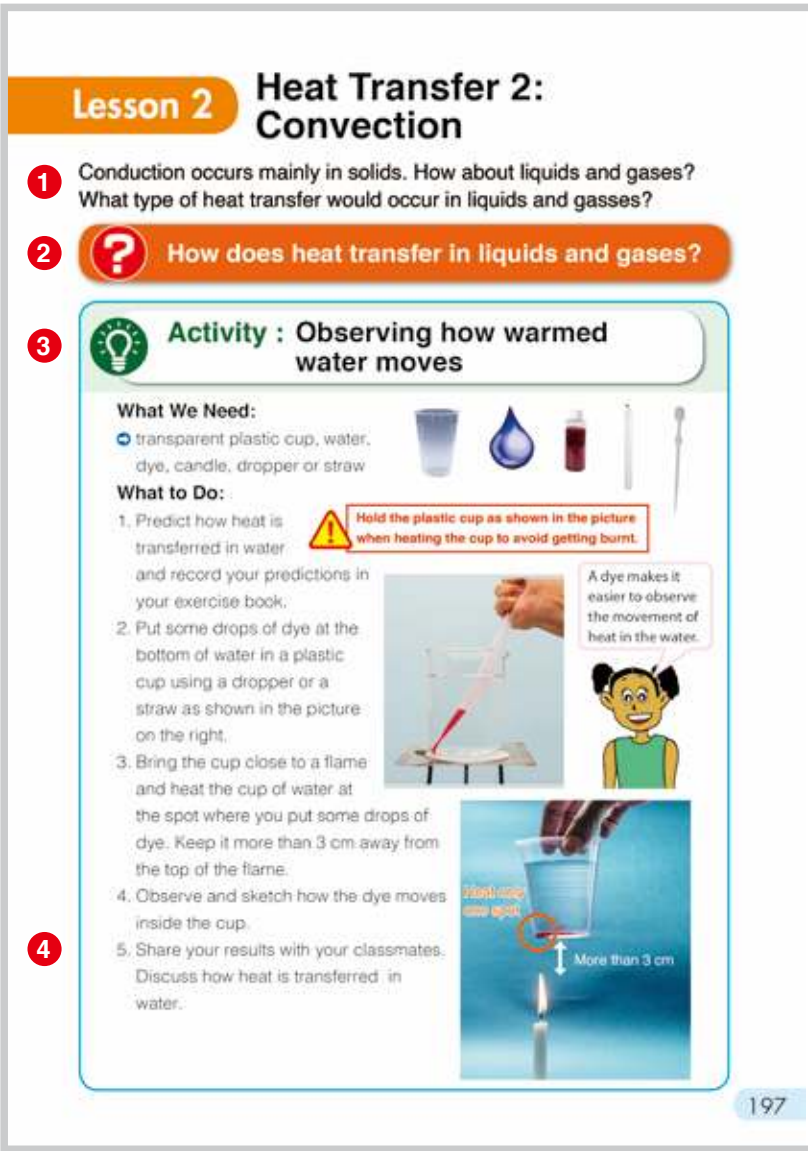
How does heat transfer in liquids and gases?

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 waterand record their predictions in their exercise books.
- Advice 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:
1. Predict how heat is transferred in water and record your predictions in your exercise book.
2. 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.
3. 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.
4. Observe and sketch how the dye moves inside the cup.
5. Share your results with your classmates. Discuss how heat is transferred in water.

Hold the plastic cup as shown in the picture when heating the cup to avoid getting burnt.

A dye makes it easier to observe the movement of heat in the water.

More than 3 cm

4

197

Teacher's Notes

Tips for the Activity

1. Make sure the water is steady before putting in the dye.
2. If a straw or dropper is to used get a small amount of dye and make sure to place it in gently to avoid the water from moving.
3. Wait for the dye to settle properly at the base of the cup on one side before putting it over the candle flame.
4. 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.

SAFETY

1. Make sure to place the cup more than 3 cm above the flame.
2. Hold the cup at the top of it to avoid getting burnt.
3. Blow the candle off after the experiment.

