SCIENCE
Teacher's Manual

Grade 6

Papua New Guinea
Department of Education

JICA

'FREE ISSUE
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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.

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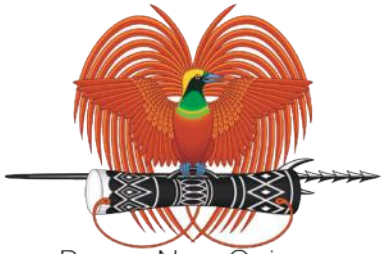
Science
Teacher's Manual

Grade 6



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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 6 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 6 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.

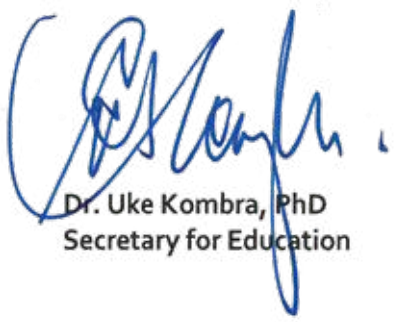
Science is a very interesting and enjoyable subject if taught well. This Grade 6 Teacher's Manual contains very interesting student activities with clear and precise step by step lesson flows for all lessons and teacher notes to assist teachers understand the science concepts for each lesson. These concepts are expanded from the Grades 6-8 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 6 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 6-8 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

Topic Title

Lesson Title

Lesson No. in the Topic

Introduction of the lesson

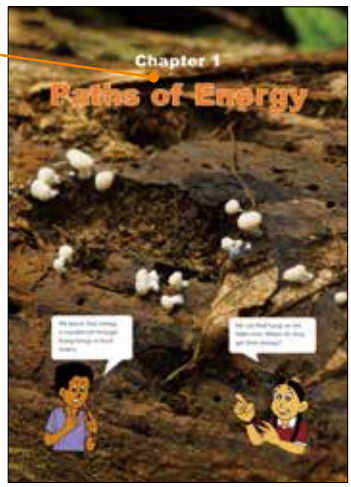
Key Question in the lesson

Activity

Discussion based on student's findings

Chapter Introduction

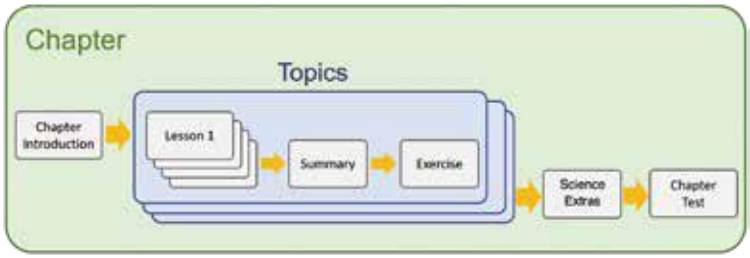
Chapter No. and Name



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 Extra
6. Chapter test



(main content page)


Summary

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

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

Herbivores | Carnivores | Omnivores

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

Sun | Predator | Prey | Producer | Consumer | Consumer

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

12

After all lessons in the topic done...

Summary

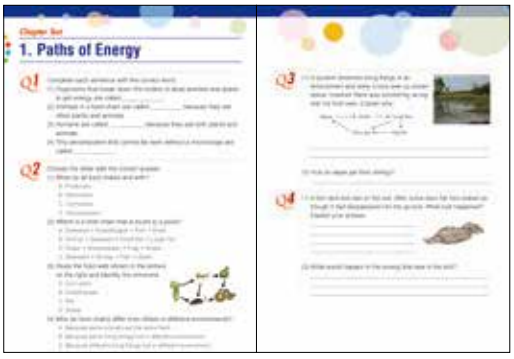
Summary of the lesson

Exercise

Science Extras

After all topics done...

Chapter test



Go to next Chapter...

1.2 Main contents in the Teacher's Manual

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

Basic lesson information

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

Textbook page of the lesson

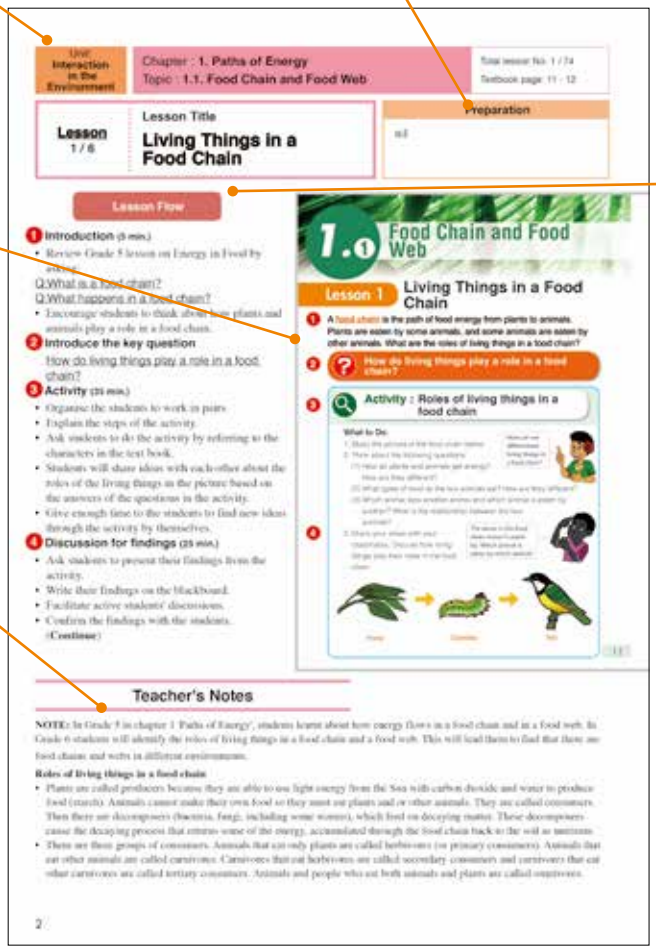
Corresponding textbook page number is shown at the center. The numbers in red circle on the page correspond to the 'Lesson Flow' to show where the content is in the lesson flow.

Teacher's Notes

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

Preparation

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



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

❶ Introduction

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

❷ Showing a key question

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

❸ Activity

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

Lesson Flow

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

Lesson Objectives

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

Assessment

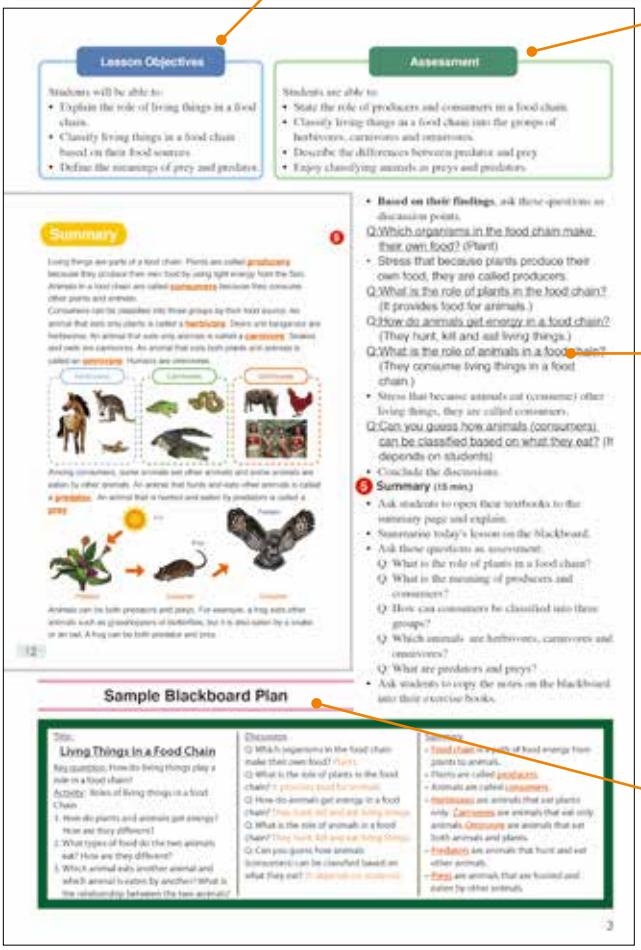
Teacher should reflect own lesson along this criteria through the lesson. The three components of knowledge, thinking skills, attitude & values are also indicated in the teacher's manual.

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

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

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

Refer to Teachers Guide for detail information.



Sample Blackboard Plan

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

❹ Discussion

In the discussion part, the teacher allows students to present their results or findings from the activity and to share with all other students. The teacher allows time to students to think and seek the answers for the key question by using the results or findings in the activity. The teacher must verify the results to the students to avoid misconceptions. In the case, for Grade 6, some of the results in the activity would be same as the conclusion of the lesson.

❺ Summary

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

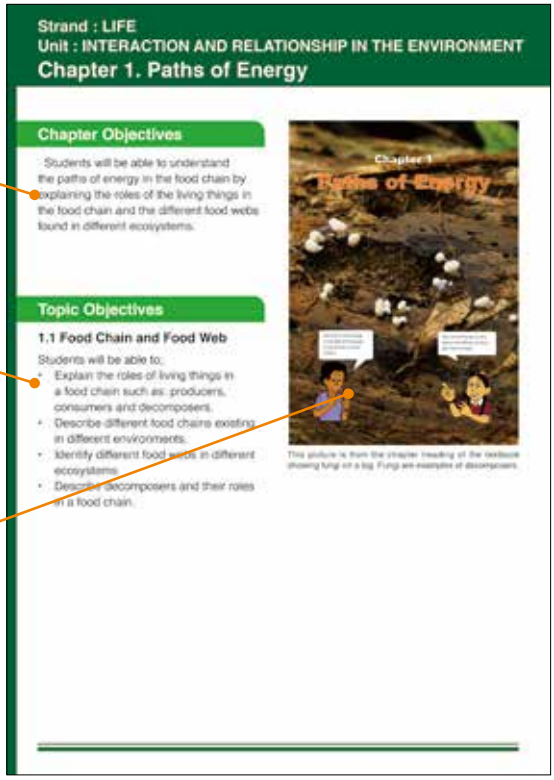
1.3 Chapter Introduction in Teacher's Manual

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

Chapter Objectives
The objectives to achieve the chapter are introduced.

Topic Objectives
The objectives to achieve each topic are introduced.

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

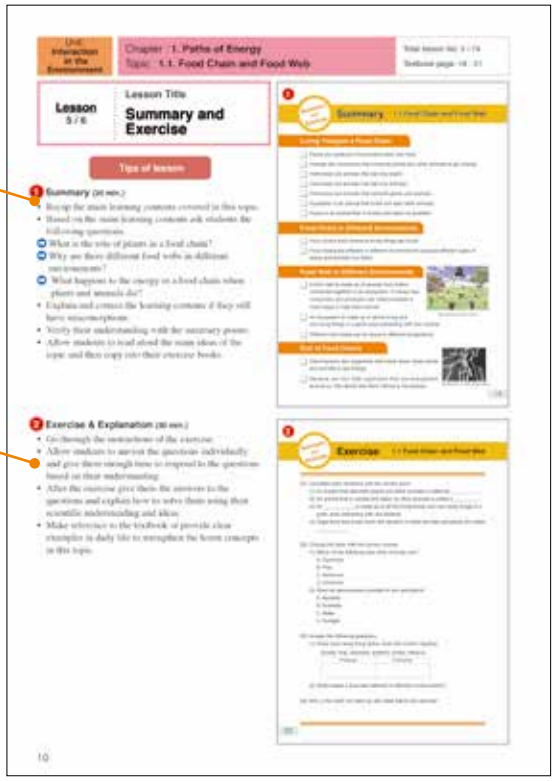


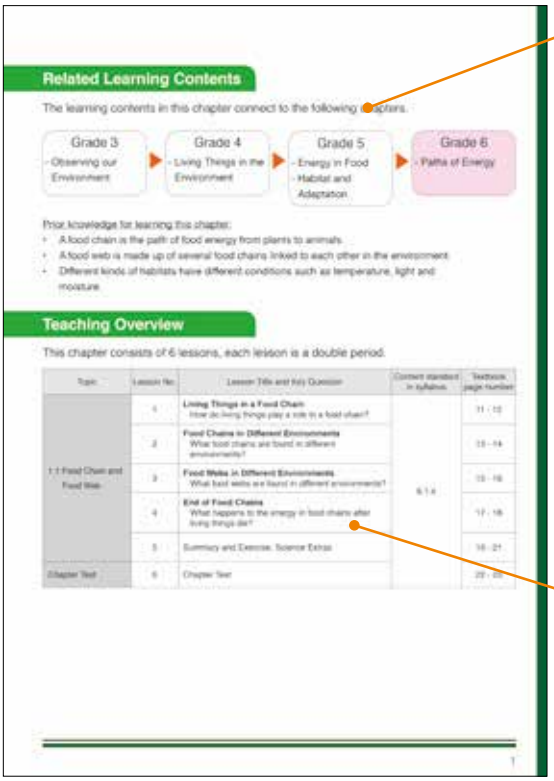
1.4 Summary and Exercise / Science Extras in Teacher's Manual

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

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

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



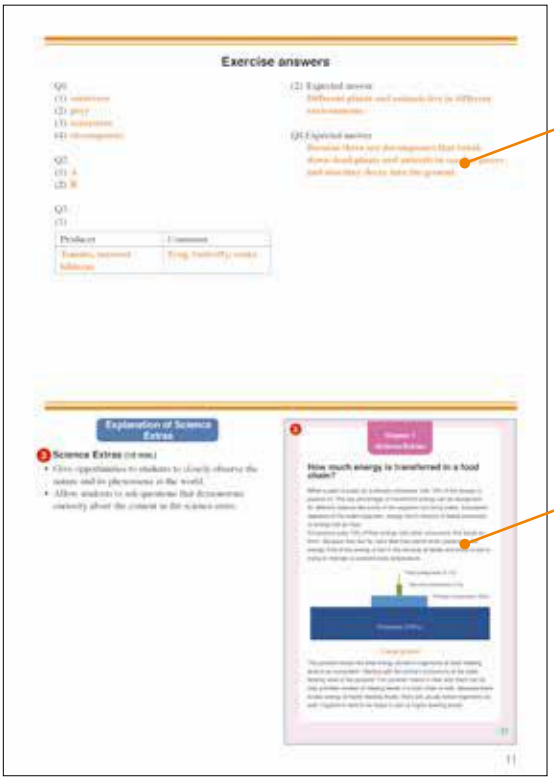


Related Learning Contents

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

Teaching Overview

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



Answer of Exercise Question

Answers of the questions in exercise are provided.

Science Extras

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

2. How to deliver a Science Lesson

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

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

3. What to consider while presenting the lesson

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

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

In several lessons, basic science instruments such as a thermometer, compass, digital scale and simple electric circuit are required. For Grade 6 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 6 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 80 minutes (40 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. Paths of Energy	1.1 Food Chain and Food Web	TERM 1	1	1	Living Things in a Food Chain	2
					2	2	Food Chain in Different Environments	4
					3	3	Food Web in Different Environments	6
					4	4	End of Food Chains	8
					5	5	Summary and Exercise	10
					6	6	Chapter test	12
EARTH AND SPACE	OUR EARTH	2. Change and Formation of Land	2.1 The Changes on the Earth's Surface		7	1	Breaking Apart of Rocks	16
					8	2	Carrying Away of Sediments	18
					9	3	Works of Rivers	20
					10	4	Other Causes that Change the Earth's Surface	22
					11	5	Summary and Exercise	24
			2.2 Formation of Rock Layers and Rocks		12	6	Cross Section of a Cliff	26
					13	7	Formation of Strata	28
					14	8	Formation of Sedimentary Rock	30
					15	9	Summary and Exercise	32
					16	10	Chapter test	34
PHYSICAL SCIENCE	FORCE AND MOTION	3. Force	3.1 Forces around Us	TERM 2	17	1	Forces in Daily Life	38
					18	2	Gravity	40
					19	3	Measuring and Describing Force	42
					20	4	Summary and Exercise,	44
					21	5	Chapter test	46
LIFE	PLANTS	4. Plants and Water	4.1 Water in Plants		22	1	Paths of Water in Plants	50
					23	2	Water in Leaves	52
					24	3	Summary and Exercise	54
					25	4	Chapter test	56
LIFE	PLANTS	5. Reproduction and Heredity in Plants	5.1 Reproduction and Heredity		26	1	Flowers	60
					27	2	Pollination	62
					28	3	Reproduction in Flowering Plants	64
					29	4	Heredity in Plants	66
					30	5	Summary and Exercise,	68
					31	6	Chapter test	70
EARTH AND SPACE	SPACE	6. Star	6.1 Stars		32	1	Stars	74
					33	2	Movement of Stars	76
					34	3	Constellations	78
					35	4	Summary and Exercise	80
					36	5	Chapter test	82

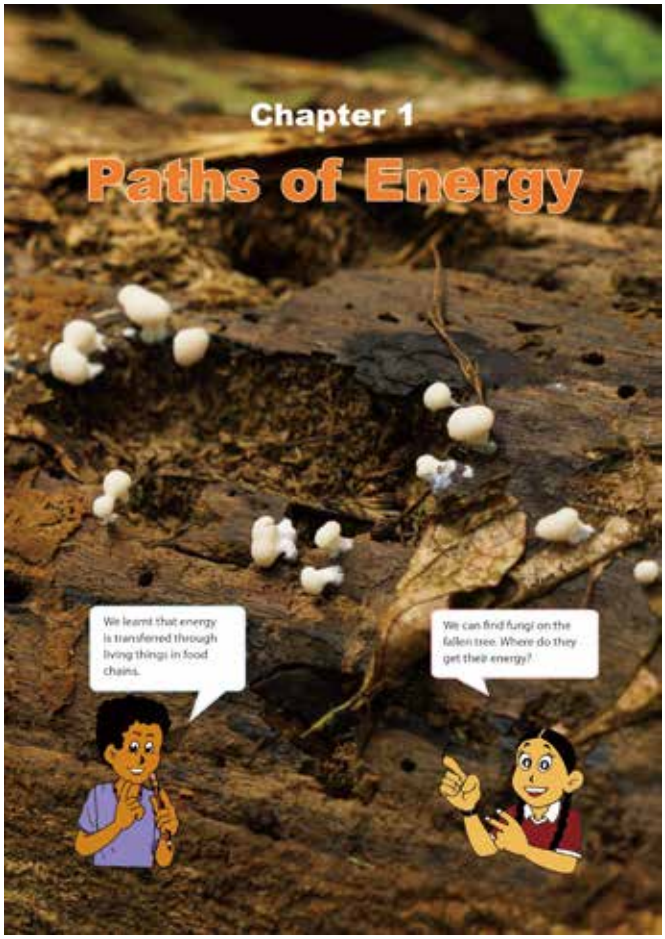
Chapters are arranged in sequential order from the first to the last. Each chapter contains one or more topics. The lesson number in the chapter is given to each lesson according to the students' textbook. Each lesson is recommended to be conducted as double periods (80 minutes). Finally, the page numbers 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
PHYSICAL SCIENCE	ENERGY	7. Energy	7.1 Forms and Uses of Energy	TERM 3	37	1	Kinetic Energy	86
					38	2	Potential Energy 1: Gravitational Potential Energy	88
					39	3	Potential Energy 2: Chemical Energy	90
					40	4	Forms of Energy	92
					41	5	Summary and Exercise	94
			7.2 Energy Conversion		42	6	Relationship between Kinetic and Gravitational Potential Energy	96
					43	7	Change in Forms of Energy in Daily Life	98
					44	8	Summary and Exercise	100
					45	9	Chapter test	102
EARTH AND SPACE	SPACE	8. Moon	8.1 Moon in Motion		46	1	Movement of the Moon	106
					47	2	Causes of Moon Phases	108
					48	3	Summary and Exercise	110
					49	4	Chapter test	112
PHYSICAL SCIENCE	ENERGY	9. Electromagnet	9.1 Properties of Electromagnet		50	1	Characteristics of Electromagnet	116
					51	2	How to Strengthen an Electromagnet 1	118
					52	3	How to Strengthen an Electromagnet 2	120
					53	4	Use of Electromagnets in Daily Life	122
					54	5	Summary and Exercise	124
					55	6	Chapter test	126
LIFE	HUMAN BEING	10. Human Body System: Respiratory System and Circulatory System	10.1 Respiratory System	TERM 4	56	1	Breathing	130
					57	2	Lungs	132
					58	3	Summary and Exercise	134
			10.2 Circulatory System		59	4	The Heart	136
					60	5	Circulation of Blood	138
					61	6	Blood	140
					62	7	Summary and Exercise	142
					63	8	Chapter test	144
PHYSICAL SCIENCE	MATTER	11. Mixtures and Solutions	11.1 Mixtures		64	1	Mixtures and Substances	148
					65	2	Types of Mixtures	150
					66	3	Separating a Mixture 1	152
					67	4	Separating a Mixture 2	154
					68	5	Summary and Exercise	156
			11.2 Solutions		69	6	Mixtures and Solutions	158
					70	7	Weight of Solution	160
					71	8	Amount of Substance Dissolved in Water 1	162
					72	9	Amount of Substance Dissolved in Water 2	164
					73	10	Summary and Exercise	166
					74	11	Chapter test	168

Chapter 1. Paths of Energy

Chapter Objectives

Students will be able to understand the paths of energy in the food chain by explaining the roles of the living things in the food chain and the different food webs found in different ecosystems.



This picture is from the chapter heading of the textbook showing fungi on a log. Fungi are examples of decomposers.

Topic Objectives

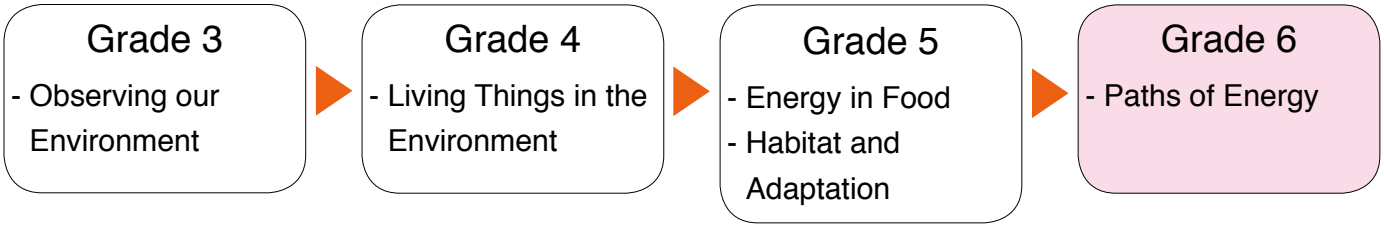
1.1 Food Chain and Food Web

Students will be able to;

- Explain the roles of living things in a food chain such as: producers, consumers and decomposers.
- Describe different food chains existing in different environments.
- Identify different food webs in different ecosystems.
- Describe decomposers and their roles in a food chain.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- A food chain is the path of food energy from plants to animals.
- A food web is made up of several food chains linked to each other in the environment.
- Different kinds of habitats have different conditions such as temperature, light and moisture.

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
1.1 Food Chain and Food Web	1	**Living Things in a Food Chain** How do living things play a role in a food chain?	6.1.4	11 - 12
	2	**Food Chains in Different Environments** What food chains are found in different environments?		13 - 14
	3	**Food Webs in Different Environments** What food webs are found in different environments?		15 - 16
	4	**End of Food Chains** What happens to the energy in food chains after living things die?		17 - 18
	5	Summary and Exercise, Science Extras		19 - 21
Chapter Test	6	Chapter Test		22 - 23

Unit: **Interaction in the Environment**	Chapter : **1. Paths of Energy** Topic : **1.1. Food Chain and Food Web**	Total lesson No: 1 / 74 Textbook page: 11 - 12

Lesson 1 / 6

Lesson Title

Living Things in a Food Chain

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review Grade 5 lesson on Energy in Food by asking:

Q:What is a food chain?

Q:What happens in a food chain?

- Encourage students to think about how plants and animals play a role in a food chain.

2 Introduce the key question

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

3 Activity (35 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Ask students to do the activity by referring to the characters in the text book.
- Students will share ideas with each other about the roles of the living things in the picture based on the answers of the questions in the activity.
- Give enough time to the students to find new ideas through the activity by themselves.

4 Discussion for findings (25 min.)

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

(**Continue**)

Teacher's Notes

NOTE: In Grade 5 in chapter 1 'Paths of Energy', students learnt about how energy flows in a food chain and in a food web. In Grade 6 students will identify the roles of living things in a food chain and a food web. This will lead them to find that there are food chains and webs in different environments.

Roles of living things in a food chain

- Plants are called producers because they are able to use light energy from the Sun with carbon dioxide and water to produce food (starch). Animals cannot make their own food so they must eat plants and or other animals. They are called consumers. Then there are decomposers (bacteria, fungi, including some worms), which feed on decaying matter. These decomposers cause the decaying process that returns some of the energy, accumulated through the food chain back to the soil as nutrients.
- There are three groups of consumers. Animals that eat only plants are called herbivores (or primary consumers). Animals that eat other animals are called carnivores. Carnivores that eat herbivores are called secondary consumers and carnivores that eat other carnivores are called tertiary consumers. Animals and people who eat both animals and plants are called omnivores.

Lesson Objectives

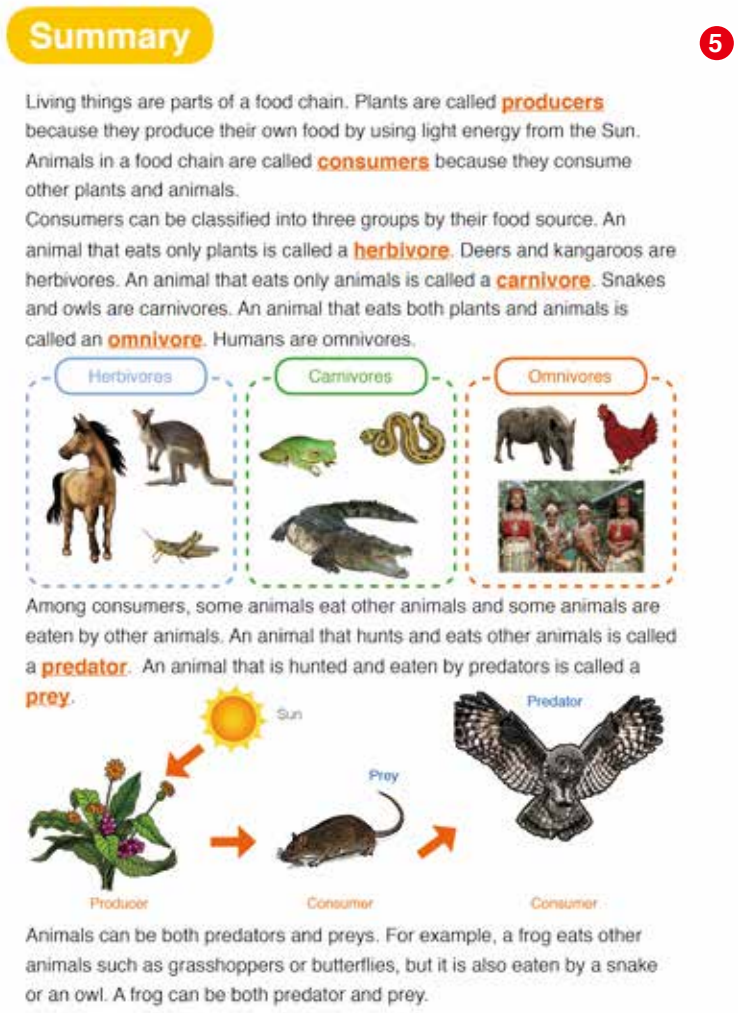
Students will be able to:

- Explain the role of living things in a food chain.
- Classify living things in a food chain based on their food sources.
- Define the meanings of prey and predator.

Assessment

Students are able to:

- State the role of producers and consumers in a food chain.
- Classify living things in a food chain into the groups of herbivores, carnivores and omnivores.
- Describe the differences between predator and prey.
- Enjoy classifying animals as preys and predators.



Summary

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

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

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

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

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

Q:Which organisms in the food chain make their own food? (Plant)

- Stress that because plants produce their own food, they are called producers.

Q:What is the role of plants in the food chain? (It provides food for animals.)

Q:How do animals get energy in a food chain? (They hunt, kill and eat living things.)

Q:What is the role of animals in a food chain? (They consume living things in a food chain.)

- Stress that because animals eat (consume) other living things, they are called consumers.

Q:Can you guess how animals (consumers) can be classified based on what they eat? (It depends on students)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  - Q: What is the role of plants in a food chain?
  - Q: What is the meaning of producers and consumers?
  - Q: How can consumers be classified into three groups?
  - Q: Which animals are herbivores, carnivores and omnivores?
  - Q: What are predators and preys?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Livng Things in a Food Chain

Key question: How do living things play a role in a food chain?

Activity: Roles of living things in a food chain

1. How do plants and animals get energy? How are they different?
2. What types of food do the two animals eat? How are they different?
3. Which animal eats another animal and which animal is eaten by another? What is the relationship between the two animals?

Discussion

Q: Which organisms in the food chain make their own food? Plants.
Q: What is the role of plants in the food chain? It provides food for animals.
Q: How do animals get energy in a food chain? They hunt, kill and eat living things.
Q: What is the role of animals in a food chain? They hunt, kill and eat living things.
Q: Can you guess how animals (consumers) can be classified based on what they eat? (It depends on students)

Summary

- Food chain is a path of food energy from plants to animals.
- Plants are called producers.
- Animals are called consumers.
- Herbivores are animals that eat plants only, Carnivores are animals that eat only animals. Omnivore are animals that eat both animals and plants.
- Predators are animals that hunt and eat other animals.
- Preys are animals that are hunted and eaten by other animals.

Unit: **Interaction in the Environment**	Chapter : **1. Paths of Energy** Topic : **1.1. Food Chain and Food Web**	Total lesson No: 2 / 74 Textbook page: 13 - 14

Lesson 2 / 6

Lesson Title

Food Chain in Different Environments

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson by asking:

Q:What is the role of plants in a food chain?
Q:What is the meaning of producers and consumers?
Q:How can we classify consumers?

- Provoke students to think of different types of food chains in different environments by asking:

Q:Are food chains the same in different environments?

2 Introduce the key question

What food chains are found in different environments?

3 Activity (35 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Ask students to do the activity by referring to the character and pictures in the textbook.
- Check students' activity and if necessary guide them towards their findings.
- Students will share ideas with each other about different types of food chains in different environments.
- Give enough time to the students to find new ideas through the activity by themselves.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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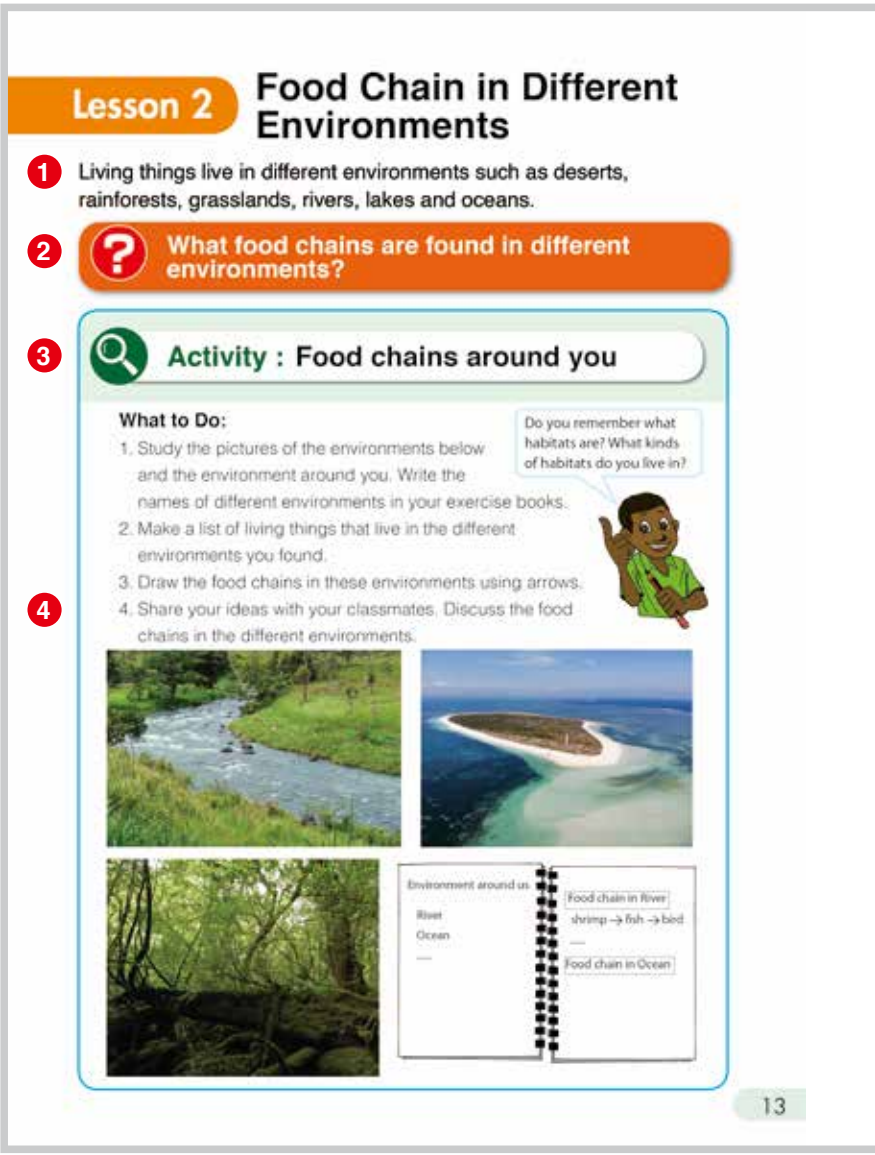


Teacher's Notes

- The table below shows some examples of food chains in different environments. This shows that food chains are in different enviroments. For example, in a grassland you might find grass, grasshopper, snake and eagle living there. You can not find them in a swamp.

Different environments	Examples of food chains
(1) River	River grass → prawn → fish
(2) Ocean	Phytoplankton → lobster → fish → dolphin
(3) Swamp	Algae → mosquito larva → tilapia
(4) Grassland	Grass → grasshopper → snake → eagle
(5) Rainforest	Mushroom → ant → lizard → snake

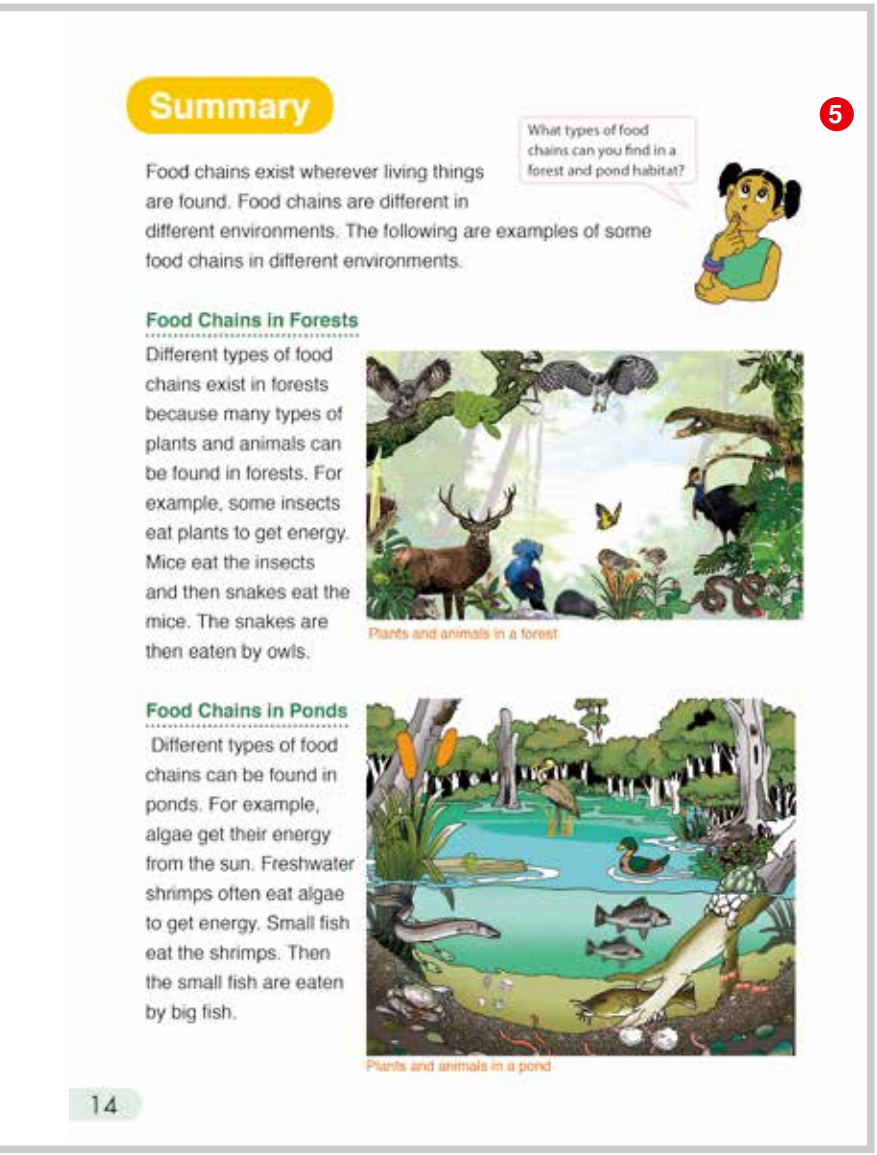
- All food chains start with energy from the Sun. This energy is captured by plants. Thus, the living part of a food chain always starts with plants and ends with decomposers. The decomposers are the final level or stage in food chains.

Lesson Objectives

Students will be able to:
- Identify different food chains existing in different environments.
- Describe the food chains around their environment.

Assessment

Students are able to:
- List different food chains from different environments such as ocean, forest and river.
- Draw the diagrams of simple food chains around their environment.
- Enjoy discovering the food chains in their environment.



Summary

5

What types of food chains can you find in a forest and pond habitat?

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

Food Chains in Forests

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

Plants and animals in a forest

Food Chains in Ponds

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

Plants and animals in a pond

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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:Why do living things live in different environments? (Because in different environments they are able to find their own food, etc...)

Q:Why are food chains different? (Because different living things live in different environments, different animals eat different food in different environments, etc...)

Q:What would be a food chain in a forest? (It depends on students)

- Conclude the discussions.

5 Summary (15 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: Do the same living things live in an environment?
  - Q: Why are food chains different in different environments?
  - Q: What would be a food chain in a pond environment?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Food Chains in Different Environments

Key question:
What food chains are found in different environments?

Activity: Food chains around you

1.What kinds of environment are you surrounded by? Coastal, swamp, river, grassland, pond.

2. List of living things.
Example: Prawns, fish, seaweed, bird, etc...

3. Ocean food chain
Seaweed → small fish → tuna

Discussion

Q: Why do living things live in different environments?
Because in different environments they are able to find their own food, etc...

Q:Why are food chains different?
Because different living things live in different environments, different animals eat different food in different environments, etc...

Q:What would be a food chain in a forest?
(It depends on students.)

Summary

- Food chains exist everywhere where living things are found.
- Food chains are different according to the type of environment.
- Example:
  1. Rainforest food chain
  Fruits → butterfly → hornbill → Eagle
  2. Ocean Food Chain
  Seaweed → Shrimps → small fish → tuna

Unit: **Interaction in the Environment**	Chapter : **1. Paths of Energy** Topic : **1.1. Food Chain and Food Web**	Total lesson No: 3 / 74 Textbook page: 15 - 16

Lesson 3 / 6

Lesson Title

Food Webs in Different Environments.

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review Grade 5 Chapter 1 lesson 3, 'Food Webs' and the previous lesson by asking:

Q:What is a food web?

Q:Why are food chains different in different environments?

- Provoke students to think by asking:

Q:How about food webs, are they also different in different environments?

2 Introduce the key question

What food webs are found in different environments?

3 Activity (35 min.)

- Organise the students to work in pairs.
- Explain the steps of the activity.
- Ask students to do the activity by referring to the characters and the picture in the textbook.
- Check students' activity and if necessary guide them towards their findings.
- Ask students to share their ideas with each other about how living things are connected to each other in the environments in the picture.
- Give enough time to the students to find new ideas through the activity by themselves.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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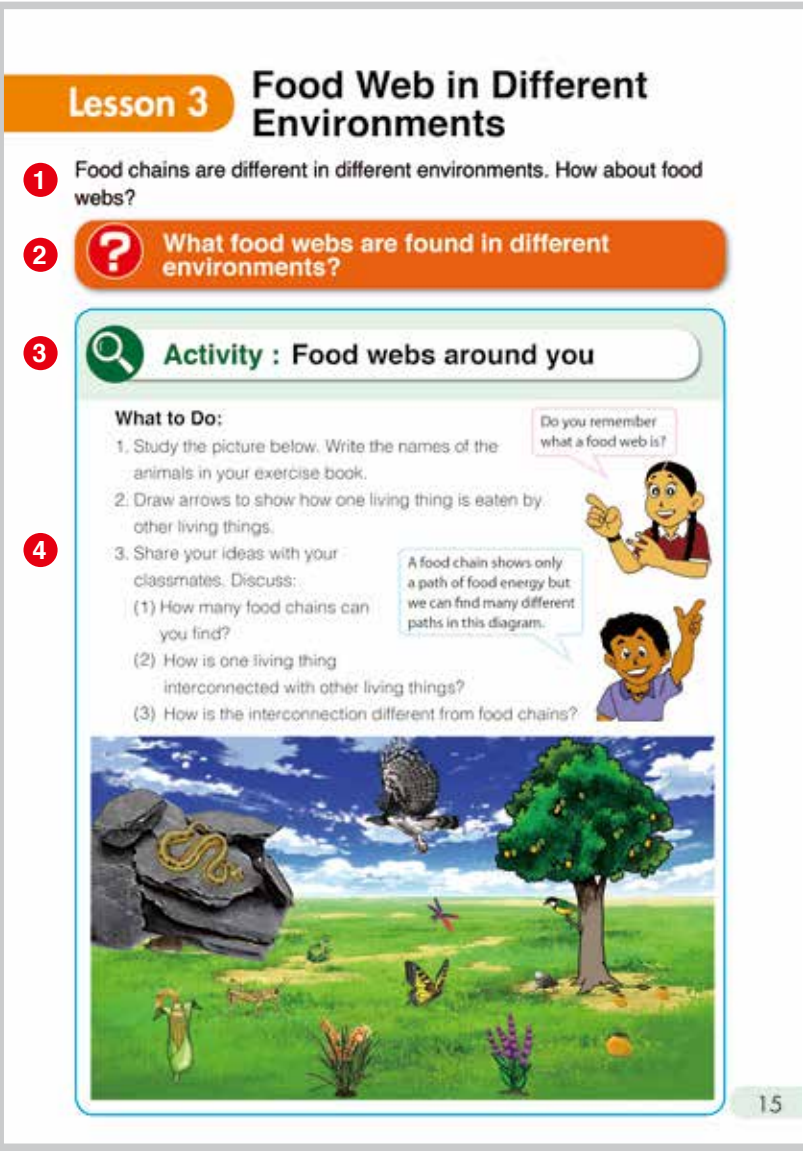

Lesson 3 Food Web in Different Environments

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

2 What food webs are found in different environments?

3 Activity : Food webs around you

4

What to Do:

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

Do you remember what a food web is?

A food chain shows only a path of food energy but we can find many different paths in this diagram.

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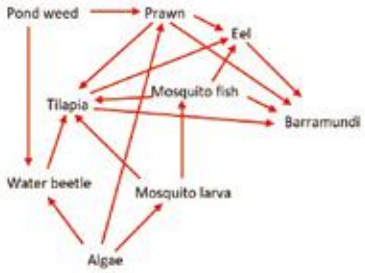
Teacher's Notes

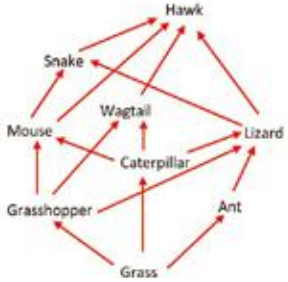
Tips for the Lesson

- Let students notice that the components in food webs in different environments are different.
- Also explain to students that a food web gets more complex when there are many different types of living things living in an ecosystem.
- In the sample food web of fresh water there are a number of living things. In such environment organisms compete to get what they need to survive.
- A healthy food web has many producers and many herbivores. The food web only has a few carnivores and omnivores.
- Refer to the energy pyramid learnt in Grade 5, chapter 1 'Energy From Food' shows energy flow from one level to next level.

Food webs in the Freshwater Environment



Food webs in Grassland Environment

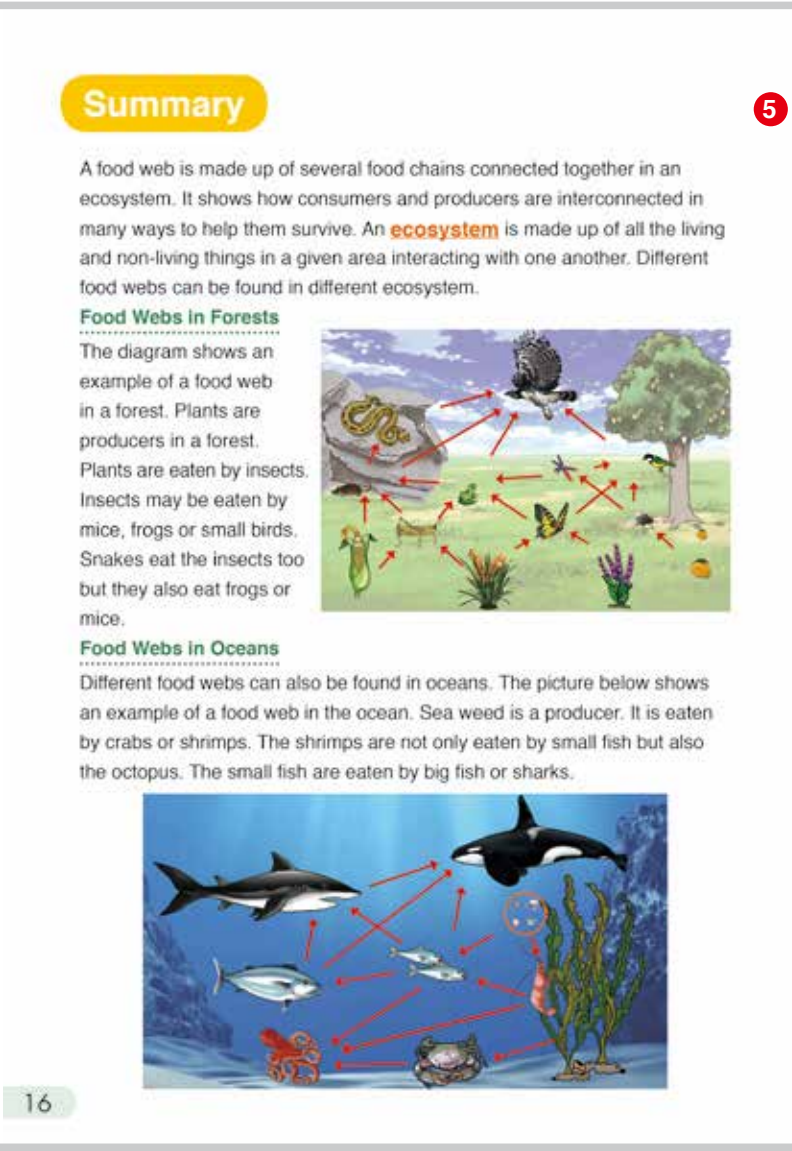


Lesson Objectives

Students will be able to:
- Explain what a food web is.
- Explain what an ecosystem is.
- Identify different food webs found in different ecosystems.

Assessment

Students are able to:
- State what a food web is by relating to food chains.
- Define what an ecosystem is by relating to food webs.
- Draw a food web to show connections of food chains in ecosystems such as a forest and an ocean.



Summary

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

Food Webs in Forests

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

Food Webs in Oceans

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

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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:Is the shape of a food web the same as a food chain?
(No.)

Q:How is a food web different from a food chain?
(Not only one path, complicated paths.)

Q:How is one living thing interconnected to other living things?
(One living thing connects many other living things.)

- Let students draw a food web in an ocean. (Refer to Teacher's Notes)

Q:Why is the food web in the ocean looking different from the food web in the forest?
(Different plants and animals are there, producers, preys and predators are different in different environments, etc...)

- Conclude the discussions.

5 Summary (15 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 are food webs different from food chains?
  Q: What is an ecosystem?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Food Webs in Different Environments

Key question:
What food webs are found in different environments?
Activity: Food webs around you.
Allow students to draw a food web in a forest. (Refer to Teacher's Notes)

Discussion
Q: Is the shape of a food web the same as a food chain? No.
Q: How is a food web different from a food chain?
Not only one path, complicated paths.
Q: How is one living thing interconnected to other living things?
One living thing connects many other living things.
Let's draw food web in ocean
Allow students to draw a food web in ocean. (Refer to Teacher's Notes)

Q:Why is the food web in the ocean looking different from the food web in the forest?
Different plants and animals are there, producers, preys and predators are different in different environments.
Summary
- Different food webs exist in different environments.
- When an environment is different, there are different producers, preys and predators.
- An ecosystem is made up of all the living and non-living things in a given area interacting with one another.

Unit: **Interaction in the Environment**	Chapter : **1. Paths of Energy** Topic : **1.1. Food Chain and Food Web**	Total lesson No: 4 / 74 Textbook page: 17 - 18

Lesson 4 / 6

Lesson Title

End of Food Chains

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Recap on the previous lesson by asking:

Q:How do food webs look different from food chains?

Q:What is an ecosystem?

- Encourage students to focus on their daily experience of when they see a dead plant or animal and ask:

Q:Have you seen dead plants or animals?

Q:What happens after they die?

2 Introduce the key question

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

3 Activity (35 min.)

- Organise the students to work in groups.
- Explain the steps of the activity.
- Go outside with students and let them observe under fallen leaves and soil.
- Ask them to record their observations in their exercise books.
- After observation, students will share ideas about living things they found in or near fallen leaves and soil.
- Give enough time to the students to find new ideas through the activity by themselves.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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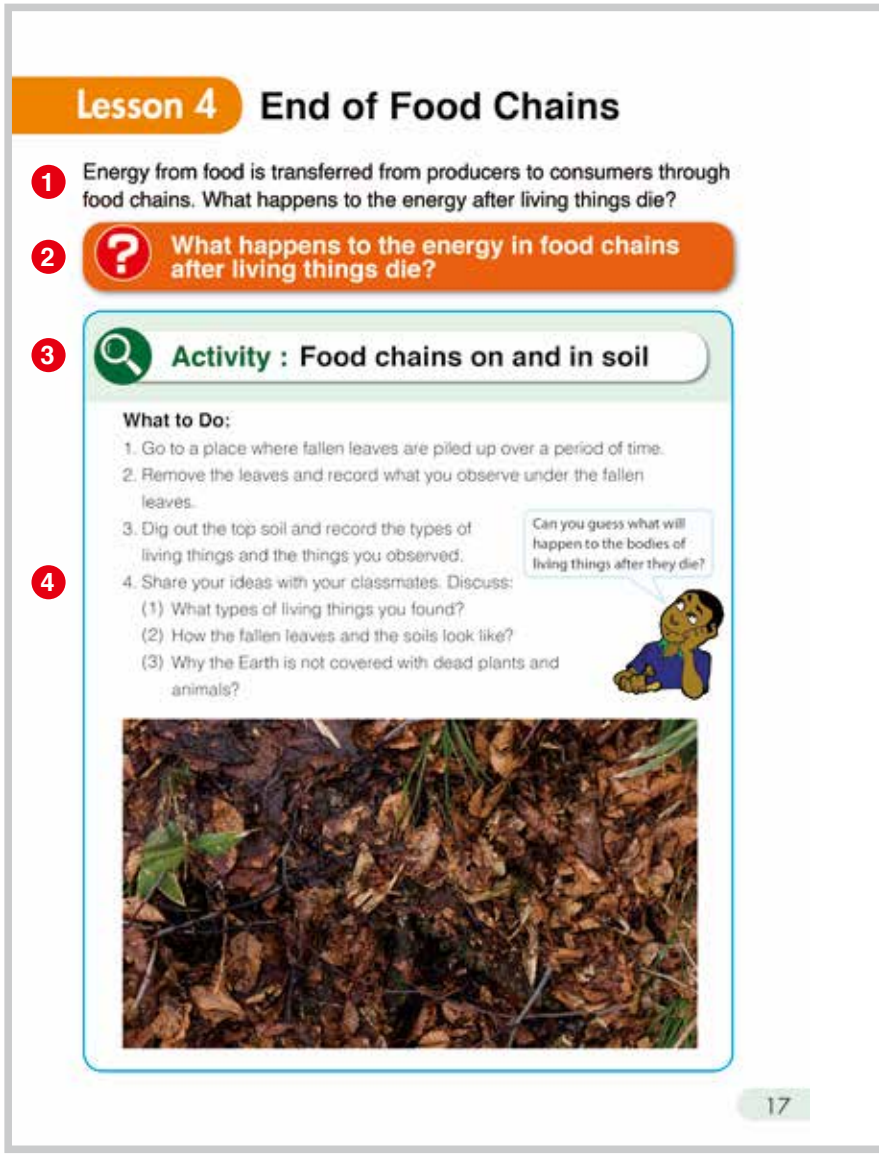

Lesson 4 End of Food Chains

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

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

3 Activity : Food chains on and in soil

What to Do:

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

Can you guess what will happen to the bodies of living things after they die?

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Teacher's Notes

What is decomposition?

Decomposition is the process by which living things are broken down into simpler forms of matter. (Rotting , Decaying)

How does decomposition occur?

Nature has a way of disposing (transferring to another) dead organisms. There are some tiny living things that feed on dead animals and plants bodies. Therefore, the dead animals and plants bodies gradually start to under go the process, of **decomposition**. That is why the Earth is not covered with bodies of dead animals and plants.

Examples of decomposers

1) Bacteria
2) Fungi (singular- Fungus)
3) Algae
4) Lichen

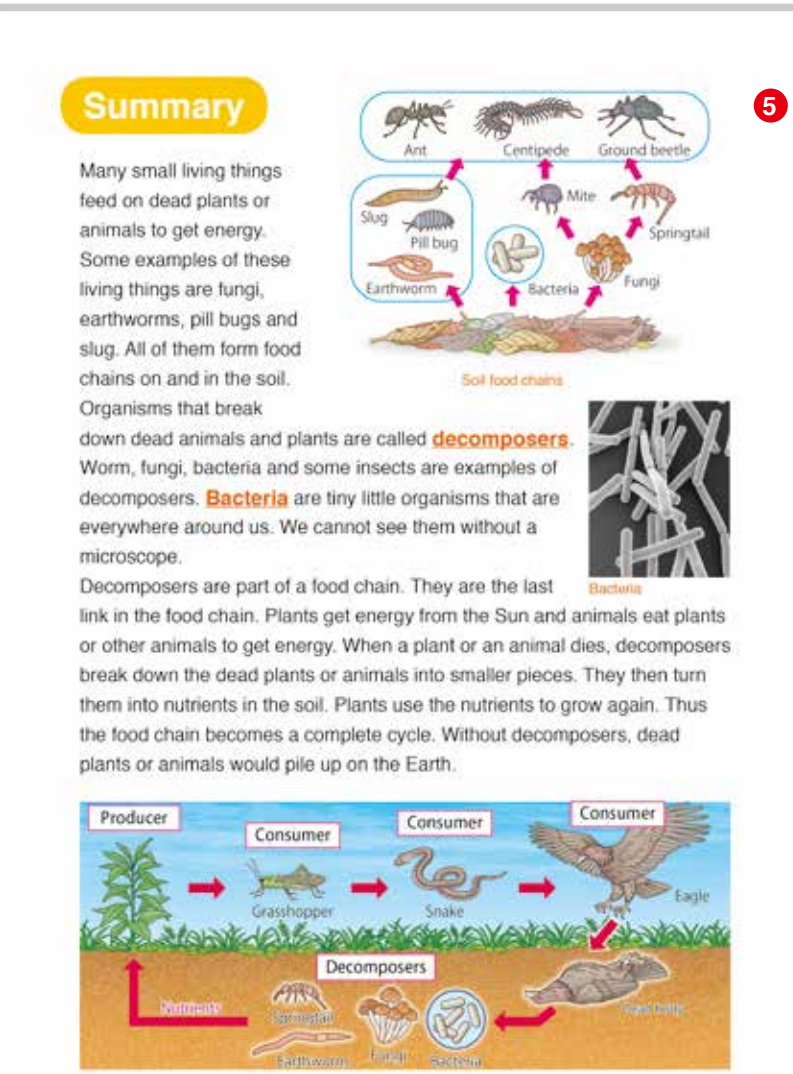
- Bring students to a place where there are rotten and decaying materials piled up so students can be able to observe decomposers.
- Decomposers may transmit diseases. So the students must wash their hands with soap after the observations.

Lesson Objectives

Students will be able to:
- Explain what happens to the energy in a food chain after living things die.
- Describe what decomposers are.
- Communicate their ideas with others.

Assessment

Students are able to:
- Describe the flow of energy in a food chain after living things die in relation to the roles of decomposers.
- List the types of decomposers and their roles in a food chain.
- Express their ideas to others positively.



Summary

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

Soil food chains

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

Bacteria

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

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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 types of living things did you find? (fungi, earthworms, pill bugs, ants, slug, many different kinds of insects, rotten plants, etc.)

Q:How do the fallen leaves and the soils look like? (Fallen leaves: Some decay, crumble, got rotten, etc. Soil: It includes many different kinds of living things, brown or black colour, wet, etc...)

Q:Why is the Earth not covered with dead plants and animals? (It depends on students' ideas.)

- Explain that after living things die, there are some living things that feed on dead plants and animal bodies to get energy.

Q:What do you think about the energy in the food chain after living things die? (Energy is passed on to other living things in the soil, etc.)

- Conclude the discussions.

5 Summary (15 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 happens to the energy in the food chain when living things die?
  Q: What are decomposers?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

End of Food Chains

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

Activity: Food Chains on and in soil

Living things you found

Animals	Plants
earthworm, pill bugs, ants, slugs, different kinds of insects	fungi, rottent plants

Discussion

Q: What types of living things did you find?
Fungi, earthworms, pill bugs, ants, slug, many different kinds of insects, rotten plants, etc.

Q: How do the fallen leaves and the soils look like?
Fallen leaves: Some decay, crumble, got rotten, etc. Soil: It includes different kinds of living things, brown or black colour, wet, etc.

Q: Why is the Earth not covered with dead plants and animals?
(It depends on students' ideas.)

Q: What do you think about the energy in the food chain after living things die?
Energy is passed on to other living things in the soil, etc.

Summary
- Organism that breaks down dead plants and animal bodies are called decomposer.
- Decomposers are part of a food chain. They are the last link in the food chain.
- Bacteria are tiny little organisms that are everywhere around us but we can only see them using a microscope.

Unit: **Interaction in the Environment**	Chapter : **1. Paths of Energy** Topic : **1.1. Food Chain and Food Web**	Total lesson No: 5 / 74 Textbook page: 19 - 21

Lesson 5 / 6

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.
  - What is the role of plants in a food chain?
  - Why are there different food webs in different environments?
  - What happens to the energy in a food chain when plants and animals die?
- 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 Food Chain and Food Web

Living Things in a Food Chain

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

Food Chain in Different Environments

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

Food Web in Different Environments

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

Example of food web

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

End of Food Chains

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

Example of decomposers

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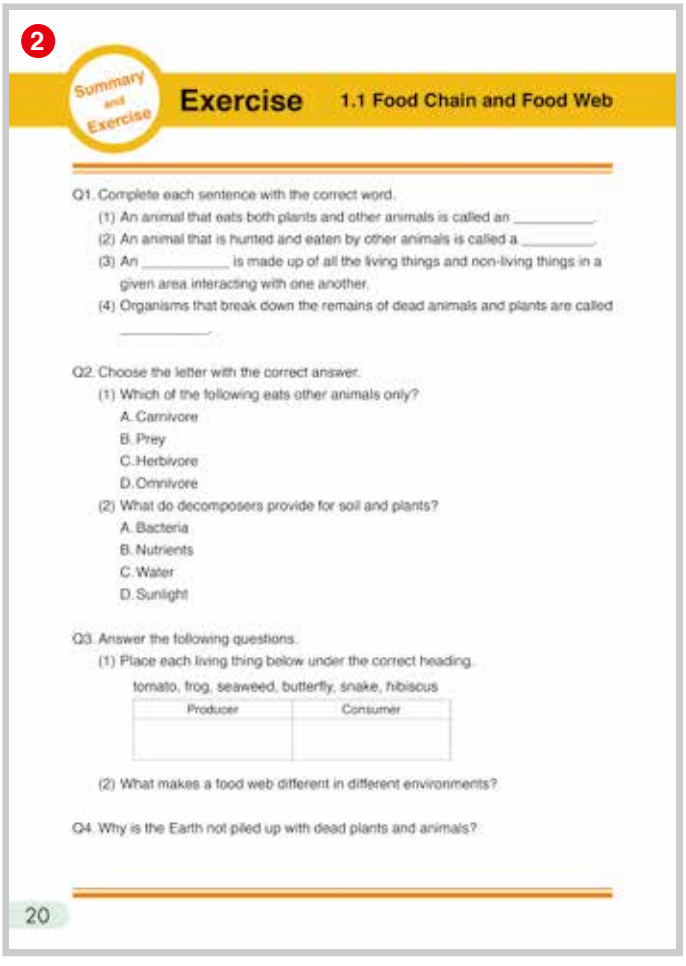
2 Exercise & Explanation (30 min.)

- 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 Food Chain and Food Web

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

A. Carnivore
B. Prey
C. Herbivore
D. Omnivore

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

A. Bacteria
B. Nutrients
C. Water
D. Sunlight

Q3. Answer the following questions.

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

tomato, frog, seaweed, butterfly, snake, hibiscus

Producer	Consumer

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

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

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Exercise answers

Q1.
(1) **omnivore**
(2) **prey**
(3) **ecosystem**
(4) **decomposers**

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

Q3.
(1)

Producer	Consumer
Tomato, seaweed hibiscus	**Frog, butterfly, snake**

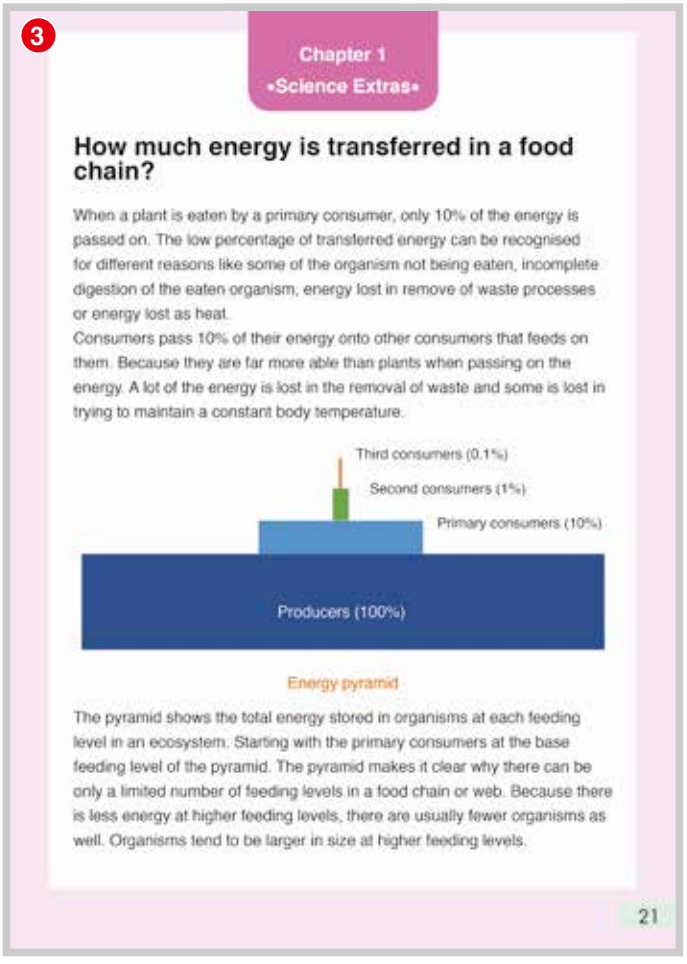
(2) Expected answer
Different plants and animals live in different environments.

Q4.Expected answer
Because there are decomposers that break down dead plants and animals into smaller pieces and also they decay into the ground.

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•

How much energy is transferred in a food chain?

When a plant is eaten by a primary consumer, only 10% of the energy is passed on. The low percentage of transferred energy can be recognised for different reasons like some of the organism not being eaten, incomplete digestion of the eaten organism, energy lost in remove of waste processes or energy lost as heat.
Consumers pass 10% of their energy onto other consumers that feeds on them. Because they are far more able than plants when passing on the energy. A lot of the energy is lost in the removal of waste and some is lost in trying to maintain a constant body temperature.

Energy pyramid

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

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Lesson 6 / 6

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

1. Paths of Energy

Q1 Complete each sentence with the correct word.

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

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

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

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

Q2 Choose the letter with the correct answer.

(1) What do all food chains end with?

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

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

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

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

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

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

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

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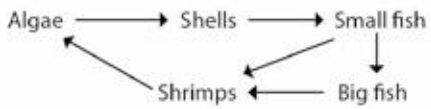
Q3

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



Some arrows in the food webs are pointing in the opposite directions.

(2) How do algae get their energy?

Algae get their energy from the Sun.

Q4

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

(Expected answer) The dead bird had been broken down into smaller pieces by decomposers like worms, ants and bacteria.

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

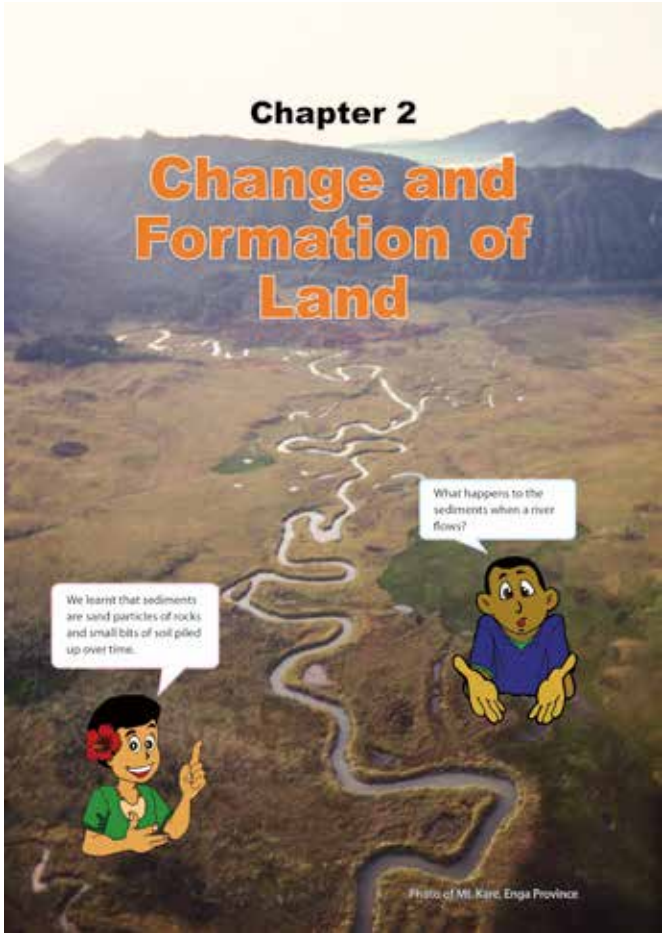
(Expected answer) The energy that is in the dead bird has been turned into nutrients in the soil.

Chapter 2. Change and Formation of Land

Chapter Objectives

Students will be able to understand the process of weathering, erosion and deposition that cause changes on the Earth's surface overtime while earthquakes, volcanoes and landslides cause the rapid changes on the Earth's surface.

They will also be able to explain how strata and sedimentary rocks are formed.



This picture is from the chapter heading of the textbook showing a river flowing from Mt. Kare, Enga Province.

Topic Objectives

2.1 The Changes on the Earth's Surface

Students will be able to;

- Explain that weathering is a process where a rock is broken down into smaller pieces overtime.
- State how wind, water, acid rain and plants cause weathering.
- Demonstrate how the process of erosion occurs.
- Describe what happens to the rocks and soil during and after being carried away by running water.
- Identify other causes that change the Earth's surface.

2.2 Formation of Rock Layers and Rocks

Students will be able to;

- Explore the different layers of rocks by their colour and size.
- Explain that the layers of rocks are formed when sediments are deposited at the bottom of lakes or seafloor by flowing rivers.
- Describe how sedimentary rocks are formed.
- Classify different types of sedimentary rocks according to their physical properties.

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;

- Three kinds of rocks: sedimentary rock, metamorphic rock and igneous rock.
- Use of rocks and minerals
- Fossils give us information about organisms that live long ago.

Teaching Overview

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

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
2.1 The Changes on the Earth's Surface	1	**Breaking Apart of Rocks** How does the surface of the Earth change?	6.3.1	25 - 26
	2	**Carrying Away of Sediments** What happens to sediments after weathering?		27 - 28
	3	**Works of Rivers** What happens to sediments after they are carried away by rivers?		29 - 30
	4	**Other Causes that Change the Earth's Surface** What else change the surface of the Earth?		31 - 32
	5	Summary and Exercise		33 - 34
2.2 Formation of Rock Layers and Rocks	6	**Cross Section of a Cliff** Why does a rock section of cliff have striped pattern?		35 - 36
	7	**Formation of Strata** How are strata formed?		37 - 38
	8	**Formation of Sedimentary Rock** How are sedimentary rocks formed?		39 - 40
	9	Summary and Exercise, Science Extras		41 - 43
Chapter Test	10	Chapter Test		44 - 45

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.1. The Changes on the Earth's Surface**	Total lesson No: 7 / 74 Textbook page: 25 - 26

Lesson 1 / 10

Lesson Title

Breaking Apart of Rocks

Preparation

jar, some pieces of the same coloured chalk,salt

Lesson Flow

1 Introduction (5 min.)

- This is the first lesson and there is no review.
- Motivate students to look at the picture in the introduction of the textbook and ask the question:

Q:This rock was not like this before, what has caused it to change the way it looks now?

2 Introduce the key question

How does the surface of the Earth change?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to what the character is saying for their investigations.
- Have students to do the activity.
- Record their findings in their exercise books.
- Check students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the 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.
- Facilitate active students' discussions.

