SCIENCE
Teacher's Manual

Grade 5

Papua New Guinea
Department of Education

From
the People of Japan

JICA

QUIS-ME
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Department of Education & JICA

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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.

A special acknowledgement is given to the People and the Government of Japan for the partnership and support in funding and expertise through Japan International Cooperation Agency (JICA) - QUIS-ME Project with Curriculum Development Division (CDD).

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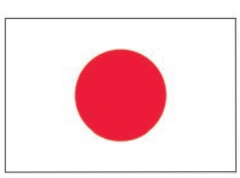

From
the People of Japan

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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.

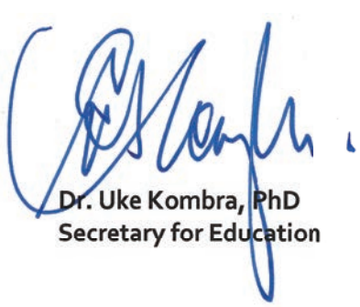
Science is a very interesting and enjoyable subject if taught well. This Grade 5 Teacher's Manual contains very interesting student activities with clear and precise step by step lesson flows for all lessons and teacher notes to assist teachers understand the science concepts for each lesson. These concepts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

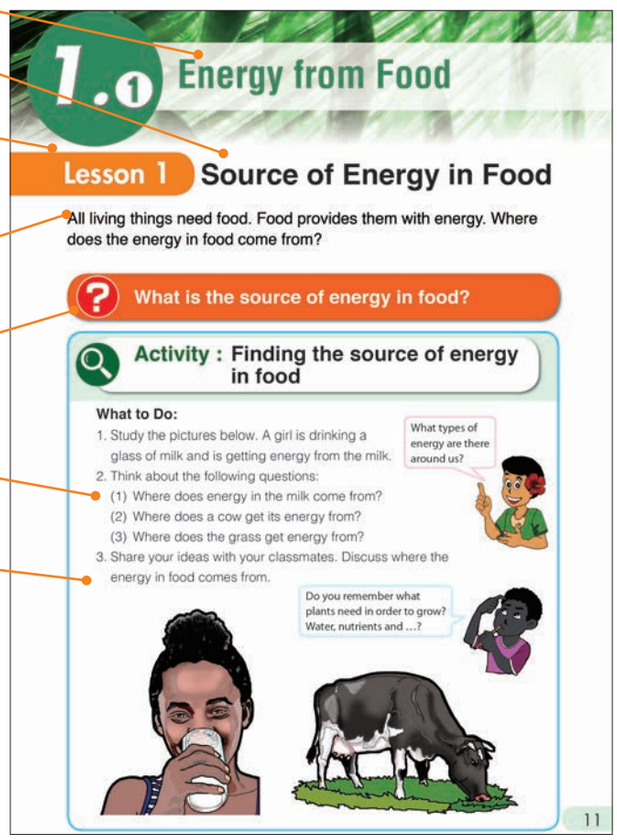
Firstly, the composition of the textbook is introduced, then, the components in this teacher's manual are introduced in the following section.

1.1 Composition of Science textbook

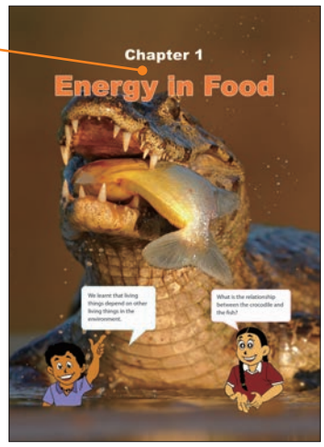
The Science Textbook is designed like this to have its components to repeatedly appear in each chapter, as shown in the top-right box ('structure in a chapter'). Each component is shown in the right.

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



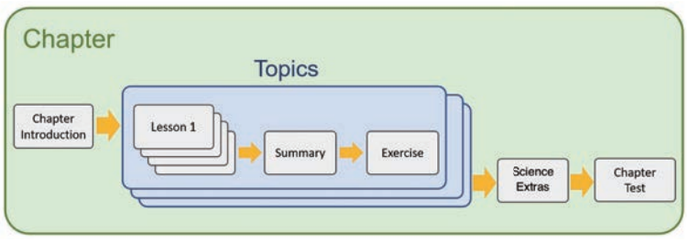
Chapter Introduction



Structure in a chapter

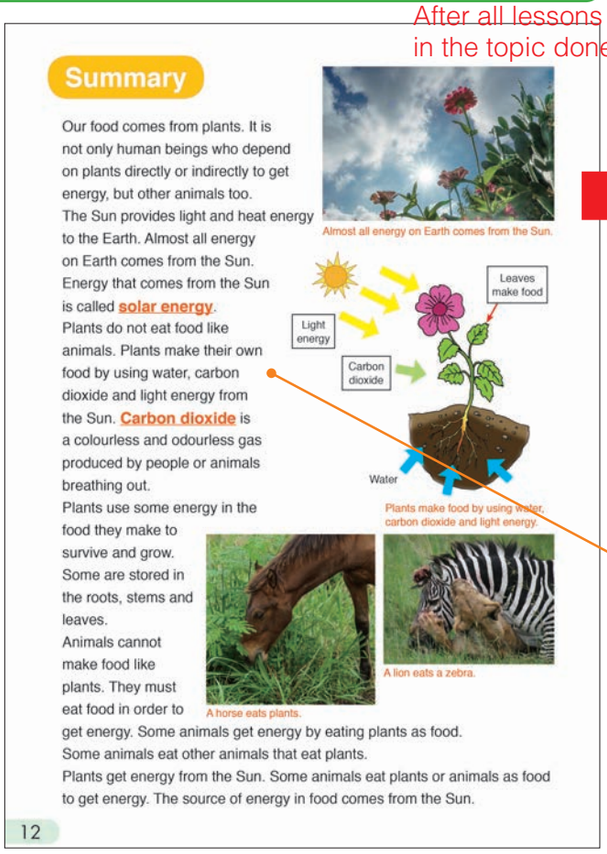
The Science Textbook consists of several chapters based on learning contents according to the syllabus. All chapters have regular components as shown in the diagram below.

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



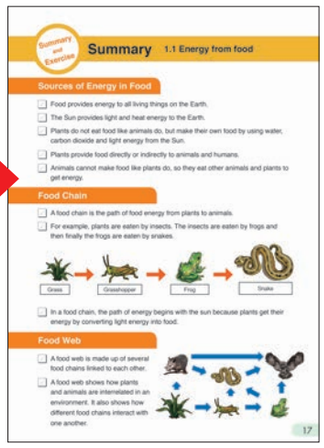
(main content page) **Summary** **Exercise**

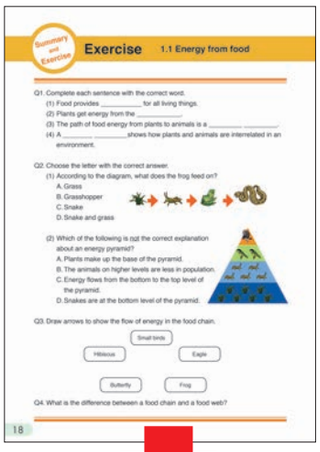
After all lessons in the topic done...


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.

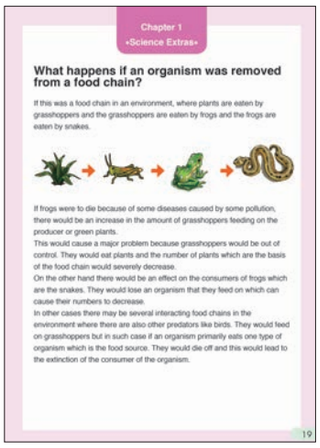
Almost all energy on Earth comes from the Sun.
Light energy
Carbon dioxide
Water
Leaves make food
Plants make food by using water, carbon dioxide and light energy.
A horse eats plants.
A lion eats a zebra.
12


Summary 1.1 Energy from food
Sources of Energy in Food
Food Chain
Food Web
17

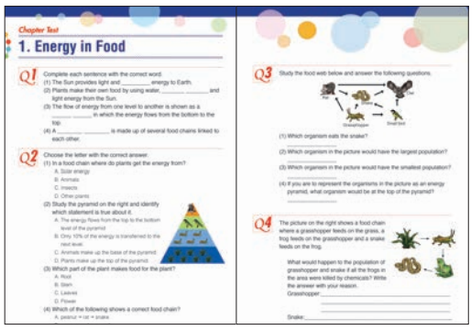

Exercise 1.1 Energy from food
18

Summary of the lesson

Science Extras


Chapter 1 «Science Extras»
What happens if an organism was removed from a food chain?
19

Chapter test


Chapter Test
1. Energy in Food

After all topics done...

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

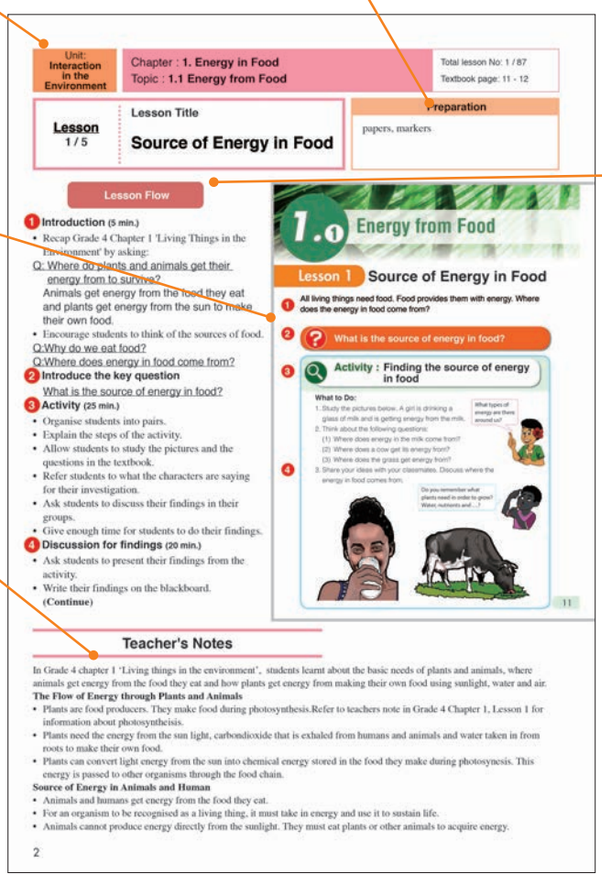
Corresponding textbook page number is shown at the center. The numbers in red circle on the page correspond to the 'Lesson Flow' to show where the content is in the lesson flow.

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.


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.
(Continue)
1.0 Energy from Food
Lesson 1 Source of Energy in Food
1 All living things need food. Food provides them with energy. Where does the energy in food come from?
2 What is the source of energy in food?
3 Activity : Finding the source of energy in food
What to Do:
1. Study the pictures below. A girl is drinking a glass of milk and is getting energy from the milk.
2. Think about the following questions:
(1) Where does energy in the milk come from?
(2) Where does a cow get its energy from?
(3) Where does the grass get energy from?
3. Share your ideas with your classmates. Discuss where the energy in food comes from.
4
11
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 photosynthesis.
• 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.
2

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

1 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.

2 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.

3 Activity

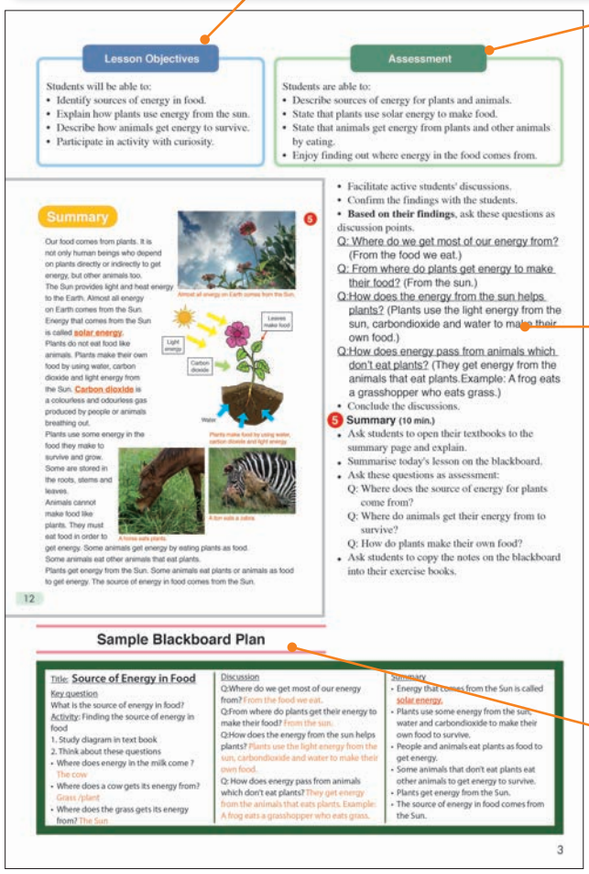
The activity is delivered to examine their guess and prediction to the key question. In some lessons, the teacher may deliver the activity without students' prediction or hypothesis. These two different ways are dependent on the lesson content. Activities are carried out by a group, individually or done 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.

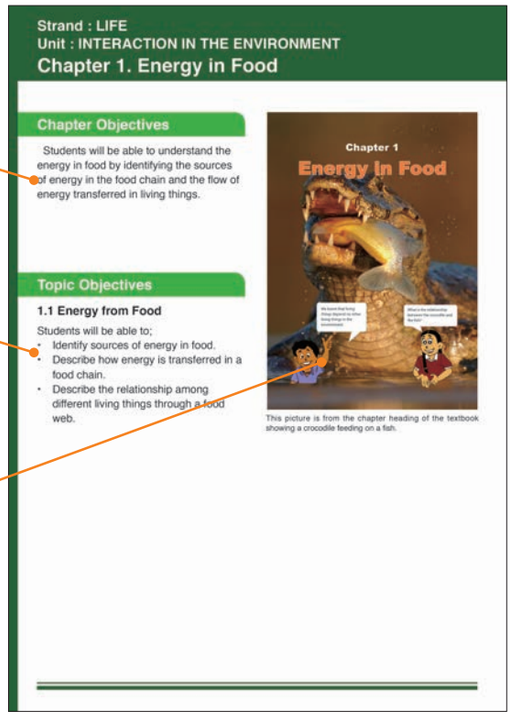
1.3 Chapter Introduction in Teacher's Manual

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.


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.

Chapter 1
Energy in Food

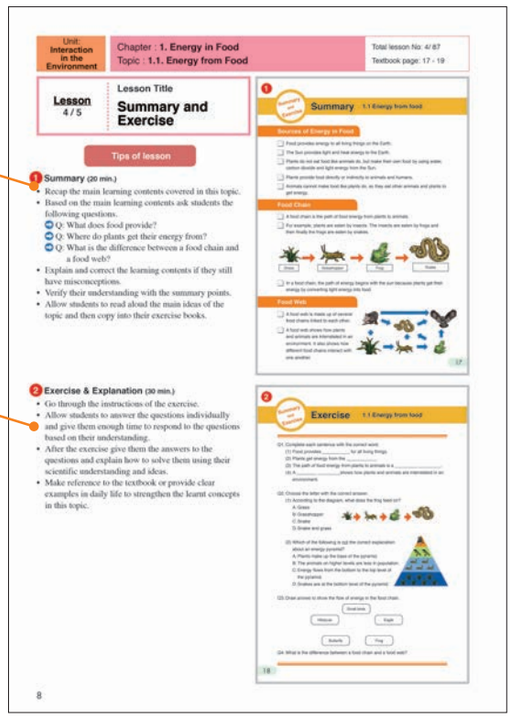
This picture is from the chapter heading of the textbook showing a crocodile feeding on a fish.

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.


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

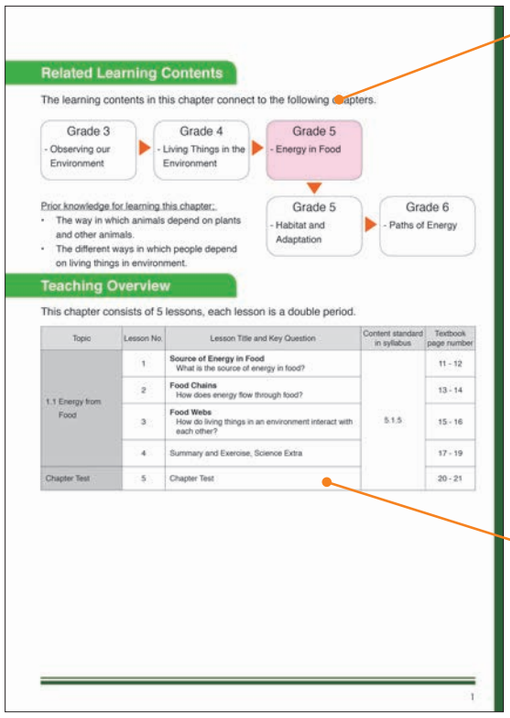
1 Summary (20 min.)
- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - Q: What does food provide?
  - Q: Where do plants get their energy from?
  - Q: What is the difference between a food chain and a food web?
- Explain 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.

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.

Summary 1.1 Energy from food

Exercise 1.1 Energy from food

8



Related Learning Contents

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

Grade 3 - Observing our Environment → Grade 4 - Living Things in the Environment → Grade 5 - Energy in Food → Grade 6 - Paths of Energy

Grade 5 - Habitat and Adaptation

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

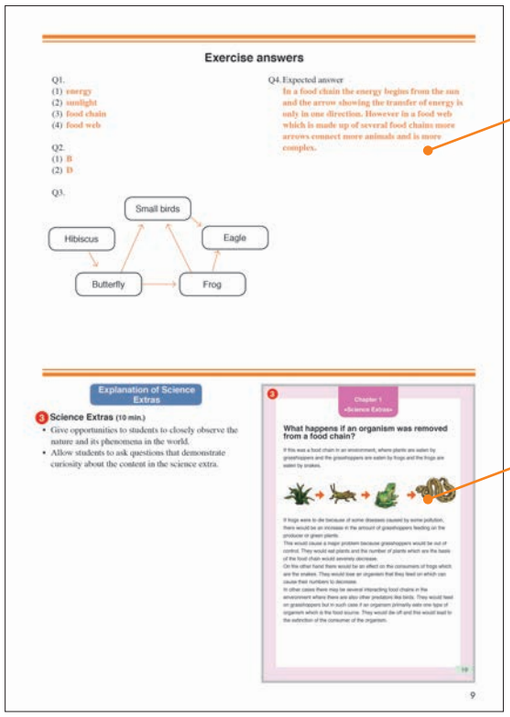
1

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.



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

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.

9

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

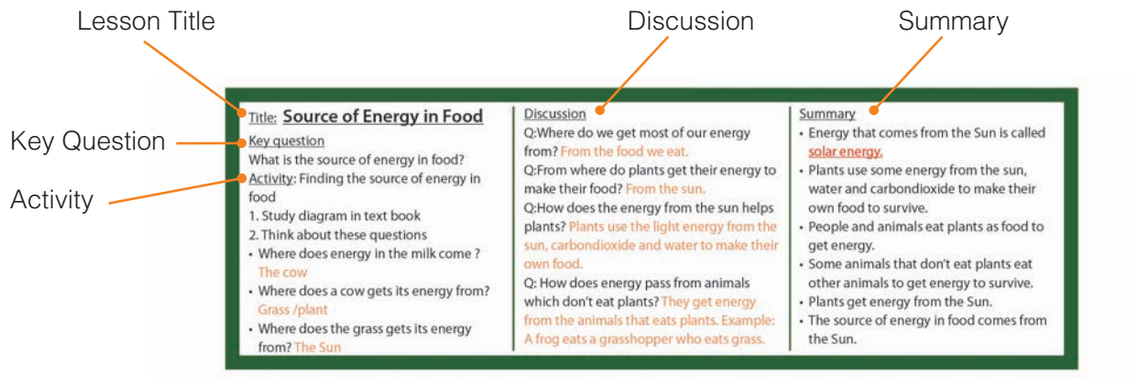
The common practice for the teachers utilising the blackboard is dividing it into sections for each subject. The Blackboard is an important teaching tool for teachers when utilised well. Therefore, in this Teacher's Manual it introduces the strategy for enhancing the effectiveness of blackboards for 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
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PHYSICAL SCIENCE	MATTER	4. New Matter	4.1 Common Chemical Changes	TERM 2	21	1	How to tell a Chemical Change	48
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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
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					28	3	Change in State of Matter 1: Solid and Liquid	64
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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
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					43	6	Summary and Exercise	98
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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
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					48	4	Uses of Rocks and Minerals	110
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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
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					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
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					84	7	Heat Transfer 2: Convection	188
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					86	9	Summary and Exercise	192
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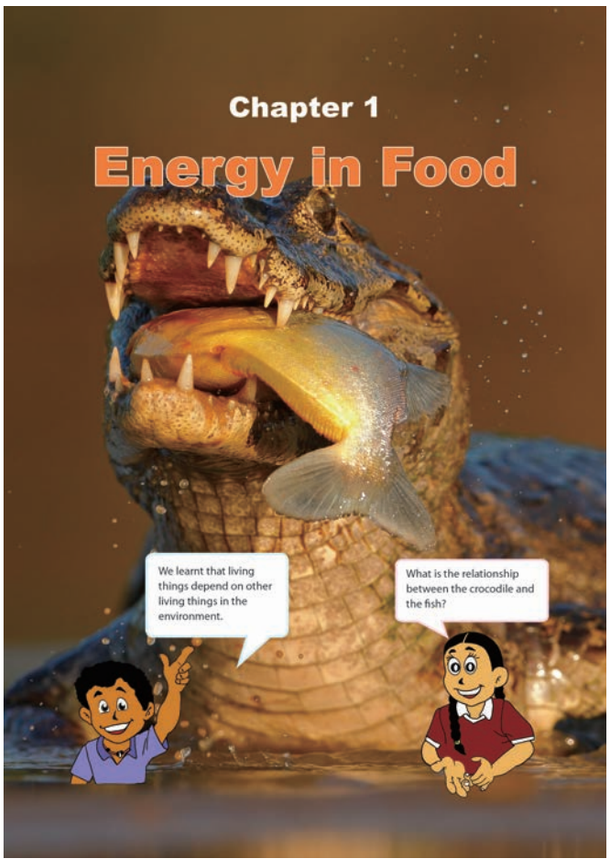
Strand : LIFE
Unit : INTERACTION IN THE ENVIRONMENT

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.



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

Topic Objectives

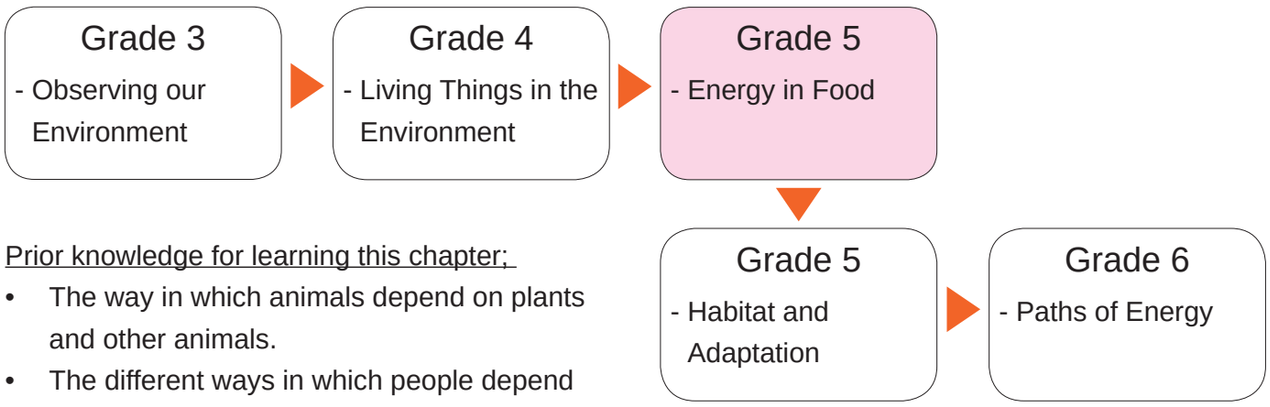
1.1 Energy from Food

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.

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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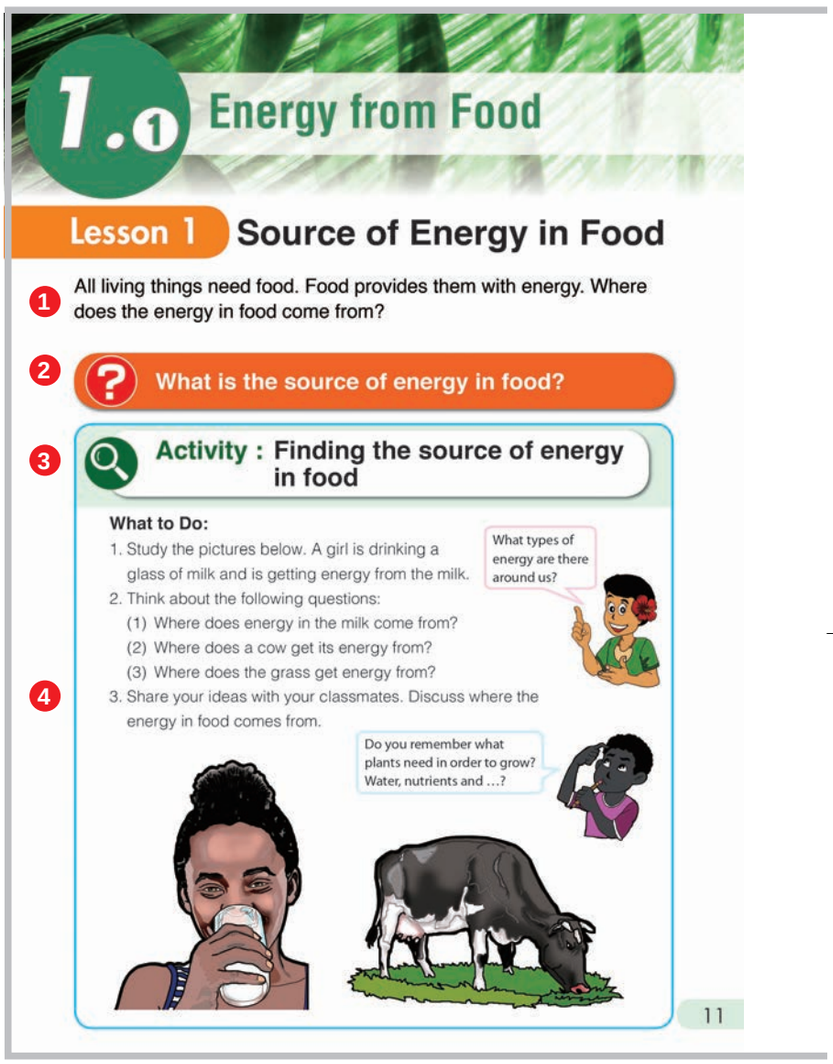


1.1 Energy from Food

Lesson 1 Source of Energy in Food

1 All living things need food. Food provides them with energy. Where does the energy in food come from?

2 What is the source of energy in food?

3 Activity : Finding the source of energy in food

What to Do:

1. Study the pictures below. A girl is drinking a glass of milk and is getting energy from the milk.
2. Think about the following questions:
   (1) Where does energy in the milk come from?
   (2) Where does a cow get its energy from?
   (3) Where does the grass get energy from?
3. Share your ideas with your classmates. Discuss where the energy in food comes from.

4

What types of energy are there around us?

Do you remember what plants need in order to grow? Water, nutrients and ...?

11

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

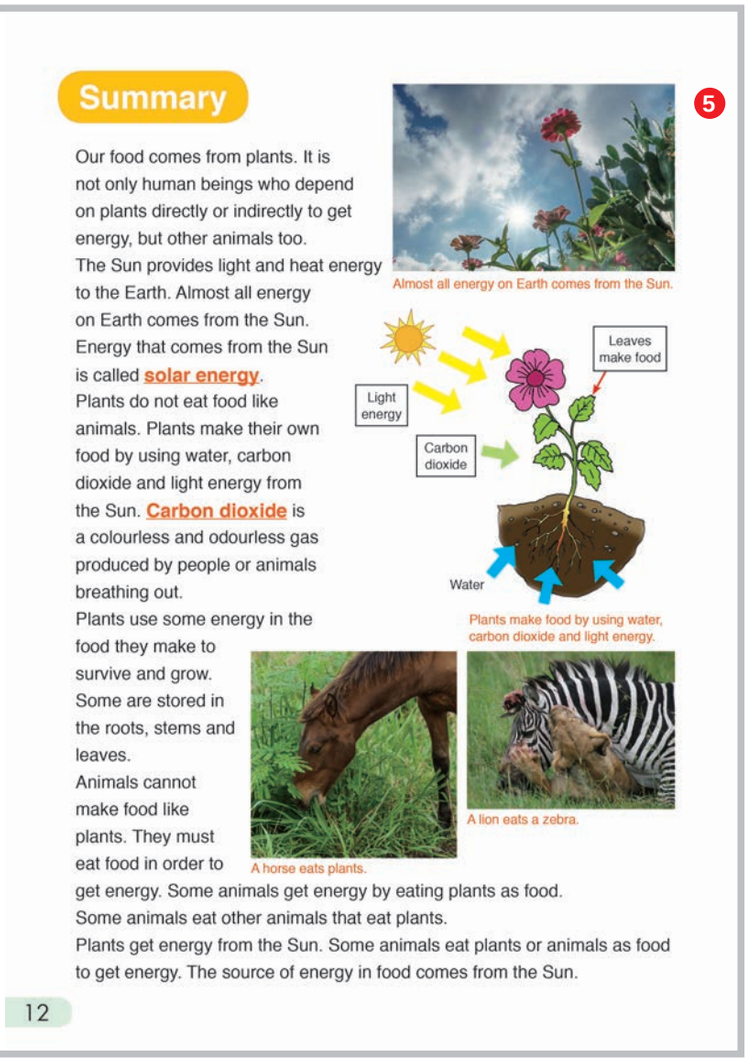
- Animals and humans get energy from the food they eat.
- For an organism to be recognised as a living thing, it must take in energy and use it to sustain life.
- Animals cannot produce energy directly from the sunlight. They must eat plants or other animals to acquire energy.

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: From 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, carbondioxide 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, carbondioxide 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 carbondioxide 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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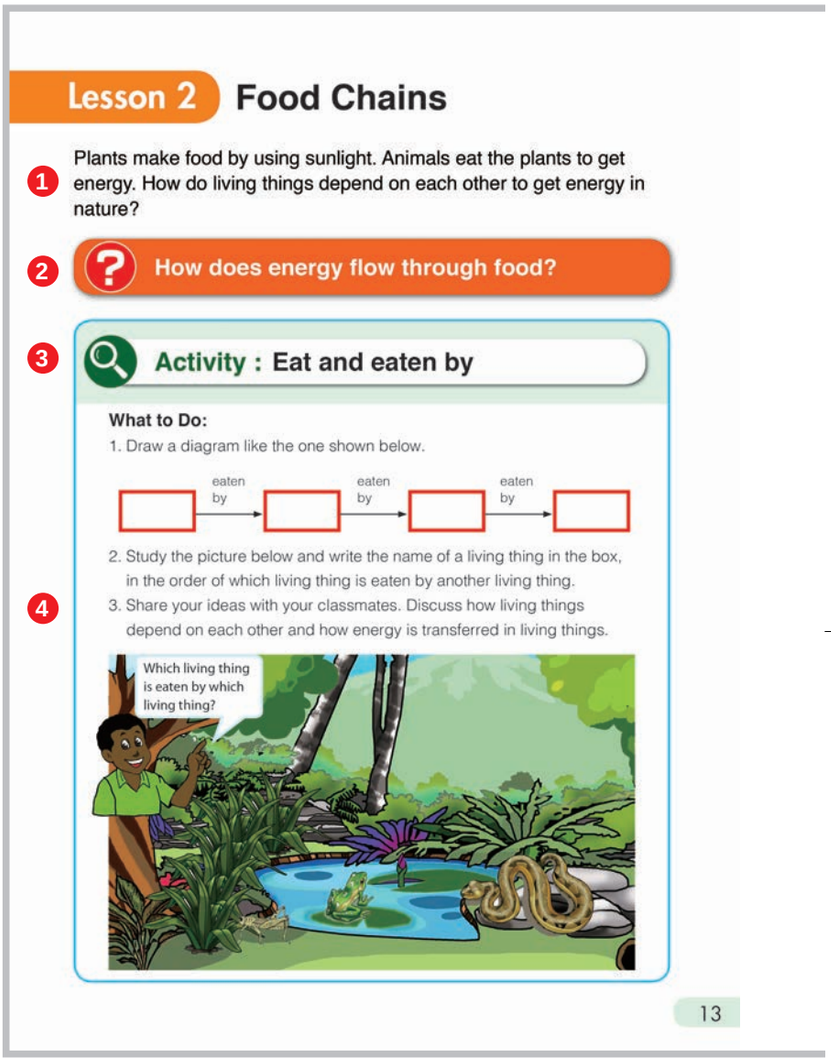


Lesson 2 Food Chains

1 Plants make food by using sunlight. Animals eat the plants to get energy. How do living things depend on each other to get energy in nature?

2 How does energy flow through food?

3 Activity : Eat and eaten by

What to Do:

1. Draw a diagram like the one shown below.

eaten by | eaten by | eaten by

2. Study the picture below and write the name of a living thing in the box, in the order of which living thing is eaten by another living thing.
3. Share your ideas with your classmates. Discuss how living things depend on each other and how energy is transferred in living things.

4

13

Teacher's Notes

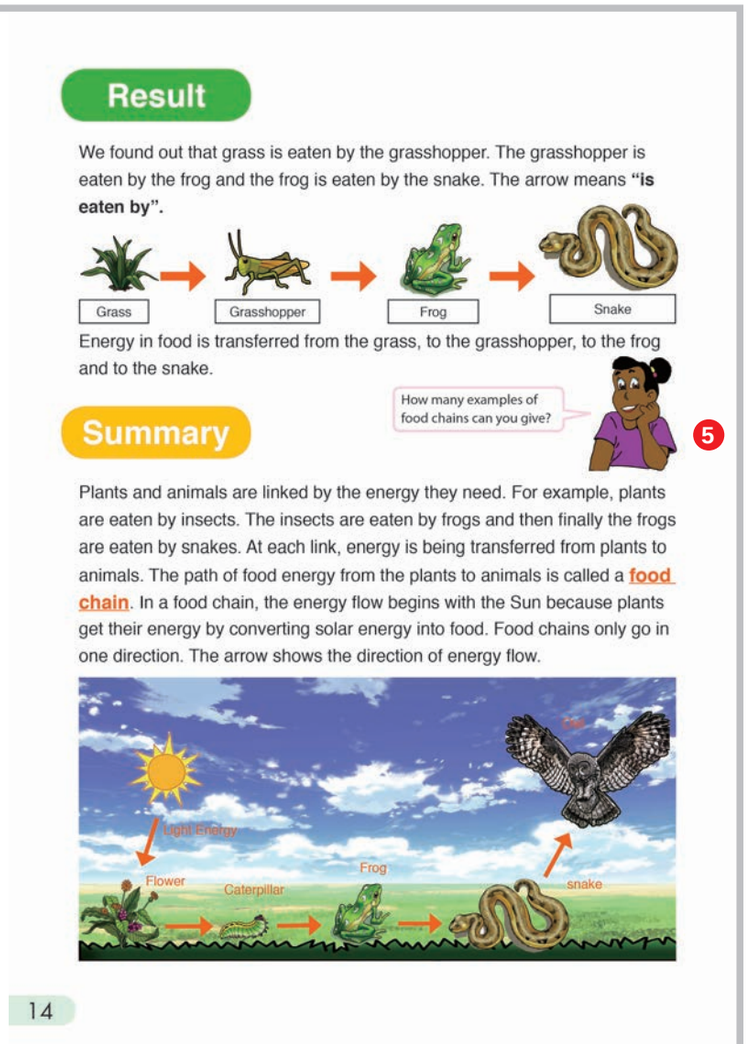
- A food chain will be taught in Grade 6 Chapter 1, lesson 2 'Food Chains in Different Environment'. In this lesson, students will identify food chains in different environment. In addition, students will learn about food web which is the combination of various food chains. This lesson is the foundation 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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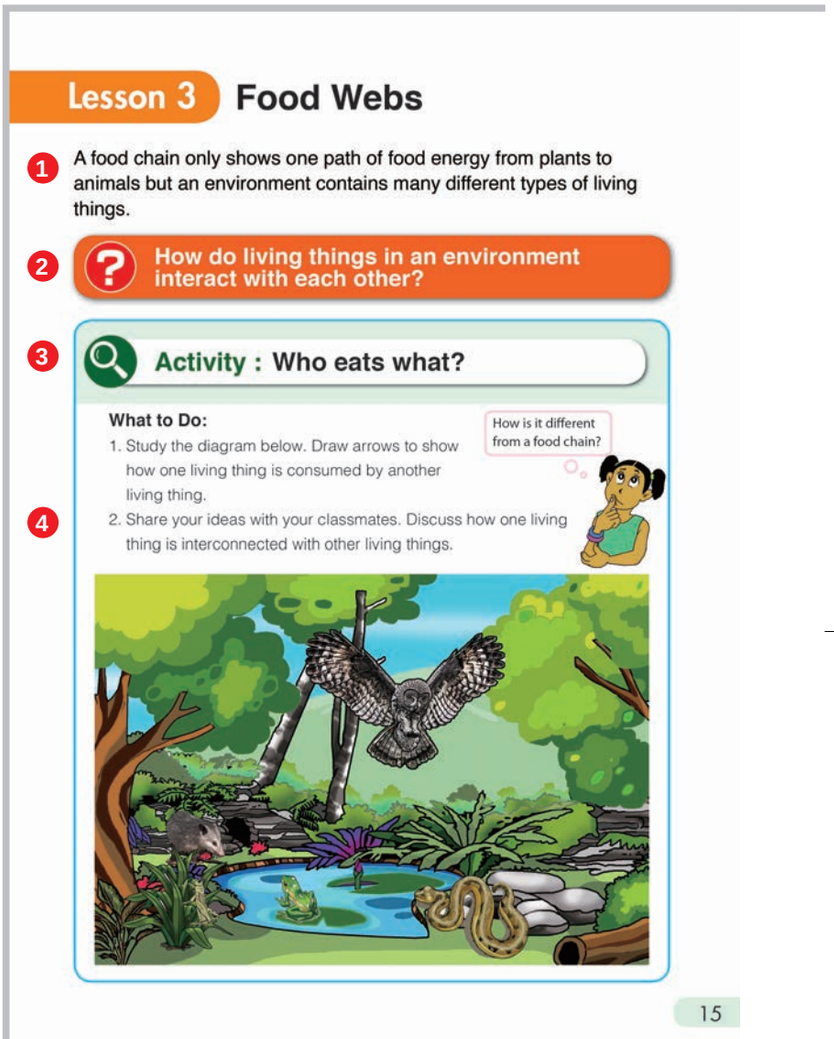


Lesson 3 Food Webs

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.