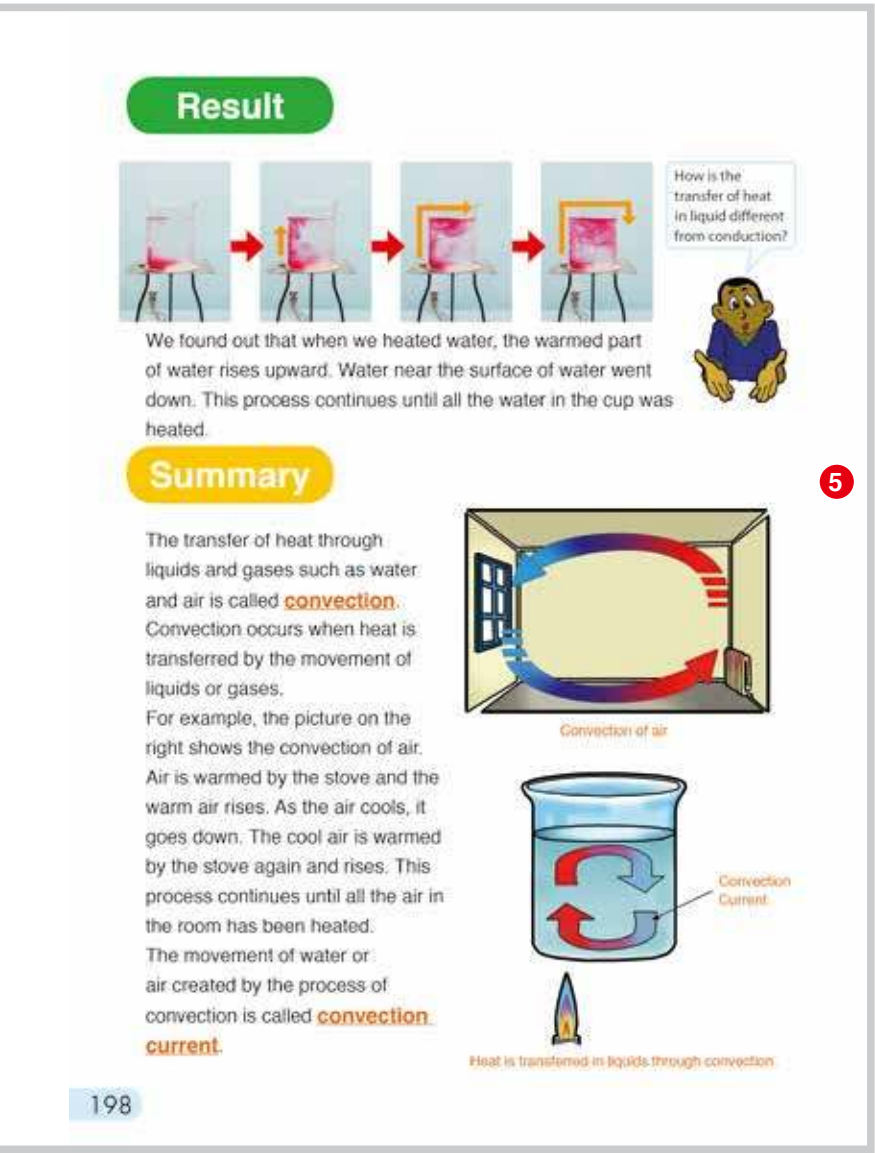
- Convection occurs when heat is transferred through a gas or liquid by the hotter material moving into a cooler area.
- Convection occurs when particles with a lot of heat energy in a liquid or gas move and take the place of particles with less heat energy. Liquids and gases expand when they are heated. This is because the particles in liquids and gases move faster when they are heated than they do when they are cold.

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

Heat is transferred in liquids through convection

198

- Write their results on the blackboard.
- Faciliate 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 up to the top part of the water.)

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.

Sample Blackboard Plan

Title:

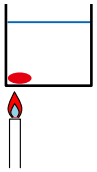
Heat Transfer 2: Convection

Key question

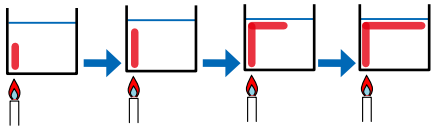
How does heat transfer in liquids and gases?