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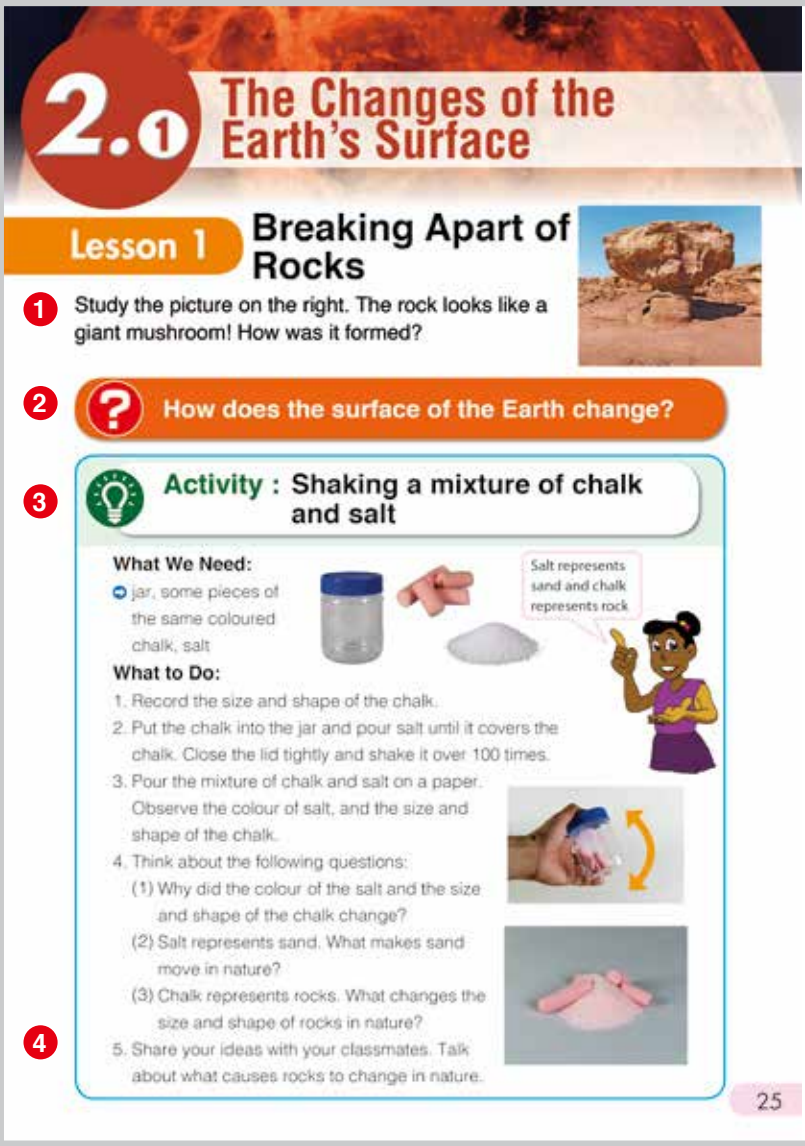


Teacher's Notes

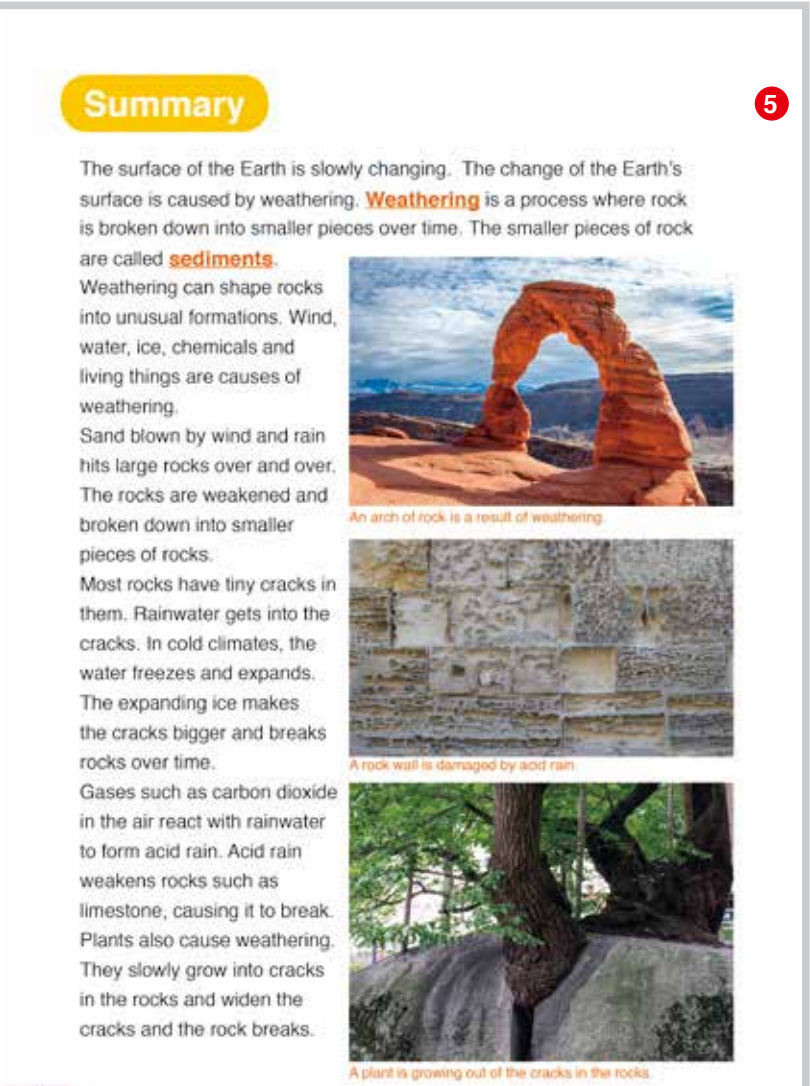
- Weathering is the breakdown of rocks at the Earth's surface, by the action of rainwater, extremes of temperature and biological activity. It does not involve the removal of rock material.
- There are three types of weathering; physical, chemical and biological.
- Physical weathering is the geological process of breaking apart rocks without changing their chemical composition. Overtime, movements of the earth and environment can break apart rock formations, causing physical weathering.
- Chemical weathering is caused by chemical reactions with water and substances dissolved in it.
- Biological weathering is the weakening and subsequent disintegration of rocks by plants, animals and microbes. Growing plant roots can exert pressure on the rock. Although the process is physical, the pressure is exerted by a biological process (i.e. growing roots)

Lesson Objectives

Students will be able to:
- Define the word weathering.
- Explain how the process of weathering can change the earth's surface.
- Communicate their findings with others.

Assessment

Students are able to:
- State that weathering is a process where a rock is broken down into smaller pieces overtime.
- Describe the agents of weathering such as wind, rain, chemicals and living things.
- Express their opinion with confidence.



Summary 5

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

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

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

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

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

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

An arch of rock is a result of weathering.

A rock wall is damaged by acid rain.

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

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

Q:Why did the colour of salt, size and the shape of the chalk change? (Because of shaking.)

Q:Salt represents sand. What makes sand move in nature? (Sand is moved by wind, rain, water etc...)

Q:Chalk represents rocks. What changes the size and shape of rocks in nature? (Wind, rain, water can change the size and shape of rocks.)

- Conclude the discussions.

5 Summary (15 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 weathering?
  Q: What are the small pieces of rocks called?
  Q: How do plants cause weathering?
  Q: What are the causes of weathering?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Breaking Apart of Rocks

Key question:
How does the surface of the Earth change?

Activity:
Shaking a mixture of chalk and salt
1. What is the difference about the chalk before and after shaking the mixture?
Before- the chalk was smooth, fine and had sharp edges.
After- the chalk was rough, sharp edges were gone and there were holes (some particles gone).

Discussion
Q: Why did the colour of salt, size and the shape of the chalk change?
Because of shaking.
Q: Salt represents sand. What makes sand move in nature?
Sand is moved by wind, rain, water etc...
Q: Chalk represents rocks. What changes the size and shape of rocks in nature?
Wind, rain, water can change the size and shape of rocks.

Summary
- Weathering is the process where rock is broken down into smaller pieces overtime.
- The small pieces of rocks are called sediments.
- Weathering is caused by:
  1. Wind
  2. Water
  3. Ice
  4. Chemicals and
  5. Living things.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.1. The Changes on the Earth's Surface**	Total lesson No: 8 / 74 Textbook page: 27 - 28

Lesson 2 / 10

Lesson Title

Carrying Away of Sediments

Preparation

tray, water, sand and ruler

Lesson Flow

1 Introduction (5 min.)

- Review the last lesson.

Q:What is weathering?

Q:What causes rocks to break down into sediments?

- Motivate students to think about how broken sediments are found in different places by asking:

Q:How do sediments move from one place to another?

2 Introduce the key question

What happens to sediments after weathering?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to what the character is saying for their investigations.
- Have students to do the activity.
- Let students record their findings in their exercise books by sketching how the beach looked before and after the waves hit it.
- Check students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the students to discuss their findings in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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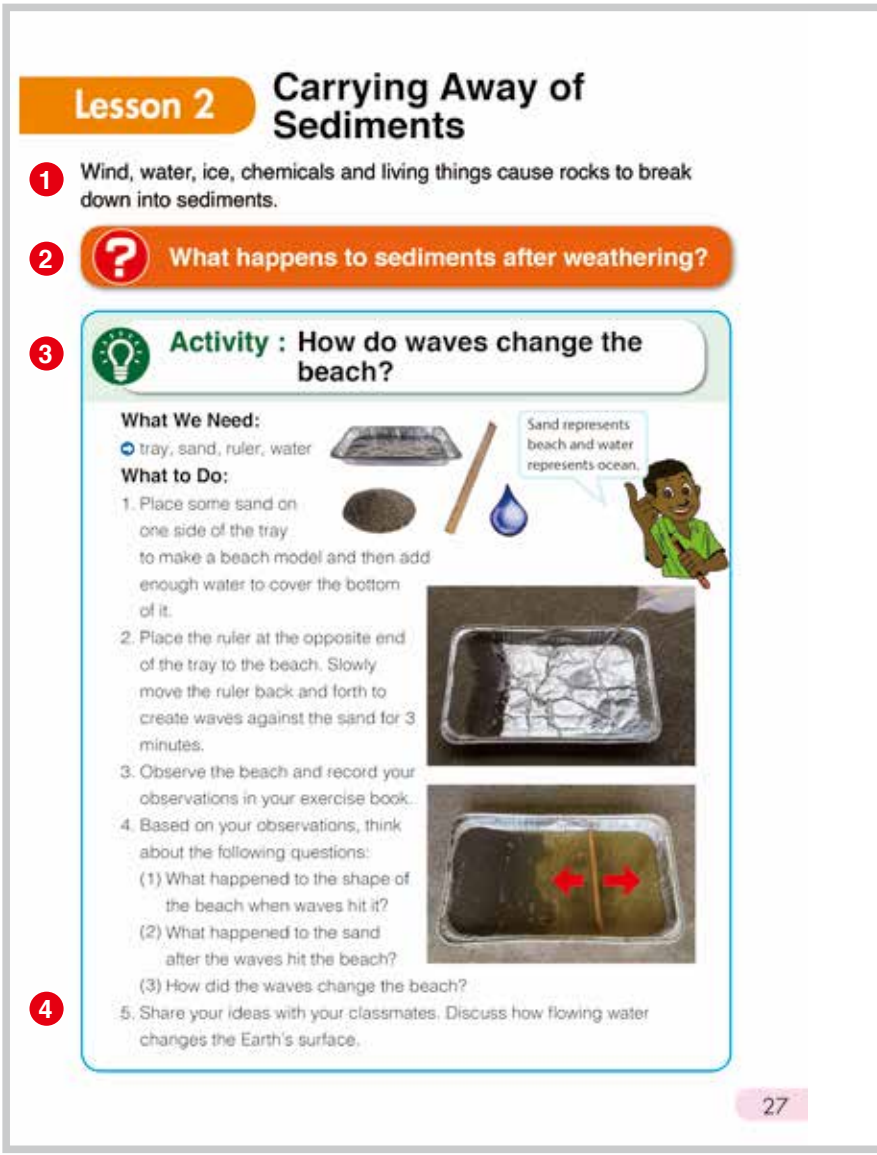

Lesson 2 Carrying Away of Sediments

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

2 What happens to sediments after weathering?

3 Activity : How do waves change the beach?

What We Need:
tray, sand, ruler, water

What to Do:
1. Place some sand on one side of the tray to make a beach model and then add enough water to cover the bottom of it.
2. Place the ruler at the opposite end of the tray to the beach. Slowly move the ruler back and forth to create waves against the sand for 3 minutes.
3. Observe the beach and record your observations in your exercise book.
4. Based on your observations, think about the following questions:
(1) What happened to the shape of the beach when waves hit it?
(2) What happened to the sand after the waves hit the beach?
(3) How did the waves change the beach?
5. Share your ideas with your classmates. Discuss how flowing water changes the Earth's surface.

Sand represents beach and water represents ocean.

4

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Teacher's Notes

Additional information on types of erosion

- Wind erosion – is the removal of soil particles by force and kinetic energy of the wind. These particles are transported and deposited when the wind energy drops.
- Water erosion - is caused by the kinetic energy of rain falling on the soil surface and by the mechanical force of run off.
- Gravity erosion – is the mass movement of soil that occurs on steep slopes under the influence of gravity. The process involves the transfer of slope – forming materials from higher to lower grounds due to self-weight.
- Ice erosion – when large mass of ice (glacier) melts it starts to move and carries large amount of soil with it.

Some effects of soil erosion

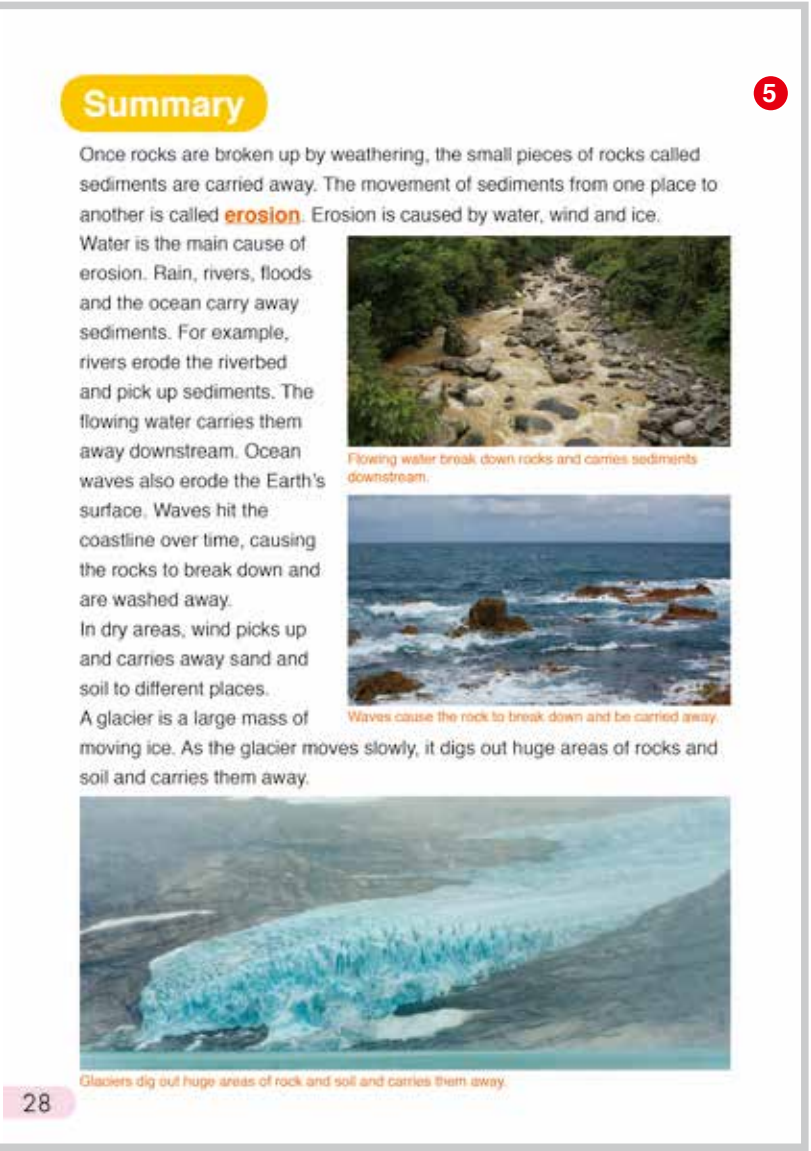
- The effects of soil erosion is behind the loss of fertile land. It has led to increase pollution and sedimentation in streams and rivers, clogging these waterways and causing declines in fish and other species.
- Soil erosion can also lead to landslides and floods.

Lesson Objectives

Students will be able to:
- Define erosion.
- Identify the causes of soil erosion.
- Examine the model of how waves change a beach.

Assessment

Students are able to:
- Explain that erosion is the movement of sediments from one place to another.
- Describe that soil erosion is caused by water, wind and ice.
- Sketch the aspects of erosion when waves flow over the beach.
- Participate in the activity with interest.



Summary

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

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

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

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

Flowing water break down rocks and carries sediments downstream.

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

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

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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 happens to the shape of the beach when waves hit it? (It changes gradually.)

Q:What happened to the sand on the beach after waves hit the beach? (The sand is washed away.)

Q:How did waves work on the beach? (It erodes the Earth's surface, causing the sand and rocks to break down and be washed away.)

- Conclude the discussions.

5 Summary (15 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 erosion?
  Q:How is erosion caused?
  Q:What is the main cause of erosion?
  Q:How does glacier cause erosion?
- Ask students to copy notes on the blackboard into their exercise books.

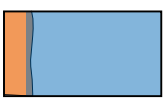
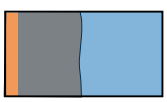
Sample Blackboard Plan

Title:

Carrying Away of Sediments

Key question:
What happens to sediments after weathering?

Activity : How do waves change the beach?
Sketch of how the shape of the beach looks like before and after.

Before	After
	

Discussion

Q: What happens to the shape of the beach when waves hit it?
It changes gradually. The size of the beach becomes smaller.
Q: What happened to the sand on the beach after waves hit the beach?
The sand is washed away.
Q: How did waves work on the beach?
It erodes the Earth's surface, causing the sand and rocks to break down and be washed away.

Summary
- The movement of sediments from one place to another is called erosion.
- Erosion is caused by water, wind and ice.
- Water is the main cause of erosion.
- A river erodes riverbeds, picks up sediments and carries them downstream.
- Ocean waves also erode the Earth's surface, causing rocks to break down and be washed away.
- A glacier digs out huge areas of rock and soil and carries them away.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.1. The Changes on the Earth's Surface**	Total lesson No: 9 / 74 Textbook page: 29 - 30

Lesson 3 / 10

Lesson Title

Works of Rivers

Preparation

buckets of water
scoop for fetching water

Lesson Flow

1 Introduction (5 min.)

- Review the last lessons.

Q:What is weathering and erosion?
Q:What is the main cause of erosion?

- Motivate students to think about rivers or flowing water and ask the question:

Q:How does weathering and erosion occured in a flowing water or river?

2 Introduce the key question

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

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to what the character is saying for their investigations.
- Have students to do the activity.
- Let students record their findings in their exercise books.
- Check the students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the 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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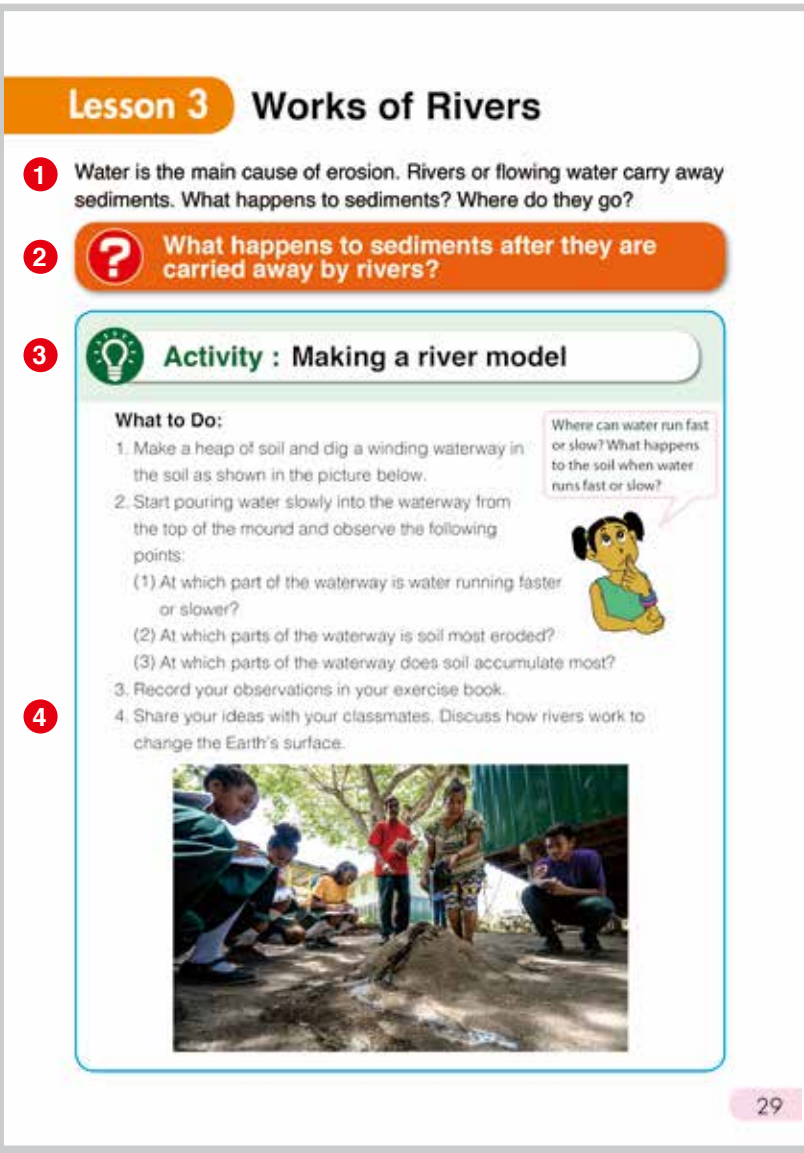

Lesson 3 Works of Rivers

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

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

3 Activity : Making a river model

What to Do:

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

Where can water run fast or slow? What happens to the soil when water runs fast or slow?

4

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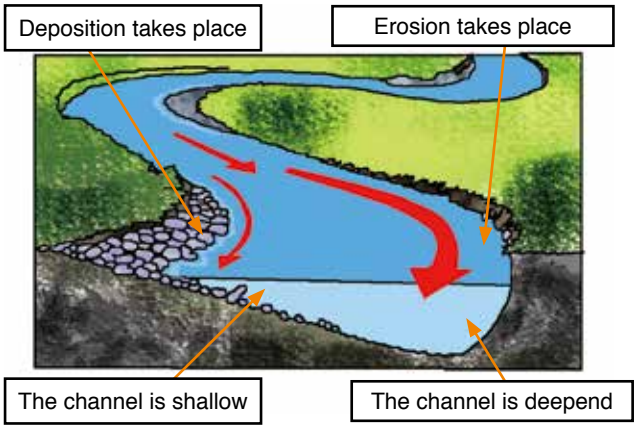
Teacher's Notes

Diagram showing what happens on a river bend.



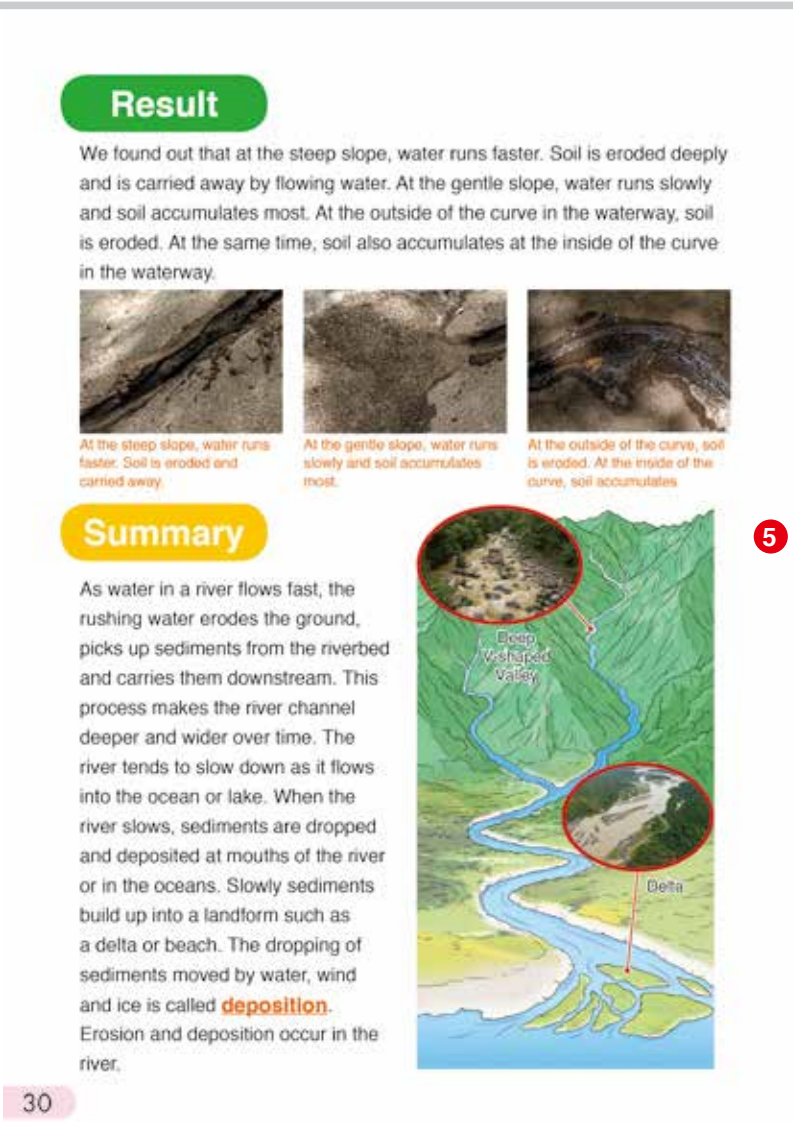
- In deeper sections water flows faster and erodes materials from the riverbank. The water flows more slowly in the shallow areas near the inside of each bend.
- When the river goes around the bend, the force of water is greatest towards the outside of the bend. When it hits the bank it causes erosion. The erosion deepens the channel at the bend and wears away the bank.
- On the inside of the bend, water movement is slower. Materials build up showing deposition is taking place. This makes the bank gently sloping and the river channel shallow.

Lesson Objectives

Students will be able to:
- Define deposition.
- Observe a model of river to see how it works.
- Describe the works of river on land.

Assessment

Students are able to:
- State that deposition is the dropping of sediments moved by water, wind and ice.
- Sketch a simple diagram showing how a river works.
- Explain that a river changes the surface of the land by erosion and deposition.
- Show responsibility in a given task when working outdoors.



Result

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

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

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

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

Summary

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

30

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

Q:At which parts of the waterway is water running faster or slower? (At the steep slope.)

Q:At which parts of the waterway is soil most eroded by flowing water? (At the outside of the curve in the waterway.)

Q:At which parts of the waterway does soil accumulate the most? (The inside of the curve and the end of the waterway.)

Q:What happens to the pieces of rocks or soil carried by water when a river slows down? (Rocks and soil settled out of the water.)

- Conclude the discussions.

5 Summary (15 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 a river change the river bank?

  Q:What cause smaller pieces of rocks to settle downstream?

  Q:What is deposition?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Works of Rivers

Key question:

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

Activity: Making a river model

An Example of students' findings.

The riverbank is broken up by water.

The water flows very fast in deeper sections.

A lot of small stones and sand are found along the river side and the end of river.

Big rocks are found on the bottom of the water.

Discussion

Q: At which parts of the waterway is water running faster or slower?

At the steep slope.

Q: At which parts of the waterway is soil most eroded by flowing water? At the outside of the curve in the waterway.

Q: At which parts of the waterway does soil accumulate the most? The inside of the curve and the end of the water way.

Q: What happens to the pieces of rocks or soil carried by water when a river slows down?

Rocks and soil settled out of the water.

Summary

- A river changes the surface of land by weathering, erosion and deposition.
- Weathering is a process where rock is broken down into smaller pieces.
- Erosion is the carrying of sediments from one place to another by flowing water.
- Deposition is the settling of eroded rocks or sand moved by water.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.1. The Changes on the Earth's Surface**	Total lesson No: 10 / 74 Textbook page: 31 - 32

Lesson 4 / 10

Lesson Title

Other Causes that Change the Earth's Surface

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:What causes the surface of the earth to change?

- Encourage students to think of other ways that may cause the surface of the earth to change by asking:

Q:Are there any causes that change the earth's surface?

2 Introduce the key question

What else changes the surface of the Earth?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to what the characters are saying for their investigations.
- Have students do the activity.
- Record their findings in their exercise books.
- Check students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the 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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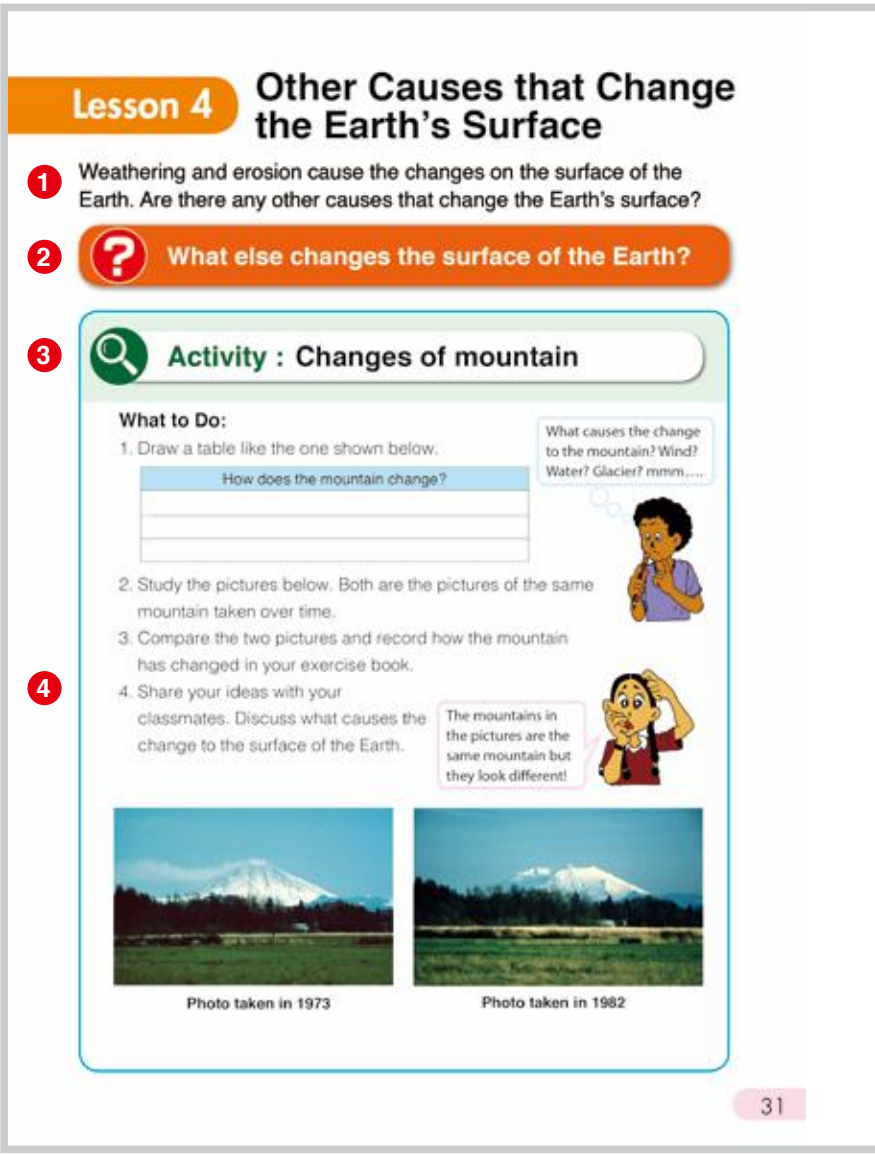


Teacher's Notes

- The surface of the earth changes all the time. Some changes are due to slow processes, such as erosion and weathering and some changes are due to rapid processes, such as landslides, volcanic eruptions and earthquakes.

Some additional information

Effects of Volcanic eruptions

- Volcanic eruptions can cause earthquakes, fast floods, landslides and rock falls. Lava can travel very far and burn, burry or damage anything in its path. The large amount of dust and ash can make it hard to breathe and is smelly.

Effects of Earthquakes

- Earthquakes can be very dangerous. They can make buildings fall down and set off landslides. An earthquake that occurs at the bottom of the sea can push water upwards and create massive waves called tsunamis.

Effects of landslides

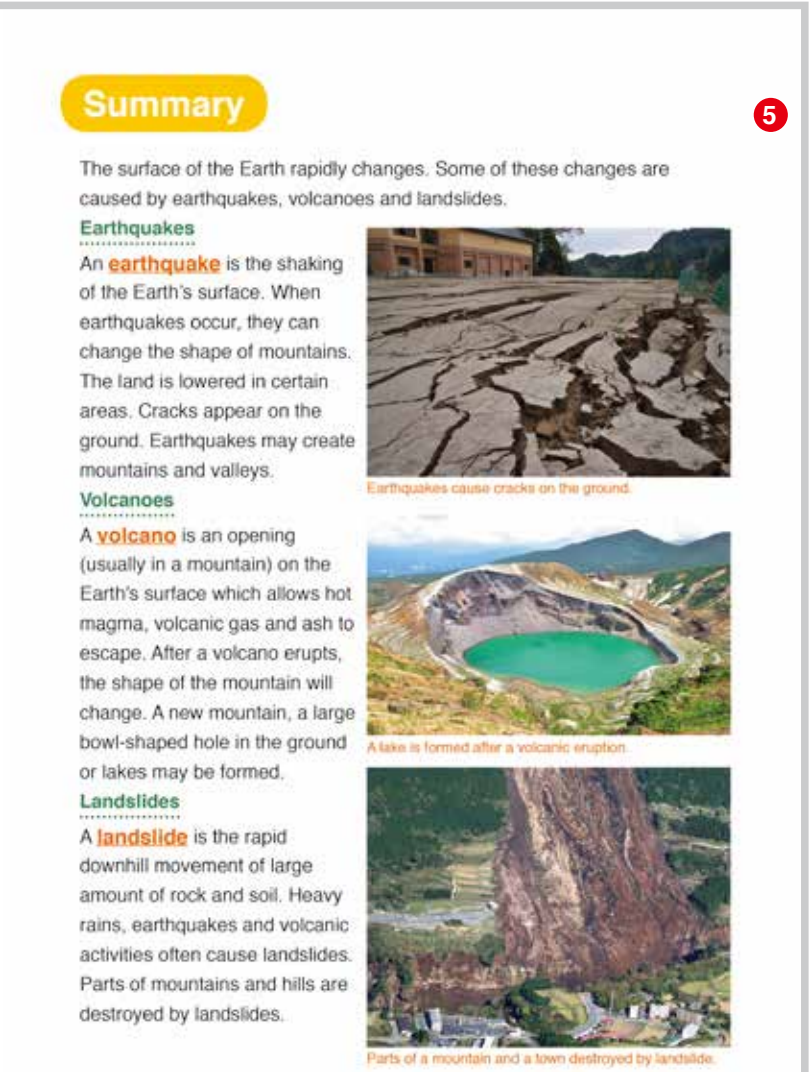
- Landslides cause property damage, injury and death. For example, water supplies, fisheries, sewage disposal systems, dams and roadways can be affected for years after the landslide.

Lesson Objectives

Students will be able to:
- Define volcano, earthquake and landslide.
- Identify other causes that change the surface of the Earth.
- Communicate well with classmates during discussion.

Assessment

Students are able to:
- Explain the meanings of volcano, earthquake and landslide.
- State the causes of change in the shape of the mountain in the activity.
- List other causes of how the earth's surface changes.
- Express their ideas when comparing the pictures.



Summary

5

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

Earthquakes

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

Earthquakes cause cracks on the ground.

Volcanoes

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

A lake is formed after a volcanic eruption.

Landslides

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

Parts of a mountain and a town destroyed by landslide.

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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 natural disasters do you know?
(Earthquake, volcanoes, landslide etc...)

Q:What happens to the earth's surface when these disasters occur? (Earthquake - cracks appear on the ground.)
(Volcanoes- create a large bowl-shape hole in the ground.)
(Landslide- Parts of a mountain or hill are destroyed.)

- Explain that earth's surface is rapidly changing by earthquakes, volcanoes and landslides.
- Conclude the discussions.

5 Summary (15 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 causes the changes in the Earth's surface?
  Q:What is an earthquake?
  Q:What is a volcano?
  Q:What is a landslide?
  Q:How do they change the surface of the Earth?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Other Causes that Change the Earth's Surface

Key question:
What else changes the surface of the Earth?

Activity: Changes of mountain

How does the mountain change?

Discussion

Q: What natural disasters do you know?
Earthquake, volcanoes, landslide, tsunami flooding etc...
Q: What happens to the earth's surface when these disasters occur?
Earthquake- cracks appear on the ground.
Volcanoes- create a large bowl-shape hole in the ground.
Landslide- Parts of a mountain or hill are destroyed.

Summary

- Other causes that change the surface of the earth are:
  1. Earthquake- shaking of the ground caused by the sudden movement of the earth's crust. It changes the shape of mountains, lowers land and make cracks.
  2. Volcano- an opening in the Earth's crust which allows hot magma, volcanic gas or ash to escape. It changes the shape of mountain and form new mountain or lakes.
  3. Landslide- the rapid downhill movement of a large amount of rock and soil. It destroys the mountain or hills.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.1. The Changes on the Earth's Surface**	Total lesson No: 11 / 74 Textbook page: 33 - 34

Lesson 5 / 10

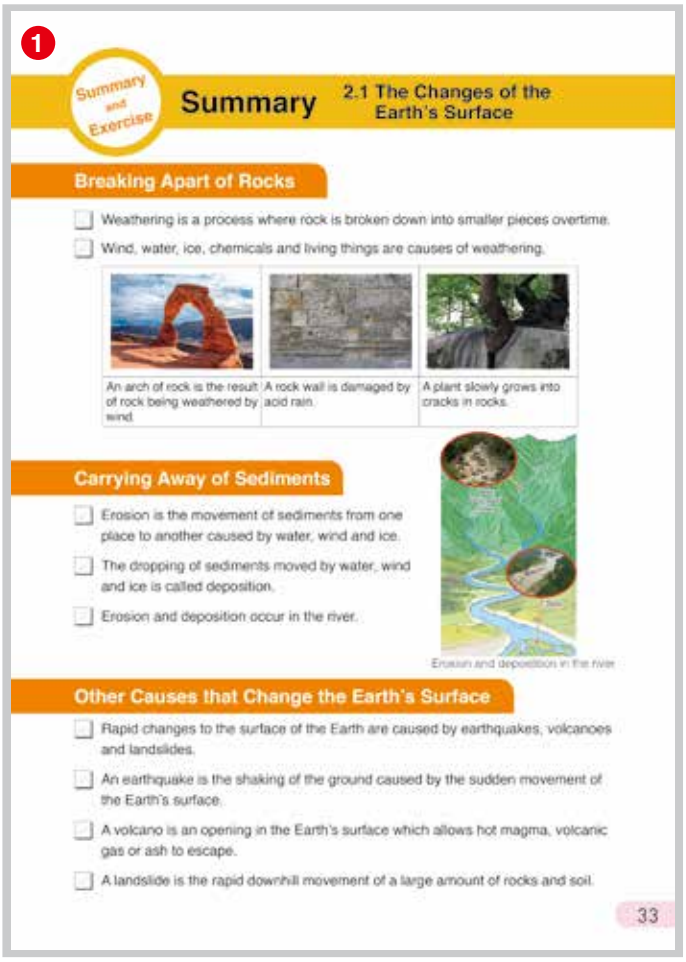
Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (40 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - What is weathering?
  - How do plants cause weathering?
  - What are some changes that causes the Earth 's surface to change rapidly?
  - Where are sedimentary rocks formed?
  - How does a river change the river bank?
- 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 The Changes of the Earth's Surface

Breaking Apart of Rocks

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

An arch of rock is the result of rock being weathered by wind.

A rock wall is damaged by acid rain.

A plant slowly grows into cracks in rocks.

Carrying Away of Sediments

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

Erosion and deposition in the river

Other Causes that Change the Earth's Surface

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

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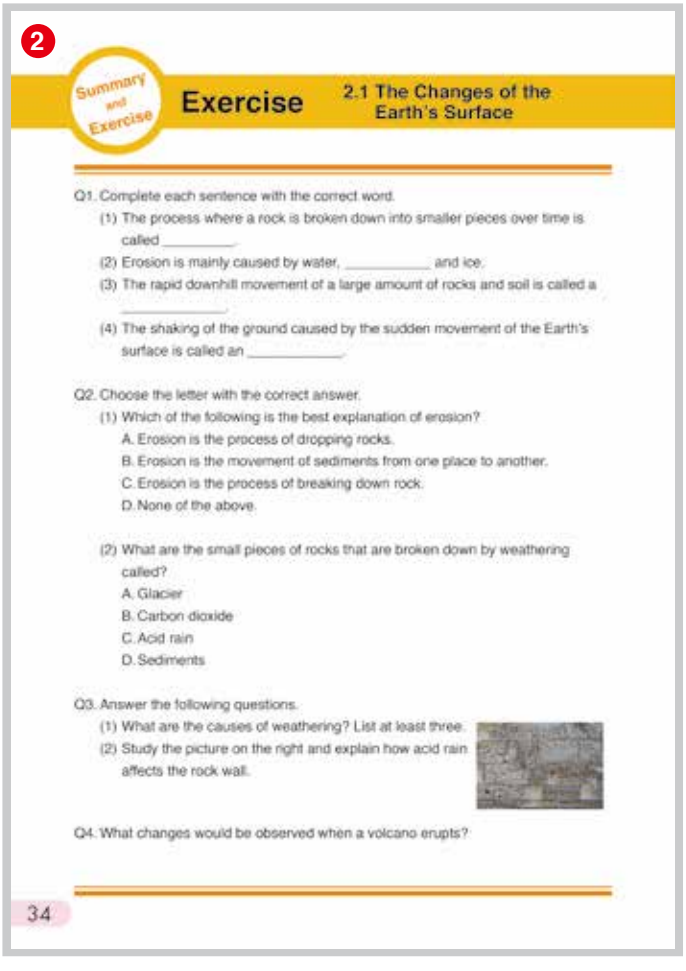
2 Exercise & Explanation (40 min.)

- 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 contents in this topic.



2

Summary and Exercise

Exercise 2.1 The Changes of the Earth's Surface

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

A. Erosion is the process of dropping rocks.
B. Erosion is the movement of sediments from one place to another.
C. Erosion is the process of breaking down rock.
D. None of the above.

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

A. Glacier
B. Carbon dioxide
C. Acid rain
D. Sediments

Q3. Answer the following questions.

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

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

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

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Exercise answers

Q1.
(1) **weathering**
(2) **wind**
(3) **landslide**
(4) **earthquake**

Q2.
(1) B
Once rocks are broken up by weathering, the small pieces of rocks called sediments are carried away. This is caused by water, wind and ice.

(2) **D**

Q3.
(1) **Wind, water, ice, chemicals and living things.**
(2) **Acid rain weakens the rock wall causing it to break down.**

Q4.Expected answer
1) Shape of the mountain would change. 2) A new mountain would be formed. 3) A large bowl-shaped hole would be formed in the ground. 4) A large-shaped lake would be formed.

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Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.2. Formation of Rock Layers and Rocks**	Total lesson No: 12 / 74 Textbook page: 35 - 36

Lesson 6 / 10

Lesson Title

Cross Section of a Cliff

Preparation

tape measure, hand lens, shovel, colours and a picture of a cross section of a cliff

Lesson Flow

1 Introduction (5 min.)

- This is a new topic and there is no review.
- Motivate students by showing a picture of a cross section of a cliff and then pose the question:

Q:What can you see on this picture?

2 Introduce the key question

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

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to what the character is saying for their investigation.
- Have students to do the activity.
- Have students sketch the cross section and record their findings in their exercise books.
- Check the students activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the 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.
- Facilitate active students' discussions.
- Confirm the findings with the students.

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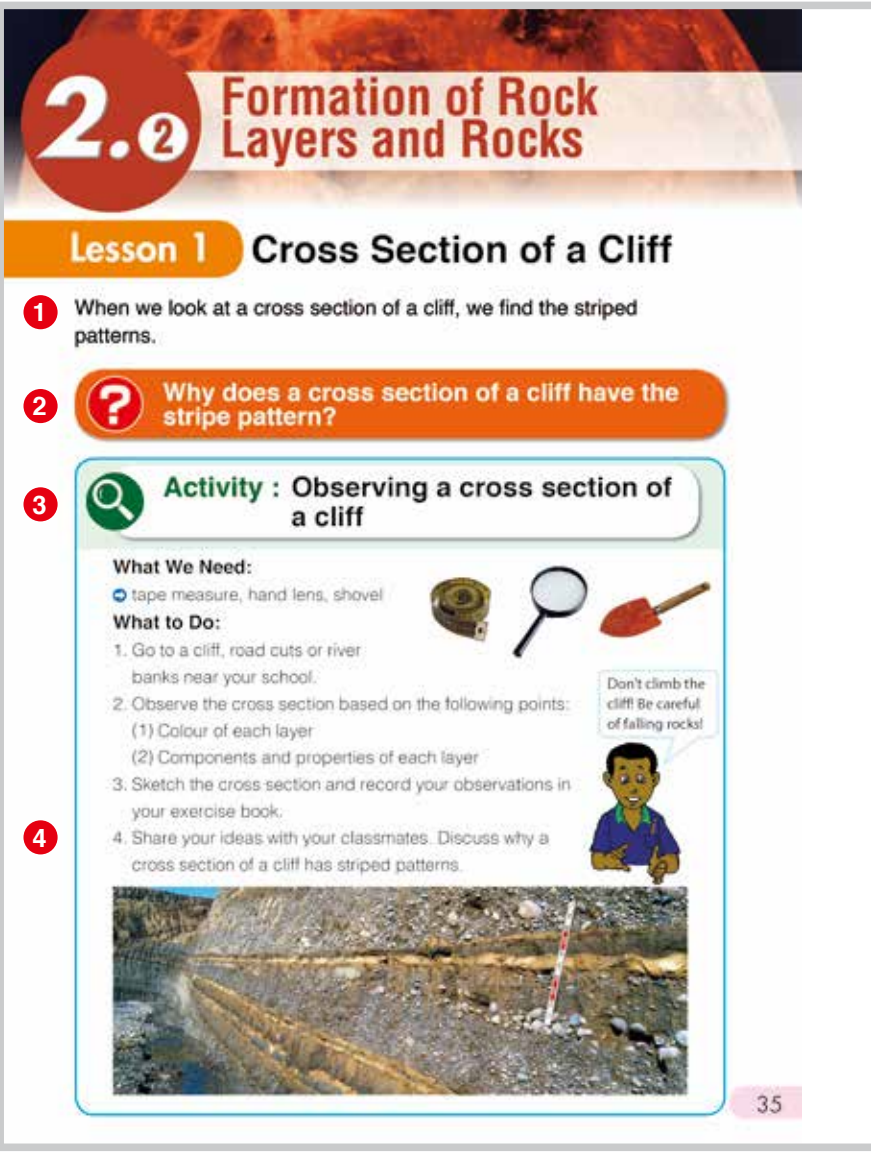


Teacher's Notes

- A stratum (plural: strata) is a layer of sedimentary rock or soil or igneous rock that were formed in the Earth's surface.
- Strata come in many layers. The study of strata is called stratification. Stratification is the layering that occurs in most sedimentary rocks and in igneous rocks.
- Stratification in sedimentary rocks may result from the changes in texture or composition during deposition; it also may result from pauses in deposition that allow the older deposits to undergo changes before additional sediments cover them.
- A sequence of strata, therefore, may appear as alternations of coarse and fine particles, as a series of colour changes resulting from differences in mineral composition or merely, as layers of similar aspect separated by distinct planes of parting.
- Stratification in volcanic rocks differ from sedimentary rocks. Fragmental volcanic material are sorted in flight under the influence of gravity before falling to the ground. This may form well sorted out layers.

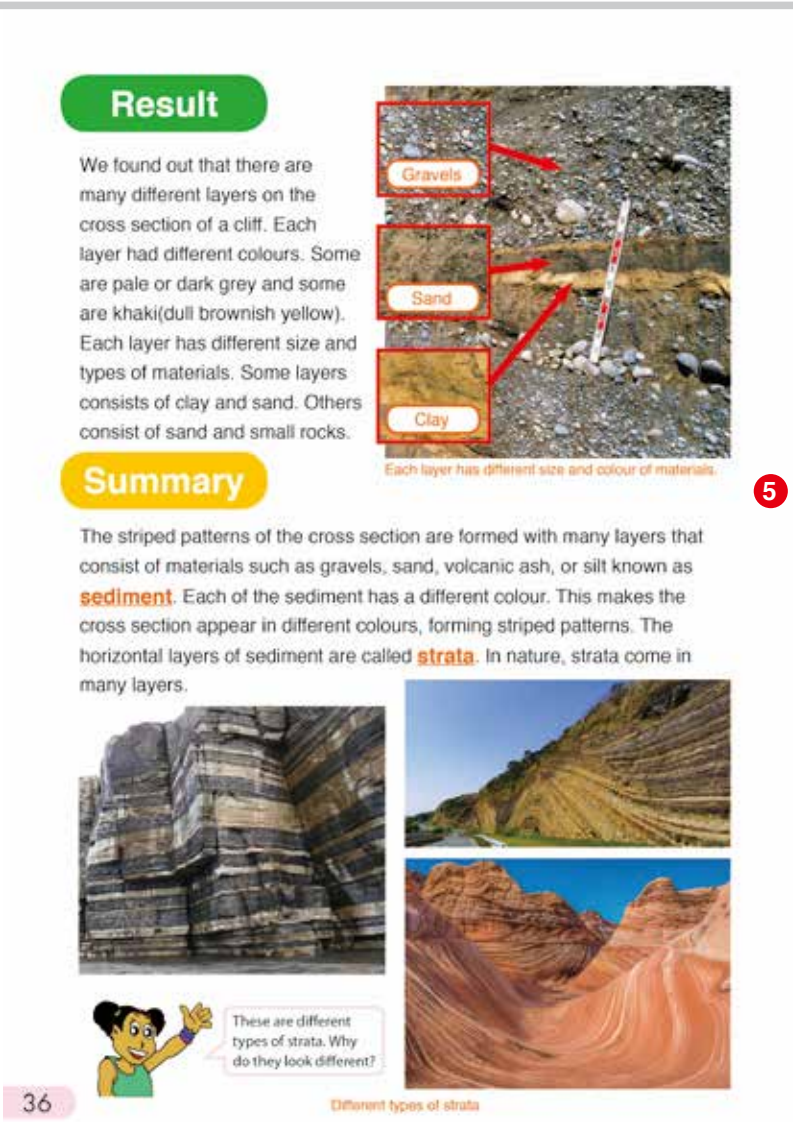
NOTE: Khaki is a light brown colour or brownish -yellow

Lesson Objectives

Students will be able to:
- Observe a cross section of a cliff.
- Explain the reason why the cross section of a cliff looks like stripe patterns.
- Define strata.

Assessment

Students are able to:
- Sketch the cross section of the cliff in terms of the colour, components and properties of each layer.
- Explain the reason of stripe patterns in terms of their colour, components and properties of each layer.
- Cooperates in group activities to investigate.



Result

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

Each layer has different size and colour of materials.

Summary

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

Different types of strata

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

Q:What colour of layers did you find? (It depends on the location of the cliff)

Q:What type of materials formed each layer? (Gravels, sand, volcanic ash, clay etc.) The answer varies depending on the location of the cliff.

Q:Did you find the properties of each layer? (Texture is different, the size of particles is different, etc...)

Q:Why does the cross section of the cliff have stripe patterns? (Because of the different colours found in the gravels, sand, clay etc.)

- Explain that the layer of sand, clay or gravel is called strata. Strata come in many layers.
- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q:What are some examples of sediments?
  Q:What are strata?
  Q:What types of sediments form strata?
  Q:Why does the cross section of a cliff have stripe patterns?
- Ask students to copy notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Cross Section of a Cliff

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

Activity: Observing a cross section of a cliff. (Example of result.)
There are different layers found on the cross section.
The layers are in different colours.
Each layer has different size of materials such as rocks, stones, clay and sand.

Discussion
Q:What colour of layers did you find? It depends on the location of the cliff
Q:What type of materials formed each layer? Gravels, sand, volcanic ash, clay etc. (The answer varies depending on the location of the cliff.)
Q:Did you find the properties of each layer? Texture is different, the size of particles is different, etc...
Q:Why does the cross section of the cliff have stripe patterns? Because of the different colours found in the gravels, sand, clay etc.

Summary
- The stripe patterns of the cross section are formed with many layers that consist of materials known as sediments.
- Each sediment has different colours, so the cross section looks different as the stripe pattern.
- The horizontal layers of rocks or sand is called strata.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.2. Formation of Rock Layers and Rocks**	Total lesson No: 13 / 74 Textbook page: 37 - 38

Lesson 7 / 10

Lesson Title

Formation of Strata

Preparation

clear plastic bottle, water,
soil including gravels and sand

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:Why does the cross section of a cliff have stripe patterns?

- Motivate students to think about how the strata are formed and ask the question:

Q:What makes strata?

2 Introduce the key question

How are strata formed?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer the students to what the characters are saying for their investigations and let students predict.
- Write their predictions in their exercise books.
- Have students to do the activity based on their predictions.
- Record their findings in their exercise books.
- Check students' activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the students to discuss their findings in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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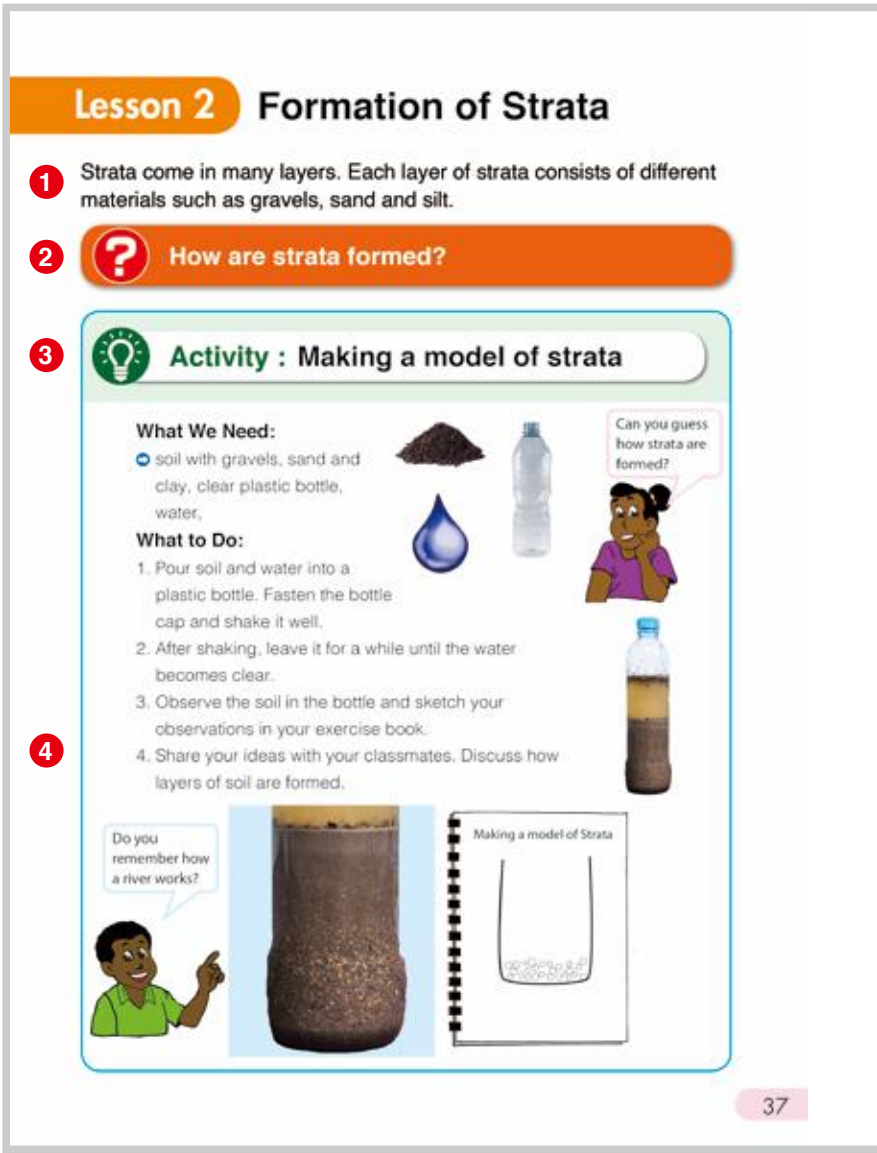


Teacher's Notes

- Strata are layers of rock or sometimes soil. In nature, strata come in many different layers, the singular is **stratum**.
- These layers are deposited as sediments, often in the sea and are slowly changed by pressure, heat and chemical action. The rock layer is formed by weathering and erosion and the particles are transported and deposited in the sedimentary basin. The sediment particles are cemented over hundreds of years to form layers.
- These are the three natural processes that change the shape of the earth.
  1. Erosion is the movement of sediments from one place to another.
  2. Weathering is the process where rock is broken down into smaller pieces over time.
  3. Deposition is when sediments are deposited or dropped off, in different location.

Tips for the Lesson

1. The result of the activity has to be checked in the next lesson because water in the container will be clear within 24 hours for a good result.
2. The discussion and the summary of the lesson can be done the next day when the result is observed.

Lesson Objectives

Students will be able to:
- State how strata are formed.
- Relate the result of the activity to the formation of strata in nature.
- Communicate their findings with classmates.

Assessment

Students are able to:
- Describe that strata are formed by works of flowing water that causes weathering, erosion and deposition.
- Explain the formation of strata based on the result of the activity.
- Give presentations with confidence.

- 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 do you think causes the larger particles to be deposited at the bottom layer of the container? (It is the weight of the particles. The heavier particles settled to the bottom.)

Q:What happens to the sediments when they are deposited? (They are divided into different sizes forming layers.)

Q:What helps sediments to be divided into different sizes? (Moving water, etc...)

- Conclude the discussions.

5 Summary (15 min.)

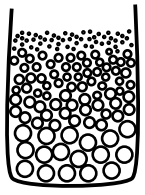
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q:How are strata formed?
  Q:Why are sediments deposited as layers?
  Q:What are the three processes involved in the formation of strata?
  Q: Where are strata usually formed?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Formation of Strata

Key question:
How are strata formed?
Activity: Making a model of strata
Example of result.



In my observation there were some layers seen. Smaller particles settled at the top layer while the bigger particles settled at the bottom layer of the container.

Discussion
Q: What do you think causes the larger particles to be deposited at the bottom?
It is the weight of the particles. The heavier particles settled to the bottom.
Q: What happens to the sediments when they are deposited?
They are divided into different sizes forming layers.

Q: What helps sediments to be divided into different sizes? Moving water, etc.

Summary
- Strata are formed by works of flowing water.
- Weathering, erosion and deposition are the processes that are involved in the formation of strata
- These processes repeat over and over forming strata.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.2. Formation of Rock Layers and Rocks**	Total lesson No: 14 / 74 Textbook page: 39 - 40

Lesson 8 / 10

Lesson Title

Formation of Sedimentary Rock

Preparation

syringe, water, sugar, sand, spoon, paper cup

Lesson Flow

1 Introduction (5 min.)

- Review the last lesson.

Q:How are strata formed?

Q:What are the three processes involved in the formation of strata?

- Motivate students to think about the grade five lesson on rocks and ask the question:

Q:What makes up a sedimentary rock?

2 Introduce the key question

How are sedimentary rocks formed?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Have students to do the activity.
- Allow students to observe carefully step four of the activity that gives the result on the formation of sedimentary rocks.
- Have students record their findings in their exercise books.
- Check students' activity and if necessary guide them towards their findings.
  Give enough time for students to do their findings.
- Ask the students to discuss how sedimentary rock is formed in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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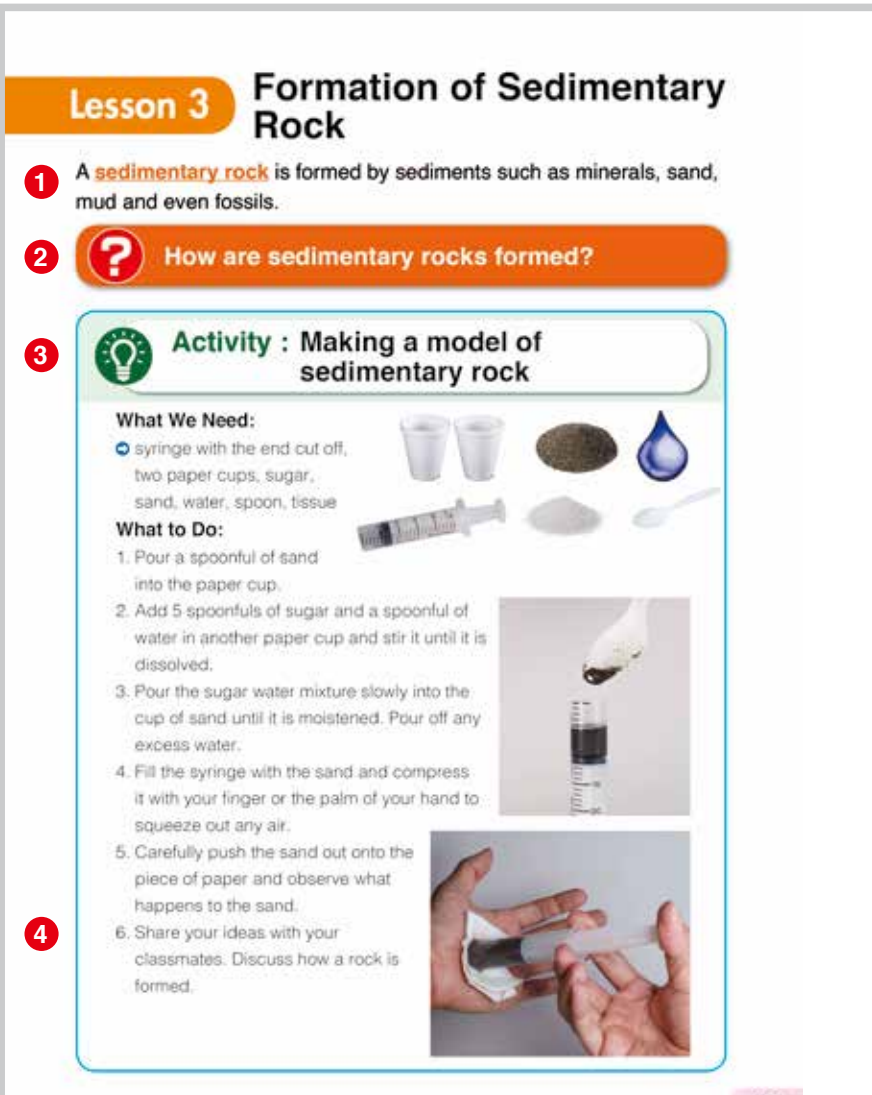

Lesson 3 Formation of Sedimentary Rock

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

2 How are sedimentary rocks formed?

3 Activity : Making a model of sedimentary rock

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

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

4

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Teacher's Notes

Result of the activity

Tips for the Activity

1. Use 10 – 20 millilitres syringe for the activity (it is sold in pharmacies).
2. Remove remaining water and air strongly in Step 4.
3. Remind students that sugar is not necessary in nature to form sedimentary rocks. The role of the sugar in this experiment is a glue to stick sand together instead of tons of pressure and millions of years in nature.

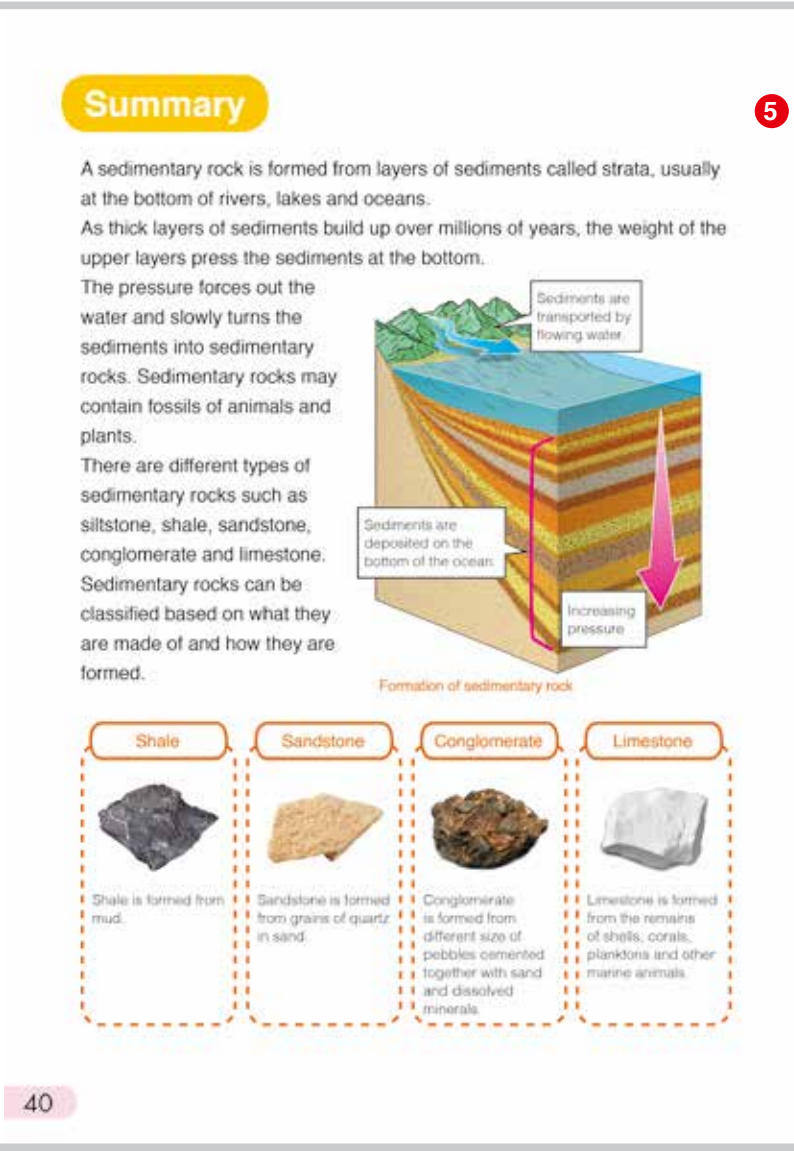
- Sedimentary rocks are formed by the accumulation of sediments. There are some basic types of sedimentary rocks.
  - Clastic sedimentary rocks such as breccia, conglomerate, sandstone, siltstone and shale are formed from mechanical weathering.
  - Organic sedimentary rocks such as coal, some dolomites and some limestones form from accumulation of plant or animal debris.
- Conglomorate is a typical example of a clastic sedimentary rock that contains large rounded particles. The space between the pebbles is generally filled with smaller particles or chemical cement that binds the rock together.
- Coal is a typical example of a an organic sedimentary rock that is formed manily from dead debris such as leaves, roots, and other plant or animal material.

Lesson Objectives

Students will be able to:
- Explain how a sedimentary rock is formed.
- Identify the different types of sedimentary rocks.
- Take part in the investigation actively.

Assessment

Students are able to:
- Explain the process of formation of sedimentary rocks by relating to the result of the activity.
- Describe the four types of sedimentary rocks; shale, sandstone, conglomerate and limestone.
- Perform simple experiments with curiosity.



Summary

A sedimentary rock is formed from layers of sediments called strata, usually at the bottom of rivers, lakes and oceans.
As thick layers of sediments build up over millions of years, the weight of the upper layers press the sediments at the bottom.
The pressure forces out the water and slowly turns the sediments into sedimentary rocks. Sedimentary rocks may contain fossils of animals and plants.
There are different types of sedimentary rocks such as siltstone, shale, sandstone, conglomerate and limestone.
Sedimentary rocks can be classified based on what they are made of and how they are formed.

Formation of sedimentary rock

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

Q:How sedimentary rocks are formed in nature? (Sedimentary rocks are formed from layers of sediments that are deposited over the years. The weight of the upper layers presses the sediments at the bottom. The pressure forces out the water and turns the sediments into sedimentary rocks.)

- Conclude the discussions.

Summary (15 min.)

5 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 are sedimentary rocks formed?
  Q:How are sedimentary rocks formed?
  Q:What kinds of sedimentary rocks are there?
  Q:How can sedimentary rocks be classified?
  Q:What are some examples of sedimentary?
  Q:Which type of sedimentary rocks is formed from living things?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Formation of Sedimentary Rock**

Key question:
How are sedimentary rocks formed?
Activity: Making a model of sedimentary rock
1. What did you do in step four?
Pressure was applied to the sand.
2. What was squeezed out? Water.
3. What was the result of applying pressure?
It causes the sediments to be glued together and become hard.

Discussion
Q: How are sedimentary rocks formed in nature?
Sedimentary rocks are formed from layers of sediments that are deposited the over years. The weight of the upper layers presses the sediments at the bottom. The pressure forces out the water and turns the sediments into sedimentary rocks.

Summary
- Sedimentary rocks are formed from layers of sediments that pile on top of each other over years. The weight of the upper layers presses the sediments at the bottom. The pressure forces out the water and turns the sediments into sedimentary rocks.
- Formation of Sedimentary rocks usually occurs from the bottom of rivers, lakes and oceans.
- Sedimentary rocks can be classified on what they are made of and how they are formed.
- Examples of sedimentary rocks are shale, sandstone, conglomerate and limestone.

Unit: **Our Earth**	Chapter : **2. Change and Formation of Land** Topic : **2.2. Formation of Rock Layers and Rocks**	Total lesson No: 15 / 74 Textbook page: 41 - 43

Lesson 9 / 10

Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - What types of sediments form strata?
  - What are strata?
  - What are the three processes involved in the formation of strata?
  - How long does it take to form strata?
- 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 2.2 Formation of Rock Layers and Rocks

Cross Section of a Cliff

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

Strata

Formation of Strata

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

Weathering, Erosion, Deposition

Formation of strata by works of water

Formation of Sedimentary Rocks

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

Sandstone, Conglomerate

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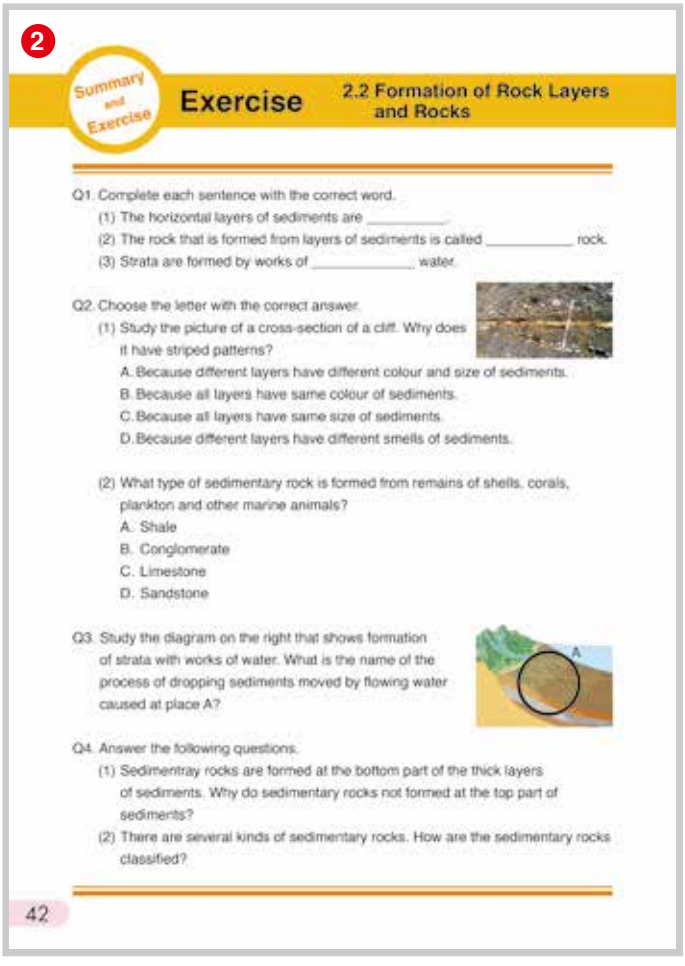
2 Exercise & Explanation (40 min.)