4

How is it different from a food chain?

15

Teacher's Notes

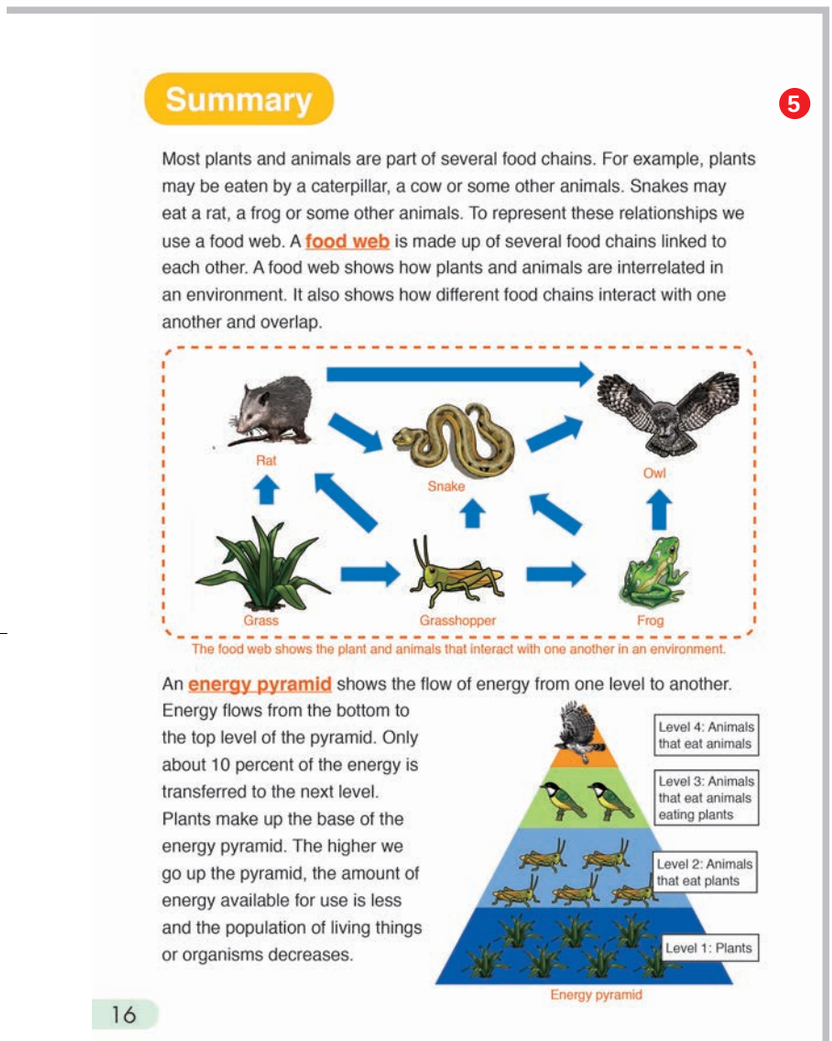
- A food web will be taught in Grade 6 Chapter 1, lesson 3 'Food Webs in Different Environment'. In this lesson, student will understand that a food web varies in different environments. Teachers are requested to refer to them prior to this lesson.
- A food web is the interconnection of food chains. 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 5

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.)

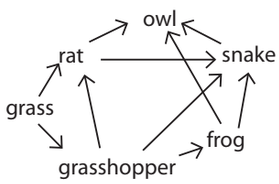
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q:What is a food web?
  Q:How are a food web and a food chain different?
  Q:What is an energy pyramid?
  Q:Explain the relationship between the 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

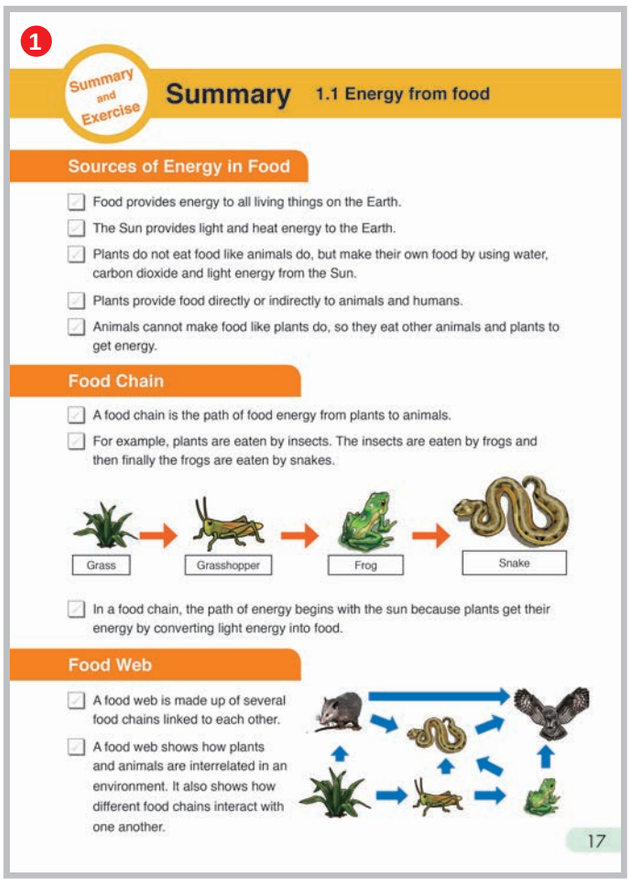
Lesson Title

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.

Grass → Grasshopper → Frog → Snake

- 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.

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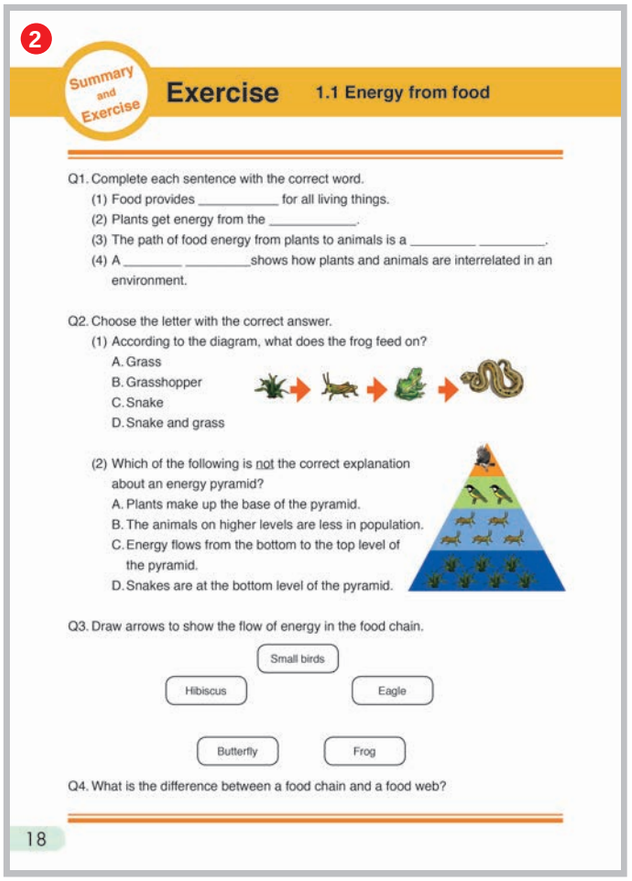
2 Exercise & Explanation (30 min.)

- 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.

Small birds
Hibiscus
Eagle
Butterfly
Frog

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

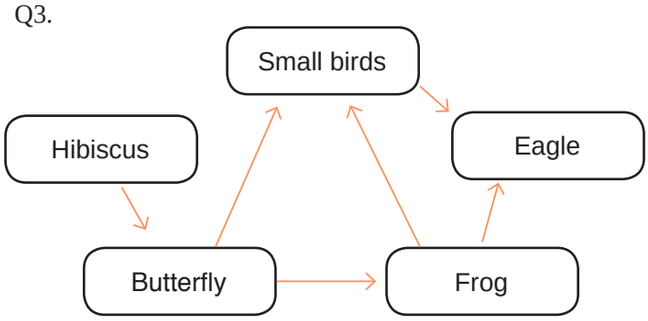
18

Exercise answers

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

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

Q3.

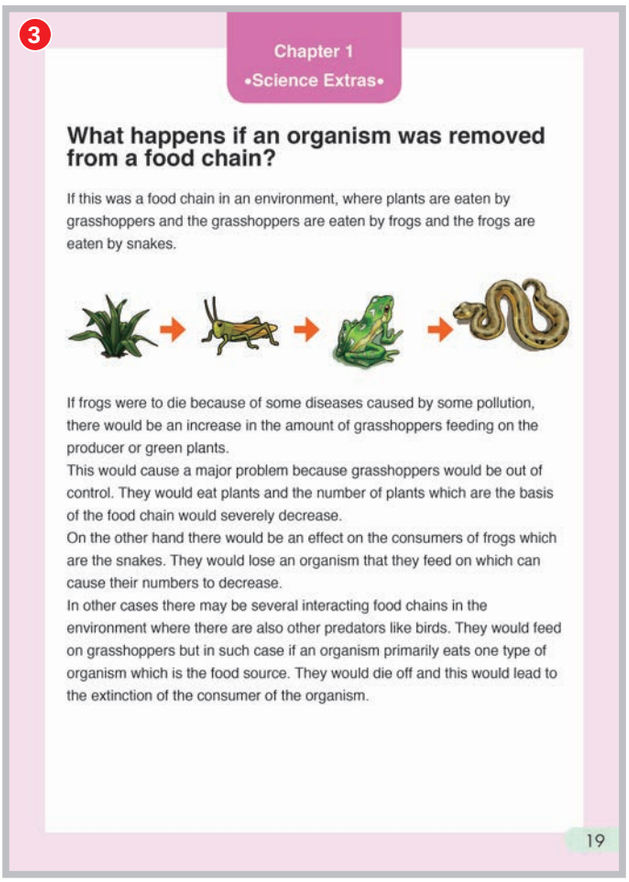


Q4. Expected answer
In a food chain the energy begins from the sun and the arrow showing the transfer of energy is only in one direction. However in a food web which is made up of several food chains more arrows connect more animals and is more complex.

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.

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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.

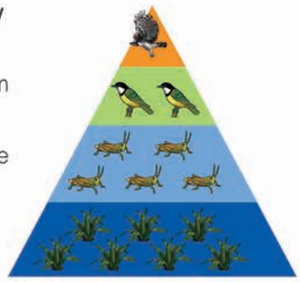
Q2 Choose the letter with the correct answer.

(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

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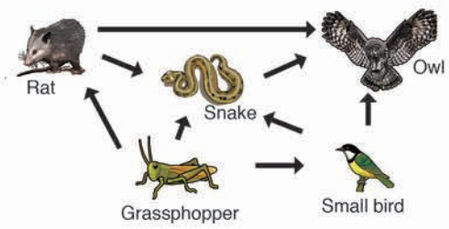
Q3

Study the food web below and answer the following questions.



(1) Which organism eats the snake?
Owl

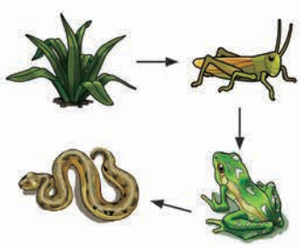
(2) Which organism in the picture would have the largest population?
Grasshopper

(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.

Strand :PHYSICAL SCIENCE
Unit : FORCE AND MOTION

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

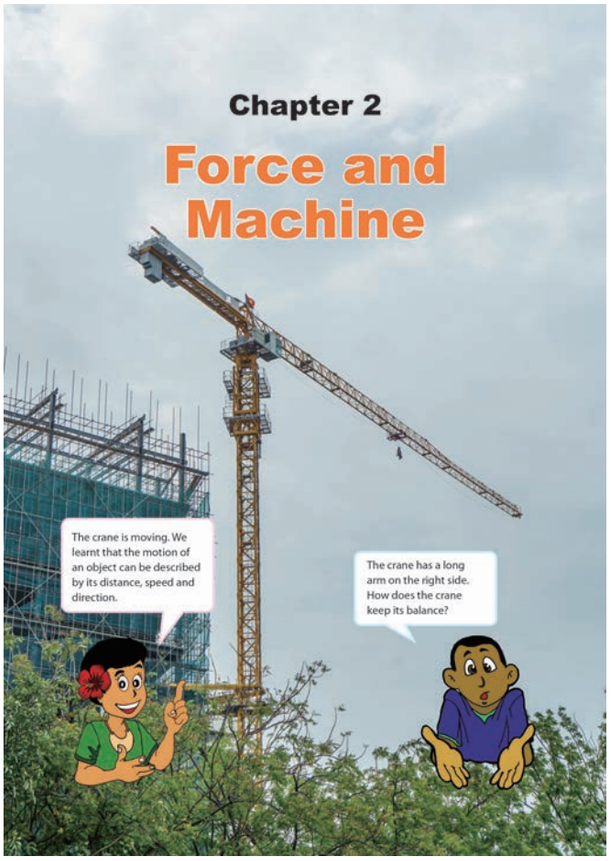
Students will be able to;

- 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;

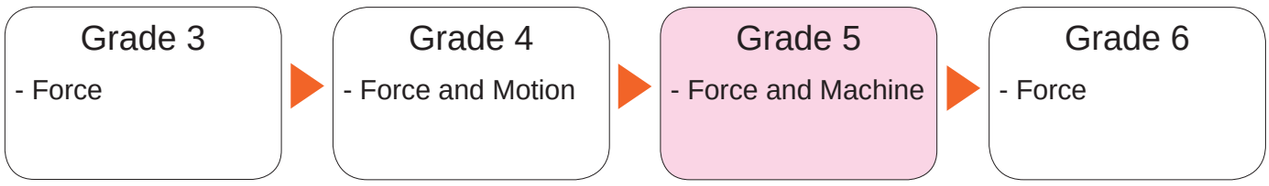
- Explain that lesser effort is needed to lift the load, when the effort is applied further away from the fulcrum.
- Explain that lesser effort is needed to lift the load, when the object is placed at a shorter distance from the fulcrum.
- Identify that a lever is balanced when the product of the weight 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?

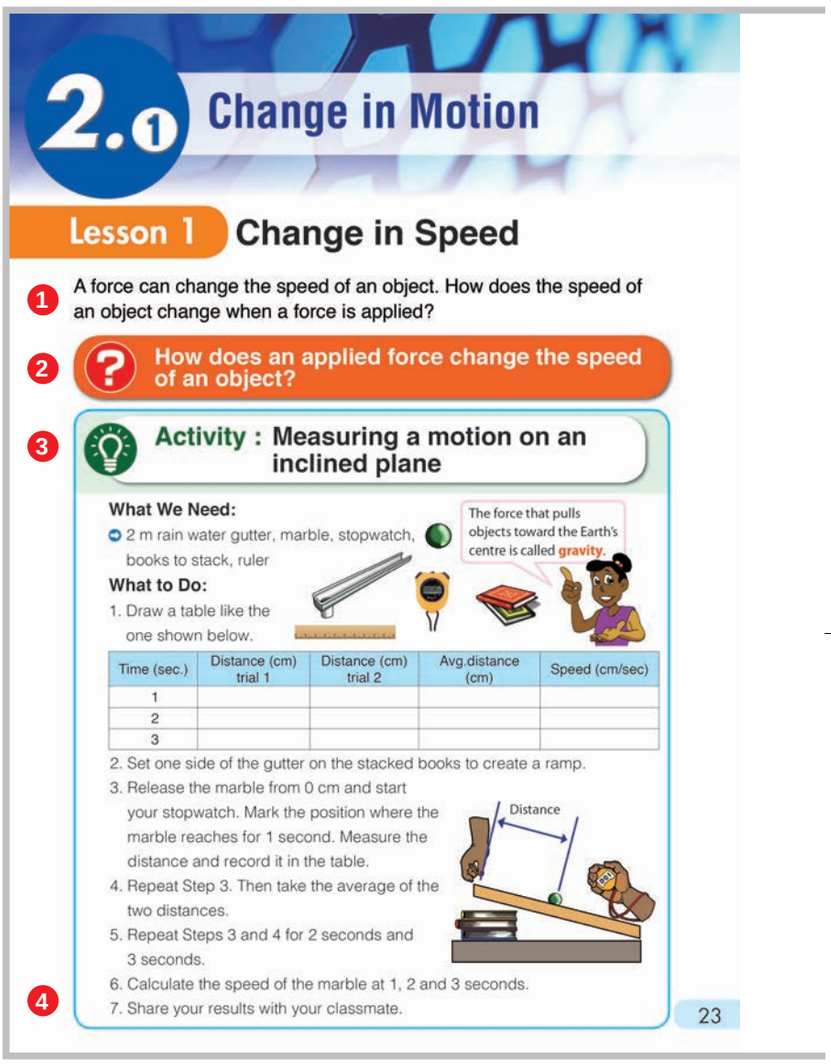
3 Activity (30 min.)

- 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.

(Continue)



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

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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

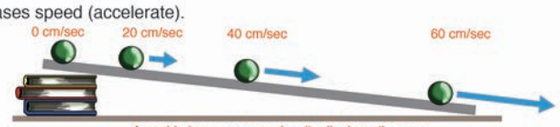
Discussion

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?

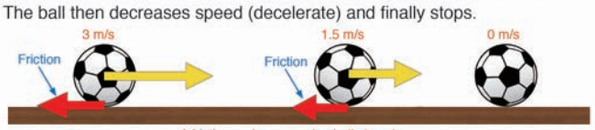
Summary

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.

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

Q: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.

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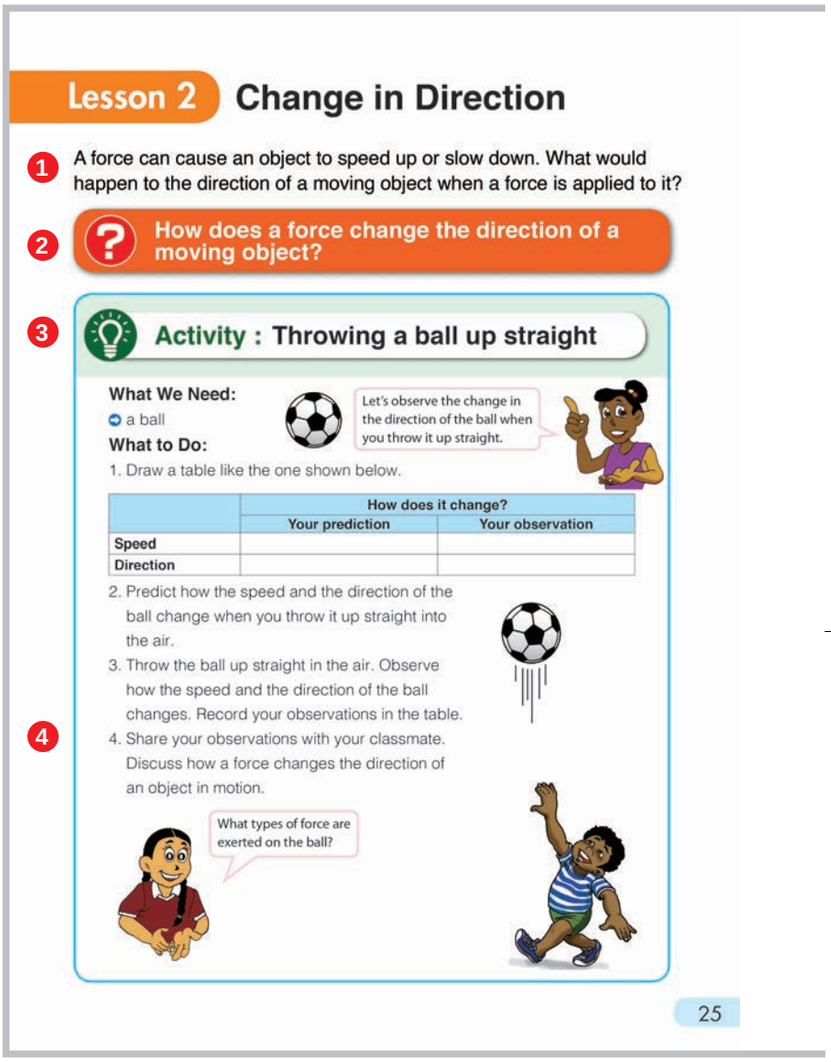

Lesson 2 Change in Direction

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:

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.

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

What types of force are exerted on the ball?

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Teacher's Notes

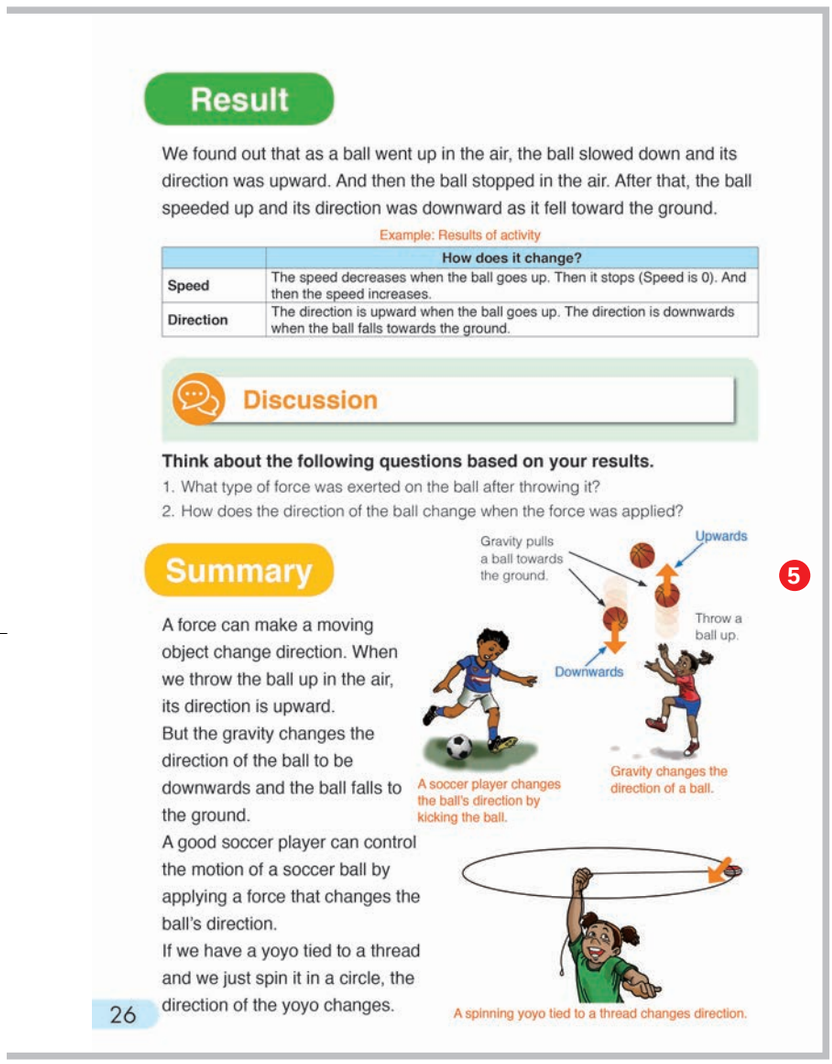
- As the theory of free fall discovered by Galileo Galilei explained, the light object and the heavy object fall in the same time theoretically if there is no air. If you can prepare balls of different sizes and weights, the variety will assist students to clearly understand the movement of object in 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.

- 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 up

	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

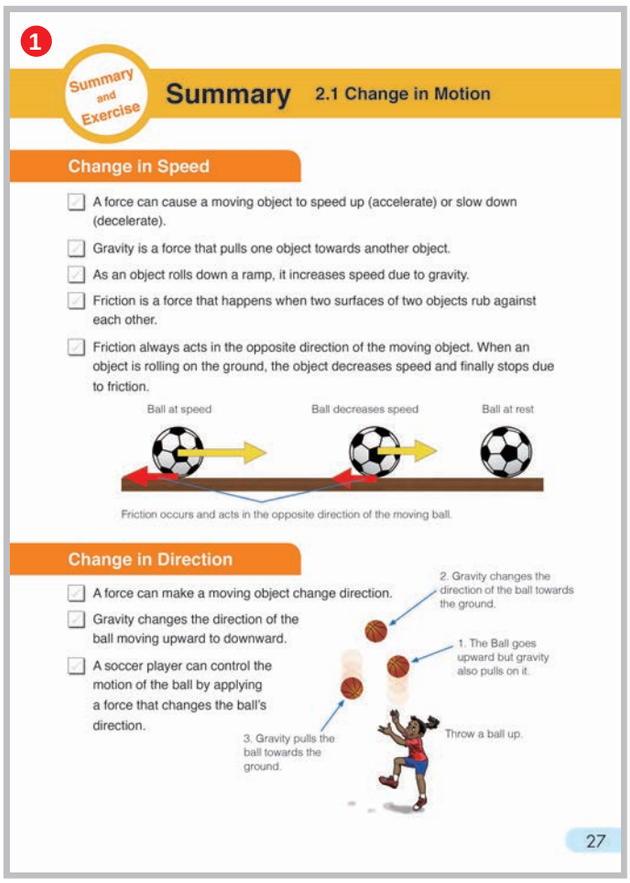
Lesson Title

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.

Ball at speed | Ball decreases speed | Ball at rest

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.

2. Gravity changes the direction of the ball towards the ground.
1. The Ball goes upward but gravity also pulls on it.
3. Gravity pulls the ball towards the ground.
Throw a ball up.

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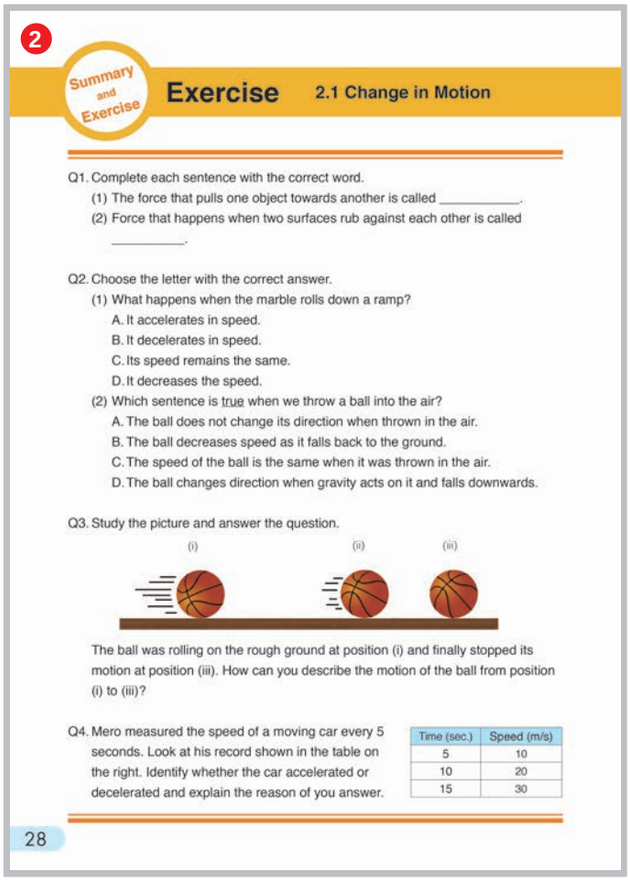
2 Exercise & Explanation (30 min.)

- 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.

(i) (ii) (iii)

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

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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. Finally the marble comes to slows down or decelerates and comes to a stop.
(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.

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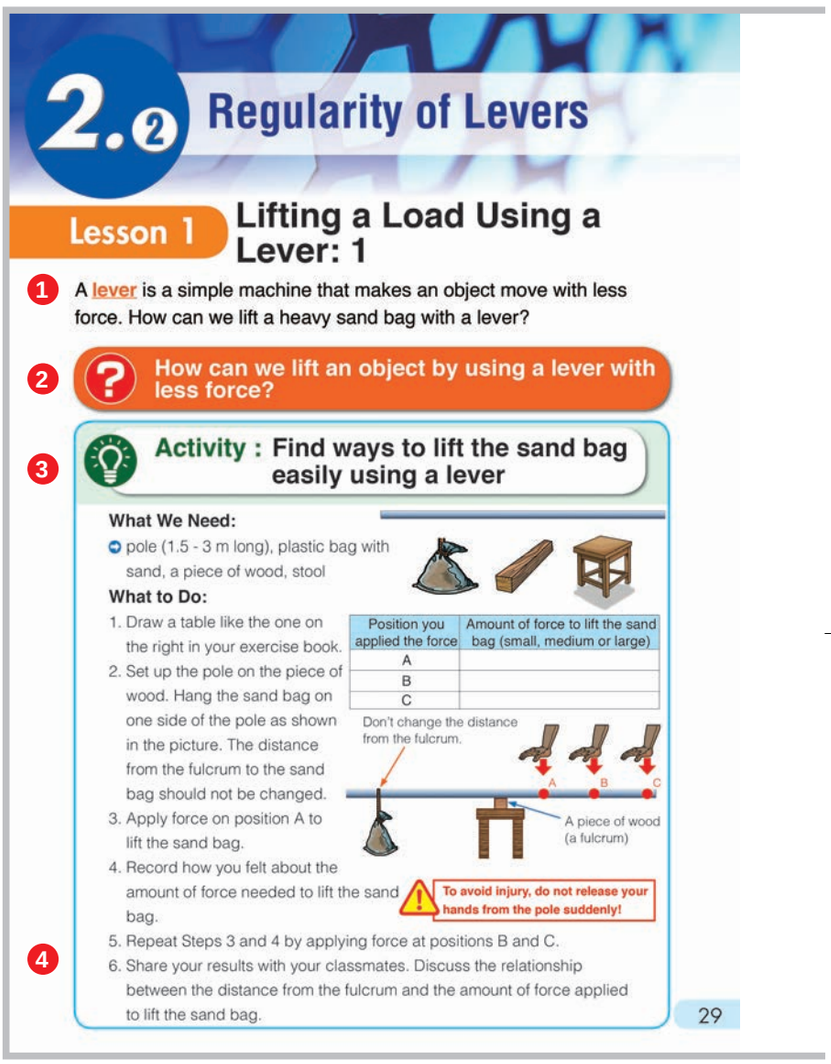

2.2 Regularity of Levers

Lesson 1 Lifting a Load Using a Lever: 1

1 A lever is a simple machine that makes an object move with less force. How can we lift a heavy sand bag with a lever?

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

3 Activity : Find ways to lift the sand bag easily using a lever

What We Need:

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

What to Do:

1. Draw a table like the one on the right in your exercise book.
2. Set up the pole on the piece of wood. Hang the sand bag on one side of the pole as shown in the picture. The distance from the fulcrum to the sand bag should not be changed.
3. Apply force on position A to lift the sand bag.
4. Record how you felt about the amount of force needed to lift the sand bag.
5. Repeat Steps 3 and 4 by applying force at positions B and C.
6. Share your results with your classmates. Discuss the relationship between the distance from the fulcrum and the amount of force applied to lift the sand bag.

Position you applied the force	Amount of force to lift the sand bag (small, medium or large)
A	
B	
C	

Don't change the distance from the fulcrum.

A piece of wood (a fulcrum)

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

4

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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 10kg. 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.

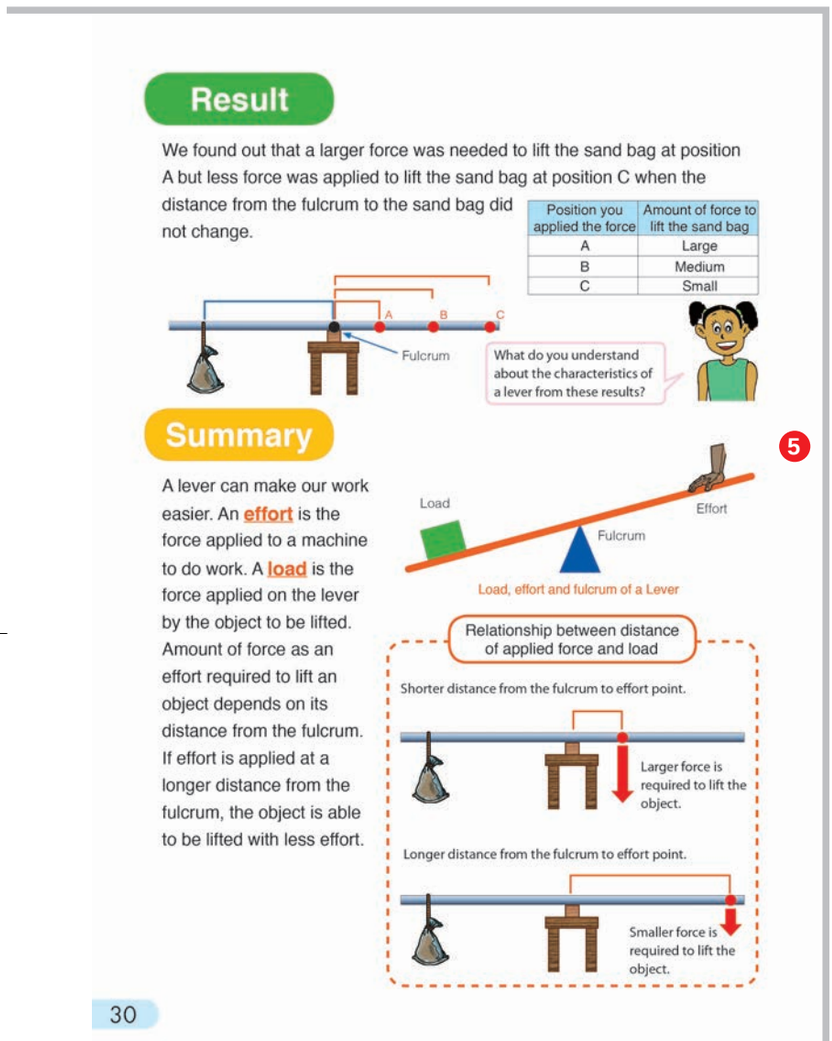
Pay close attention to the pole in case it breaks. Have student stand at a safe distance.

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.