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 up to the top part of the water.

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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.2. Heat Transfer**	Total lesson No: 85 / 87 Textbook page: 199 - 200

Lesson 8 / 10

Lesson Title

Heat Transfer 3: Radiation

Preparation

nil

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

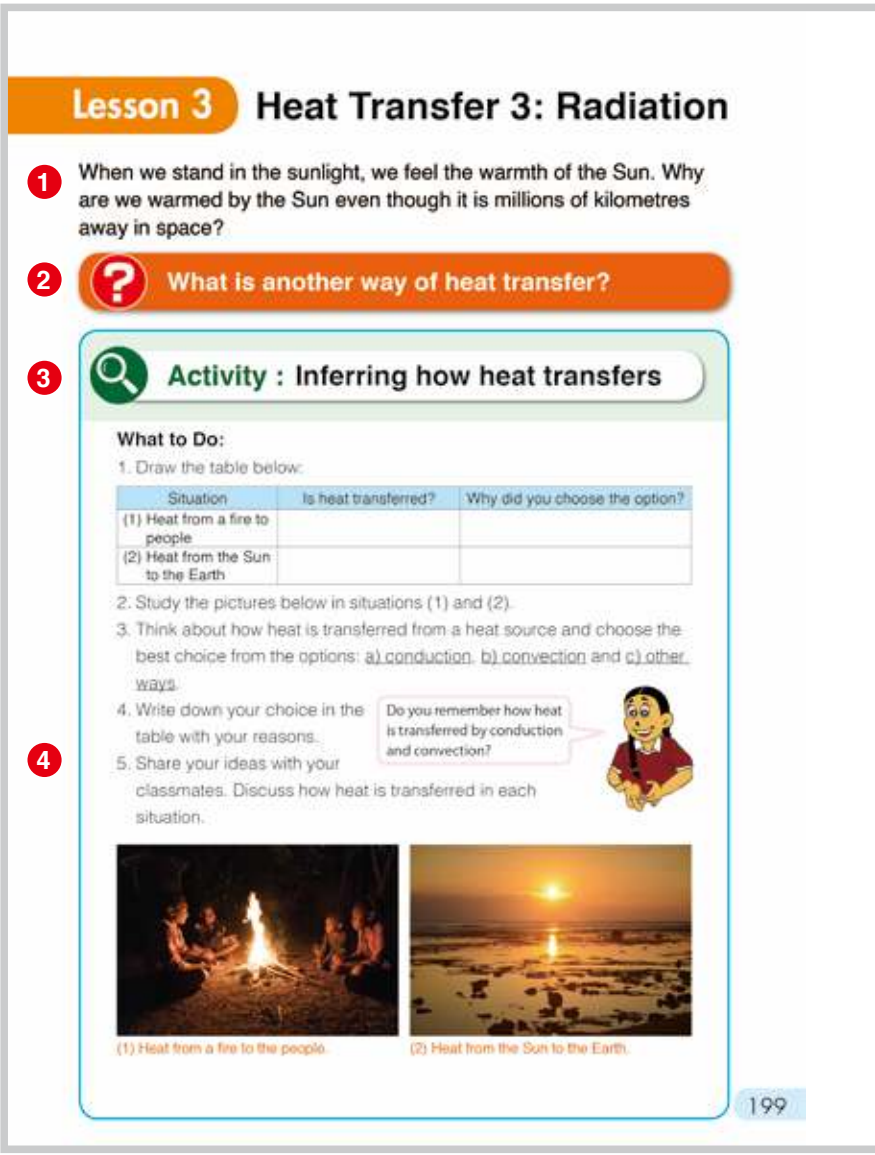
What is another way of heat transfer?

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.
5. Share your ideas with your classmates. Discuss how heat is transferred in each situation.

4 Do you remember how heat is transferred by conduction and convection?

(1) Heat from a fire to the people. (2) Heat from the Sun to the Earth.