- 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 contents in this topic.



2

Summary and Exercise

Exercise 2.2 Formation of Rock Layers and Rocks

Q1. Complete each sentence with the correct word.
(1) The horizontal layers of sediments are _____.
(2) The rock that is formed from layers of sediments is called _____ rock.
(3) Strata are formed by works of _____ water.

Q2. Choose the letter with the correct answer.
(1) Study the picture of a cross-section of a cliff. Why does it have striped patterns?
A. Because different layers have different colour and size of sediments.
B. Because all layers have same colour of sediments.
C. Because all layers have same size of sediments.
D. Because different layers have different smells of sediments.

(2) What type of sedimentary rock is formed from remains of shells, corals, plankton and other marine animals?
A. Shale
B. Conglomerate
C. Limestone
D. Sandstone

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

Q4. Answer the following questions.
(1) Sedimentray rocks are formed at the bottom part of the thick layers of sediments. Why do sedimentary rocks not formed at the top part of sediments?
(2) There are several kinds of sedimentary rocks. How are the sedimentary rocks classified?

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Exercise answers

Q1.
(1) **strata**
(2) **sedimentary**
(3) **flowing**
Strata are formed by works of flowing water or river. As rivers slow down, sediments are deposited at the bottom of oceans and lakes as layers and are divided into different sizes. When weathering, erosion and deposition processes are repeated overtime, strata are formed.

Q2.
(1) **A**
The striped patterns of the cross section are formed with many layers that consist of materials such as gravels, sand, volcanic ash sediment. Each of the sediments has a different colour and size. This makes the section look different in colours.
(2) **C**

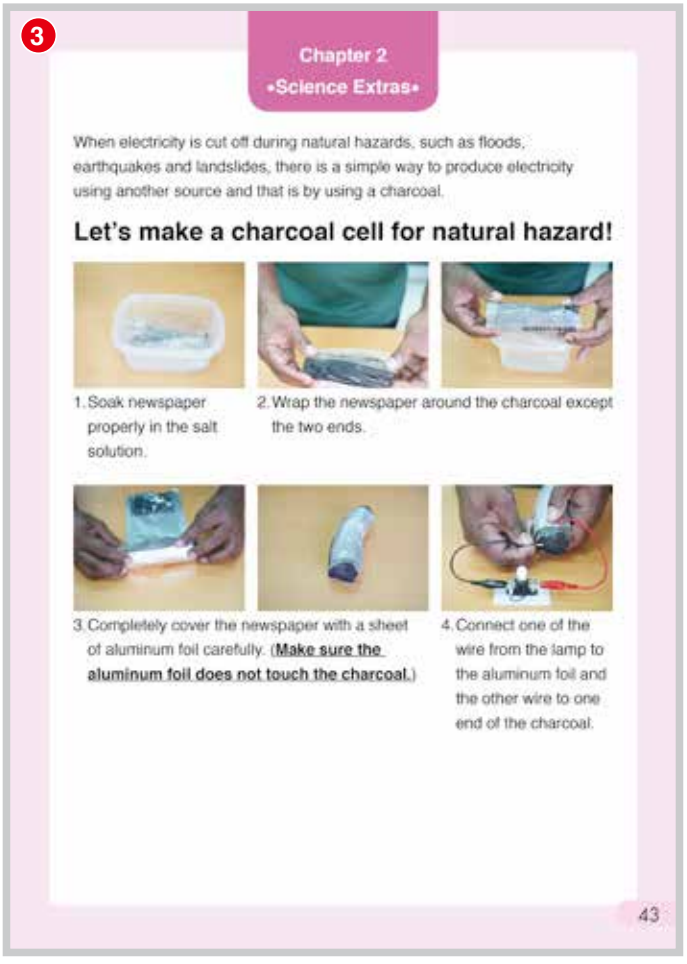
Q3.
Deposition

Q4. Expected answer
(1) **Because the weight of sediments at the top part presses the sediments at the bottom and the pressure forces and turns the sediments at the bottom into sedimentary rocks.**
(2) **Sedimentary rocks can be classified based on what they are made of.**

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 2
•Science Extras•

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

Let's make a charcoal cell for natural hazard!

1. Soak newspaper properly in the salt solution.
2. Wrap the newspaper around the charcoal except the two ends.
3. Completely cover the newspaper with a sheet of aluminum foil carefully. (**Make sure the aluminum foil does not touch the charcoal.**)
4. Connect one of the wire from the lamp to the aluminum foil and the other wire to one end of the charcoal.

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Lesson
10 / 10

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

2. Change and Formation of Land

Q1 Complete each sentence with the correct word.

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

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

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

Q2 Choose the letter with the correct answer.

(1) What is sediment?

A. Decaying plant or animal material.
B. The process of rocks being broken down and carried away.
C. The top layer of the soil.
(D.) Bits of rock, sand and silt caused by weathering of rocks.

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

A. The glaciers cause no change.
B. The glaciers melt and form giant lakes.
(C.) The glaciers cause erosion by taking sediments and moving them somewhere else.
D. The glaciers melt and freeze.

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

A. Deposition
B. Erosion
C. Weathering
(D.) Landslide

(4) How do plants weather rocks?

A. When the leaves dissolve the rocks.
(B.) When roots grow into cracks of rocks and expand the rocks.
C. When the plants moves water from the roots to the leaves.
D. When water in the leaves evaporates.

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Q3

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

Weathering

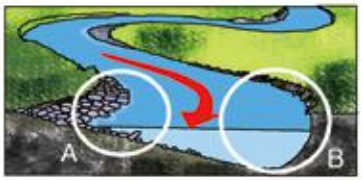
(2) Explain how freezing water can cause the weathering of rocks.

When water in cracks of a rock freezes and expands, it makes the cracks bigger and breaks the rocks.

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

Position A: Deposition

Position B: Erosion



Q4

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

(2) Why do sedimentary rocks appear in strata?

(Expected Answer) Because sediments that are deposited at the bottom of sea or lakes as layers where strata is formed turn into sedimentary rocks.

Chapter 3. Force

Chapter Objectives

Students will be able to understand contact and non-contact forces, gravity as a force that holds objects towards the Earth, how to measure force in newton (N) using spring balance and use arrows to show the magnitude, direction and point of application of force.

Topic Objectives

3.1 Forces around Us

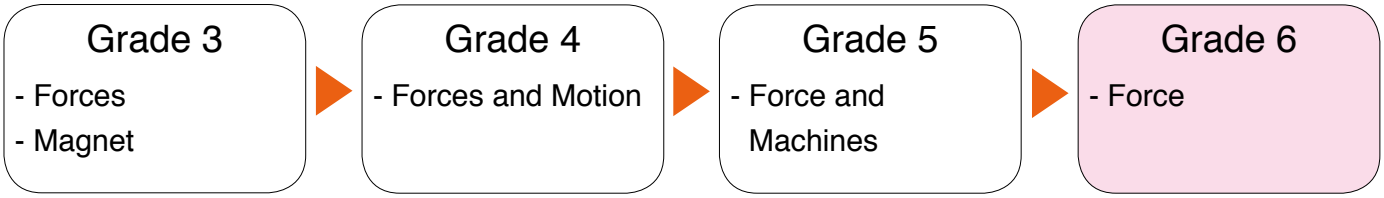
Students will be able to;

- Classify the daily forces such as elastic, magnetic, frictional and gravitational forces into two: contact and non-contact forces.
- State that gravity pulls objects towards the ground or earth.
- Explain that force is described by its point of application, direction and magnitude.
- State that newton (N) is the unit of measurement for measuring force.

This picture is from the chapter heading of the textbook showing the International Space Station which is a large spacecraft in orbit around the Earth. Pictures on page 49 of the textbook shows the activity inside the spacecraft.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- A force can cause a moving object to speed up (accelerate) or slow down (decelerate).
- A force can make a moving object change direction.

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
3.1 Forces around Us	1	**Forces in Daily Life** What types of forces can we find in our daily life?	6.2.3 6.2.4	47 - 48
	2	**Gravity** What is Gravity?		49 - 50
	3	**Measuring and Describing Force** How can we measure and describe a force?		51 - 52
	4	Summary and Exercise, Science Extras		53 - 55
Chapter Test	5	Chapter Test		56 - 57

Unit: **Force and Motion**	Chapter : **3. Force** Topic : **3.1. Forces around Us**	Total lesson No: 17 / 74 Textbook page: 47 - 48

Lesson 1 / 5

Lesson Title

Forces in Daily Life

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review Grade 3 Chapter 9 Lesson 1, 'How objects move' by asking:

Q:What is a force?

Q:What can force do if it is applied to an object?

(Force can move it, etc)

- Encourage the students to think about other types of forces that are acting on objects around us.

2 Introduce the key question

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

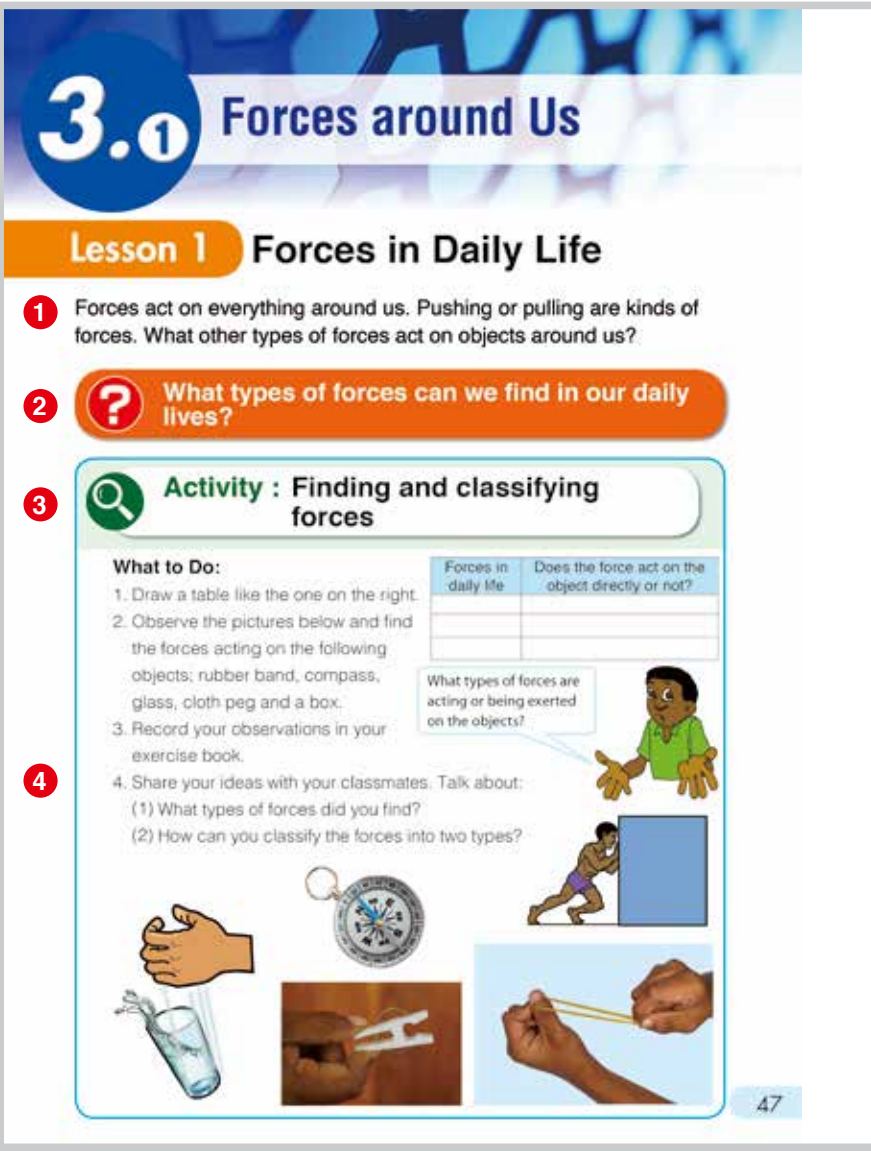
3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask students to conduct the activity by referring to the character in the textbook and record their findings in the table.
- Check students activity and if necessary guide them towards their findings.
- Give enough time for the students to do their findings.
- Ask students to discuss their findings in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

(Continue)



Teacher's Notes

In Grade 3, Chapter 9 they learnt about 'Force' and in Grade 5, Chapter 2 'Force in Motion'.

Force is any action or influence that accelerates or changes the shape of an object. It has direction and magnitude. Force can be classified as contact and non-contact forces.

Below are some examples of non-contact forces and their characteristics.

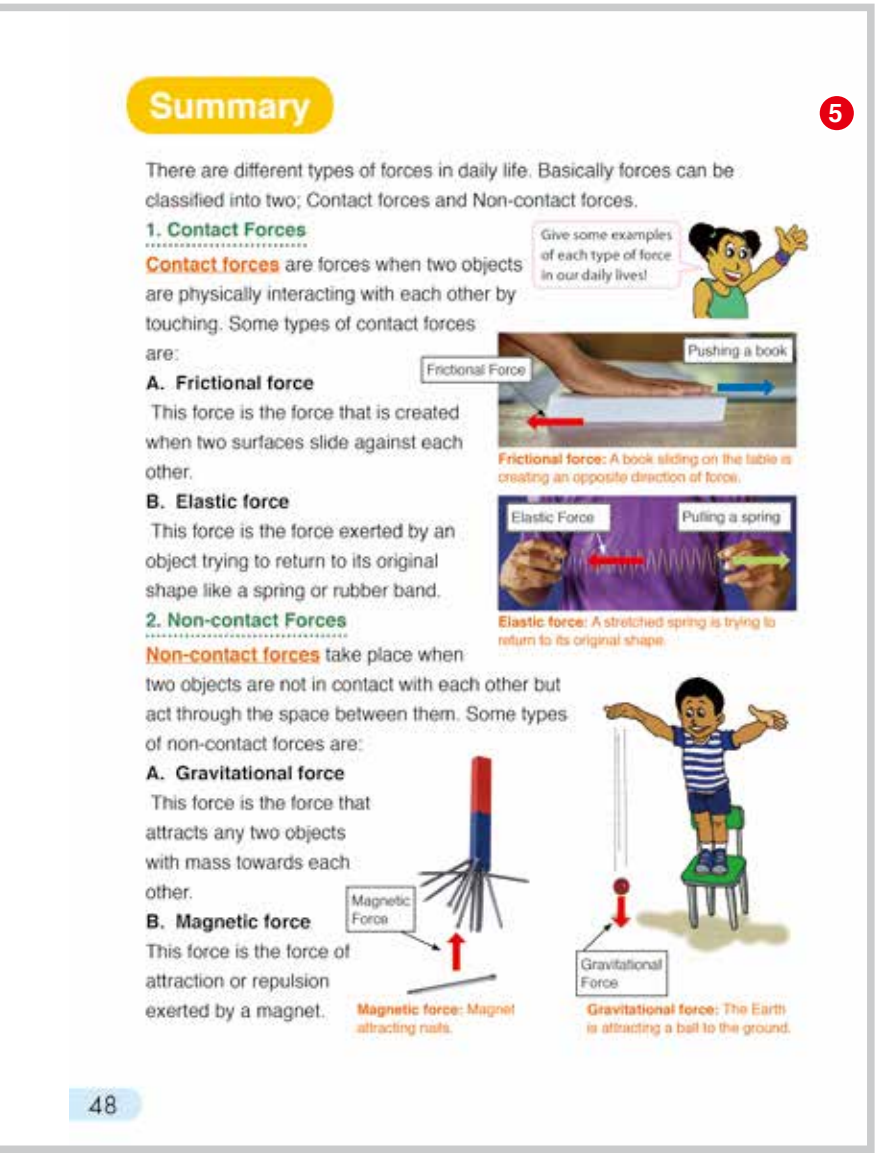
- Gravitational force is the force which the earth, moon, or other massively large objects attract other objects towards themselves. By definition, this is the weight of the object. All objects on earth experience a force of gravity that is directed 'downward' towards the centre of the earth.
- Magnetic force is a force found between a magnet's poles. The same poles repel and the opposite poles attract.
- Electrostatic force is the force between charged matters. Same charged matters repel and opposite charged matters attract. Example: The hair on body stands when putting on a sweater. Also when we scrape off foam, the smaller bits of foam stick onto our hands and arms. These are caused by electrostatic force.

Lesson Objectives

Students will be able to:
- Explain what contact and non-contact forces are.
- Categorise the different types of forces as contact and non-contact force.
- Participate in group discussion actively.

Assessment

Students are able to:
- State the differences between contact and non-contact forces.
- Classify forces into contact and non-contact forces in a list.
- Share their ideas with others freely.



Summary

5

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

1. Contact Forces

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

A. Frictional force

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

B. Elastic force

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

2. Non-contact Forces

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

A. Gravitational force

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

B. Magnetic force

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

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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 types of forces did you find? (Push, pull, pinch, magnet, friction, and gravity)

Q:Which forces can move an object when touching it? (Push, pull, pinch)

Q:What types of force move objects without touching it? (Magnet and gravity)

Q:How can we classify the forces into two types? (Forces when two objects are touching and forces when two objects are not touching each other.)

- Conclude the discussions.

5 Summary (15 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:How can forces be classified into two types?
  Q:Which types of force are non-contact forces?
  Q:Describe what contact forces are.
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Forces in Daily Life

Key question:

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

Activity:

Finding and classifying forces

Types of forces	Does the force act directly or not?
Elastic	Acts directly (yes)
Magnetic	Does not (no)
Gravitational	Does not (no)
Frictional	Acts directly (yes)

Discussion

Q:What types of forces did you find? Push, pull, pinch, magnet, friction, and gravity

Q:Which forces can move an object when touching it? Push, pull, pinch

Q:What types of force move objects without touching it? Magnet and gravity

Q:How can we classify the forces into two types? Forces when two objects are touching and forces when two objects are not touching each other.

Summary

Forces can be classified into two types. Contact forces and Non-contact forces.

1. Contact forces:
- Forces when two objects are physically interacting with each other by touching.

Examples of contact forces are Frictional and Elastic forces.

2. Non-contact forces:
- Forces when two objects are not in contact with each other

Examples of non-contact forces are Gravitational and Magnetic forces.

Unit: **Force and Motion**	Chapter : **3. Force** Topic : **3.1. Forces around Us**	Total lesson No: 18 / 74 Textbook page: 49 - 50

Lesson 2 / 5

Lesson Title

Gravity

Preparation

use pictures if necessary

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson learnt. Ask:

Q:What are contact forces and non-contact forces?

- Encourage the students to think about gravity, by asking:

Q:Why does a stone fall to the ground when we drop it?

2 Introduce the key question

What is Gravity?

3 Activity (35 min.)

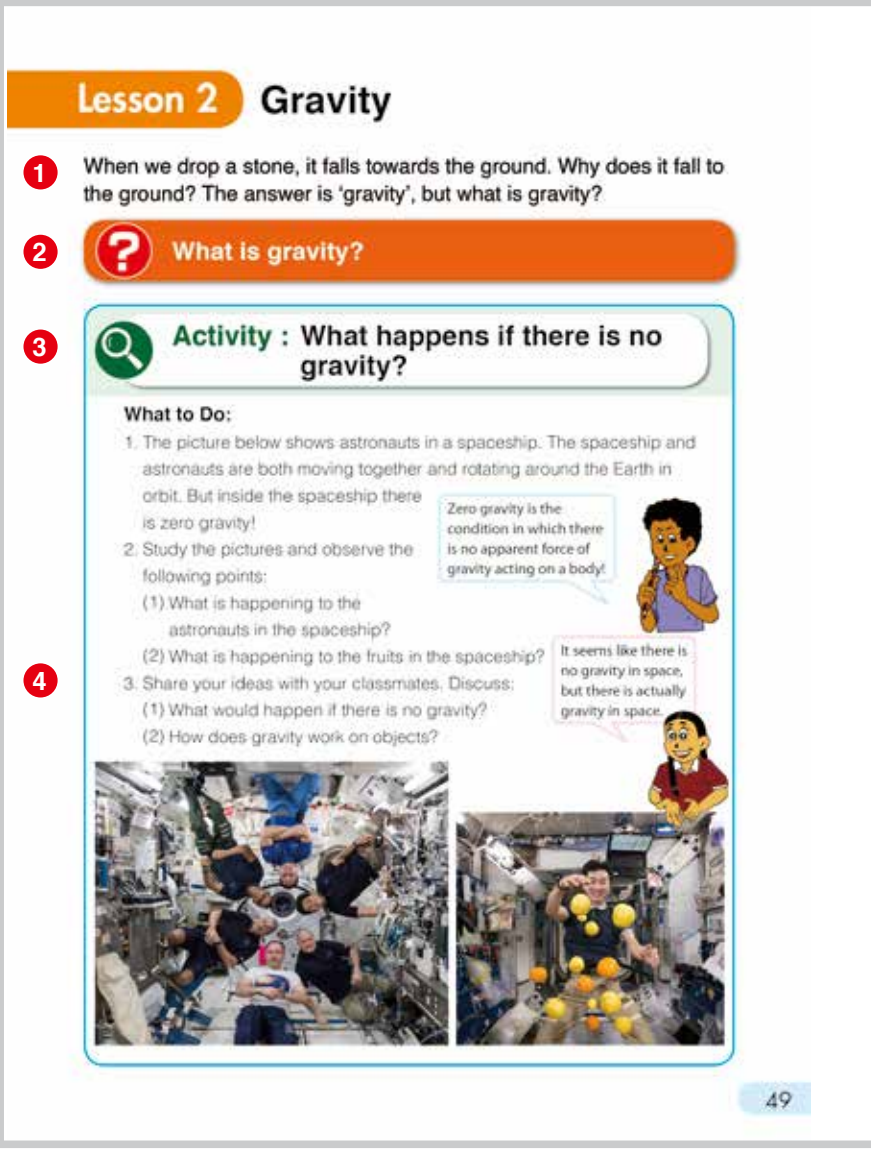
- Organise students into groups.
- Explain the steps of the activity.
- Refer students to the pictures and the characters in the textbook.
- Explain the meaning of zero gravity.
- Ask the students to conduct the activity and record their findings in the table.
- Check each group during the activity and if necessary guide them towards their findings by asking:

Q:What is happening to the astronauts and fruits in the picture?

- 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. **(Continue)**



Lesson 2 Gravity

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

2 What is gravity?

3 Activity : What happens if there is no gravity?

What to Do:

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

4

Zero gravity is the condition in which there is no apparent force of gravity acting on a body!

It seems like there is no gravity in space, but there is actually gravity in space.

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Teacher's Notes

In Grade 3, Chapter 9 'Force', they learnt that gravity pulls objects towards the centre of the Earth. In Grade 5, Chapter 2 'Force in Motion' they learnt that gravity changes the speed and direction of a moving object.

What is the definition of force of gravity?

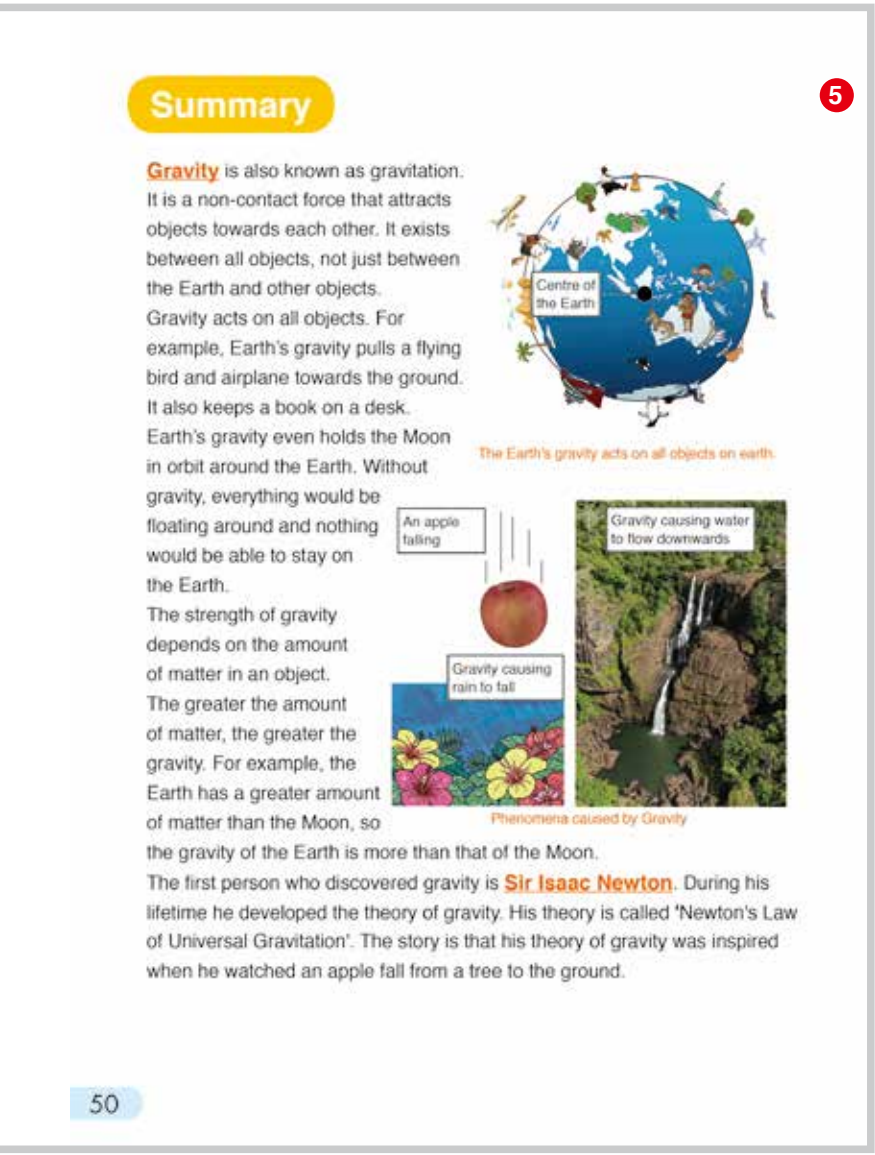
- Gravity is a force of attraction that exists between any two masses, any two bodies and any two particles. Gravity is not just the attraction between objects and the Earth but between all objects, everywhere in the universe.
- Zero Gravity or Zero-G can simply be defined as the state or condition of weightlessness. It also refers to the state in which the net or an apparent effect of gravity (i.e. the gravitational force) is zero.
- The condition of apparent weightlessness occurs when a body in a gravitational field changes places to neutralise its gravitational force. For example, astronauts are seen floating around in the outer space. Astronauts orbiting the Earth in a space station experience zero gravity or weightlessness because their spacecraft continuously undergoes changes in velocity in its orbit in order to prevent it from being pulled into the atmosphere.

Lesson Objectives

Students will be able to:
- Explain what gravity is.
- Describe how gravity acts on objects on the Earth.
- Identify the scientist who discovered gravity.

Assessment

Students are able to:
- State the definition of gravity and the relationship between the strength of gravity and the amount of matter.
- Give some examples of the effect of gravity on objects on the Earth.
- Name the scientist who discovered gravity.



Summary

Gravity is also known as gravitation. It is a non-contact force that attracts objects towards each other. It exists between all objects, not just between the Earth and other objects.
Gravity acts on all objects. For example, Earth's gravity pulls a flying bird and airplane towards the ground. It also keeps a book on a desk.
Earth's gravity even holds the Moon in orbit around the Earth. Without gravity, everything would be floating around and nothing would be able to stay on the Earth.
The strength of gravity depends on the amount of matter in an object. The greater the amount of matter, the greater the gravity. For example, the Earth has a greater amount of matter than the Moon, so the gravity of the Earth is more than that of the Moon.
The first person who discovered gravity is **Sir Isaac Newton**. During his lifetime he developed the theory of gravity. His theory is called 'Newton's Law of Universal Gravitation'. The story is that his theory of gravity was inspired when he watched an apple fall from a tree to the ground.

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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 would happen if there is no gravity on Earth? .(Everything would be floating, we would not keep a book on a desk, etc...)

Q:How does gravity work on objects? (Gravity pulls objects towards the ground and keeps them there.)

Q:What do you think gravity is? (Gravity is a non-contact force that pulls or attracts objects towards the ground or the Earth.)

- Conclude the discussions.

5 Summary (15 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 is gravity?
  Q: What does gravity do to objects?
  Q: What does the strength of gravity depend on?
  Q: Who discovered gravity?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:
Gravity

Key question:
What is gravity?

Activity:
What happens if there is no gravity?
1. What is happening to the astronauts in the spaceship?
   They are floating.
2. What is happening to the fruits in the spaceship?
   The fruits are also floating.

Discussion
Q: What would happen if there is no gravity on Earth?
Everything would be floating, we would not keep a book on a desk.
Q: How does gravity work on objects?
Gravity pulls objects towards the ground and keeps them there.
Q: What do you think gravity is?
Gravity is a non-contact force that pulls or attracts objects towards the ground or the Earth.

Summary
- Gravity is a non-contact force that attracts objects towards each other.
- Earth's gravity acts on all objects on the Earth.
- The strength of gravity depends on the amount of mass in an object.
- The greater the amount of matter, the greater the gravity.
- The first person who discovered gravity is Sir Isaac Newton.

Unit: **Force and Motion**	Chapter : **3. Force** Topic : **3.1. Forces around Us**	Total lesson No: 19 / 74 Textbook page: 51 - 52

Lesson 3 / 5

Lesson Title

Measuring and Describing Force

Preparation

spring balance, string, various objects to weigh and weighing pan

Lesson Flow

1 Introduction (5 min.)

- Revise previous lesson learnt. Ask:

Q:What is gravity?

- Encourage the students to think about how to describe even if it cannot be seen.

2 Introduce the key question

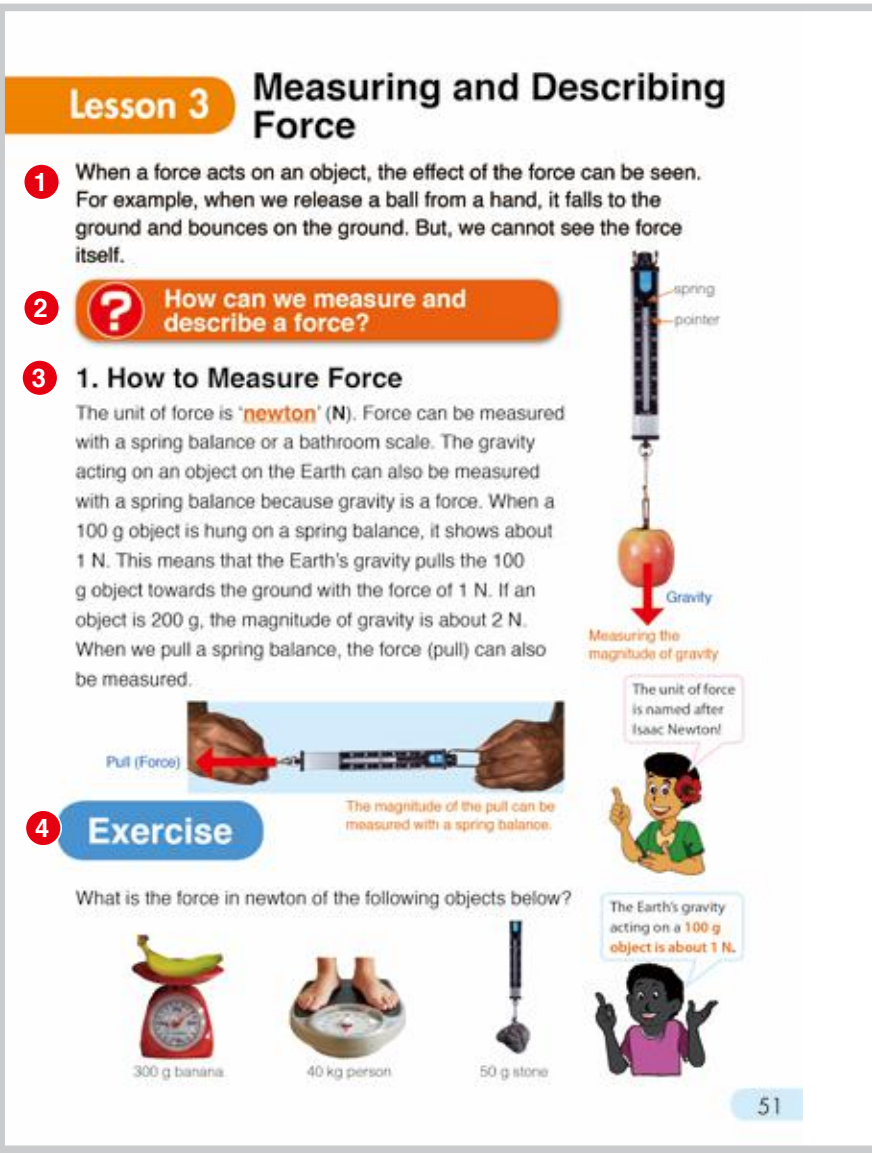
How can we measure and describe a force?

3 Discussion & Activity (15 min.)

- Explain the unit of force as newton and how to use and read a spring balance.
- Let students measure the mass of an object using a spring balance and record the measurements in grams first.
- Ask students to present the measurements from their activity.
- Write their measurements on the blackboard.
- Demonstrate how to convert gram (g) into newton (N) on the blackboard.
- Let students calculate the weight (the gravitational force) of the object that they measured.
- Have students demonstrate how to calculate on the blackboard.
- Confirm their demonstrations with the students.

4 Exercise (15 min.)

- Ask students to solve the questions in the exercise.
- Have students demonstrate how to calculate on the blackboard.
- Confirm the findings with the students.



Lesson 3 Measuring and Describing Force

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

2 How can we measure and describe a force?

3 1. How to Measure Force

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

4 Exercise

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

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Teacher's Notes

1. Preparation for this Lesson:

- If you do not have a spring balance, you may use one of the weighing machines shown in the picture of textbook.
- Prior to the lesson, make a selection of objects that will be used in the activity. The weights of the objects should not exceed the maximum scale on the weighing equipments.

2. How to teach converting gram into newton

(1) 100 g is equal to 1 N

(2) To convert gram into newton, divide by 100.

Case1: Converting 200 g into newton

100 g is equal to 1 N. You can convert gram to newton by simple division.

Formula:

200÷100 = 2

Answer: 2 N

Case2: Converting 1 kg into newton

First, convert kilogram to gram.1 kg is equal to 1000 g. You can convert gram to newton by dividing

Formula:

1kg = 1000 g

Therefore, 1000÷100 = 10

Answer: 10 N

Lesson Objectives

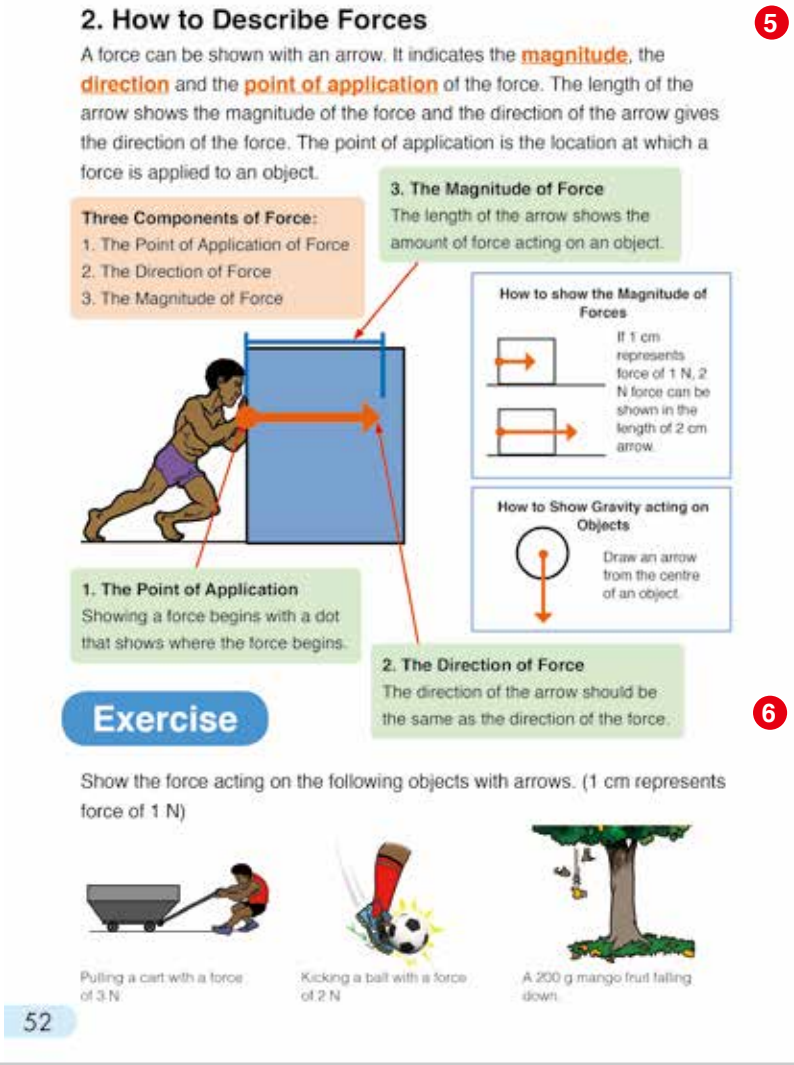
Students will be able to:

- Measure force with a measuring instrument.
- Explain how to describe force.
- Calculate the force in newton [N].
- State the unit of force.

Assessment

Students are able to:

- Measure the weight of an object in newton (N) with a spring balance.
- Describe the force applied to an object with an arrow in the diagram.
- Calculate the force by converting gram (g) into newton (N).
- Explain that the unit of force is newton (N).



2. How to Describe Forces

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

Three Components of Force:
1. The Point of Application of Force
2. The Direction of Force
3. The Magnitude of Force

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

How to show the Magnitude of Forces
If 1 cm represents force of 1 N, 2 N force can be shown in the length of 2 cm arrow.

How to Show Gravity acting on Objects
Draw an arrow from the centre of an object.

1. The Point of Application
Showing a force begins with a dot that shows where the force begins.

2. The Direction of Force
The direction of the arrow should be the same as the direction of the force.

Exercise

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

Pulling a cart with a force of 3 N

Kicking a ball with a force of 2 N

A 200 g mango fruit falling down

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Sample Blackboard Plan

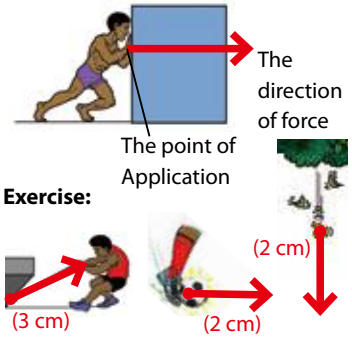
Title:

Measuring and Describing Force

Key question:
How can can we measure and describe a force?

Activity 1: Measuring force
1 N = 100 g
e.g. 200 g = 200 ÷ 100 = 2 Answer: 2 N
Exercise:
1) 300÷100 =3 3 N
2) 40 kg = 40000 g, 40000÷100=400 400 N
3) 50 ÷100 = 0.5 0.5 N

Activity 2: Describing force



Summary
- The unit of force is newton (N).
- Force can be measured with spring balance or a bathroom scale.
- Force can be described by an arrow. It indicates:
  - its point of application
  - the direction of the force, and
  - the magnitude of the force
- The length of the arrow shows the magnitude of force.
- The direction of arrow shows the direction of force.
- The point of application is the location at which a force is applied to an object.

5 Discussion & Activity (15 min.)

- Explain how to describe a force using an arrow by highlighting the meanings of the arrow such as the point of application, the direction and the magnitude of force.
- Demonstrate how to describe a force with an arrow step by step on the blackboard.
- Let students describe a force with an arrow in their exercise book.
- Check students' activity and guide them towards their findings if necessary.
- Have students demonstrate how to describe a force on the blackboard.
- Confirm the demonstration with the students.

6 Exercise (15 min.)

- Ask students to solve the questions in their exercise books.
- Have students answer the questions by demonstrating on the blackboard.
- Confirm the findings with the students.

7 Summary (15 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 is the unit of force?
  Q:How can we measure a force?
  Q:How can we describe a force?
  Q:What does an arrow indicate when we describe a force?
  Q:How do you describe the point of application, the magnitude and the direction of force with an arrow?
- Ask students to copy the notes on the blackboard into their exercise books.

Unit: **Force and Motion**	Chapter : **3. Force** Topic : **3.1. Forces around Us**	Total lesson No: 20 / 74 Textbook page: 53 - 55

Lesson 4 / 5

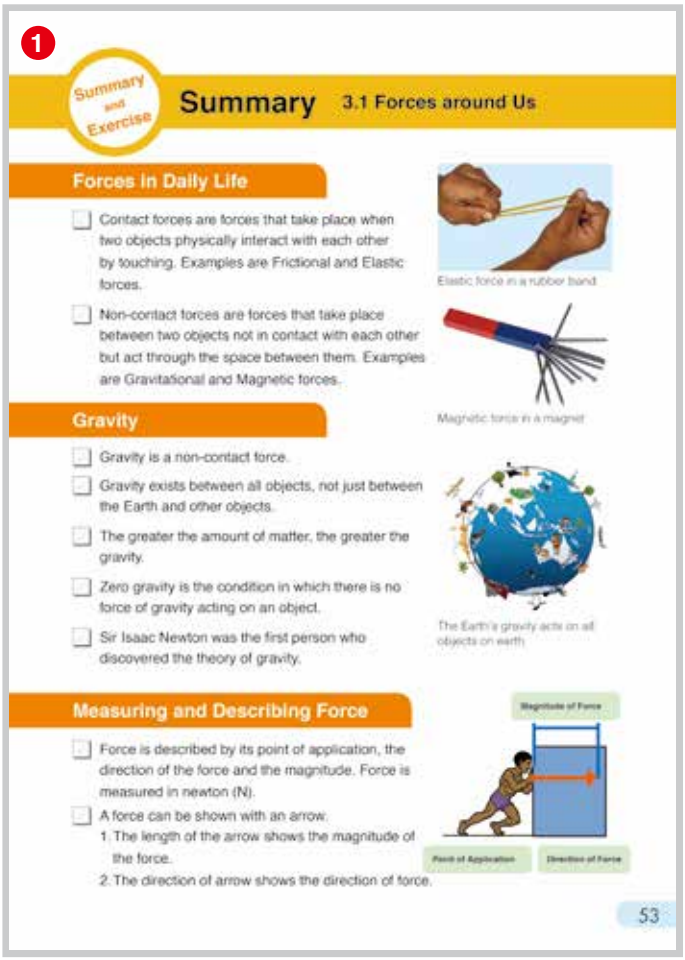
Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - What types of forces are around us?
  - How is a force described?
  - Can you describe what gravity is?
- 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 3.1 Forces around Us

Forces in Daily Life

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

Elastic force in a rubber band

Magnetic force in a magnet

Gravity

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

The Earth's gravity acts on all objects on earth

Measuring and Describing Force

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

Magnitude of Force

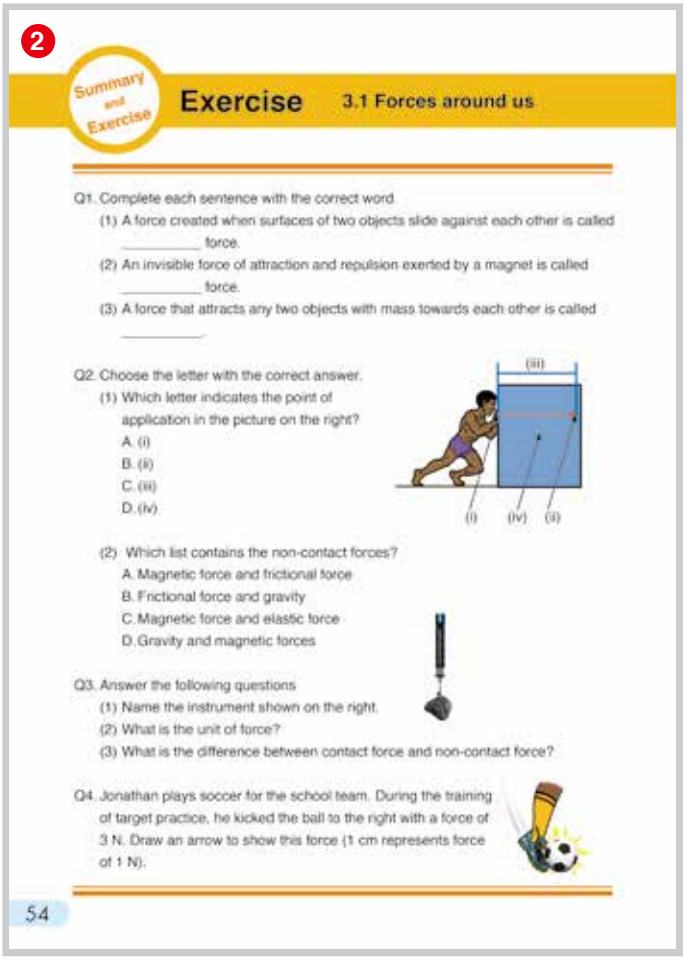
Point of Application

Direction of Force

53

2 Exercise & Explanation (40 min.)

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



2

Summary and Exercise

Exercise 3.1 Forces around us

Q1. Complete each sentence with the correct word.

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

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

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

Q2. Choose the letter with the correct answer.

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

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

(iii)

(i) (iv) (ii)

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

A. Magnetic force and frictional force
B. Frictional force and gravity
C. Magnetic force and elastic force
D. Gravity and magnetic forces

Q3. Answer the following questions.

(1) Name the instrument shown on the right.

(2) What is the unit of force?

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

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

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Exercise answers

Q1.
(1) **frictional**
(2) **magnetic**
(3) **gravity**

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

Q3.
(1) **Spring balance**
(2) **newton (N)**
(3) Expected answer
Contact force is when two objects are physically touching with each other. Whereas non-contact force is when two objects are not in contact with each other but act through the space between them.

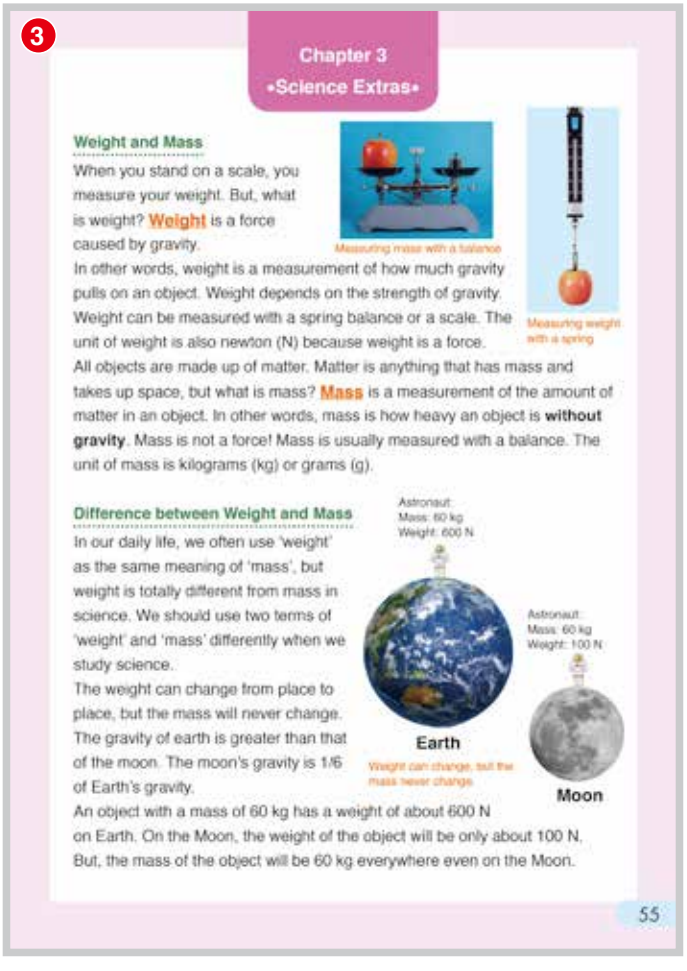
Q4.

(The length of the arrow should be 3 cm.)

Explanation of Science Extras

3 Science Extras (10 min.)

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



3

Chapter 3
•Science Extras•

Weight and Mass

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

Measuring mass with a balance

Measuring weight with a spring

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

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

Difference between Weight and Mass

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

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

Astronaut
Mass: 60 kg
Weight: 600 N

Earth

Weight can change, but the mass never change.

Astronaut
Mass: 60 kg
Weight: 100 N

Moon

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

55

Lesson 5 / 5

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

3. FORCE

Q1 Complete each sentence with the correct word.

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

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

(3) The unit for measuring force is the newton (N).

Q2 Choose the letter with the correct answer.

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

A. Albert Einstein
B. Isaac Newton
C. Benjamin Franklin
D. Thomas Edison

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

A. Fred pushed a trolley across the lawn onto the concrete path.
B. Sandy shot a basketball into the loop to score two points.
C. Ketsin shot a bird high up in the tree with a forked sling shot.
D. Lolo used a coconut palm to slide downhill into the river below.

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

A. a contact force.
B. an elastic force.
C. a magnetic force.
D. a non-contact force.

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

A. 4 N B. 400 N
C. 40 N D. 4000 N

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(5) The strength of gravity depends on:

A. the mass of an object.

B. the size of the object.

C. the colour of an object.

D. the hardness of an object.

Q3

Answer the questions.

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

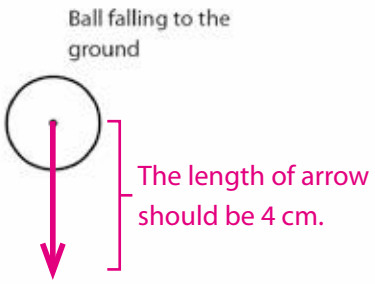
(1) What force is exerted on the ball when it is falling?

Gravity

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

4 newton

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



Q4

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

(Expected answer) There was less friction between the surface of the floor and the sole of the shoe.

Chapter 4. Plants and Water

Chapter Objectives

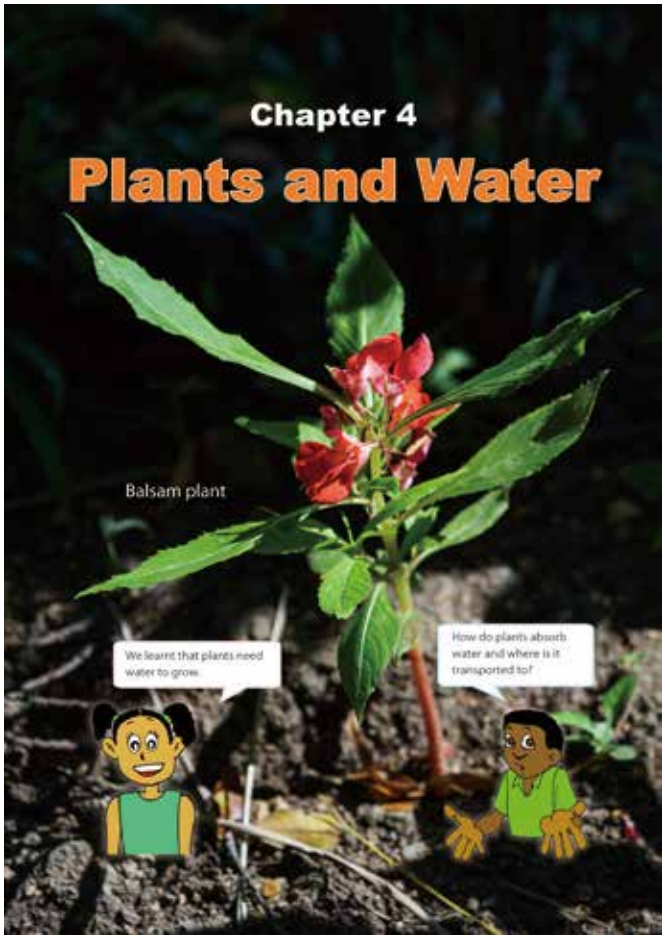
Students will be able to understand the transpiration process of plants in which water absorbed by roots pass through from the roots to the stem and to leaves and evaporate from the leaves, through conducting experiments.

Topic Objectives

4.1 Water in Plants

Students will be able to;

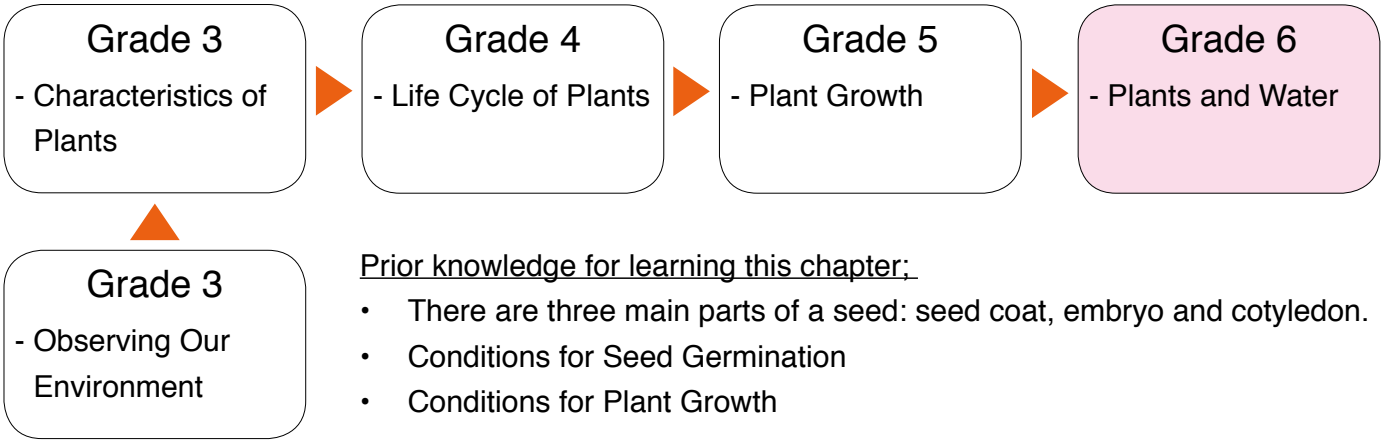
- Describe that water absorbed by roots pass through the tubes from the roots to the stem, to the leaves and to the flowers.
- Explain that water is released from leaves into air in the form of water vapour.



This picture is from the chapter heading of the textbook showing a balsam plant growing in a garden.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- There are three main parts of a seed: seed coat, embryo and cotyledon.
- Conditions for Seed Germination
- Conditions for Plant Growth

Teaching Overview

This chapter consists of 4 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
4.1 Water in Plants	1	**Paths of Water in Plants** Which parts of a plant does water pass through?	6.1.2	59 - 60
	2	**Water in Leaves** Where does the water in the leaves go?		61 - 62
	3	Summary and Exercise, Science Extras		63 - 65
Chapter Test	4	Chapter Test		66 - 67

Unit: **Plants**	Chapter : **4. Plants and Water** Topic : **4.1. Water in Plants**	Total lesson No: 22 / 74 Textbook page: 59 - 60

Lesson 1 / 4

Lesson Title

Paths of Water in Plants

Preparation

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

Lesson Flow

Preparatory Activity for this lesson

The students will do the activity of Step 1 & 2 to set-up the experiment on the day before this lesson.

- Organise students into groups.
- Explain the activity of Step 1 and 2.
- Ask them to do the activity. (Stop the activity here.)

1 Introduction (5 min.)

- Review Gr 5 Chapter 3 Lesson 3, 'Function of Plant Parts' by asking:

Q:What are the functions of roots, stems and leaves?

Q:Where do the plants take in or absorb water?

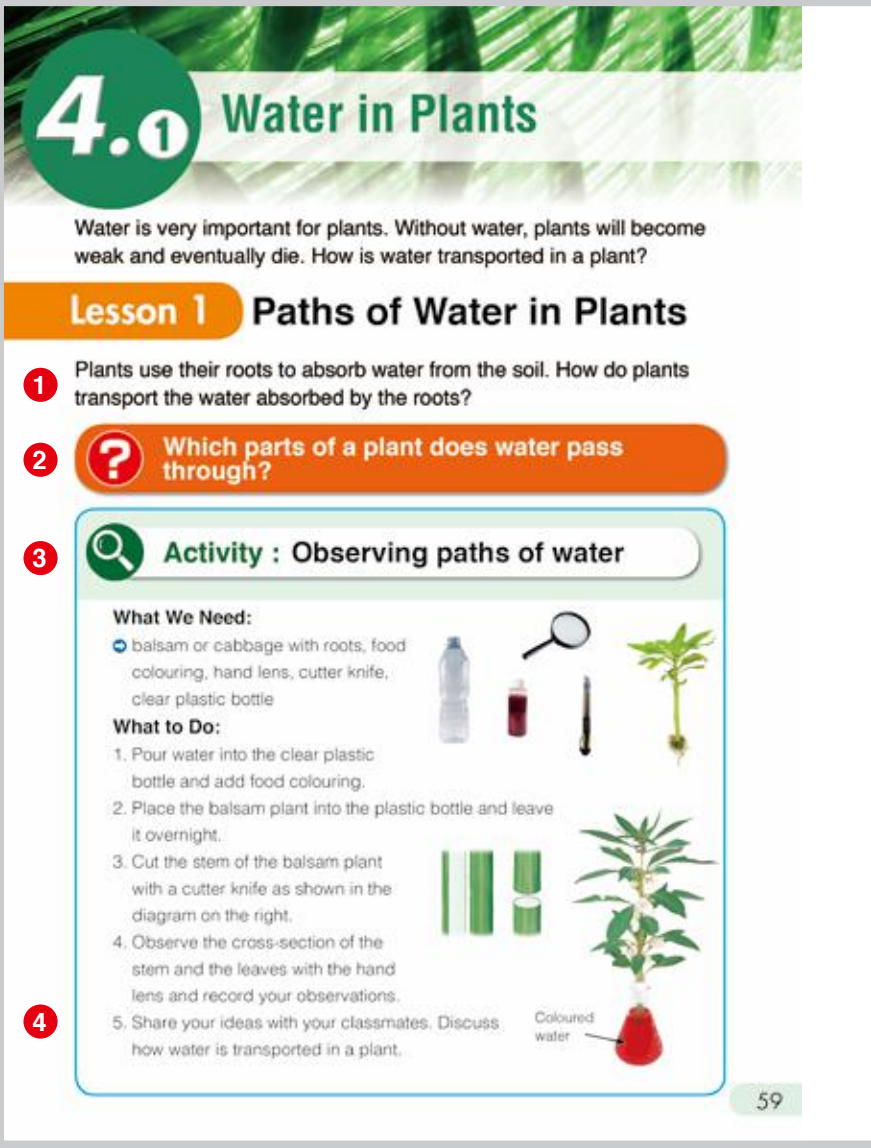
- Encourage the students to think about how water is transported in plants.

2 Introduce the key question

Which parts of a plant does water pass through?

3 Activity (35 min.)

- Organise students into groups.
- Explain the activity of Step 3 and 4 and the safety rules for using a cutter knife.
- Demonstrate how to make a cross-section cut of stem and have students cut the stem with/without dye.
- Assist students to use a cutter.
- Ask students to observe and sketch the cross-section of the stem and leaves.
- Check students' activity and if necessary guide them towards their findings.



Teacher's Notes

In Grade 3 Chapter 3, 'Characteristics of Plants', students learnt about 'Function of Plant Parts'. If balsam is difficult to find, use potato plant or pak choi cabbage.

SAFETY

1. Always cut away from your body.
2. Pull back the blade into its casing after use.
3. Always pass the knife handle first.

Pak choi cabbage with its roots on.

In plants, a tube-like passage made up of vascular tissues called xylem and phloem are two modes of transportation. Water and minerals travel upwards through the xylem, while phloem transport synthesised food to other parts of the plant. The movement of water and other nutrients from one part of a plant to another is called translocation.

How to cut the plant for observation

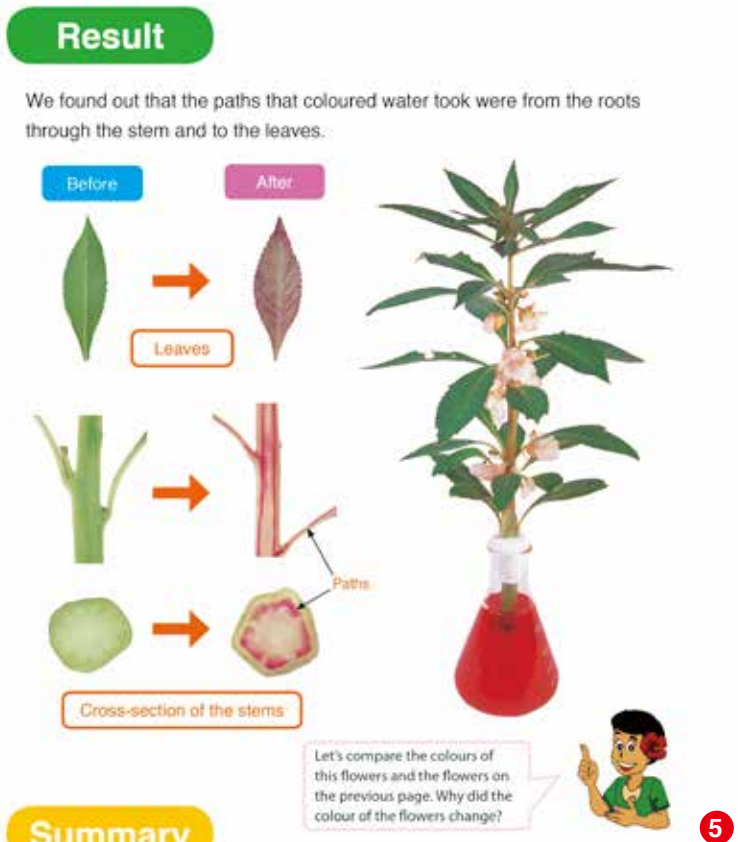
- Remove the plant from the dye and cut the cross section above the part that has been in the dye.
- The cross section slice of the stem to be cut for observation under the magnifying glass should be approximately 1 – 2 mm thick.
- The longitudinal cut should be done after the cross section cut.

Lesson Objectives

Students will be able to:
- Observe the paths of water in plants.
- Identify the parts of plant that water travels through.
- Use the cutter to cut the parts of plant correctly.

Assessment

Students are able to:
- Sketch the coloured parts by the dye in the stem and the leaves.
- State how water is transported through the tube from the roots, to stem and to the leaves.
- Make a cross-section cut in the stem using a cutter with care.



4 Discussion for findings (25 min.)

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

Q:Where did the dyed water pass through the stem? (The water passed through tubes, it passed both sides of the stem inside, it passed through tubes that are arranged in the shape of ring inside the stem, etc...)

Q:Which parts of the leaf show the presence of the dye? (Mainly back side of the leaves.)

Q:What happened to the colour of flowers? (The colour of flowers changed to the colour of dye.)

Q:How does water pass through a plant from roots? (From roots, to stem, to leaves and flowers.)

- Conclude the discussions.

5 Summary (15 min.)

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

Q:In which parts of plants does water pass though?

Q:How does the water moves through a plant from the roots?

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

Sample Blackboard Plan

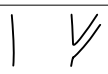
Title:

Paths of Water in Plants

Key question:

Which part of plant does water pass through?

Activity: Observing paths of water

Part of balsam with no dye	Part of balsam with dye
	
	

Discussion

Q:Where did the dyed water pass through the stem? The water passed through like tubes, it passed both sides of the stem inside, it passed through tubes that are arranged in the shape of ring inside the stem, etc.

Q:Which parts of the leaf show the presence of the dye?
Mainly the back side of the leaves.

Q:What happened to the colour of flowers?
The colour of flowers changed to the colour of dye.

Q:How does water pass through a plant from roots?
From roots, to stem, to leaves and flowers.

Summary
- Water absorbed by the roots pass through the tubes from the roots to the stems and the leaves.
- Water is transported to all parts of the of the plants through these long tubes.

Unit: **Plants**	Chapter : **4. Plants and Water** Topic : **4.1. Water in Plants**	Total lesson No: 23 / 74 Textbook page: 61 - 62

Lesson 2 / 4

Lesson Title

Water in Leaves

Preparation

two clear plastic bags, strings, two plants

Lesson Flow

1 Introduction (5 min.)

- Review the last lesson.

Q:How does water flow through plant?
Q:In which part of plants does water pass through?

2 Introduce the key question

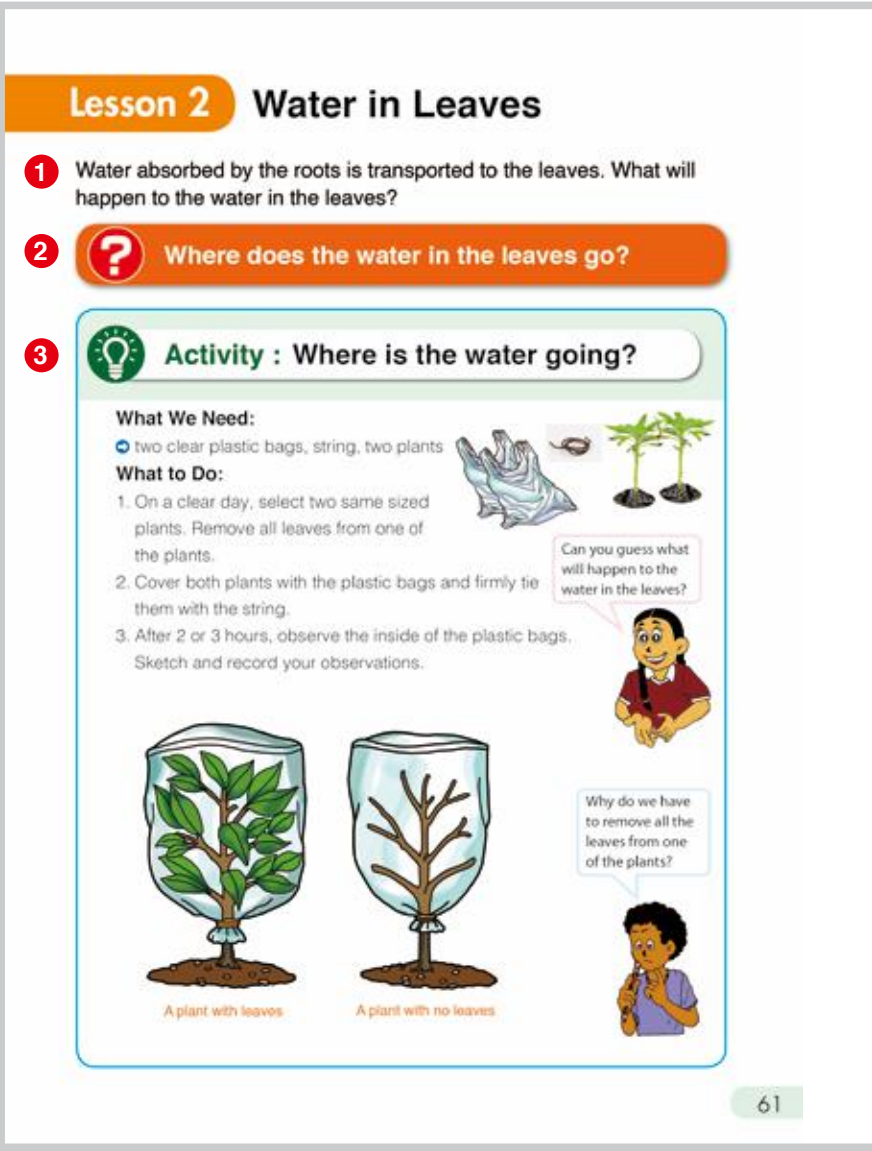
Where does the water in the leaves go?

3 Activity 1. (15 min.)

- Explain the ground rules for outside activity.
- Organise students into groups.
- Explain the steps of the activity.
- Go outside with the students.
- Ask students to set up the activity.
- Advice students that the two plants should be in the sunlight for 2 or 3 hours.
- Have them sketch and record their observation in their exercise book.
- STOP THE LESSON and teach another subject's lesson.

Activity 2. (20 min.)

- Resume this lesson again when water droplets form inside the plastic bag of plant with leaves.
- Go outside with the students.
- Ask them to observe the inside of the plastic bags of the two plants.
- Have them sketch and record their observation in their exercise book.
  Give enough time for students to do their observations.


Lesson 2 Water in Leaves

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

2 Where does the water in the leaves go?

3 Activity : Where is the water going?

What We Need:
two clear plastic bags, string, two plants

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

Can you guess what will happen to the water in the leaves?

Why do we have to remove all the leaves from one of the plants?

A plant with leaves

A plant with no leaves

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Teacher's Notes

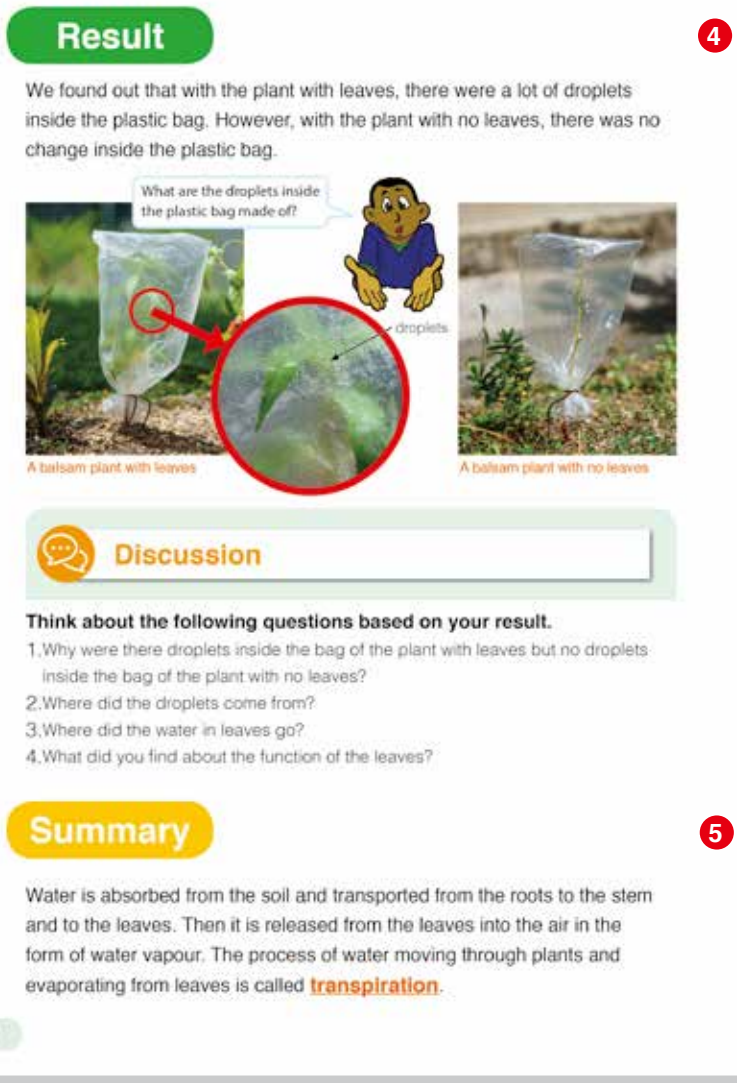
- Transpiration is the evaporation of water from the surface of leaf cells in actively growing plants. This water is replaced by additional absorption from the soil leading to a continuous column of water in the plant's xylem. The process of transpiration provides the plant with evaporative cooling, nutrients, carbon dioxide entry and water to provide plant structure.
- Rates of transpiration depend on the water potential gradient from the soil to the atmosphere and the resistances to its movement through the plant. Water enters the root and travels through the cortex and endodermal layers of cells to reach the xylem where water ascends to the leaf where, if not used in the plant, evaporates. If water loss is greater than water uptake, air bubbles can form in the xylem. Plants reduce water loss by closing their stomata, developing thick cuticles, or by possessing leaf hairs to increase the boundary layer. Stomata are quick to respond to environmental cues to protect the plant from losing too much water, but still allowing in enough carbon dioxide to drive photosynthesis.