Load, effort and fulcrum of a Lever

Relationship between distance of applied force and load

Shorter distance from the fulcrum to effort point.

Longer distance from the fulcrum to effort point.

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

Q:What condition did you change to find the way to lift a sandbag 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 sandbag 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 sandbag.)

- 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 sandbag 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 sandbag 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 sandbag.

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.

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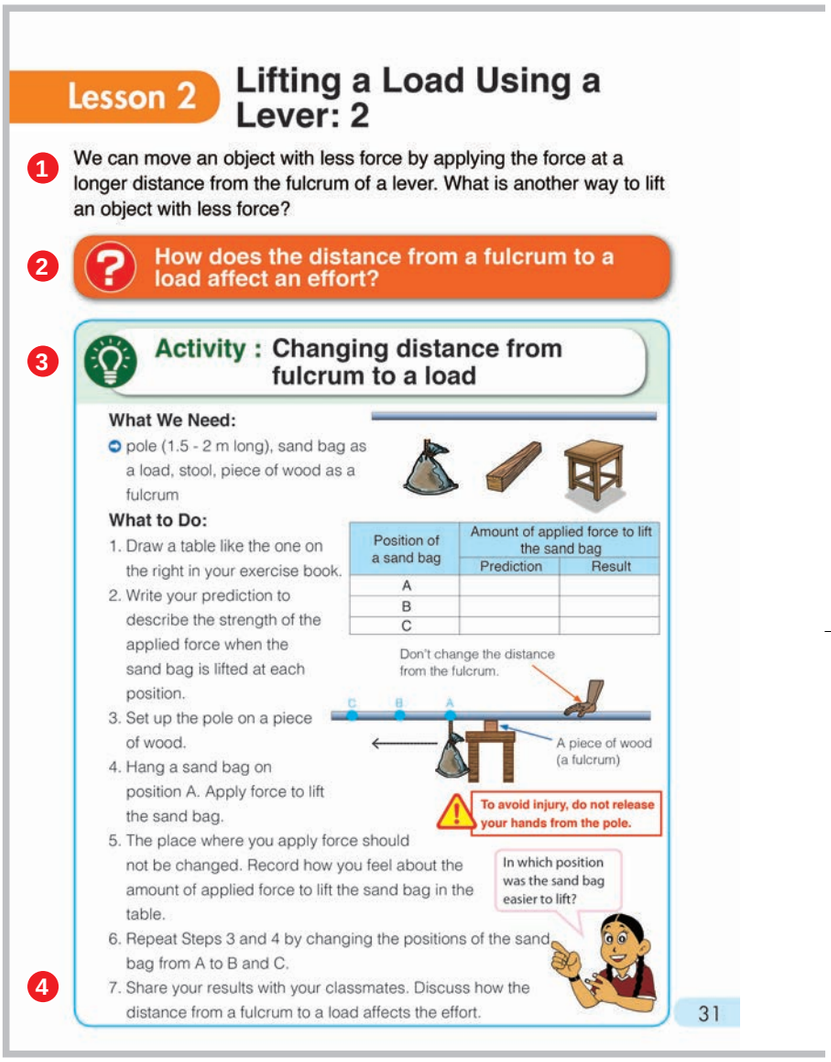

Lesson 2 Lifting a Load Using a Lever: 2

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.

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

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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

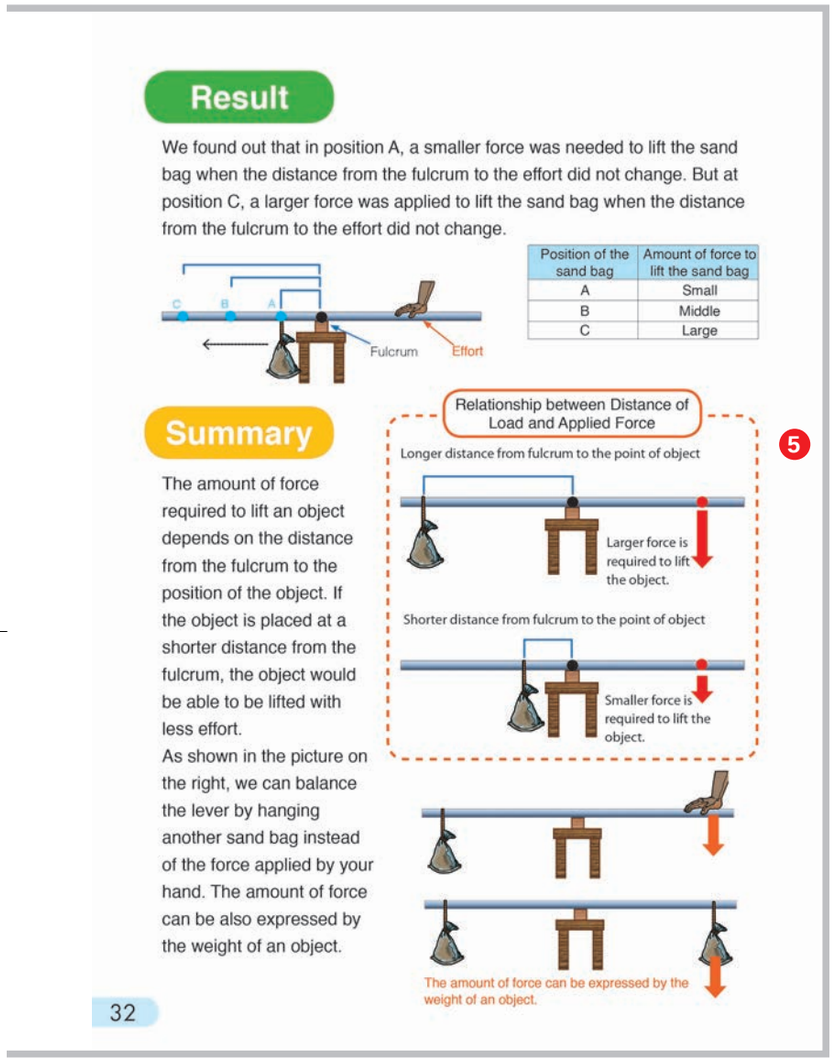
- Keep students at a safer distance when gathering around the setup.
- Remember not to let go of the pole suddenly as it can hurt you and your friends.

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.

- 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 sandbag 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 sandbag is moved further away from the fulcrum. Less force is needed as the sandbag is moved closer to the fulcrum.)

Q:What relationship do you find between the amount of force required to lift a sandbag and the distance of the sandbag from a fulcrum? (If the sandbag is placed at a shorter distance from the fulcrum, we need less force to lift. If the sandbag 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 sandbag 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 sandbag is moved further away from the fulcrum. Less force is needed as the sandbag is moved closer to the fulcrum.

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

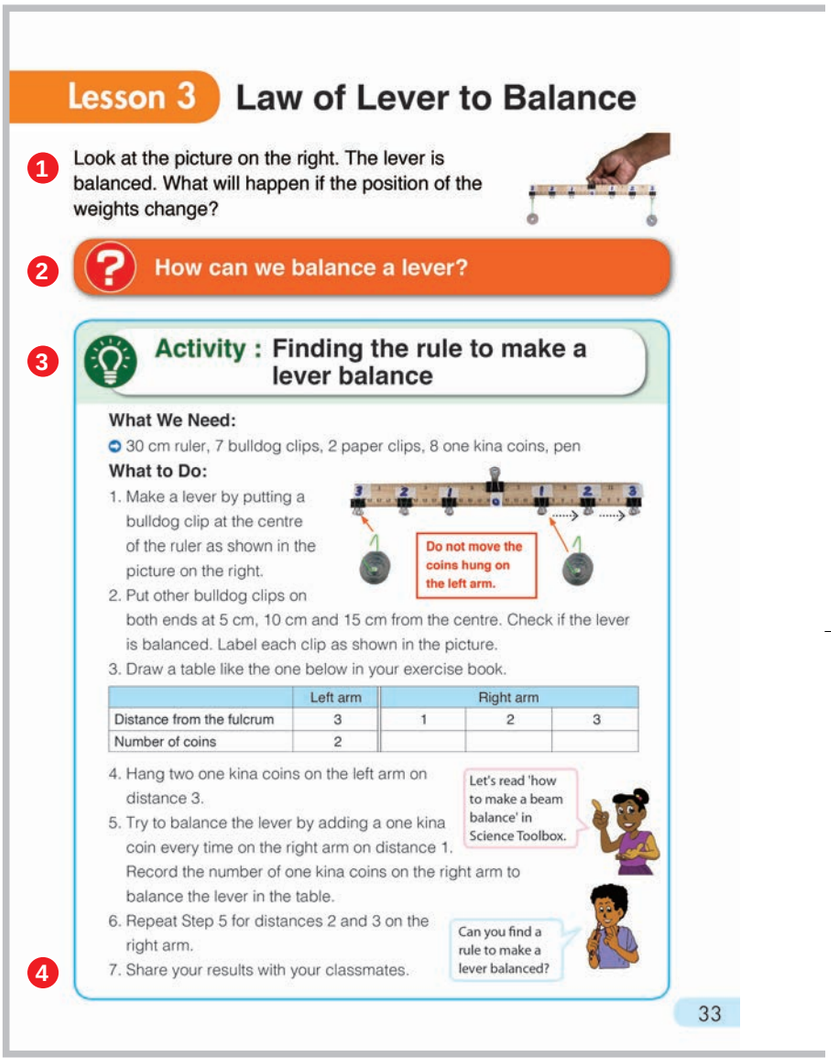
How can we balance a lever?

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

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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

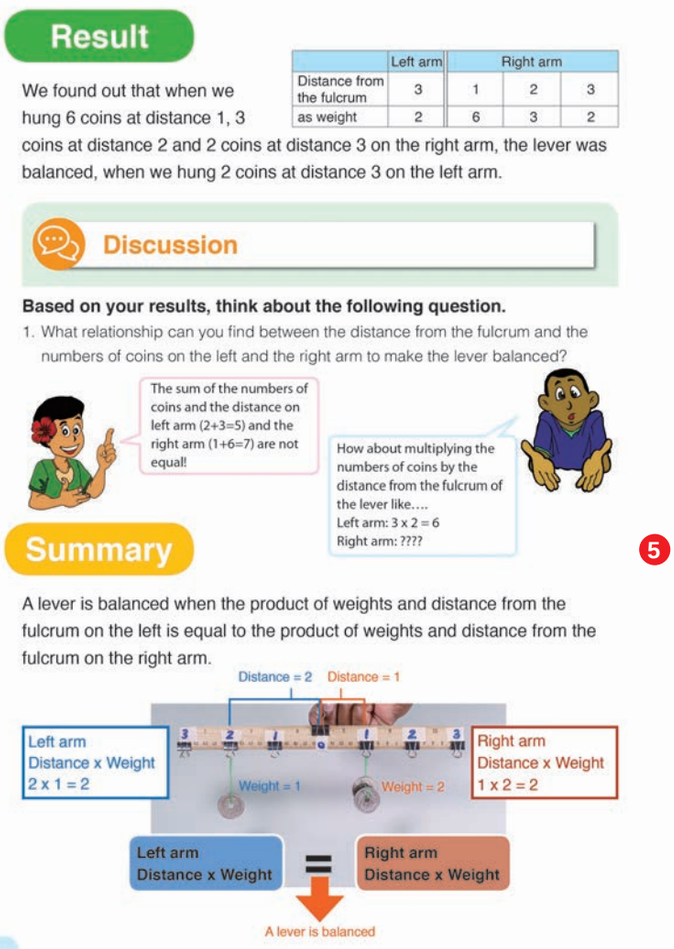
- Do not put or hold paper clips or other small objects in the mouth when making the balance.
- Be careful when using tools to cut. Example scissors. Do not pull tools from others. Wait till others are finished.

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.



Result

We found out that when we hung 6 coins at distance 1, 3 coins at distance 2 and 2 coins at distance 3 on the right arm, the lever was balanced, when we hung 2 coins at distance 3 on the left arm.

	Left arm	Right arm		
Distance from the fulcrum	3	1	2	3
as weight	2	6	3	2

Discussion

Based on your results, think about the following question.

1. What relationship can you find between the distance from the fulcrum and the numbers of coins on the left and the right arm to make the lever balanced?

The sum of the numbers of coins and the distance on left arm (2+3=5) and the right arm (1+6=7) are not equal!

How about multiplying the numbers of coins by the distance from the fulcrum of the lever like....
Left arm: 3 x 2 = 6
Right arm: ????

Summary

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

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

Q: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	

Unit: **Force and Motion**	Chapter : **2. Force and Machine** Topic : **2.2. Regularity of Levers**	Total lesson No: 12 / 87 Textbook page: 35 - 37

Lesson 7 / 8

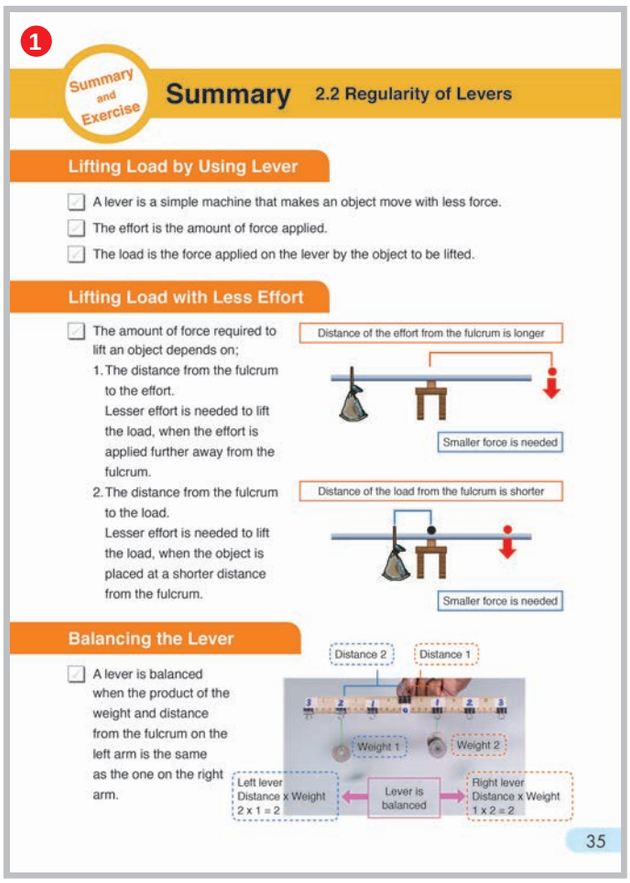
Lesson Title

Summary and Exercise

Tips of lesson

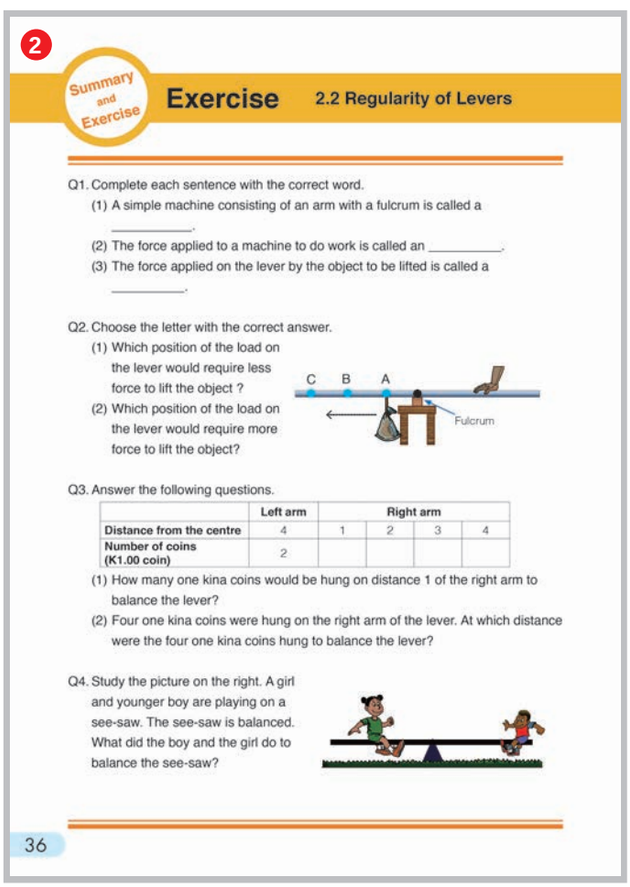
1 Summary (20 min.)

- 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**

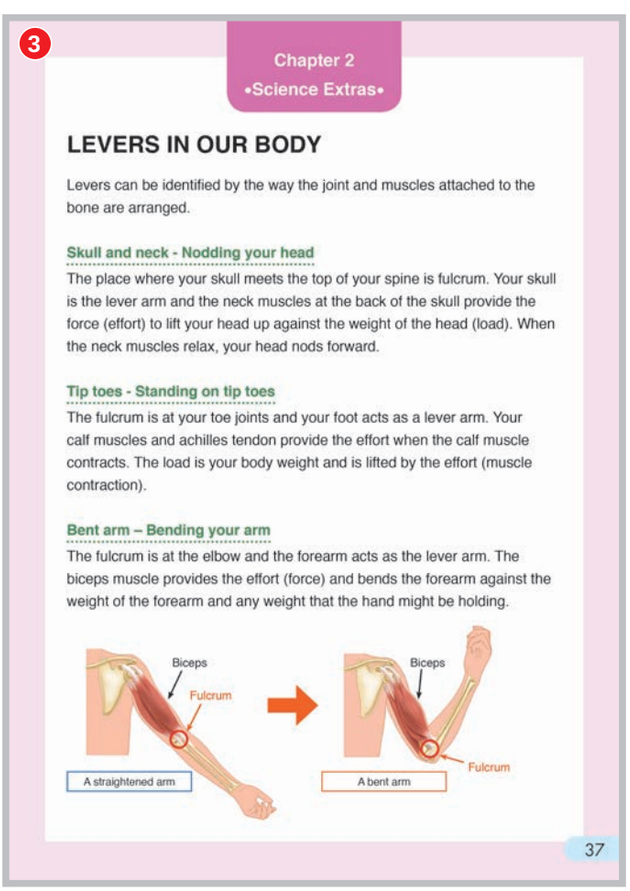
Q3.
(1) **8 one kina coins**
(2) **Distance 2.**

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.

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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.

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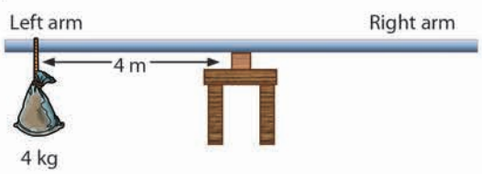
Q3

(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)

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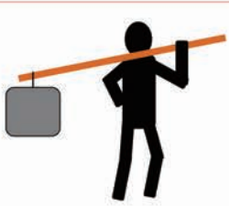
(ii) The lever is balanced when the other weight is hanging on the right arm at the distance of 2 m from the fulcrum. Calculate what would be the amount of weight on the right arm?

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 put the centre of the pole on his shoulder and hold the pole infront and further away from the shoulder making the distance longer.

Strand : EARTH AND SPACE
Unit : WEATHER AND CLIMATE

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.

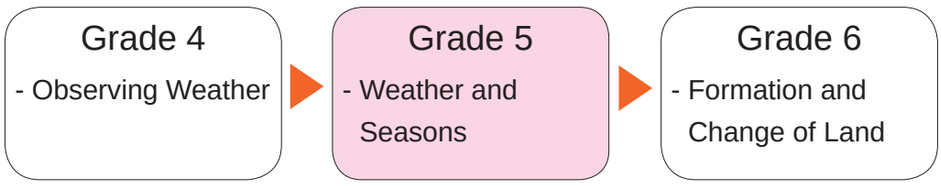
3.2 Seasons

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.

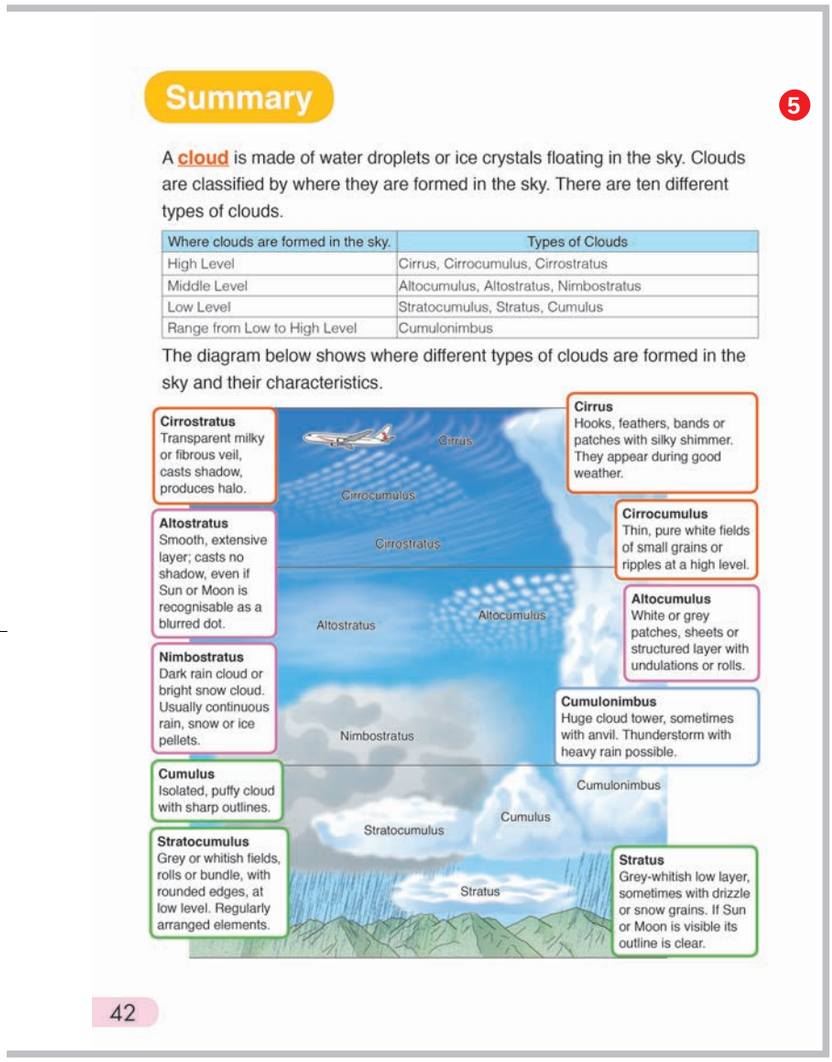
- Altitude is the height or point above sea level or ground level.
- Clouds are given different names based on their shape and their height in the sky. Some clouds are near the ground. Others are almost as high as jet planes fly.Some are puffy like cotton. Others are grey and uniform.
- Cumulonimbus 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.

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- 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? Similarity- 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?

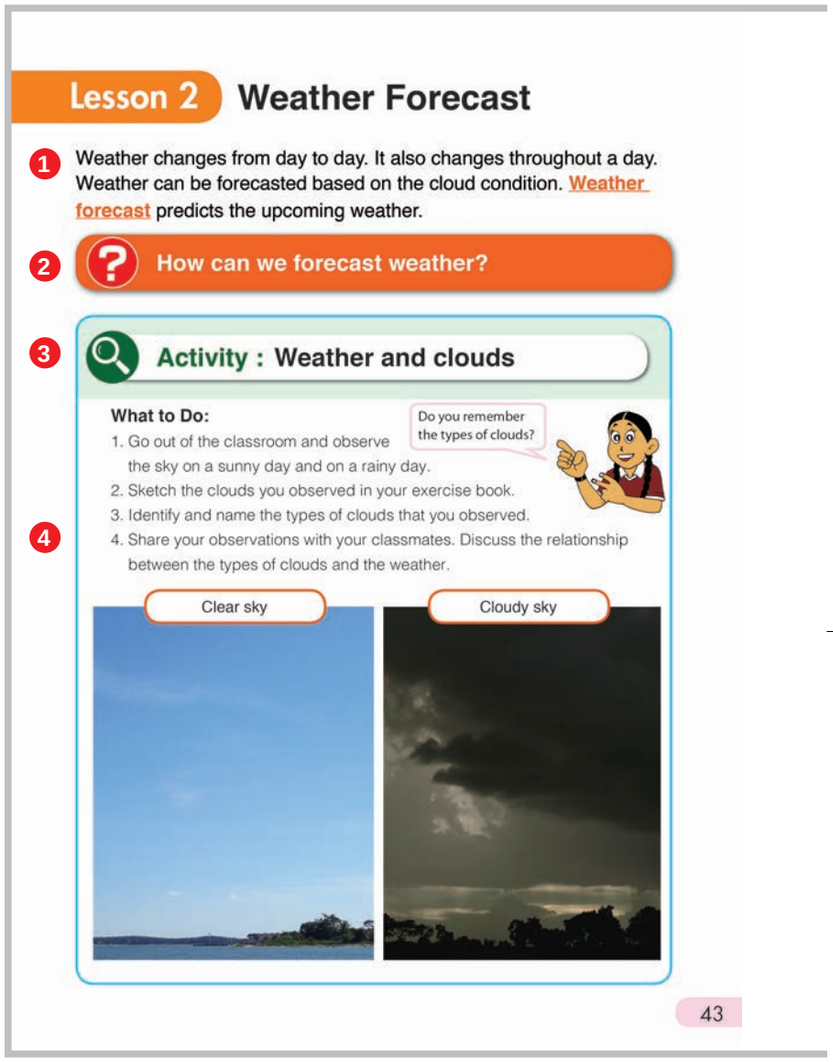
3 Activity (20 min.)

- 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

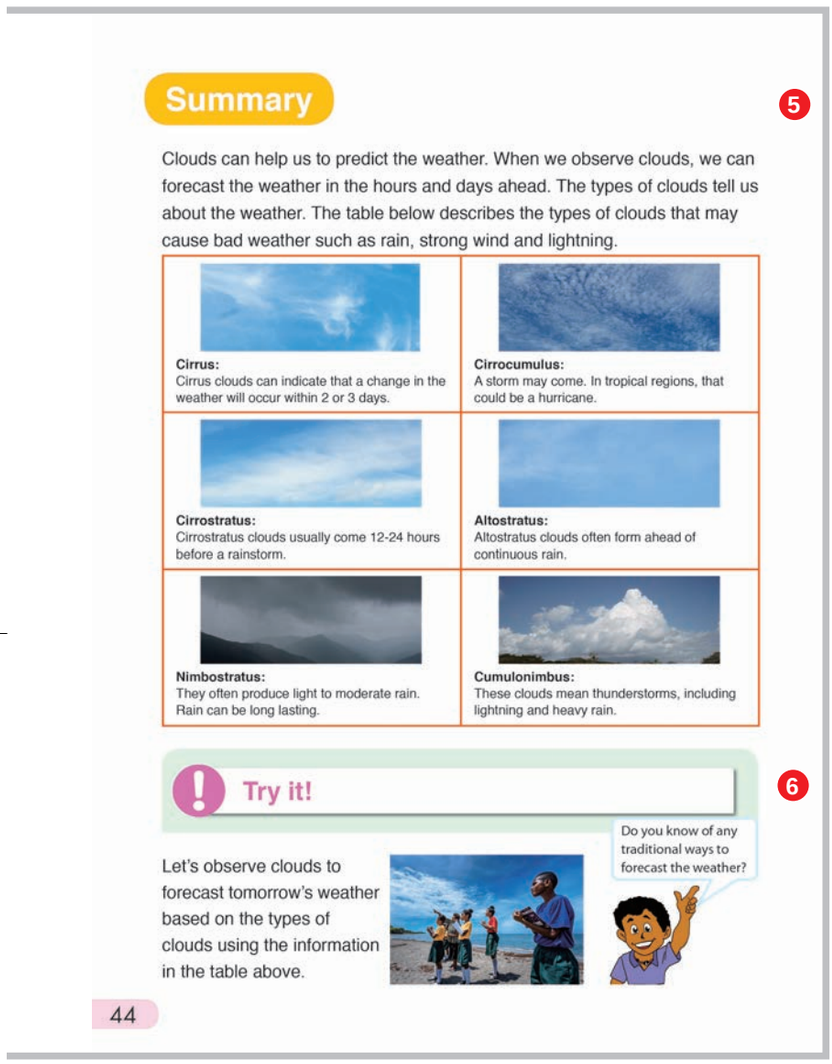
- This activity can be done two times, on a sunny day and on a rainy day, before the discussion. The weather condition varies and the result shown in the blackboard plan is just an example. Thus, the lesson need to be facilitated based on the condition in your place when it is conducted. Refer to the 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.

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- **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

Unit: **Weather and Climate**	Chapter : **3. Weather and Seasons** Topic : **3.1. Observing Clouds**	Total lesson No: 16 / 87 Textbook page: 45 - 46

Lesson 3 / 7

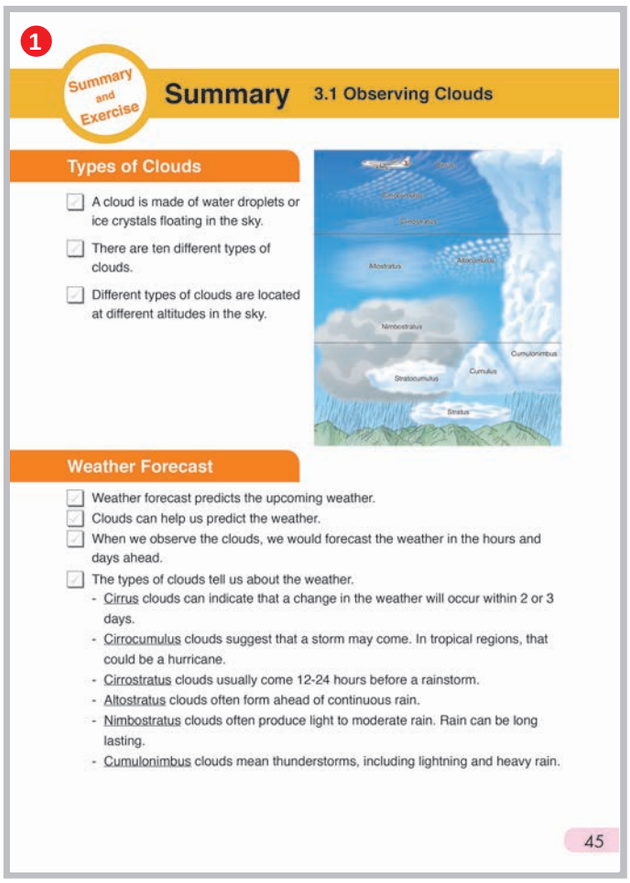
Lesson Title

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.

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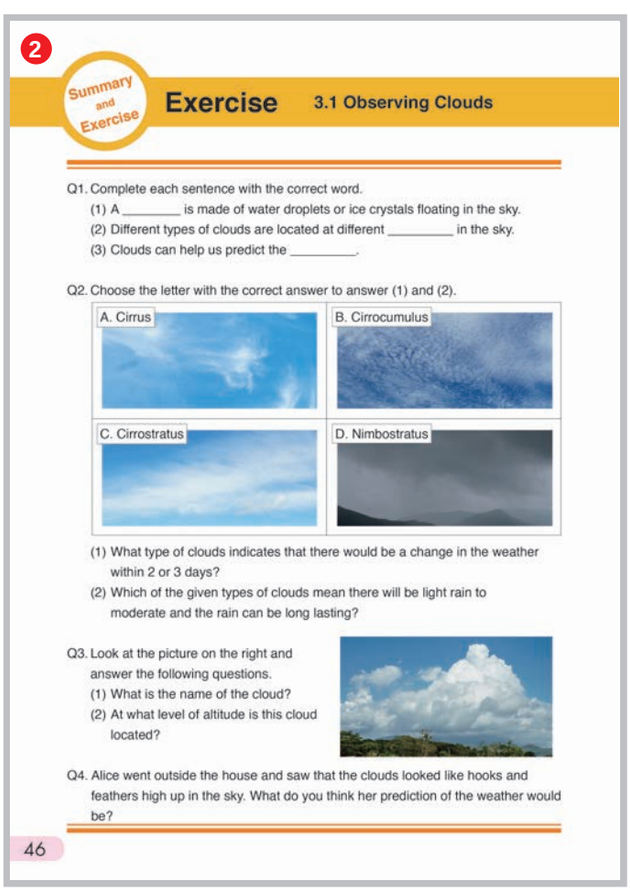
2 Exercise & Explanation (30 min.)

- 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).

(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?

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Exercise answers

Q1.
(1) **cloud**
(2) **altitude**
(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 0r 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 is 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.

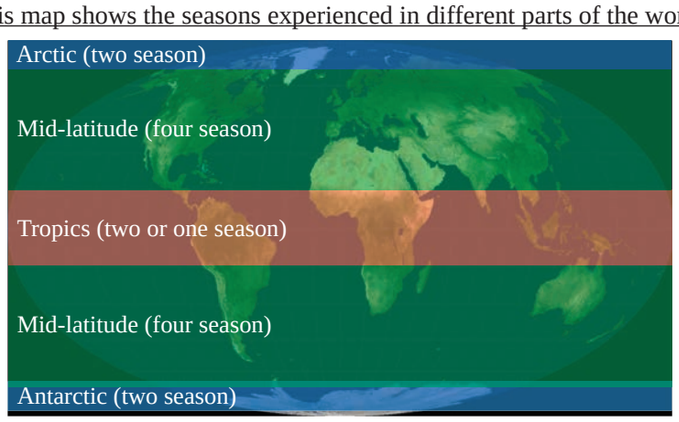
4 Discussion for findings (20 min.)

- 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.

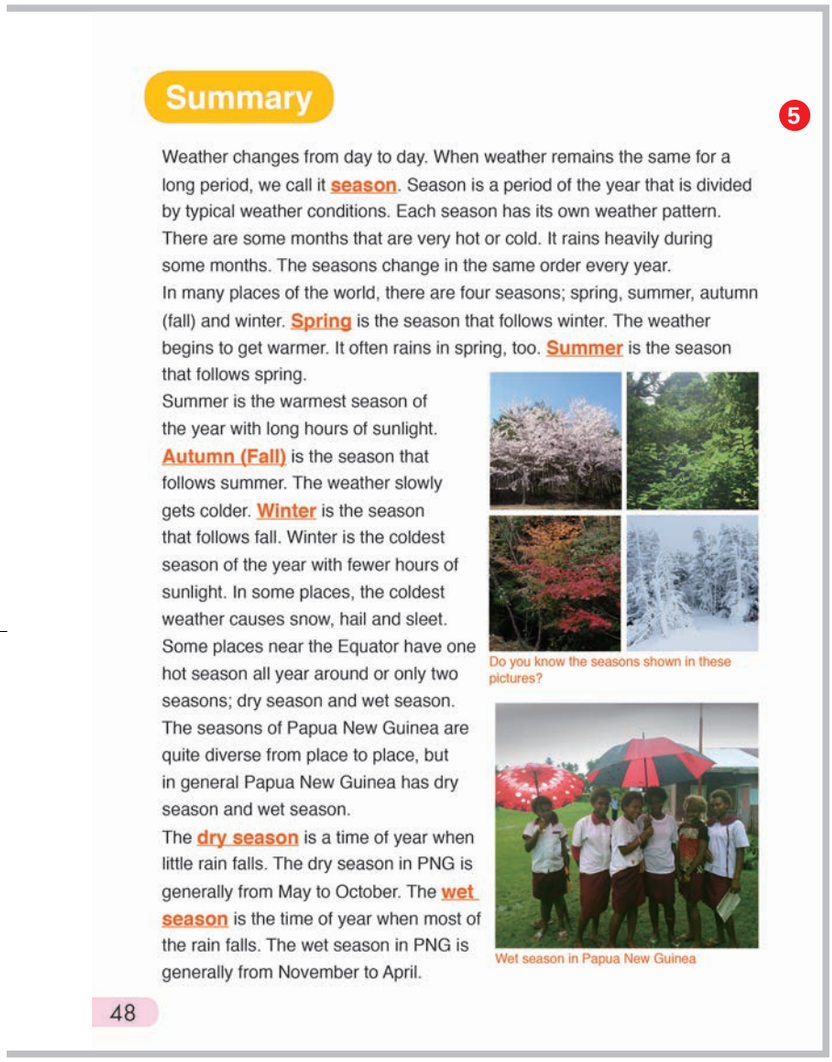
Note: Explain that the graph used in the activity is made up of two graphs put together as one. There's the line graph that shows the temperature (which the temperature is read from the dots on the line) and bar graph that shows the amount of rainfall (the amount of rainfall is read from where the bar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

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- 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?