199

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

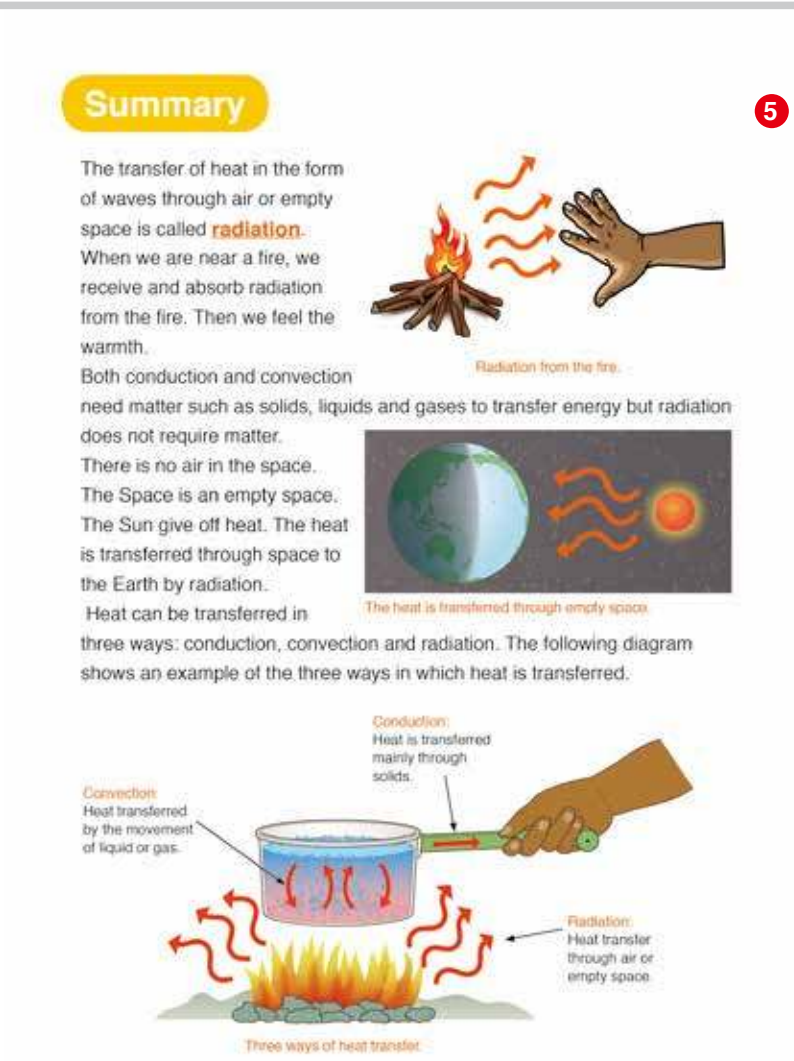
- All heat sources emit radiation in the transfer in energy in the form of light ray called electromagnet wave (learning content in higher Grade). Some electromagnet waves such as infrared and ultraviolet ray cannot be seen by human's eyes.
- 'Mumu' is a traditional cooking style in Papua New Guinea. Heated stones even though 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.

Radiation from the fire

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.

The heat is transferred through empty space

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.

Three ways of heat transfer

200

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.

Unit: **Energy**	Chapter : **11. Heat** Topic : **11.2. Heat Transfer**	Total lesson No: 86 / 87 Textbook page: 201 - 203

Lesson 9 / 10

Lesson Title

Summary and Exercise

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.

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

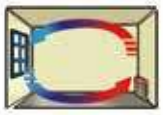
Conduction is the transfer of heat from one place to another through matter.

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 transfered 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 recieve and absorb radiation when we are near the fire. This makes us feel warm.

201

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.

2

Summary and Exercise

Exercise 11.2 Heat Transfer

Q1. Complete each sentence with the correct word.

(1) The transfer of heat through liquids and gases is called _____.

(2) Heat from the Sun travels through space and reaches the Earth by _____.

(3) The transfer of heat from one place to another through matter is called _____.

Q2. Choose the letter with the correct answer.

(1) When you put a metal spoon into the hot water, the spoon gradually becomes warm. Which type of heat transfer is occurring?

A. Conduction
B. Absorption
C. Radiation
D. Convection

Q3. Answer the following.

(1) When you sit near a fire you can feel the heat. What type of heat transfer is this?

(2) 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'.