Lesson Objectives

Students will be able to:
- Define transpiration.
- Relate the conditions of plants to the functions of leaves.
- Explain the function of leaves.
- Communicate their findings with other classmates.

Assessment

Students are able to:
- State the definition of transpiration.
- Explain the reason why all leaves must be removed from one of plants to investigate the function of leaves.
- Explain what happens to water in leaves.
- Share their ideas during discussion in their groups.



Result

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

What are the droplets inside the plastic bag made of?

droplets

A balsam plant with leaves

A balsam plant with no leaves

Discussion

Think about the following questions based on your result.

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

Summary

5

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

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4 Result and Discussion (25 min.)

- Ask students to present their findings from the activity.
- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Confirm that there are droplets inside the plastic bag of the plant with leaves.
- **Based on their findings**, ask these questions as discussion points.

Q:Where did the droplets come from? (From the leaves.)

Q:Why are there no droplets inside the plastic bag of the balsam plant without leaves? (Because there are no leaves.)

Q:Where will the water absorbed by roots go? (To all parts of the plant.)

Q:What is the function of leaves? (Leaves release water from inside the plants.)

- Conclude the discussions.

5 Summary (15 min.)

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

  Q:Where does the water in the leaves come from?

  Q:What happens to water in leaves?

  Q:What is transpiration?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Water in Leaves

Key question:

Where does the water in the leaves go?

Activity:

Where is the water going?

At start

With Leaves Without Leaves

After 2-3 hours

With Leaves Without Leaves

Discussion

Q: Where did the droplets come from?

From the leaves.

Q: Why are there no droplets inside the plastic bag of the balsam plant without leaves?

Because there are no leaves.

Q: Where will the water absorbed by roots go?

To all parts of the plant.

Q: What is the function of leaves?

Leaves release water from inside the plant.

Summary

- The process of water moving through the plants and its evaporation from leaves is called Transpiration.

Unit: **Plants**	Chapter : **4. Plants and Water** Topic : **4.1. Water in Plants**	Total lesson No: 24 / 74 Textbook page: 63 - 65

Lesson 3 / 4

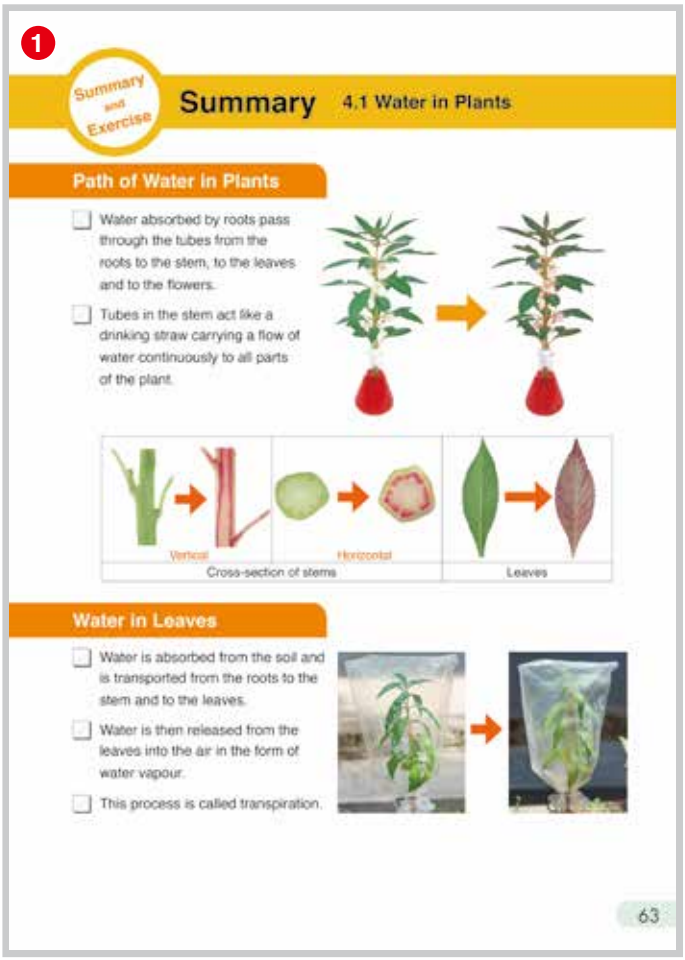
Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - How can the water get to all parts of the plant?
  - How do plants continuously absorb the water?
  - What are three pathways of water in plants?
- 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 (40 min.)

- Go through the instructions of the exercise.
- Allow students to answers 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) **leaves**
(2) **tubes**
(3) **transpiration**

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

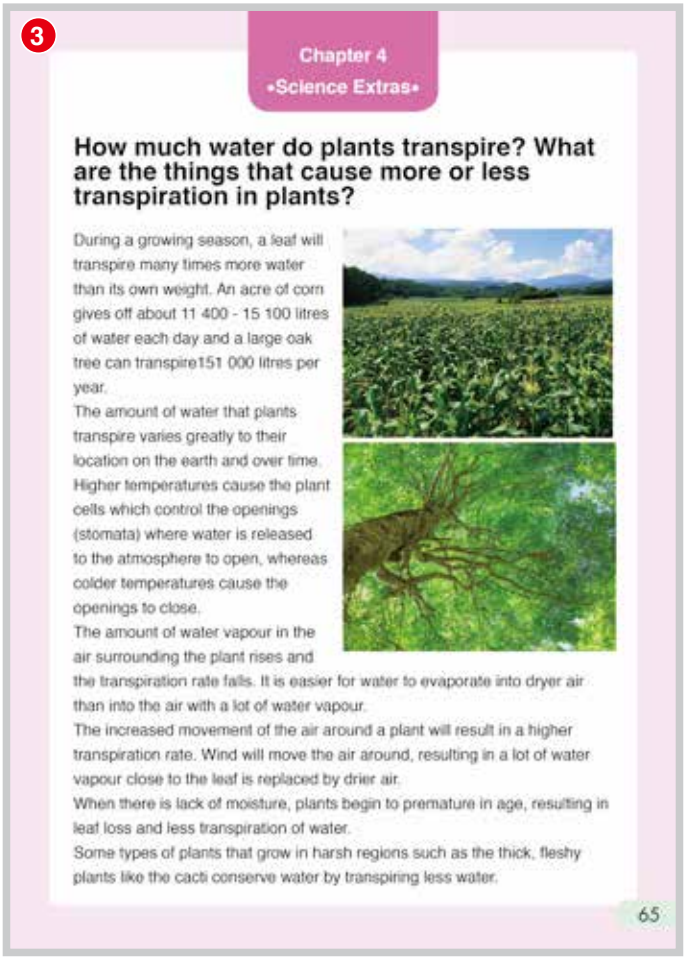
Q3.Expected answer
There are tubes through which water passes in the stem of plant to its parts.

Q4.Expected answer
The plant with no leaves does not release water vapour into the air. Therefore, there was no water vapour in the plastic bag and water droplets were not observed.

Explanation of Science Extras

3 Science Extras (10 min.)

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



3

Chapter 4
•Science Extras•

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

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

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

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

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

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

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

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Unit: **Plants**	Chapter : **4. Plants and Water** Topic : **4.1. Water in Plants**	Total lesson No: 25 / 74 Textbook page: 66 - 67

Lesson 4 / 4

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

4. Plants and Water

Q1 Complete each sentence with the correct word.

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

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

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

Q2 Choose the letter with the correct answer.

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

A. roots
B. stems
C. leaves
D. flowers

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

A. The skins
B. The flower
C. The stem
D. The tubes

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

A. roots to the stem and to the leaves.
B. leaves to the stem and to the root.
C. stems to the roots and to the leaves.
D. roots to the leaves and to the stem.

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

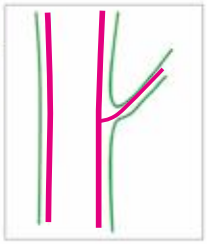
A. evaporates from stems.
B. evaporates from leaves.
C. comes from air.
D. comes from soil.

Plant 1 Plant 2

66

Q3

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



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

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

Because water is also transported to the flowers.

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

Water is released from the leaves to air.

Q4

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

The tubes that the plant uses to transport water is connected from the plant roots, to the stem and to the leaves.

Chapter 5. Reproduction and Heredity in Plants

Chapter Objectives

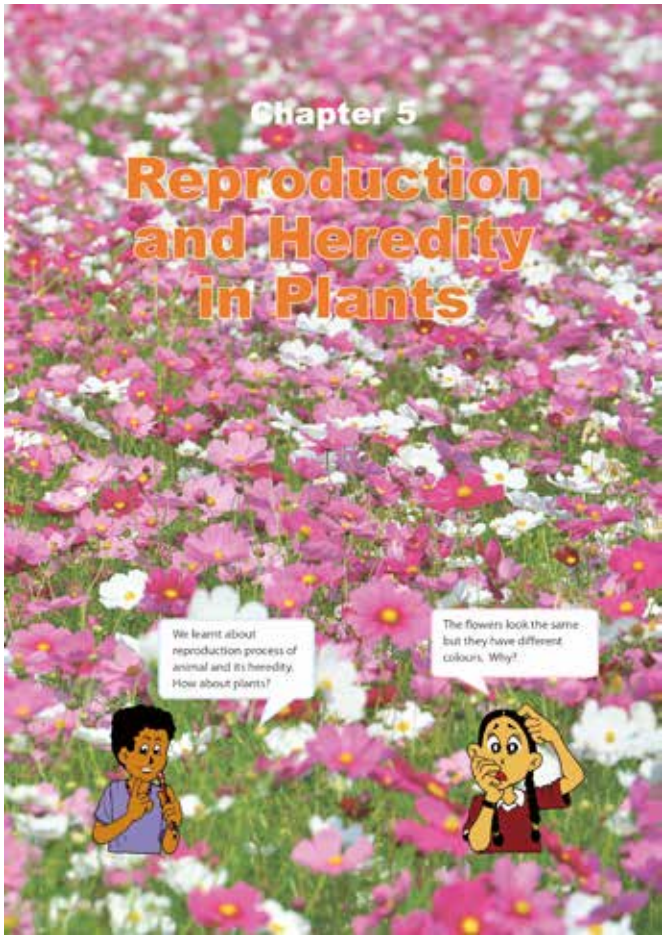
Students will be able to identify the main reproductive parts of a flower, the ways the pollen grains are transferred to the stigma, the process of seed development and also describe the traits that are passed from parents to young plants.

Topic Objectives

5.1 Reproduction and Heredity

Students will be able to;

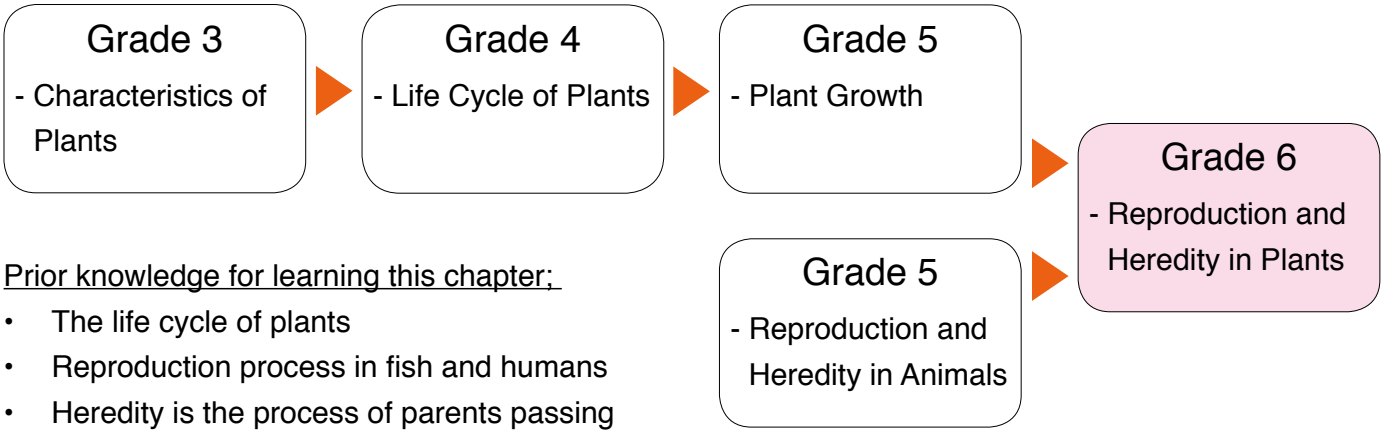
- Identify the two main reproductive parts of a flowering plant.
- Describe the four different types of pollination.
- Compare the differences between the stages in the process of seed development.
- Identify the similarities in the young and adult tomato plant.



This picture is from the chapter heading of the textbook showing same kind of flowers but are different coloured.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- The life cycle of plants
- Reproduction process in fish and humans
- Heredity is the process of parents passing traits to their children.

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 Reproduction and Heredity	1	**Flowers** What are the structures of a stamen and a pistil?	6.1.1	69 - 70
	2	**Pollination** How are pollen grains transferred to the stigma?		71 - 72
	3	**Reproduction in Flowering Plants** How do plants produce seeds?		73 - 74
	4	**Heredity in Plants** Do plants inherit the traits from their parents?		75 - 76
	5	Summary and Exercise, Science Extras		77 - 79
Chapter Test	6	Chapter Test		80 - 81

Unit: **Plants**	Chapter : **5. Reproduction and Heredity in Plants** Topic : **5.1. Reproduction and Heredity**	Total lesson No: 26 / 74 Textbook page: 69 - 70

Lesson 1 / 6

Lesson Title

Flowers

Preparation

Any substituted flower must have all the likeness in parts to that of the 'Hibiscus' flower, hand lens, cutter knife

Lesson Flow

1 Introduction (5 min.)

- Ask the students to recall the Gr 4 lesson on 'Life Cycle of a Plant - Flowering'.

Q: What do plants produce before they bear fruits?
Q: What are some parts of a flower that you can recall?

2 Introduce the key question

What are the structures of a stamen and a pistil?

3 Activity (35 min.)

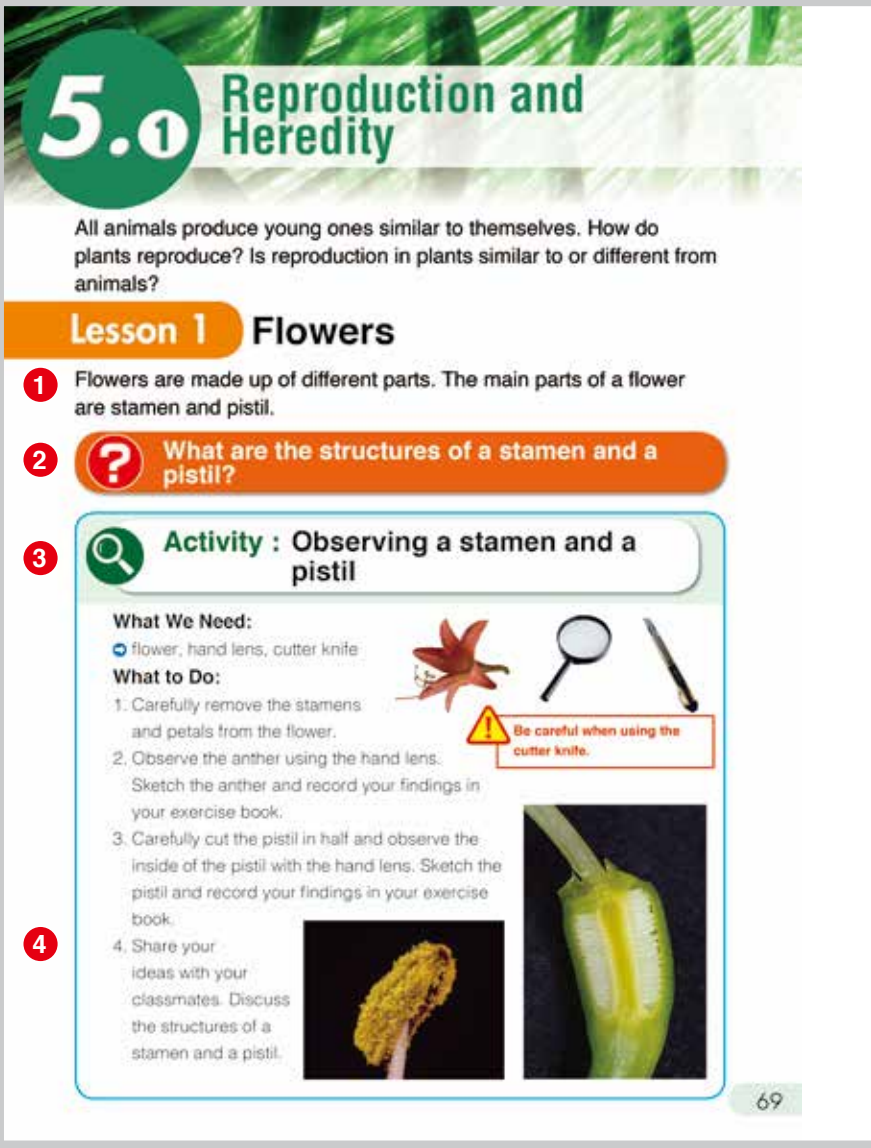
The students must be instructed on the day before this lesson to bring a fresh 'HIBISCUS' flower from home.

- Organise students into groups.
- Explain Safety Rules (Refer to Teachers notes).
- Explain the steps of the activity.
- Ask students to spot the important points in Steps 1, 2 and 3.
- Ask students to refer to the pictures below the activity and compare them
- Check students' activity and if necessary guide students towards their findings.
- Give enough time for the students to do their findings.

4 Discussion for findings (25 min.)

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

(Continue)



Teacher's Notes

- Prior to this lesson refer to Parts of the flower taught in Grade 4, Lesson 1 'Flowering Plants' on Topic 7.1.
- A cross-sectional image of a flower like in the textbook above is a 'generalised model' to explain the common structure of flowers which usually differs from the actual flower as each flower has different characters (That is why we can distinguish and classify plants).
- The activity recommends the 'HIBISCUS' for this observation because (1) it is common and (2) it is big enough. However the structure of pistil and stamen are not the same as the image in the textbook (Stamens are attached to the pistil).
- You can use other flowers available around your classroom, however, you need to review the structure of the flower in advance
- Discuss and identify the similarities and differences between the 'observed flower' and the common diagram to help deepen students' understanding.

SAFETY

1. Always keep your fingers behind the sharp cutting edge of the cutter.
2. Always work (cut) away from your body.
3. Always retrieve the blade of the cutter back into its case after use.

Lesson Objectives

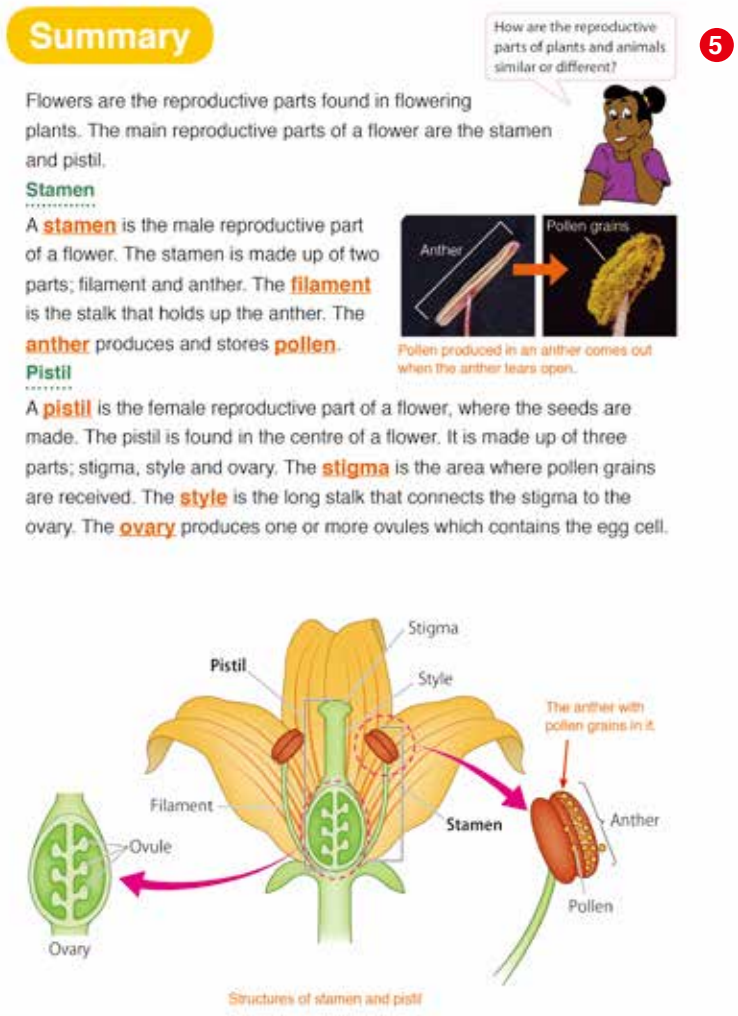
Students will be able to:

- Identify the two main reproductive parts of a flowering plant.
- Compare the differences in the parts of the stamen and the pistil.
- Hold the cutter and lens and use them correctly.

Assessment

Students are able to:

- Draw and label the parts of the stamen and the pistil.
- Observe the parts of the anther and the pistil.
- State the parts of the anther and the pistil.
- Contribute their own ideas about the reproductive parts of flowering plants.



Summary

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

5

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

Stamen

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

Anther

Pollen grains

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

Pistil

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

Stigma

Pistil

Style

The anther with pollen grains in it

Filament

Stamen

Anther

Ovule

Pollen

Ovary

Structures of stamen and pistil

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- Facilitate active students' discussions.
- Confirm the drawings with the parts of a stamen and a pistil with the students.
- **Based on their findings**, ask these questions as discussion points.

Q:What do the anthers do for the plant's flowers? (They produce pollens.)

Q:Where is the pistil located on the flower? (In the centre.)

Q:Which part of the pistil is located closer to the anthers? (The stigma)

- Explain that stigmas are held up by the style and they have hairy surfaces to capture the pollens from the anthers.

Q:What are the 'seed-like' structures in the ovary of the pistil? (The ovules - the eggs.)

- Conclude the discussions.

5 Summary (15 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 parts of the stamen?
  Q: What are the parts of the pistil?
  Q: Why is the pistil known as the female part of the flower?
  Q: Why is the stamen known as the male part of the flower?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

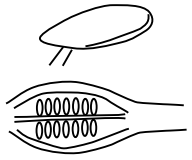
Flowers

Key question:

What are the structures of a stamen and a pistil?

Activity: Observing a stamen and a pistil

Sketches of Anther and Pistil



Stamen

Pistil

My Observations/Findings

Anther – tiny powder (dust)

Pistil (Ovary) – little seeds inside

Discussion

Q: What do the anthers do for the plant's flower? They produce pollens

Q: Where is the pistil located on the flower? In the centre

Q: Which part of the pistil is located closer to the anthers? The stigma

Q: What are the 'seed-like' structure in the ovary of the pistil? The ovules – the eggs

Summary

- Stamen is the male part of the flower which includes the filaments, anthers and pollens.
- Pistil is the female part of the flower which includes the stigmas, style, ovary and ovule.

Unit: **Plants**	Chapter : **5. Reproduction and Heredity in Plants** Topic : **5.1. Reproduction and Heredity**	Total lesson No: 27 / 74 Textbook page: 71 - 72

Lesson 2 / 6

Lesson Title

Pollination

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Revise the last lesson.

Q:What are the parts of the stamen?
Q:What are the parts of the pistil?
Q:What does the anther produce?

- Explain what pollination is.
- Encourage students to think of the ways of pollination by asking:

Q:How do plants transfer pollen from an anther to a stigma?

2 Introduce the key question

How are the pollen grains transferred to the stigma?

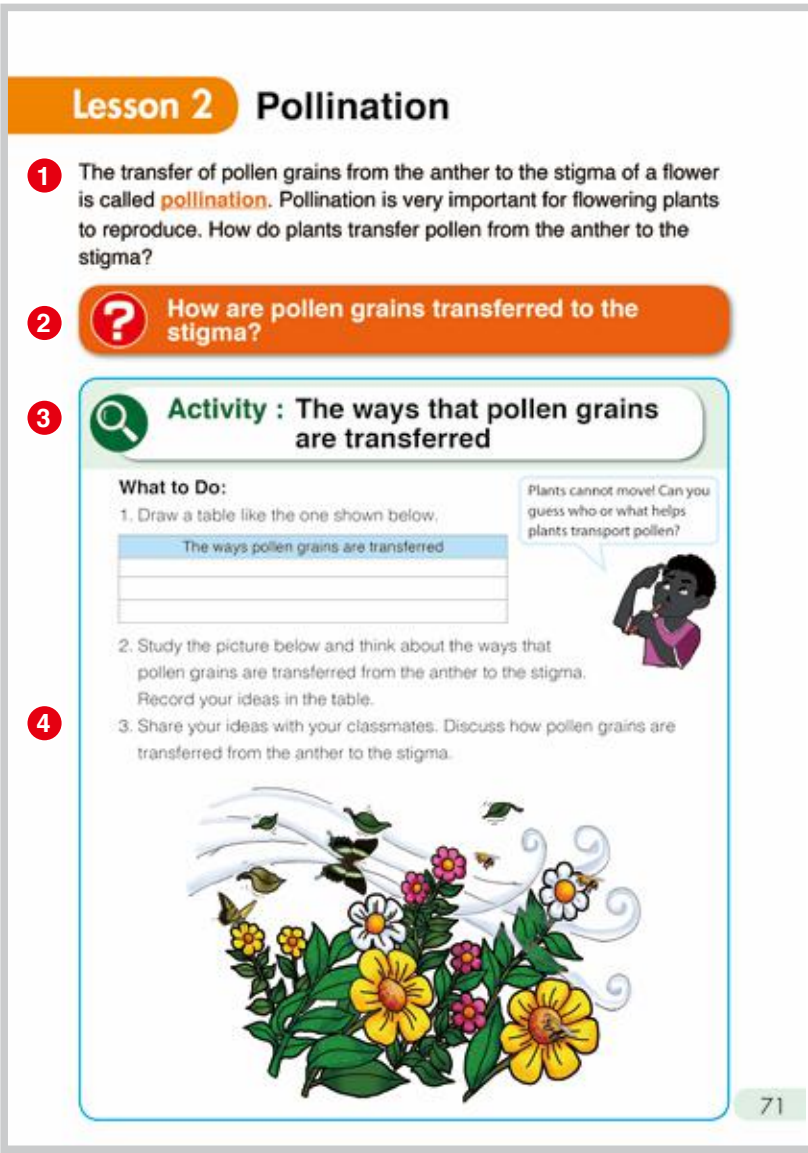
3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask the students to spot the important points in step 2.
- Refer students to the picture and the character in the textbook.
- Check students' activity and if necessary guide students 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 (25 min.)

- Ask students to present their findings from the activity.

(Continue)



Lesson 2 Pollination

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

2 How are pollen grains transferred to the stigma?

3 Activity : The ways that pollen grains are transferred

What to Do:

1. Draw a table like the one shown below.

The ways pollen grains are transferred

Plants cannot move! Can you guess who or what helps plants transport pollen?

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

4 3. Share your ideas with your classmates. Discuss how pollen grains are transferred from the anther to the stigma.

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Teacher's Notes

- Plants have adapted many traits for pollination Some have improved features to attract animals like birds, bats, butterflies, bumblebees, bees and beetles. Some others have changed their shape to effectively use wind for pollination.
- Bright coloured blossoms attract bees, flies, butterflies, and moths to collect nectar and pollen. Sometimes lines on their petals will guide the insects down into the blossom. Petal shapes also adapt to allow only certain insects and birds to pollinate the flower. Flowers like the goldenrod have a general flower/petal shape that attracts several kinds of insects. Some petals accommodate desired insects, birds and bats by opening during the time of day or night when the pollinator feeds. Bees pollinate flowers with sweet, light fragrances like those found in sages, mints and clovers. Petals scented in strong sweet scents attract night-feeding moths and bats. Petals have adapted to make rotten flesh scents that attract moths and flies.
- Wind-pollinated flowers are not colourful and have large amount of pollens which are small and light to be easily airborne, with their stamens and stigmas exposed to air currents. The stigmas of some kind wind-pollinated flowers such as corn are feathery to catch pollens from the wind.

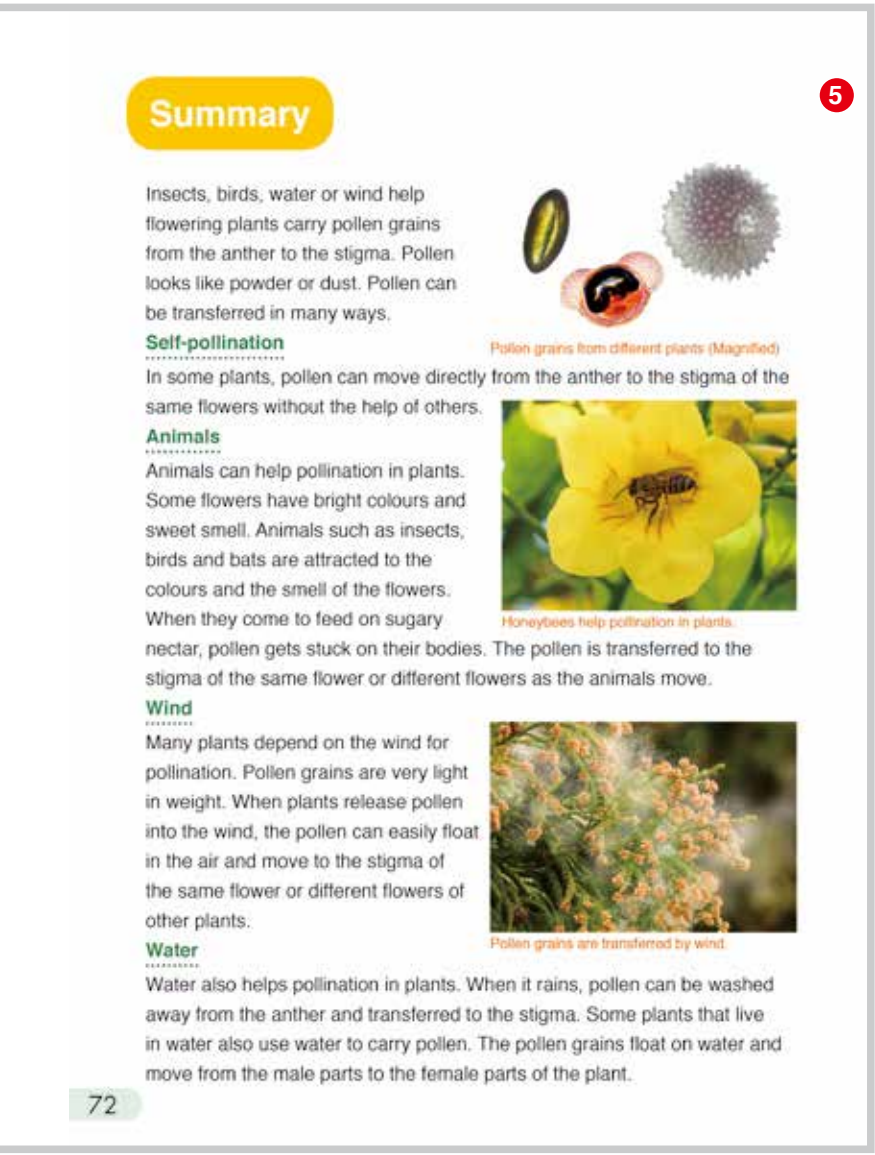
1. **Insects**: Bees, flies and butterflies are common examples of insects that pollinate flowers. Bees are perhaps the most important pollinator of many garden plants and most commercial fruit trees.
2. **Bats**: Flowers with very strong fragrances attract bats in the night. In the tropics and deserts, bats are often the pollinators of nocturnal flowers such as agave, guava, and morning glory.
3. **Birds**: Bright coloured flowers attract birds like the humming birds. Flowers visited by birds are usually sturdy and are oriented in such a way as to allow the birds to stay near the flower without getting their wings entangled in the nearby flowers.

Lesson Objectives

Students will be able to:
- Explain what pollination is.
- Describe how pollen grains are carried.
- Show appreciation to know the things involved in the pollination process.

Assessment

Students are able to:
- State how pollination is important for plants.
- List the ways of pollination such as self-pollination, by animals, wind and water.
- Participate in the activity with interest.



Summary

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

Pollen grains from different plants (Magnified)

Self-pollination

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

Animals

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

Honeybees help pollination in plants.

Wind

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

Pollen grains are transferred by wind.

Water

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

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

Q:How do the pollen grains get transferred from the anthers to the stigma? (They are carried by bees, bats, butterfies, birds, wind, etc...)

Q:Why do plants need other things to carry pollens? (They cannot move like animals.)

Q:Why do insects such as bees or butterfies come to flowers? (They are attracted to the bright colours or sweet smell of flowers.)

- Conclude the discussions.

5 Summary (15 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 pollination?
  Q:Why is pollination important for plants?
  Q:How are the pollen grains transferred from the anthers to the stigma?
  Q:How do some insects transfer the pollen grains to the stigma of another flower?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Pollination

Key question:

How are pollen grains transferred to the stigma?

Activity:

The ways that pollen grains are transferred

By itself
By animals
By wind
By water

Discussion

Q:How do the pollen grains get transferred from the anthers to the stigma? They are carried by bees, bats, butterfies, birds, wind, etc.

Q:Why do plants need other things to carry pollens? They cannot move like animals.

Q:Why do insects such as bees or butterfies come to flowers? They are attracted to bright colours or sweet smell of flowers.

Summary

- Pollination is the transfer of pollen grains from the anthers to the stigma.
- Pollination is very important for flowering plants to reproduce.
- Pollen grains transfer to the stigma through four main ways.
  1. Self-pollination
  2. Animals
  3. Wind
  4. Water

Unit: **Plants**	Chapter : **5. Reproduction and Heredity in Plants** Topic : **5.1. Reproduction and Heredity**	Total lesson No: 28 / 74 Textbook page: 73 - 74

Lesson 3 / 6

Lesson Title

Reproduction in Flowering Plants

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the last lesson.

Q:What is pollination?

Q:How are the pollen grains transferred from the anther to the stigma?

- Motivate students to think about reproduction in plants and ask this question:

Q:What happens to the pollen grains after they are transferred onto the stigma?

2 Introduce the key question

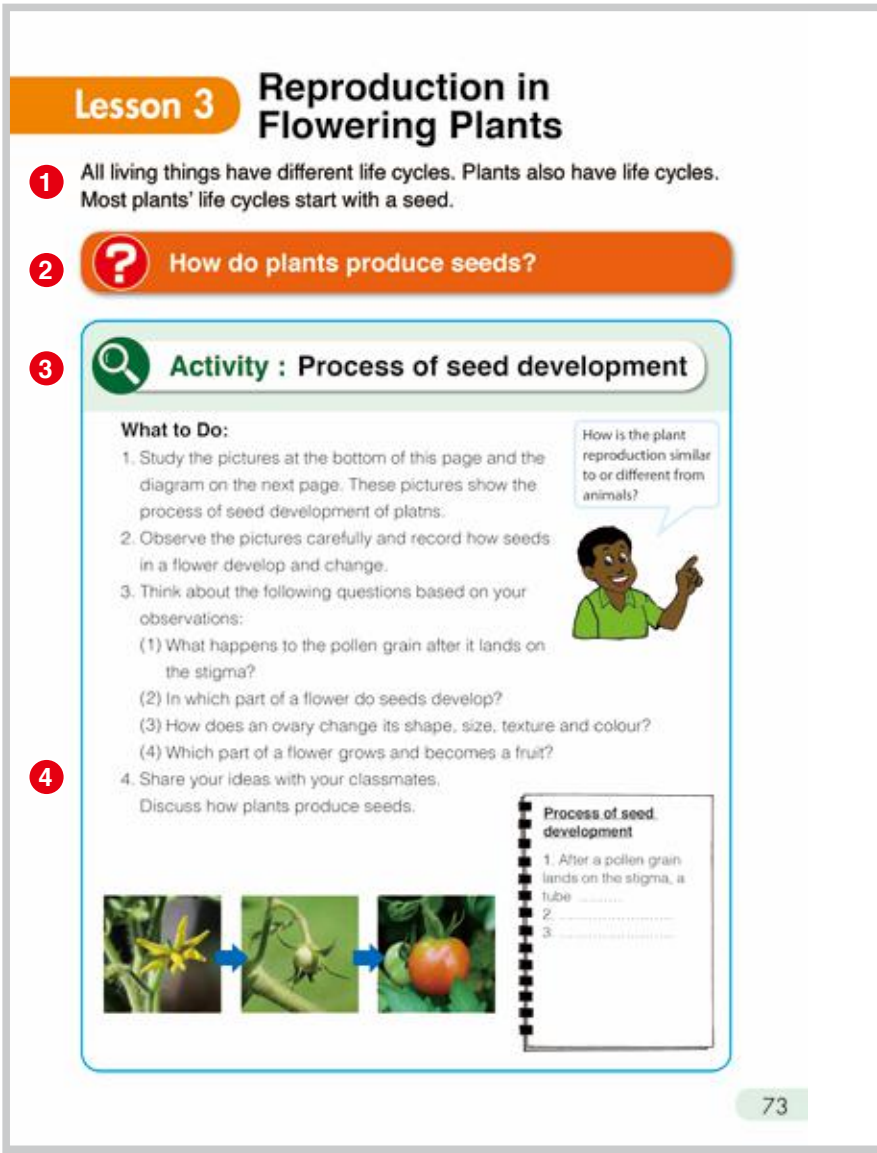
How do plants produce seeds?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to what the character is saying for their investigation.
- Ask to predict and record their prediction in their exercise books.
- Have students do Step 2 in the activity.
- Refer students to the questions in Step 3 and the pictures below the activity when doing the activity.
- Have students do Step 3 based on their observation.
- Ask students to discuss their findings with their groups.

4 Discussion for findings (25 min.)

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



Lesson 3 Reproduction in Flowering Plants

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

2 How do plants produce seeds?

3 Activity : Process of seed development

What to Do:

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

How is the plant reproduction similar to or different from animals?

Process of seed development

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

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Teacher's Notes

Fertilisation

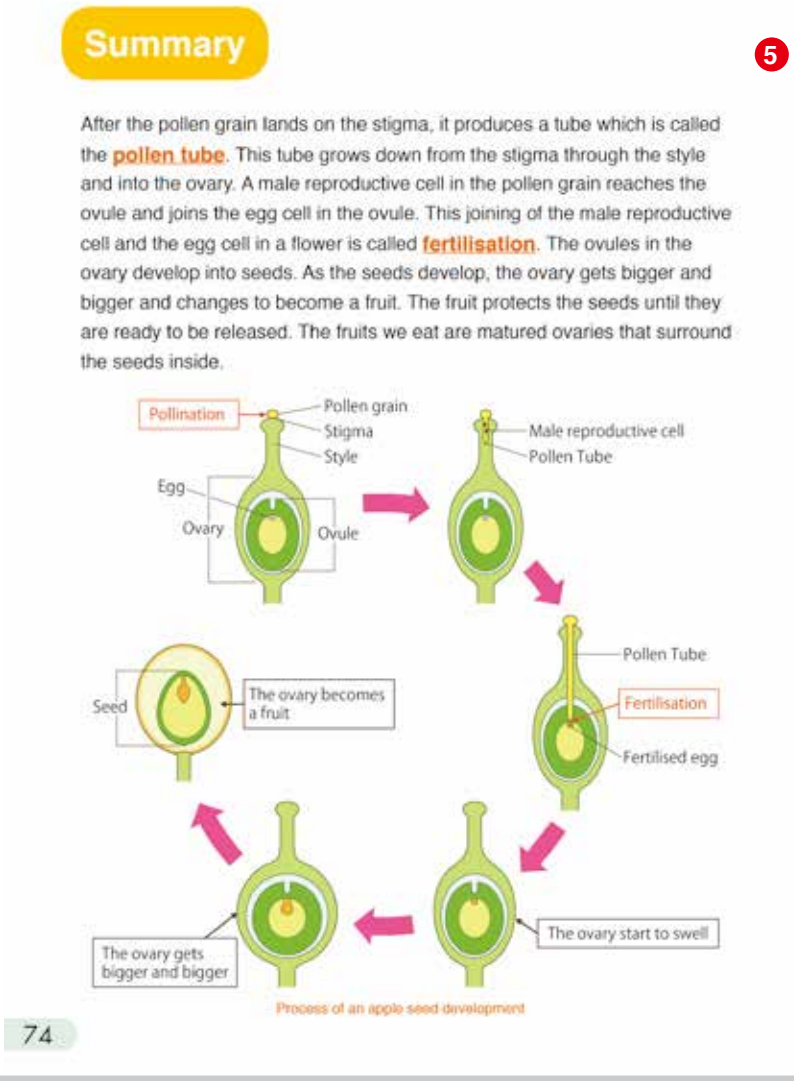
- The stigma releases a sugary substance that stimulates the growth of the pollen tube.
- The pollen contains the vegetative and the generative nucleus and the cell ruptures the stigma and passes through the style.
- The pollen grains attaches itself to the stigma of the female reproductive structure, the pollen tube grows and enters the ovule making a tiny pore called a micropyle.
- The pollen tube does not reach the ovary in a straight line. The pollen tube grows near the style and curls to the bottom of the ovary and then near the receptacle.
- The pollen tube then breaks into the ovule through the micropyle and then the micropyle bursts into the embryo sac.
- In the embryo sac, on the male nucleus fuses with the nucleus of the egg and forms a diploid zygote. This process is known as true fertilisation or syngamy.

Lesson Objectives

Students will be able to:
- Explain the process of reproduction in flowering plants.
- Investigate the way in which plants reproduce.
- Show curiosity in exploring the seed development.

Assessment

Students are able to:
- State the process of reproduction in plants from pollination to production of seeds.
- Describe the way of seed development by comparing the different stages using the pictures.
- Express their ideas on seed development during discussion.



Summary

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

Process of an apple seed development

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- Write their findings on the blackboard.
- Facilitate active students' discussions.
- Ask students to observe the diagram of 'Process of Seed Development' below the page of Summary.
- Confirm their findings by checking the diagram of the 'Process of Seed Development' with students.
- **Based on their findings and the diagram,** ask these questions as discussion points.

Q:What is the purpose for the pollen to grow a tube through the style of the stigma? (To fertilise the egg cells in the ovule.)
Q:Where do seeds develop? (In the ovary)
Q:What will the ovary become? (Fruits)

- Conclude the discussions.

5 Summary (15 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 in the flowers?
  Q: Explain how seeds develop after fertilisation.
  Q: Which part of the flower become the seeds?
  Q: Which part of the flower becomes the fruit?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Reproduction in Flowering Plants**

Key question: How do plants produce seeds?

Activity: Process of seed development

Process of Seed development
1. What happens to the pollen grain after it lands on the stigma?
It grows a tube
2. In which part of the flower do seeds develop?
In the ovule
3. How does the ovary change its shape and size?
The ovary gets bigger and bigger.
4. Which part of a flower grows and becomes a fruit?
The ovary becomes the fruit.

Discussion

Q: What is the purpose for the pollen to grow a tube through the style of the stigma?
To fertilise the egg cells in the ovule.

Q: Where do seeds develop? In the ovary.
Q: What will the ovary become? Fruits

Summary
- Fertilisation is the joining of male cell and female egg cells in the ovule.
- The ovules in the ovary develop into seeds.
- Seeds grow in the ovary.
- After fertilisation, the ovary grows bigger into a fruit and changes its shape.

Unit: **Plants**	Chapter : **5. Reproduction and Heredity in Plants** Topic : **5.1. Reproduction and Heredity**	Total lesson No: 29 / 74 Textbook page: 75 - 76

Lesson 4 / 6

Lesson Title

Heredity in Plants

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review Grade 5 Chapter 6 Lesson 'From Parents to Young'.

Q:What is heredity and traits?

Q:What are the traits of animals?

- Encourage students to think about heredity in plants, by asking:

Q:Animals look like their parents. How about plants?

2 Introduce the key question

Do plants inherit the traits from their parents?

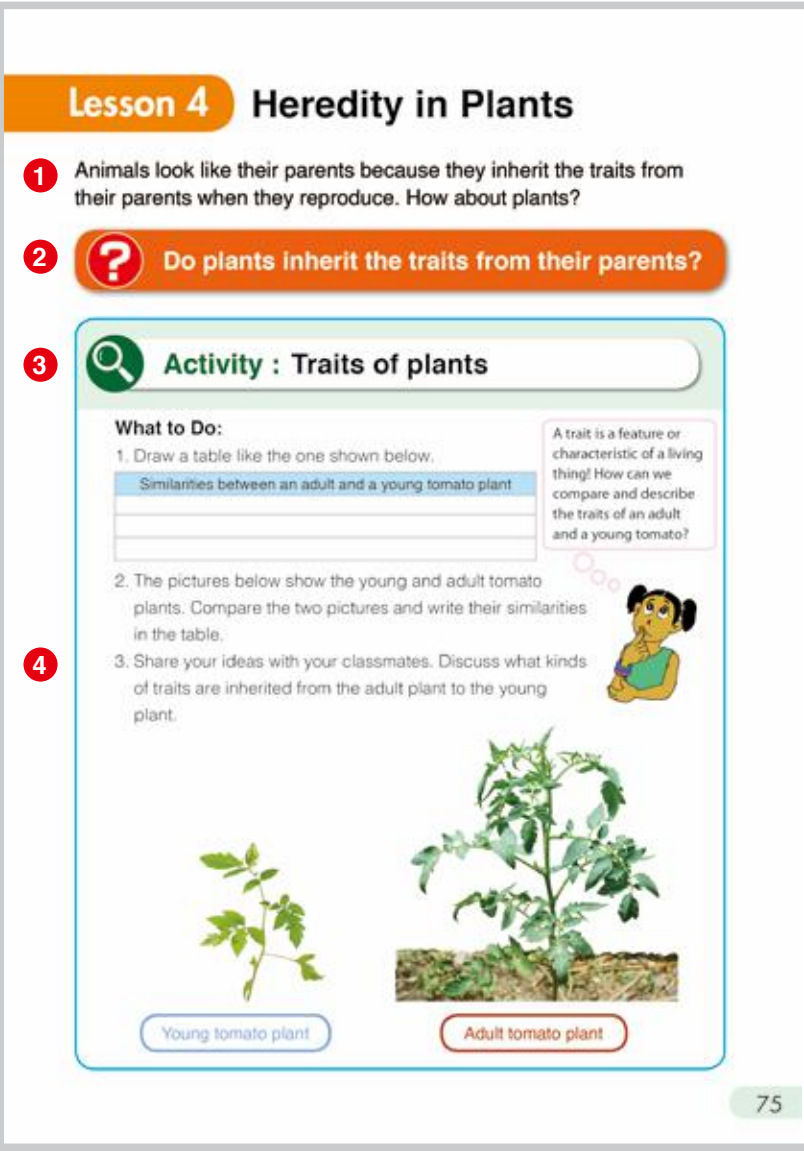
3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Refer students to the picture and the character in the textbook.
- Ask 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 (25 min.)

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

(Continue)



Teacher's Notes

- As studied in Grade 5, Chapter 6 Lesson: 'From Parents to Young', a child looks like the parents. Traits pass from parents to their offspring. The idea of particulate heredity that follows the laws is called Mendelian inheritance originally discovered by Johann Gregor Mendel (1822–1884). He proposed the idea in 1865 and 1866 and re-discovered in 1900.
- When he crossed **purple (P)** flower and **white (w)** (parental or P generation), the First generation (**F_1 generation**) were all purple-flowered. In the Second Generation (**F_2 generation**), he found that purple flower to white flower ratio of 3 to 1. He explained the reason logically that the purple color is dominant trait, whereas the white color is recessive so that the purple hides the white color in F_1, but the white traits still exists behind the purple trait.
- When we cross the F_1 and F_1, parents possess both the purple and the white traits, the possible combination of F_2 results in this cross are tabulated in the table on the right (Table called 'Punnett square' proposed by R. C. Punnett).
- The white color appears only when the offspring is given white traits from both parents. Therefore, purple flower to white flower ratio indicates 3 to 1.

F_1

	P	P
w	Pw	Pw
w	Pw	Pw

F_2

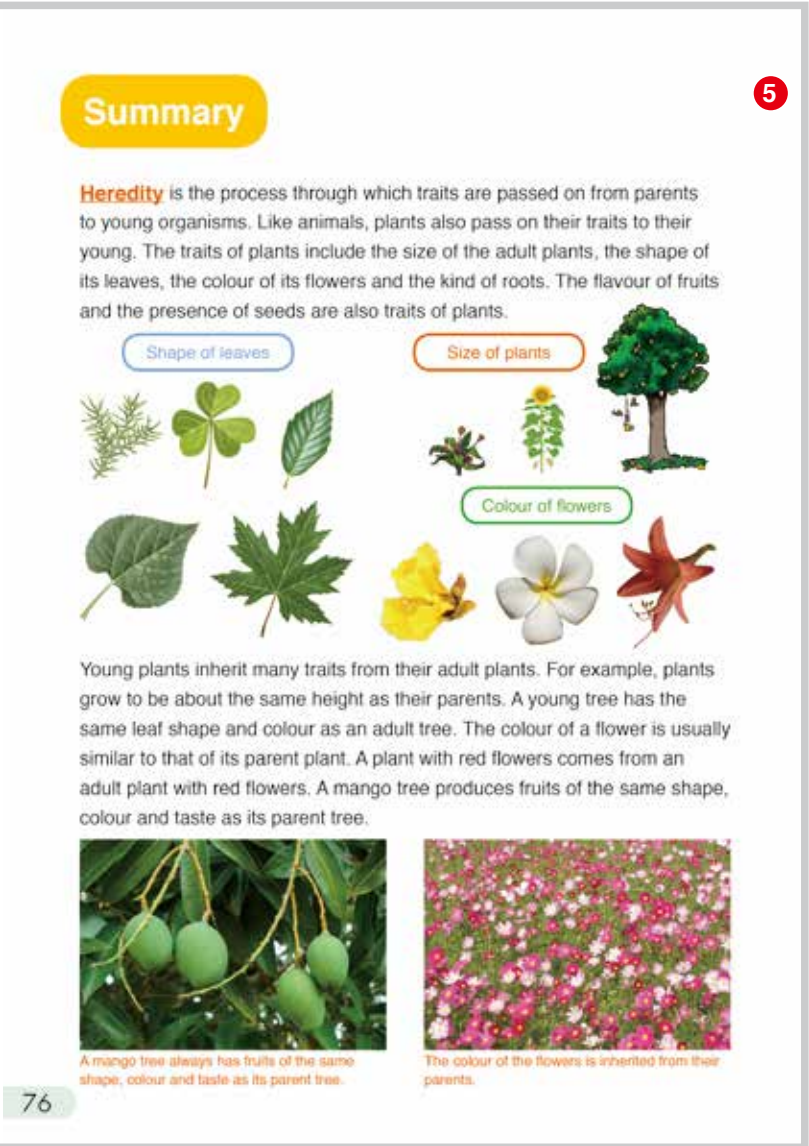
	P	w
P	PP	Pw
w	Pw	ww

Lesson Objectives

Students will be able to:
- Identify the similarities in the young and adult tomato plant
- Understand what traits plants inherit.
- Value others' effort and opinions.

Assessment

Students are able to:
- List the similarities of young and adult tomato plants through observation.
- State the different types of the traits of plants.
- Listen to other's responses on the traits of plants carefully.



Summary

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

Shape of leaves

Size of plants

Colour of flowers

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

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

The colour of the flowers is inherited from their parents.

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- Confirm the similarities between the young and the adult tomato plants with the students.
- **Based on their findings**, ask these questions as discussion points.

Q:What parts of an adult and young tomato plants are similar? (Leaf, stem, etc.)
Q:How are their leaves similar? (The shape, size, colour, smell, etc)
Q:How are their stems similar? (The shape, thickness, texture, colour, etc)
Q:When young tomato plants grow and become adults, what kinds of flowers and fruits do they produce? (Their flowers and fruits would be similar to the adults' flowers and fruits.)
Q:Can you guess what kinds of traits of plants are there? (The shape of leaves, size, colour, tastes of fruits, etc.)

- Conclude the discussions.

5 Summary (15 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 are young and adult tomato plants similar?
  Q: What types of the traits of plants are there?
  Q: Why don't tomato plants produce apples?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Heredity in Plants

Key question:
Do plants inherit the traits from their parents?

Activity:Traits of plants

Similarities between an adult and a young tomato plant
Leaf margin
Leaf blades
Leaf veins
Shape of stem, etc.

Discussion

Q:What body parts are adult and young tomato plants similar? Leaf, stem, etc.
Q:How are their leaves similar? The shape, size, colour, smell, etc.
Q:How are their stems similar? The shape, thickness, texture, colour, etc.
Q:When young tomato plants grow and become adults, what kinds of flowers and fruits do they make? Their flowers and fruits would be similar to the adults' flowers and fruits.
Q:Can you guess what kinds of traits of plants are there? The shape of leaves, size, colour, tastes of fruits, etc.

Summary

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

Unit: **Plants**	Chapter : **5. Reproduction and Heredity in Plants** Topic : **5.1. Reproduction and Heredity**	Total lesson No: 30 / 74 Textbook page: 77 - 79

Lesson 5 / 6

Lesson Title

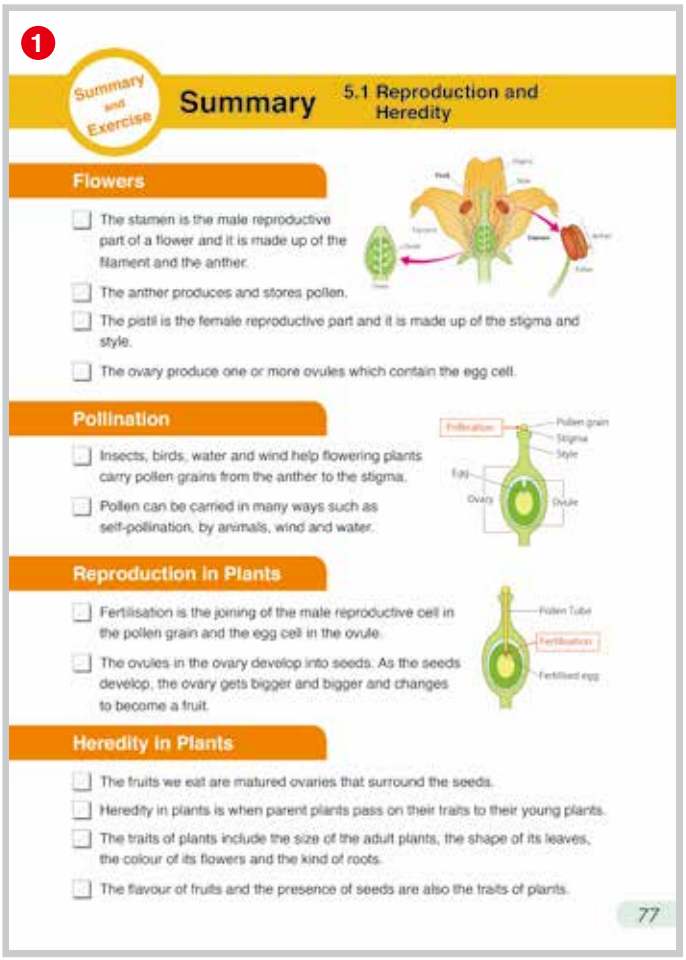
Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - How can we describe different parts of the male and the female parts of a flower?
  - How can we describe the ways in which the pollen grains move to the stigma of a flower?
  - What happens during fertilisation in plants?
- 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 5.1 Reproduction and Heredity

Flowers

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

Pollination

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

Reproduction in Plants

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

Heredity in Plants

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

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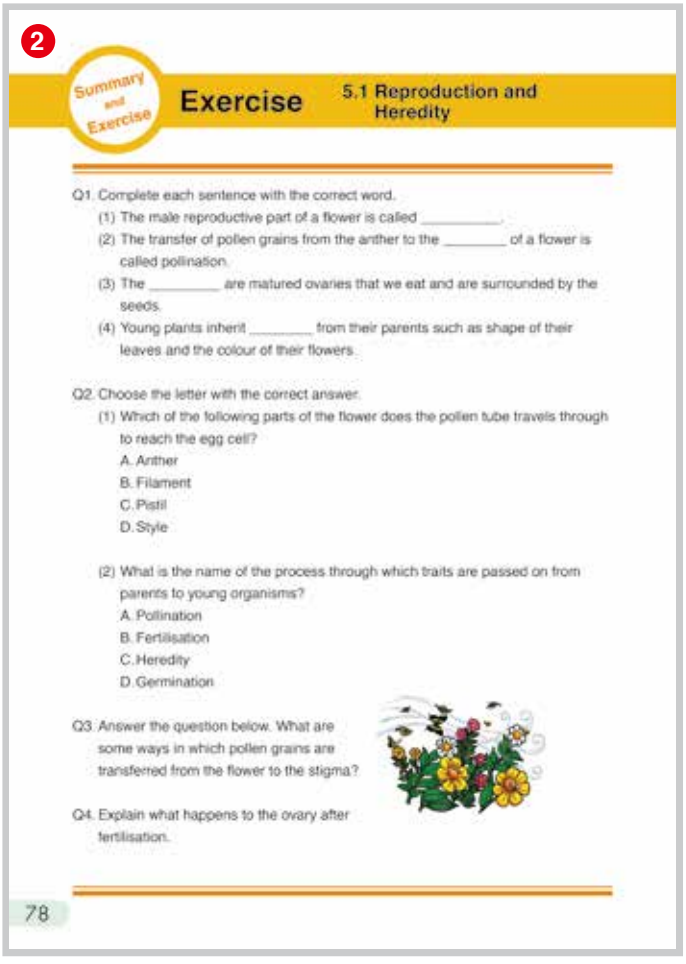
2 Exercise & Explanation (40 min.)

- 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 5.1 Reproduction and Heredity

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

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

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

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

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

Q4. Explain what happens to the ovary after fertilisation.

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Exercise answers

Q1.
(1) **stamen**
(2) **stigma**
(3) **fruits**
(4) **traits**

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

Q3. **wind, insect and animals**

Q4.Expected answers
The ovule in the ovary develops into the seed. As the seed develops, the ovary gets bigger and bigger and changes into a fruit.

Explanation of Science Extras

3 Science Extras (10 min.)

- Give opportunities to students to talk about how flowers are pollinated in the world.
- Allow students to think of ways in which vanilla flowers can be pollinated.

3

Chapter 5
•Science Extras•

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

In 1829 on the island of Reunion on the east of Madagascar, a 12 year slave boy by the name of Edmund Albius was the first to solve the botanical mystery by inventing a technique of pollination for the sterilised vanilla flower to produce fruits. His technique of hand-pollination is still being used to this day.
He observed that little bees were happily pollinating the plants everywhere, but here the bees were nowhere to be found near the vanilla flowers.

Fruits of vanilla plant

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

Flower of vanilla

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Lesson 6 / 6

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

5. Reproduction and Heredity in Plants

Q1 Complete each sentence with the correct word.

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

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

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

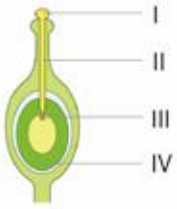
Q2 Choose the letter with the correct answer.

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

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

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

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



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

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

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

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

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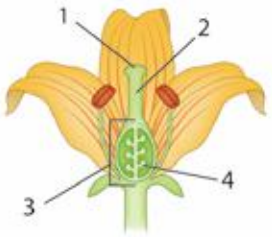
Q3

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



1. Stigma
2. Style
3. Ovary
4. Ovule

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

Pollen grains can be transferred by the wind.

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

Because the young plant inherits this trait from the parent plant.

Q4

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

(Expected answer) It is easily blown by the wind and increases the chance of pollination.

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

(Expected answer) The two plants are different kinds because their leaves are different. When they bear flowers, their flowers will be different.

Chapter 6. Star

Chapter Objectives

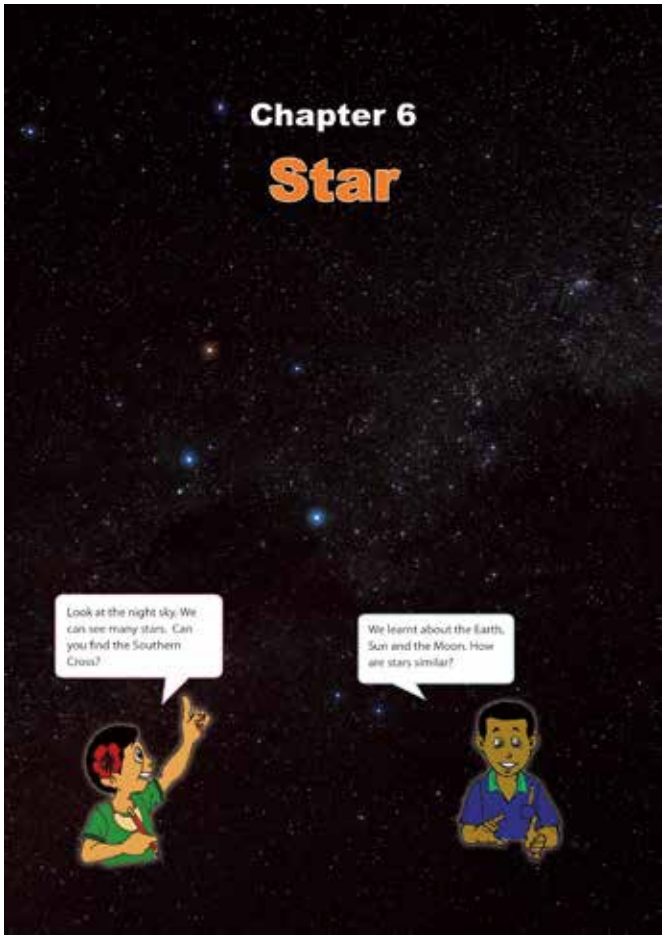
Students will be able to understand what a star is and the movements of stars in the sky.
Students will also be able to understand constellations as groups of stars that form a particular pattern in the sky which were used by people in ancient times and even today for navigation and agriculture.

Topic Objectives

6.1 Stars

Students will be able to;

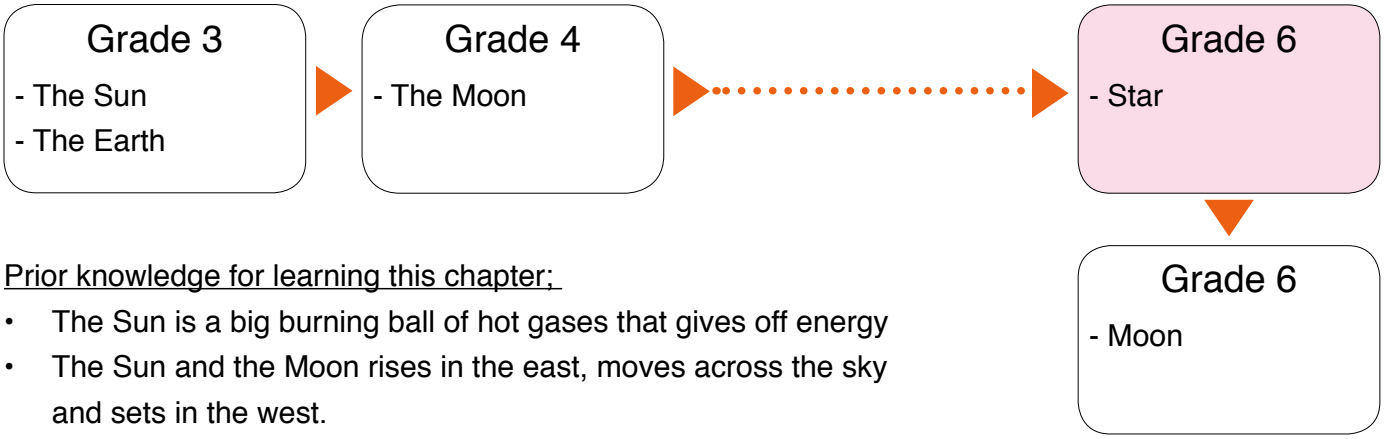
- Describe what a star is.
- Identify different types of stars by their colours, brightness and size.
- Identify that the stars seem to rise in the east, move across the sky and set in the west.
- Explain that the position of the stars in each constellation does not change because the stars actually do not move.
- Identify the groups of stars and their patterns in the sky.
- Infer each group of constellations, their meanings and how they are applied in real life situations.



This picture is from the chapter heading of the textbook showing stars that have different colours and brightness in the night sky. The southern cross is placed in the middle of the picture.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- The Sun is a big burning ball of hot gases that gives off energy
- The Sun and the Moon rises in the east, moves across the sky and sets in the west.

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
6.1 Stars	1	**Stars** What is a star?	6.3.3	83 - 84
	2	**Movement of Stars** How do stars move?		85 - 86
	3	**Constellations** What are constellations?		87 - 88
	4	Summary and Exercise, Science Extras		89 - 91
Chapter Test	5	Chapter Test		92 - 93

Unit: **Space**	Chapter : **6. Star** Topic : **6.1. Stars**	Total lesson No: 32 / 74 Textbook page: 83 - 84

Lesson 1 / 5

Lesson Title

Stars

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Based on students' experiences about the night sky, tell them that we can see many thousands of stars during the night.
- Motivate students to think about how stars look like, how big they are and how far they are from the earth (us).

2 Introduce the key question

What is a star?

3 Activity (35 min.)

- Explain the steps of the activity.
- Refer students to the picture and and the characters in the textbook.
- Have students do the activity and record their findings.
- Encourage students to classify the stars based on their ideas.
- Check student's activity and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask them 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.

(Continue)

Teacher's Notes

Tips of the Lesson

- Students are going to use the picture in the student textbook to do the activity.
- Guide students to classify the stars in terms of their colour, brightness, size and temperature.
- The table below shows the star colours and their temperatures.

Class	Colour	Temperature (K)
O	Blue	30 000-80 000
B	Blue-white	10 000 -30 000
A	White	7 500-10 000
F	White-Yellow	6 000-7 500
G	Yellow	5 000-6 000
K	Red Orange	3 500-5 000
M	Red	2 000-3 500

- Stars are classified with a letter depending on their surface temperature, as O, B, A, F, G, K or M. They are not in alphabetical order, stars with similar surface temperatures to our sun are classified as G whereas a much hotter star maybe classified as B or O
- Kelvin is a temperature scale that is often used in astronomy and space science. It is similar to the Celsius scale. The zero point in the Kelvin scale is defined as the coldest possible temperature, known as 'absolute zero' which is –273.15 °C. (Zero Kelvin is equivalent to -273.15 °C)

Lesson Objectives

Students will be able to:
- Understand what a star is.
- Identify the different types of stars.
- Investigate stars with interest.

Assessment

Students are able to:
- Explain the definition of a star.
- Classify stars based on their properties; colours, brightness and sizes.
- Show interest in learning about stars.

Summary

5

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

Colours

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

The colours and temperatures of stars

Brightness

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

Sirius in the constellation Canis Major

Size

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

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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 stars similar? (They shine.)
Q:How are stars different from the Moon? (The stars can shine by themselves but the Moon cannot.)
Q:What types of properties do stars have? (Colour, size, and brightness)
Q:How many colours of stars can you find? (It depends on students.)
Q:How can we classify stars? (Based on their colour, size, and brightness)

- Conclude the discussions

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask the following questions as assessment:
  Q: What is a star?
  Q: How can we classify stars?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Stars**

Key question: What is a star?

Activity:
How are stars similar and different?

Results:

How are they similar	How are they different
All stars are hot.	Colours
Some stars are similar in their colours, temperature and brightness	Stars are different in the amount of heat they produce. (temperature)
Shinning	Size
	Brightness

Discussion

Q: How are stars similar? They shine.
Q: How are stars different from the Moon? The stars can shine by themselves, but the Moon cannot shine.
Q: What types of properties do stars have? Colour, size, and brightness
Q: How many colours of stars can you find? It depends on students.
Q: Can you guess how we can classify stars? Based on their colour, size, and brightness

Summary

- A star is a giant ball of hot gases.
- It gives off light, heat, and other forms of energy.
- The sun is also a star.
- Stars can be classified by their colour, size, brightness and temperature.

Unit: **Space**	Chapter : **6. Star** Topic : **6.1. Stars**	Total lesson No: 33 / 74 Textbook page: 85 - 86

Lesson 2 / 5

Lesson Title

Movement of Stars

Preparation

exercise book, compass, pen and colour pencils

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson.

Q:What is a star?

Q:What are some similarities and differences of stars?

- Encourage students to think about how stars move like the sun.

2 Introduce the key question

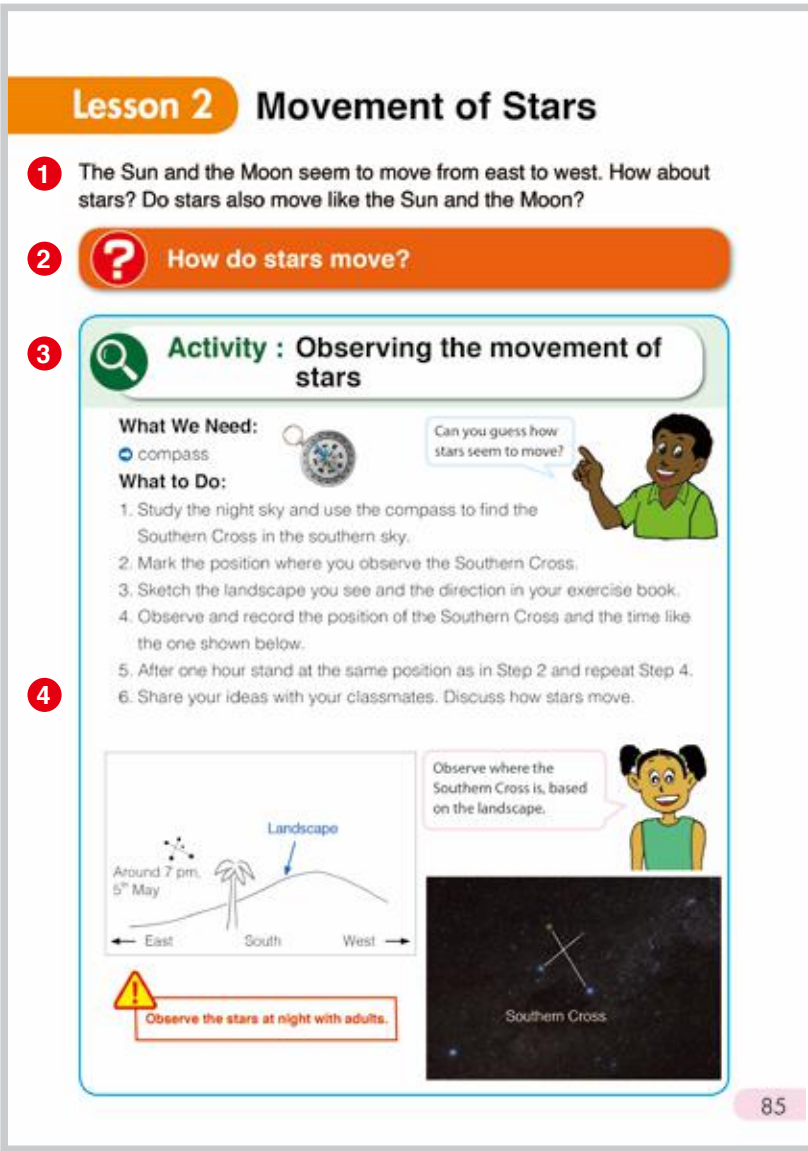
How do stars move?