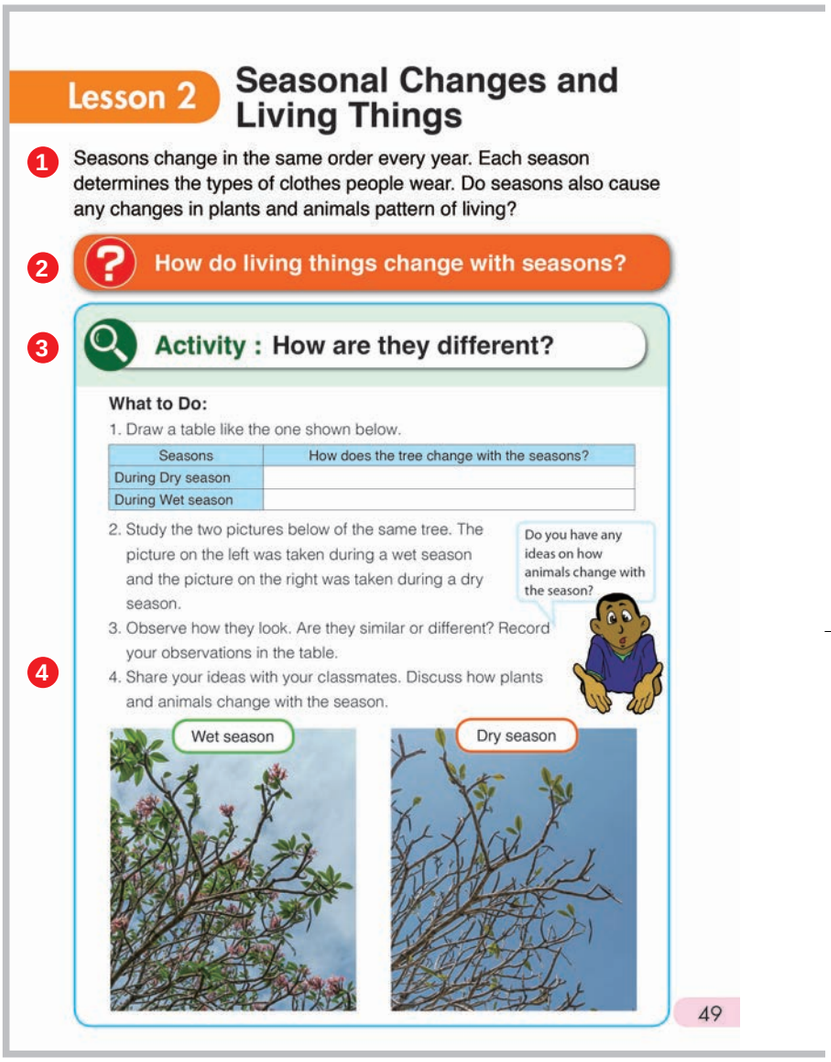
3 Activity (25 min.)

- 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

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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.

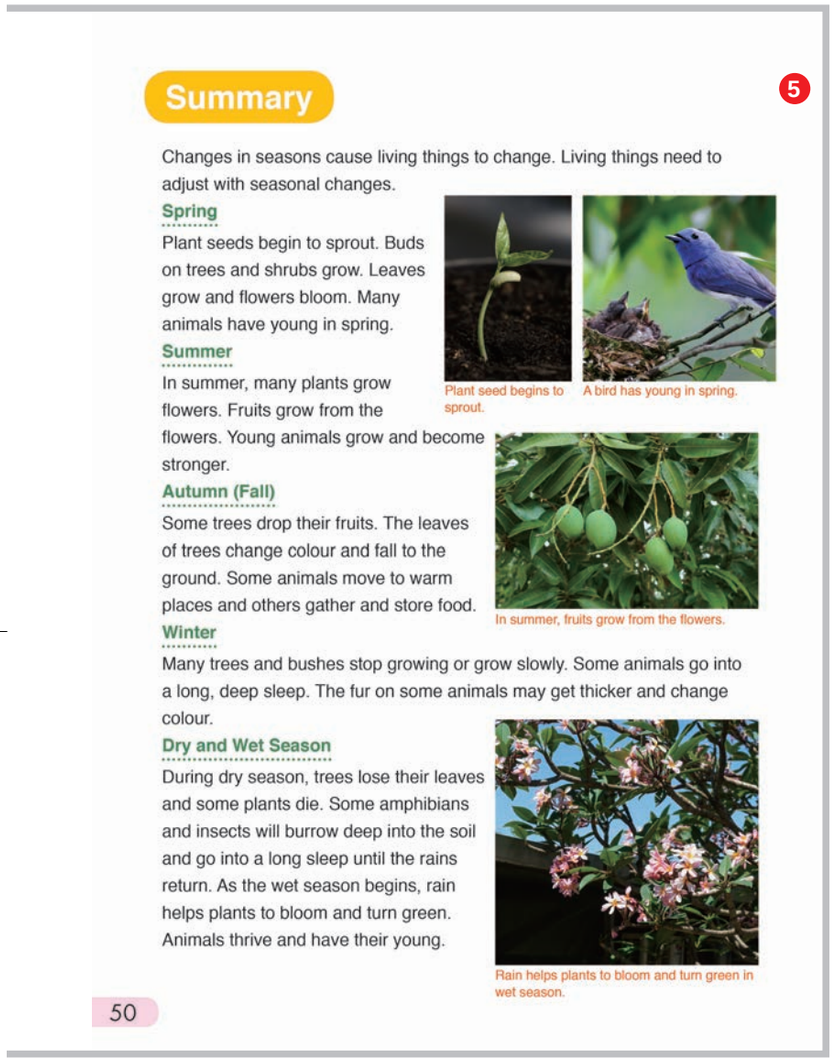
Note: This can be discussed with the students based on the second question in the discussion.

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 5

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.

Plant seed begins to sprout.

A bird has young in spring.

Summer

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

In summer, fruits grow from the flowers.

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.

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

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

Q:How do 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

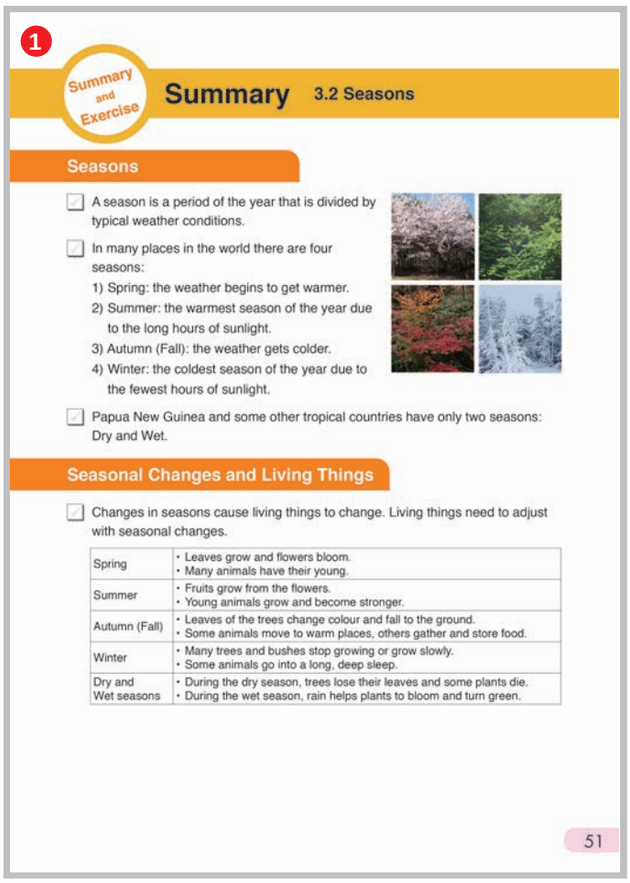
Lesson Title

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.

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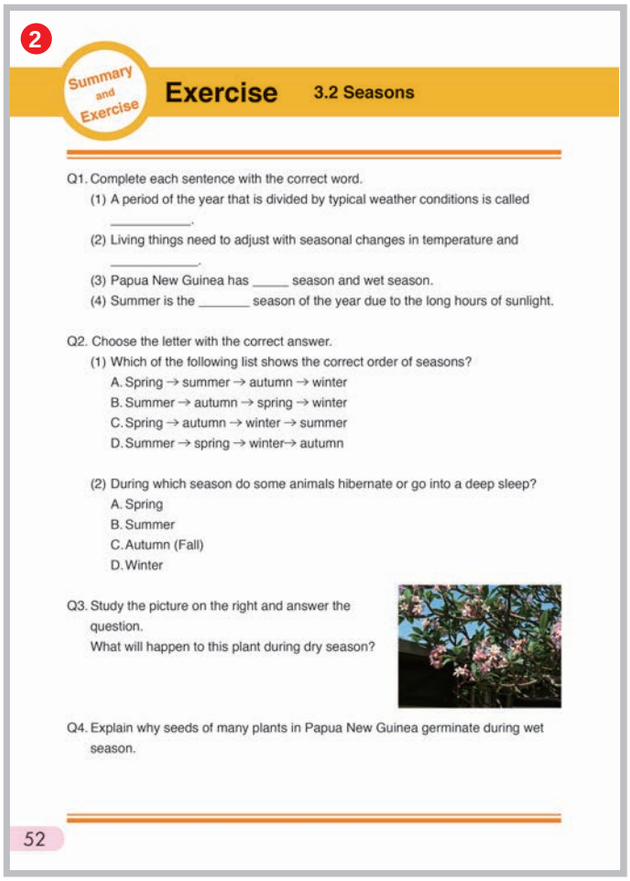
2 Exercise & Explanation (30 min.)

- 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 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.

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Exercise answers

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

(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.

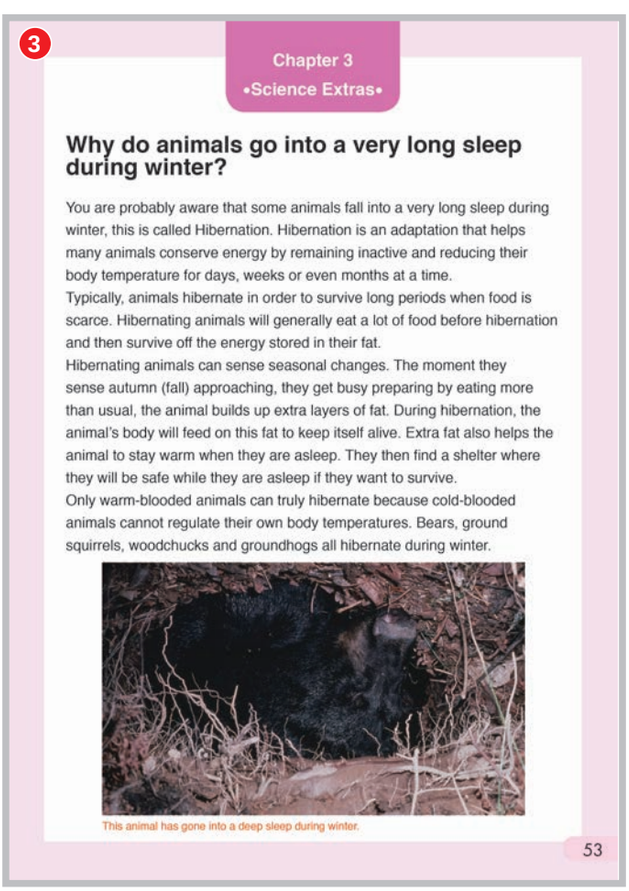
Q3. **The leaves turn brown and drop to the ground.**

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.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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.

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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

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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?

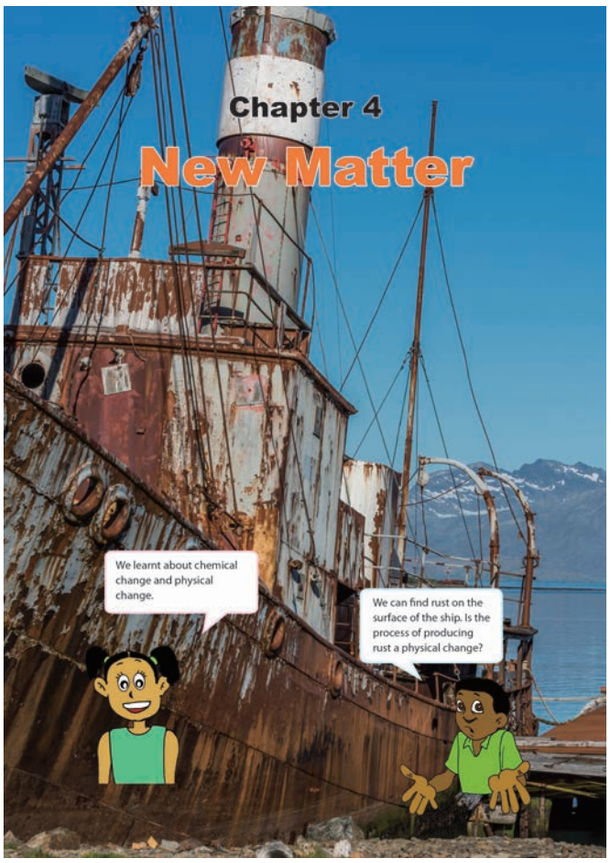
Weather would be fine but might change within 2 or 3 days.

Strand : PHYSICAL SCIENCE
Unit : MATTER

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

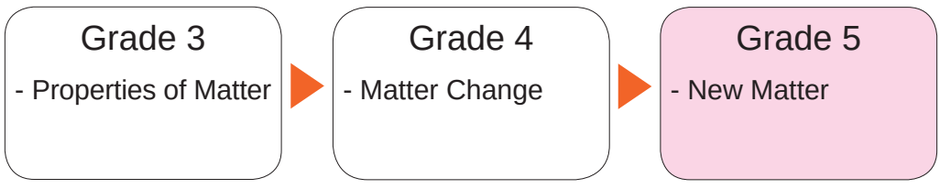
4.1 Common Chemical Changes

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.

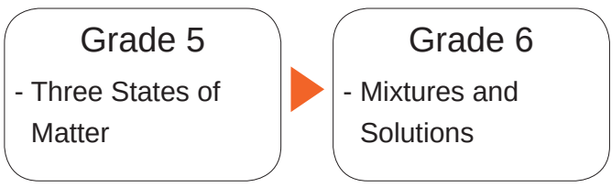
Related Learning Contents

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.

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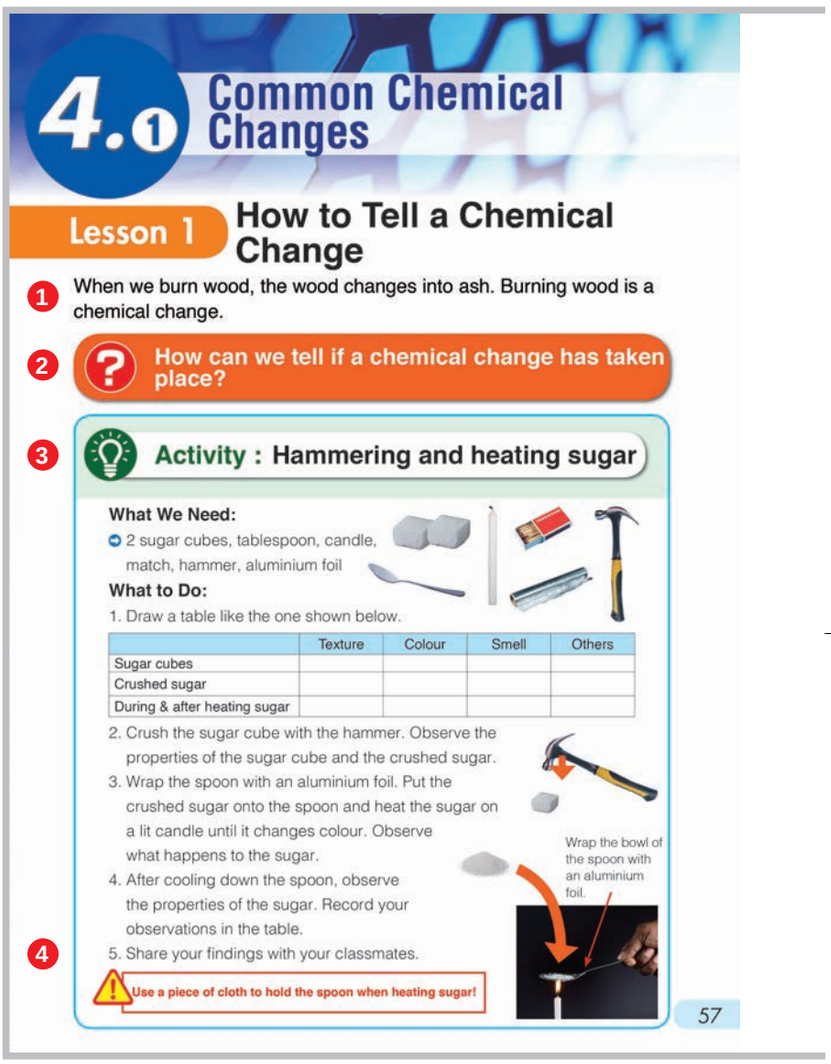


Teacher's Notes

- 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

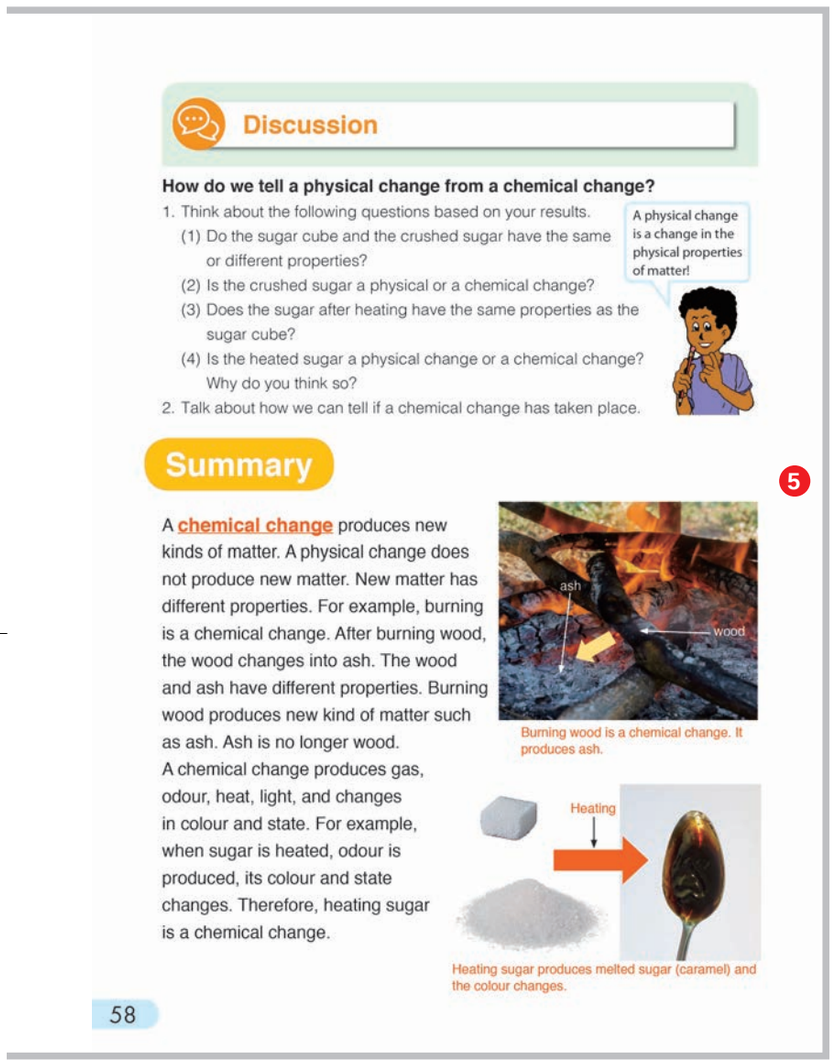
Students will be able to:

- 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.

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- 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 the heated 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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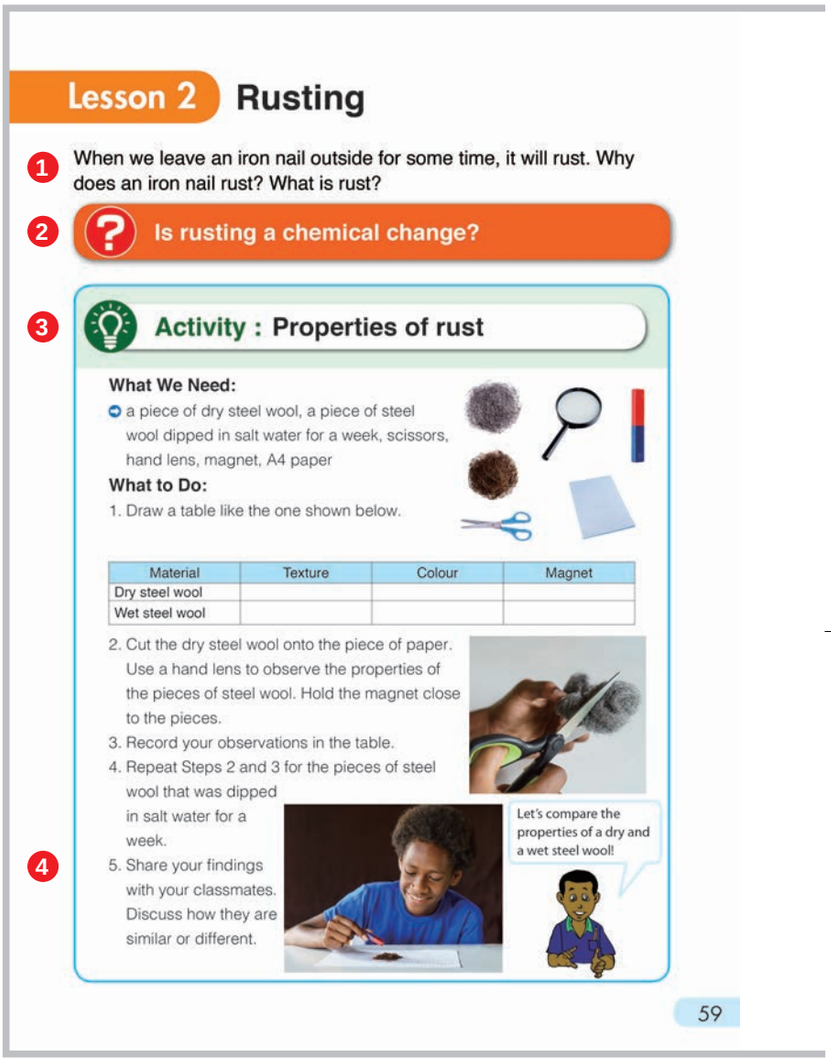

Lesson 2 Rusting

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!

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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

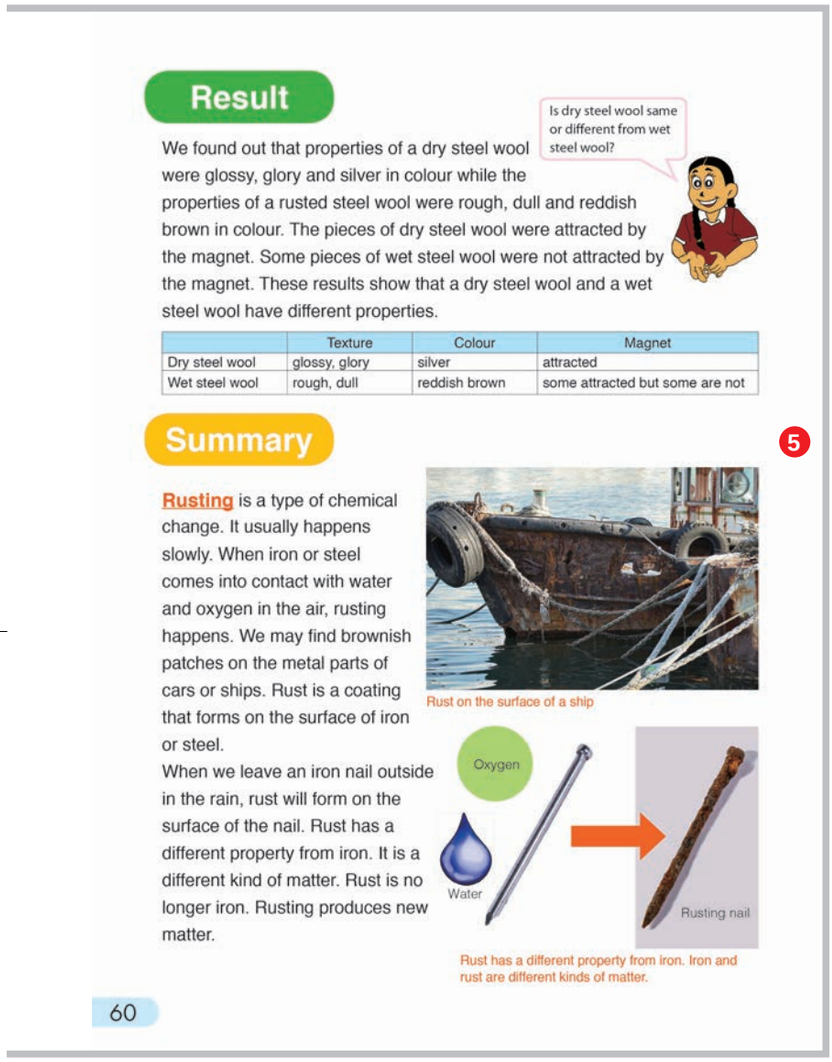
- One of the properties of rust is it becomes an insulator that it cannot conduct electricity just as not been attracted to a magnet.
- Not all metals rust. For example, aluminium doesn't rust because it has a protective layer of aluminium oxide on its surface. This stops the metal coming into direct 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.

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

Summary

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

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

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- 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 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?

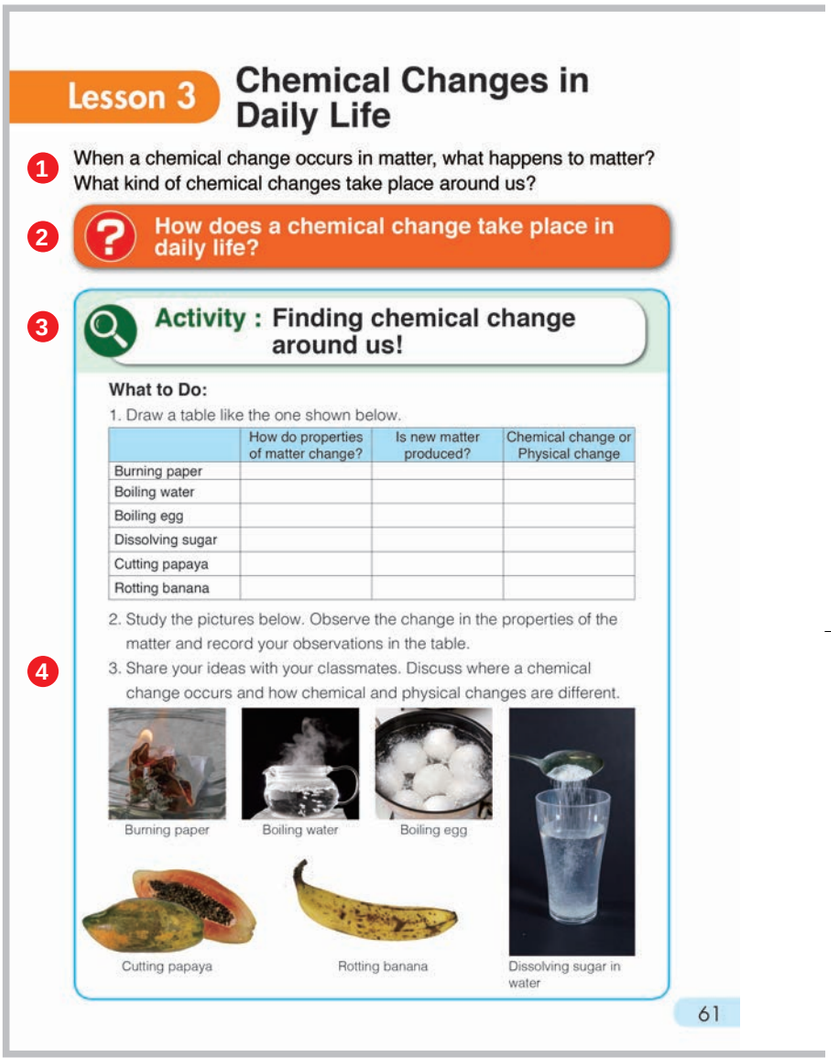
3 Activity (20 min.)

- 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.

(Continue)



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

4

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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

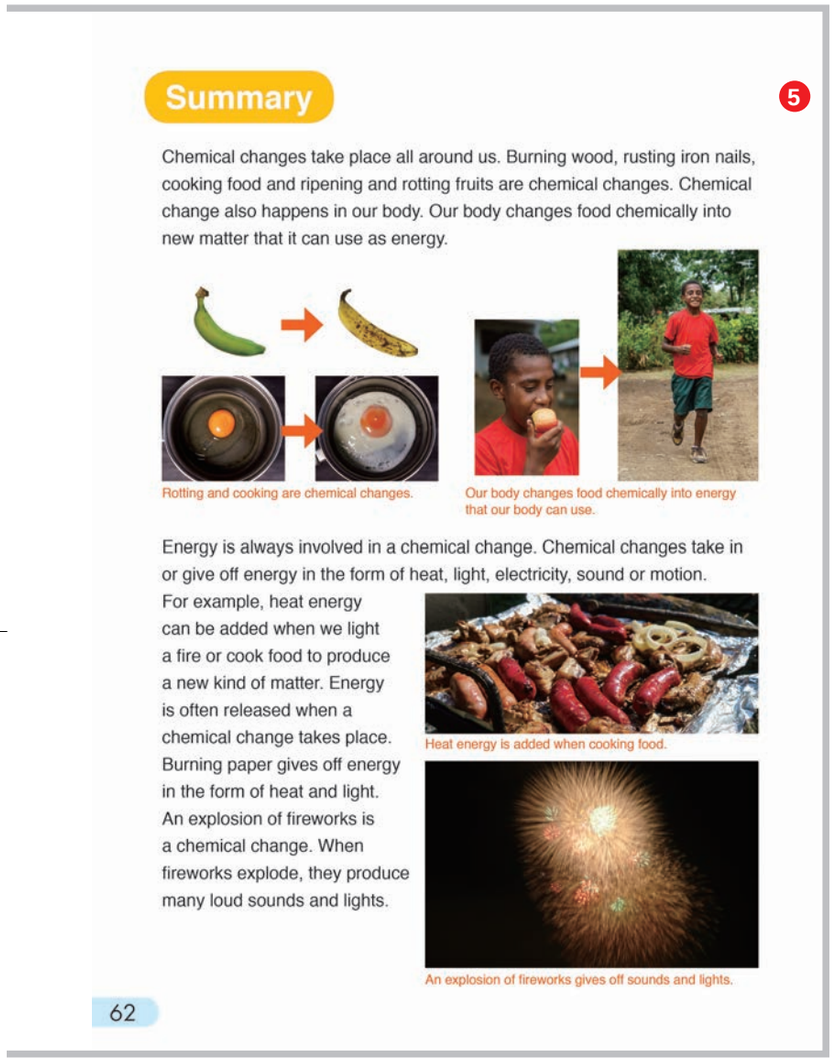
1. Digestion of Food
2. Washing detergents used in washing dirt from clothes, dishes and our bodies etc.
3. Effect of Medicine in our body taken when ill with different kinds of sickness and diseases.
4. Changing of colour of falling leaves. For instance, leaf of an almond tree (talis or okari tree).

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.

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

Q: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, the physical properties of the mango such as the size, shape change but 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, the physical properties of the mango such as the size, shape change but 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

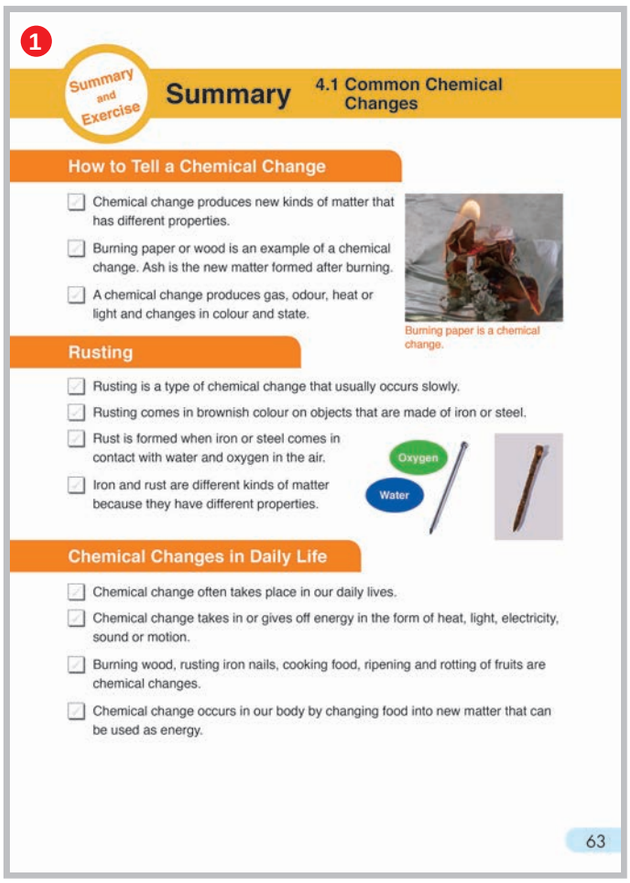
Lesson Title

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.

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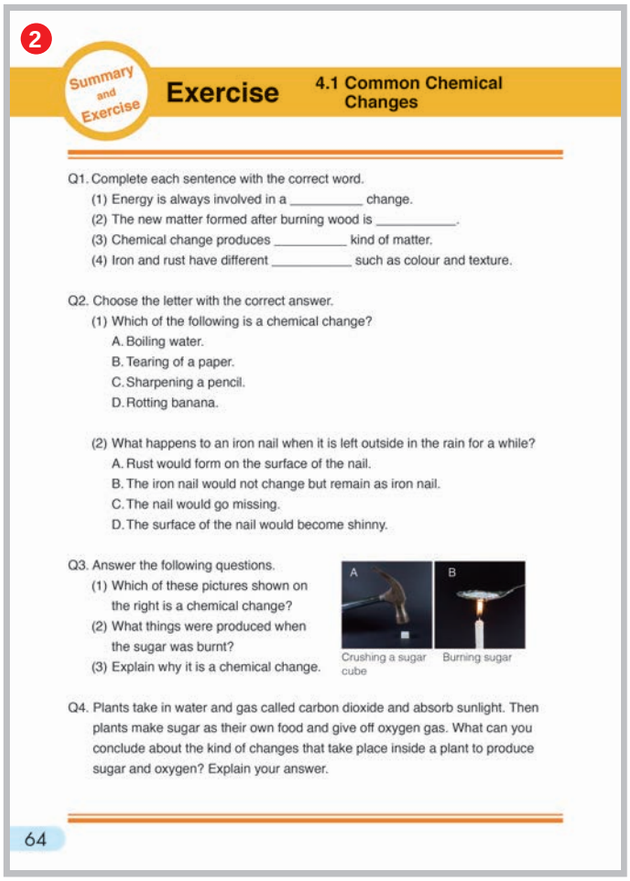
2 Exercise & Explanation (30 min.)

- 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.

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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.

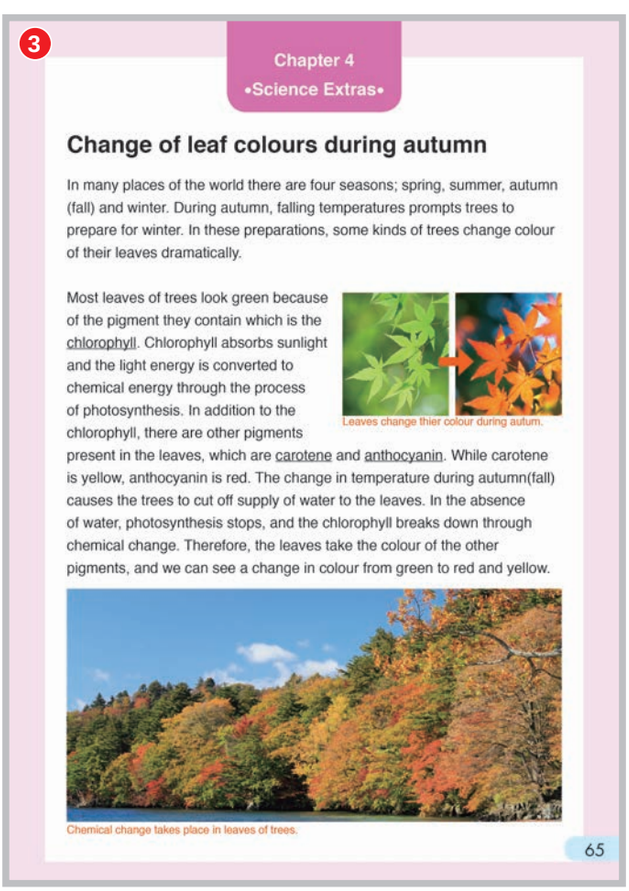
Q3.
(1) **The burning sugar**
(2) **When sugar is burnt, odour (sweet smell) is produced, colour changes as well as the state changes from solid to liquid. (Caramel)**
(3) **Heating sugar produces a caramel that has different colour as a new kind of matter.**

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 thier colour during autum.