202

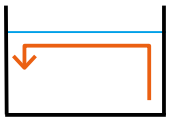
Exercise answers

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 absords the heat through the space between the fire and us. Whereas in solids and liquids heat is transfered 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) **Because the handle does not get too hot to grab it. There is less conduction of heat on the handle due to far distance from the heat source.**

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.

3

Chapter 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.

Examples of change in which heat is taken in.

A burning candle

Dissolving salt

Melting ice cubes

203

Lesson
10 / 10

Lesson Title

Chapter Test

Answers of the Chapter Test

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.

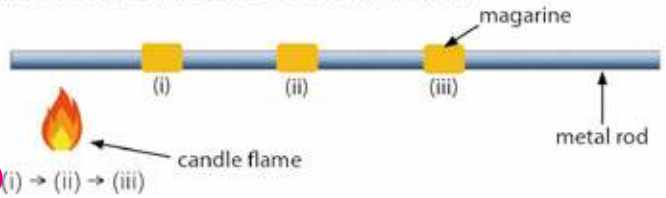
(1) Which is not a source of heat energy?

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 magarine at (i), (ii) and (iii). What is the correct order of the pats of magarine 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

204

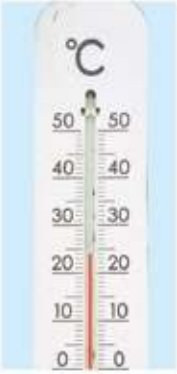
Q3

(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
 Hot cup of tea	Cup of tea	Hand Spoon

(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

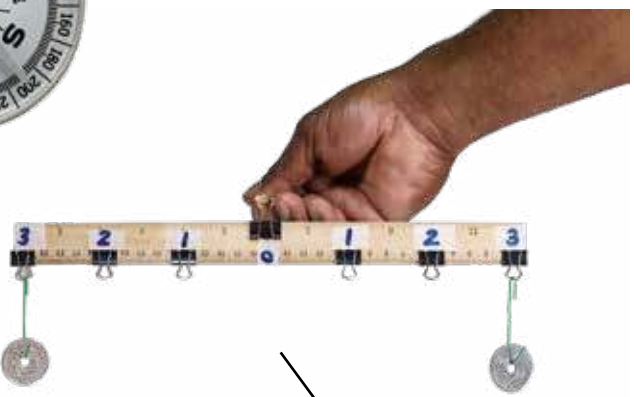
1. How to use a Thermometer
2. How to use a Compass
3. How to use a Tape measure
4. How to make a Beam balance
5. How to read a bar Graph

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

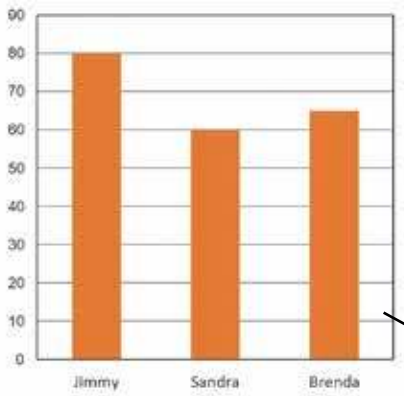
Tape measure

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 [°C].

2. Measuring temperature

STEP 1:

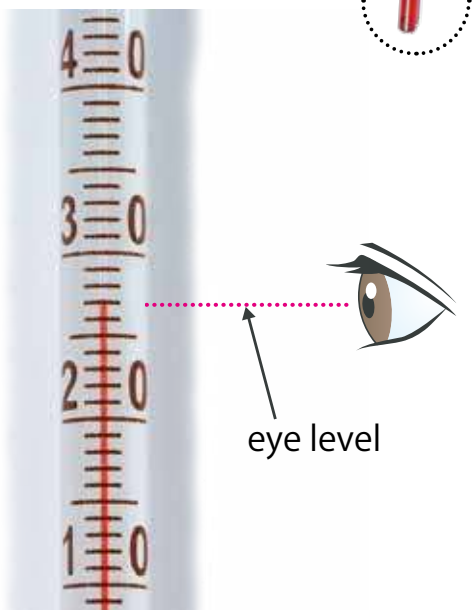
Place the bulb in the place where you want to measure the temperature. Make sure that there are no bright lights or direct sunlight shining on the bulb.