3 Activity (35 min.)

- This activity should be done in the night when the sky is clear showing the stars with the assistance from adults.
- Explain the steps of the activity.
- Refer students to the character in the textbook to have their predictions of how stars move.
- Remind students to draw a landscape of their area before plotting in the movement. It makes students find the movement of stars easily.
- Southern Cross is one of the constellation that students can find easily. It can be found in the Southern sky.
- The observations should be done at hourly intervals at the same position. For example: 7:00 PM, 8:00 PM

STOP THE LESSON HERE.

(Discussion and Summary to be treated on the next day)



Lesson 2 Movement of Stars

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

2 How do stars move?

3 Activity : Observing the movement of stars

What We Need:
- compass

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

4

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Teacher's Notes

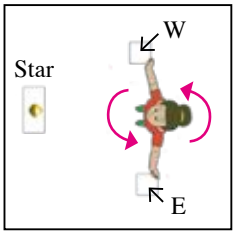
What direction do stars move in the sky?

The Sun, Moon and stars all appear to rise in the East and set in the West, because the Earth revolves on its axis in the opposite direction from West to East every 24 hours. The movement of the star we see are not the actual star movements. It is what we observe on the Earth as it moves towards the East while the stars and other celestial objects pass us overhead. While the Sun, Moon and stars travel from East to West direction, how we see them moving depends entirely on which direction we are facing at that time:

Facing North: Stars rotate counter-clockwise (right to left)
Facing South: Stars rotate clockwise (left to right)
Facing East: Stars rise in front, and set behind
Facing West: Stars rise behind, and set in front

Discover why the stars appear to rise and set

Follow these simple steps to learn what's really happening.



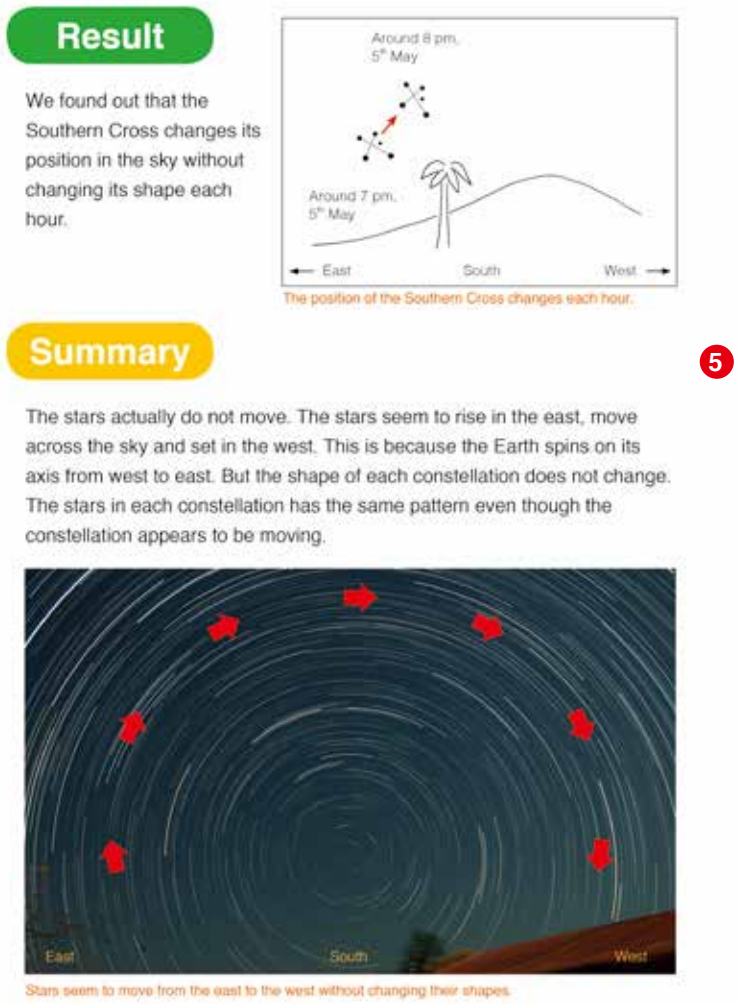
1. Write 'Star' on a paper and put it on a wall.
2. Write 'E' for east and 'W' for west on slip of paper
3. Ask a student to stand about 3 metres away, directly facing the 'Star'. The student represents 'Earth'.
4. Ask the student to keep turning around towards the east (anti-clockwise) slowly and to keep seeing the 'Star'.
5. This activity would help students to understand that the star appears to move from East to West because of the Earth's rotation.

Lesson Objectives

Students will be able to:
- Observe the movement of stars in the sky.
- Describe the movement of the stars by observating a the night sky.

Assessment

Students are able to:
- Sketch the position of the star as time passes by.
- Explain that stars seem to rise from the east, move across the sky and set in the west due to the Earth's rotation.
- Actively observe the movement of stars in the night.



Result

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

The position of the Southern Cross changes each hour.

Summary

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

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

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5

4 Discussion for findings (25 min.)

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

Q:How did the Southern Cross move in the sky? (It moved from east to west.)
Q:What happened to the shape of the Southern Cross as time went by? (The shape did not change, etc.
- Remind students of the movement of the Sun by asking:

Q:Does the Sun move or seem to move around the Earth? (It seems to move.)
Q:Why does the Sun seem to move? (It is because of the Earth's rotation.)
Q:Why do you think that stars move or seem to move? (It depends on students answers)
- Conclude the discussions.

5 Summary (15 min.)

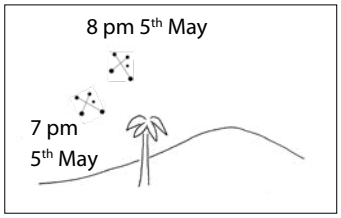
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: How do stars move?
  Q: Stars do not move, but they appear to move from east to west. Why?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Movement of Stars

Key question: How do stars move?
Activity: Observing the movement of stars.
(An example)



Discussion
Q: How did the Southern Cross move in the sky? It moved from east to west.
Q: What happened to the shape of the Southern Cross as time went by?
The shape did not change, etc.
Q: Does the Sun move or seem to move around the Earth?
It seems to move.
Q: Why does the Sun seem to move?
It is because of Earth's rotation.
Q: Why do you think that stars move or seem to move?
It depends on students.

Summary
- Stars do not move, but they appear to move from east to west.
- The shape of each constellation does not change.
- The position of the constellation change as time when by because the earth is rotating on is axis from west to east.

Unit: **Space**	Chapter : **6. Star** Topic : **6.1. Stars**	Total lesson No: 34 / 74 Textbook page: 87 - 88

Lesson 3 / 5

Lesson Title

Constellations

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review previous lesson. Ask:

Q:How do stars move?

Q:Stars do not move, but they appear to move from east to west. Why?

- Motivate students to think about group of stars seen in the night and ask:

Q:Have you seen a group of stars that look like objects or animals?

2 Introduce the key question

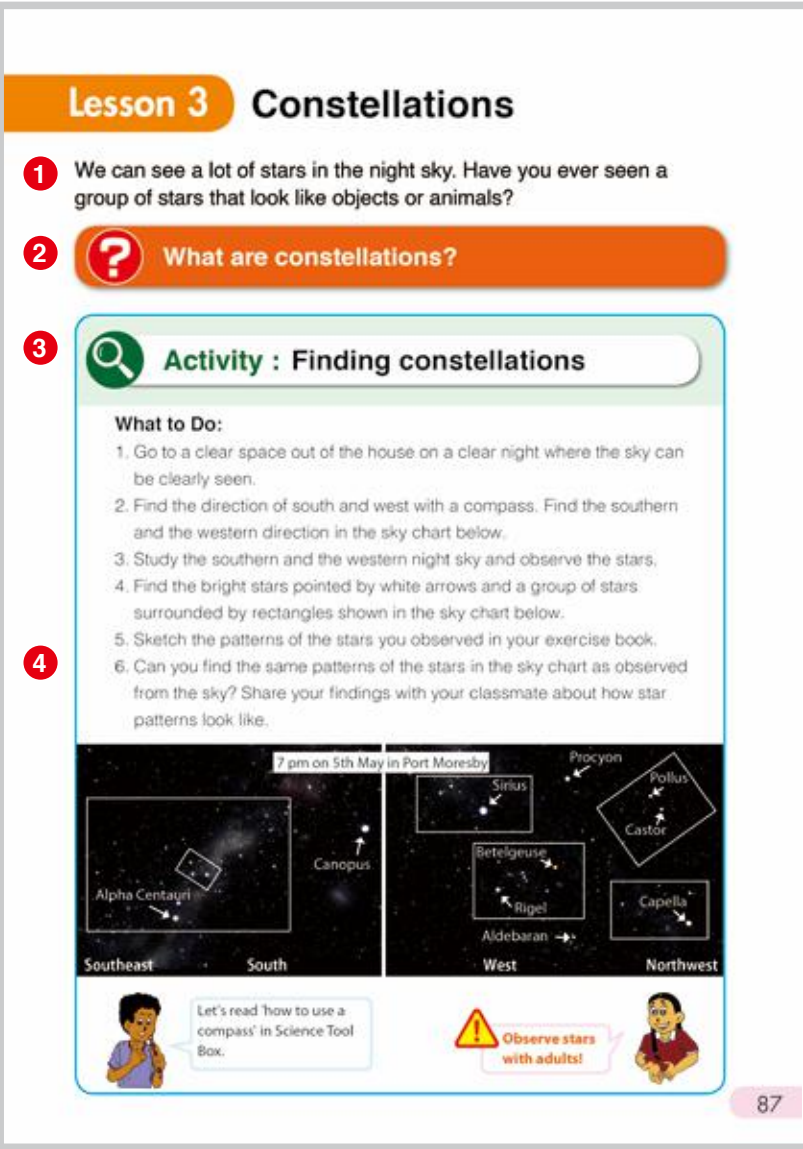
What are constellations?

3 Activity (35 min.)

- This activity should be done individually.
- Explain the steps of the activity.
- Advise the students to carry out the observation with an adult.
- As a guide, refer students to the characters below the pictures of the patterns of stars for their investigation.
- Ask the students to draw patterns of the star they find in the night sky.

STOP THE LESSON HERE.

(Discussion and Summary to be treated on the next day)



Lesson 3 Constellations

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

2 What are constellations?

3 Activity : Finding constellations

What to Do:

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

4

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Teacher's Notes

- The months of April and May are better for observing the stars because 7 out of the 9 constellations can be observed at once. (See the table below)

Rank	Name of star	Constellation belong to (Meaning)
1	Sirius	Canis Major (A greater dog)
2	Canopus	Carina (Keel of a ship)
3	Alpha Centauri	Centaurus (Half human, half horse)
6	Capella	Auriga (A charioteer)
7	Rigel	Orion (A hunter in Greek)
8	Procyon	Canis Minor (A lesser dog)
9	Betelgeuse	Orion (A hunter in Greek)

- The grouping of 88 constellations is the manner in modern astronomy based on the asterisms of Greek and Roman mythology. However, there are other types of grouping. For instance, the area connected Sirius, Begelgeuse and Procyon is known as a 'Big Triangle'. Charioteer (Auriga) is called 'Pentagon' in some countries.

NOTE: Refer to the table above and identify two constellations that cannot be seen in the months of April and May.

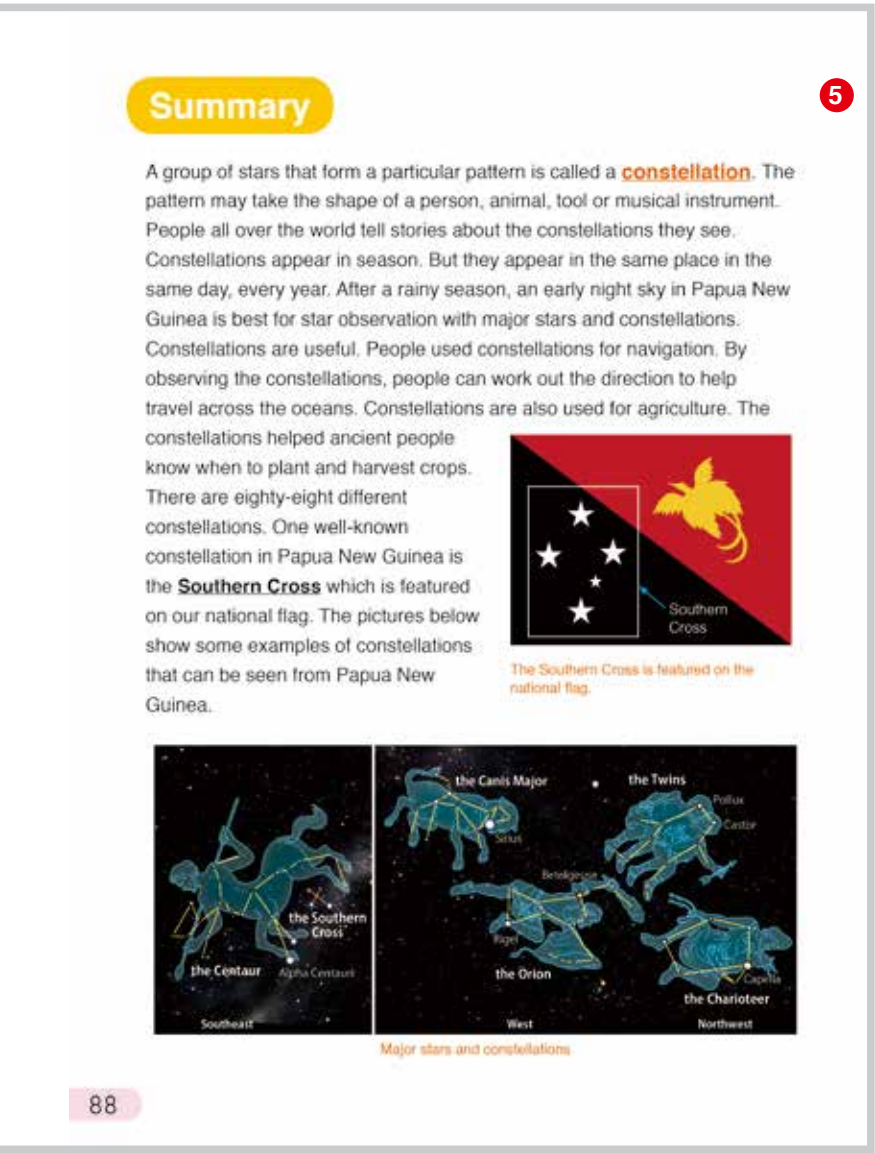
- If the moon appears on the day to observe, change the date to a few days later as moon rise delays 50 min every day.
- Discussion and summary are to be done the next day after the observation in the night.
- Keep a record of the observation to cross check with the students result.

Lesson Objectives

Students will be able to:
- Understand what a constellation is.
- Observe the constellations in the night sky.
- Investigate the constellations positively.

Assessment

Students are able to:
- Explain the meaning and the uses of a constellation.
- Sketch the different patterns of stars seen in the night sky.
- Show- keeness to find out different types of constellations.



Summary

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

The Southern Cross is featured on the national flag.

Major stars and constellations

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5

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.
- Display their observations on the blackboard.
- Facilitate active students' discussions.
- **Based on their findings**, ask the following questions as discussion points.

Q:Which pattern of stars that you have drawn is found on our national flag? (The one with the cross pattern/ Southern Cross)

Q:In which direction did you observe the Southern Cross? (In the southern sky.)

Q:Why do you think the Southern Cross is useful? (It is useful to find the direction or for navigation.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask the following questions as assessment:
  Q: What do we called the group of stars seen in sky at night that forms specific patterns?
  Q: How many constellations are there altogether?
- Ask students to copy the notes on the blackboard into their exercise books.

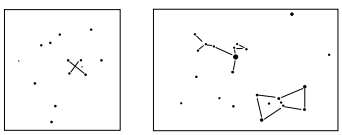
Sample Blackboard Plan

Title:

Constellations

Key question:
What are constellations?
Activity: Finding constellations

Find a group of stars and draw the pattern.
(An example)



South West

Discussion

Q: Which pattern of stars that you have drawn is found on our national flag?The one with the cross pattern/ Southern Cross.

Q: In which direction did you observe the Southern Cross? In the southern sky.

Q: Why do you think the Southern Cross is useful? It is useful for navigation.

Summary

- A constellation is a group of stars that forms a particular pattern.
- There are 88 different constellations.
- One of the well- known constellations in Papua New Guinea is the Southern Cross.
- Constellations are useful:

1. People used constellation for navigation.
2. Constellations are also used for agriculture.

Unit: **Space**	Chapter : **6. Star** Topic : **6.1. Stars**	Total lesson No: 35 / 74 Textbook page: 89 - 91

Lesson 4 / 5

Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - What are some properties of stars?
  - How do stars seem to move?
  - What is a constellation?
- 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 6.1 Stars

Stars

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

The colours and temperatures of stars

Movement of Stars

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

Constellation

- ☐ Constellation is a group of stars that form a particular pattern in the sky.
- ☐ The pattern appears in the shape of a person, animal, tool or musical instrument.
- ☐ There are eighty-eight different constellations which are very useful to people for navigation and agriculture.
- ☐ Southern Cross is a well-known constellation seen in a Papua New Guinea night sky. Hence, it is featured on the national flag.

The Southern Cross on the national flag

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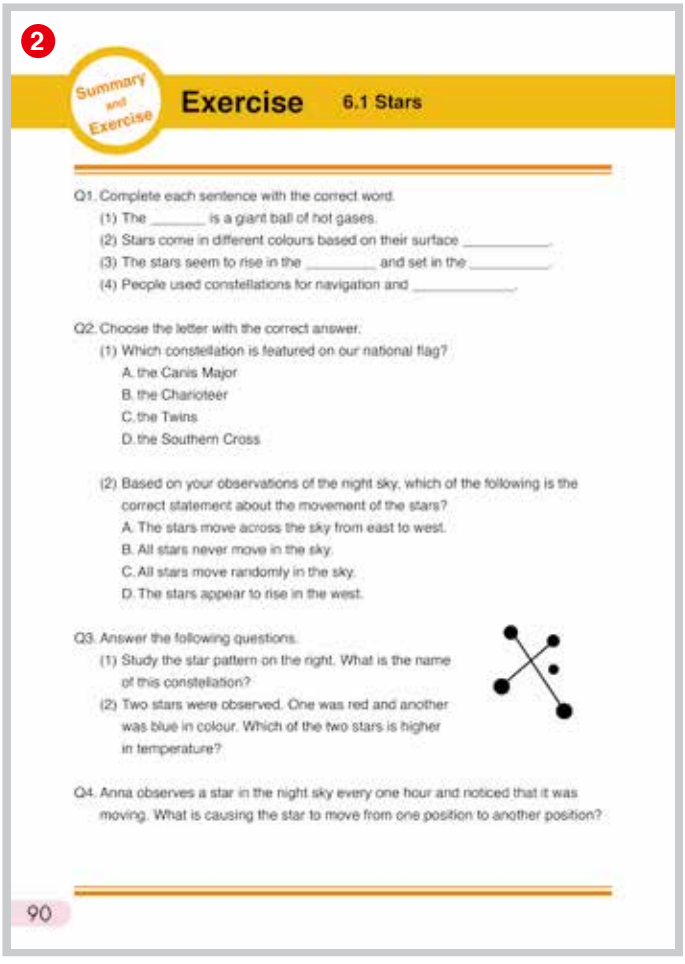
2 Exercise & Explanation (40 min.)

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



2

Summary and Exercise

Exercise 6.1 Stars

Q1. Complete each sentence with the correct word.
(1) The _____ is a giant ball of hot gases.
(2) Stars come in different colours based on their surface _____.
(3) The stars seem to rise in the _____ and set in the _____.
(4) People used constellations for navigation and _____.

Q2. Choose the letter with the correct answer.
(1) Which constellation is featured on our national flag?
A. the Canis Major
B. the Charioteer
C. the Twins
D. the Southern Cross

(2) Based on your observations of the night sky, which of the following is the correct statement about the movement of the stars?
A. The stars move across the sky from east to west.
B. All stars never move in the sky.
C. All stars move randomly in the sky.
D. The stars appear to rise in the west.

Q3. Answer the following questions.
(1) Study the star pattern on the right. What is the name of this constellation?
(2) Two stars were observed. One was red and another was blue in colour. Which of the two stars is higher in temperature?

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

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Exercise answers

Q1.
(1) **star**
(2) **temperature**
(3) East, West
(4) **agriculture**

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

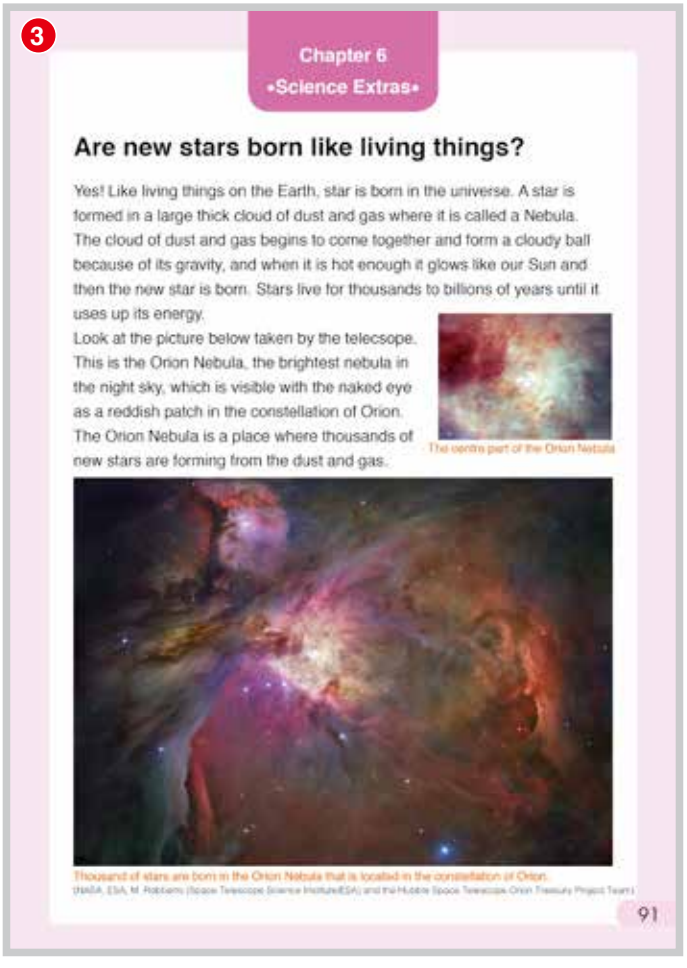
Q3.
(1) Southern Cross
(2) The blue star has the higher temperature.

Q4.
This occurs as a result of the Earth's spinning on its axis.

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 6
•Science Extras•

Are new stars born like living things?

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

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

The centre part of the Orion Nebula

Thousand of stars are born in the Orion Nebula that is located in the constellation of Orion.

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Unit: **Space**	Chapter : **6. Star** Topic : **6.1. Stars**	Total lesson No: 36 / 74 Textbook page: 92 - 93

Lesson 5 / 5

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

6. Star

Q1 Complete each sentence with the correct word.

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

(2) Hot stars are white (Blue-white) or blue.

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

(4) There are 88 different constellations in the sky.

Q2 Choose the letter with the correct answer.

(1) What is a constellation?

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

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

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

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

(2) Why do stars come in different colours?

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

B. Because they have different temperatures.

C. Because of their distance from the Earth.

D. Because of their sizes.

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

A. the Twins

B. the Orion

C. the Canis Major

D. the Southern Cross

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

A. Alpha Centauri

B. Canopus

C. Rigel

D. Sirius

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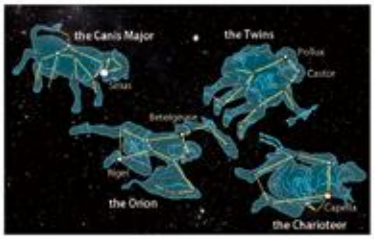
Q3

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

It is helpful to people for navigation and agriculture purposes.

(2) In which constellation does Sirius belong to?

Canis Major



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

The white and blue stars are hotter than the orange and red stars.

Q4

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

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

(Expectied answer) This is because the Earth spins on its axis. The actual positions of stars in the space do not change.

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

(Expected answer) The Sun, Moon and the stars all appear to rise in the east, move across the sky and set in the west.

Chapter 7. Energy

Chapter Objectives

Students will be able to understand kinetic, gravitational potential energy and chemical energy. Students will also be able to understand the different forms of energy and how they can be changed from one form to another.

Topic Objectives

7.1. Forms and Uses of Energy

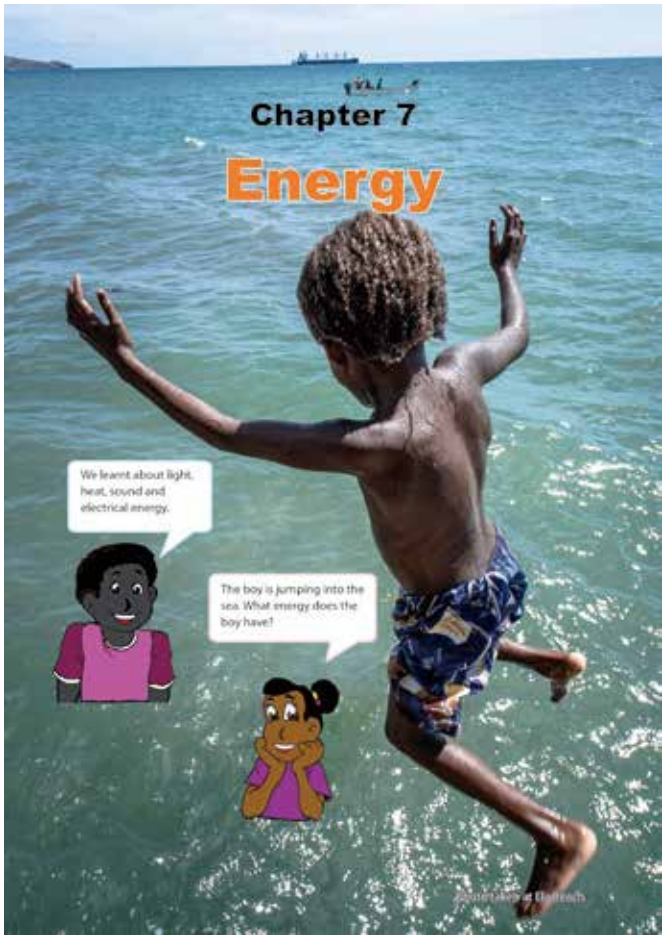
Students will be able to;

- State that kinetic energy is the energy of an object in motion.
- State that gravitational potential energy is the energy stored in an object at rest.
- Explain that chemical energy is a form of potential energy stored in foods, batteries and fuels.
- Describe different forms of energy used in daily situations.

7.2. Energy Conversion

Students will be able to;

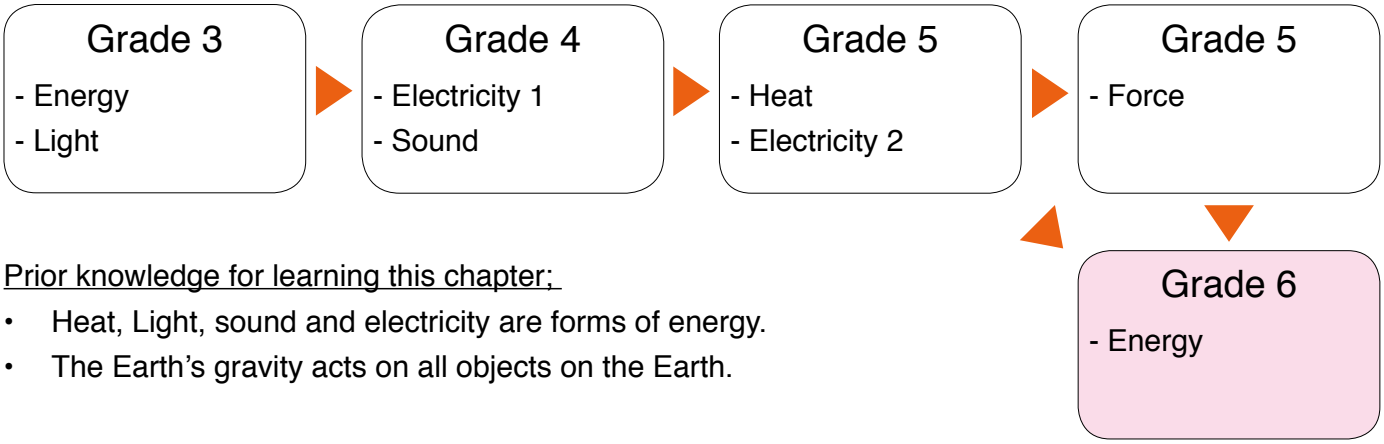
- Describe the gravitational potential energy in the marble is changed to kinetic energy and back to gravitational potential energy.
- Explain that energy exist in many forms and can be changed from one form to another.



This picture is from the chapter heading of the textbook showing the boy jumping into the sea due to the gravitational force by the Earth.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Heat, Light, sound and electricity are forms of energy.
- The Earth's gravity acts on all objects on the Earth.

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
7.1 Forms and Uses of Energy	1	**Kinetic Energy** What form of energy does a moving object have?	6.2.1	95 - 96
	2	**Potential Energy 1: Gravitational Potential Energy** What form of energy is stored in an object at rest?		97 - 98
	3	**Potential Energy 2: Chemical Energy** What different forms of energy are stored in an object?		99 - 100
	4	**Forms of Energy** What situations do the different forms of energy exist in?		101 - 102
	5	Summary and Exercise		103 - 104
7.2 Energy Conversion	6	**Relationship between Kinetic and Gravitational Potential Energy** What is the relationship between kinetic and potential energy?		105 - 106
	7	**Change in Forms of Energy in Daily Life** How does energy change form?		107 - 108
	8	Summary and Exercise, Science Extras		109 - 111
Chapter Test	9	Chapter Test		112 - 113

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.1. Forms and Uses of Energy**	Total lesson No: 37 / 74 Textbook page: 95 - 96

Lesson 1 / 9

Lesson Title

Kinetic Energy

Preparation

bottles of water, ball

Lesson Flow

1 Introduction (5 min.)

- Review the learnt content on energy. Ask:

Q:What kinds of energy do you know?

(Heat, light, sound, electrical and chemical energy)

- Encourage the students to think about whether a moving object has energy.

2 Introduce the key question

What form of energy does a moving object have?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask the students to conduct the activity and record their results in the table.
- Check each group during activity by asking:

Q:Which speed of the ball knocked down more bottles?

- Ask students to discuss their results in their groups.

4 Discussion for findings (25 min.)

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

(Continue)

Teacher's Notes

- Energy is the ability to do work. Energy can change and move things. Electricity, sound, light, heat, chemical and magnetism are forms of energy and they have been learnt in Grades 3, 4, 5 and 6.
- Kinetic energy is a new terminology, however, the concept to be taught here is similar to 'force and gravity' in Chapter 3.

Tips of the Activity

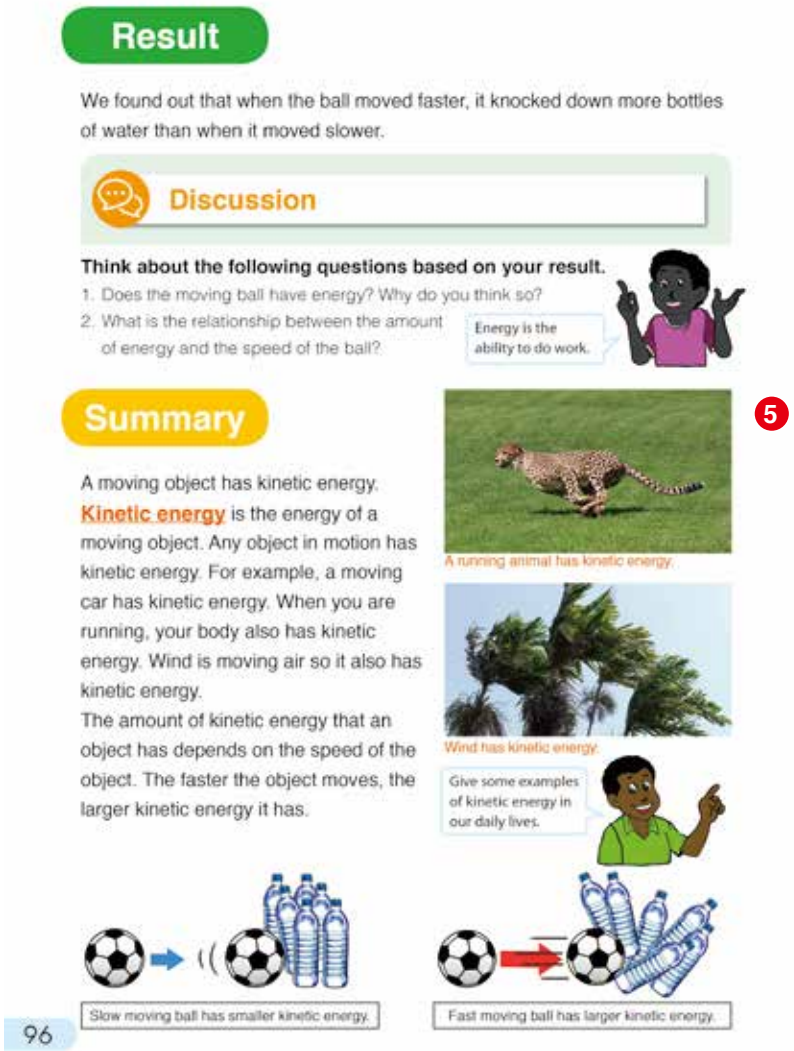
- For this lesson a straight or flat surface is required to conduct an activity in-order for the students to observe the effect of different speeds of the ball on the pet bottles with water.
- Prepare a regular size ball; soccer or basketball and six plastic bottles filled with water to the brim.
  1. Place the water filled plastic bottles in rows as show in the textbook.
  2. Mark a distance of 5-6 meters from the pet bottles.
  3. To roll the ball, aim for the center of the lined pet bottles of water.
  4. Bend one knee towards the ground for the hand to be closer to the ground/floor to roll the ball.
  5. The rolled ball should roll on the ground/floor from the starting point towards the center of the lined pet bottles. It is like playing the 'lawn bowling'.
- Another name for plastic bottle is 'PET Bottle'. PET stands for polyethylene terephthalate. It is a form of polyester that is moulded into plastic bottles and containers for packaging foods and beverages.

Lesson Objectives

Students will be able to:
- Explain what kinetic energy is.
- Describe the relationship between the amount of energy and speed of an object in motion.
- Express the results of their experiments.

Assessment

Students are able to:
- State that kinetic energy is the energy of an object in motion.
- Demonstrate the amount of energy exerted by the number of fallen containers in a slow and fast rolling ball.
- Explain confidently their findings about kinetic energy.



Result

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

Discussion

Think about the following questions based on your result.

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

Energy is the ability to do work.

Summary

A moving object has kinetic energy. Kinetic energy is the energy of a moving object. Any object in motion has kinetic energy. For example, a moving car has kinetic energy. When you are running, your body also has kinetic energy. Wind is moving air so it also has kinetic energy.
The amount of kinetic energy that an object has depends on the speed of the object. The faster the object moves, the larger kinetic energy it has.

A running animal has kinetic energy.

Wind has kinetic energy.

Give some examples of kinetic energy in our daily lives.

Slow moving ball has smaller kinetic energy.

Fast moving ball has larger kinetic energy.

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

Q:What is energy? (Energy is an ability to do work.)
Q:Does the rolling ball have energy? (Yes, the rolling ball has energy.)
Q:Why do you think so? (The rolling ball was able to knock down the bottles of water.)
Q:What is the relationship between the amount of energy and the speed of ball?(The faster a ball moves, the more the amount of energy there is. The slower a ball moves, the less the amount of energy there is.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard
- Ask these questions as assessmet:
  Q: What is kinetic energy?
  Q: What does the amount of kinetic energy of an object depend on?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Kinetic Energy

Key question:
What form of energy does a moving object have?
Activity: Knocking down bottles of water

	Number of bottles knocked down		
Speed of ball	1st	2st	3st
Slow	2	1	3
Fast	5	4	4

Discussion
Q: What is energy?
Energy is an ability to do work.
Q: Does the rolling ball have energy?
Yes, the rolling ball has energy.
Q: Why do you think so?
The rolling ball was able to knock down the bottles of water.
Q: What is the relationship between the amount of energy and the speed of ball?
The faster a ball moves, the more the amount of energy there is. The slower a ball moves, the less the amount of energy there is.

Summary
- Kinetic energy is the energy of a moving object. A moving object has kinetic energy.
- The amount of energy in the moving object depends on the speed of the moving object.
- The faster the object moves the large kinetic it has.

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.1. Forms and Uses of Energy**	Total lesson No: 38 / 74 Textbook page: 97 - 98

Lesson 2 / 9

Lesson Title

Potential Energy 1: Gravitational Potential Energy

Preparation

bottles of water, tray, sand, ruler

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson. Ask:

Q:What is kinetic energy?

Q:What does the amount of kinetic energy of an object depend on?

- Encourage the students to think about whether an object at rest has energy.

Q:Does an object on a desk also have any energy when it is at rest?

2 Introduce the key question

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

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask the students to conduct the activity and record their results.
- Check each group during activity by asking:

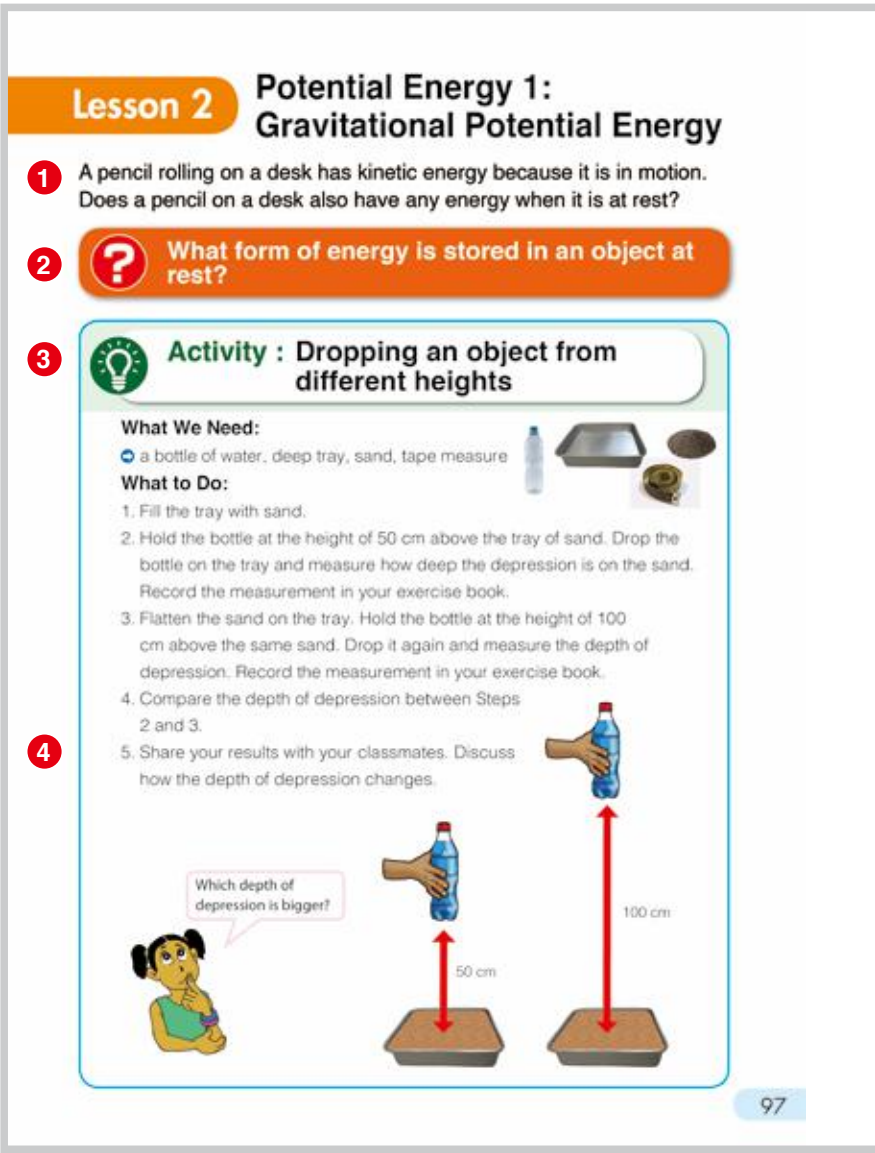
Q:Which height of the bottle made a big depression in the sand?

- Ask students to discuss their results in their groups.

4 Discussion for findings (25 min.)

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

(Continue)


Lesson 2 Potential Energy 1: Gravitational Potential Energy

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

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

3 Activity : Dropping an object from different heights

What We Need:
a bottle of water, deep tray, sand, tape measure

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

4

Which depth of depression is bigger?

50 cm

100 cm

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Teacher's Notes

- Even if an object remains in the same position and seems to be doing nothing, it has a potential to work because of its position or stresses within itself, its electric charge, or other factors. We call such energy 'Potential energy'.
- Common potential energy includes the gravitational potential energy of an object that depends on its mass and its distance from another object, the elastic potential energy of an extended spring, chemical energy stored in chemical substances and the electric potential energy of an electric charge in an electric field.
- Chemical potential energy is taught in the next lesson.

Tips of the Activity

Allow students to measure in their own way for the first test then demonstrate a better way to measure the depression.

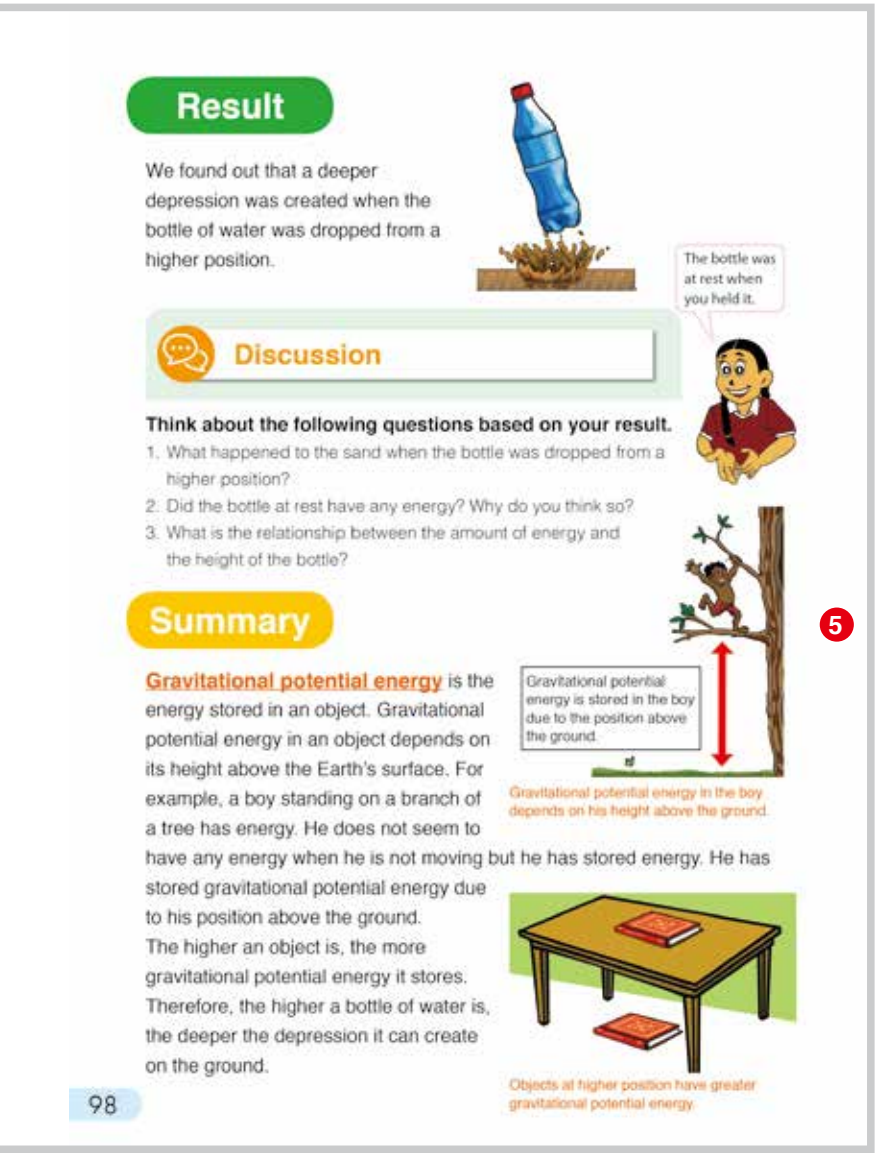
1. Height of the drop must be taken from the surface of the sand upward with a metre ruler.
2. The pet bottle of water must be positioned above the assumed center of the sand it will fall on before the drop.
3. Measure the depression or depth created by the fall. Use the tape measure by placing the starting end of the tape measure in the lowest part of the depression.
4. Take a straight ruler (30 cm) and place it behind the tape measure. Slide the straight ruler (30 cm) down just touching the surfacing of the sand before taking and recording the measurement of the depression.

Lesson Objectives

Students will be able to:
- Understand what gravitational potential energy is.
- Describe the relationship between the amount of energy and height of an object.
- Express the results of their experiments.

Assessment

Students are able to:
- State that gravitational potential energy is the energy stored in an object.
- Explain how gravitational potential energy in an object depends on its height above the Earth's surface.
- Explain confidently their results about potential energy.



Result

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

The bottle was at rest when you held it.

Discussion

Think about the following questions based on your result.

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

Summary

Gravitational potential energy is the energy stored in an object. Gravitational potential energy in an object depends on its height above the Earth's surface. For example, a boy standing on a branch of a tree has energy. He does not seem to have any energy when he is not moving but he has stored energy. He has stored gravitational potential energy due to his position above the ground. The higher an object is, the more gravitational potential energy it stores. Therefore, the higher a bottle of water is, the deeper the depression it can create on the ground.

Gravitational potential energy is stored in the boy due to the position above the ground.

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

Objects at higher position have greater gravitational potential energy.

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

Q:What happened to the sand when the bottle was dropped from a high position? (It made a deeper depression in the sand.)

Q:Did the bottle at rest have any energy? (Yes, it had energy.)

Q:Why do you think so? (The bottle at rest was able to create the depression on the ground.)

Q:What is the relationship between the amount of energy and the height of the bottle? (The higher the bottle was positioned, the more the amount of energy is. The lower the bottle was positioned, the less energy it had.)

- Conclude the discussions.

5 Summary (15 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 gravitational potential energy?
  Q: What is the relationship between the amount of energy and the height of an object?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Gravitational Potential Energy

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

Activity:
Dropping an object from different heights

Example:
Bottle drop at the height of 50 cm created a depression depth of _____ cm.
Bottle dropped at the height of 100 cm created a depression depth of _____ cm.

Discussion
Q: What happened to the sand when the bottle was dropped from a high position?
It made a deeper depression in the sand.
Q: Did the bottle at rest have any energy?
Yes, it had energy.
Q: Why do you think so?
The bottle at rest was able to create the depression on the ground.
Q: What is the relationship between the amount of energy and the height of the bottle?
The higher the bottle was positioned, the more the amount of energy is. The lower the bottle was positioned, the less energy it had.

Summary
- Gravitational Potential energy is the energy stored in an object.
- Gravitational Potential energy in an object depends on its height above the Earth's surface.
- The higher the object is the more gravitational potential it has.

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.1. Forms and Uses of Energy**	Total lesson No: 39 / 74 Textbook page: 99 - 100

Lesson 3 / 9

Lesson Title

Potential Energy 2: Chemical Energy

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson. Ask:

Q:What is gravitational potential energy?

Q:What is the relationship between the amount of energy and the height of an object?

- Encourage the students to think about the form of energy that is stored in food and wood.

Q:What form of energy is stored in food or wood?

2 Introduce the key question

What different forms of energy are stored in objects?

3 Activity (35 min.)

- Explain the steps of the activity.
- Ask the students to conduct the activity and record their findings in the table.
- Check each group during the activity by asking:

Q:What are the sources of energy?

- 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.
- Facilitate active students' discussions.
- Confirm the findings with the students.

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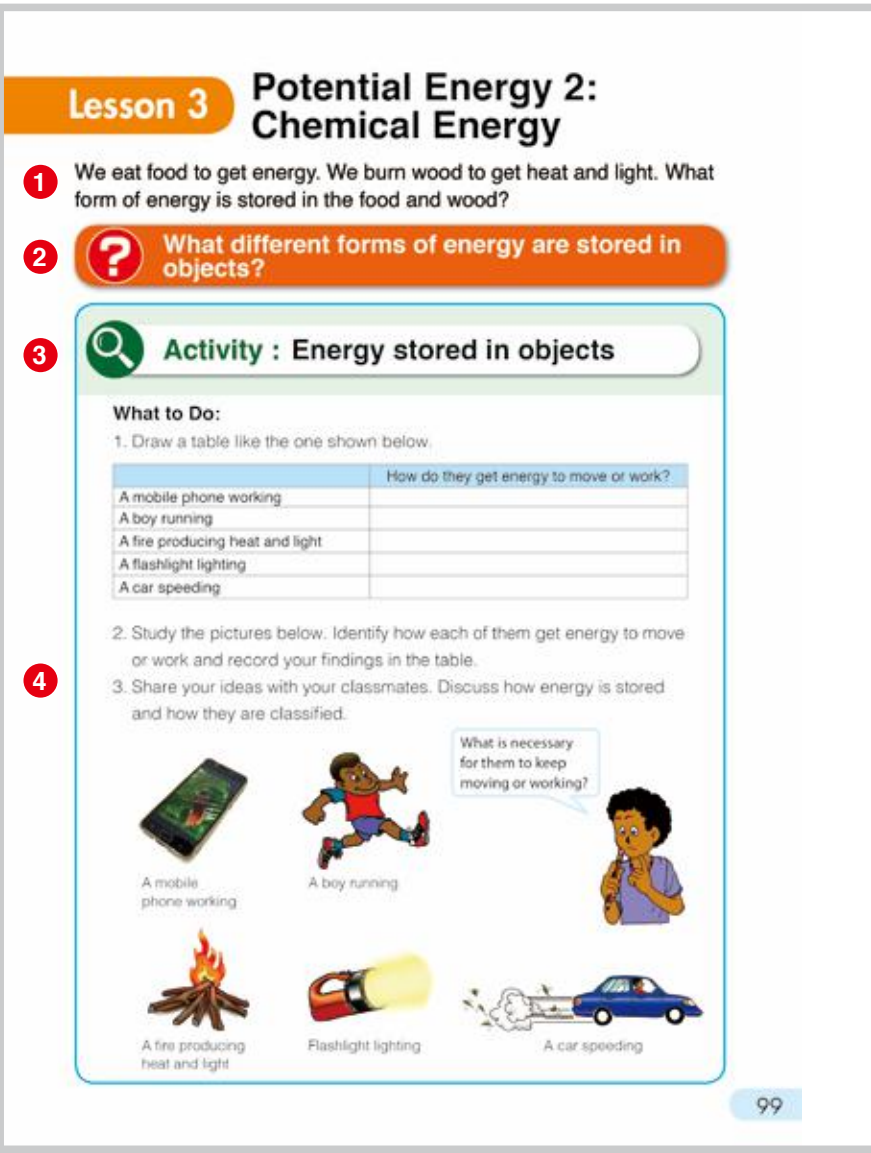

Lesson 3 Potential Energy 2: Chemical Energy

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

2 What different forms of energy are stored in objects?

3 Activity : Energy stored in objects

What to Do:

1. Draw a table like the one shown below.

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

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

4

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Teacher's Notes

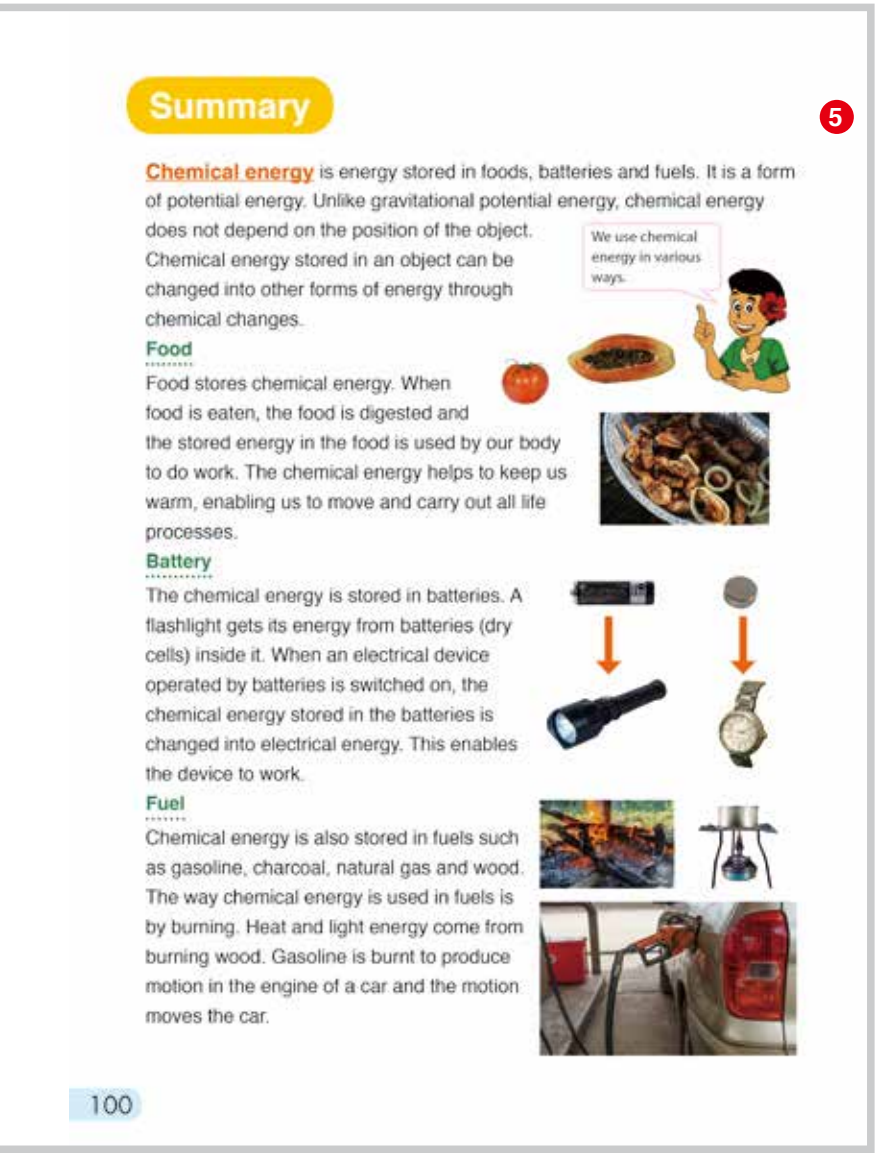
- Chemical energy is a type of potential energy in any form of matter that is considered to be used as food, battery and fuel. These chemical substances have a potential to work.
- Chemical energy can be observed and measured only when a chemical reaction occurs. It is released when a chemical reaction takes place between two or more substances. The energy that is released from the chemical reaction is often in a form of heat and light or converted to other forms of energy.
- Example:
  1. Battery: Chemical reaction in a dry cell (battery) releases energy as electricity which is converted to light energy in a torch.
  2. Food: Digestion of food is a chemical reaction that mainly converts heat energy used by the cells in our body.
  3. Fuel: Petroleum products such as kerosene or diesel can be burned to release light and heat energy. (Many daily items and activities involve chemical energy that is converted into other forms of energy.)
  4. Photosynthesis: Plants converts light energy into chemical energy that can later be released to fuel the organisms.

Lesson Objectives

Students will be able to:
- Understand what a chemical energy is.
- Identify how chemical energy can be changed into other forms of energy.

Assessment

Students are able to:
- Explain that chemical energy is a form of potential energy stored in foods, batteries and fuels.
- Describe the examples of how chemical energy changes into other forms of energy in daily life.



Summary

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

We use chemical energy in various ways.

Food

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

Battery

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

Fuel

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

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

Q: What forms of energy do the pictures describe? (A mobile phone: sound and light energy, A boy: kinetic energy, A firewood: light and heat energy, A flashlight: light energy, A moving car: kinetic energy.)

Q: What are the sources of energy in the pictures? (Battery, foods, wood, fuel)

- Explain what a chemical energy is, and ask the question:

Q: How does chemical energy change its form? (It changes into kinetic, sound, light and heat energy.)

- Conclude the discussions.

5 Summary (15 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 chemical energy?
  Q: How does chemical energy change into other forms of energy?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Chemical Energy

Key question : What different forms of energy are stored in objects?

Activity: Energy stored in objects

	How do they get energy to move or work?
A mobile phone	Battery
A boy running	Food
A fire	Wood
A flashlight	Battery
A car	Fuel

Discussion

Q: What forms of energy do the pictures describe?
A mobile phone: sound and light energy, A boy: kinetic energy, A firewood: light and heat energy, A flashlight: light energy, A moving car: kinetic energy.

Q: What are the sources of energy in the pictures? Battery, foods, wood, fuel

Q: How does chemical energy change its form? It changes into kinetic, sound, light and heat energy.

Summary

- Chemical Energy is form of potential energy stored in an object such as food, battery and fuel.
- Through chemical change, chemical energy stored in objects can be changed into other forms of energy such as light, sound, heat and kinetic energy.

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.1. Forms and Uses of Energy**	Total lesson No: 40 / 74 Textbook page: 101 - 102

Lesson 4 / 9

Lesson Title

Forms of Energy

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson. Ask:

Q:What is chemical energy?

Q:How does chemical energy change into other forms of energy?

- Encourage the students to think about the forms of energy in daily life.

Q:Can you identify what forms of energy can be found in our daily lives?

2 Introduce the key question

What situations do the different forms of energy exist in?

3 Activity (35 min.)

- Explain the steps of the activity.
- Ask the students to conduct the activity and record their findings in the table
- Check each group during activity by asking:

Q:Do you remember what characteristics each form of energy has?

- Give enough time for students to do their findings.
- Ask students to discuss their findings with their groups.

4 Discussion for findings (25 min.)

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

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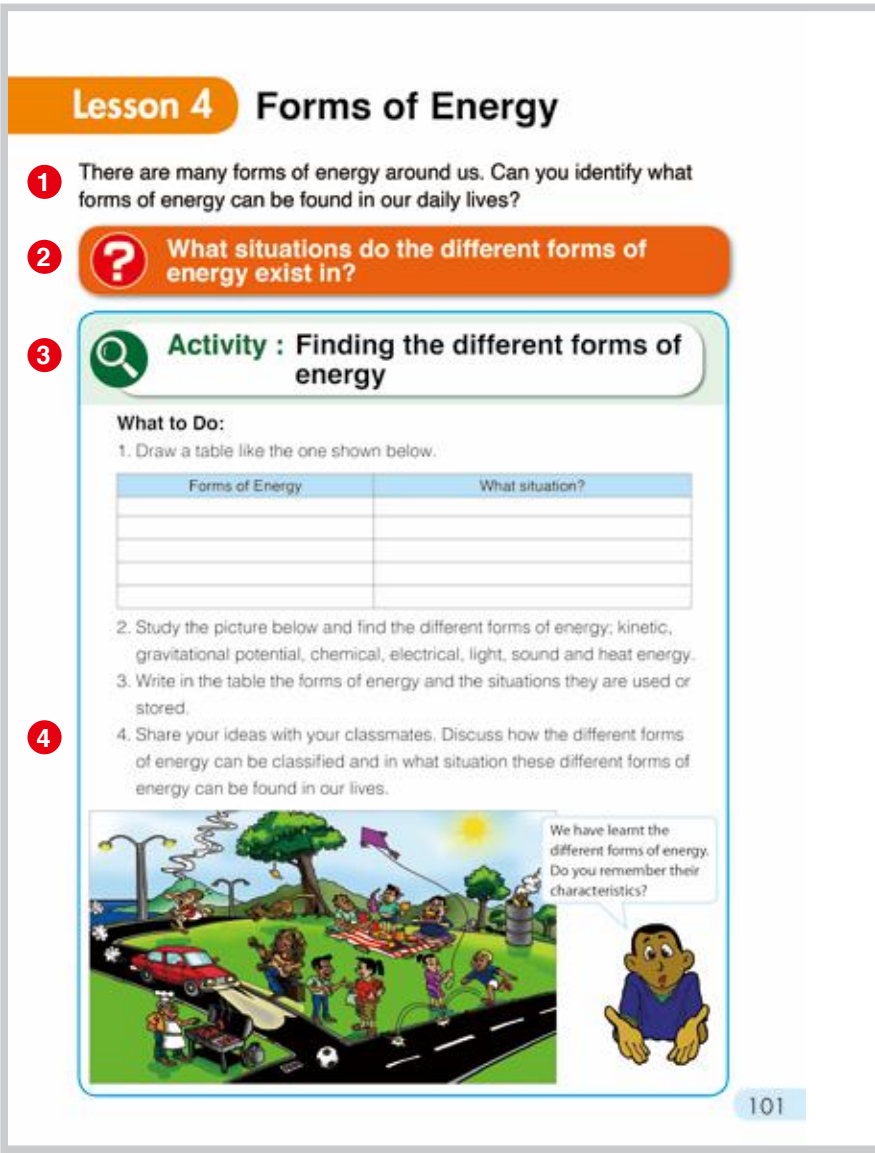

Lesson 4 Forms of Energy

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

2 What situations do the different forms of energy exist in?

3 Activity : Finding the different forms of energy

What to Do:

1. Draw a table like the one shown below.

Forms of Energy	What situation?

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

101

Teacher's Notes

- Apart from kinetic energy, gravitational potential energy and chemical energy were learnt in the previous lessons. Electrical, sound, light and heat energies have been learnt in Grades 3, 4, 5 and 6. Guide students to recall all those types of energies so that students can link and deepen understanding on energy.
- During the discussion, have students to clearly explain how daily activities involve different forms of energy in a situation. Examples include multiple forms of energy such as:
  1. The mango hanging has gravitational potential energy and has chemical energy in itself.
  2. The streetlamp is using electrical energy and providing light energy.
  3. Car is using chemical energy to produce kinetic energy to move and sound energy in the engine.

- For enrichment, provide some examples or situations that are done locally in your area.
  Example: water pumps, generators, solar lights, machines for working in the garden and many more.

Lesson Objectives

Students will be able to:
- Identify different forms of energy used in daily life.
- Cooperate with friends actively during the lesson.

Assessment

Students are able to:
- List the different forms of energy used in daily situations in a table.
- Confidently discuss their findings with classmates.

Summary

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


Kinetic Energy


Gravitational Potential Energy


Chemical Energy


Heat and Light Energy


Electrical Energy

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

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

Q: What forms of energy can be identified in the picture? (Gravitational potential, kinetic, light, heat, electrical and chemical energy are found.)

Q:What are the sources of energy around us? (Sun, a moving ball, a fruit on a tree, food, playing guitar, talking people, a running dog, fuel, etc)

- Conclude the discussions.

5 Summary (15 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 forms of energy are we surrounded by?
  Q: Where can we find different forms of energy in daily life?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Forms of Energy

Key question: What situations do the different forms of energy exist in?

Activity: Finding the different forms of energy

Form of Energy	What situation?
Electric and light	Light from the lamp
Chemical	The food people eat.
Kinetic	A plane flying
Gravitational Potential	Apple hanging on the tree
Heat and light	Sun shinning
Chemical and kinetic	Swing the golf club
heat and chemical	Melting ice cream

Discussion

Q: What forms of energy can be identified in the picture?

Gravitational potential, kinetic, light, heat, electrical and chemical energy are found.

Q: What are the sources of energy around us? Sun, a moving ball, a fruit on a tree, food, playing guitar, talking people, a running dog, fuel, etc.

Summary

- Energy can be widely found in our everyday lives and comes in many different forms.

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.1. Forms and Uses of Energy**	Total lesson No: 41 / 74 Textbook page: 103 - 104

Lesson 5 / 9

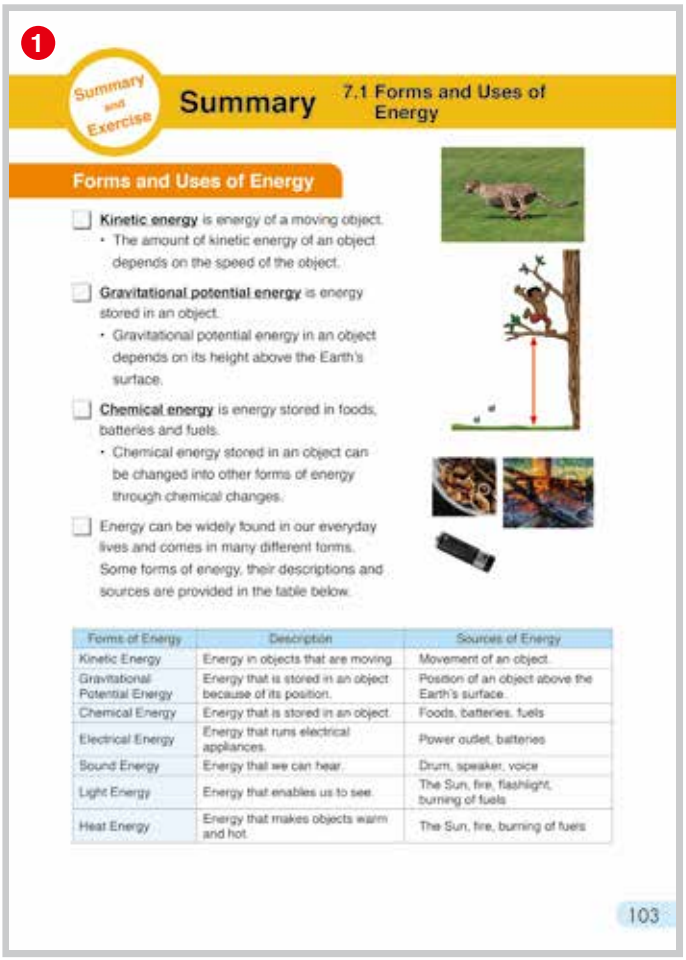
Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (40 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students following questions.
  - What forms of energy come from stored energy?
  - How are these forms used in life?
- 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 7.1 Forms and Uses of Energy

Forms and Uses of Energy

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

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

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2 Exercise & Explanation (40 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 of the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strenghten the learnt concepts in this topic.

2

Summary and Exercise

Exercise 7.1 Forms and Uses of Energy

Q1. Complete each sentence with the correct word.

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

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

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

Q2. Chose the letter with the correct answer.

(1) Which pictures are examples of kinetic energy?

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

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

A. A girl running

B. Charcoal for barbeque

C. A boy standing on top of the roof

D. Sound from a speaker

Q3. Answer the following questions.

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

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

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

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Exercise answers

Q1.
(1) **gravitational potential**
(2) **kinetic**
(3) **chemical**

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

Q3.
(1) **The amount of kinetic energy depends on the speed of an object.**
(2) **The book that is on top of the table.**

Q4. Expected answer
Ketsin observed kinetic energy in the wind (moving air) and gravitational potential energy in the coconut when it was attached to the tree and kinetic energy when the coconut fell of the tree.

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.2. Energy Conversion**	Total lesson No: 42 / 74 Textbook page: 105 - 106

Lesson 6 / 9

Lesson Title

Relationship between Kinetic and Gravitational Potential Energy

Preparation

clear plastic tube, marble

Lesson Flow

1 Introduction (5 min.)

- Review the potential energy and kinetic energy, by asking:

Q:What is gravitational potential energy?

Q:What is kinetic energy?

- Encourage the students to think about the relationship between potential and kinetic energy.

Q:Are there any relationship between kinetic and potential energy?

2 Introduce the key question

What is the relationship between kinetic and potential energy?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask the students to conduct the activity by referring to the character in the textbook and record their findings in the table.
- Check each group during the activity by asking:

Q:What happens to the height and speed when a marble is dropped?

- Ask students to discuss their results in their groups.

4 Discussion for findings (25 min.)

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

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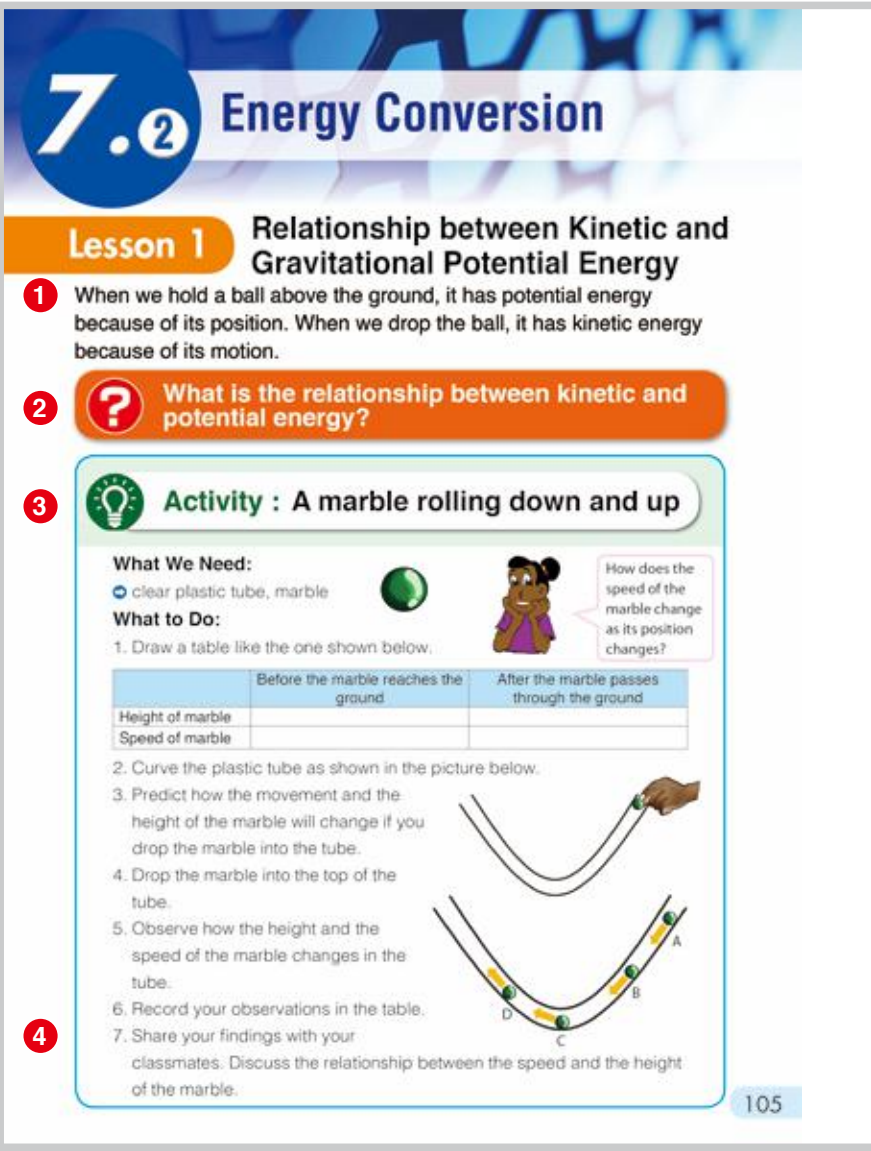

7.2 Energy Conversion

Lesson 1 Relationship between Kinetic and Gravitational Potential Energy

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

2 What is the relationship between kinetic and potential energy?

3 Activity : A marble rolling down and up

What We Need:
clear plastic tube, marble

What to Do:
1. Draw a table like the one shown below.