Chemical change takes place in leaves of trees.

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Unit: **Matter**	Chapter : **4. New Matter** Topic : **4.1. Common Chemical Changes**	Total lesson No: 25 / 87 Textbook page: 66 - 67

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.

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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.

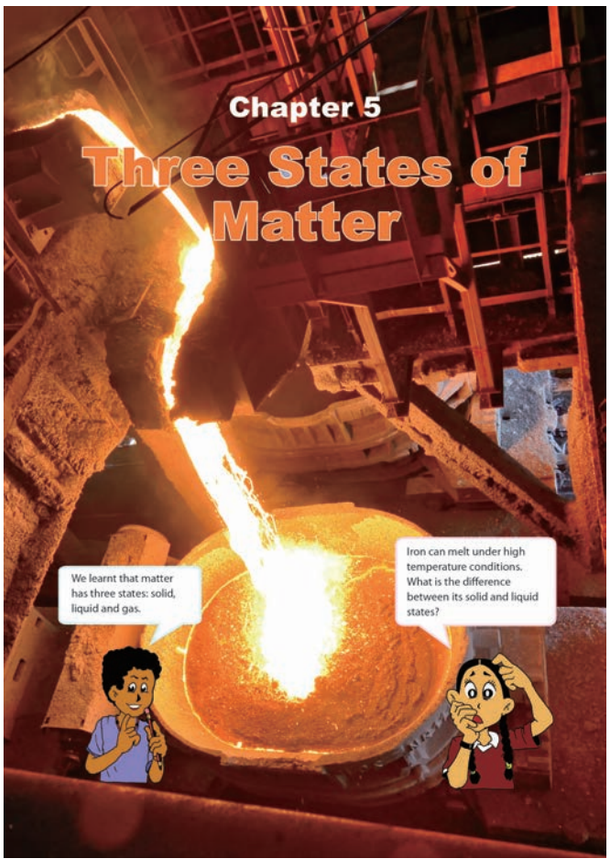
(2) Explain why the melting ice is not a chemical change.
(Expected answer) The only thing that changes is the physical state of water from ice to water. The water still remains as water and new substance does not produce.

Strand : PHYSICAL SCIENCE
Unit : MATTER

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

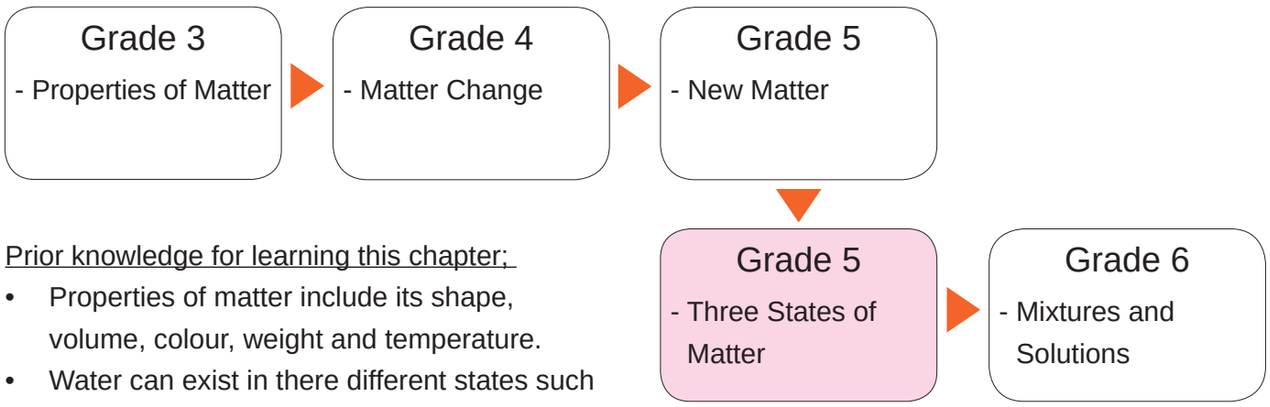
5.1 Properties of Three States of Matter

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 there 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

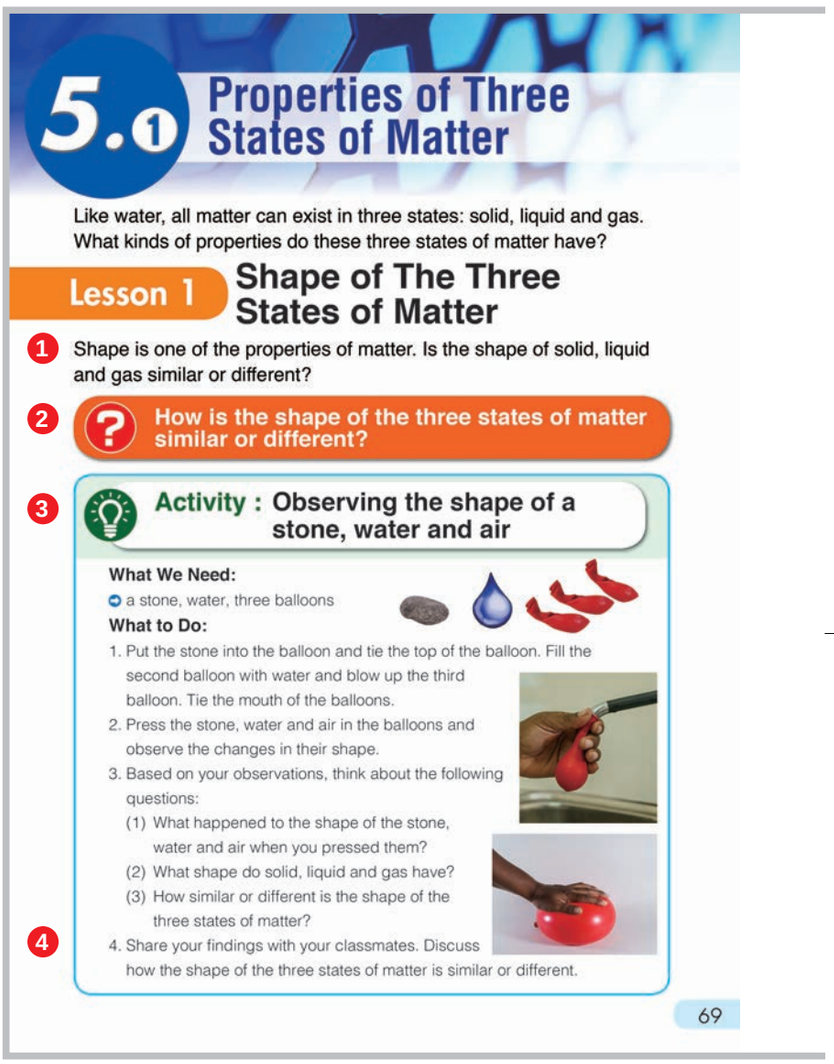
How is the shape of three states of matter similar or different?

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.

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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.

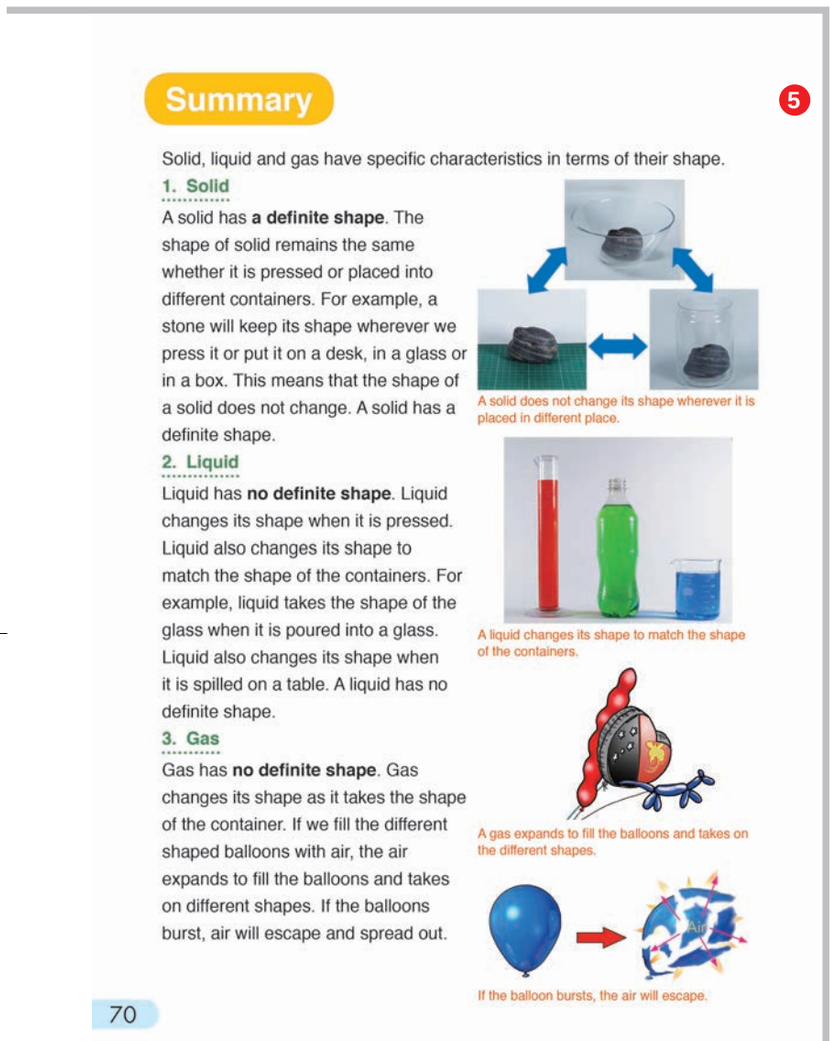
SOLID	LIQUID	GAS
		
Has fixed shape.	No fixed shape Takes shape of the container.	No fixed shape Takes shape of the container.

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 5

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.

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- 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, the 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 don't 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 don't 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.

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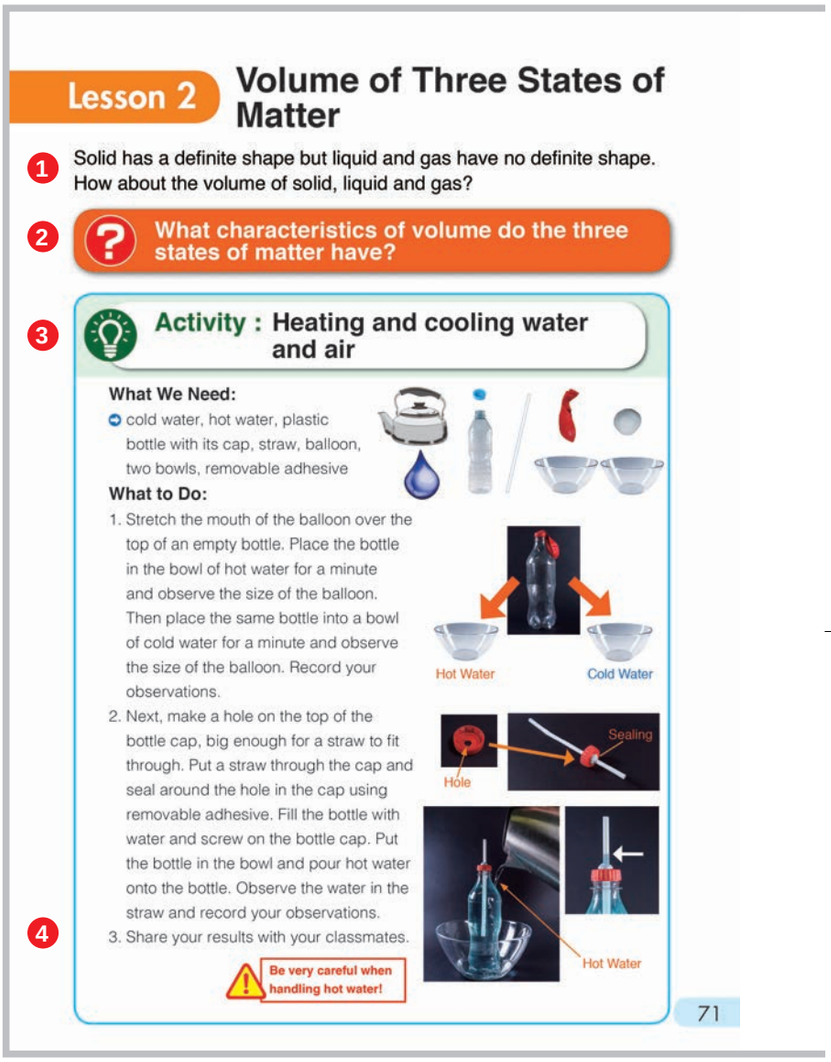


Teacher's Notes

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

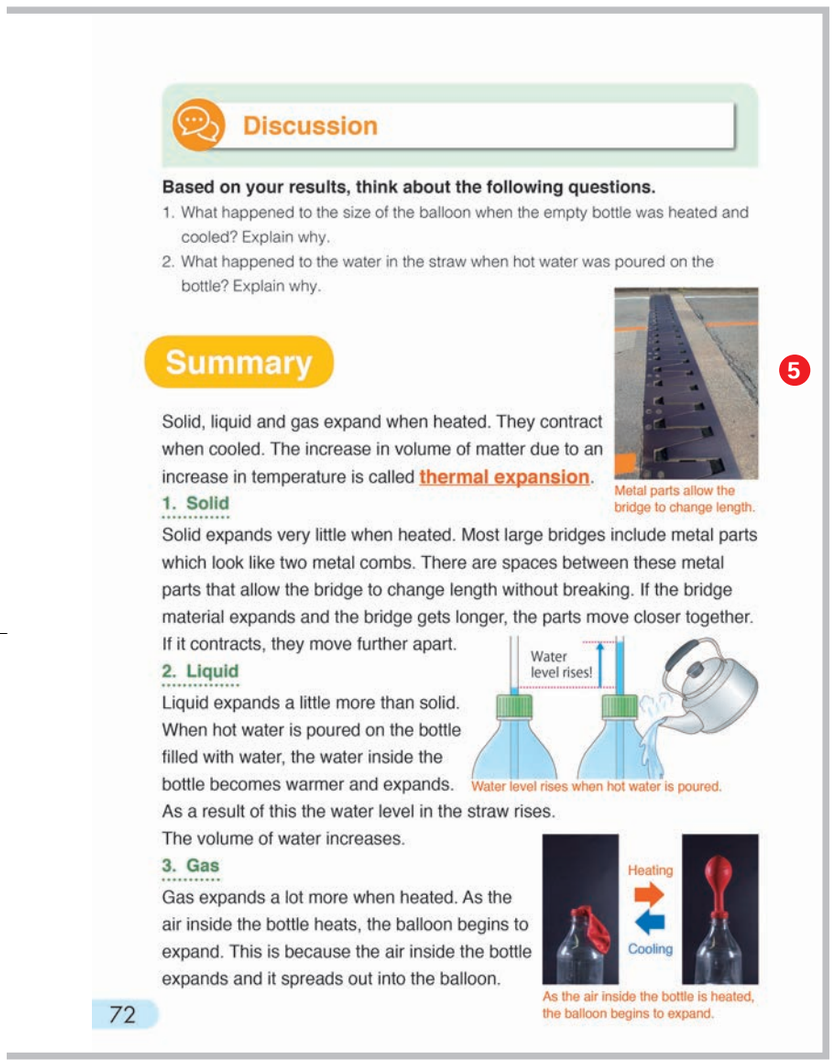
- Gaps are left between sections of railway line to allow expansion in hot day.
- Telephone wires are deliberately left loose to allow for contraction in winter.
- Central heating systems have an expansion pipe to allow the heated water to expand without bursting out the system.
- Soft drinks like Coca 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 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.

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

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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:

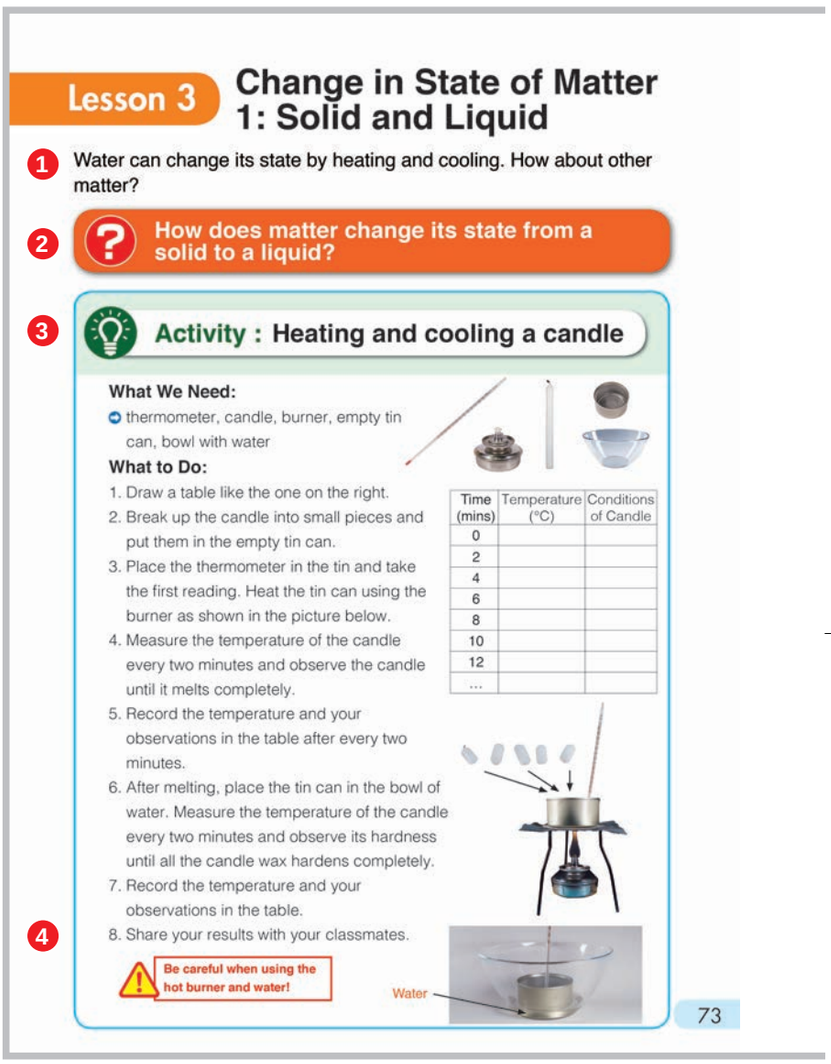
Q:How about other matter? Do you think they can also change their states like water?

2 Introduce the key question

How does a 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

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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

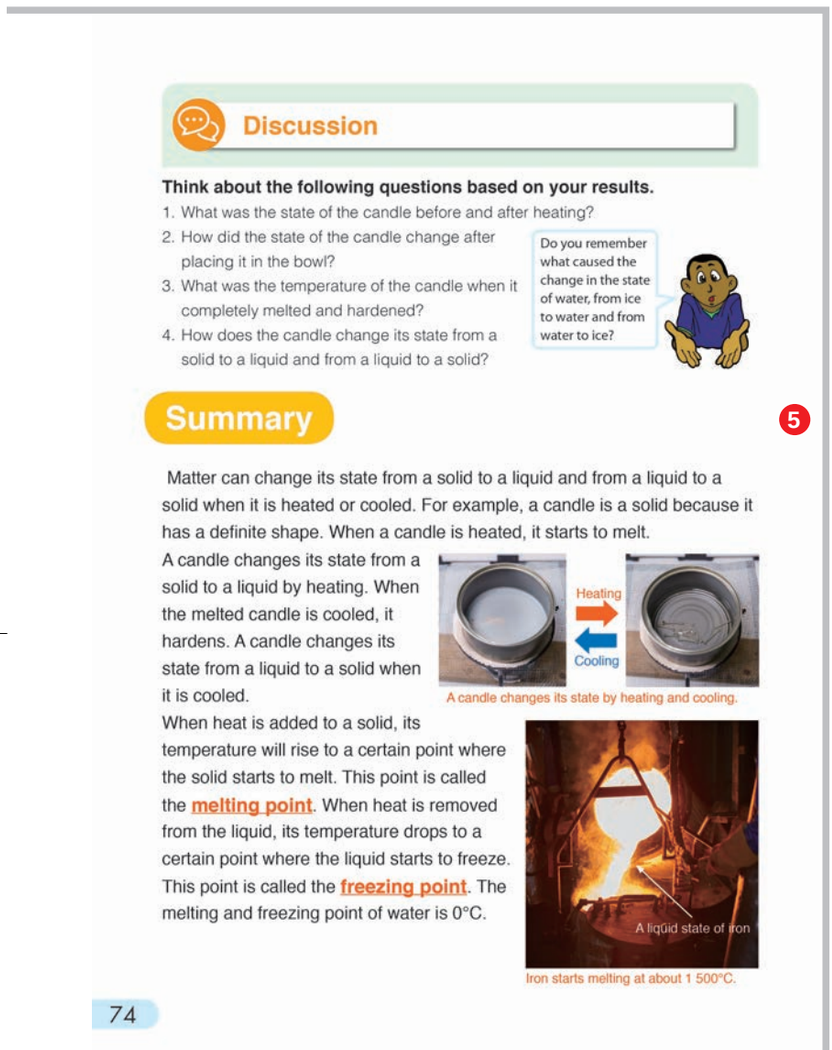
Students will be able to:

- 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

5

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.

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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 was the temperature that 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.

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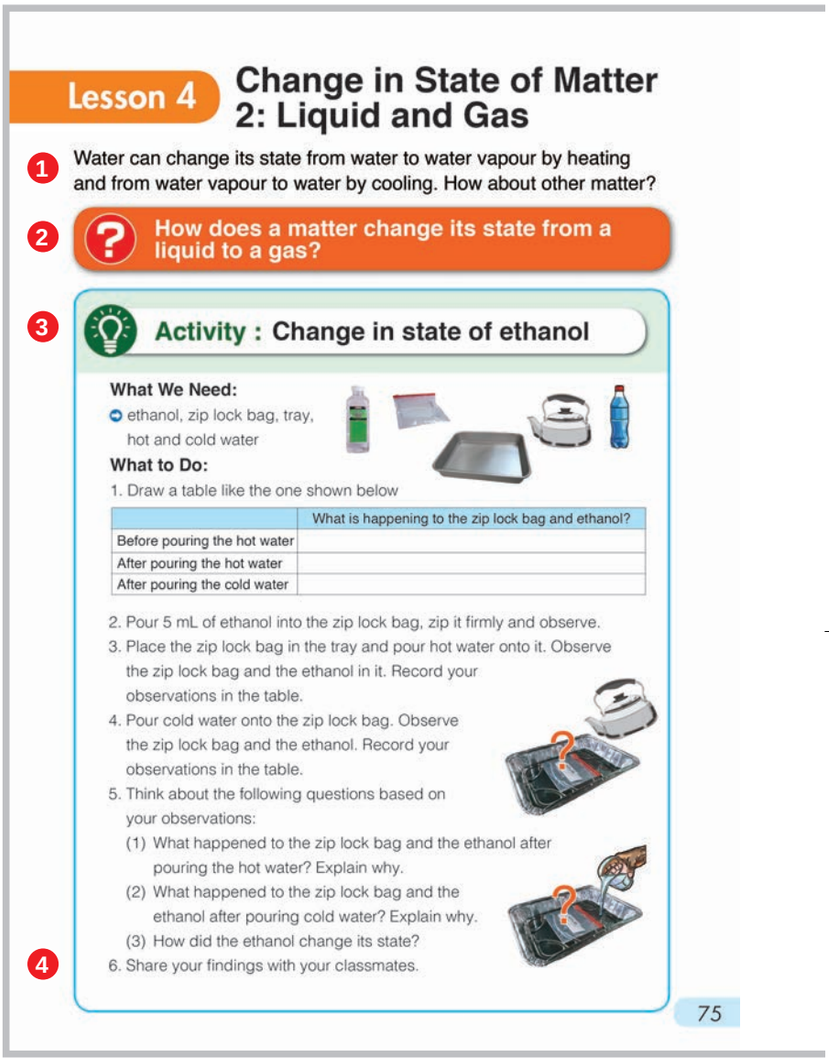

Lesson 4 Change in State of Matter 2: Liquid and Gas

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

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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

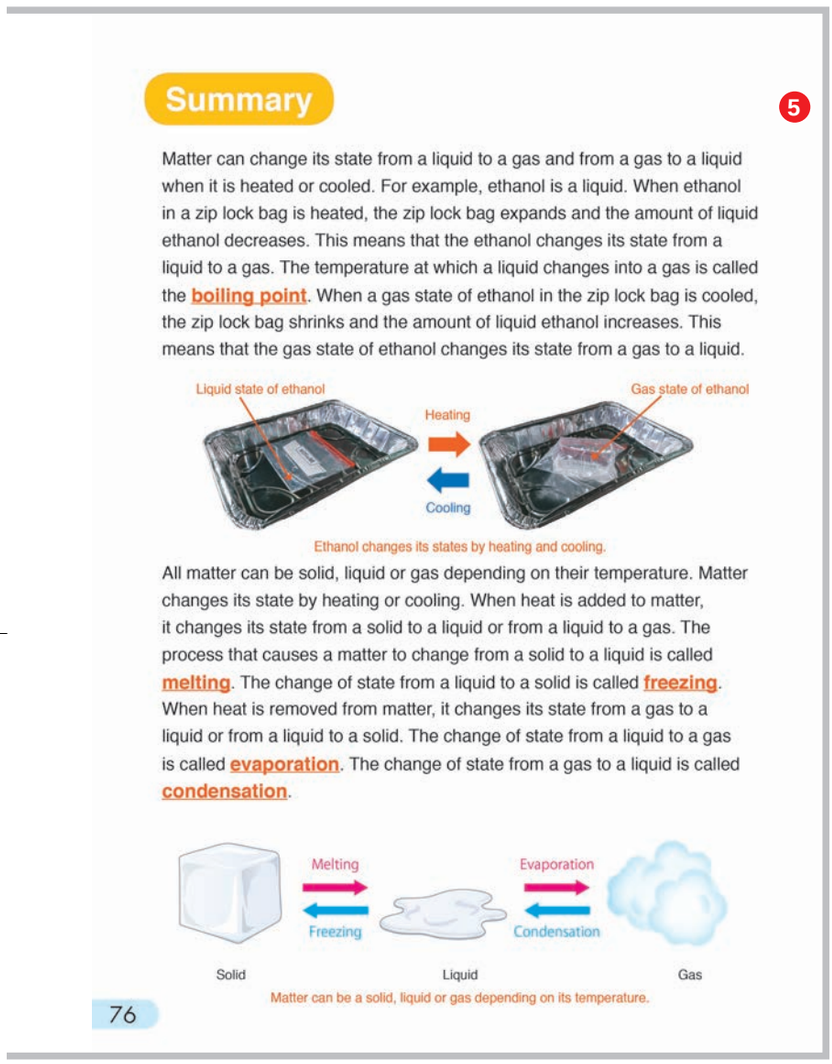
- A methylated spirit can substitute the ethanol if unavailable. BUT, be very careful as it is poisonous which can lead to serious health problems or even death when they drink. Keep out of reach after the lesson.
- A deeper and wider tray or dish is good to use as it can accommodate a lot of water when 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.

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- 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 expands. The amount of ethanol decreases. State change: Liquid to Gas
After pouring cold water	Zip lock shrink 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.

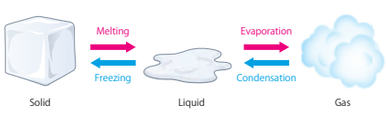
Q: Why? The ethanol changed from liquid to gas when heated. The amount of gas in zip lock increased and it expanded.

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

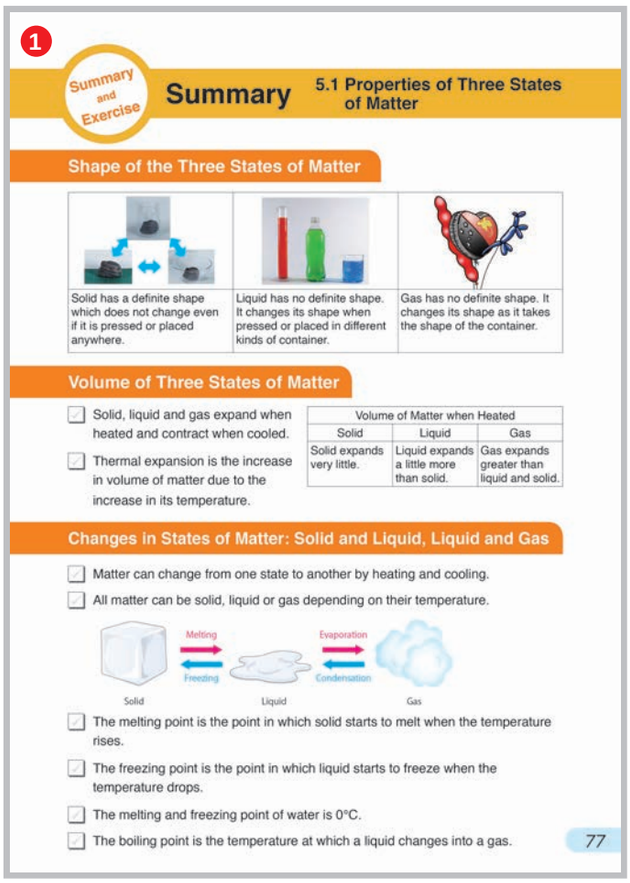
Lesson Title

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.

Melting / Freezing / Evaporation / Condensation

Solid Liquid Gas

- 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.

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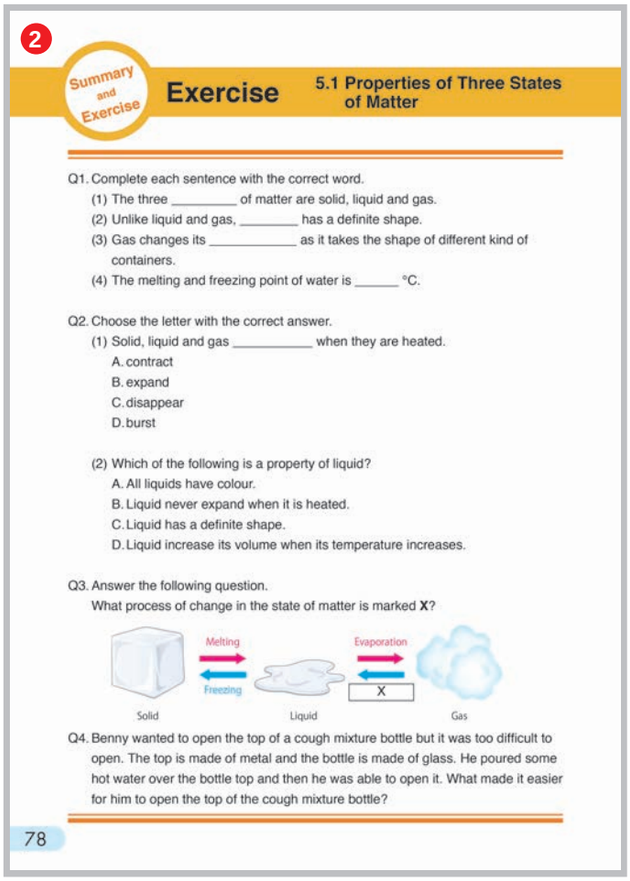
2 Exercise & Explanation (30 min.)

- 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**?

Melting / Freezing / Evaporation / X

Solid Liquid Gas

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?

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Exercise answers

Q1.
(1) **states**
(2) **solid**
(3) **shape**
(4) **0**

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

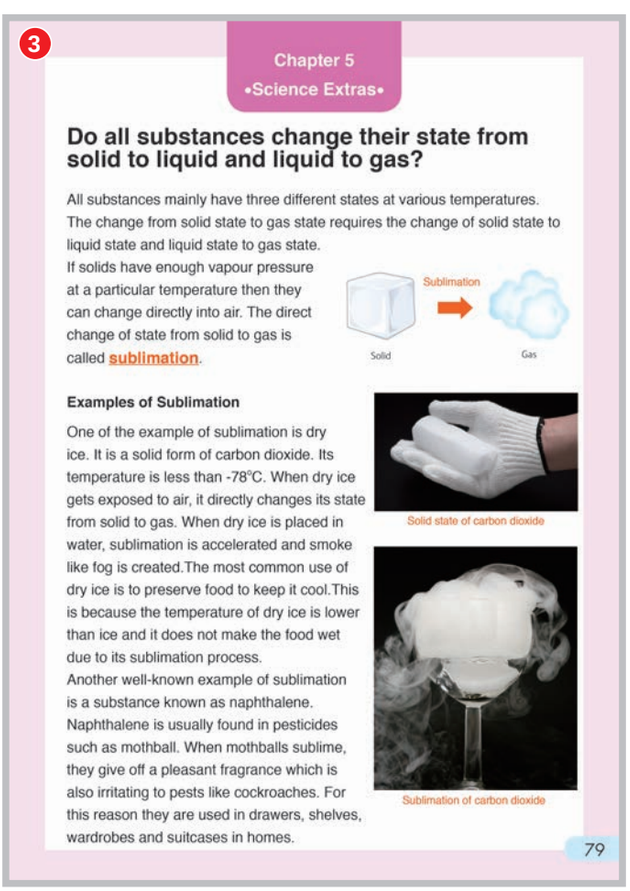
Q3.
X: **Condensation**

Q4. Expected Answer
The hot water that was poured over the top of the bottle made the bottle expand and he was able to expand the bottle.

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

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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.

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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

A burning candle

(2) Study the diagram below.

← Bowl of hot water

What will happen to the balloon when the bottle is placed into the bowl of hot water?

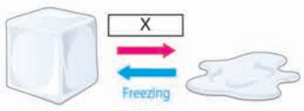
The balloon will expand.

(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.

Strand : LIFE
Unit : ANIMALS

Chapter 6. Reproduction and Heredity in Animals

Chapter Objectives

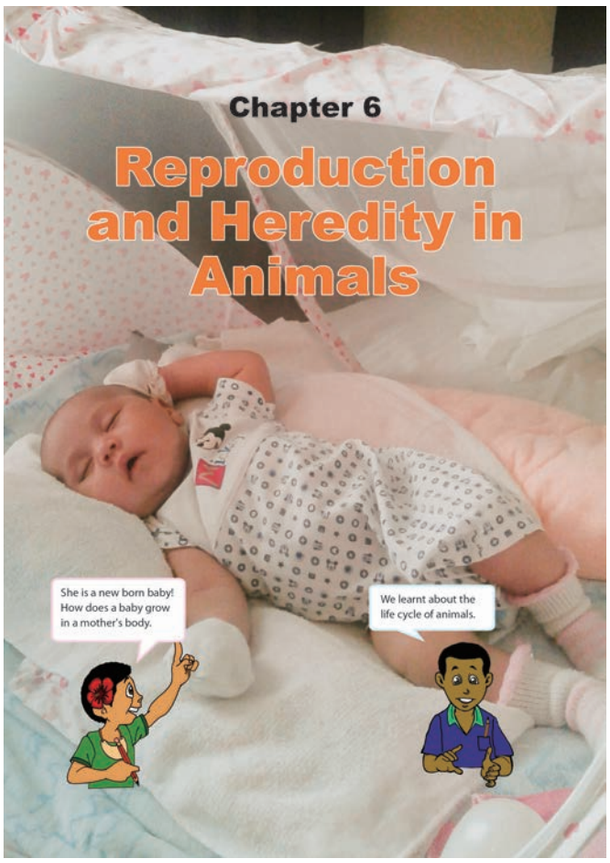
Students will be able to understand the reproduction of animals by comparing the reproductive process as in fish and human. Students will also able be to understand traits from parents to their children by heredity.