STEP 2:

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

STEP 3:

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



How to use a Compass

Compass

1. What is a compass?

A compass is an instrument 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.

2. Finding directions

STEP 1:

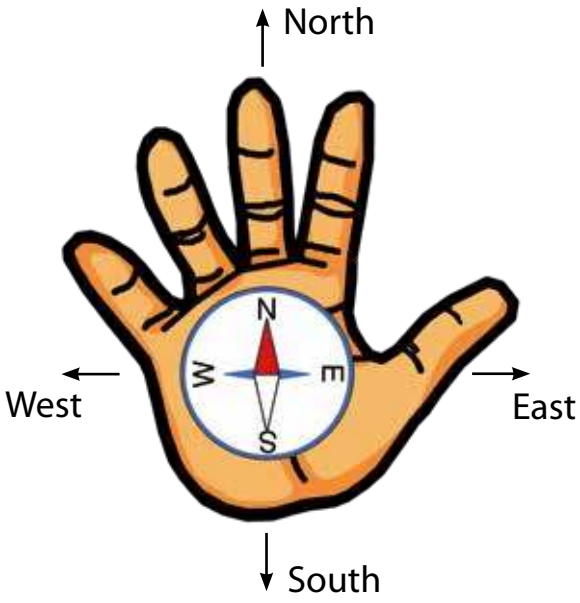
When you want to face North, place the compass flat on your palm and hold your palm in front of your chest as shown in the picture on the right.

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

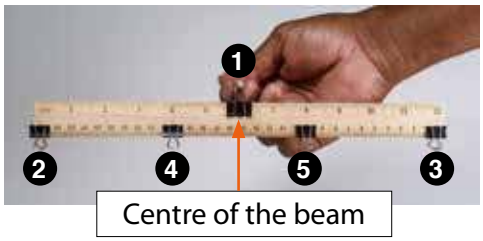
1. What is a Beam Balance?

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 1st 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 1st bulldog 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 1st clip, put the 2nd and the 3rd 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 4th clip and the 5th clip with their centres on the marks and also on the same edge as the 2nd and 3rd clips. Check if the beam is balanced.

(3) Between the two clips on the right side and on the left side, put the 6th clip and the 7th clip with their centres on the marks and on the same edge as the 2nd, 3rd, 4th and 5th 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:

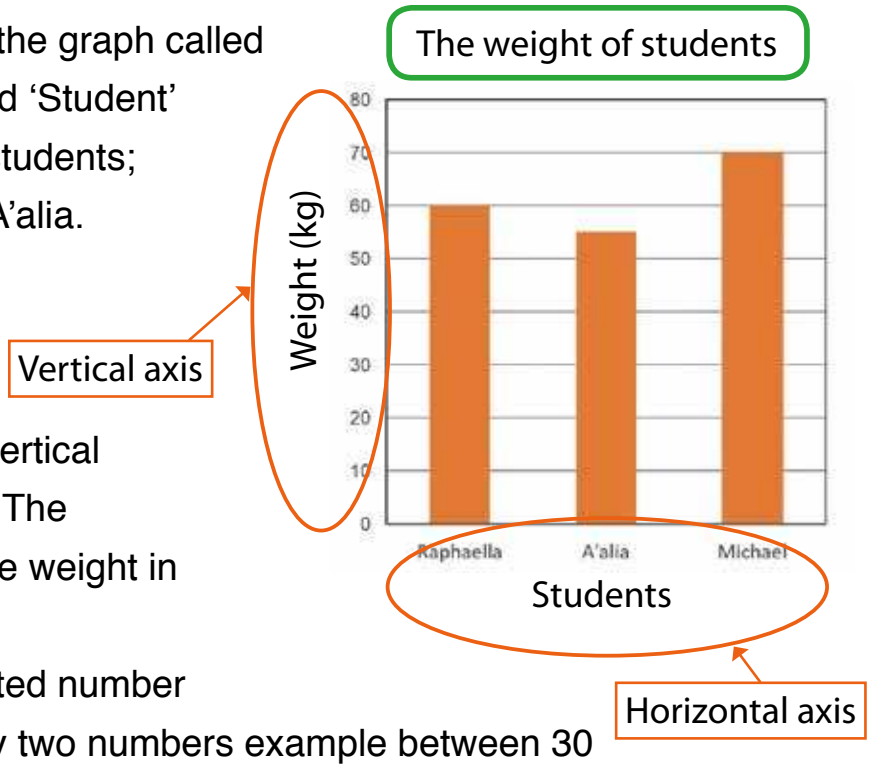
Read the title of the bar. What is the bar graph about?