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

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

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

4

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Teacher's Notes

- As described in 'Teacher's Notes' for lesson 4 in this chapter, situations include multiple forms of energy. For instance, a car running has kinetic, chemical (fuel), sound and heat energy.
- It occurs because energy is transformed from one form to another when it is consumed. It means energy as a whole never disappears even if it is consumed. It just changes into other forms of energies. Chemical energy changes into electrical energy when dry cells are connected to the electric bulb.
- Energy is transferable to a different location or object, but it cannot be created or destroyed. This transformation is known as 'energy conversion' or 'conservation of energy'.
- This activity is a typical and suitable example to understand how the gravitational potential energy is transformed into kinetic energy. The higher the object the more gravitational potential energy and less kinetic energy. Conversely, the lower the object the more kinetic energy and less gravitational potential energy. However, the total energy is constant.

Tips of the Activity

- Try out all improvised material prior the lesson.
- If a clear plastic tube is not available, cut a bicycle tyre (20 or 21 inch) by half the circumference.
- Focus on the speed of the rolling marble from the highest point to the lowest point.

Lesson Objectives

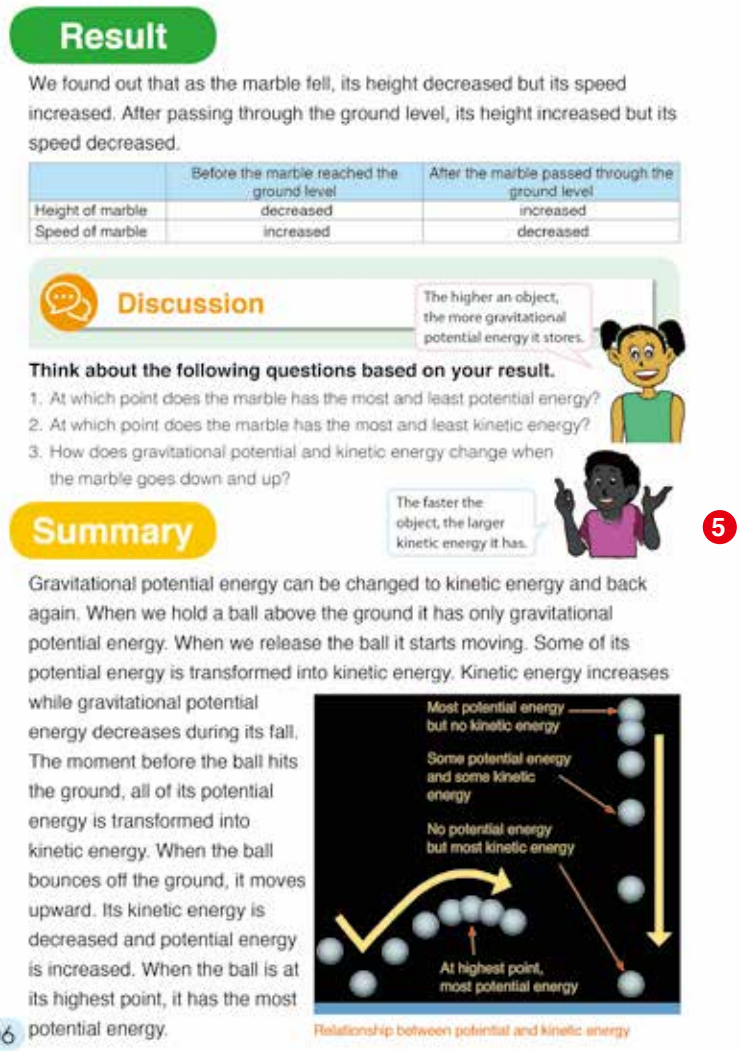
Students will be able to:

- Find out the relationship between gravitational potential energy and kinetic energy through experiment.
- Experiment on the relationship between gravitational potential energy and kinetic energy.

Assessment

Students are able to:

- Describe how gravitational potential energy and kinetic energy convert each other based on the result of the experiment.
- Record the results of their experiment in a table.



Result

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

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

Discussion

The higher an object, the more gravitational potential energy it stores.

Think about the following questions based on your result.

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

The faster the object, the larger kinetic energy it has.

Summary

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

Relationship between potential and kinetic energy

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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:At which point does the marble have the most and least potential energy? (The most energy: When we hold it. The least energy: Just before it reaches the bend.)

Q:At which point does the marble has the most or the least kinetic energy? (The most energy: When it reaches the bend. The least energy: When we hold it.)

Q:How does the gravitational potential energy and the kinetic energy change when the marble goes down and up? (When the marble goes down, potential energy decreases but kinetic energy increases. When the marble goes up, potential energy increases but kinetic energy decreases.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these question as assessment:
  Q: How do potential and kinetic energy change when a ball is dropped to the ground?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Relationship between Kinetic and Gravitational Potential Energy

Key question : What is the relationship between kinetic and potential energy?
Activity: A marble rolling down and up

	Before the marble.....	After the marble...
Height of....	Decreasing	Increasing
Speed of....	Increasing	Decreasing

Discussion

Q: At which point does the marble have the most and least potential energy?
The most energy: When we hold it. The least energy: Just before it reaches the bend.
Q: At which point does the marble has the most and least kinetic energy?
The most energy: When it reaches the bend. The least energy: When we hold it.
Q: How does the gravitational potential energy and the kinetic energy change when the marble goes down and up?

When the marble goes down, potential energy decreases but kinetic energy increases. When the marble goes up, potential energy increases but kinetic energy decreases.

Summary

- Gravitational potential energy can be changed to kinetic energy and back again.
- When a ball goes down, the potential energy decreases but the kinetic energy increases.
- When a ball goes up, the potential energy increases but the kinetic energy decreases.

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.2. Energy Conversion**	Total lesson No: 43 / 74 Textbook page: 107 - 108

Lesson 7 / 9

Lesson Title

Change in Forms of Energy in Daily Life

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Revise the previous lesson. Ask:

Q:When an object falls to the ground, how do potential and kinetic energy change?

- Encourage the students to think about the change in the other forms of energy, by asking:

Q:Do other forms of energy also change in different forms?

2 Introduce the key question

How does energy change form?

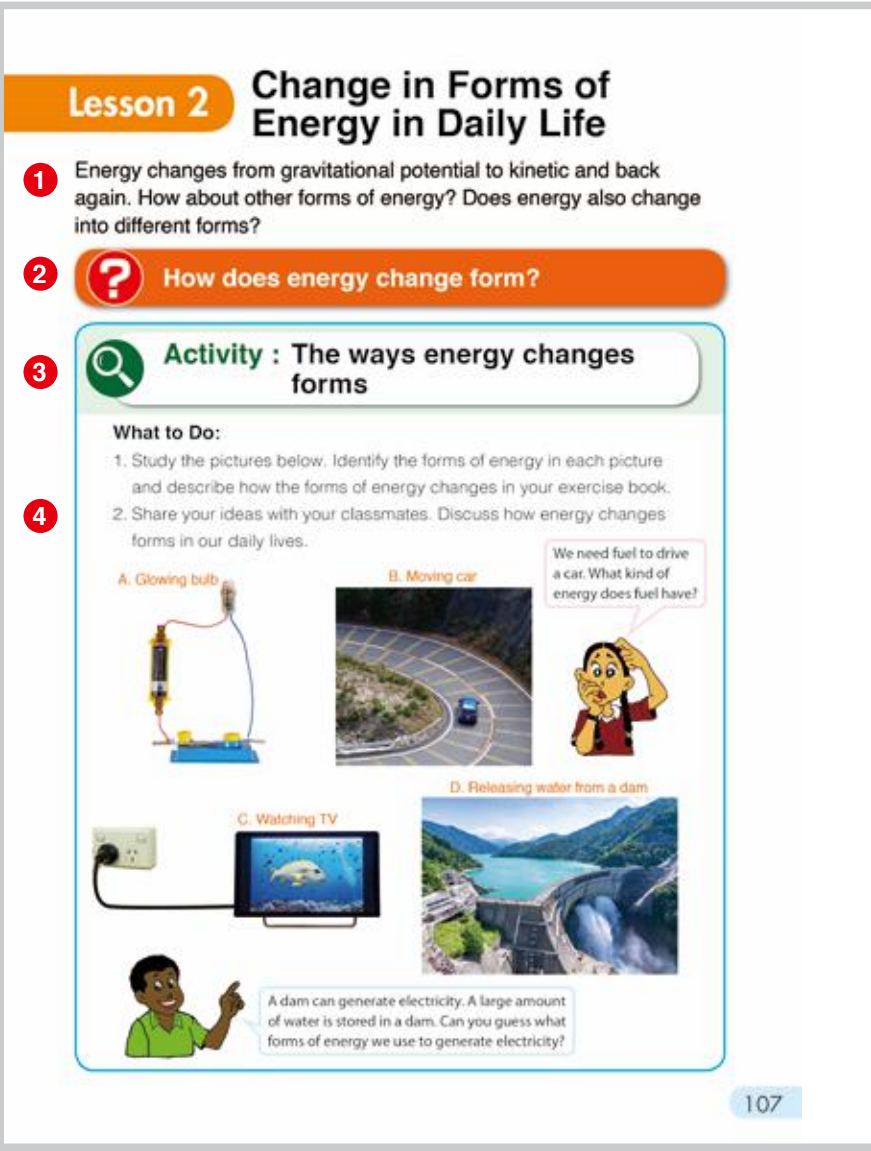
3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask students to refer to the pictures below the activity and the characters in the textbook.
- Have the students conduct the activity and record their findings in their exercise book.
- 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.
- Facilitate active students' discussions.
- Confirm the findings with the students.

(Continue)



Lesson 2 Change in Forms of Energy in Daily Life

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

2 How does energy change form?

3 Activity : The ways energy changes forms

What to Do:

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

4

A. Glowing bulb

B. Moving car

We need fuel to drive a car. What kind of energy does fuel have?

C. Watching TV

D. Releasing water from a dam

A dam can generate electricity. A large amount of water is stored in a dam. Can you guess what forms of energy we use to generate electricity?

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Teacher's Notes

- Energy transformation is not just the process in between two forms of energy. As the example in this activity implies, chemical energy changes into kinetic, sound and heat energy while a car is moving. Even in night time, light energy is used to illuminate roads.
- Encourage the students to think about their daily experiences where one form of energy is used which then transforms into other forms of energy. Think critically if there are other forms of energies transformed.
- Further discussion of how energy transformation enriches our life can be initiated. The following guided question may be helpful; What will happen if chemical energy cannot be transformed into heat energy?, What are the benefits of the change from kinetic energy to electric energy? This way of thinking will help students when learning food chain and food web (energy transfer from a certain organism to another).
- The arrow → indicates the next form of energy change. In science the arrow → is the short way of expressing 'changing into' in this case; chemical energy in dry cell changes into the form of electric energy. The electric energy then changes into the form of light and heat energy. Writing it in a sentence like this is very long. Therefore, the arrow helps explain long expressions in a short way.

Lesson Objectives

Students will be able to:
- Identify ways energy changes form.
- Study the examples of ways energy changes forms.
- Share their ideas of how energy changes to another form.

Assessment

Students are able to:
- Explain that energy can be changed from one form to another.
- Describe the ways energy changes from one form to another from the examples in the pictures.
- Discuss confidently with peers ways energy changes from one form to another.

Summary

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

Chemical Energy → Electrical Energy → Light and Heat Energy

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

Chemical Energy → Kinetic, Sound and Heat Energy

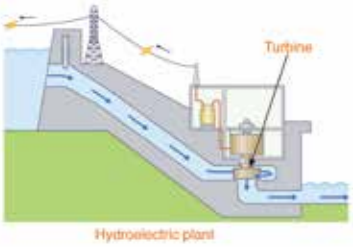
A car needs fuel to move. Fuel stores chemical energy. The engine in a car changes the chemical energy to kinetic energy to move the car. Then sound and heat energy are also released.

Electric Energy → Light and Sound Energy

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

Potential Energy → Kinetic Energy → Electrical Energy

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



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

Q:A large amount of water is stored in a dam. Can you guess what forms of energy is stored in the dam? (Gravitational potential energy)

Q:What happens to water if the dam releases the water? (Water flows down to the ground.)

Q:How does water change its forms of energy? (Potential to kinetic energy)

- Explain how a dam generates electricity.

Q:Where can we find the change in the forms of energy in daily life? Give some examples. (It depends on students' answers.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these question as assessment:
  Q: What forms of energy does a kerosene stove has and changes into when it is used?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Change in Forms of Energy in Daily Life

Key question:

How does energy change form?

Activity:The ways energy changes forms

A. Lighting a bulb
Chemical → electric → Light and heat
B. Moving car
Chemical → Kinetic, sound and heat
C. Watching TV
Electric → Light and sound

D. Releasing water from a dam
Potential → kinetic → electric

Discussion

Q: A large amount of water is stored in a dam. Can you guess what forms of energy is stored in the dam? Gravitational potential energy

Q: What happens to water if the dam releases the water? Water flows down to the ground.

Q: How does water change its form of energy? Potential to kinetic energy

Q: Where can we find the change in the forms of energy in daily life? Give some examples. It depends on students' answers.

Summary

- Energy can exist in many forms and can be changed from one form to another.
- Some examples of changes in daily life are:

Lighting a bulb
Chemical → electric → Light and heat
Moving car
Chemical → Kinetic, sound and heat
Watching TV
Electric → Light and sound

Unit: **Energy**	Chapter : **7. Energy** Topic : **7.2. Energy Conversion**	Total lesson No: 44 / 74 Textbook page: 109 - 111

Lesson 8 / 9

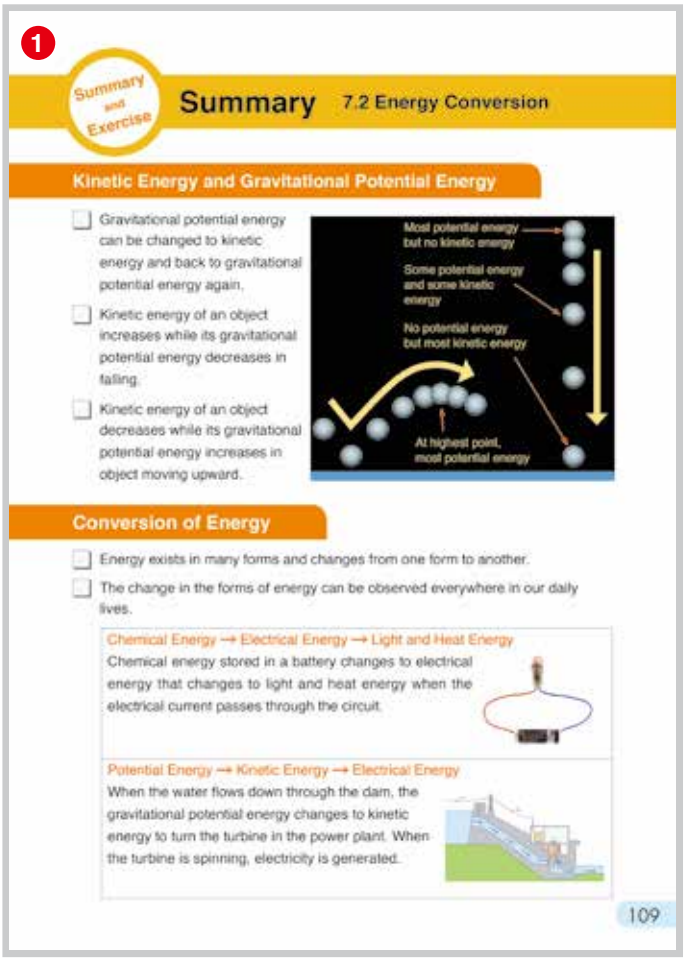
Lesson Title

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 following questions.
  - What forms of energy come from stored energy?
  - How are these forms used in life?
- Explain and correct the learning contents again if they still have misconception.
- 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.



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Summary and Exercise

Summary 7.2 Energy Conversion

Kinetic Energy and Gravitational Potential Energy

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

Conversion of Energy

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

Chemical Energy → Electrical Energy → Light and Heat Energy

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

Potential Energy → Kinetic Energy → Electrical Energy

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

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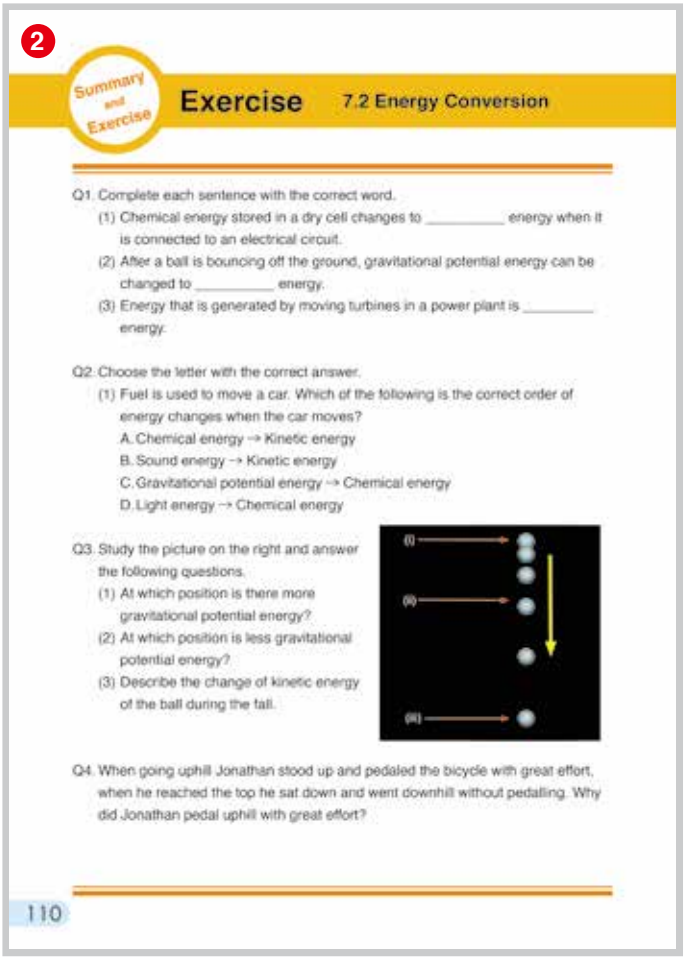
2 Exercise & Explanation (40 min.)

- 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 of the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strenghten the learnt concepts in this topic.



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Summary and Exercise

Exercise 7.2 Energy Conversion

Q1. Complete each sentence with the correct word.

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

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

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

Q2. Choose the letter with the correct answer.

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

A. Chemical energy → Kinetic energy
B. Sound energy → Kinetic energy
C. Gravitational potential energy → Chemical energy
D. Light energy → Chemical energy

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

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

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

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

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

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Exercise answers

Q1.
(1) **electrical**
(2) **kinetic**
(3) **electrical**

Q2.
(1) **A**

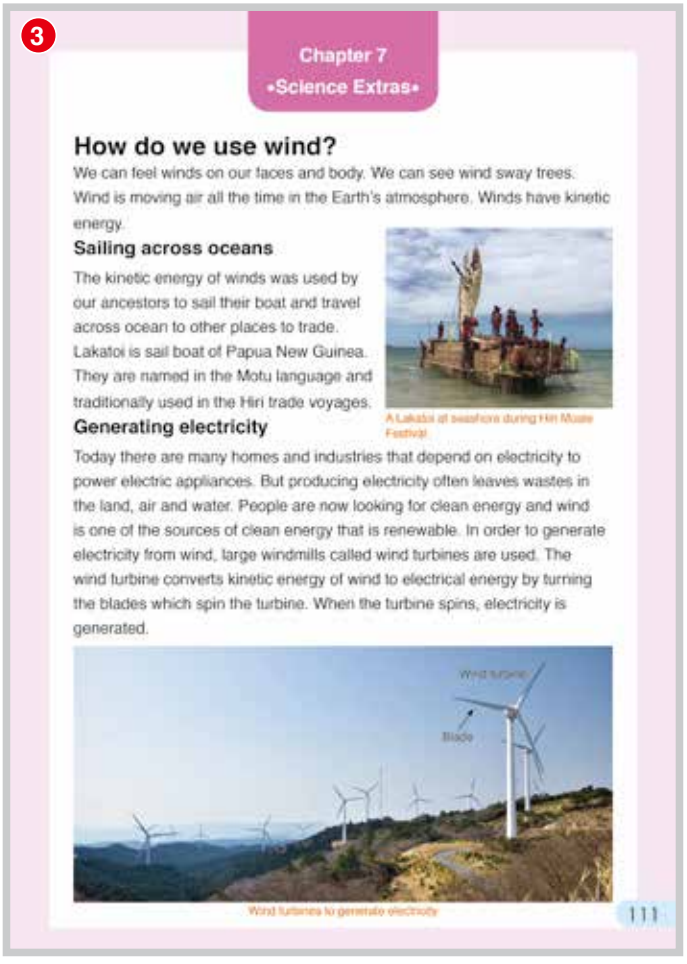
Q3.
(1) **(i)**
Because it is at the highest point.
(2) **(iii)**
Because it is at the lowest point.
(3) **Kinetic energy of the ball increases.**

Q4.Expected answer
Jonathan used great effort to pedal uphill because the kinetic energy of the bicycle converts into gravitational potential energy.

Explanation of Science Extras

3 Science Extras (10 min.)

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



3

Chapter 7
•Science Extras•

How do we use wind?

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

Sailing across oceans

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

A Lakatoi at seashore during Hiri Moale Festival

Generating electricity

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

Wind turbine
Blade

Wind turbines to generate electricity

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Lesson 9 / 9

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

7. ENERGY

Q1 Complete each sentence with the correct word.

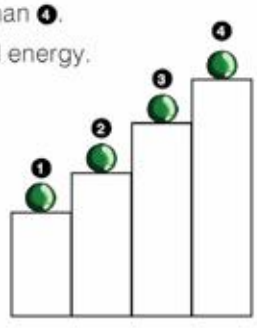
(1) The stored energy in a battery is called chemical energy.
(2) The energy that a moving object has is called kinetic energy.
(3) A generator is a machine that generates electricity by converting kinetic energy when its turbine is spinning.
(4) The stored energy in an object placed at high place is gravitational potential energy.

Q2 Choose the letter with the correct answer.

(1) Which list contains sources of chemical energy?
A. Power outlet, battery and bulb
B. Voice, speaker and drum
C. Fuel, battery and food
D. Air, sunlight and fire

(2) There are four marbles on each cupboard at different heights. Which is true if the marbles were to fall off the cupboards?
A. Marble ❸ has more gravitational potential energy.
B. Marble ❶ will have more speed when it falls.
C. Marble ❷ will have more kinetic energy than ❹.
D. Marble ❹ has more gravitational potential energy.

(3) Which of the marbles would increase in speed more than the others during the fall?
A. ❶
B. ❷
C. ❸
D. ❹



(4) Which of the following is not correct about energy?
A. Energy can change from one form to another.
B. Kinetic energy can be changed to gravitational potential energy.
C. An object being at rest does not have any energy.
D. The Sun is a source of heat and light energy.

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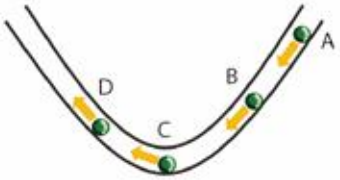
Q3

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



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

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

(iii) Describe the energy change during the marble moving from point C to D.
(Expected answer) The kinetic energy changes to gravitational potential energy as the marble goes up the slope.

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

i) Listening to the radio working by batteries
Chemical energy → Electrical energy → Sound energy

ii) Cooking using a gas stove
Chemical energy → Heat energy + Light energy

iii) Generating electricity at a hydroelectric plant
Gravitational potential energy → Kinetic energy → electrical energy

Q4

Melo is riding his bike along the path. He starts on level ground. But when he gets to a hill, he has to pedal harder to go up the hill at the same speed. Why does this happen?
(Expected answer) He pedals harder because the force of gravity is pulling him backward.

Chapter 8. Moon

Chapter Objectives

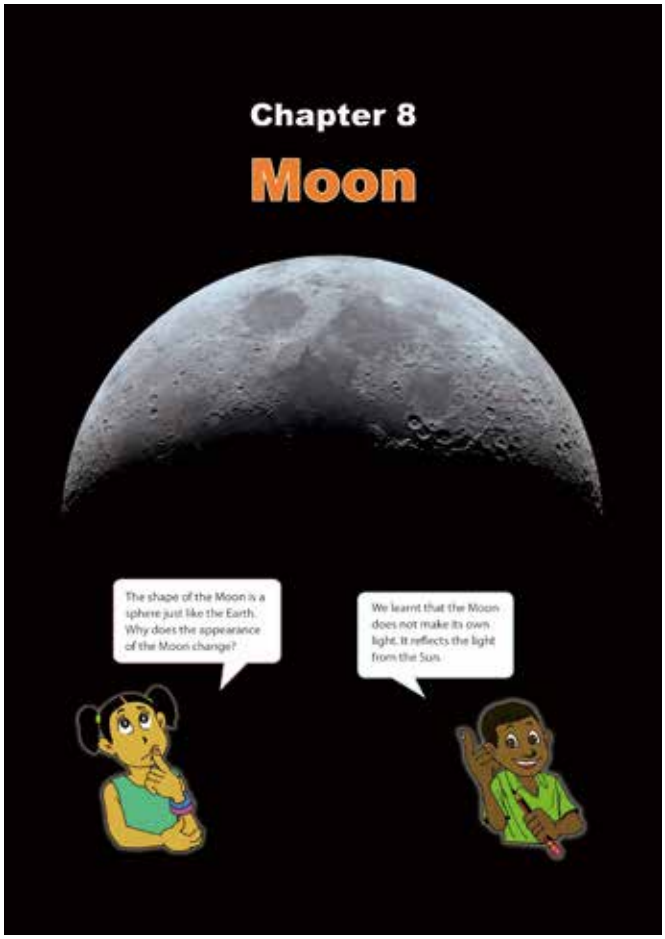
Students will be able to understand that while the moon spins on its own axis, it also revolves around the Earth at the same time.Students will also be able to understand the relationship between the moon phases and the position of the Moon, the Sun and the Earth.

Topic Objectives

8.1 Moon in Motion

Students will be able to;

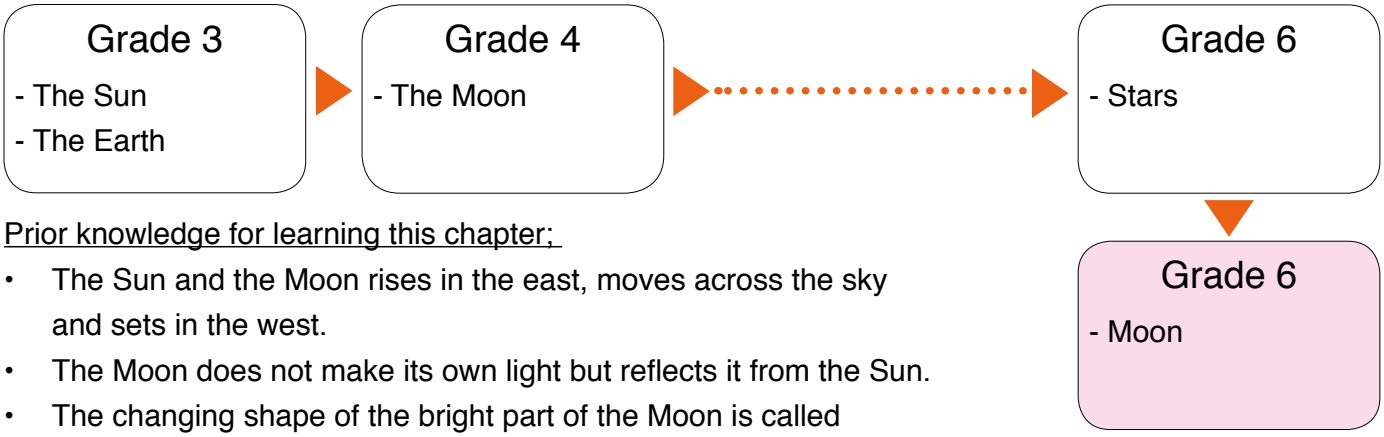
- Describe the movement of the moon as it rotates on its axis and revoles in the orbit around the Earth.
- Explain that the moon phases depend on the relationship between the position of the Moon and the Sun as seen from the Earth.



This picture is from the chapter heading of the textbook showing the surface of the Moon at the phase of waxing crescent.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- The Sun and the Moon rises in the east, moves across the sky and sets in the west.
- The Moon does not make its own light but reflects it from the Sun.
- The changing shape of the bright part of the Moon is called phases of the Moon.

Teaching Overview

This chapter consists of 4 lessons, each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
8.1 Moon in motion	1	**Movement of the Moon** How does the Moon move in space?	6.3.2	115 - 116
	2	**Causes of Moon Phases** What causes the phases of the Moon?		117 - 118
	3	Summary and Exercise, Science Extras		119 - 121
Chapter Test	4	Chapter Test		122 - 123

Unit: **Space**	Chapter : **8. Moon** Topic : **8.1. Moon in Motion**	Total lesson No: 46 / 74 Textbook page: 115 - 116

Lesson 1 / 4

Lesson Title

Movement of the Moon

Preparation

two different colours of clay: blue and white, pan, pencil,

Lesson Flow

1 Introduction (5 min.)

- Recap the main learning contents in Grade 4 on 'Movement of the Moon in the Sky'.

Q:How does the Moon move in the sky during the day?

Q:In what direction does the Moon move?

- Motivate students to think about how the Moon moves when seen from space.

2 Introduce the key question

How does the Moon move in space?

3 Activity (35 min.)

- Organise the students into small groups.
- Explain the steps of the activity.
- Make sure to explain what the different models represent. (e.g. blue clay represents the earth)
- Refer students to the pictures shown in the student textbook as a guide for their investigation.
- Have students do the activity and record their findings in their exercise books.
- Ask students to discuss their findings and to think about the two questions in the activity 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.

(Continue)

8.1 Moon in Motion

Lesson 1 Movement of the Moon

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

2 How does the Moon move in space?

3 Activity : Revolving and spinning

What We Need:
one blue clay, one white clay, pan, pencil

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

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Teacher's Notes

Far Side of the Moon

We always see only one side of the Moon because the Moon rotates on its axis at the same rate that it orbits the Earth. (27 days, 7 hours, 43 minutes, and 11.47 seconds.)

The side that we can see from Earth is called the near side while the other side is called the far side which we never see from Earth.

Humans had no idea what the far side of the Moon looked like until October 1959, when a Soviet spacecraft, Luna 3, transmitted the first photographs of the far side. The far side of the Moon looks very different to the near side, The far side of the Moon doesn't have ancient pools of solidified lava, which is actually called maria.

The near side of the Moon

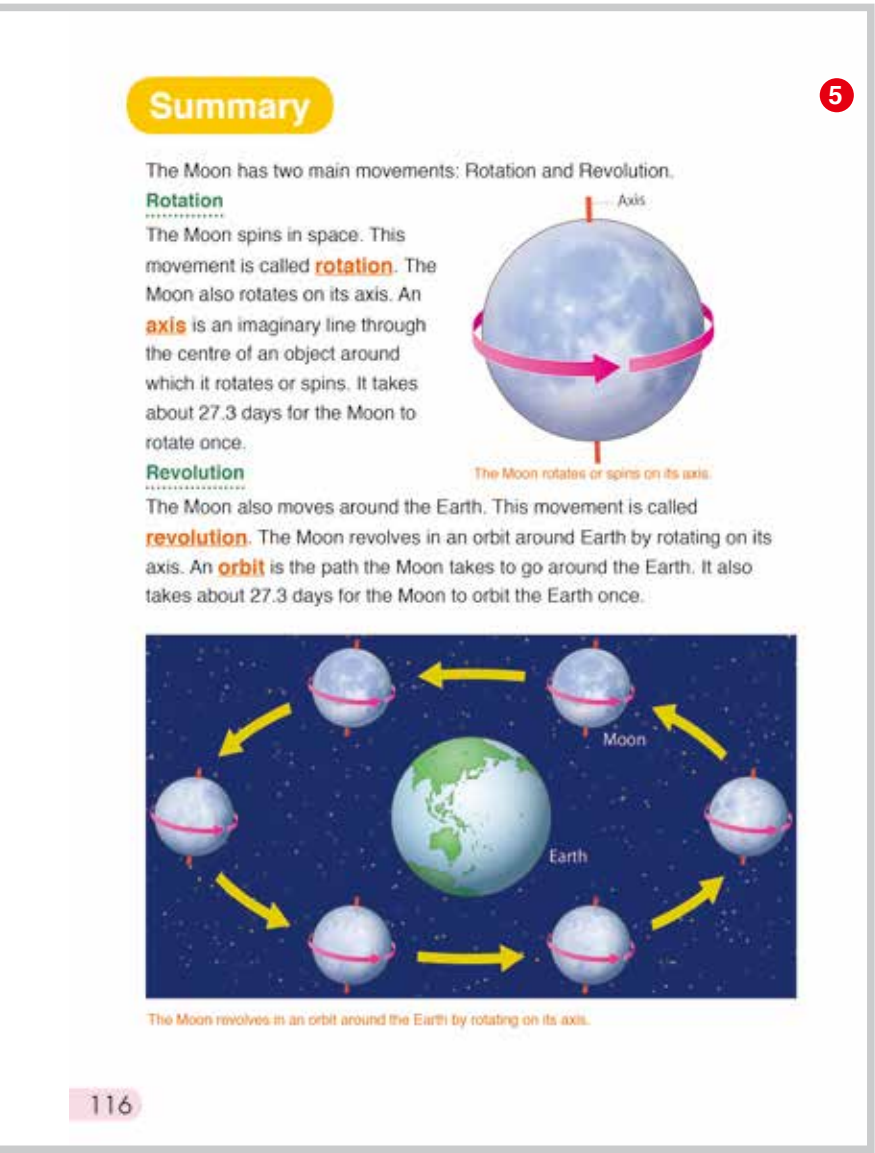
The far side of the Moon

Lesson Objectives

Students will be able to:
- Infer how the Moon moves in the space through the activity.
- Define the terms axis and orbit.
- Observe the movements of the moon when modelling it.

Assessment

Students are able to:
- Explain how the Moon moves around the Earth in relation to rotation and revolution.
- State the definition of axis and orbit.
- Enjoy modelling the movement of the Moon in space.



Summary

The Moon has two main movements: Rotation and Revolution.

Rotation

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

The Moon rotates or spins on its axis.

Revolution

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

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

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

Q:How are the two movements of the white clay in Steps 2 and 4 different?(In Step 2, the white clay was spinning around the blue clay just like it was spinning in space.
In Step 4, the white clay was moved in an orbit manner on its axis which was modelled with a pencil.)

- Encourage students to relate the concept to the real Moon and the Earth and asked:

Q:How does the Moon move? (The Moon moves in two main ways by Rotation and Revolution around the Earth.)

- Conclude the discussions.

5 Summary (15 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 the Moon move in space?
  Q: What is the meaning of axis?
  Q: What is the meaning of orbit?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Movement of the Moon

Key question:
How does the Moon move in space?
Activity:Revolving and spinning
Results:
Q: How did the white clay move when it was moved around in the pan? It spun around the blue clay which represents the earth.
Q: How did you move the white clay with an inserted pencil? It was moved in an orbit as it was revolving the earth.

Discussion
Q. How are the two movements of the white clay in Steps 2 and 4 different?
In Step 2, the white clay was spinning around the blue clay just like it was spinning in space
In Step 4, the white clay was moved in an orbit manner on its axis which was modelled with a pencil.
Q. How does the Moon move?
The Moon moves in two main ways by Rotation and Revolution around the Earth.

Summary
- The moon moves around the earth in two main ways;
  1. Rotation
  2. Revolution
- The movement of the Moon spining on its axis is called rotation.
- The movement of the Moon around the Earth is called revolution.
- An axis is an imaginary line through the centre of an object around which an object rotates or spins.
- An orbit is the path the Moon takes to go around the Earth.

Unit: **Space**	Chapter : **8. Moon** Topic : **8.1. Moon in Motion**	Total lesson No: 47 / 74 Textbook page: 117 - 118

Lesson 2 / 4

Lesson Title

Causes of Moon Phases

Preparation

small ball to represent the moon, flash light (torch) to represent the sun

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:What are the two main ways that the Moon moves in space?

Q:What is the meaning of orbit and axis?

- Based on student's prior knowledge of Grade 4 learning contents ask:

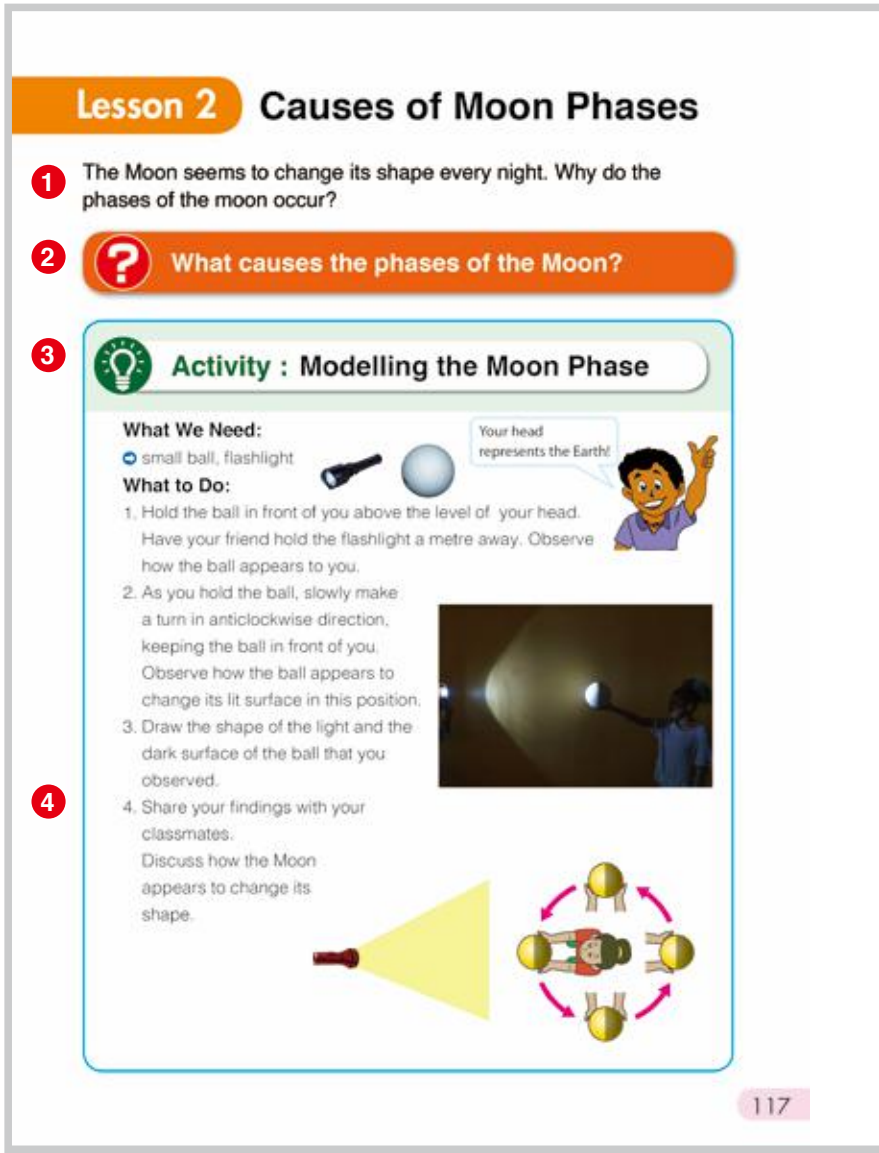
Q:What are the different phases of the moon?

2 Introduce the key question

What causes the phases of the Moon?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask students to do their predictions about the causes of the moon phases.
- Have students do the activity step by step and record their observations.
- Remind the students not to flash the flashlight directly to their friends' eyes.
- Check student's activity and if necessary guide them towards their findings.
- Encourage students to indicate the changes in the pattern of light and the shaded part of the ball from various positions.
- Ask students to share their results and discuss how the Moon appears to change its shape.



Lesson 2 Causes of Moon Phases

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

2 What causes the phases of the Moon?

3 Activity : Modelling the Moon Phase

What We Need:
- small ball, flashlight

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

Your head represents the Earth!

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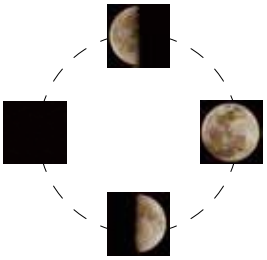
Teacher's Notes

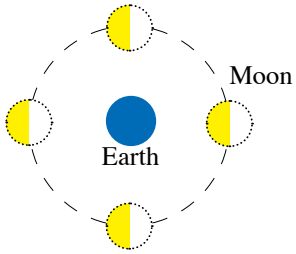
Tips for the Activity

- This activity works best in a very dark room using a very bright light source. Cardboard work well to cover windows.
- Students will usually observe that their own shadows will cover the ball (Moon model) when it is opposite the light source. Ask them to hold the ball above the shadow of their head.
- Teacher should guide the students well to turn anticlockwise (left) when making turns to observe the changes in the shape of the moon. Remind the students not to flash the torch directly to their friends' eyes.
- Figure a) shows the Moon as seen from Earth. Figure b) shows the Moon as viewed from the Solar system.

a) View of moon from Earth



b) View of moon from solar system

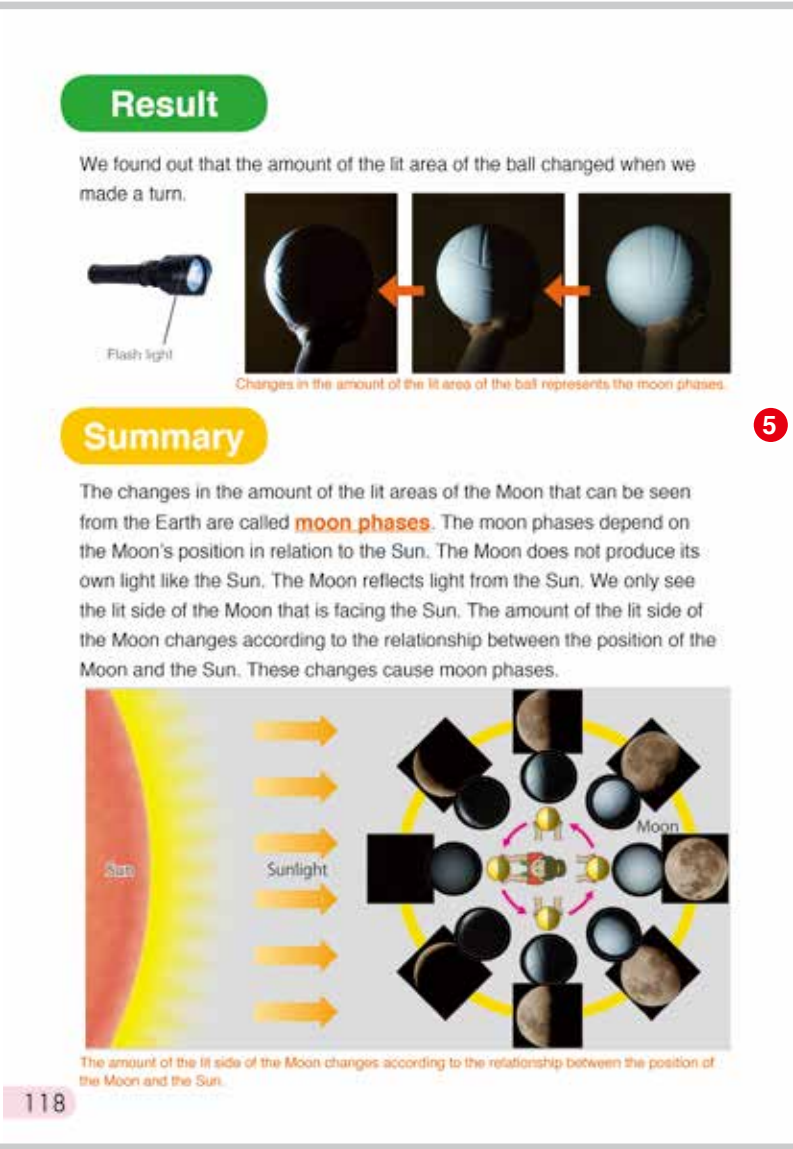


Lesson Objectives

Students will be able to:
- Relate the causes of the moon phases to the results of activity.
- Examine the different phases of the moon using the moon model.
- Actively participate in class activity.

Assessment

Students are able to:
- Explain the causes of the moon phases through the observation of the moon model.
- State the different phases of the Moon by using the moon model.
- Show responsibility when doing the activity.



Result

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

Flash light

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

Summary

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

Sun
Sunlight
Moon

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

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5

4 Discussion for findings (25 min.)

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

Q:What happened to the amount of the lit area of the ball (Moon's model) when you turned anticlockwise? (It changed.)

Q:What do we call the changes in the amount of the lit areas of the Moon? (It is called the Moon phases.)

Q:Why did the moon appear to change its shape slowly each night? (Because as it orbits the Earth, part of it that is facing the Sun is always lit up. From the Earth it is viewed in different shapes.)

- Conclude the discussions.

5 Summary (15 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 causes the moon phases?
  Q: The Moon does not make its own light, where does it get its light from?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

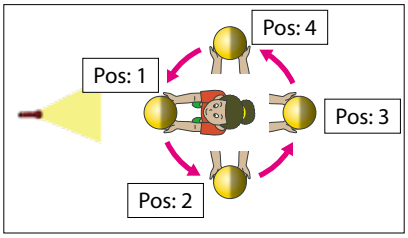
Title:

Causes of Moon Phases

Key question

What causes the phases of the Moon?

Activity: Modelling the Moon Phase



Discussion

Q:What happened to the amount of the lit area of the ball (Moon's model) when you turned anticlockwise? It changed.

Q: What do we call the changes in the amount of the lit areas of the Moon? It is called the Moon phases.

Q: Why did the moon appear to change its shape slowly each night? Because as it orbits the Earth, part of it that is facing the Sun is always lit up. From the Earth it is viewed in different shapes.

Summary

- The changes in the amount of lit side of the Moon seen from the earth is called Moon Phases.
- The moon phases depend on the Moon's position in relation to the Sun.
- The change in the relationship between the position of the Moon and the Sun are caused by the orbit of the moon around the Earth.

Unit: **Space**	Chapter : **8. Moon** Topic : **8.1. Moon in Motion**	Total lesson No: 48 / 74 Textbook page: 119 - 121

Lesson 3 / 4

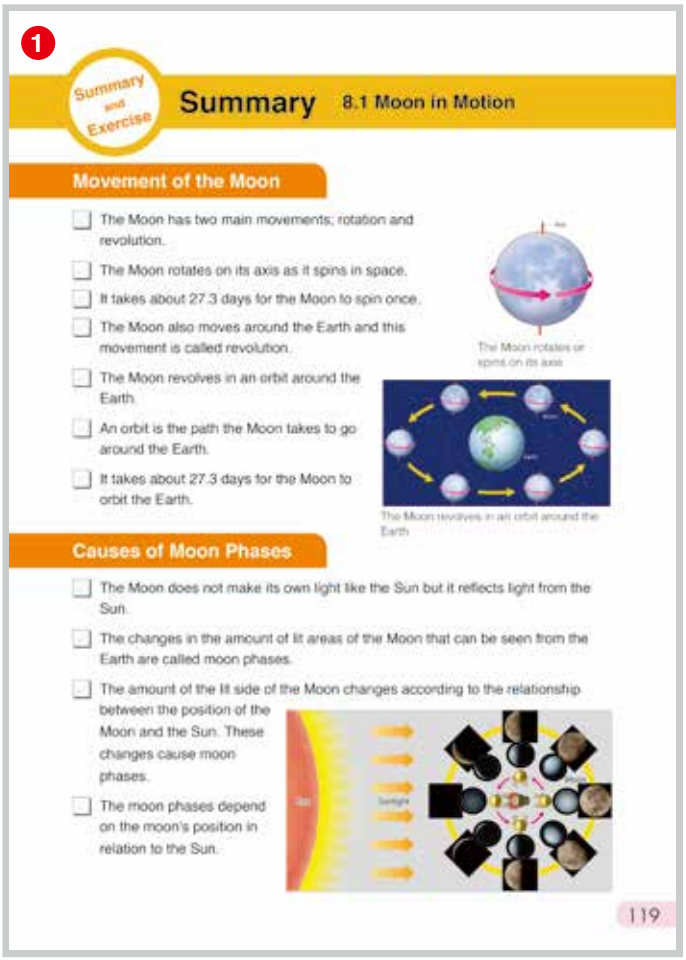
Lesson Title

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 following questions.
  - What are the two main movements of the moon?
  - How does the moon revolve the Earth?
  - What causes the phases of the moon?
- Explain and the correct learning contents again if they still have misconception.
- 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 Moon in Motion

Movement of the Moon

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

The Moon rotates or spins on its axis

The Moon revolves in an orbit around the Earth

Causes of Moon Phases

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

Sun Sunlight

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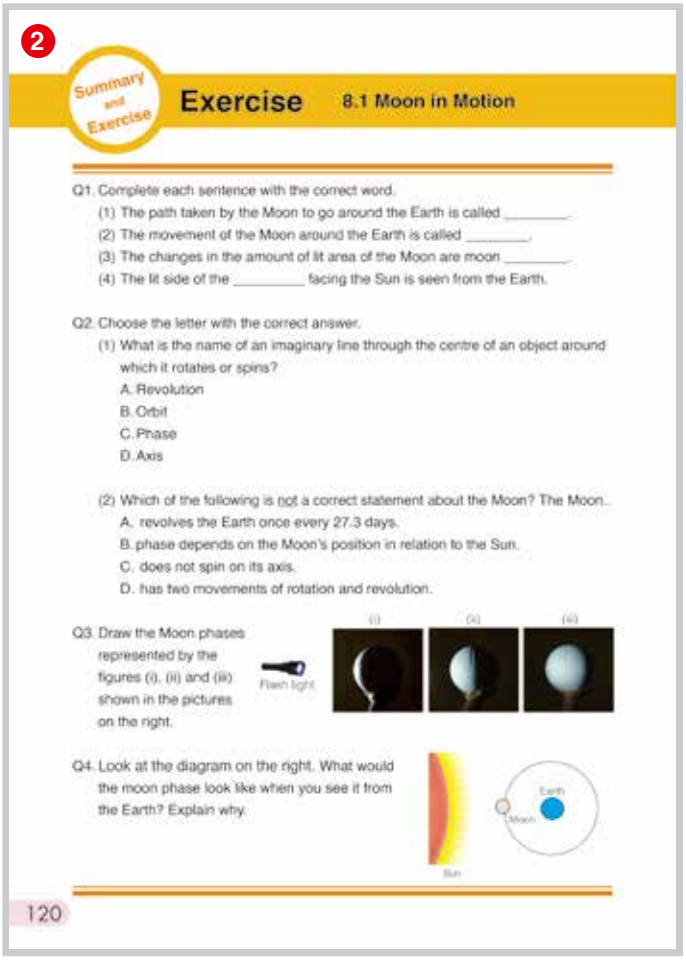
2 Exercise & Explanation (40 min.)

- 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 of the questions and explain how to solve them using their scientific understanding and ideas.
- Make reference to the textbook or provide clear examples in daily life to strenghten the learnt concepts in this topic.



2

Summary and Exercise

Exercise 8.1 Moon in Motion

Q1. Complete each sentence with the correct word.

(1) The path taken by the Moon to go around the Earth is called _____.
(2) The movement of the Moon around the Earth is called _____.
(3) The changes in the amount of lit area of the Moon are moon _____.
(4) The lit side of the _____ facing the Sun is seen from the Earth.

Q2. Choose the letter with the correct answer.

(1) What is the name of an imaginary line through the centre of an object around which it rotates or spins?
A. Revolution
B. Orbit
C. Phase
D. Axis

(2) Which of the following is not a correct statement about the Moon? The Moon...
A. revolves the Earth once every 27.3 days.
B. phase depends on the Moon's position in relation to the Sun.
C. does not spin on its axis.
D. has two movements of rotation and revolution.

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

Flash light

(i) (ii) (iii)

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

Sun Earth Moon

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Exercise answers

Q1.
(1) **orbit**
(2) **revolution**
(3) **phases**
(4) **moon**

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

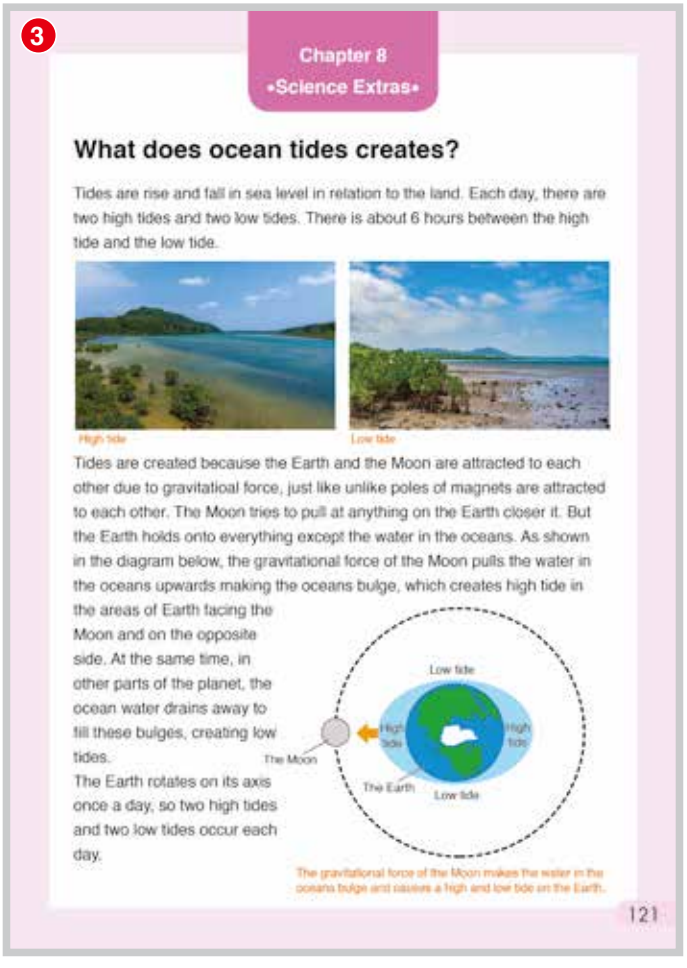
Q3. Examples of answers.
Refer to diagrams in textbook page 189 for answers to (i), (ii) and (iii)

Q4.
The phase of the moon at this time would be new moon because the shadow part of the Moon is facing the Earth.

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•

What does ocean tides creates?

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

High tide

Low tide

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

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

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

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Chapter Test

8. Moon

Q1 Complete each sentence with the correct word.

(1) The Moon can be seen moving from East to West in the sky.
(2) The Moon reflects light from the Sun.
(3) It takes the Moon about 27.3 days to orbit the Earth.
(4) The path taken by the Moon to go around the Earth is called orbit.

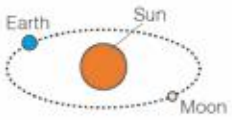
Q2 Choose the letter with the correct answer.

(1) What causes the Moon's phases to change?
A. The Moon's spin
B. The Moon's revolution around the Earth
C. The Earth's spin
D. The Sun's spin

(2) What happens when you see the Moon's phases change? The Moon seems to change its
A. colour.
B. speed.
C. shape.
D. distance.

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

A. 

B. 

C. 

D. 

(4) Why does the Moon appear to move across the sky in the day?
A. It travels around the Earth every day.
B. The Earth rotates on its axis.
C. All objects in space are moving.
D. It is extremely far away.

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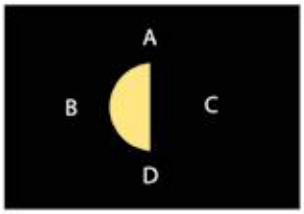
Q3

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



(1) At what direction is the sun?

B

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

Because the area is not lit by the Sun.

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

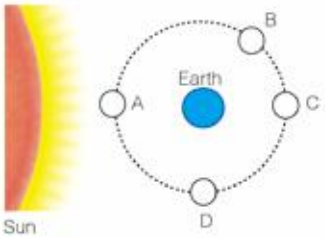
Revolution

Q4

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

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

B



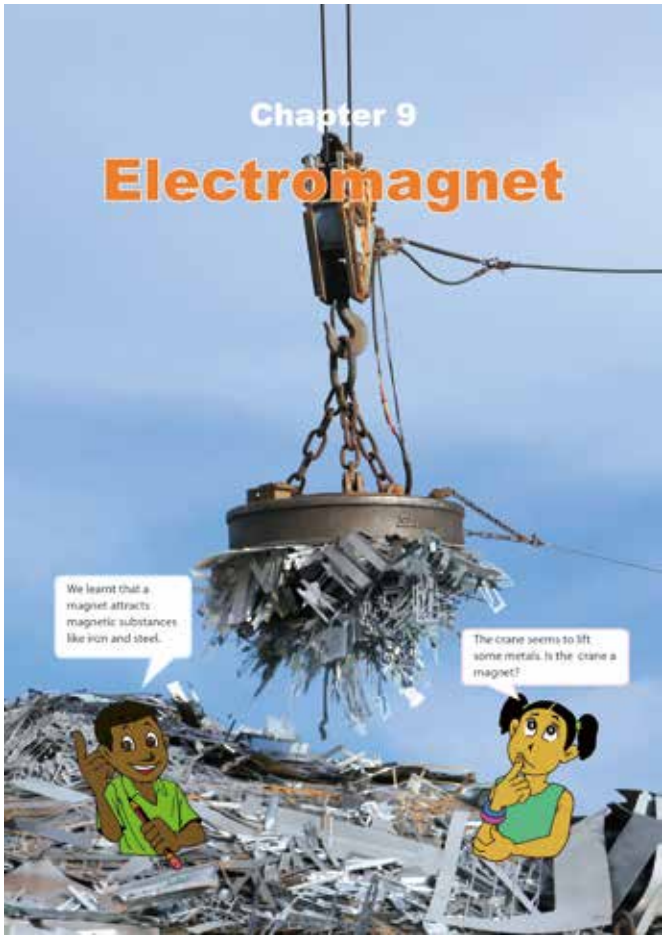
(2) How will the phase of the Moon look like if the Moon is at position C in the diagram? Explain why.

The phase of the Moon observed from the Earth would be full moon. Because the lit side of the Moon facing the Sun is on the left and the Earth is located on left of the Moon in the diagram.

Chapter 9. Electromagnet

Chapter Objectives

Students will be able to understand the characteristics of electromagnets, the different ways to strengthen an electromagnet and the uses of electromagnets in daily life.



This picture is from the chapter heading of the textbook showing a huge electromagnet and attracted scrape metals attached to it.

Topic Objectives

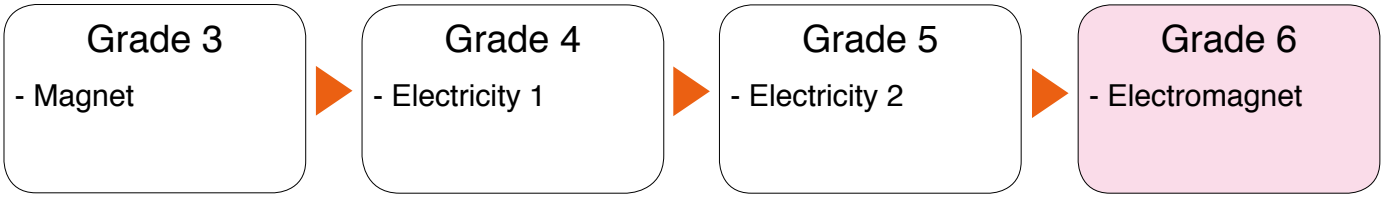
9.1 Properties of Electromagnet

Students will be able to;

- Identify the characteristics of electromagnets compared to a bar magnet.
- Identify the relationship between the strength of an electromagnet and electric current.
- Identify the relationship between the strength of an electromagnet and the number of coils.
- List the uses of electromagnets in daily life.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Magnets attract magnetic objects.
- Magnets have two poles: north and south poles.
- Electric current flows through closed circuits.

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
9.1 Properties of Electromagnet	1	**Characteristics of Electromagnet** What are the characteristics of an electromagnet?	6.2.2	125 - 126
	2	**How to Strengthen an Electromagnet 1** How can we change the strength of an electromagnet?		127 - 128
	3	**How to Strengthen an Electromagnet 2** What is another way to change the strength of an electromagnet?		129 - 130
	4	**Uses of Electromagnets in Daily Life** How are electromagnets used in our daily lives?		131 - 132
	5	Summary and Exercise, Science Extras		133 - 135
Chapter Test	6	Chapter Test		136 - 137

Unit: **Energy**	Chapter : **9. Electromagnet** Topic : **9.1. Properties of Electromagnet**	Total lesson No: 50 / 74 Textbook page: 125 - 126

Lesson 1 / 6

Lesson Title

Characteristics of Electromagnet

Preparation

sticky tape, iron nail, magnet wire (enamel wire), dry cell, cell box, sand paper, steel clips.

Lesson Flow

1 Introduction (5 min.)

- Ask the students to recall what they have learnt in their previous grades about magnets and electricity. Ask:

Q:Do you remember what you have learnt about magnets and electric current?

- Motivate students to think about electromagnet.
- Ask students to read the introduction part and then explain about electromagnet.

2 Introduce the key question

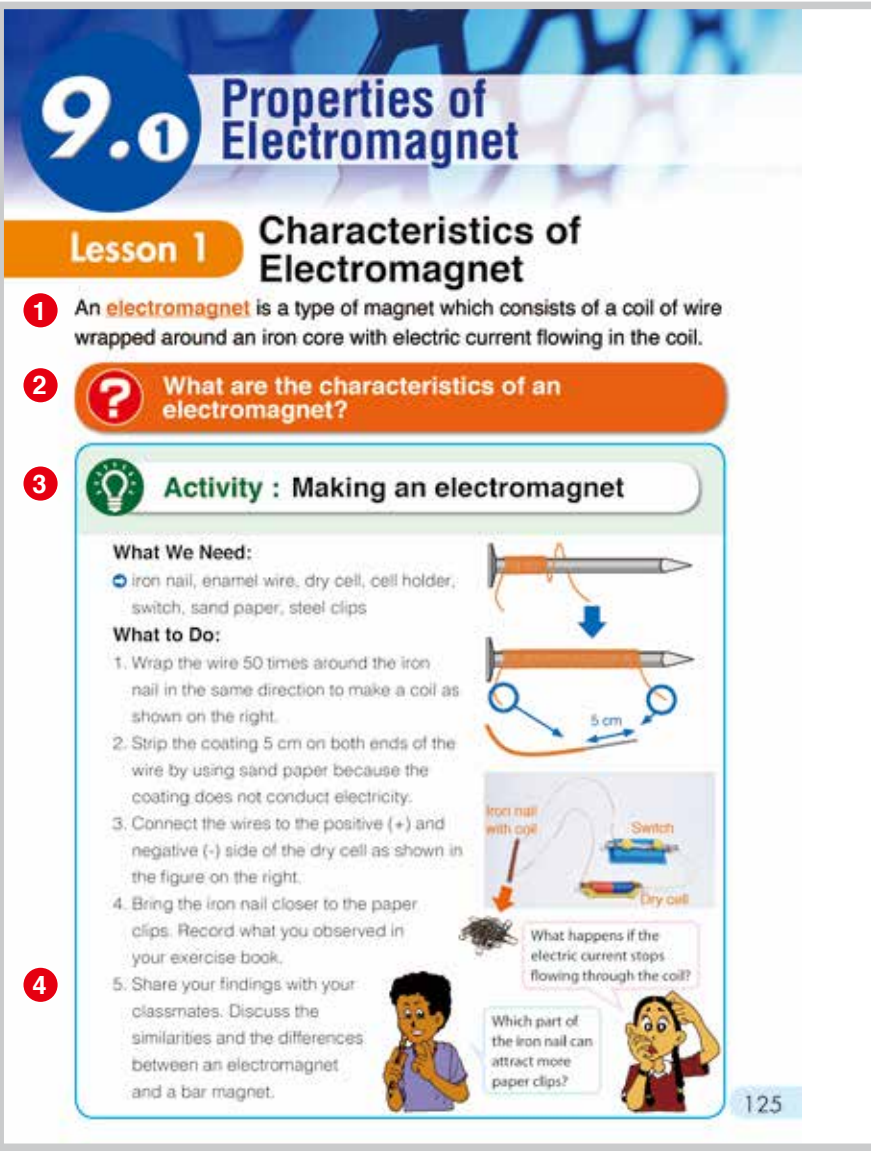
What are the characteristics of an electromagnet?

3 Activity (35 min.)

- Organise students into groups and remind them of the safety rules.
- Explain the activity step by step.
- Let students set up coils by assisting them.
- Refer students to what the characters are saying for their investigations.
- Have students do the activity and record their results in their exercise books.
- Give enough time for them to experiment and record in their results.
- Ask the students to discuss their results and the similarities and the differences of an electromagnet and a bar magnet in their groups.

4 Discussion for findings (25 min.)

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



Teacher's Notes

SAFETY

1. The children should take care not to get burned nor leave the dry cell connected because the coil will be hot when the current is flowing through the electromagnet.
2. Swith off or remove the dry cell after the experiment to prevent excessive coil current which can overheat the coil.

Tips for the Activity

- Use a 3 inch nail, Enamel wire can be 100 cm / 1 m long and AA battery or dry cell can be used but make sure it is new and not been used already. Wires at both ends of the electromagnet must be 30 cm long.
- When coiling the wire make sure to smoothen out the enamel wire slowly to avoid getting tangled up.
- If there is no sand paper, a scissor or knife can be used to strip off the coating on both ends of the wire but gently and properly.

Tips for the Lesson

In Grade 3, students have learnt about Magnets and their properties. Give them the opportunity to recall connecting to this lesson.

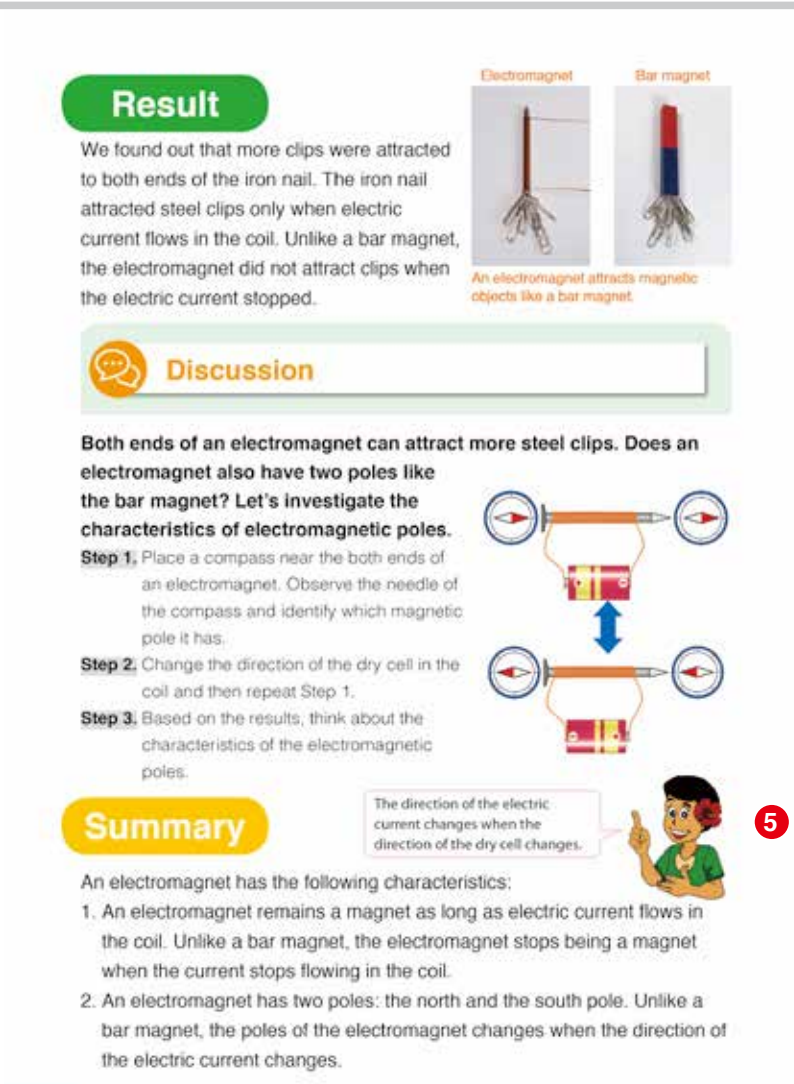
- Lessons on Magnet
  1. A magnet has a north and a south pole.
  2. The like poles repel each other, while the unlike poles attract each other.
  3. Iron can be made into a magnet.
- Lessons on Electricity
  1. A dry cell has positive and negative terminal.
  2. Current always flows in the same direction.

Lesson Objectives

Students will be able to:
- Make an electromagnet.
- Identify the characteristics of an electromagnet.
- Explore the characteristics of an electromagnet with curiosity.

Assessment

Students are able to:
- Demonstrate how to make an electromagnet by connecting iron nail, enamel wire and dry cell.
- List the characteristics of an electromagnet by comparing a bar magnet with an electromagnet.
- Enjoy making an electromagnet.



Result

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

Electromagnet | Bar magnet

An electromagnet attracts magnetic objects like a bar magnet.

Discussion

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

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

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

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

Summary

The direction of the electric current changes when the direction of the dry cell changes.

An electromagnet has the following characteristics:

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

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

Q:What characteristics does an electromagnet have? (It can attract magnetic materials, the end of coil can attract magnetic materials most, it cannot attract magnetic materials without electricity, etc...)