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.

Grade 3	Grade 4	Grade 5	Grade 6
- Characteristics of Animals	- Life cycle of Animals	- Reproduction and Heredity in Animals	- Reproduction and Heredity in Plants

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 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 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

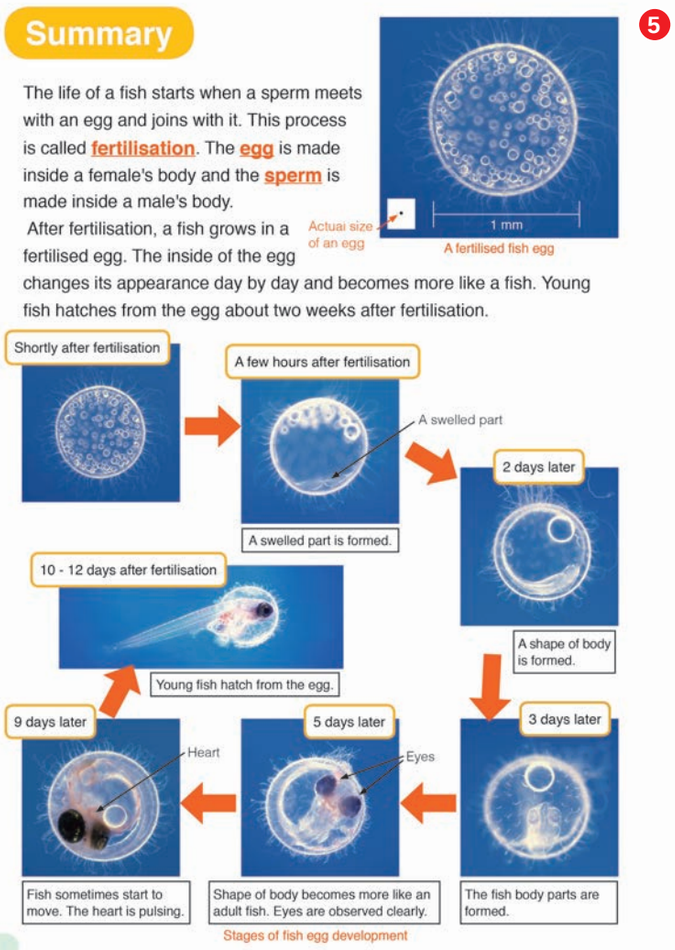
- Egg lying is one way that fish use for reproduction and it involves the eggs growing until they hatch into fry after seven to ten days. Different fish use different methods when it comes to fertilising the eggs. There are many methods and these are some;
  1. Scattering method- the female fish scatter 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 see clearly in the beginning? (backbone, 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 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? Backbone, shape of fish
Q: After that, what body part of fish can you find? 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

Summary
- Reproduction is a process were 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.

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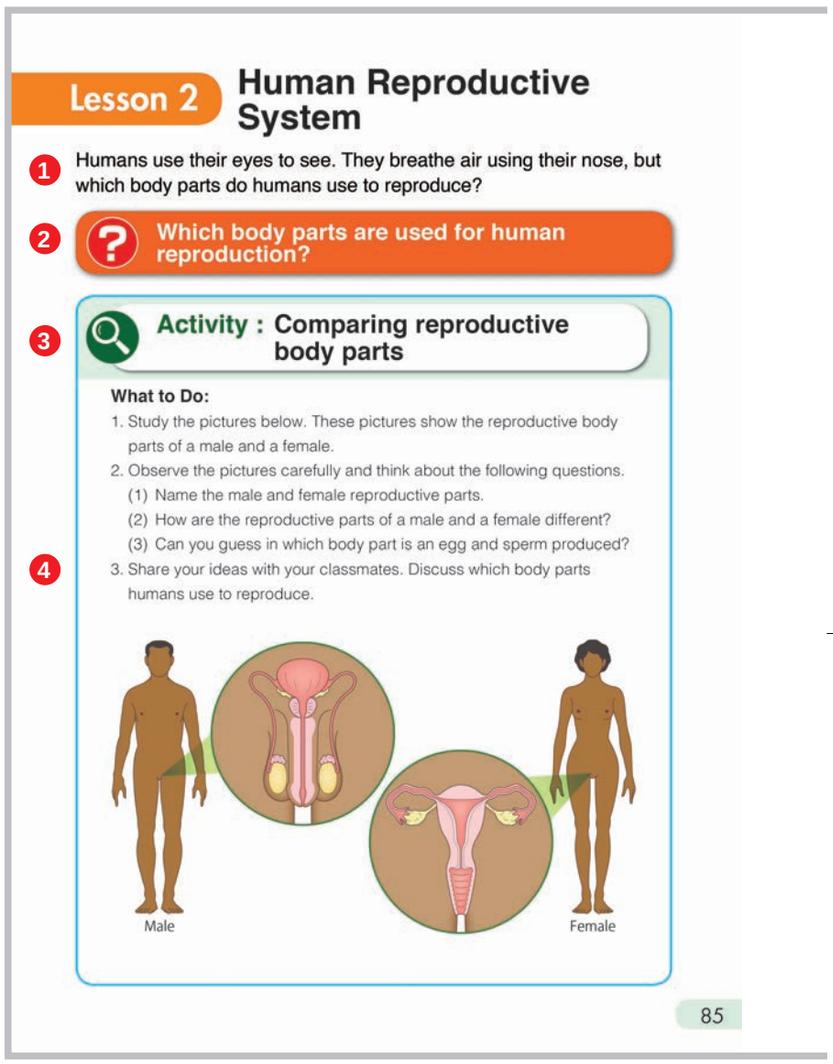

Lesson 2 Human Reproductive System

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

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Teacher's Notes

- This lesson is a very sensitive lesson and would cause embarrassment to either boys or girls so before teaching these lesson 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.

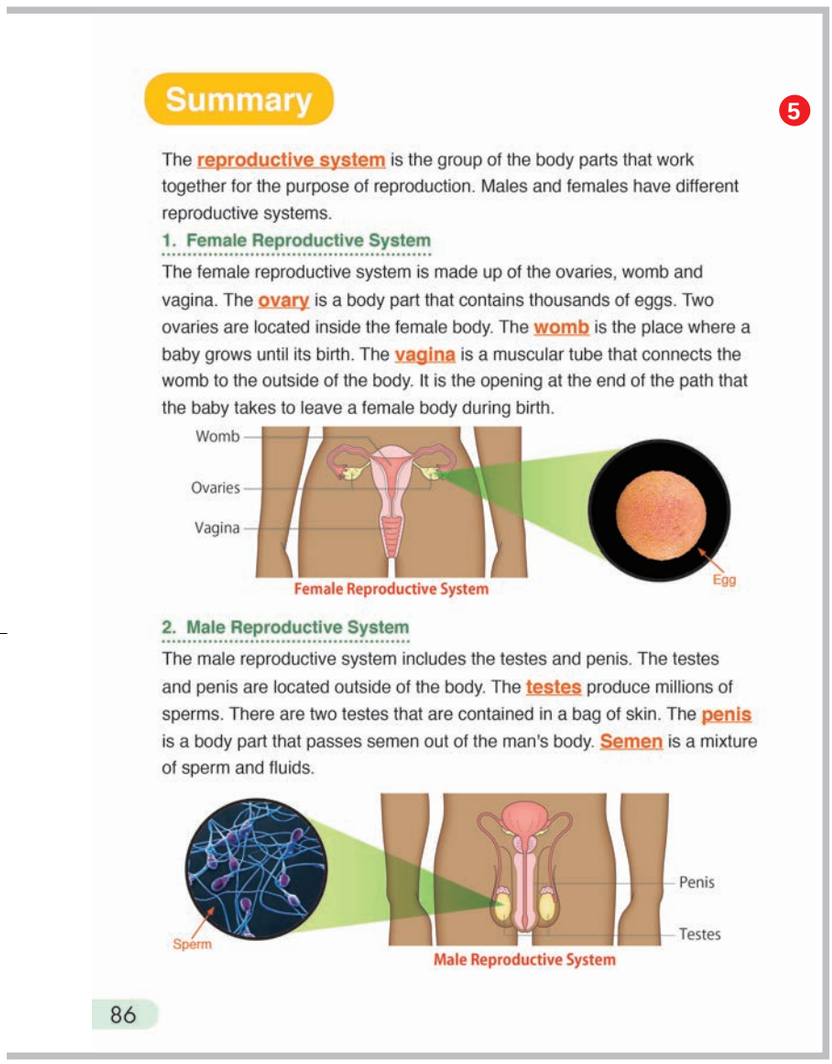
Male	Female
1. The reproductive system of the male is located outside the body and around the pelvis region, to maintain the temperature required by the sperm to stay healthy. 2. Produce sperm. 3. To provide sperm to the ovum for fertilisation.	1. The female reproductive system is located entirely inside 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

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- 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 is 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 human reproductive 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 sperm is 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 find the answers to 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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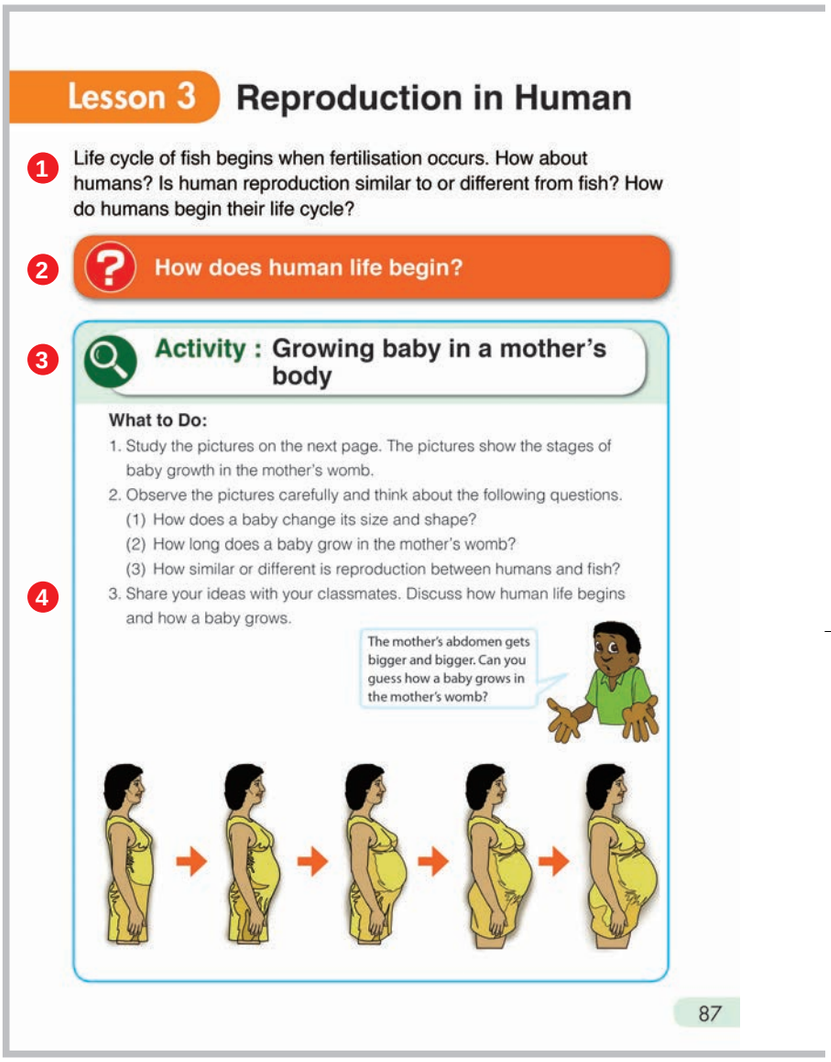

Lesson 3 Reproduction in Human

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?

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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

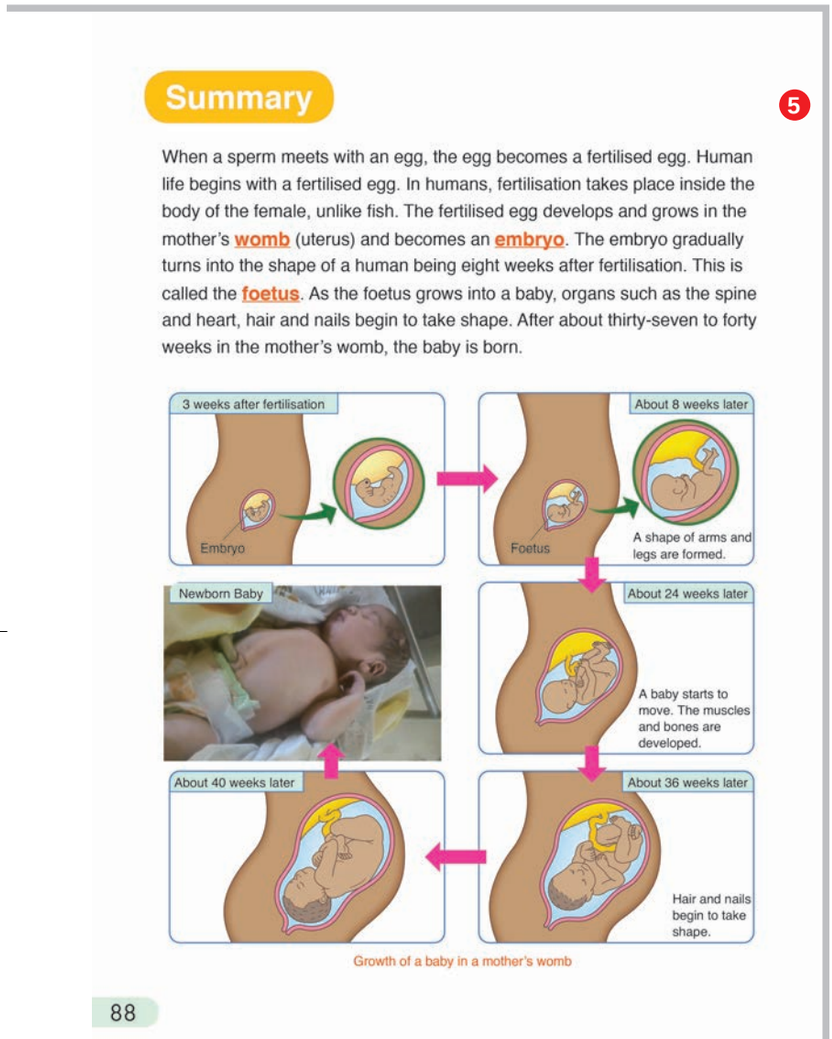
1. Zygote is a fertilised egg. This occurs when an egg joins with a sperm in a female body (this stage is not in the textbook above, but it is similar the fertilisation of fish which is the first lesson of this topic).
2. Embryo is an early stage of development of an organism that develops from a zygote (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

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- **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: Process of the birth of a baby.
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 fertilized 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 fertilization 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 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?

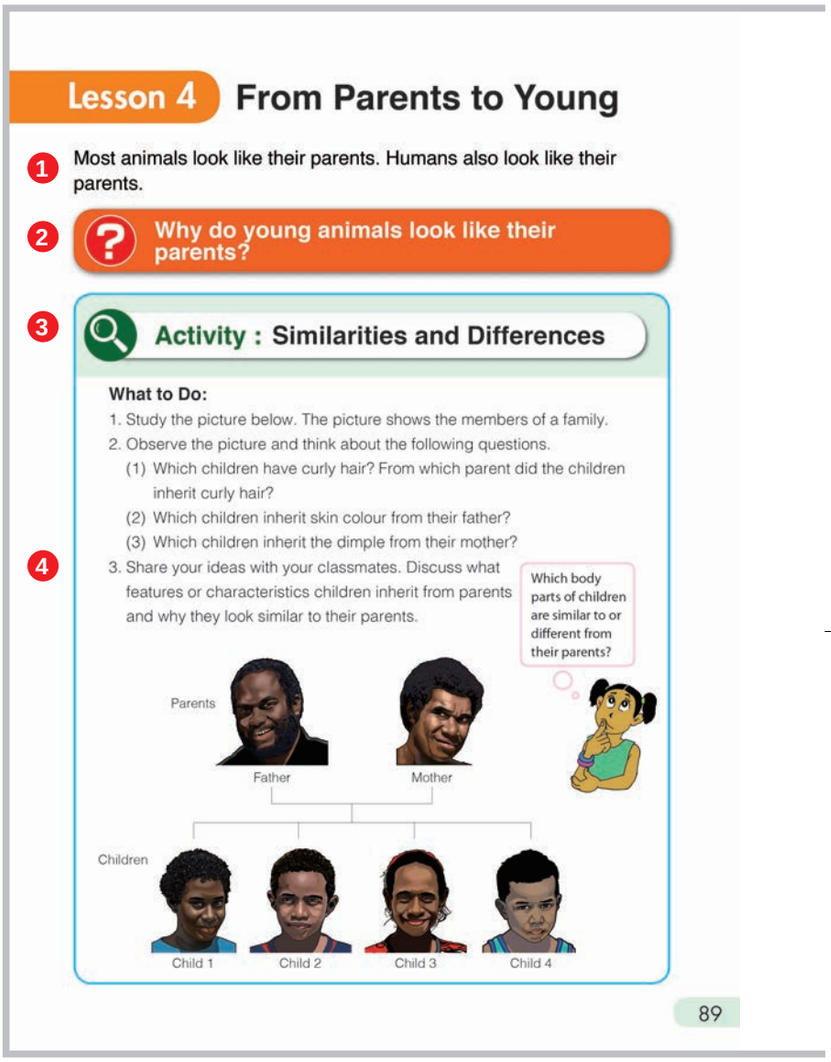
3 Activity (25 min.)

- 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 acticvity.
- 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.

(Continue)



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

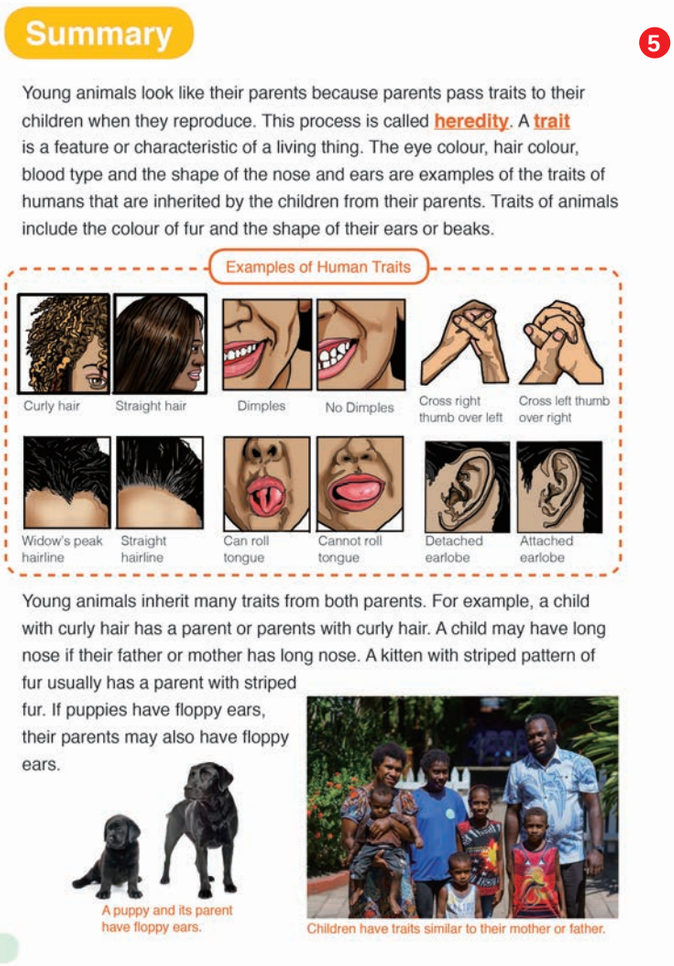
- **What is heredity?** The passing of traits from parents to children either through asexual or sexual reproduction , the offspring cells or organisms acquire the genetic information of their parents. 'Inheritance' is the same concept but used in more scientific context.
- **What is Trait?** A Trait 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 5

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.

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

Q: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? (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: Chilld 1 and 3
2. Which children inherit skin colour from their father? Child 1 and 4
3. Which children inherit the dimple from their mother? Child 2

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 children inherit some characteristes of their parents' body parts.

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

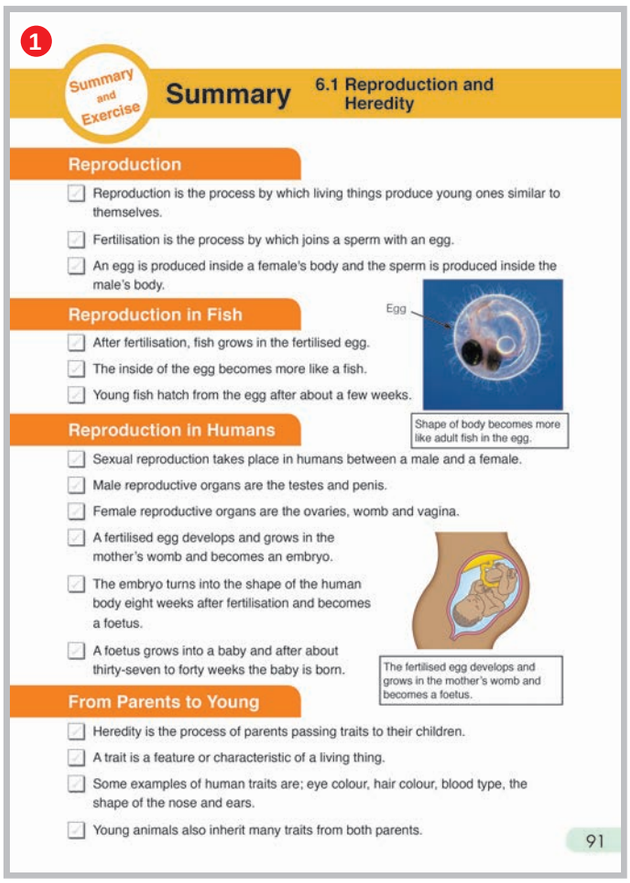
Lesson Title

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

- 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.

Egg

Shape of body becomes more like adult fish in the egg.

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.

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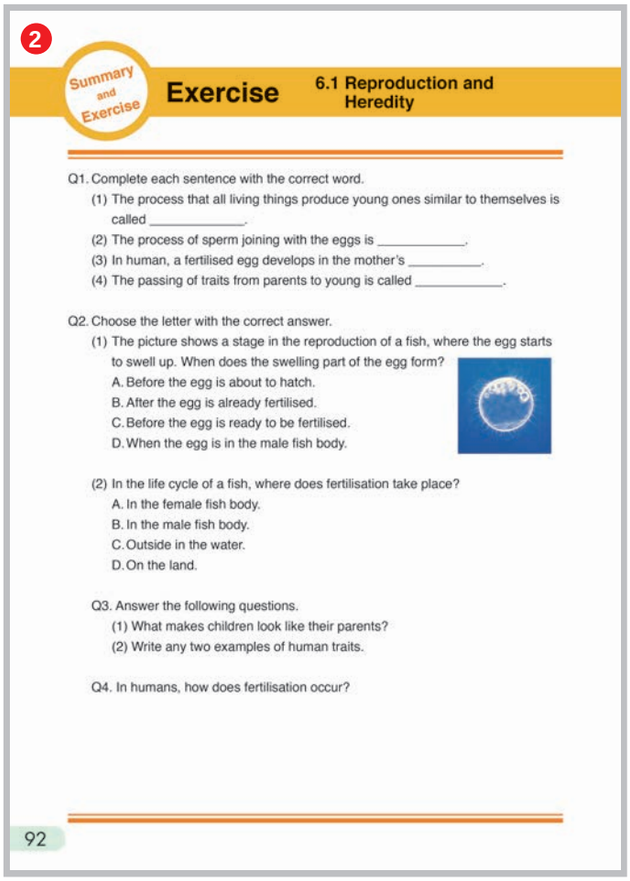
2 Exercise & Explanation (30 min.)

- 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?

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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 an egg meets with a sperm, 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.

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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.

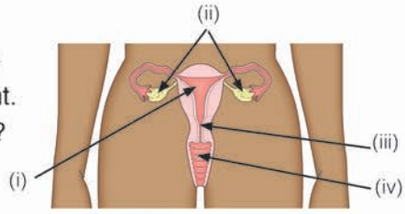
(4) The female body part that contains thousands of eggs is called ovary.

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?

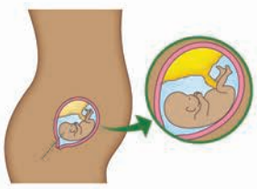


A. (i) B. (ii)
C. (iii) D. (iv)

(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

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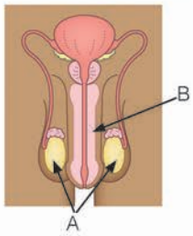
Q3

(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

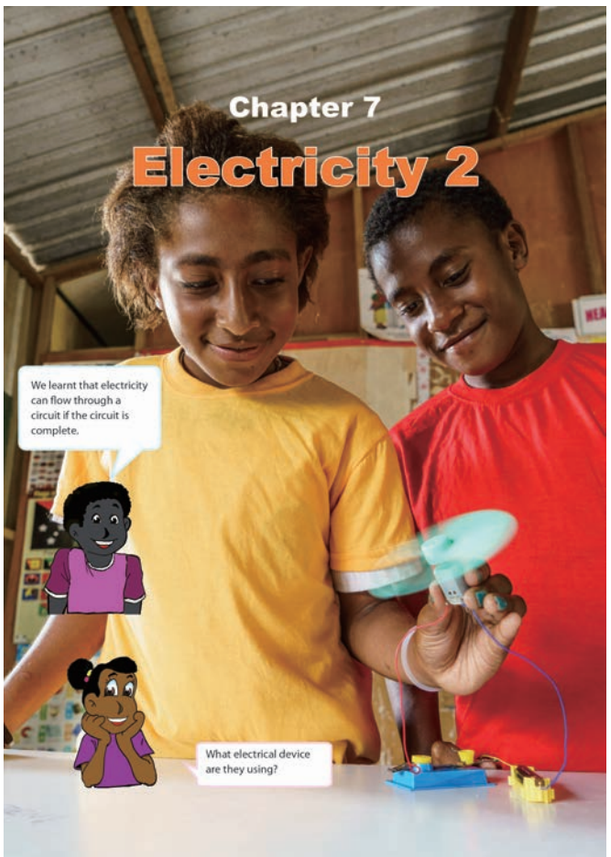
Foetus of human

Strand : PHYSICAL SCIENCE
Unit : ENERGY

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.



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.

Topic Objectives

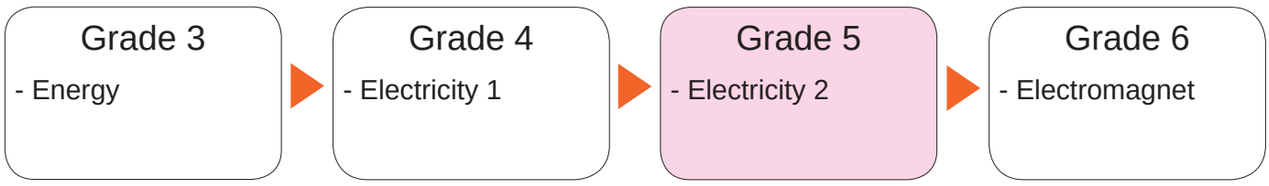
7.1 Electrical Circuit

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.

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 rmake 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?

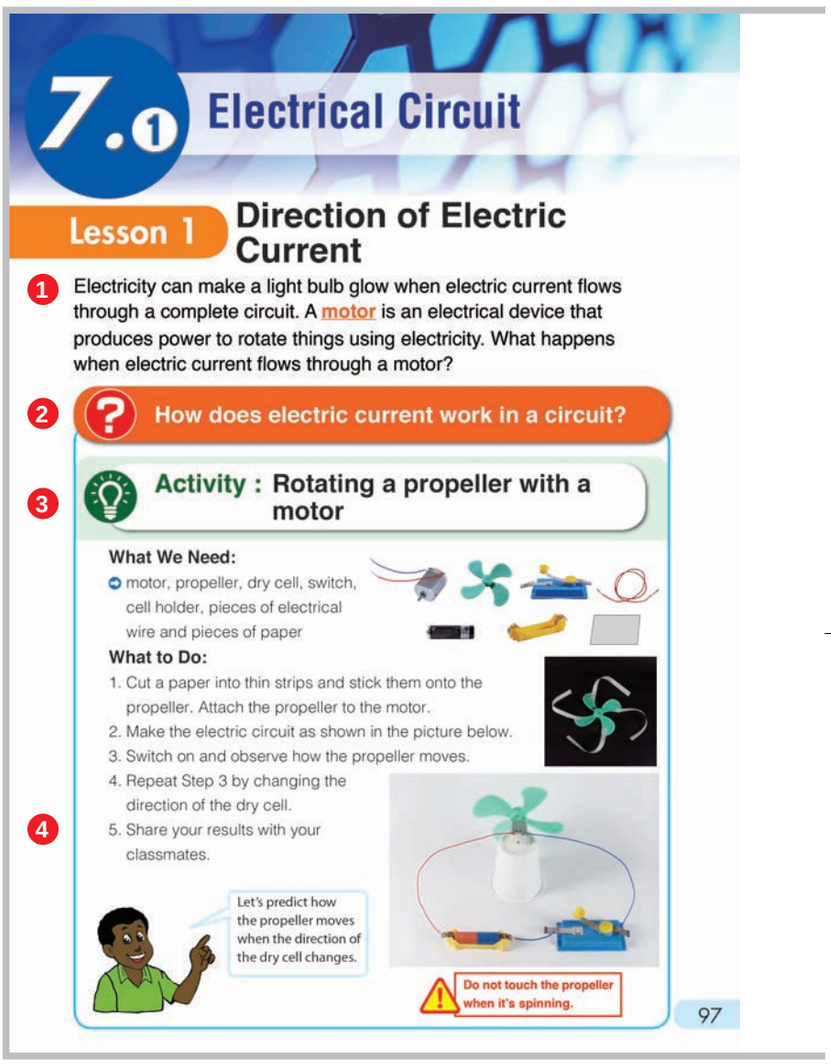
3 Activity (30 min.)

- 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

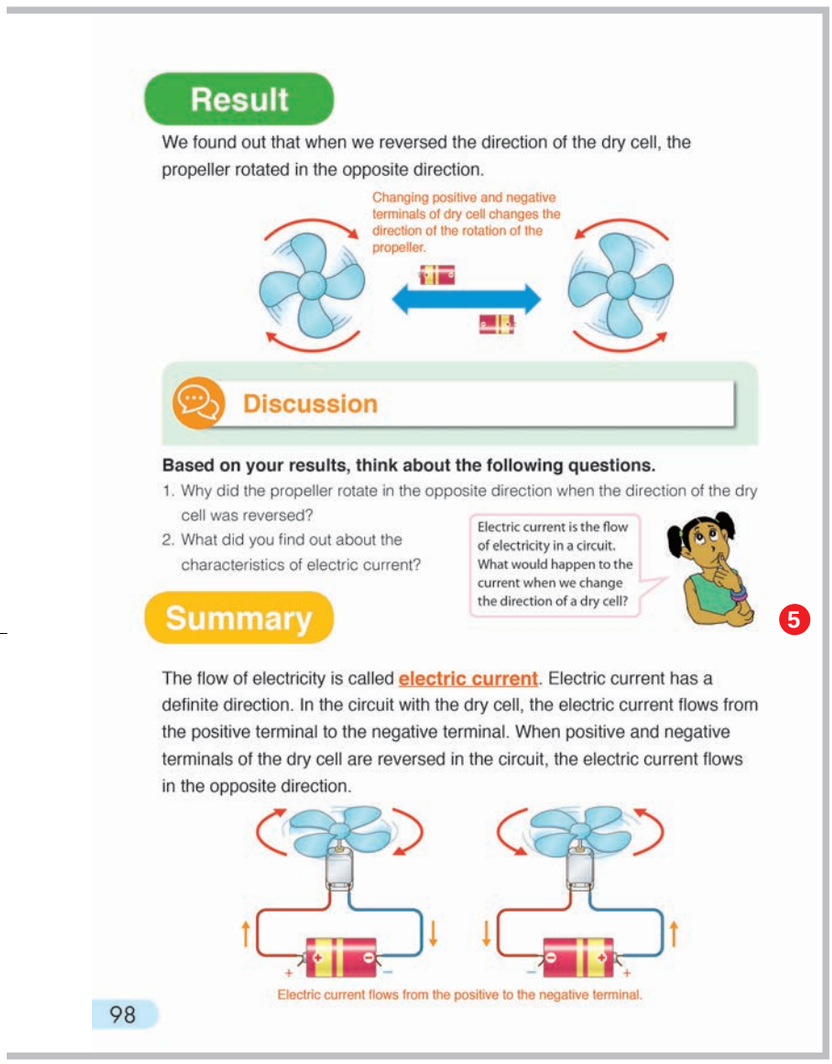
How does electric current flow in a circuit? The direction of an electric current is by law the direction in which a positive charge would move. Thus, the current in the external circuit is directed away from the positive terminal and towards the negative terminal of the battery. Electrons would actually 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.



Result

We found out that when we reversed the direction of the dry cell, the propeller rotated in the opposite direction.

Changing positive and negative terminals of dry cell changes the direction of the rotation of the propeller.

Discussion

Based on your results, think about the following questions.

1. Why did the propeller rotate in the opposite direction when the direction of the dry cell was reversed?
2. What did you find out about the characteristics of electric current?

Electric current is the flow of electricity in a circuit. What would happen to the current when we change the direction of a dry cell?

Summary

The flow of electricity is called **electric current**. Electric current has a definite direction. In the circuit with the dry cell, the electric current flows from the positive terminal to the negative terminal. When positive and negative terminals of the dry cell are reversed in the circuit, the electric current flows in the opposite direction.

Electric current flows from the positive to the negative terminal.

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- 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 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.)

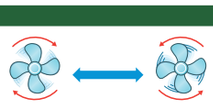
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: From which terminal of the dry cell does the electric current flows through a circuit?
  Q: What would happen to the electric current when we 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;

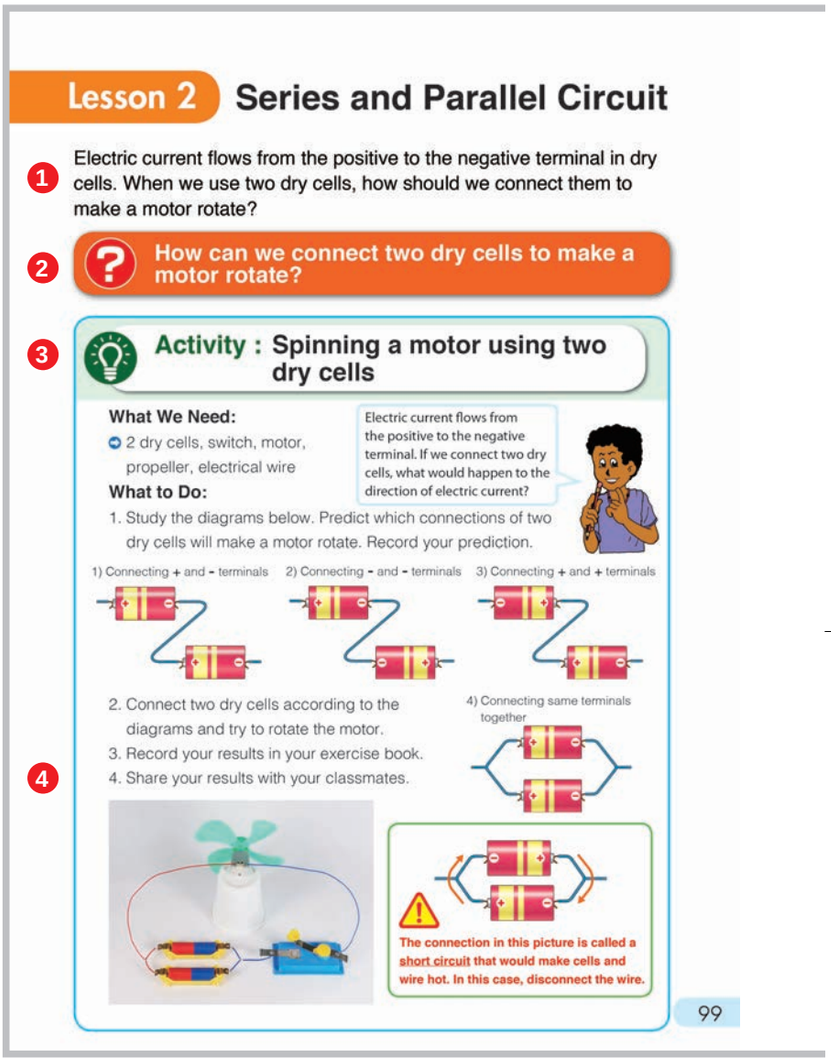
Q:How should we connect two dry cells to make a motor rotate?