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.



(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

Accelerate is to increase in speed. 24
Adaptation is the use of body part or a behaviour that helps an organism survive in its environment or a new environment. 148
Alloy is a mixture of two or more metals. 120
Autumn (fall) is the season that follows summer. The weather slowly gets colder. 48
Behaviour is the way organisms act in a certain situation. 148
Boiling point is the temperature at which a liquid changes into a gas. 76
Camouflage 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
Carbon dioxide is a colourless and odourless gas produced by people or animals when they breathe out. 12
Cast is the opposite of its mould. 124
Chemical change is a change that produces new kinds of matter..... 58
Circuit diagram is a diagram representing an electrical circuit drawn using symbols. 104
Cloud is made of water droplets or ice crystals floating in the sky. 42
Condensation is the process that causes a matter to change from gas to liquid. 76
Conduction is the transfer of heat from one place to another through matter. 196
Convection is the transfer of heat through liquids and gases such as water and air..... 198
Convection current is the movement or flow of water or air created by the process of convection. 198
Core is the hottest, innermost layer of the Earth. 114
Cotyledon is the part of a plant that stores food. 164
Crust is the thinnest outer layer of the Earth. 114
Decelerate is to reduce in speed or slow down. 24
Degrees Celsius is the unit of measurement used to measure temperature. 192
Desert is a large, hot, dry area of land with very little water and very few plants. ... 150
Dry season is a time of year when little rain falls. 48
Effort is the force applied to a machine to do work. 30
Egg is the female reproductive cell. 84
Electric current is the flow of electricity. 98
Electric circuit components are basically the various parts of circuit such as dry cells, bulb, switch and motor..... 103

Embryo in animals is an early developmental stage of an animal while it is within the mother's womb (uterus) or in the egg. 88

Embryo in plants is the tiny plant inside the seed. 164

Energy pyramid is a representation of the flow of energy from one energy level to another. 16

Evaporation is the process that causes a matter to change from liquid to a gas. ... 76

Fertilisation is the process where the egg meets the sperm and joins it. 84

Foetus is the unborn offspring of an animal that develops from an embryo. 88

Food chain is the path of food energy from the plants to animals. 14

Food web consists of several food chains linked to each other. 16

Fossil is the remains of once a living thing. 124

Freezing is the process that causes a matter to change from a liquid to a solid. ... 76

Freezing point is the temperature at a certain point where liquids start to change to solid. 74

Freshwater habitats are natural water sources that do not contain salt. 136

Friction is the force that occurs when two surface of objects rub against each other from opposite directions. 24

Germination is the process of the seed growing into a seedling. 165

Grassland habitat is an area mostly covered by grasses with few or no trees. ... 142

Habitat is the part of a natural environment where a plant or an animal lives. 134

Heat is a form of energy. 186

Heredity is the way in which traits are passed on from parents to young organisms. 90

Hibernation is the state of inactivity where animals go to a deep sleep. 156

Igneous rock is a rock formed when melted rock from inside the Earth cools and hardens. 118

Lever is a type of simple machine that makes an object move with less force. 29

Load is the force applied on the lever by the object to be lifted. 30

Magma is melted rock form in the Earth or a result of volcanic eruption. 118

Mantle is the thick, hot layer of the Earth. 114

Melting is the process that causes a matter to change from a solid to a liquid. ... 76

Melting point is the temperature at a certain point where solids start to melt. 74

Metamorphic rock is a rock formed when a rock inside the Earth has been changed by heat and pressure. 118

Migration is the movement of fish, bird and other animals from one place to another. 156