- Conduct additional experiment if time permits.
- **Based on their results from the additional experiment,** ask these questions again. (If there is not enough time for the additional experiment, ask students to observe the two pictures of the additional experiment)

Q:Does an electromagnet have a north and a south pole? (Yes, it has a north and a south pole)

Q:Why do you think so? (The needles of the compass placed near an electromagnet indicate the different direction, etc...)

Q:How does the poles of an electromagnet change? (They also change, etc)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is an electromagnet?
  Q: What are the characteristics of an electromagnet?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Characteristics of Electromagnet**

Key question: What are the characteristics of an electromagnet?

Activity: Making an electromagnet

1.What happened when the wire was connected to the dry cell?
- It attracted the paper clips.

2.What happened when the switch was turned off?
- It could not attract the paper clips.

Discussion 1:

Q: What characteristics does an electromagnet have? (Refer to 'Lesson Flow'.)

Additional Experiment: Results:

If the direction of the dry cells changed, the direction of the needle of a compass also changed, etc...

Q: Does an electromagnet have a north and a south pole? Yes, it has a north and a south pole.

Q: Why do you think so? The needles of the compass placed near an electromagnet indicate the different direction, etc.

Q: How does the poles of an electromagnet change? They also change, etc...

Summary

- Electromagnet is a type of magnet which consists of a coil of wire wrapped around an iron core with electric current flowing in the coil.
- Characteristics of an electromagnet
  1. It can attract iron when electric current is flowing through. It cannot attract iron without electric current.
  2. It has North and South poles. The poles changes when the direction of the electric current changes.

Unit: **Energy**	Chapter : **9. Electromagnet** Topic : **9.1. Properties of Electromagnet**	Total lesson No: 51 / 74 Textbook page: 127 - 128

Lesson 2 / 6

Lesson Title

How to Strengthen an Electromagent 1

Preparation

electromagnet used in the last lesson, 3 dry cells, 3 cell boxes, switch

Lesson Flow

1 Introduction (5 min.)

- Revise the previous lesson. Ask:

Q:What are the characteristics of an electromagnet?

- Ask students to guess the ways to increase the strength of electromagnet by asking:

Q:How can we increase the strength of electromagnet?

- Recap on the connection of a circuit from Grade 4 lessons on 'Electricity 1'.

2 Introduce the key question

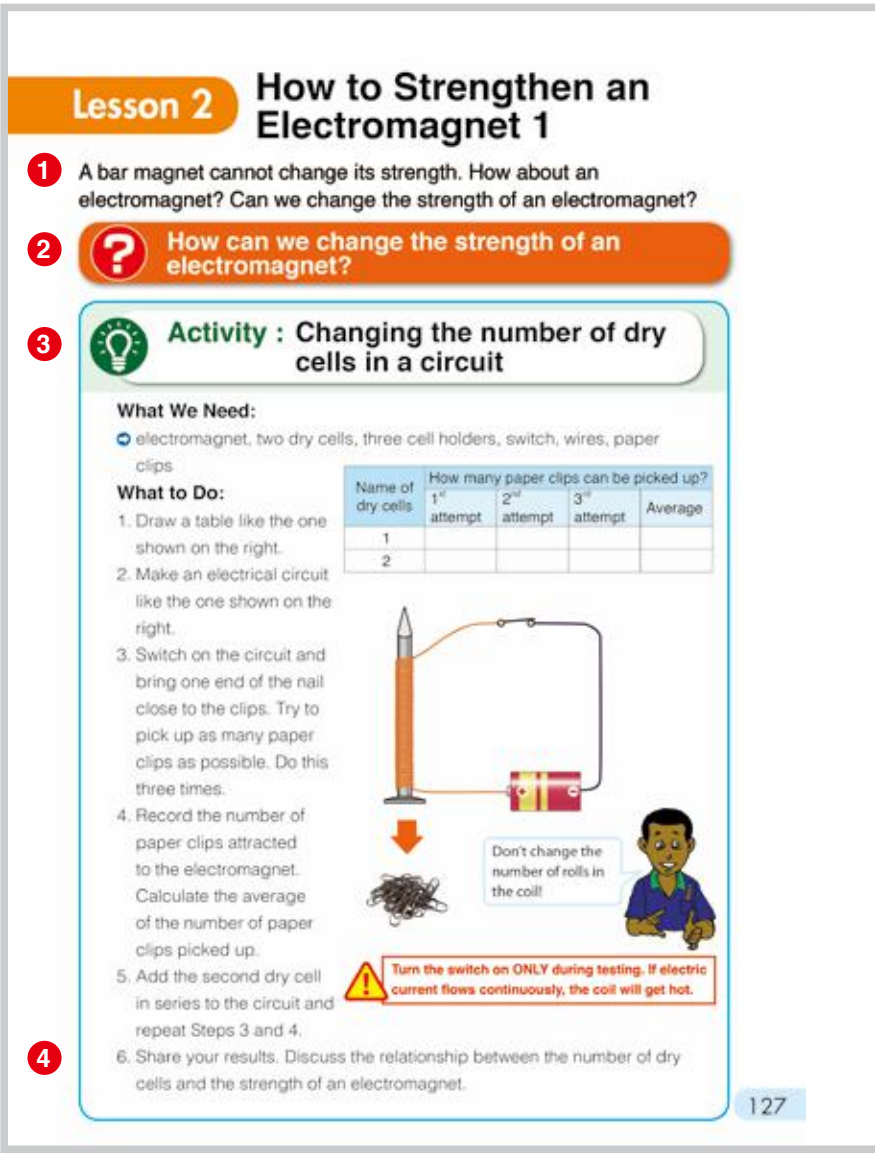
How can we change the strength of an electromagnet?

3 Activity (35 min.)

- Organise students into groups and explain the steps of the activity.
- Remind students of the safety rules.
- Explain how to calculate the average.
- Assist them to set up an electric circuit if necessary.
- Ask students to do the activity and record their results in the table.
- Give enough time for them to experiment and record their results.
- Ask students to discuss their findings in their groups.

4 Discussion for findings (25 min.)

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



Lesson 2 How to Strengthen an Electromagnet 1

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

2 How can we change the strength of an electromagnet?

3 Activity : Changing the number of dry cells in a circuit

What We Need:

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

What to Do:

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

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

Don't change the number of rolls in the coil!

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

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Teacher's Notes

SAFETY: The same rules from the last lesson should be used.

- Prior to the lesson, the teacher must do an experiment and make sure that connections are properly made.

# of dry cell	Number of paper clips attracted			
	1st attempt	2nd attempt	3rd attempt	Average
1	11	15	13	13
2	19	23	18	20
3	21	24	21	22

How to find the average:

- Instruct students to do 3 or 4 attempts each and find the average.
- Add the 3 attempts and divide the total by the number of attempts.

e.g. 11+ 15+ 13 = 39

39 / 3 = 13

You should improvise switch if there is no switch or connection can be done without the switch.

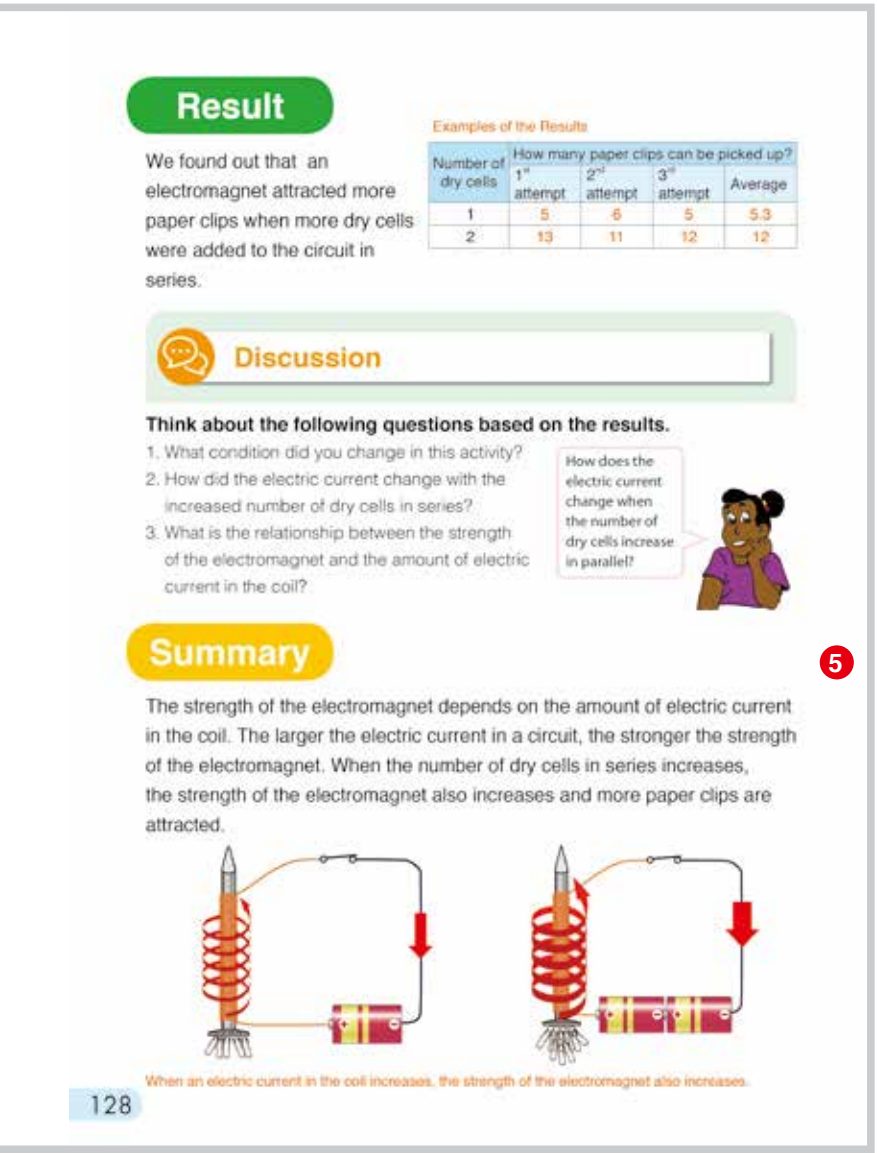
- The terminals (+, -) on the battery must be opposite to each other and the length of the wires should be 30 cm long.
- Wire should be tied onto the dry cell holder where there is a hole. Push the wire in, twist and turn so it is tighten to the holder.
- If there are no dry cell holders, paper can be used to wrap and connect the dry cells.

Lesson Objectives

Students will be able to:
- Explain the relationship between the strength of an electromagnet and electric current.
- Participate in the activity with curiosity.

Assessment

Students are able to:
- State how to increase the strength of an electromagnet in relations to the strength of electric current.
- Enjoy discovering how to increase the strength of an electromagnet.



Result

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

Examples of the Results

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

Discussion

Think about the following questions based on the results.

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

How does the electric current change when the number of dry cells increase in parallel?

Summary

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

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

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- Write their results on the blackboard.
- Confirm the results with the students.
- **Based on their results,** ask these questions.

Q:What condition did you change in this experiment? (The number of dry cells.)
Q:What conditions were constant? (The number of rolls in the coils and the iron nail.)
Q:How does the electric current change with the increasing number of dry cells in series? (The electric current increases.)
Q:What is the relationship between the strength of an electromagnet and the electric current in the coil?

- Explain that the strength of electromagnet depends on the amount of electric current. As the number of dry cells increase, the flow of electric current becomes larger which enables the strength of electromagnet to increase.
- Conclude the discussions.

5 Summary (15 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 the strength of electromagnet depend on?
  Q: What happens to the strength of electromagnet when the number of dry cells connected in series increases?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **How to Strengthen an Electromagnet 1**

Key question: How can we change the strength of an electromagnet?
Activity: Changing the number of dry cells in a circuit

# of dry cells	Number of paper clips attracted ?			
	1st attempt	2nd attempt	3rd attempt	Average
1	Refer to the 'Teacher's Note'			
...				

Discussion
Q: What condition did you change in this experiment?
The number of dry cells.
Q: What conditions were constant? The number of rolls in the coils and the iron nail.
Q: How does the electric current change with the increasing number of dry cells in series?
The electric current increases.
Q: What is the relationship between the strength of an electromagnet and the electric current in the coil?
As the number of dry cells increases, the flow of electric current becomes larger which enables the strength of electromagnet to increase.

Summary
- The strength of electromagnet depends on the amount of electric current in the circuit.
- The larger the electric current flows, the strength of electromagnet also increases.

Unit: **Energy**	Chapter : **9. Electromagnet** Topic : **9.1. Properties of Electromagnet**	Total lesson No: 52 / 74 Textbook page: 129 - 130

Lesson 3 / 6

Lesson Title

How to Strengthen an Electromagnet 2

Preparation

same electromagnet used in the last lesson, dry cell, cell box, switch

Lesson Flow

1 Introduction (5 min.)

- Revise the previous lesson. Ask:

Q:What should be done in order to increase the strength of an electromagnet?

- Ask the students to guess another way to strengthen an electromagnet by asking:

Q:Is there a different way to strengthen an electromagnet?

2 Introduce the key question

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

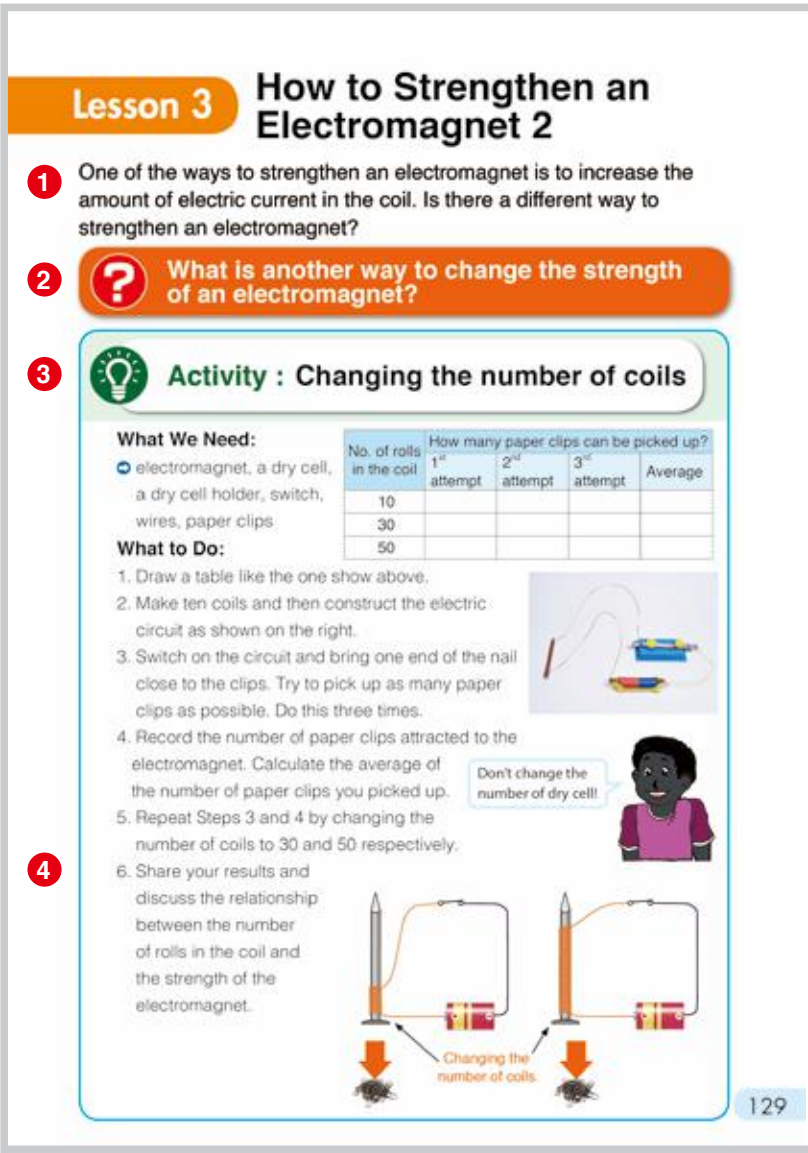
3 Activity (35 min.)

- Organise students into groups and explain the steps of the activity.
- Remind students of the safety rules.
- Explain how to calculate the average.
- Assist them to set up an electric circuit if necessary.
- Ask students to do the activity and to record their results in the table.
- Give enough time for them to experiment and record their results.
- Ask students to discuss their findings based on the result in their groups.

4 Discussion for findings (25 min.)

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

(Continue)



Lesson 3 How to Strengthen an Electromagnet 2

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

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

3 Activity : Changing the number of coils

What We Need:
electromagnet, a dry cell, a dry cell holder, switch, wires, paper clips

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

What to Do:
1. Draw a table like the one show above.
2. Make ten coils and then construct the electric circuit as shown on the right.
3. Switch on the circuit and bring one end of the nail close to the clips. Try to pick up as many paper clips as possible. Do this three times.
4. Record the number of paper clips attracted to the electromagnet. Calculate the average of the number of paper clips you picked up.
5. Repeat Steps 3 and 4 by changing the number of coils to 30 and 50 respectively.
6. Share your results and discuss the relationship between the number of rolls in the coil and the strength of the electromagnet.

Don't change the number of dry cell!

Changing the number of coils

4

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Teacher's Notes

SAFETY: Same safety rule to be applied as in the previous lessons.

Tips for the Activity

- Since the students will be using the same electromagnet used in the last lesson, you can also start by removing 20 coils from each end to 10 coils first.
- When you change the dry cell make sure to start all over again.
- Note: Prior to the lesson, the teacher must do an experiment and make sure connections are properly made.

Additional information on the relationship between the strength of electromagnet and the number of coils

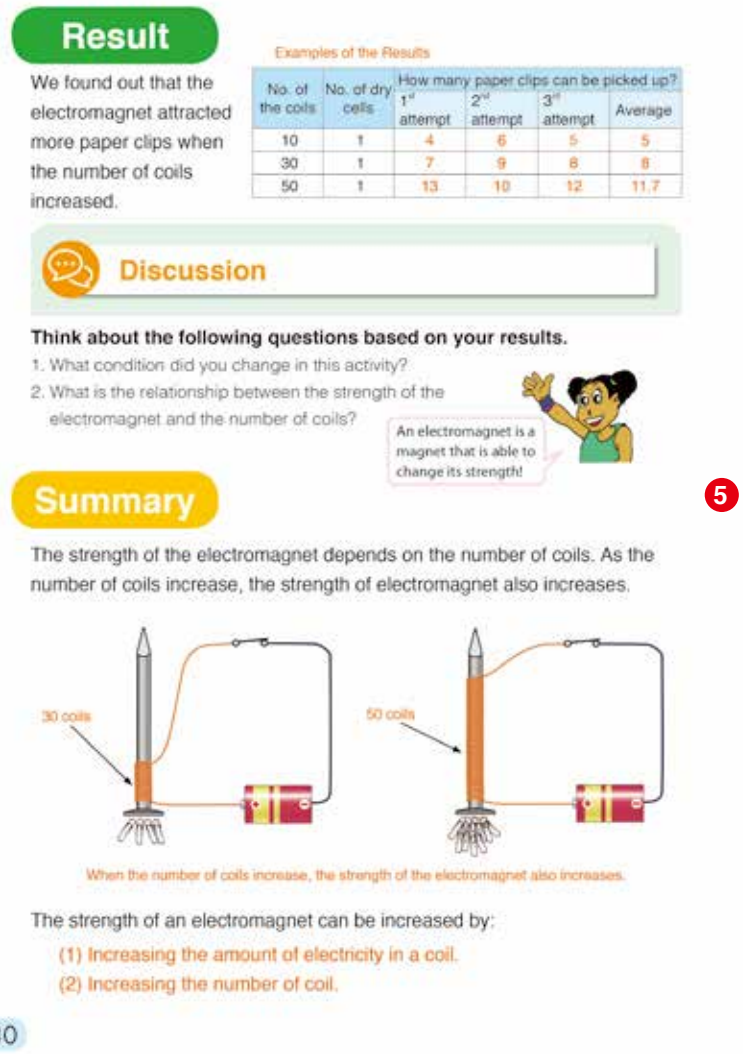
- The current passing through an electromagnet produces a magnetic field. Therefore, the more turns of the coil you have, the greater the magnetic field and the stronger the electromagnet. This will mean more paper clips being picked up by the nail.

Lesson Objectives

Students will be able to:
- Explain the relationship between the strength of an electromagnet and the number of coils.
- Participate in the activity with curiosity.

Assessment

Students are able to:
- State how to increase the strength of an electromagnet in relation to the number of coils.
- Show curiosity through the experiment.



Result

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

Examples of the Results

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

Discussion

Think about the following questions based on your results.

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

An electromagnet is a magnet that is able to change its strength!

Summary

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

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

The strength of an electromagnet can be increased by:

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

(2) Increasing the number of coil.

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

Q:What condition did you change in this experiment? (The number of rolls in the coil.)

Q:What conditions were constant? (The number of dry cells and the iron nail.)

Q:What is the relationship between the strength of electromagnet and the number of rolls in the coil? (The strength of electromagnet depends on the number of rolls of the coil. As the number of rolls of the coils increases, the strength of electromagnet increases.)

- Explain that the strength of electromagnet also depends on the number of rolls of the coil. As the number of rolls increase the strength of electromagnet also increases that is why it was able to attract more clips.
- Conclude the discussions.

5 Summary (15 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 the strength of electromagnet depend on?
  Q: What happens to the strength of electromagnet when the number of rolls in the coil increases?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

How to Strengthen an Electromagnet 2

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

Activity:
Changing the number of coils

(Example of the results)

# of rolls in the coil	How many steel clips can be attract? 1st attempt	2nd attempt	3rd attempt	Average
10	4	6	5	5
30	7	9	8	8
50	13	10	12	11.7

Discussion
Q: What condition did you change in this experiment? The number of rolls in the coil.
Q: What conditions were constant? The number of dry cells and the iron nail.

Q: What is the relationship between the strength of electromagnet and the number of rolls in the coil? The strength of electromagnet depends on the number of rolls of the coil. As the number of rolls of the coils increases, the strength of electromagnet increases.

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

Unit: **Energy**	Chapter : **9. Electromagnet** Topic : **9.1. Properties of Electromagnet**	Total lesson No: 53 / 74 Textbook page: 131 - 132

Lesson 4 / 6

Lesson Title

Uses of Electromagnets in Daily Life

Preparation

electromagnet, two dry cells, two cell holders, switch, bar magnet, paper clips, any magnetic substances

Lesson Flow

1 Introduction (5 min.)

- Recap the previous lesson. Ask:

Q:How can we increase the strength of an electromagnet?

- Ask the students if they have seen a coil of wire in an appliance by asking:

Q:Which appliance have you seen a coil in it?

2 Introduce the key question

How are electromagnets used in our daily lives?

3 Activity (35 min.)

- Organise students into groups and remind them of the safety rules.
- Explain the steps of the activity.
- Let them put all the items at point A and use electromagnet to transport the items to point B.
- Encourage the students to carefully observe what happens when lifting and releasing the magnetic items.
- Refer students to what the character is saying for their investigation.
- Give enough time for students to do the activity and record the findings in their exercise book.

4 Discussion for findings (25 min.)

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

(Continue)


Lesson 4 Uses of Electromagnets in Daily Life

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

Scrap metal yard

2 How are electromagnets used in our daily lives?

3 Activity : Transporting objects using battery, wire and nail

What We Need:

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

What to Do:

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

Point B

Point A

4

Is it possible to do the same thing with a bar magnet?

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Teacher's Notes

SAFETY: Same safety rule to be applied as in the previous lessons.

Tips for the Activity

- In order to lift a metal spoon (heavy objects) the strength of the electromagnet should be increased by increasing the number of coils or the electric current.

Difference between electromagnet and a permanent magnet:

- An electromagnet is a kind of magnet whose magnetic field is created by the flow of electric current. The magnetic field disappears when the current stops. Electromagnets offer the advantages of controlled holding power and on command release.
- A permanent magnet is an object made from a material that is magnetized. It always has a magnetic field and will display a magnetic behaviour at all times.

Electromagnets are used in many objects such as in:

- Speakers in telephones, radios, televisions, etc.
- Motors in fans, refrigerator, etc.

Some places where electromagnet is used to lift or move heavy objects:

- Recycling factory
- Wharf (big containers are moved from ships)

Lesson Objectives

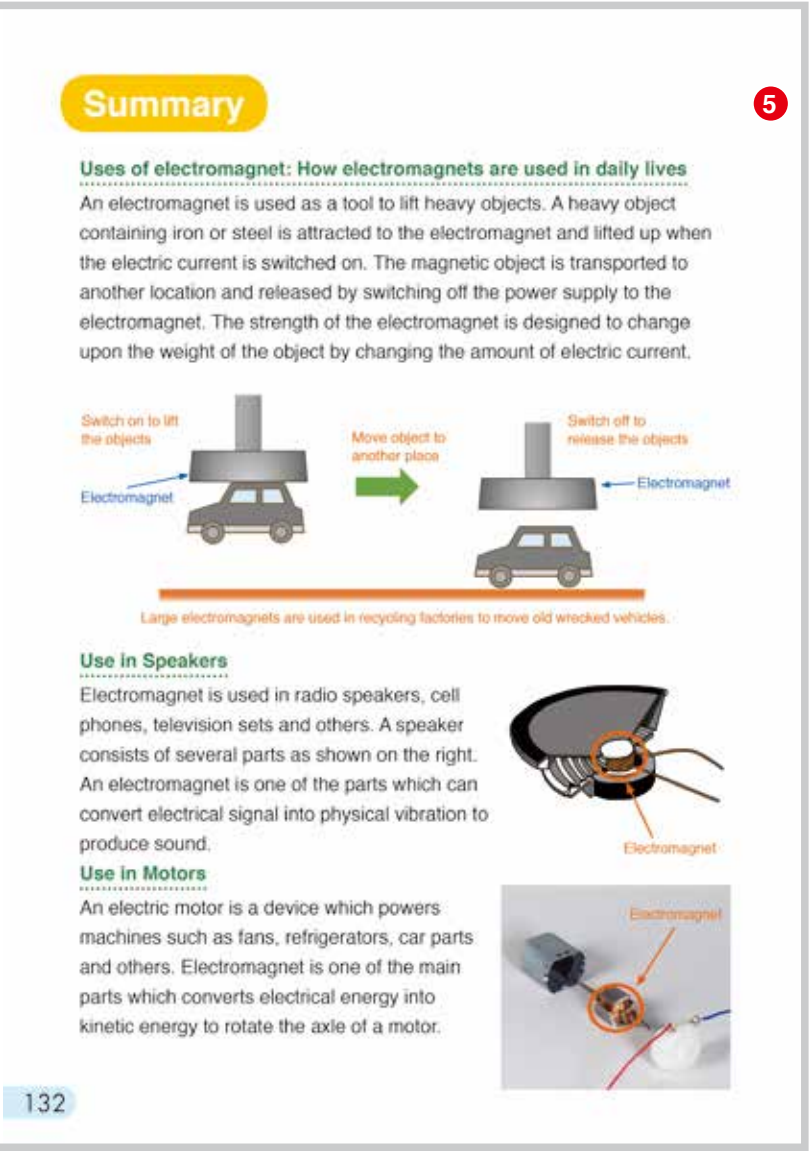
Students will be able to:

- Discover how electromagnet can move magnetic objects from one place to another.
- Identify how strength of electromagnet can be increased to move heavy objects.
- Describe how electromagnets are used in daily life.

Assessment

Students are able to:

- Demonstrate by moving the magnetic objects from point A to point B without dropping them using the electromagnet.
- Explain that the strength of an electromagnet can increased by increasing the number of dry cells and coils to move heavy objects.
- Identify some uses of electromagnets in daily life.



Summary

5

Uses of electromagnet: How electromagnets are used in daily lives

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

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

Use in Speakers

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

Use in Motors

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

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

Q:How can we increase the strength of an electromagnet to lift or move the heavy object from one point to another? (By increasing the number of roll of the coils and the electric current).

- Explain that in order to move a heavy object from one point to another the strength of an electromagnet has to be increased by increasing the number of roll of the coils and the electric current.
- Show a coil of wire from a phone or radio to the students and ask if they have seen it in any appliances.

Q:What are some appliances that have electromagnets? (Refer to some examples in the blackboard plan)

5 Conclude the discussions.

Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is the use of electromagnet?
  Q: What does electromagnets depend on to lift and move heavy objects?
  Q: What else uses electromagnet?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Uses of Electromagnets in Daily Life

Key question

How are electromagnets used in our daily lives?

Activity:

Transporting objects using battery, wire and nail

1.What happened when the switch was turned?

2.How did you lift the metal spoon?

Discussion

Q: How can we increase the strength of an electromagnet to lift or move the heavy object from one point to another?

By increasing the number of roll of the coils and the electric current that would increase the strength of an electromagnet.

Q: What are some appliances that use electromagnet?

Speaker- radio, television, phone,
Motors- fan, refrigerator, car parts.

Summary

- Electromagnet is used as tools for heavy lifting.
- Electromagnet depends on the electric current to lift and move heavy objects. When it is turned ON it lifts heavy objects and when turned OFF it releases.
- Electrical appliances use electromagnets, some examples are:
  Speakers- radio, television, phone,
  Motors- fan, refrigerator, car parts.

Unit: **Energy**	Chapter : **9. Electromagnet** Topic : **9.1. Properties of Electromagnet**	Total lesson No: 54 / 74 Textbook page: 133 - 135

Lesson 5 / 6

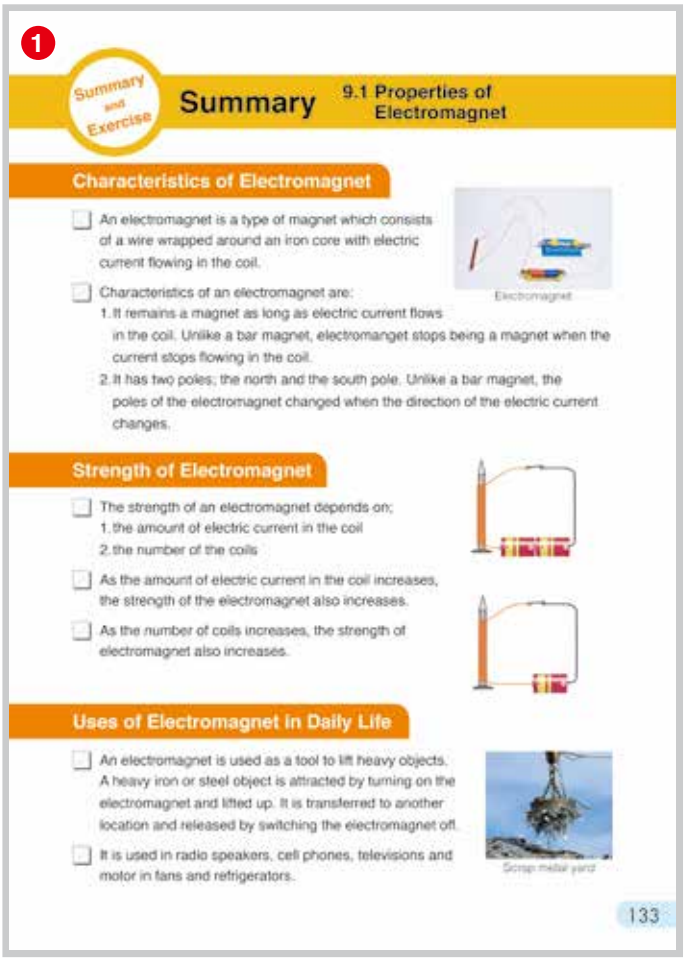
Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - What is an electromagnet?
  - What characteristics does an electromagnet have?
  - How can we increase the strength of an electromagnet?
  - What are some uses of electromagnet in daily life?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.



1

Summary and Exercise

Summary 9.1 Properties of Electromagnet

Characteristics of Electromagnet

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

Characteristics of an electromagnet are:

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

Electromagnet

Strength of Electromagnet

The strength of an electromagnet depends on:

1. the amount of electric current in the coil
2. the number of the coils

As the amount of electric current in the coil increases, the strength of the electromagnet also increases.

As the number of coils increases, the strength of electromagnet also increases.

Uses of Electromagnet in Daily Life

An electromagnet is used as a tool to lift heavy objects. A heavy iron or steel object is attracted by turning on the electromagnet and lifted up. It is transferred to another location and released by switching the electromagnet off.

It is used in radio speakers, cell phones, televisions and motor in fans and refrigerators.

Scrap metal yard

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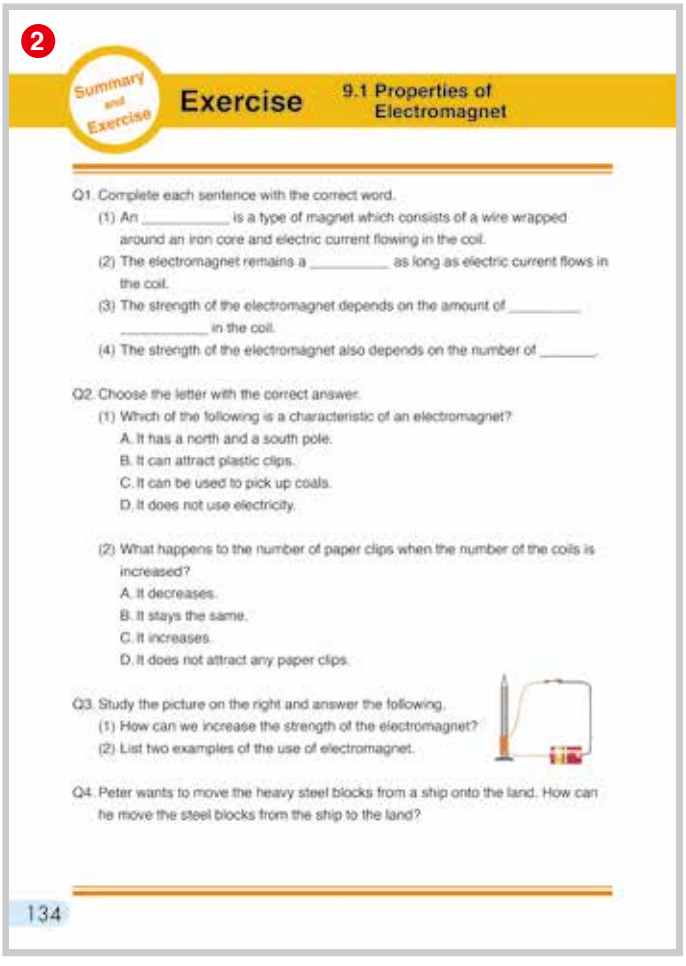
2 Exercise & Explanation (40 min.)

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



2

Summary and Exercise

Exercise 9.1 Properties of Electromagnet

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

A. It has a north and a south pole.
B. It can attract plastic clips.
C. It can be used to pick up coals.
D. It does not use electricity.

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

A. It decreases.
B. It stays the same.
C. It increases.
D. It does not attract any paper clips.

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

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

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

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

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Exercise answers

Q1.
(1) **electromagnet**
(2) **magnet**
(3) **electric current**
(4) **rolls**

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

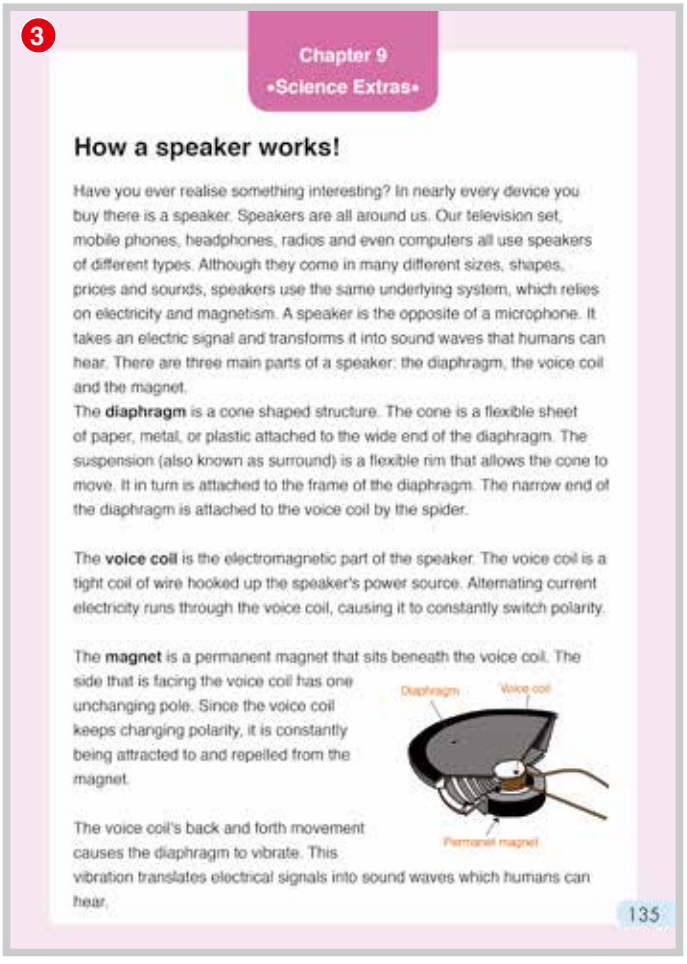
Q3. Expected Answer
(1) **Increases amount of electric current and number of rolls in the coil**
(2) **Cranes for heavy lifting, speaker, motor, etc**

Q4. Expected answer
He will turn on the electromagnet to lift up the metal to transfer to another place then release the metal by switching off the electromagnet.

Explanation of Science Extras

3 Science Extras (10 min.)

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



3

Chapter 9
•Science Extras•

How a speaker works!

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

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

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

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

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

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Lesson 6 / 6

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

9. Electromagnet

Q1 Complete each sentence with the correct word.

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

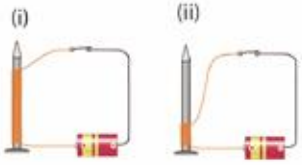
(2) As the electric current and the number of rolls increases the strength of the electromagnet also increases.

Q2 Choose the letter with the correct answer.

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

A. Dry cell, wire and piece of wood
B. Dry cell, wire and iron nail
C. Magnet, iron nail and wire
D. Magnet and dry cell

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



A. Because (i) has shorter iron nail.
B. Because (i) has more rolls of coil.
C. Because (i) has many dry cells.
D. Because (i) has thinner iron nail.

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

A. Because the iron core is too short.
B. Because the number of dry cells is not enough.
C. Because the weight of iron core is too light.
D. Because the electric current does not flow in the coil.

(4) How are electromagnets different from magnets?

A. Only bar magnet can be turned on/off.
B. Only electromagnet can be turned on/off.
C. Only bar magnet can change its strength.
D. Only electromagnet has north and south poles.

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Q3

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

They can attract magnetic substance such as paper clips and nails

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

(Expected answers) fans, refrigerator, speakers, telephone, etc.

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

1. By adding more dry cells
2. By increasing the number of coils.

Q4

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

The poles of the electromagnet changes when the direction of the electric current changes.

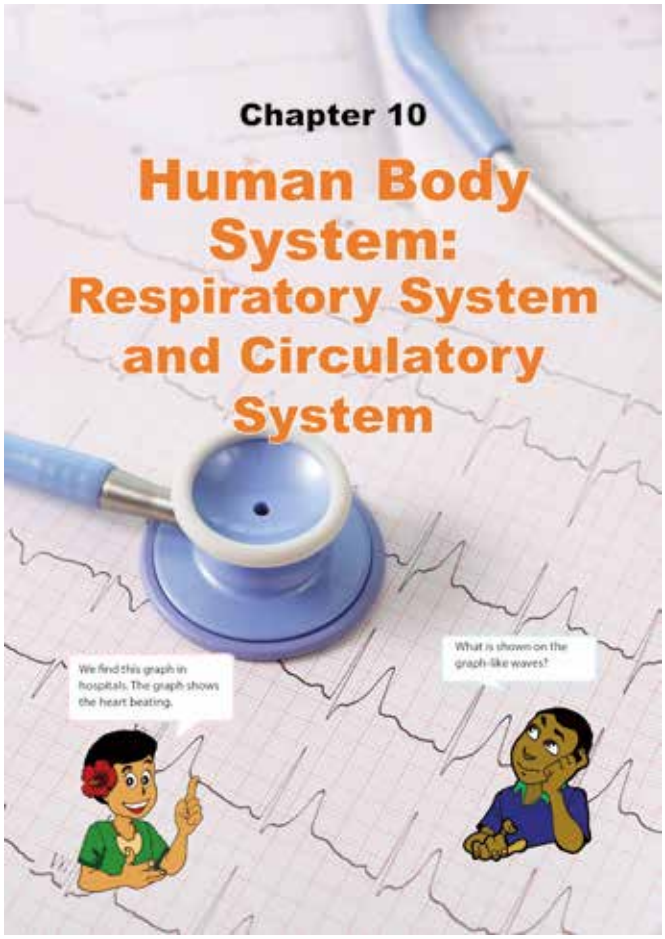
(2) Scrap metal yards use an electromagnet to separate iron from scrap materials. Explain how using an electromagnet instead of a regular magnet helps to separate iron from scrap materials?

(Expected answer) When electricity passes through the electromagnet, it becomes a magnet which helps separate iron from scrap materials. But when the flow of electricity stops, it loses it's magnetism.

Chapter 10. Human Body System: Respiratory System and Circulatory System

Chapter Objectives

Students will be able to understand the main organs and its function of respiratory system and circulatory system in the human body sytem.



This picture is from the chapter heading of the textbook showing a graph of the heart beating called a 'cardiograph' and a stethoscope.

Topic Objectives

10.1 Respiratory System

Students will be able to;

- Describe the function of the major organs of the respiratory system such as trachea, lungs and alveoli.
- Explain how air moves in and out of the lungs through observing a lung model.

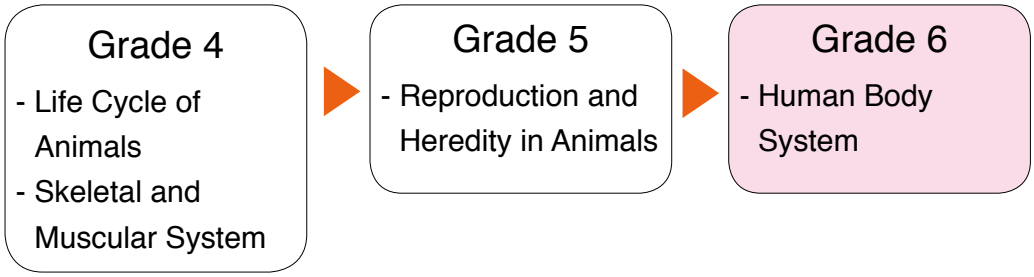
10.2 Circulatory System

Students will be able to;

- Describe the structure and function of the heart.
- Explain how blood flows in the human body through the blood vessels.
- Describe the components of blood such as red cells, white cells and platelets and its functions.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Structure of the human bones and muscles and how bones and muscles work together.
- Structure and function of male and female reproductive systems.

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
10.1 Respiratory System	1	**Breathing** How does air move in and out of our body?	6.1.3	139 - 140
	2	**Lungs** What are the functions and structures of lungs?		141 - 142
	3	Summary and Exercise		143 - 144
10.2 Circulatory System	4	**The Heart** What does the heart do?		145 - 146
	5	**Circulation of Blood** How does blood flow through the body?		147 - 148
	6	**Blood** How does blood carry oxygen and carbon dioxide?		149 - 150
	7	Summary and Exercise, Science Extras		151 - 153
Chapter Test	8	Chapter Test		154 - 155

Unit: **Human Being**	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.1. Respiratory System**	Total lesson No: 56 / 74 Textbook page: 139 - 140

Lesson 1 / 8

Lesson Title

Breathing

Preparation

limewater, two clear plastic bags

Lesson Flow

1 Introduction (5 min.)

- Recap Gr 3 Chapter 4 'Characteristics of Animals'. State that breathing is a characteristic of animals where air is taken in through lungs or gills and ask:

Q:How do fish breathe in water? (They use their gills to breathe in water.)

Q:What about animals that live on land? (They take in air through their lungs)

Q:Why do we keep breathing? (To be alive)

- Express that air is very essential in life and without air there is no life.

2 Introduce the key question

How does air move in and out of our body?

3 Activity (35 min.)

- Organise students in groups.
- Explain the steps of the activity.
- Remind students to observe the colour of the limewater carefully after shaking.
- Have students do the activity and record their result.
- Ask them to discuss the results in their groups.

4 Discussion for findings (25 min.)

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

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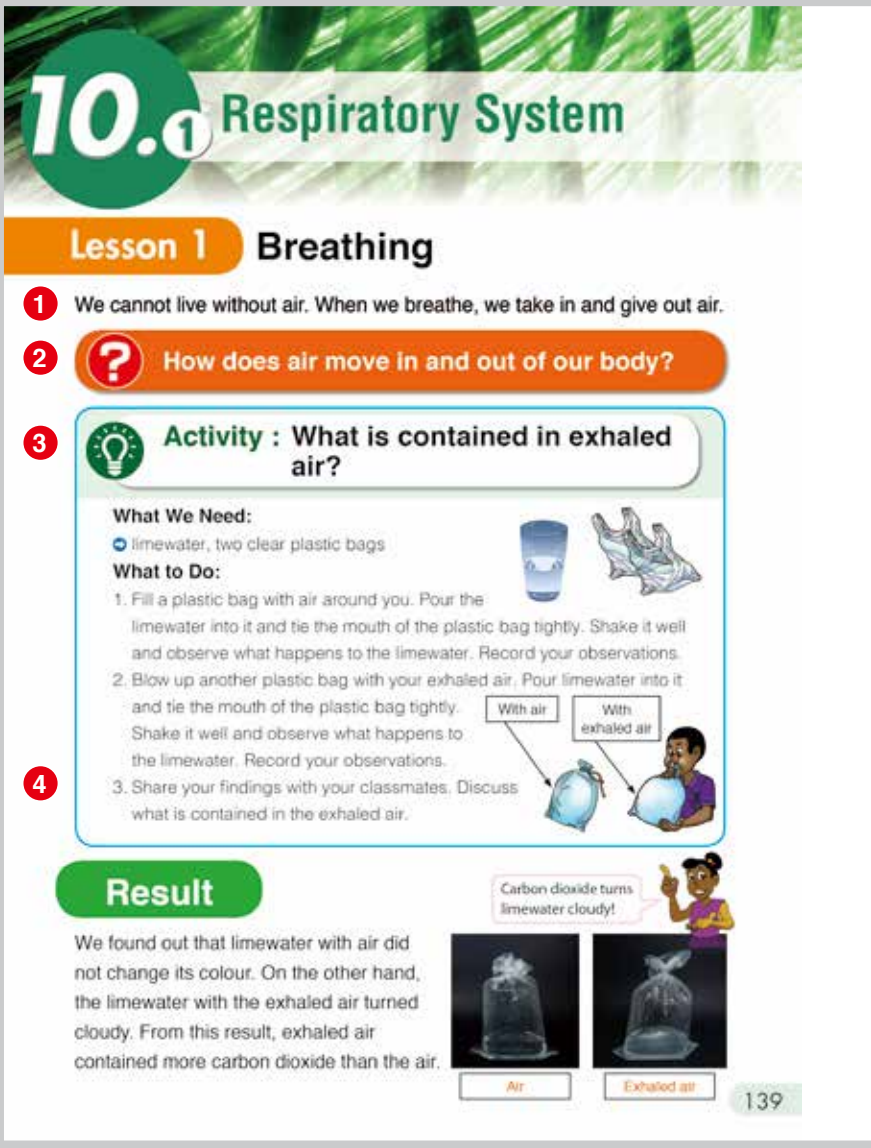


Teacher's Notes

- In Grade 3 Chapter 4, 'Characteristics of Animals' students learnt about breathing as a characteristic of animals in which animals that live on land breathe in through their lungs while those that live in water take in air through their gills.
- Lungs expand and contract, supplying life-sustaining oxygen to the body and removing a waste product called carbon dioxide.
- Breathing starts at the nose and mouth. The inhale air goes into the nose or mouth, and it travels down the back of your throat and into the windpipe or trachea and finally into the lungs.

How to prepare lime water

1. Fill up 500ml container with water.
2. Add 1 table spoon lime.
3. Shake the solution well.
4. Leave the solution to settle overnight so sediments settle at the bottom of the container.
5. Gently pour out the solution without sediments in to a cup.
6. Shake the solution for 1 minute and blow.

Tips of the Activity

1. Limewater must be prepared a night prior to the lesson.
2. Pour out limewater into a cup from the 500ml container.
3. Tie the plastic bags tightly so it doesn't spill when shaking.
4. Be careful not to allow students to taste or drink the limewater.
5. Plastic bag with exhaled air will be cloudy as it indicates carbon dioxide is present.

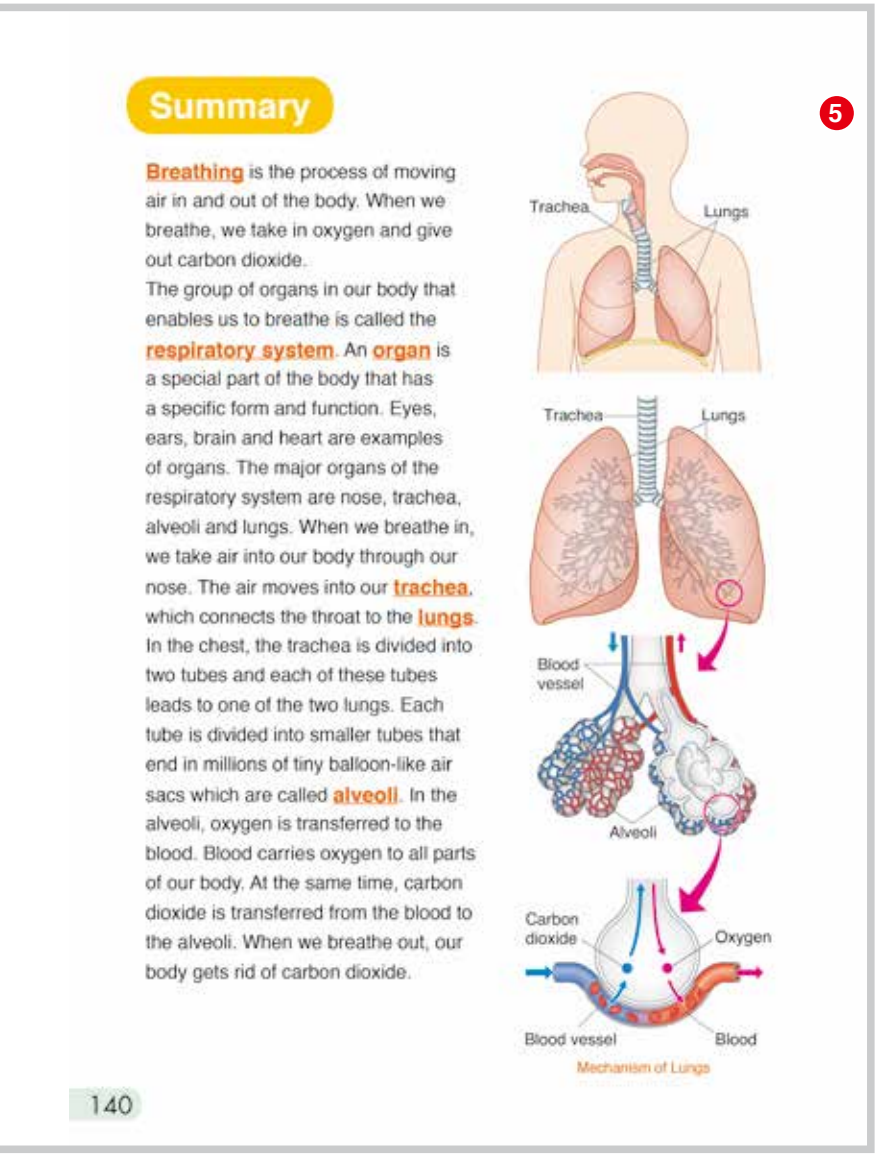
NOTE: Limewater is used to test for presence of carbon dioxide in exhaled air.

Lesson Objectives

Students will be able to:
- Understand what breathing is.
- Identify how organs work in the respiratory system.
- Observe the change of colour of the limewater with exhaled air.

Assessment

Students are able to:
- Explain what kinds of gas are exchanged during breathing.
- Describe the name of the organs and their work in the respiratory system.
- Illustrate their ideas freely in the change of colour of the limewater with exhaled air.



Summary

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

5

Mechanism of Lungs

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

Q:Is the exhaled air the same as or different from the air? (It is different from air)
Q:Why do you think so? (The colour of the limewater in air is different from that in exhaled air.)
Q:Carbon dioxide turns the limewater cloudy. Which of the two, air or exhaled air has more carbon dioxide? (Exhaled air.)
Q:What do you understand from the result of this activity? (When we breathe out, we give out carbon dioxide. When we breathe in, we take in oxygen)

- Conclude the discussions.

5 Summary (15 min.)

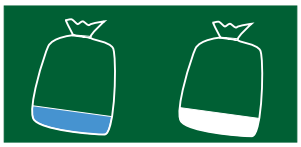
- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is breathing?
  Q: What is the respiratory system?
  Q: What are the main organs of respiratory system?
  Q: What air do we take in and give out when we breathe?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:
Breathing

Key question:
How does air move in and out of our body?

Activity:
What is contained in exhaled air?



Air | Exhaled air

Discussion
Q: Is the exhaled air the same as or different from the air? It is different from air.
Q: Why do you think so?
The colour of the limewater in air is different from that in exhaled air.
Q: Carbon dioxide turns the limewater cloudy. Which of the two, air or exhaled air has more carbon dioxide? Exhaled air
Q: What do you understand from the result of this activity? When we breathe out, we give out carbon dioxide. When we breathe in, we take in oxygen.

Summary
- Breathing is the process of moving air in and out of the body.
- When we breathe, we take in oxygen and give out carbon dioxide.
- A group of organs in our body that enables us to breathe is called the respiratory system.
- An organ is a special part of the body that has a specific form and function.
- The major organs of the respiratory system are nose, trachea, alveoli and lungs

Unit: **Human Being**	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.1. Respiratory System**	Total lesson No: 57 / 74 Textbook page: 141 - 142

Lesson 2 / 8

Lesson Title

Lungs

Preparation

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

Lesson Flow

1 Introduction (5 min.)

- Revise the previous lesson by asking:

Q:How does air move into our body?
Q:What is contained in exhaled air?

- Explain that lungs are the main organs of respiratory system and ask the question:

Q:How does the lung work?

2 Introduce the key question

What are the functions and structures of lungs?

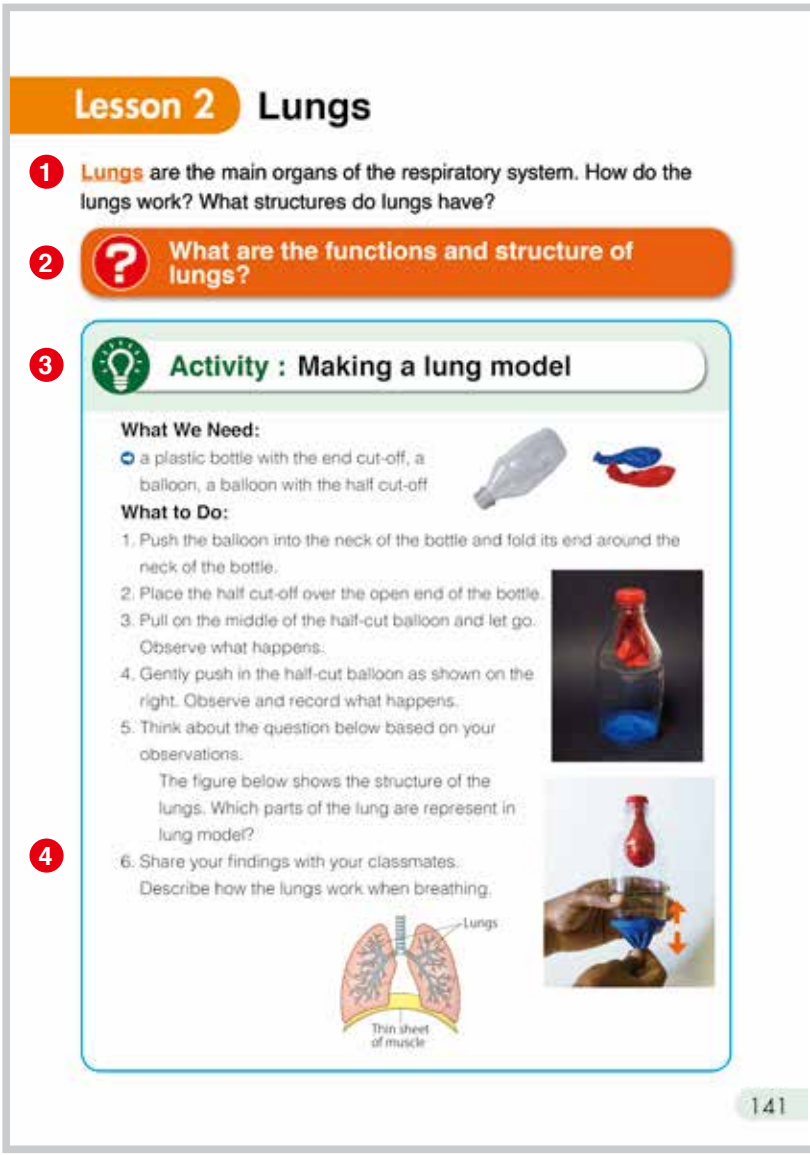
3 Activity (35 min.)

- Organise students in groups.
- Explain the steps of the activity.
- Remind students to gently pull and let go of the piece of rubber.
- Have students to do the activity and record their observations in their exercise books.
- Ask students to discuss their findings and how lungs work when breathing by comparing the lung model and the figure in their groups.
- Give enough time to the students to find new ideas through the activity by themselves.

4 Discussion for findings (25 min.)

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

(Continue)



Lesson 2 Lungs

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

2 What are the functions and structure of lungs?

3 Activity : Making a lung model

What We Need:
- a plastic bottle with the end cut-off, a balloon, a balloon with the half cut-off

What to Do:
1. Push the balloon into the neck of the bottle and fold its end around the neck of the bottle.
2. Place the half cut-off over the open end of the bottle.
3. Pull on the middle of the half-cut balloon and let go. Observe what happens.
4. Gently push in the half-cut balloon as shown on the right. Observe and record what happens.
5. Think about the question below based on your observations.
   The figure below shows the structure of the lungs. Which parts of the lung are represent in lung model?
6. Share your findings with your classmates. Describe how the lungs work when breathing.

4

Lungs
Thin sheet of muscle

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Teacher's Notes

The act of breathing has two stages – inhalation and exhalation

- Inhalation – the intake of air into the lungs through expansion of chest volume.
- Exhalation – the expulsion of air from the lungs through contraction of chest volume.
- Inhalation and exhalation involves muscles, which is called diaphram muscle.

Diaphragm muscle

1. During inhalation – the muscles contract:
   - Contraction of the diaphragm muscle – causes the diaphragm to flatten, thus enlarging the chest cavity. The chest cavity expands, thus reducing air pressure and causing air to be passively drawn into the lungs. Air passes from the high pressure outside the lungs to the low pressure inside the lungs.
2. During exhalation – the muscles relax:
   - The muscles are no longer contracting, they are relaxed.
   - The diaphragm curves and rises, the ribs descend and chest volume decreases.

Lung model

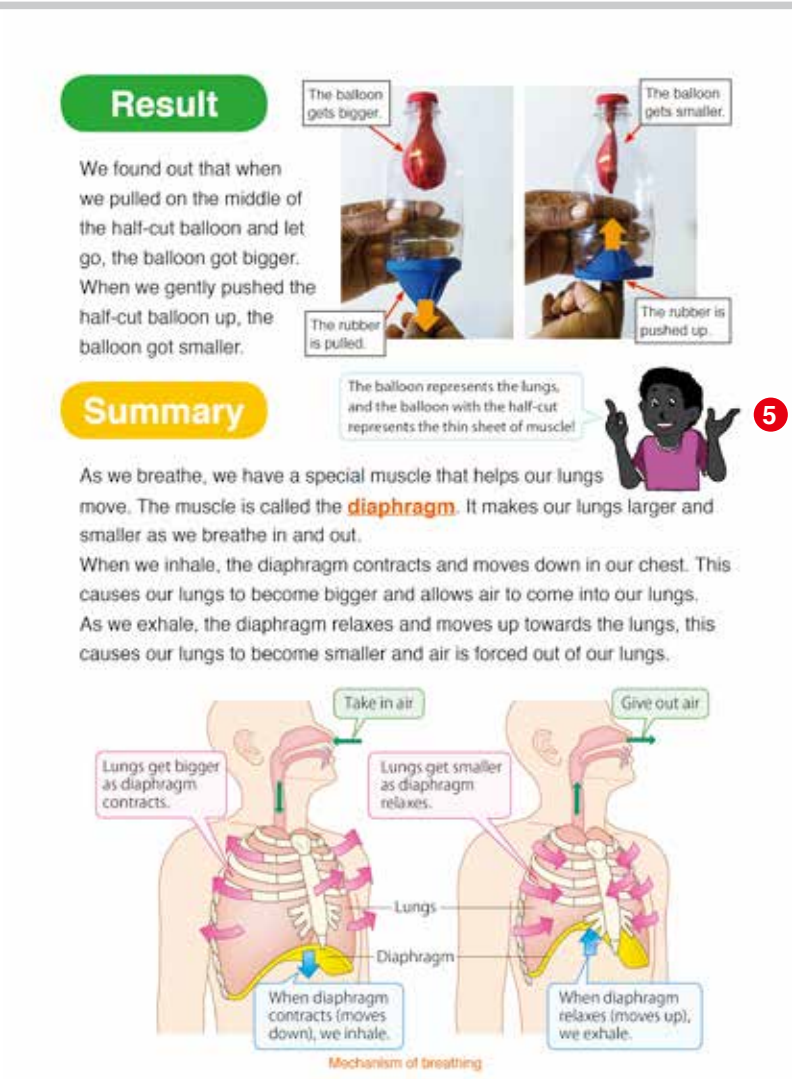
- Balloon represents lungs
- The cut out rubber is the muscle (diaphragm)
- Pulling the cut balloon shows breathing in (inhalation).
- Pushing the cut balloon shows breathing out (exhalation)

Lesson Objectives

Students will be able to:
- Identify the body parts that help human breathe.
- Describe the ways that human breathe in and out.
- Communicate their ideas to others.

Assessment

Students are able to:
- State lungs and diaphragm as the main body parts of breathing.
- Explain how lungs and diaphragm work together when breathing by comparing the lung model.
- Express their opinions during discussion.



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

Q:Which part of the lung model represents the lungs? (The balloon)

Q:Which part of the lung model represents the thin sheet of muscle? (The half cut-off balloon)

Q:What is the work of the sheet of muscle? (It changes the size of lungs, etc)

Q:How does the sheet of muscle move? (It goes up and down, etc.)

Q:Can you guess what happens to the sheet of muscle when we breath in or out? (It moves down when we breath in and moves up when we breath out.)

- Conclude the discussions.

5 Summary (15 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 helps lungs become bigger and smaller?
  Q: Which body parts help us breathe?
  Q: How does the diaphragm help when we breath in and out?
- Ask students to copy the notes on the black board into their exercise books.

Sample Blackboard Plan

Title:

Lungs

Key question:

What are the functions and structure of lungs?

Activity : Making a lung model

Results:

1. What happens to the balloon when we pull the centre of the rubber out?
   The balloon gets bigger.
2. What happens to the balloon when we push the centre of the rubber in?
   The balloon gets smaller.

Discussion

Q: Which part of the lung model represents the lungs or the thin sheet of muscle?
The lungs: The balloon
The sheet of muscle: The half cut-off balloon
Q: What is the work of the sheet of muscle?
It changes the size of lungs, etc
Q: How does the sheet of muscle move?
It goes up and down, etc.
Q: Can you guess what happens to the sheet of muscle when we breath in or out? It moves down when we breath in and moves up when we breath out.

Summary

- Lung is a respiratory organs, situated inside the rib cage, that transfer oxygen into the blood and remove carbon dioxide from it.
- Diaphragm is a special muscle that helps our lungs to move.
- When inhaling, the diaphragm moves down. This causes lungs to become bigger and allows air to come into lungs.
- When exhaling, the diaphragm moves up. This causes lungs to become smaller and air is forced out of the lungs.

Unit: **Human Being**	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.1. Respiratory System**	Total lesson No: 58 / 74 Textbook page: 143 - 144

Lesson 3 / 8

Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (40 min.)

- Recap the main learning contents covered in this topic.
- Base on the main learning contents ask students the following questions.
  - What is a respiratory system?
  - What are the major organs of the respiratory system?
  - How does breathing take place?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.

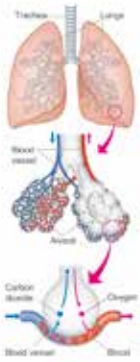
1

Summary and Exercise

Summary 10.1 Respiratory System

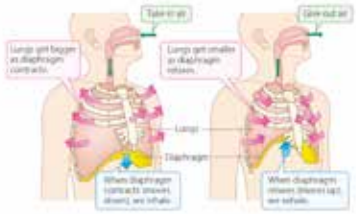
Breathing

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



Lungs

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



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2 Exercise & Explanation (40 min.)

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

2

Summary and Exercise

Exercise 10.1 Respiratory System

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

A. Eyes, ears and mouth
B. Nose, trachea and heart
C. Trachea, lungs and oxygen
D. Nose, trachea and lungs

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

A. Heart
B. Trachea
C. Alveoli
D. Diaphragm

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

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

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Exercise answers

Q1.
(1) **breathing**
(2) **organ**
(3) **respiratory**
(4) **diaphragm**

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

Q3.Expected answer

Lungs gets bigger as diaphragm contracts and air comes into our lungs as we inhale. Lungs get smaller as diaphragm relaxes and air is forced out of our lungs as we exhale.

Q4. Expected answer

When we breathe in, we take in oxygen into our body through our nose. The air moves into our trachea, which connects the throat to the lungs. In the chest, the trachea divides into two tubes and each of these tubes leads to one of your two lungs.

Unit: Human Being	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.2. Circulatory System**	Total lesson No: 59 / 74 Textbook page: 145 - 146

Lesson 4 / 8

Lesson Title

The Heart

Preparation

stopwatch

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson by asking:

Q:Which organ in our body helps us to breathe in air and how does it function?

- Based on their experiences also pose a question.

Q:What kind of physical exercise do you do at home? Walking, running, jumping.

- Provoke students to think by asking:

Q:How would you feel after taking part in a long running race? Heart beats so fast.

Q:How can you feel your heart beat?

2 Introduce the key question

What does the heart do?

3 Activity (35 min.)

- Organise students in pairs.
- Explain the steps of the activity.
- Assist students to find their pulse on their wrists.
- Ask students to measure their pulse rates at rest and after exercise for 15 seconds.
- Demonstrate how to calculate pulse rate using the formula.
- Have students to calculate their pulse rates in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their pulse rates from the activity.
- Write down their pulse rates on the black board.

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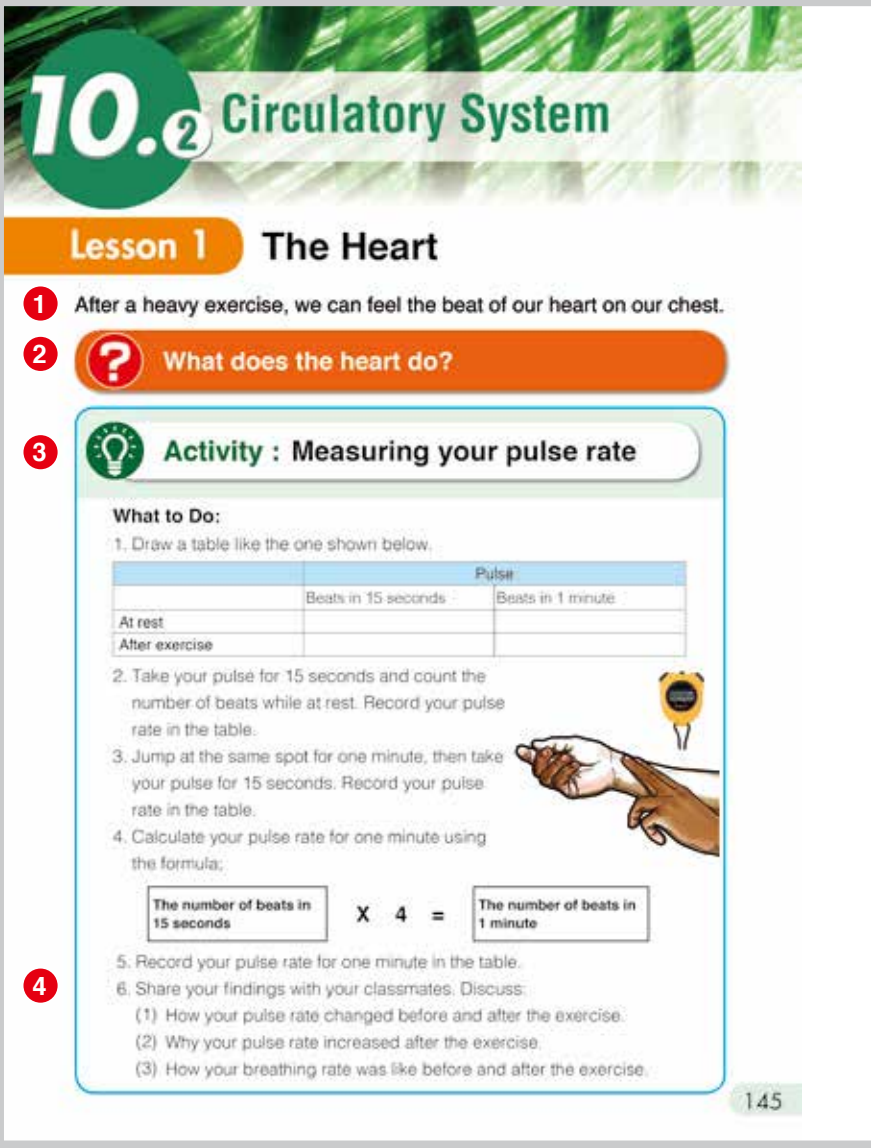


Teacher's Notes

Tips of the Acitivity

- To check your pulse at your wrist, place two fingers between the bone and the tendon over your radial artery — which is located on the thumb side of your wrist. When you feel your pulse, count the number of beats.
- Allow students to work out their pulse and breathing rates using the formula given and record in the table.
- Make sure every child can be able to feel their pulse before the activity is carried out.

How do you measure your breathing rate?

- The respiration rate is the number of breaths a person takes per minute. The rate is usually measured when a person is at rest and simply involves counting the number of breaths for one minute by counting how many times the chest rises.
- The person's breathing is likely to change if he or she knows you are counting it.
- What are respirations? Respirations are when you breathe in and out. Your respiratory, or breathing rate is the number of times you breathe in and out in 1 minute. Most people breathe in and out 12 to 20 times every minute.

Lesson Objectives

Students will be able to:
- Understand what a heart is.
- Identify the structures of a heart.
- Measure their pulse rates.

Assessment

Students are able to:
- Describe the functions and the structure of the heart.
- List the different parts of the heart.
- Use the fomular to calculate the pulse rate for one minute.