2 Introduce the key question

How can we make 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

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?

What to Do:
1. Study the diagrams below. Predict which connections of two dry cells will make a motor rotate. Record your prediction.

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.

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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's 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

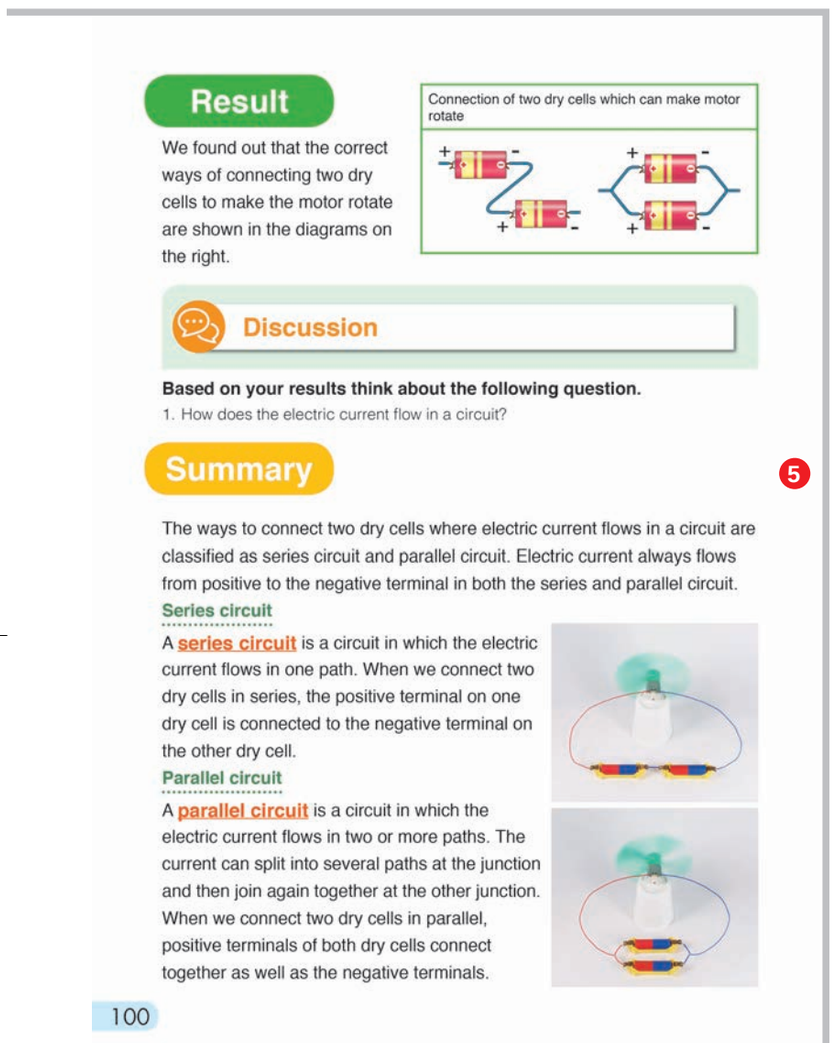
- A series circuit is one with all the loads in a row. There is only ONE path for the electricity to flow. If this circuit was a string of light bulbs, and one blew out, the remaining bulbs would turn off.
- A parallel circuit is one that has two or more paths for the electricity to flow; the loads are 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 the 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.

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5

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 one pathway. In the circuit on the right, the electric current flows 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

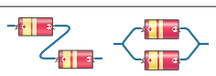
Title:

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 on 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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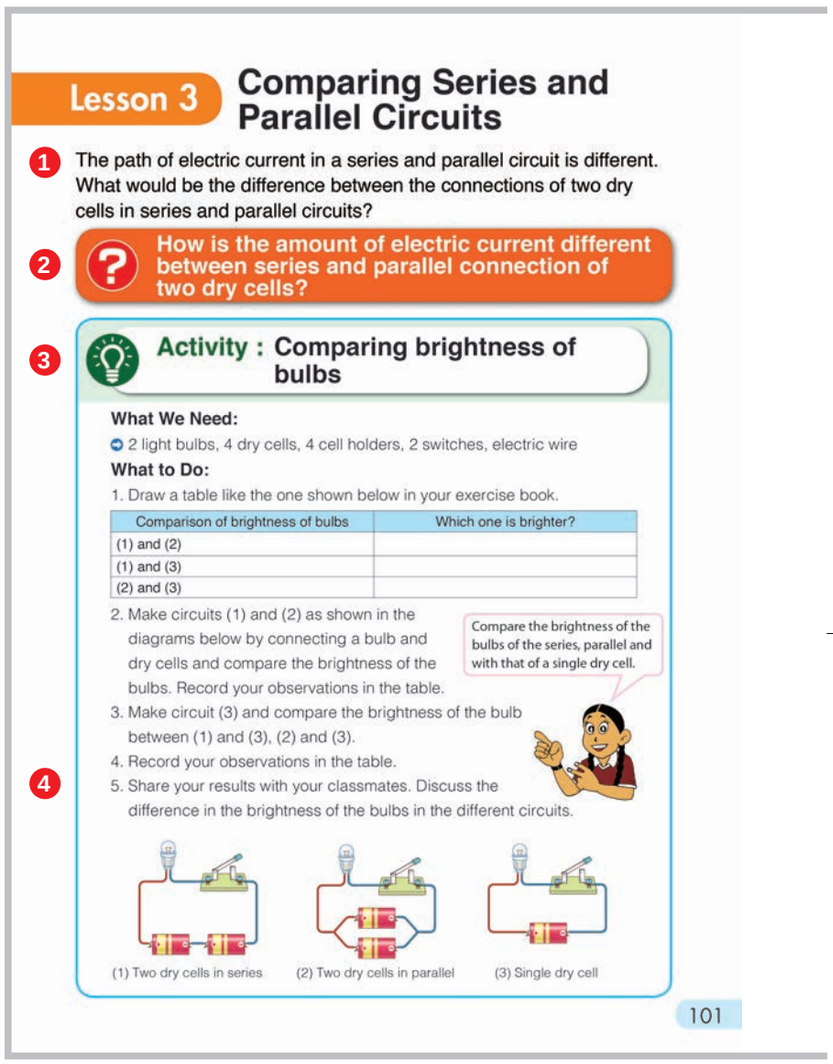

Lesson 3 Comparing Series and Parallel Circuits

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.

4

Compare the brightness of the bulbs of the series, parallel and with that of a single dry cell.

(1) Two dry cells in series (2) Two dry cells in parallel (3) Single dry cell

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Teacher's Notes

SAFETY: The safety tips for the previous lessons apply in 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

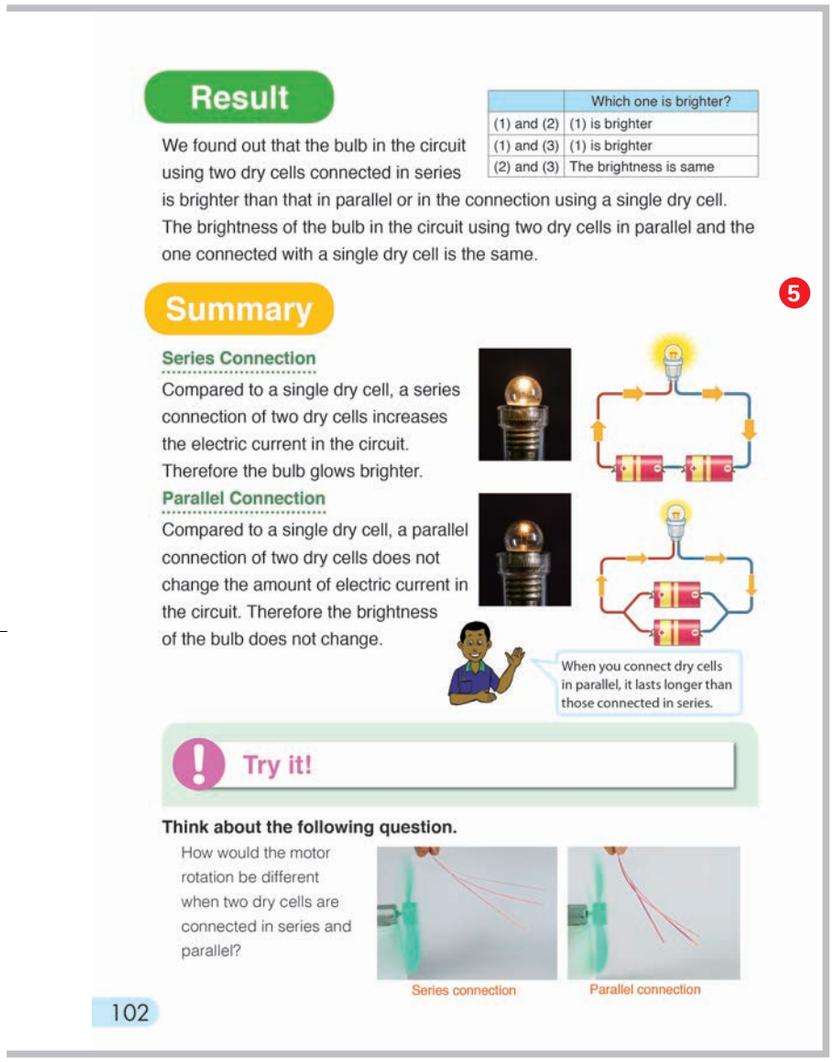
- Which circuit lasts longer series or parallel? When batteries are hooked up in series, the voltage is increased. For example, two - 6 Volt batteries connected in series produce 12 Volts. When batteries are hooked up in parallel, the voltage remains the same (6 volt), but the power (or available current) 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

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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 book.s
- 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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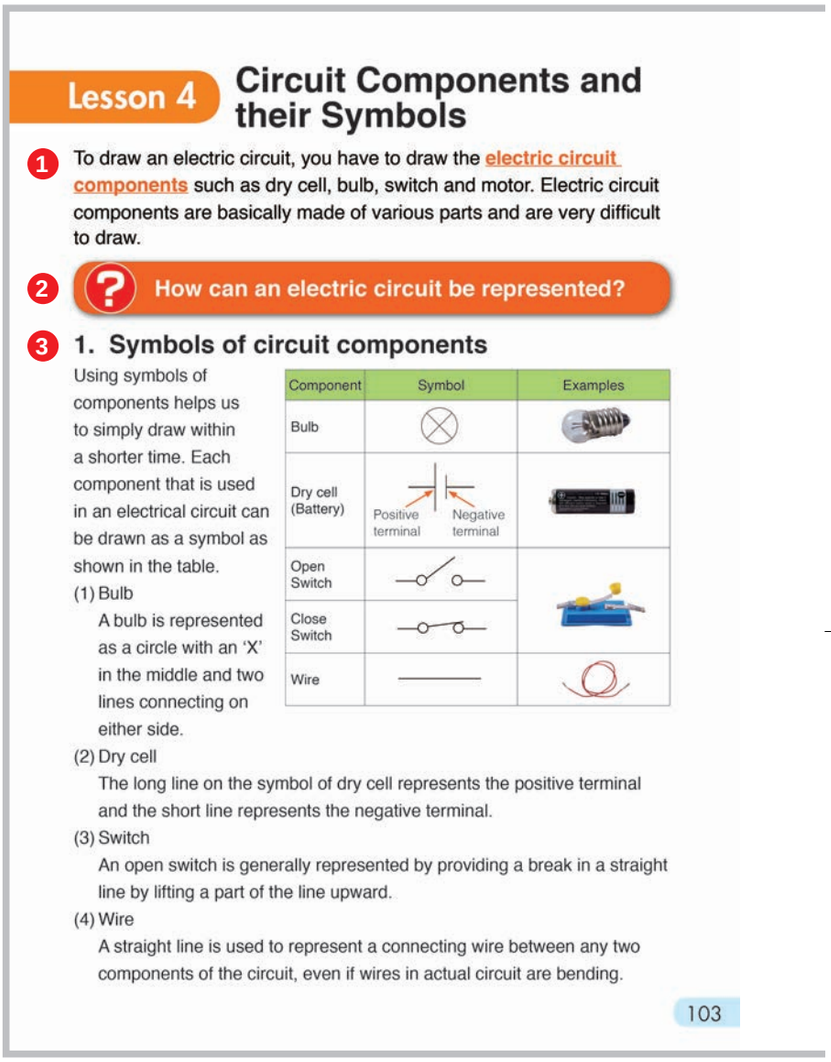

Lesson 4 Circuit Components and their Symbols

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.

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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 circuit 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

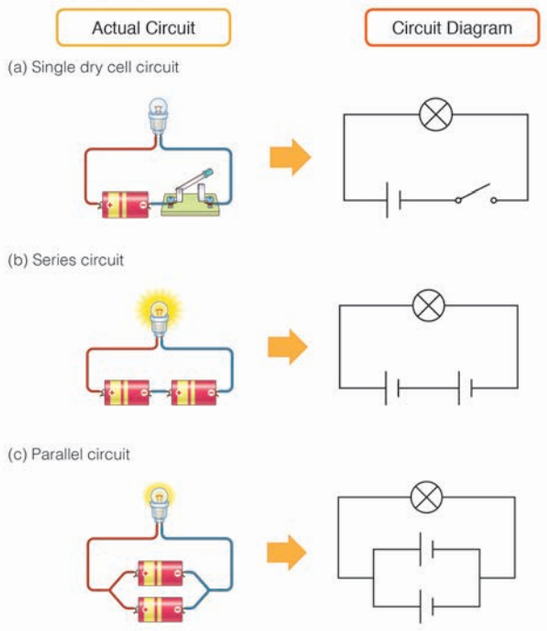
A diagram representing an electrical circuit drawn with symbols is called a **circuit diagram**. The following are some tips to draw a circuit diagram.

(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.



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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 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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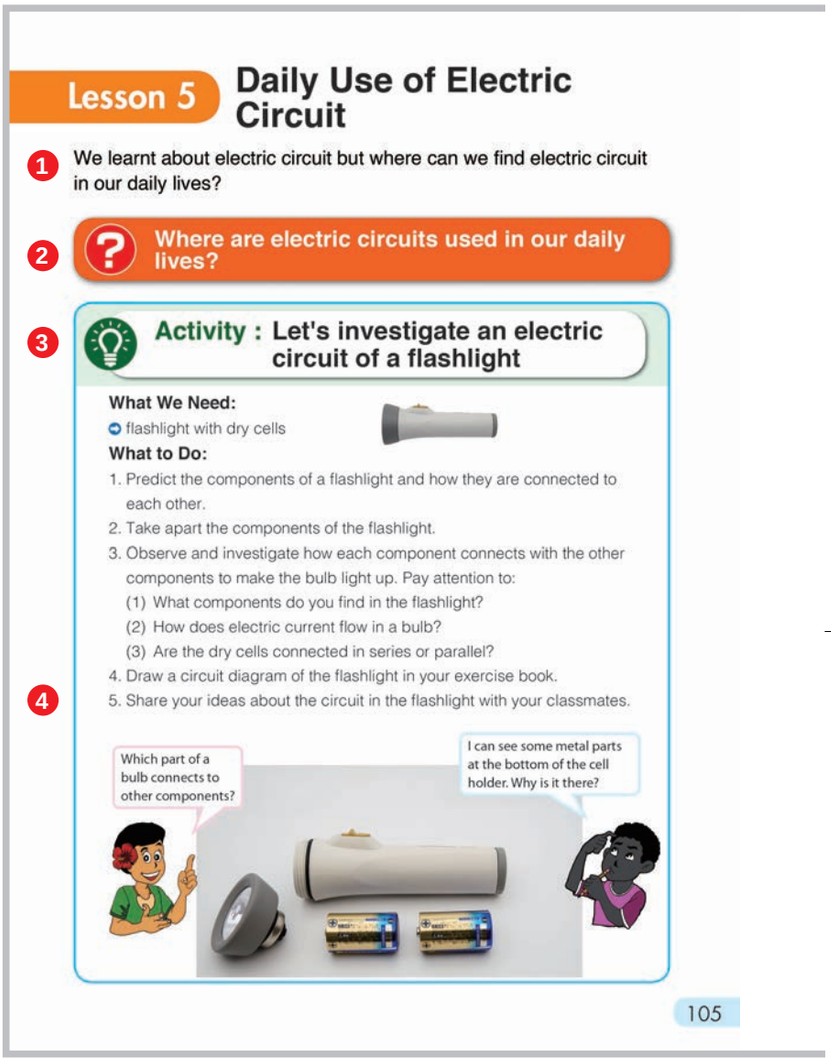

Lesson 5 Daily Use of Electric Circuit

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

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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?

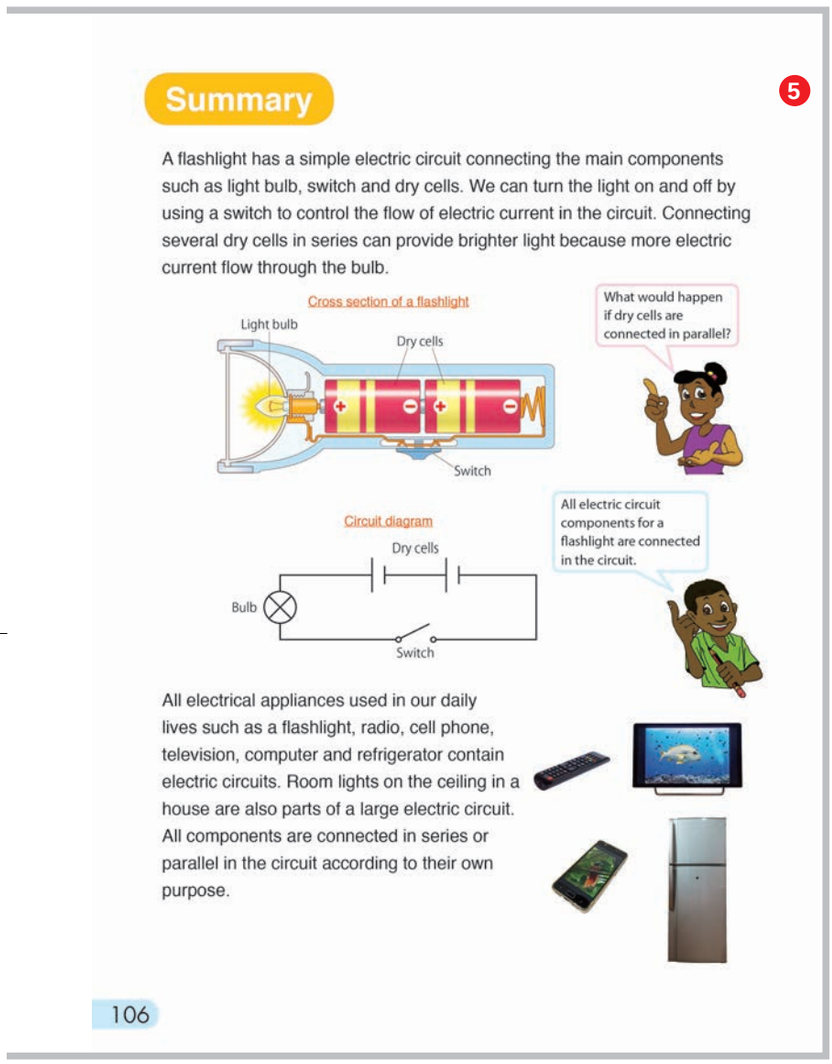
- An electric circuit can be used to transport electrical power to provide electric lighting, to run electric motors, to recharge storage batteries, to provide heat for heating, for cooking, for melting metals, to monitor conditions such as in alarm systems, to store data to run diagnostic medical equipment 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

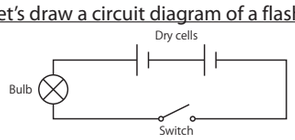
Predictions:
1. What are the components of a light torch?
2. How do the components connect to each other?

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

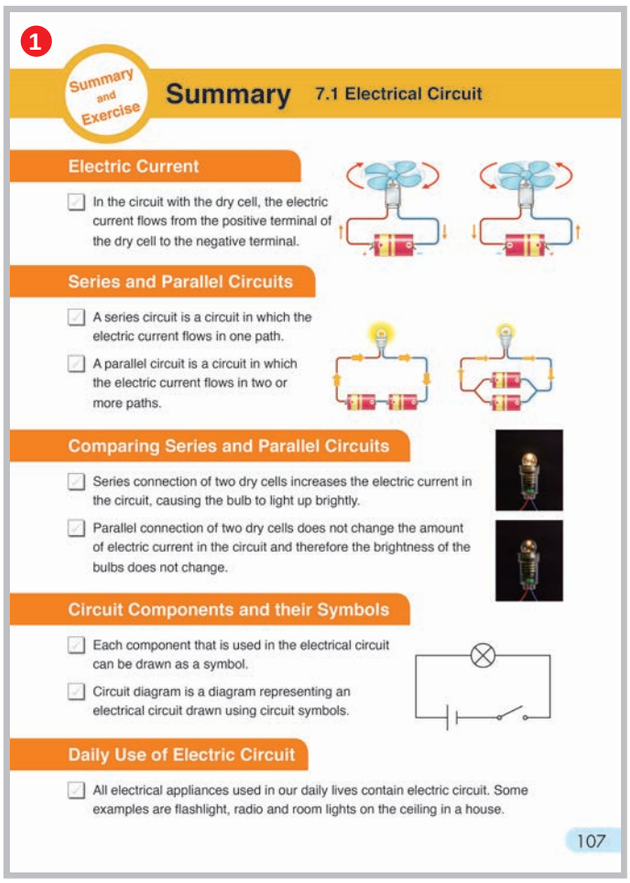
Lesson Title

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.

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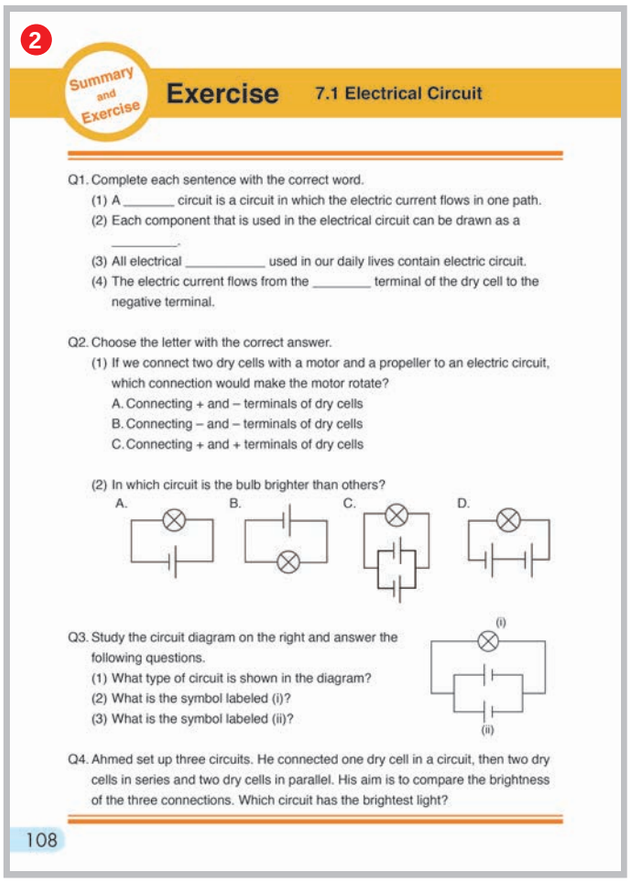
2 Exercise & Explanation (30 min.)

- 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)?

(i) (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?

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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**

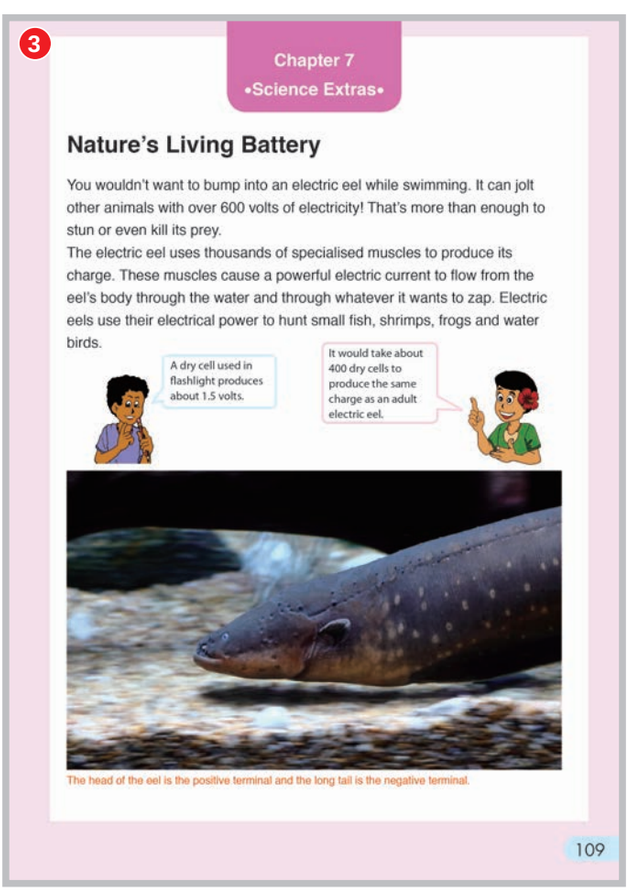
Q4.Expected answer.
Series connection has the brightest light while with the parallel and the single dry cell the brightness of the bulbs were the same.

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.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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.

The head of the eel is the positive terminal and the long tail is the negative terminal.

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Unit: **Energy**	Chapter : **7. Electricity 2** Topic : **7.1. Electrical Circuit**	Total lesson No: 44 / 87 Textbook page: 110 - 111

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

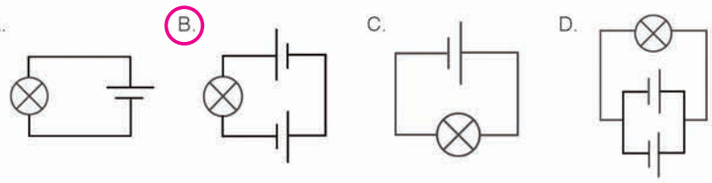
(A.) series will be faster than the one in parallel.
B. series will be slower than the one in parallel.
C. parallel will be faster than the one in series.
D. both connections will turn with the same speed.

(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

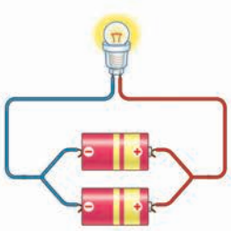
(1) Stefan took apart a flashlight to investigate how the electric circuit components are connected in it. What are the four components he would find in the flashlight?

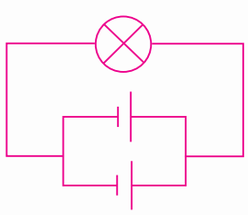
The components were a light bulb, dry cells, switch and wires.

(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.

Strand : EARTH AND SPACE
Unit : OUR EARTH

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

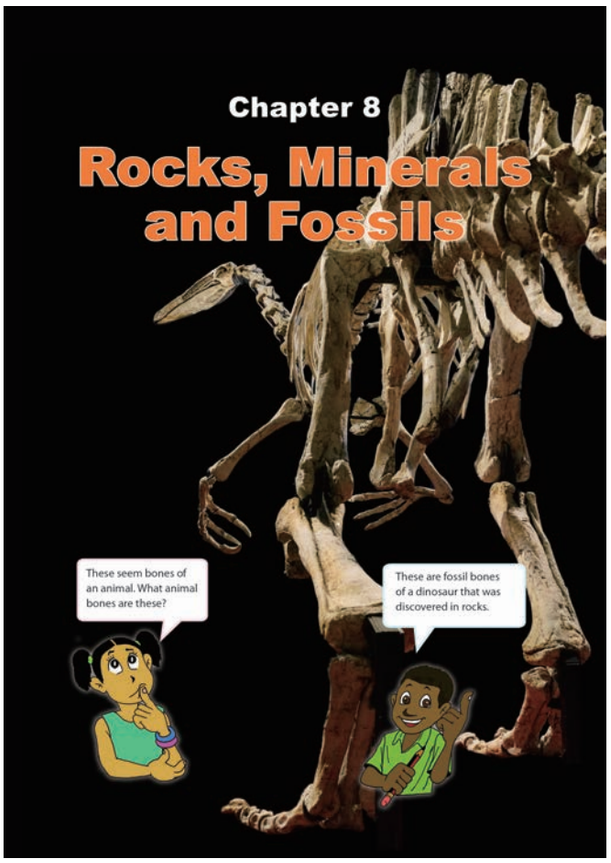
Students will be able to;

- 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.

Grade 3	Grade 4	Grade 5	Grade 6
- The Earth	- Soil for Human Beings	- Rocks, Minerals and Fossils	- Change and Formation of Land

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.

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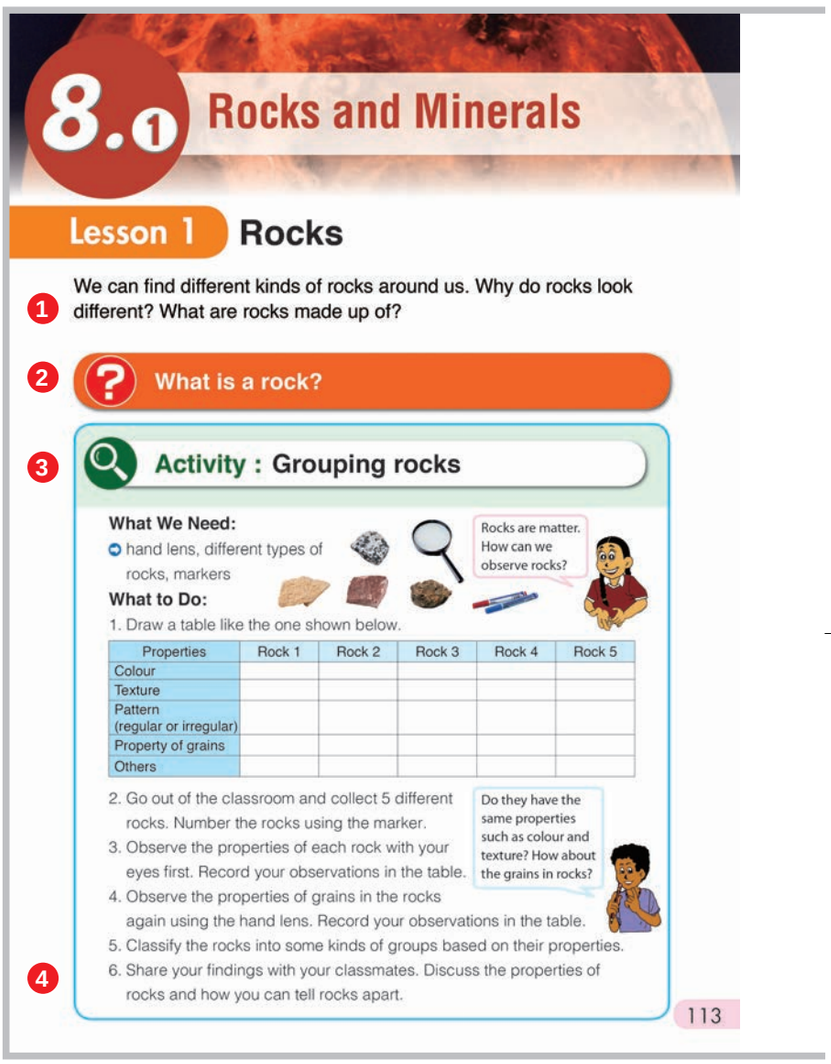

8.1 Rocks and Minerals

Lesson 1 Rocks

1 We can find different kinds of rocks around us. Why do rocks look different? What are rocks made up of?

2 What is a rock?

3 Activity : Grouping rocks

What We Need:
- hand lens, different types of rocks, markers

What to Do:

1. Draw a table like the one shown below.

Properties	Rock 1	Rock 2	Rock 3	Rock 4	Rock 5
Colour					
Texture					
Pattern (regular or irregular)					
Property of grains					
Others					

2. Go out of the classroom and collect 5 different rocks. Number the rocks using the marker.
3. Observe the properties of each rock with your eyes first. Record your observations in the table.
4. Observe the properties of grains in the rocks again using the hand lens. Record your observations in the table.
5. Classify the rocks into some kinds of groups based on their properties.
6. Share your findings with your classmates. Discuss the properties of rocks and how you can tell rocks apart.

4

Rocks are matter. How can we observe rocks?

Do they have the same properties such as colour and texture? How about the grains in rocks?

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Teacher's Notes

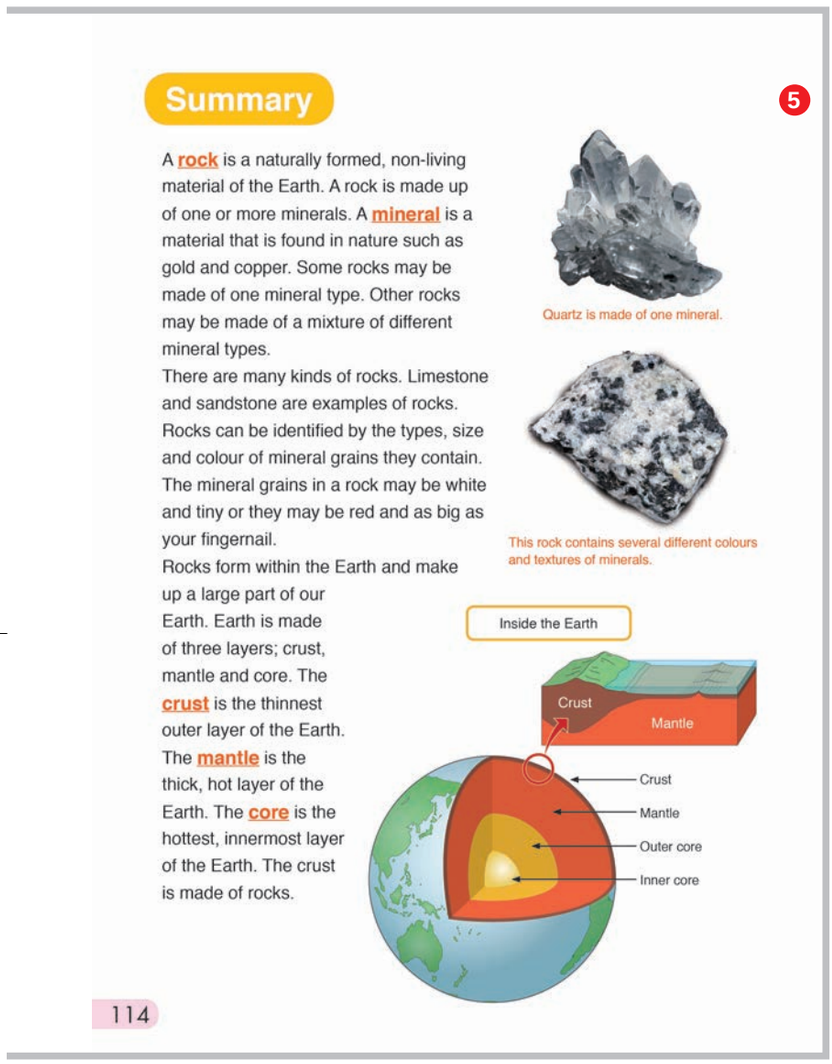
- 'Rocks' is taught Grade 3 Chapter 10. In that lesson, students are asked to describe the characteristics of rocks. In this lesson, students explain the characteristics in more scientific manner. Refer to the prior lesson to encourage students to talk scientifically.
- A rock is a naturally occurring 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

5

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

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- **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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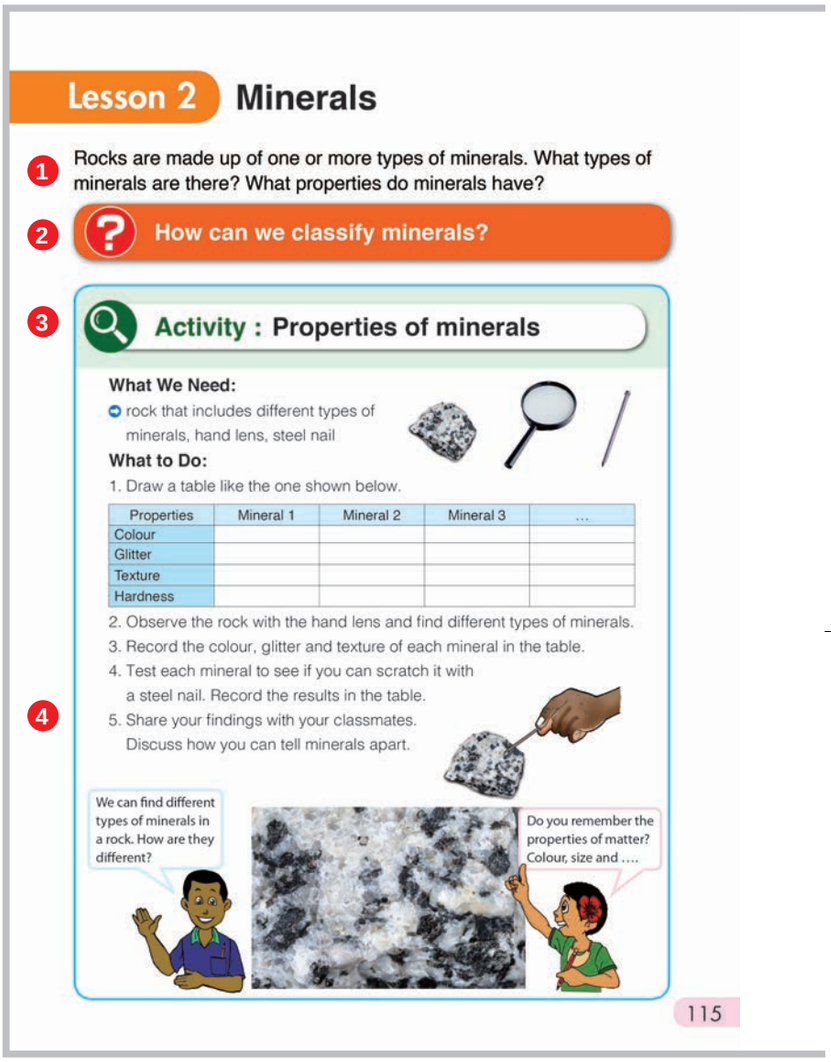

Lesson 2 Minerals

1 Rocks are made up of one or more types of minerals. What types of minerals are there? What properties do minerals have?