Glossary

Mimicry a type of animal adaptation that allows an animal to look like another kind of animal. 154
Mineral is a valuable or useful substance that is dug out of the ground. 114
Motor is an electrical device that produces power to rotate things using electricity. 97
Mould is the shape of a dead living thing found in a rock. 124
Ocean habitat is the area with salty water. 138
Organism is any living thing such as plant, animal and other living things. 144
Ovary is the female body part that contains thousands of eggs. 86
Parallel circuit is a circuit in which the electric current flows in two or more paths. 100
Penis is the male body part that passes semen out of the man's body. 86
Photosynthesis is the process by which plants make their own food (starch) from carbon dioxide and water by using light. 176
Radiation is the transfer of heat in the form of waves through air or empty space. 200
Rainforest habitat is an area with a lot of rain, warm climate and tall trees. 140
Reproduction is the process where living things produce young ones similar to themselves. 83
Reproductive system is the group of the body parts that work together for the purpose of reproduction. 86
Rock is a naturally formed, non-living material as part of the Earth crust. 114
Rusting is the red or orange coating that forms on the surface of metal due to chemical change between metal surface and the environment. 60
Season is a period of the year that is divided by typical weather conditions. 48
Sediment is a collection of sand particles of rock and small bits of soil piled up over time. 118
Sedimentary rock is a rock formed when sediments are glued together and become hard. 118
Seed coat is the hard outer layer of the seed covering the embryo and the cotyledon. 164
Semen is a mixture of sperm and fluids. 86
Series circuit is a circuit in which the electric current flows in one path. 100
Sleet is a mixture of snow and rain. 48
Solar energy is the energy that comes from the Sun. 12
Sperm is the male reproductive cell. 84
Spring is the season that follows winter. The weather begins to get warmer. 48
Sublimation is the direct change of state from solid to gas. 79

Starch is a substance made by plants to store energy in foods such as rice, bread, kaukau and potato. 164

Summer is the season that follows spring. It is warmest season of the year with long hours of sunlight..... 48

Temperature is a measure of how hot or cold a matter is. 192

Testes is the male body part that produces millions of sperm. 86

Thermal expansion is the increase in volume of matter due to an increase in temperature. 72

Thermometer is an instrument that is used to measure temperature in degrees Celsius..... 192

Trait is a feature or characteristic of a living thing. 90

Vagina is a muscular tube that connects the womb to the outside of a female's body. 86

Weather forecast is to predict the upcoming weather. 43

Wet season is the time of year when most of the rain falls. 48

Winter is the season that follows autumn (fall). Winter is the coldest season of the year with fewer hours of sunlight. 48

Womb is the place where a baby grows until its birth. 86

Glossary

Page number corresponds to Grade 4 Textbook

Anther is the part of a male flower which contains pollen. 72

Battery is a device that makes it easy to carry electricity any where you go. 78

Chemical property is the ability to change into new matter that has different properties. 138

Compost is a mixture of naturally decaying matter such as plants and animals. ... 34

Conductor is a material that electric current easily flows through. 86

Direction is the path that an object takes. Direction is expected by comparing its current position to its past position. 212

Distance is a measure of how far an object has travelled from its starting point. ... 212

Electric circuit is the circle of a pathway that electricity flows. 82

Fruit comes from flowers and they contain seeds. 96

Inclined plane 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

Insulator is a material that electric current does not flow through easily. 86

Metal is a material such as iron, copper and gold. 86

Motion is the change in the position of an object. An object in motion moves from one place to another. 210

Muscle is under our skin and covers our bones. We use our muscles when we move our body parts. 188

Oxygen is one of the gases in the air. 12

Petal is the bright colourful parts of a flower. 72

Phases of the moon mean a series of changing shapes of the bright part of the moon that we can see. 202

Physical change is a change in physical properties of matter. It may make the matter look different, but it does not change the material itself. 136

Physical property is a characteristic of matter that can be measured or observed with our five senses. 134

Pistil is a female part of a flower. 72

Pollen is a fine powder produced by flowers, which is carried by the wind or by insects to other flowers. 72

Page number corresponds to Grade 4 Textbook

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

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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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