2 How can we classify minerals?

3 Activity : Properties of minerals

What We Need:

- rock that includes different types of minerals, hand lens, steel nail

What to Do:

1. Draw a table like the one shown below.

Properties	Mineral 1	Mineral 2	Mineral 3	...
Colour				
Glitter				
Texture				
Hardness				

2. Observe the rock with the hand lens and find different types of minerals.
3. Record the colour, glitter and texture of each mineral in the table.
4. Test each mineral to see if you can scratch it with a steel nail. Record the results in the table.
5. Share your findings with your classmates. Discuss how you can tell minerals apart.

4

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Teacher's Notes

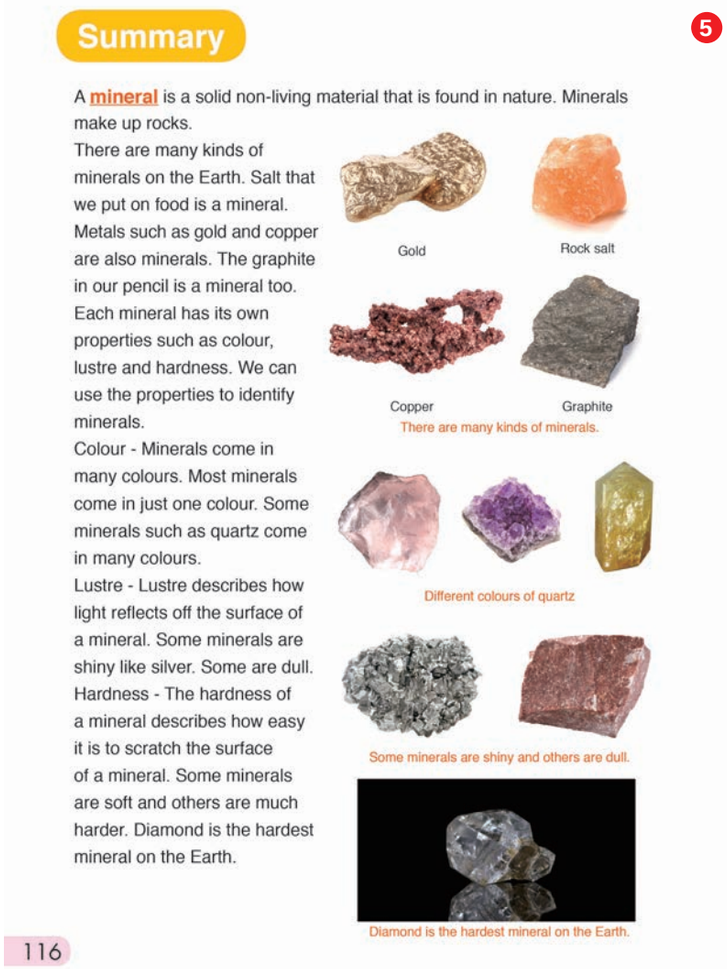
- To meet the definition of 'mineral' used by most geologists, a substance must meet five requirements: Naturally occurring, inorganic, solid, definite chemical composition and ordered internal structure.
  1. 'Naturally occurring' means that people did not make it. Steel is not a mineral because it 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 5

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.

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- **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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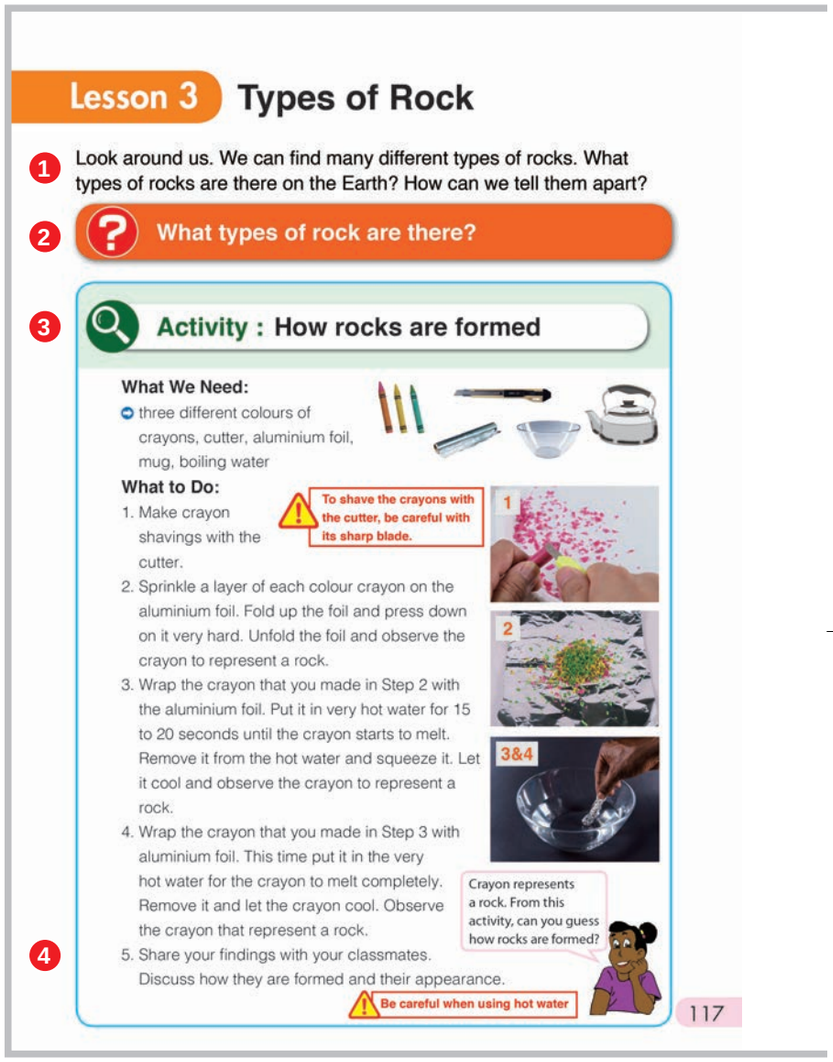

Lesson 3 Types of Rock

1 Look around us. We can find many different types of rocks. What types of rocks are there on the Earth? How can we tell them apart?

2 What types of rock are there?

3 Activity : How rocks are formed

What We Need:
- three different colours of crayons, cutter, aluminium foil, mug, boiling water

What to Do:

1. Make crayon shavings with the cutter.
2. Sprinkle a layer of each colour crayon on the aluminium foil. Fold up the foil and press down on it very hard. Unfold the foil and observe the crayon to represent a rock.
3. Wrap the crayon that you made in Step 2 with the aluminium foil. Put it in very hot water for 15 to 20 seconds until the crayon starts to melt. Remove it from the hot water and squeeze it. Let it cool and observe the crayon to represent a rock.
4. Wrap the crayon that you made in Step 3 with aluminium foil. This time put it in the very hot water for the crayon to melt completely. Remove it and let the crayon cool. Observe the crayon that represent a rock.
5. Share your findings with your classmates. Discuss how they are formed and their appearance.

To shave the crayons with the cutter, be careful with its sharp blade.

Crayon represents a rock. From this activity, can you guess how rocks are formed?

Be careful when using hot water

4

1 2 3&4

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Teacher's Notes

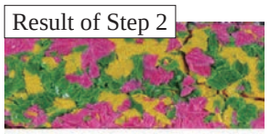
Results from the Activity

- 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.

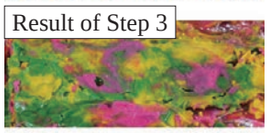
Tips for the Activity

- 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



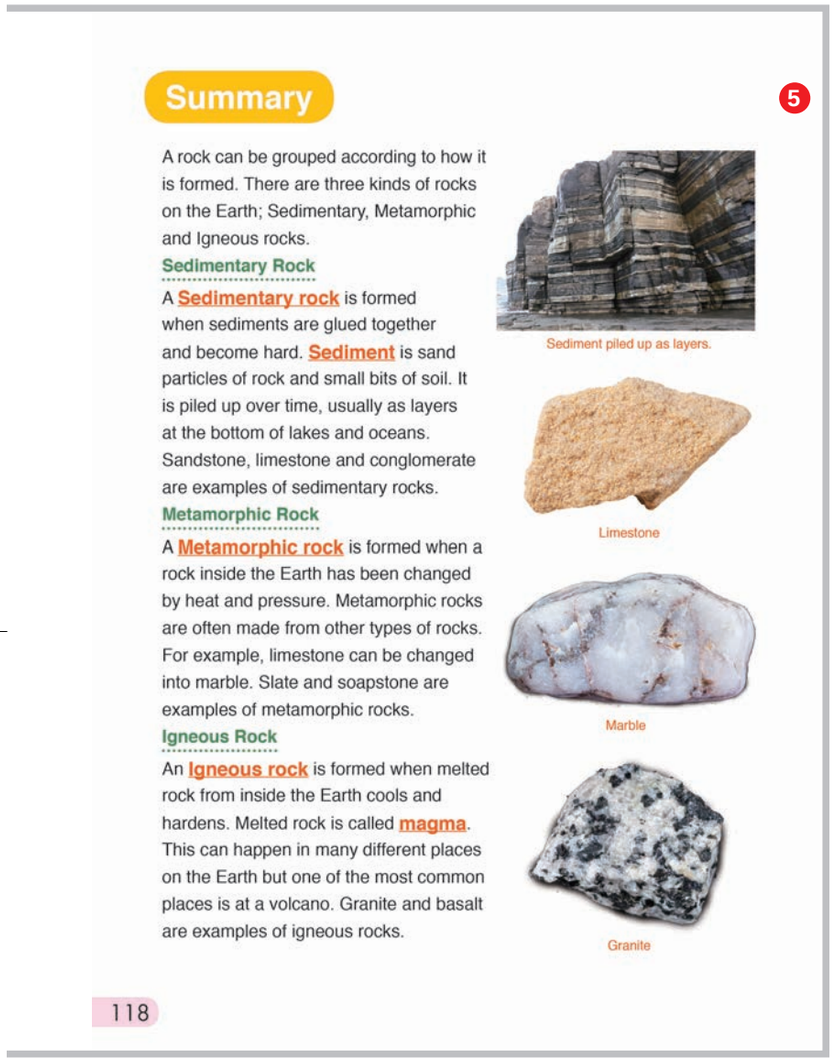
Result of Step 4

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

5

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.

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

Q: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 pervious 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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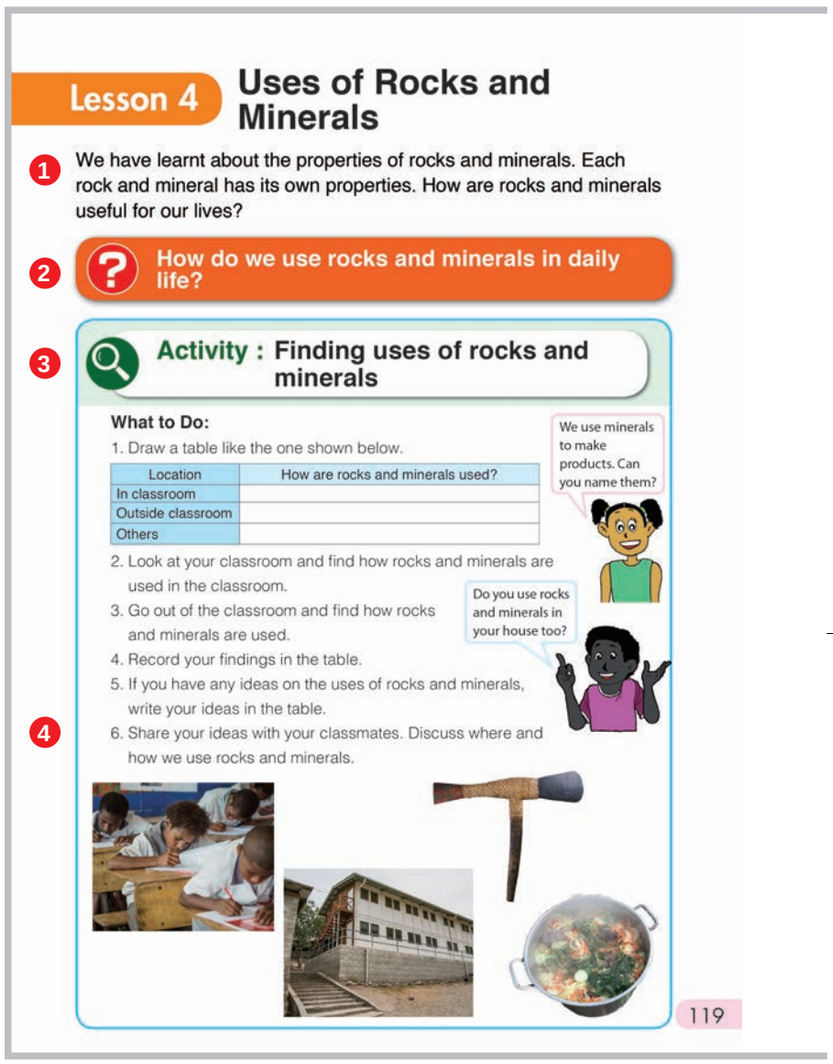

Lesson 4 Uses of Rocks and Minerals

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?

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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.

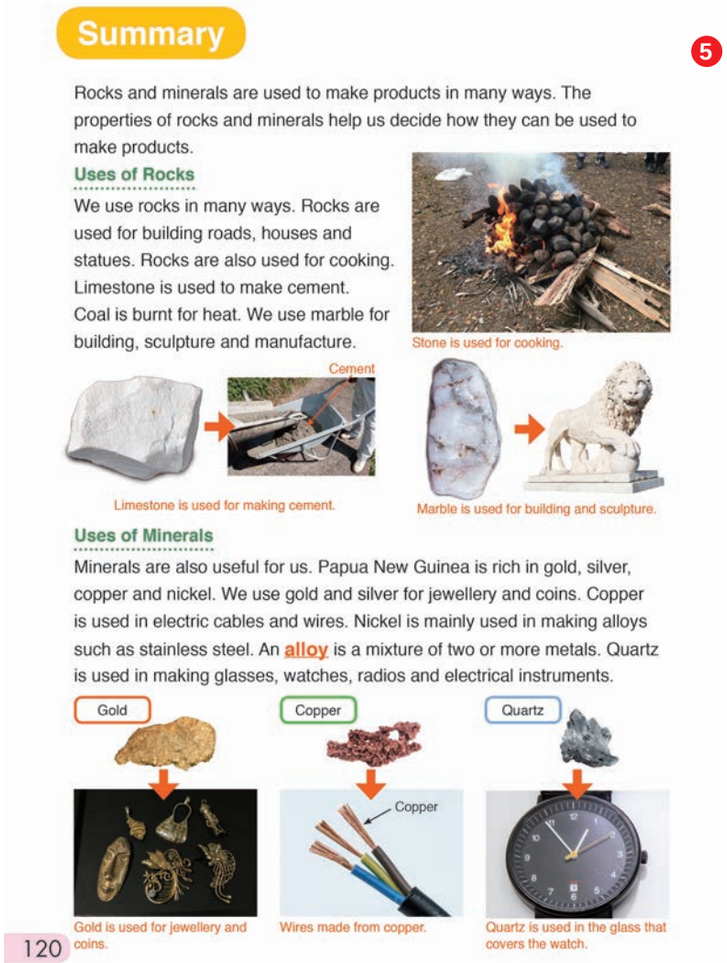
Name	Type of rock / Mineral	Use
Basalt	Igneous	in road building
Calcite	Mineral	in cement and mortars and production of lime
Granite	Igneous	for buildings, monuments and tombstones
Marble	Metamorphic	in building floor, tile in bathrooms
Obsidian	Igneous	in making arrow heads and knife
Quartz	Mineral	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

5

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

Gold is used for jewellery and coins.

Copper

Copper

Wires made from copper.

Quartz

Quartz is used in the glass that covers the watch.

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

Q:How 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

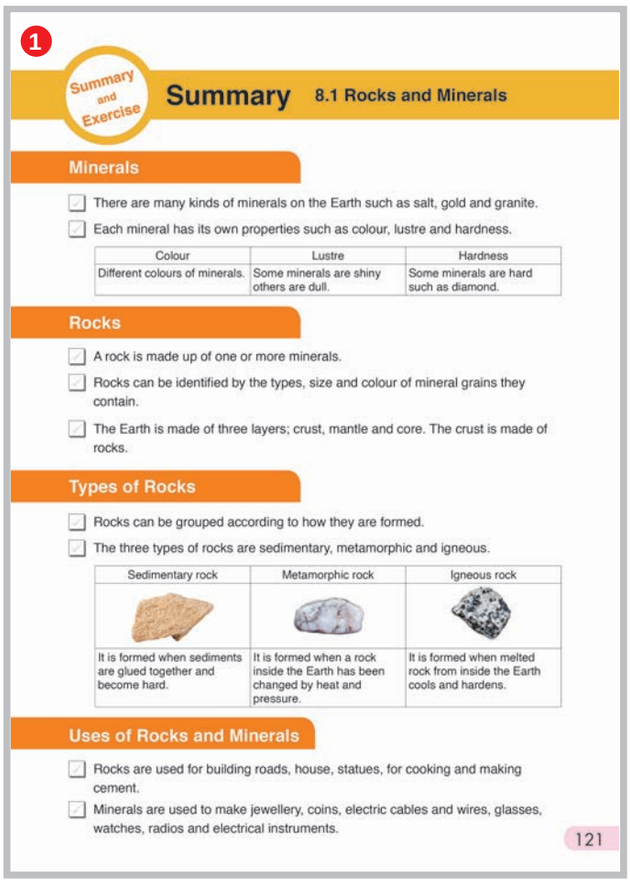
Lesson Title

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.

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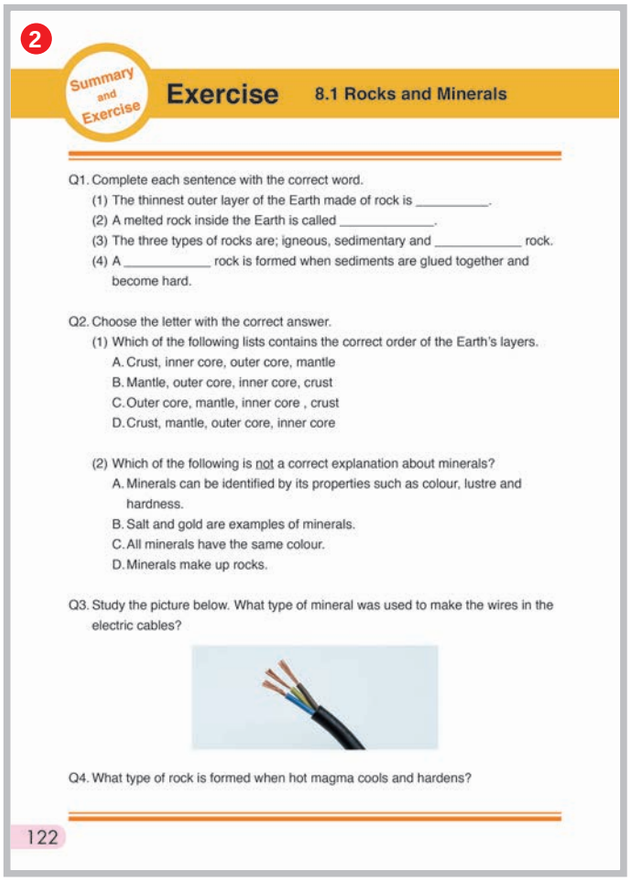
2 Exercise & Explanation (30 min.)

- 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 8.1 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?

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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 that was used to make electrical cables and wires was copper.

Q4. Expected Answer
Igneous rock is formed when melted rock in the earth cools and hardens.
Examples of Igneous rocks formed 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.

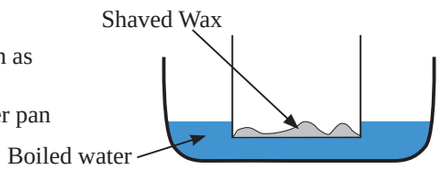
(Continue)

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.

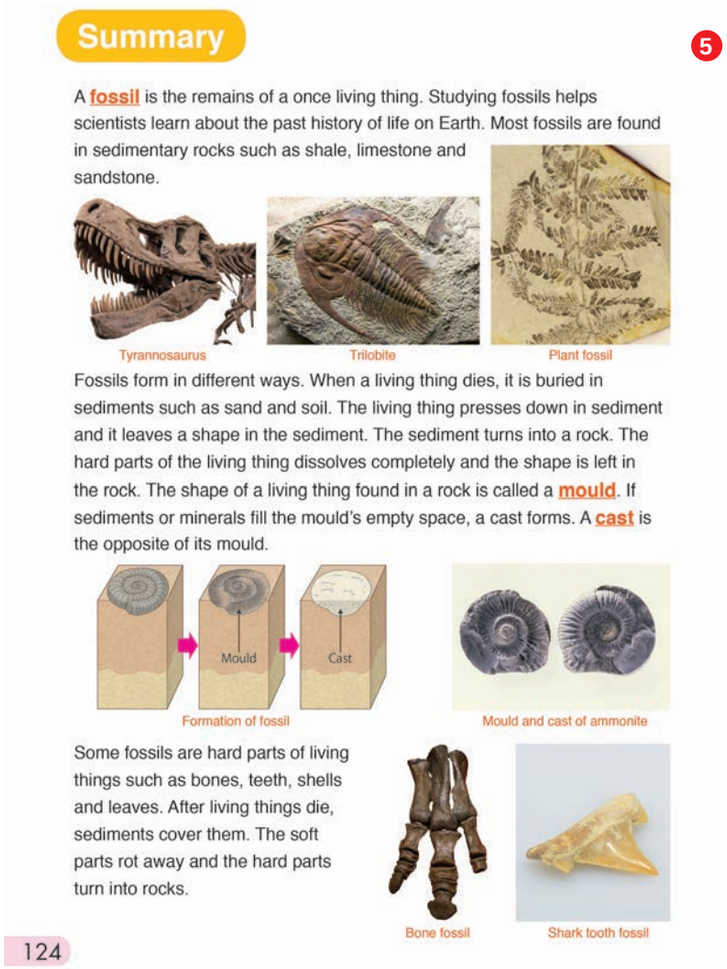


Lesson Objectives

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.

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

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- **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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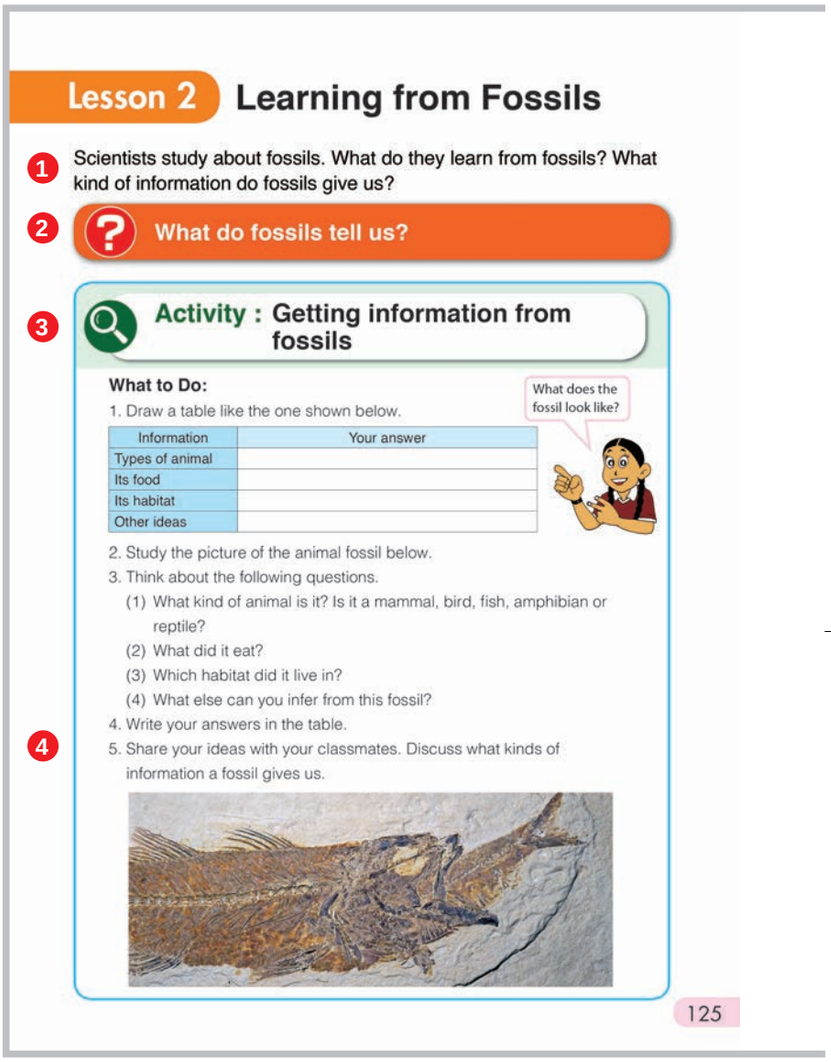

Lesson 2 Learning from Fossils

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

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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

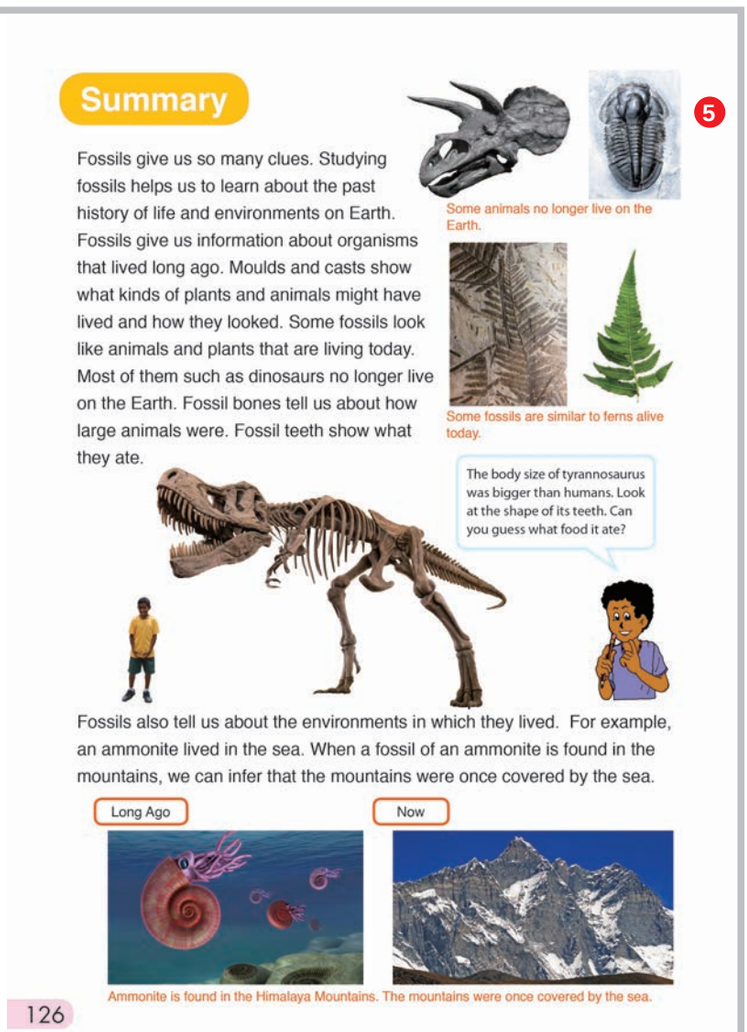
- Teacher can also provide other pictures of fossils with guided questions so students can also compare other fossil's habitats and type of food eaten.

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.

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- **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

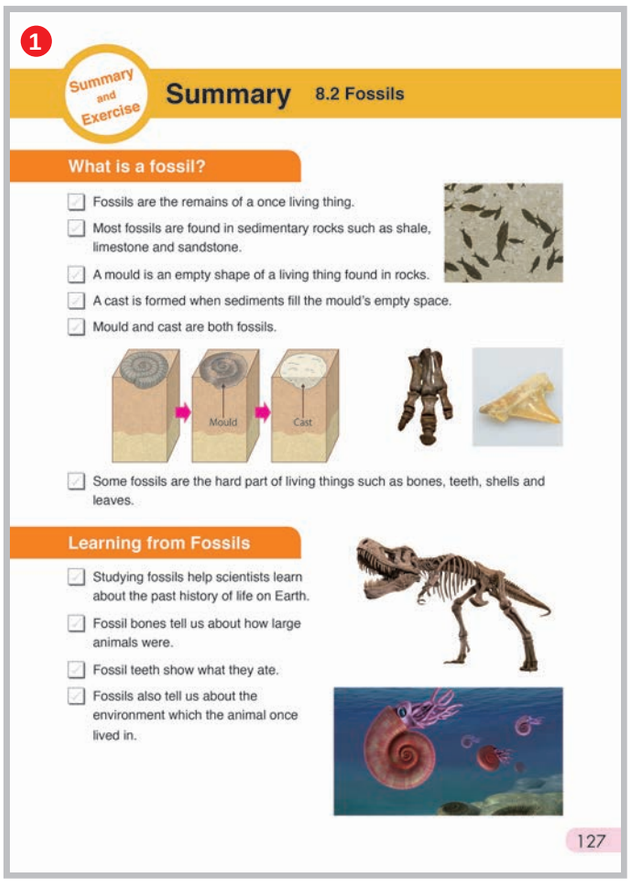
Lesson Title

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.

Mould Cast

- 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.

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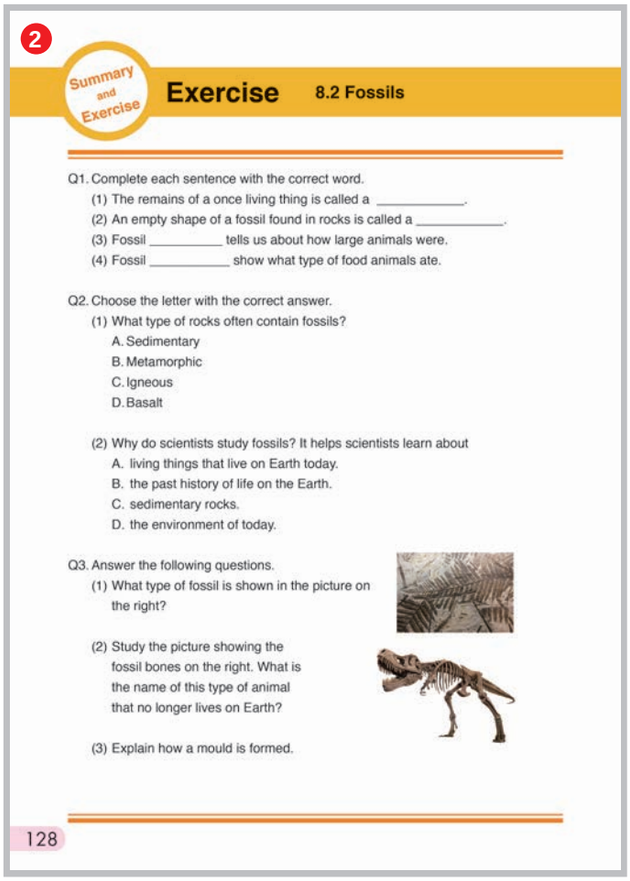
2 Exercise & Explanation (30 min.)

- 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.

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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.

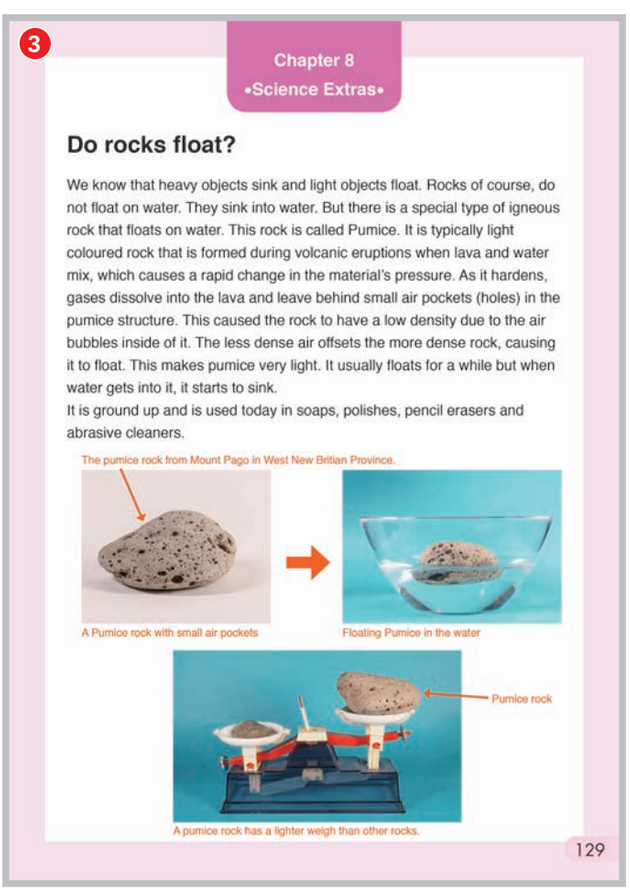
Q3. Expected answer
(1) **Plant fossil**
Some fossils are hard parts of living things such as bones, teeth, shells and leaves. After living things die, sediments covered them. The soft parts rot away and the hard parts turned to rock.

(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.


3

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 Britian 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.

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Unit: **Our Earth**	Chapter : **8. Rocks, Minerals and Fossils** Topic : **8.1. Rocks and Minerals** **8.2. Fossils**	Total lesson No: 53 / 87 Textbook page: 130- 131

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. Luster
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

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Q3

Study the diagram on the right.

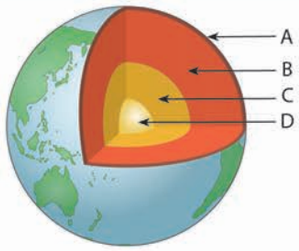
(1) Write the letter A, B, C or D for the correct layer of the Earth in the space provided.

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).

(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	Shiny	Non	Transparent	Liquid	Cannot be seen

Which of the above samples would not be classified as minerals? Explain your answer.

Samples 3 and 5 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. Sample 5 is not a mineral because it is a liquid that does not make up rocks.