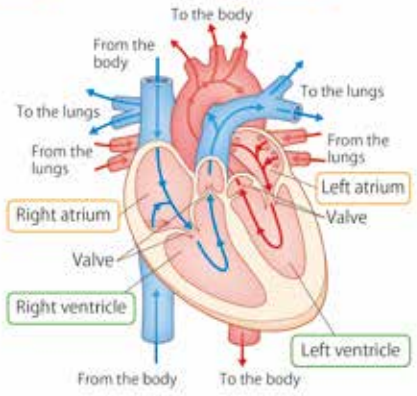
Summary

5

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

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

The heart pumps thousands of litres of blood to all parts of our body every day. The heart has four spaces which are called **chambers**. These are called the left and right **atriums** and the left and right **ventricles**. The atrium is a chamber that receives blood from the body and the lungs, and the ventricle is a chamber that pumps blood to the lungs and the body. Between the chambers there are valves. The valves open and close to control the movement and direction of blood flow. When ventricles contract, blood is forced out of the heart. We can feel this contraction as a pulse. During physical exercise, more oxygen is needed in the muscles so the blood must carry oxygen to the muscles faster than when the body is at rest. To meet these demands the pulse rate increases.



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

Q:How did your pulse rate change before and after the exercise? (The pulse rates increased after exercise.)

Q:Why did your pulse rate increase after the exercise? (Because the number of the heartbeats increased.)

Q:How was your breathing rate like before and after the exercise? (Before the exercise the breathing rate was slow and after the exercise it was faster.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is the heart made of?
  Q: How many chambers does the heart has?
  Q: What are atriums and ventricles?
  Q: Why does the pulse rate increase during exercise?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

The Heart

Key question:
What does the heart do?

Activity:
Measuring your pulse rate

Result:

	Pulse	
	15 sec	1 min
At rest	18	72
After exercise	30	120

Discussion

Q: How did your pulse rate change before and after the exercise?
The pulse rates increased after exercise.
Q: Why did your pulse rate increase after the exercise?
Because the number of the heartbeats increased.
Q: How was your breathing rate like before and after the exercise?
Before the exercise, the breathing rate was slow and after the exercise it was faster.

Summary
- The heart is an important organ in our body.
- The heart is made of a muscle called the heart muscle.
- The heart pumps thousands of litres of blood to all parts of our body.
- The heart is made of four chambers called left and right atriums and the left and right ventricles.
- The atrium is a chamber that receives blood from the body or the lungs.
- The ventricle is a chamber that pumps blood to the lungs or the body.

Unit: Human Being	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.2. Circulatory System**	Total lesson No: 60 / 74 Textbook page: 147 - 148

Lesson 5 / 8

Lesson Title

Circulation of Blood

Preparation

live fish, small clear zip bag, microscope

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson by asking:

Q:Why does your pulse rate increase after an exercise?

Q:What is the function of the heart?

- Provoke students thinking about the flow of blood in the human body by asking:

Q:How does blood flow in the human body?

2 Introduce the key question

How does blood flow through the body?

3 Activity (35 min.)

- Organise students in groups.
- Explain the steps of the activity.
- Demonstrate how each student will take turn to observe the blood flow of a fish using the microscope.
- Remind students to observe carefully the direction of the blood flow.
- Ask students to do the activity by referring to the characters in the textbook.
- Give them enough time to sketch the flow of blood in their exercise books.
- Ask students to discuss their findings in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their findings from the activity.

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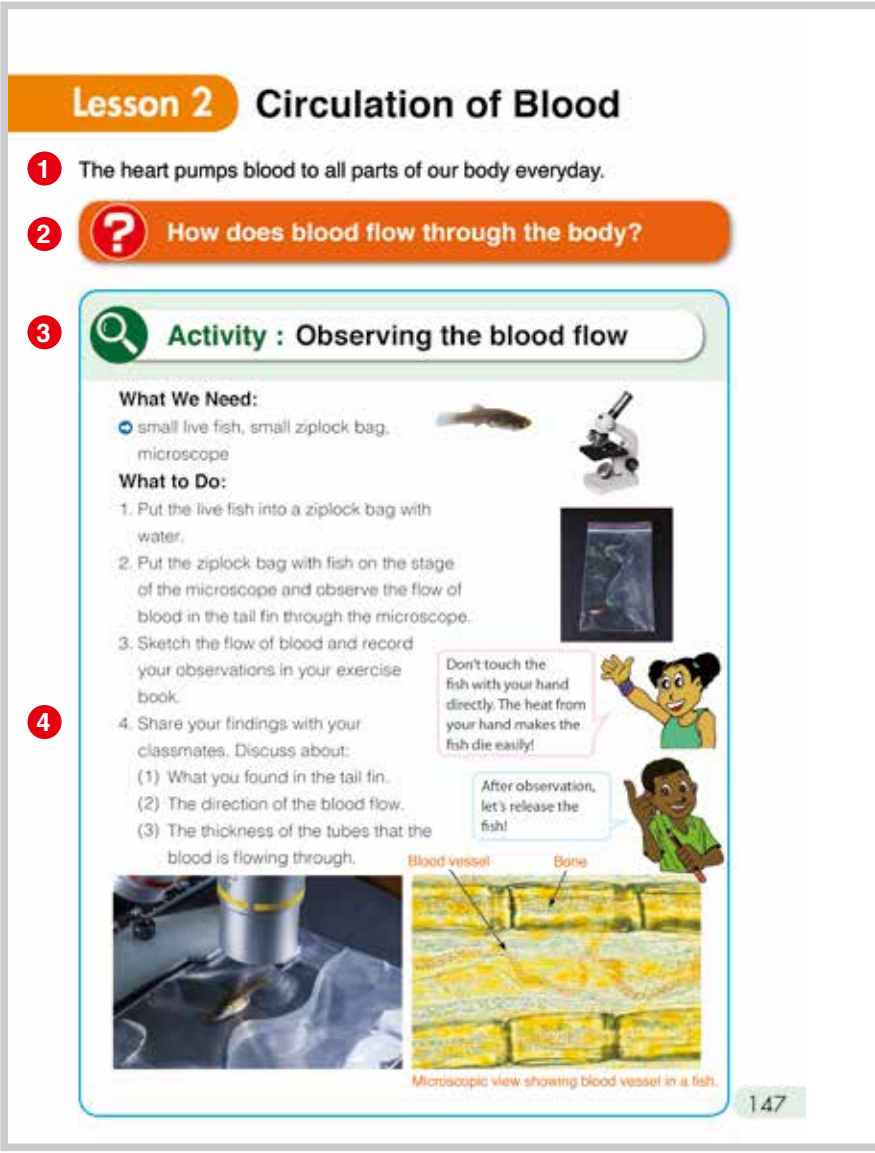

Lesson 2 Circulation of Blood

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

2 How does blood flow through the body?

3 Activity : Observing the blood flow

What We Need:
- small live fish, small ziplock bag, microscope

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

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

After observation, let's release the fish!

Blood vessel Bone

Microscopic view showing blood vessel in a fish.

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Teacher's Notes

Tips of the Activity

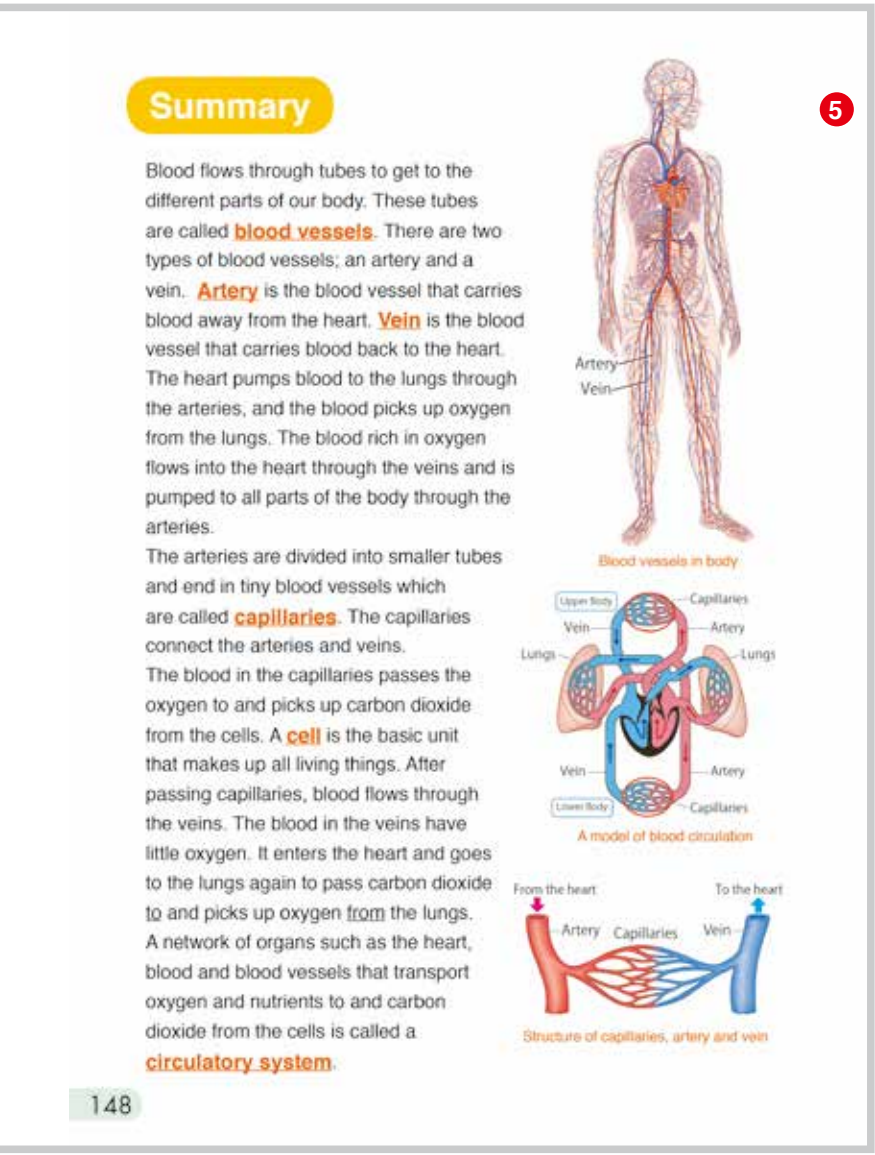
- If microscope or appropriate fish are not available teacher can use the picture in the text book to do the activity in this lesson.
- A mosquito fish can be used for this experiment and the fish should be released straight after the experiment.
- The lens of the microscope should be directly on the fishtail.
- Students can try to identify blood vessels using the microscope if possible.
- The blood circulatory system is also called the cardiovascular system, an organ system that permits blood to circulate and transport nutrients, oxygen, carbon dioxide, hormones, and blood cells to and from the cells in the body. It consists of the heart and the blood vessels running through the entire body. The two blood vessels are called the arteries and veins. The arteries carry blood away from the heart and the veins carry blood back to the heart. The artery and the vein branches out into smaller vessels called the capillaries. Capillaries are the smallest of the body's blood vessels; they connect the arteries and the veins. The capillaries have an important function where the exchange of materials between the cells occur.
- Animals that live in water take in air through their gills instead of lungs. As water passes over the gills of fish, oxygen that is present in the water is absorbed into the blood vessels through the gills. Carbon dioxide is removed from the blood vessels through the gills and it gets mixed with the water and flows out the gills.

Lesson Objectives

By the end of the lesson students will be able
- Understand the circulatory system.
- Understand how blood flows through the body.
- Observe the blood flow in a live fish using a microscope.

Assessment

Students are able to:
- Explain how different organs such as the heart, blood and blood vessels works together.
- Explain the ways that blood flow through the different types of blood vessels.
- Handle a microscope in the appropriate ways.



Summary

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

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

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

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

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

Q:What did you find in the tail fin? (small bones, tubes, blood)

Q:In which direction did the blood flow? (The blood in a tube flows in the same direction.)

Q:Was the thickness of the tubes that the blood is flowed through different or the same? (They are different.)

Q:Where was the blood flowing from? (From the heart)

Q:How does the blood flow through the body? (The blood flows through the tubes from the heart to all parts of body.)

- Conclude the discussions.

5 Summary (15 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 circulatory system?
  Q: What are the two main blood vessels?
  Q: How does blood flow in the body?
  Q: What is the main function of the blood?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

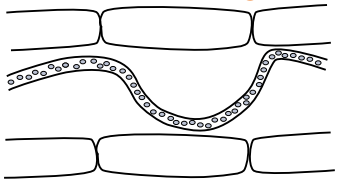
Circulation of the Blood

Key question:
How does blood flow through the body?

Activity: Observing the blood flow.

Sketch:

Students' drawing



Discussion

Q: What did you find in the tail fin? small bones, tubes, blood

Q: In which direction did the blood flow? The blood in a tube flows in the same direction.

Q: Was the thickness of the tubes that the blood is flowed through different or the same? They are different.

Q: Where was the blood flowing from? From the heart.

Q: How does the blood flow through the body? The blood flows through the tubes from the heart to all parts of body.

Summary
- Blood flows through blood vessels.
- There are two types of blood vessels; an artery and a vein.
- Artery is the blood vessel that carries blood away from the heart.
- Vein is the blood vessel that carries blood back to the heart.
- Tiny blood vessels are called capillaries.
- Blood flows through:
  Heart → Lungs → Heart → Artery → All body → capillaries → veins → heart → Lungs...

Unit: Human Being	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.2. Circulatory System**	Total lesson No: 61 / 74 Textbook page: 149 - 150

Lesson 6 / 8

Lesson Title

Blood

Preparation

nil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson by asking:

Q: How does blood flow in the body?

Q: What are the two main blood vessels?

- Encourage students to think about the blood by asking:

Q: What is the blood made of?

2 Introduce the key question

How does blood carry oxygen and carbon dioxide?

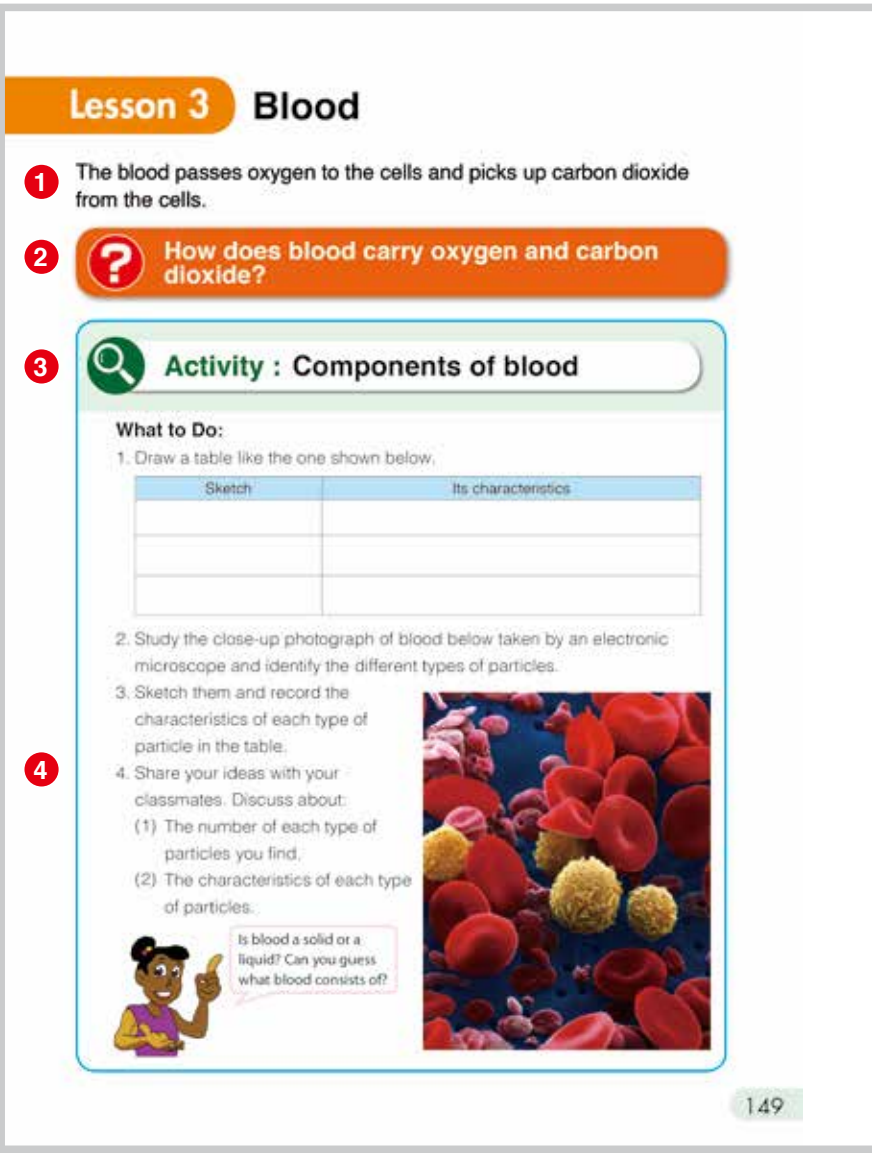
3 Activity (35 min.)

- Organise students in pairs or in groups.
- Explain the steps of the activity.
- Allow students to study the picture and the character in the textbook.
- Have students do the activity.
- Give enough time for students to do their findings.
- Ask students to discuss their ideas in their groups.

4 Discussion for findings (25 min.)

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

(Continue)



Lesson 3 Blood

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

2 How does blood carry oxygen and carbon dioxide?

3 Activity : Components of blood

What to Do:

1. Draw a table like the one shown below.

Sketch	Its characteristics

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

4

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Teacher's Notes

Composition of blood: Blood consists of two main components, plasma and formed elements.

Plasma is a clear extracellular fluid. It is a mixture of proteins, enzymes, nutrients, wastes, hormones and gases. It carries formed elements.

Formed elements are enclosed in a plasma and have a definite structure and shape. Formed elements are erythrocytes, also known as red blood cells (RBCs), leukocytes, also known as white blood cells (WBCs) and pellets.

Function of Blood: Blood has three main functions, transportation, protection and regulation.

Transportation: Blood transports gases such as oxygen (O_2) and carbon dioxide (CO_2), nutrients, waste products, hormones and heat.

Protection: Blood takes several roles in inflammation. For instance, leukocytes or white blood cells destroy invading microorganisms and cancer cells. Antibodies and other proteins destroy pathogenic substances. Platelets initiate blood clotting and help minimise blood loss.

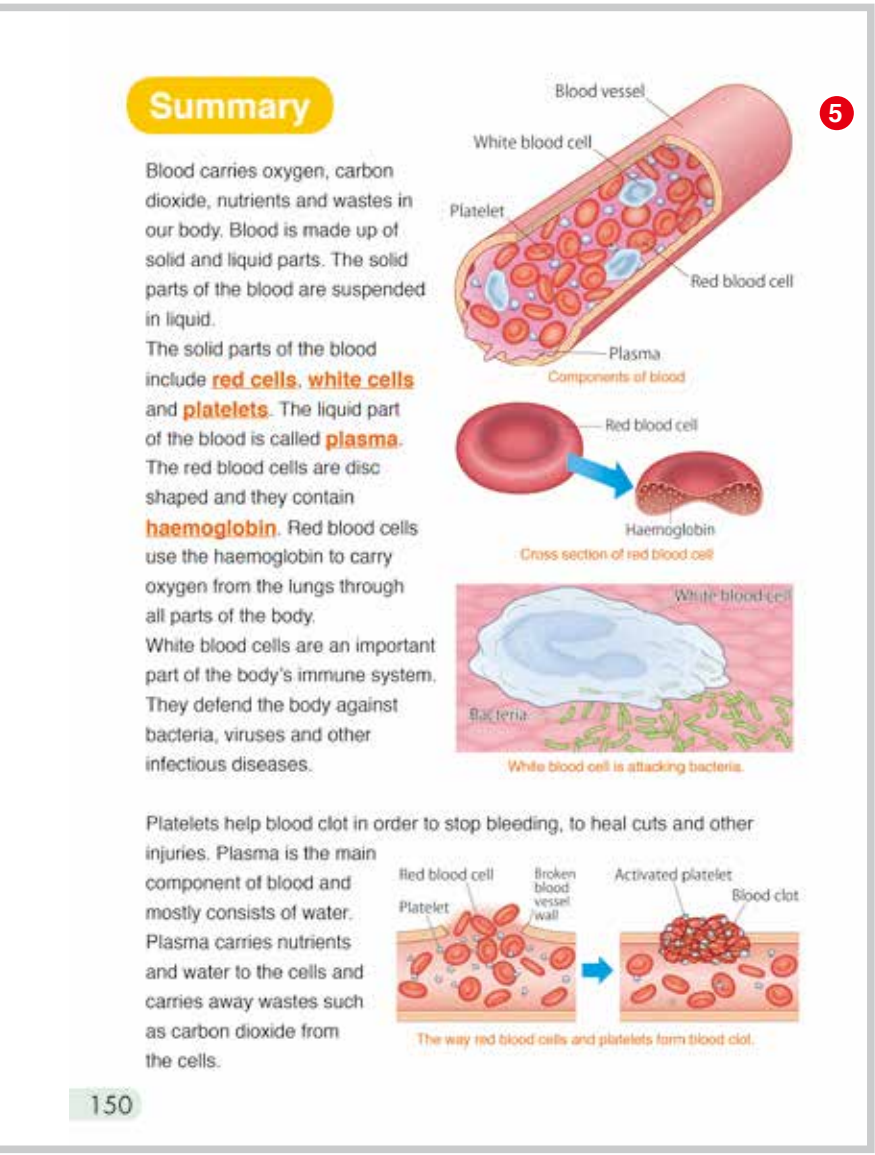
Regulation: Blood helps regulate pH by interacting with acids and bases and water balance by transferring water to and from tissues.

Lesson Objectives

Students will be able to:
- Identify the components of blood.
- Understand the characteristics of each blood particles.

Assessment

Students are able to:
- List the different components of the blood such as red cells, white cells, platelets and plasma.
- Describe how red cells, white cells, platelets and plasma work in blood.



Summary

Blood carries oxygen, carbon dioxide, nutrients and wastes in our body. Blood is made up of solid and liquid parts. The solid parts of the blood are suspended in liquid.
The solid parts of the blood include **red cells**, **white cells** and **platelets**. The liquid part of the blood is called **plasma**.
The red blood cells are disc shaped and they contain **haemoglobin**. Red blood cells use the haemoglobin to carry oxygen from the lungs through all parts of the body.
White blood cells are an important part of the body's immune system. They defend the body against bacteria, viruses and other infectious diseases.

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

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

Q:How many types of particles did you find?
(Three types of particles)

Q:What are the characteristics of each particle?

1.Red particles (red cells): It is a red-coloured particle, its shape is like a disc, it has dint, etc...
2.White particles (white cells): It is a white-coloured particle, its shape is like a ball, it has a rough surface.
3.Pink particles (Platelets): It is a white-pink coloured particle, it's smaller than other particles, etc...

- Conclude the discussions.

5 Summary (15 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 components of the blood?
  Q: What are the characteristics of red cells, white cells, platelets and plasma?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Blood**

Key question: How does blood carry oxygen and carbon dioxide?

Activity: Components of blood

Sketch	Its characteristics
	red colour, its shape is like a disc
	white colour, its colour is like a ball
	white-pink, it's smaller in size

Discussion

Q: How many types of particles did you find?
Three types of particles
Q: What are the characteristics of each particle?
1. Red particles (red cells): It is a red-coloured particle, its shape is like a disc, it has dint.
2. White particles (white cells): It is a white-coloured particle, its shape is like a ball, it has a rough surface.
3. Pink particles (Platelets): It is a white-pink coloured particle, it's smaller than other particles, etc...)

Summary

- Blood carries oxygen, carbon dioxide, nutrients and waste to cells in the body.
- Blood consists of red cells, white cells, platelets and plasma.
- Red blood cells are disc shaped and they contain haemoglobin used to carry oxygen to all body parts.
- White blood cells are an important part of the body's immune system.
- Platelets help blood clot in order to stop bleeding, to heal cuts and other injuries.
- Plasma is the main component of blood and mostly consists of water. It carries nutrients and water to the cells.

Unit: **Human Being**	Chapter : **10. Human Body System: Respiratory System and Circulatory System** Topic : **10.2. Circulatory System**	Total lesson No: 62 / 74 Textbook page: 151 - 153

Lesson 7 / 8

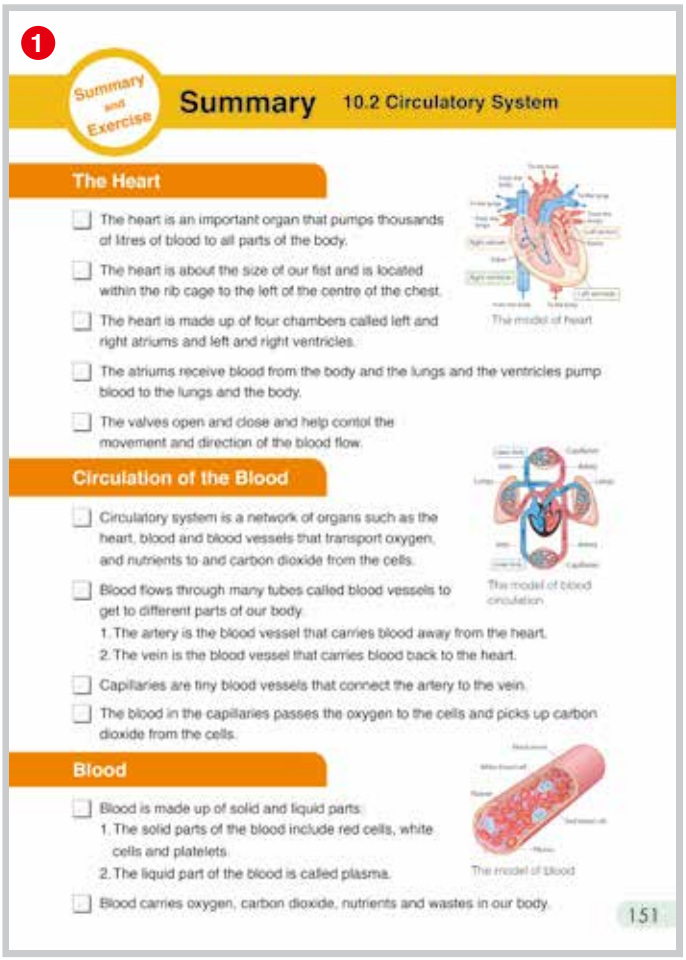
Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (30 min.)

- Recap the main learning contents covered in this topic.
- Base on the main learning contents ask students the following questions.
  - What is the work of a heart?
  - What is the function of a vein and an artery?
  - What does the blood do in our body?
- Explain and correct the learning contents if they still have misconceptions.
- Verify their understanding with the summary points.
- Allow students to read aloud the main ideas of the topic and then copy into their exercise books.



1

Summary and Exercise

Summary 10.2 Circulatory System

The Heart

- The heart is an important organ that pumps thousands of litres of blood to all parts of the body.
- The heart is about the size of our fist and is located within the rib cage to the left of the centre of the chest.
- The heart is made up of four chambers called left and right atriums and left and right ventricles.
- The atriums receive blood from the body and the lungs and the ventricles pump blood to the lungs and the body.
- The valves open and close and help contol the movement and direction of the blood flow.

The model of heart

Circulation of the Blood

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

The model of blood circulation

Blood

- Blood is made up of solid and liquid parts.
  1. The solid parts of the blood include red cells, white cells and platelets.
  2. The liquid part of the blood is called plasma.
- Blood carries oxygen, carbon dioxide, nutrients and wastes in our body.

The model of blood

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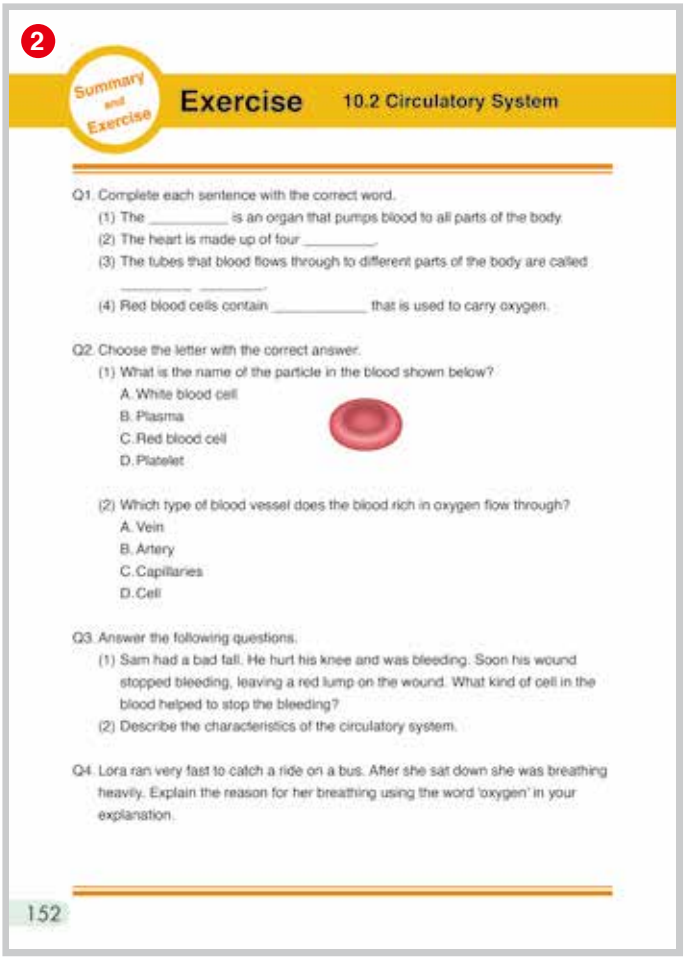
2 Exercise & Explanation 40 min.)

- Go through the instructions of the exercise.
- Allow the 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 10.2 Circulatory System

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

A. White blood cell
B. Plasma
C. Red blood cell
D. Platelet

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

A. Vein
B. Artery
C. Capillaries
D. Cell

Q3. Answer the following questions.

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

(2) Describe the characteristics of the circulatory system.

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

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Exercise answers

Q1.
(1) heart
(2) chambers
(3) blood vessels
(4) haemoglobin

Q2.
(1) C
(2) A

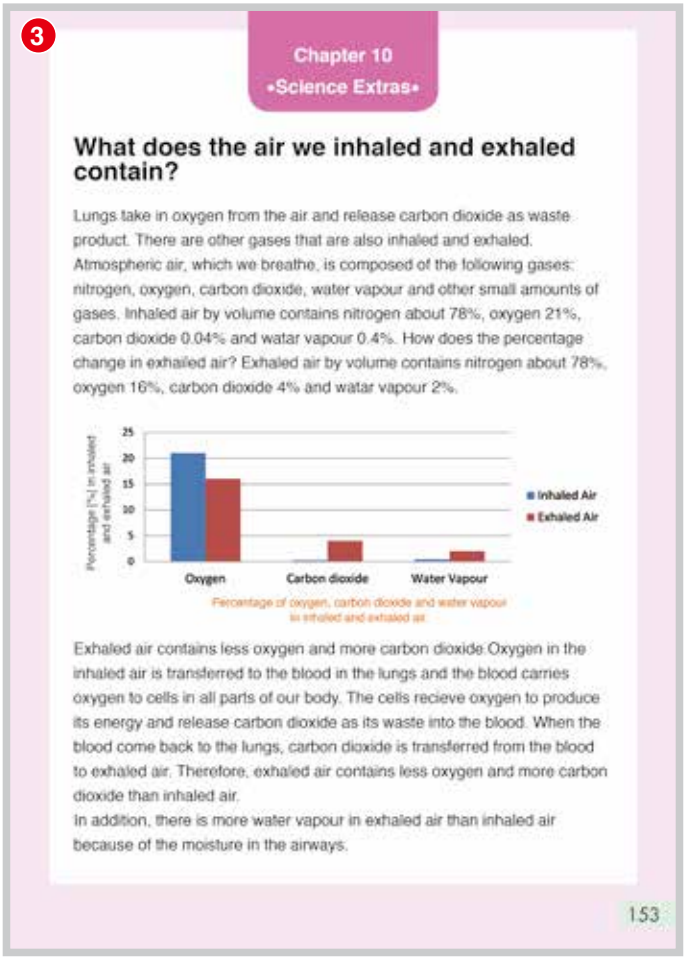
Q3.
(1) Platelets
(2) Expected answer
Circulatory system is a group of organs for transporting oxygen and carbon dioxide to and from the cells in our body.

Q4.Expected answer
The cells in her body requires more oxygen so she breathes fast to take in more oxygen and the heart beats quickly to send oxygen throughout her body.

Explanation of Science Extras

3 Science Extras (10 min.)

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



3

Chapter 10
•Science Extras•

What does the air we inhaled and exhaled contain?

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

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

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

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Lesson 8 / 8

Lesson Title

Chapter Test

Answers to the Chapter Test

Chapter Test

10. Human Body System

Q1 Complete each sentence with the correct word.

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

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

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

(4) When we breathe, we take in oxygen and get rid of carbon dioxide.

Q2 Choose the letter with the correct answer.

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

(A) Diaphragm
B. Nose
C. Alveoli
D. Trachea

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

A. Bicep muscle
B. Calf muscle
(C) Heart muscle
D. Cheek muscle

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

A. They allow any bacteria to enter the body.
(B) They defend against bacteria, viruses and other infectious diseases.
C. They transport oxygen to the heart.
D. They remove waste from the system.

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

A. Oxygen present in the inhaled air.
(B) Carbon dioxide present in the exhaled air.
C. Heat present in exhaled and inhaled air.
D. Oxygen present in exhaled air.

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Q3 Study the picture and explain how the diaphragm and the lung work as air is taken in and taken out.

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

(Expected answer) When the diaphragm contracts it moves down in our chest. This causes our lungs to become bigger and air comes in our lungs and we inhale.

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

(Expected answer) When we exhale, the diaphragm relaxes and it moves up toward the lungs. This causes our lungs to become smaller and air is forced out of our lungs.

Q4 (1) There are two types of blood vessels; an artery and a vein. What are the functions of the artery and the vein?

(Expected answers) An artery is a blood vessel that carries blood away from the heart. A vein is the one that carries blood back to the heart.

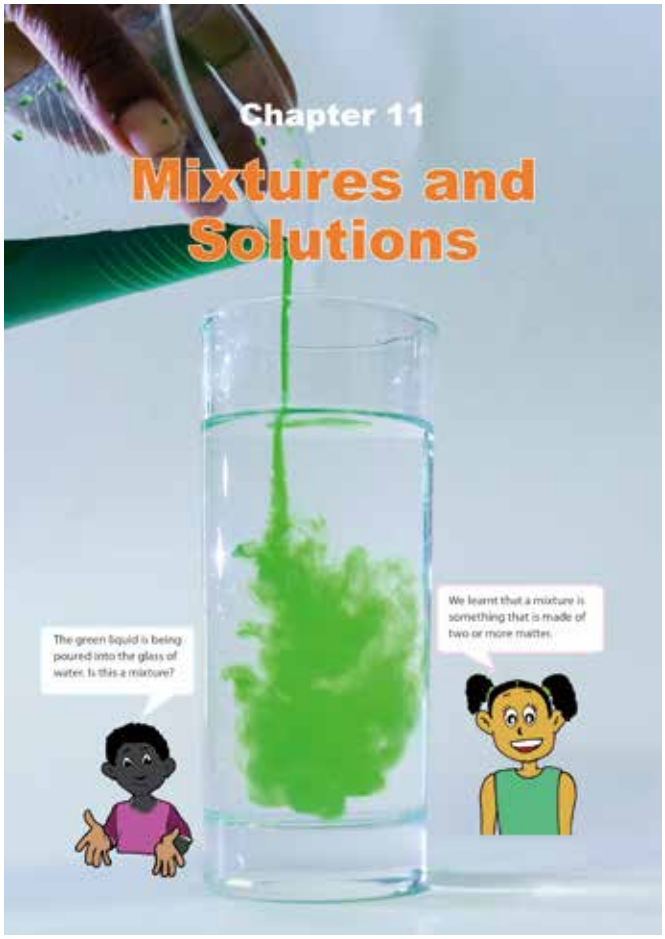
(2) How does your pulse rate change before and after an exercise? Explain why.

(Expected answer) During exercise, more oxygen are necessary for our muscle, so blood must carry oxygen to the muscle faster than when the body is resting. To meet these demands, the pulse rate increases.

Chapter 11. Mixtures and Solutions

Chapter Objectives

Students will be able to understand different types of mixtures and the ways by which mixtures can be separated, and understand that solutions are types of mixtures where one or more substances are dissolved into water and its properties.



This picture is from the chapter heading of the textbook showing a coloured liquid being poured into another liquid.

Topic Objectives

11.1 Mixtures

Students will be able to;

- Classify the different objects into substances and mixtures.
- Describe the combination of three states of substances as different types of mixture.
- Explain that filtration is a method for separating solid from liquid by using a filter.
- Explain that evaporation is a method for separating solid from liquid by evaporating all the liquid from the mixture.

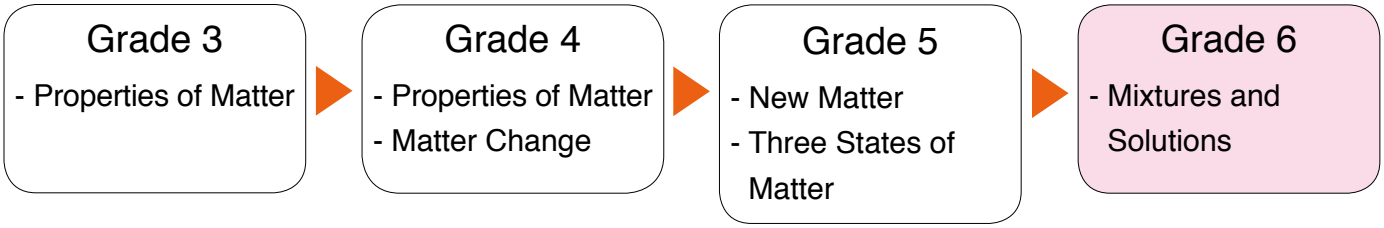
11.2 Solutions

Students will be able to;

- Describe that solutions are mixtures where two or more substances are dissolved into water evenly and these particles cannot be seen.
- State that when a substance is dissolved in water, its weight does not change.
- Explain that the amount of substances dissolved in water depends on the amount of the water and temperature of the water.

Related Learning Contents

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



Prior knowledge for learning this chapter;

- Matter can change physically and chemically.
- Matter can be solid, liquid or gas depending on its temperature.
- A mixture is a matter that is made up of two or more substances.

Teaching Overview

This chapter consists of 11 lessons; each lesson is a double period.

Topic	Lesson No.	Lesson Title and Key Question	Content standard in syllabus	Textbook page number
11.1 Mixtures	1	**Mixtures and Substances** What is a mixture?	6.2.5	157 - 158
	2	**Types of Mixtures** What types of mixtures are there?		159 - 160
	3	**Separating a Mixture 1** How can we separate sand from water in a mixture?		161 - 162
	4	**Separating a Mixture 2** How can we separate salt from water in a mixture?		163 - 164
	5	Summary and Exercise		165 - 166
11.2 Solutions	6	**Mixtures and Solutions** What is a solution?		167 - 168
	7	**Weight of Solution** What happens to the weight of a substance in a solution?		169 - 170
	8	**Amount of Substance Dissolved in Water 1** How much of a substance can dissolve in water?		171 - 172
	9	**Amount of Substance Dissolved in Water 2** How can we dissolve more substance without changing the amount of water?		173 - 174
	10	Summary and Exercise, Science Extra		175 - 177
Chapter Test	11	Chapter Test		178 - 179

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.1. Mixtures**	Total lesson No: 64 / 74 Textbook page: 157 - 158

Lesson 1 / 11

Lesson Title

Mixtures and Substances

Preparation

pictures of mixtures and substances

Lesson Flow

1 Introduction (5 min.)

- Recap Grade 3 lesson on 'Observing a Mixture'

Q:What happens if one or two different kinds of matter are put together? When one or two kinds of matter are put together they form a mixture.

Q:What are some examples of such matter? Coffee with milk and sugar, orange juice, fried rice with vegetables.

- Encourage students to think about what is a mixture and what is it made of.

2 Introduce the key question

What is a mixture?

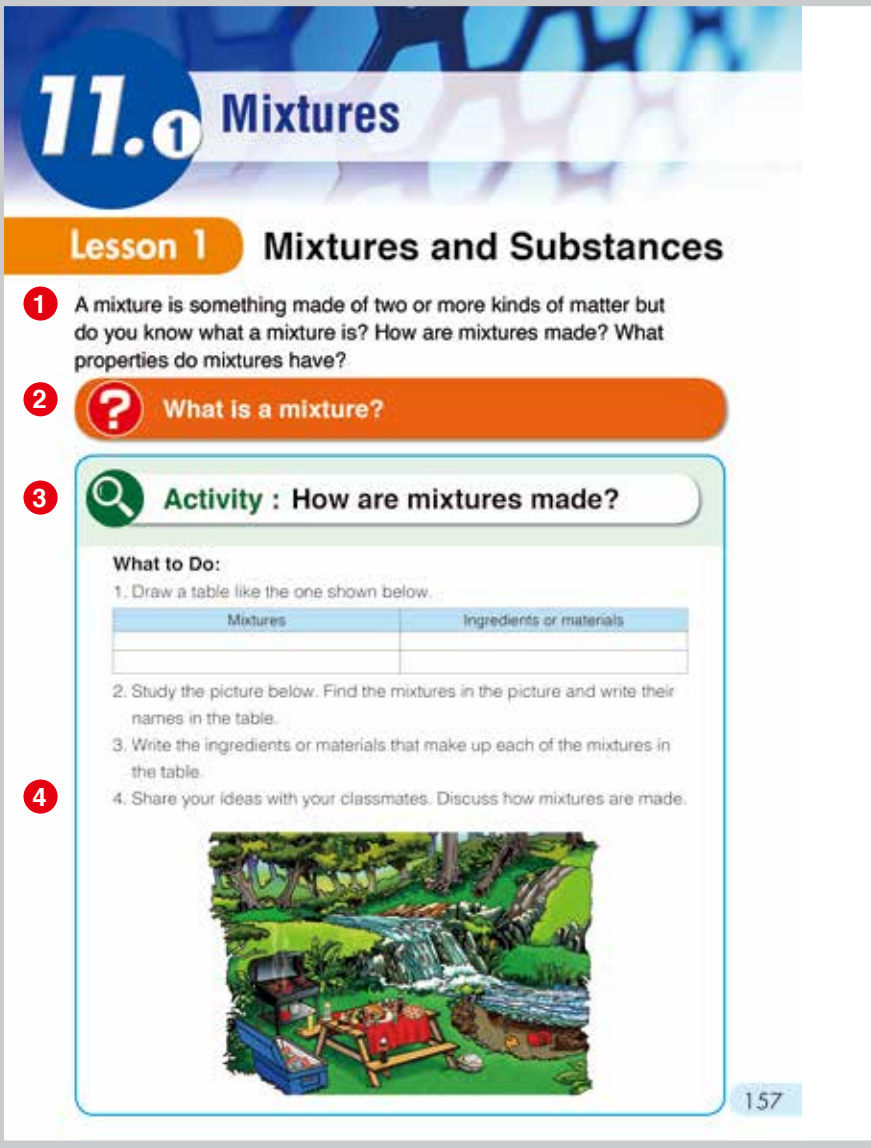
3 Activity (35 min.)

- Put students into their working groups.
- Explain the steps of the activity.
- Advise students to refer to the picture in the activity for their investigations.
- Ask students to do the activity.
- Facilitate students writing their ideas and assists if necessary.
- Have enough time for the students to do their findings through the activity.
- Ask them to share their ideas in their groups.

4 Discussion for findings (25 min.)

- Let students present their ideas from the activity.
- Write their findings on the blackboard.

(Continue)



Teacher's Notes

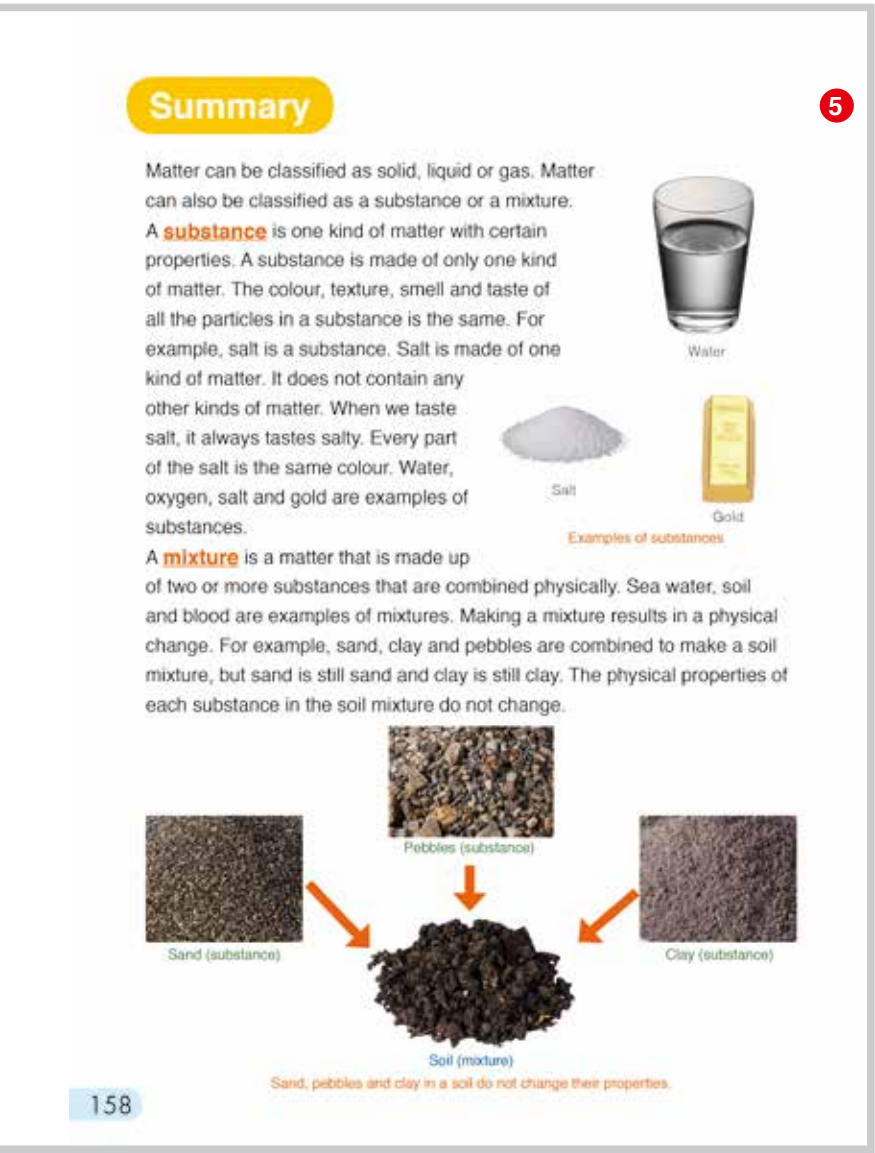
- 'Mixture and Substance' is once taught in lessons of 'Observing Mixture' and 'Separating Mixture' in Chapter 2, Grade 3. It is a must to review the lesson prior to this lesson. Particularly 'Teacher's Notes' for these lessons provides you key scientific concepts about mixture and substance as follows;
  Matter is divided into two categories such as 'Pure matter' and 'Mixed matter'. 'Pure matters' are further divided into 'Element' and 'Compound' and 'Mixed matters' are broken into 'Homogeneous' and 'Heterogenous' mixtures.
- Result examples for this activity are summarised in the 'Sample Blackboard Plan' on the right. It mainly describes food. However, the discussion should not be limited to food only. Guide the students to pay attention on anywhere of the picture. For instance; soil may contain sand, clay, worm and compost. A table is made of wood, iron and nails. A river may contain fish, crabs, shrimps, eel, stone, dead plants (twigs, leaves etc..). It is important to recall more prior knowledge learned in science lesson so that students can link and consolidate the knowledges effectively.

Lesson Objectives

Students will be able to:
- Identify what makes up a mixture.
- Explain the differences between substances and mixtures.
- Communicate their ideas with others.

Assessment

Students are able to:
- State that different materials or substances make up a mixture.
- Describe how substances and mixtures are different.
- State their opinions to classmates.



Summary

5

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

Water

Salt

Gold

Examples of substances

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

Pebbles (substance)

Sand (substance)

Clay (substance)

Soil (mixture)

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

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- Facilitate active students' discussions.
- Confirm students' findings and state that all mixtures are made up of two or more matter mixed together.
- **Based on their findings,** ask these questions as discussion points.

Q:How many kinds of mixtures did you find in the picture? (Answers will vary.)

Q:What are the mixtures made up of? They were made up of more than two kinds of substances.

Q:What are the ingredients or materials made of? (They are made of only one kind of matter.)

Q:Can you guess how mixtures and ingredients/materials are different? (It depends on students' answers.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks on the summary page and explain.
- Summarise the today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is a substance?
  Q: What is a mixture?
  Q: Name four ingredients or substances which are used to make up a mixture.
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Mixtures and Substances

Key question: What is a mixture?

Activity: How are mixtures made?

Mixtures	Ingredients or materials
Pizza	Flour, cheese, meat, tomato
Salad	Cucumber, Green leaves, tomato, etc.
Soft drink	Water, sugar, food dye, soda
Soil	Sand, pebbles, clay
...	etc

Discussion

Q: How many kinds of mixtures did you find in the picture?
(Answers will vary)

Q: What are the mixtures made up of?
They are made up of more than two kinds of substances.

Q: What are the ingredients or materials made of?
They are made of only one kind of matter.

Q: Can you guess how mixtures and ingredients/materials are different?
(It depends on students' answers.)

Summary

- A substance is one kind of matter with certain properties. It is made of only one kind of matter.
- The properties in a substance is the same.
- Water, salt and gold are substances.
- A mixture is a matter that is made up of two or more substances that are combined physically.
- Sea water, soil and blood are examples of mixtures

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.1. Mixtures**	Total lesson No: 65 / 75 Textbook page: 159 - 160

Lesson 2 / 11

Lesson Title

Types of Mixtures

Preparation

water, salt, sand, cooking oil

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson by asking:

Q:What is a substance?

Q:What is a mixture?

- Encourage students to think about the different types of mixtures by asking the key question.

2 Introduce the key question

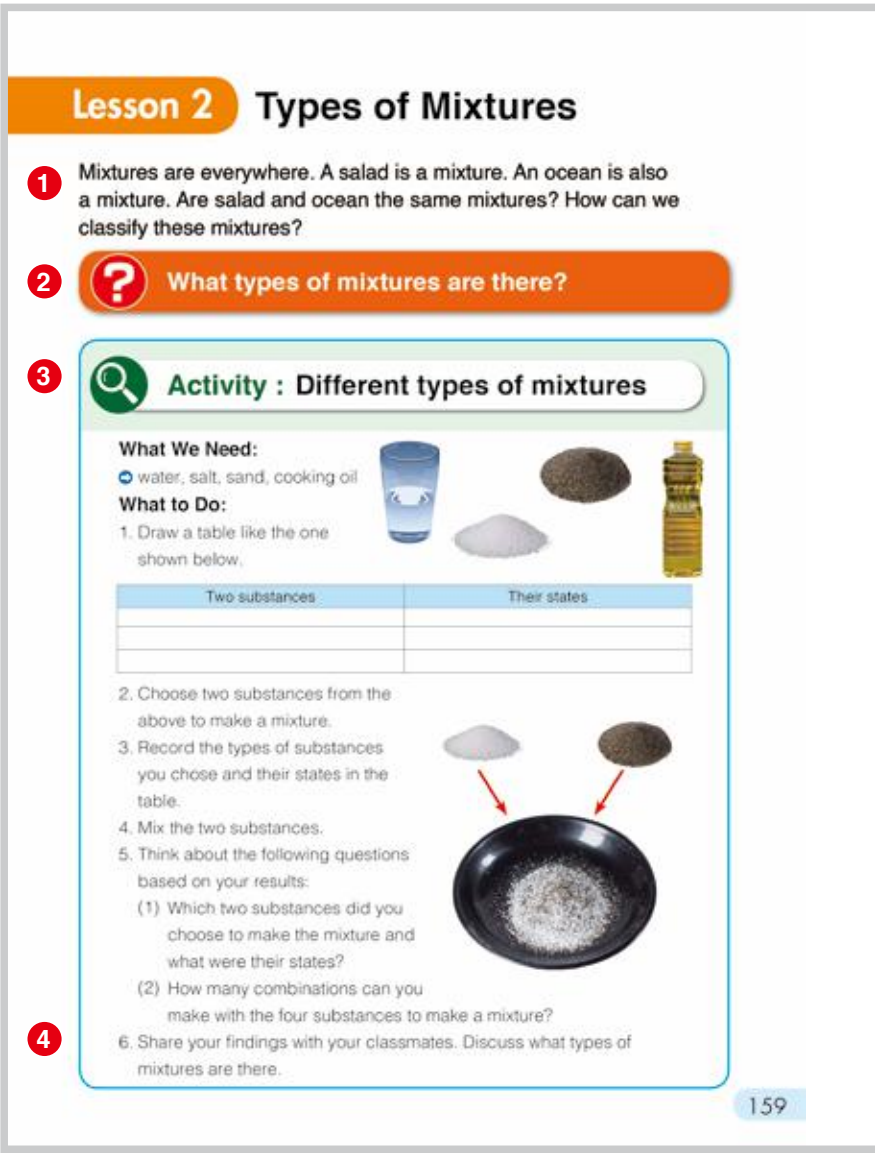
What types of mixtures are there?

3 Activity (35 min.)

- Organise students into small groups.
- Explain the steps of the activity.
- Have the students draw the table into their exercise books.
- Ask students to do the activity.
- Remind students of the safety rules while investigating.
- Check students' activities and if necessary guide them towards their findings.
- Give enough time for students to do their findings.
- Ask the students to discuss their results in their groups.

4 Discussion for findings (25 min.)

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



Lesson 2 Types of Mixtures

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

2 What types of mixtures are there?

3 Activity : Different types of mixtures

What We Need:
water, salt, sand, cooking oil

What to Do:
1. Draw a table like the one shown below.

Two substances	Their states

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

4

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Teacher's Notes

Tips for the Activity

- For this activity students can freely choose any of the substances given to make up a mixture, for example oil and salt can be a mixture.
- A mixture can involve two or more substances of the same phase (state) or different phases. The textbook introduces (1) Solid-Solid mixture, (2) Liquid-Liquid mixtures, (3) Solid-Liquid mixtures and (4) Gas-Gas mixtures. In addition, we have different types of classification of mixture - 'homogenous' and 'heterogeneous' mixtures as explained in 'Teacher's Notes' for the lesson 'Separating Mixture' in Chapter 2, Grade 3. Homogeneous mixture is uniform in composition, whereas heterogenous mixture have a non-uniform composition. In this classification, the samples in this activity can be grouped as follows;
  - Homogeneous mixture: salt and water, air (nitrogen, oxygen, carbon dioxide and water vapour)
  - Heterogenous mixture: sand and salt, sand and water, sand and oil, salt and oil, oil and water.
- Comparison between "salt and water" and "salt and oil" is a good example to understand the difference of homogenous and heterogeneous mixtures (salt doesn't dissolve in oil - heterogeneous). Use these examples for further discussion if you have an extra time.

Lesson Objectives

Students will be able to:
- Identify the different types of mixtures.
- Name the different types of mixtures.
- Mix different substances to make a mixture.

Assessment

Students are able to:
- State the different types of mixtures based on the combinations of the three states of matter.
- List some examples of the different types of mixtures.
- Show interest in making different mixtures.

Summary

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

Solid-Solid Mixtures

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

Rock is a mixture of minerals.

Liquid-Liquid Mixtures

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

Mixture of oil and water

Solid-Liquid Mixtures

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

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

Gas-Gas Mixtures

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

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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:Which two substances did you choose to make the mixture? (Sand+salt, sand+water, salt+water, water+oil, oil+sand, oil+salt)

Q:What were their states? (solid+solid, soild+liquid, liquid+liquid)

Q:How many combinations can you make with the four substances to make a mixture? (3 combinations)

Q:Are there any other combinations of mixtures? (Yes. They are:solid+gas, gas+gas, liquid+gas)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open to their textbooks on the summary page and explain.
- Summarise the today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What are mixtures?
  Q: In what ways can mixtures be done?
  Q: What are some other ways that mixtures can be done in everyday experiences?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Types of Mixtures

Key question:
What types of mixture are there?

Activity : Different types of mixtures

Results:

Substances or materials	Their states After mixing
Sand and salt	Solid – solid mixtures
Oil and water	Liquid – liquid mixture
Salt and water	Solid –liquid mixtures
Sand and water	Solid – liquid mixtures

Discussion

Q: Which two substances did you choose to make the mixture? Sand+salt, sand+water, salt+water, water+oil, oil+sand, oil+salt

Q: what were their states? solid+soli, soild+liquid, liquid+liquid

Q: How many combinations can you make with the four substances to make a mixture? 3 combinations

Q: Are there any other combinations of mixtures? Yes. They are:solid+gas, gas+gas, liquid+gas)

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

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.1. Mixtures**	Total lesson No: 66 / 74 Textbook page: 161 - 162

Lesson 3 / 11

Lesson Title

Separating a Mixture 1

Preparation

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

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson.

Q:How can the different types of mixtures be made?

Q:Give some examples of different types of mixtures.

- Show a picture or a real mixture and provoke students to think about how to separate the mixture. Ask:

Q:How can we separate this mixture?

2 Introduce the key question

How can we separate sand from water in a mixture?

3 Activity (35 min.)

- Prepare fine sand to be used for the activity. (Wash and dry it for some time prior to the lesson.)
- Put students into their groups.
- Explain the steps of the activity.
- Emphasize on safety rules for using a cutter knife.
- Assist the students to set a filter.
- Ask the students to do the activity and record their observations.
- Ask them to discuss their results in their groups.

Discussion for findings (25 min.)

4 Ask students to present their results from the activity.

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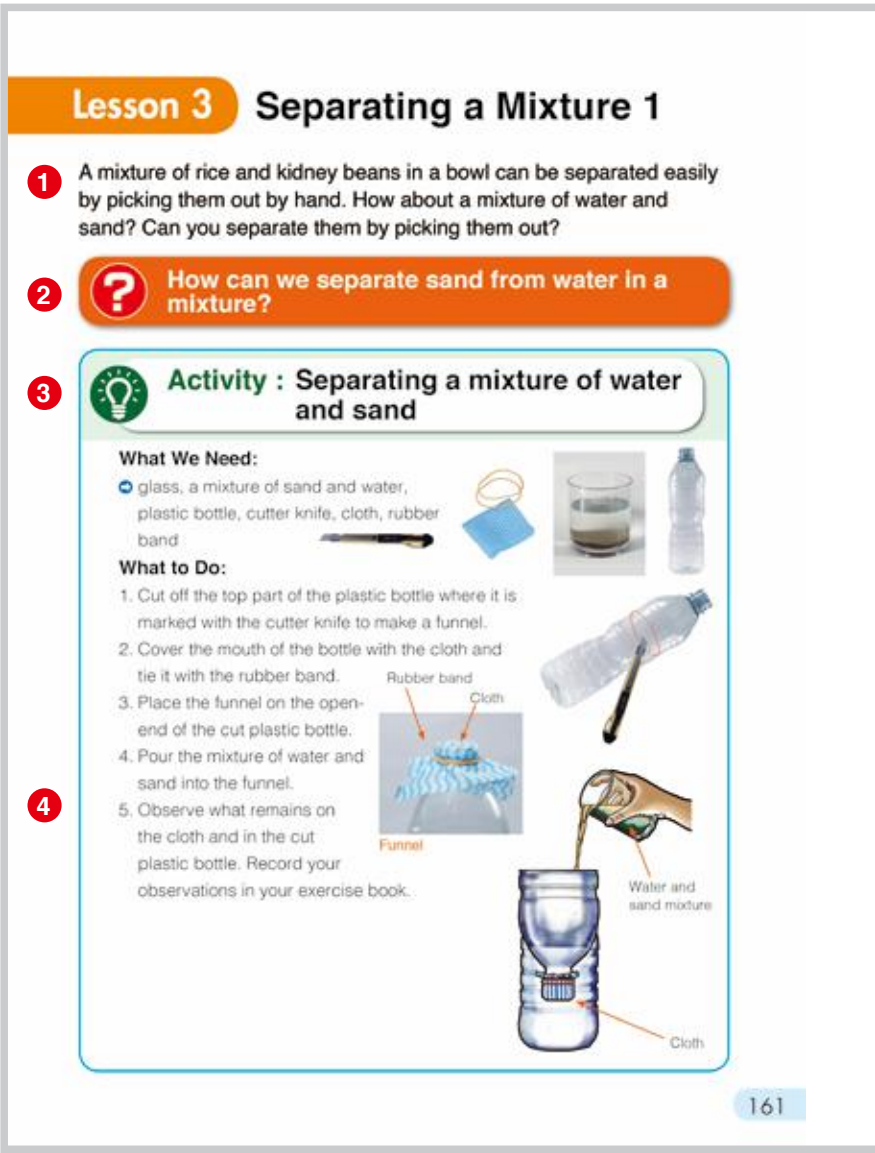

Lesson 3 Separating a Mixture 1

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

2 How can we separate sand from water in a mixture?

3 Activity : Separating a mixture of water and sand

What We Need:

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

What to Do:

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

4

Rubber band
Cloth
Funnel
Water and sand mixture
Cloth

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Teacher's Notes

Tips for the Lesson

- The water goes down to the bottle after the filtration is not so clear as shown in the diagram in the textbook. It is usually still brown, because the cloth filter cannot stop tiny sand particles.
- Students might expect to have very clear water, encourage students to understand the function of filtration by focusing on the colour of water. It must be more bright or transparent than before.

More information about Filtration

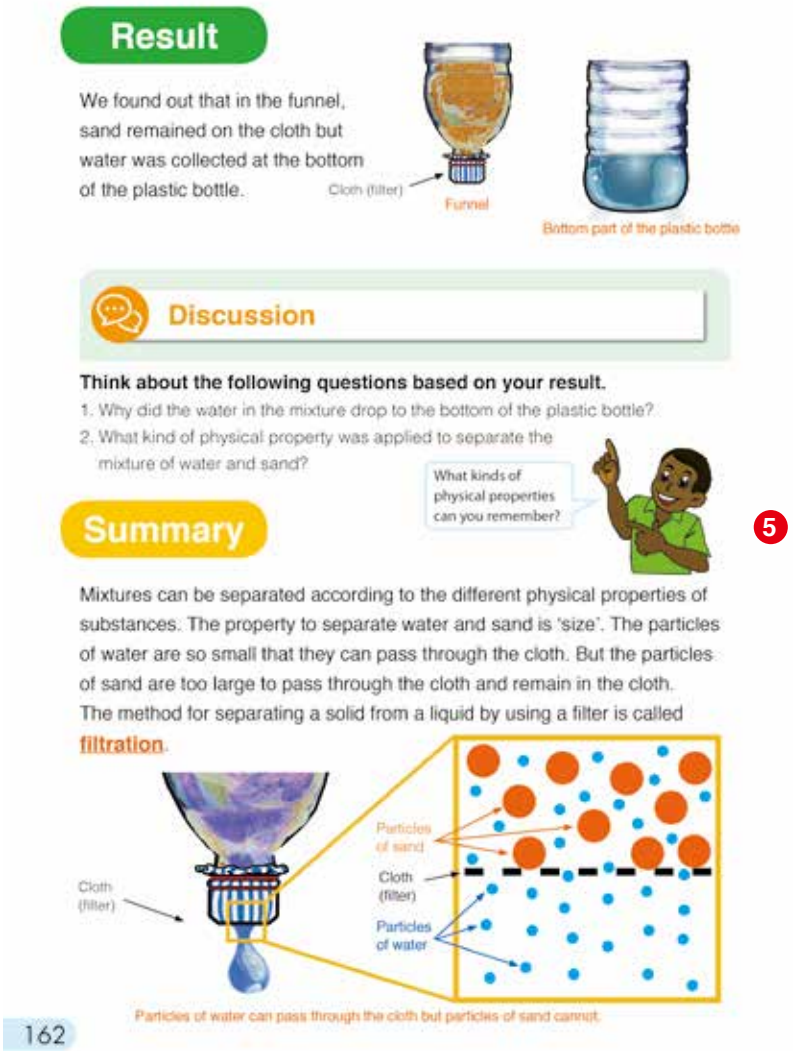
- Filtration is a physical process which separates solids from fluids (liquids or gases) by adding a medium through which only the fluid can pass. The fluid that passes through is called the filtrate. 'Heterogeneous mixtures' are more obviously mixtures to be applied for the separation than 'Homogenous mixtures'.
- For instance, filtration can separate salt in oil since salt is not dissolved (heterogeneous mixture) however, it does not separate salt dissolved in water (solution = homogenous mixtures).
- Evaporation and distillation are applied to separate homogenous mixture (evaporation is taught in next lesson).

Lesson Objectives

Students will be able to:
- Describe how mixtures are separated.
- Understand why sand can be separated by filtration.
- Show their eagerness in investigation.

Assessment

Students are able to:
- State how to separate a mixture in a way of filtration.
- Explain the reason why sand can be separated by filtration by relating to the size of particles.
- Participate actively in the investigation actively.



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

Q:Why did water in a mixture drop to the bottom of the bottle? (Because the size of the water particles are too small so they can pass through the cloth.)

Q:Why did the sand remain behind the cloth? (Because the size of the sand particles is too large so they cannot pass through the cloth.)

Q:What kind of physical property was applied to separate the mixture of water and sand? (The size of the particles of the substances.)

- Conclude the discussions.

5 Summary (15 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise the today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is the method used to separate the mixture of water and sand?
  Q: What kind of physical property of substances was applied in filtration?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Separating a Mixture 1

Key question:
How can we separate sand from water in a mixture?

Activity: Separating a mixture of water and sand

Record your observation (Result)
- In the top of the bottle, sand remained behind on the cloth.
- Water easily went through the cloth and settled at the bottom of the bottle.

Discussion

Q: Why did the water in a mixture drop to the bottom of the bottle? Because the size of the water particles are too small so they can pass through the cloth.

Q: Why did the sand remain behind the cloth?
Because the size of the sand particles is too large so they cannot pass through the cloth.

Q: What kind of physical property was applied to separate the mixture of water and sand?
The size of the particles of the substances.

Summary
- Mixtures can be separated according to different physical properties of substances such as the size.
- A method for separating a solid from a liquid using a filter is called filtration.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.1. Mixtures**	Total lesson No: 67 / 74 Textbook page: 163 - 164

Lesson 4 / 11

Lesson Title

Separating a Mixture 2

Preparation

a mixture of salt and water, burner, empty tin-can

Lesson Flow

1 Introduction (5 min.)

- Recap the previous lesson by asking:

Q:How are mixtures separated?
Q:What is filtration?
Q:What name is given to the material used in separating solid from liquid?

- Encourage students to think about other ways of separating mixtures. Ask the question:

Q:Can saltwater be separated by filtration?

2 Introduce the key question

How can we separate salt from water in a mixture?

3 Activity (35 min.)

- Organise students into small groups.
- Explain the steps of the activity.
- Remind students about the safety rules when handling the hot water.
- Facilitate Step1 and students record the result.
- Ask students to carry out Step 2 and ask them to record their results.
- Assist and facilitate students' findings if necessary.
- Ask them to share their results in their groups.

4 Discussion for findings (25 min.)

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

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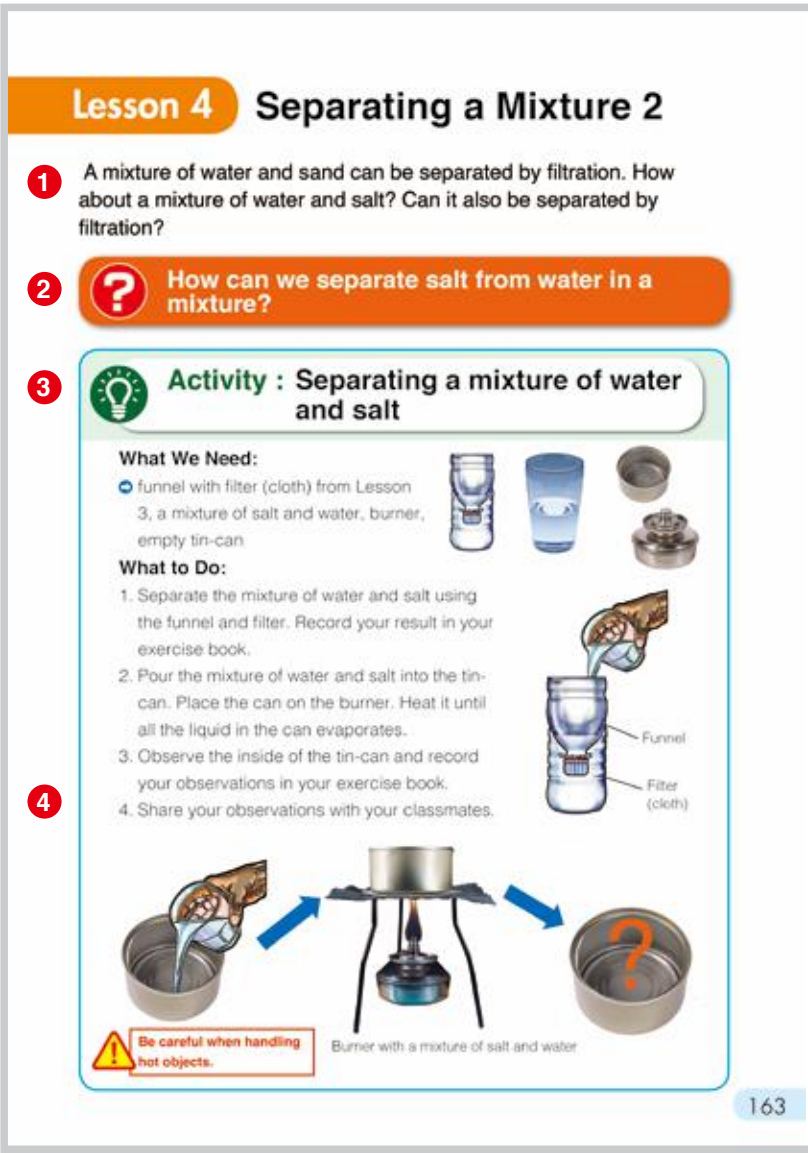
Lesson 4 Separating a Mixture 2

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

2 How can we separate salt from water in a mixture?

3 Activity : Separating a mixture of water and salt

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

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

4

Funnel
Filter (cloth)

Be careful when handling hot objects.

Burner with a mixture of salt and water

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Teacher's Notes

- The term evaporation is used as a method of separation in this lesson. However, evaporation is more commonly used when a liquid substance becomes a gas. When water is heated, it evaporates. The terminology should be used appropriately to avoid confusion.
- As briefly explained in the previous 'Teacher's Notes', evaporation separate substances of homogeneous mixture. It uses heat to separate the components of a liquid and/or gas.
- In salt solution, the water particles (molecules) keep the salt particles from rearranging themselves back into salt crystal. Salt particles are carried throughout the solution surrounded by water particles. As the water evaporates less and less water particles are present to keep the salt particles apart. The salt therefore recrystallizes and can be collected.
- Traditional salt industry uses this method to take salt out from sea water for cooking (However, modern salt industry applies more effective method now a days.)

SAFETY:

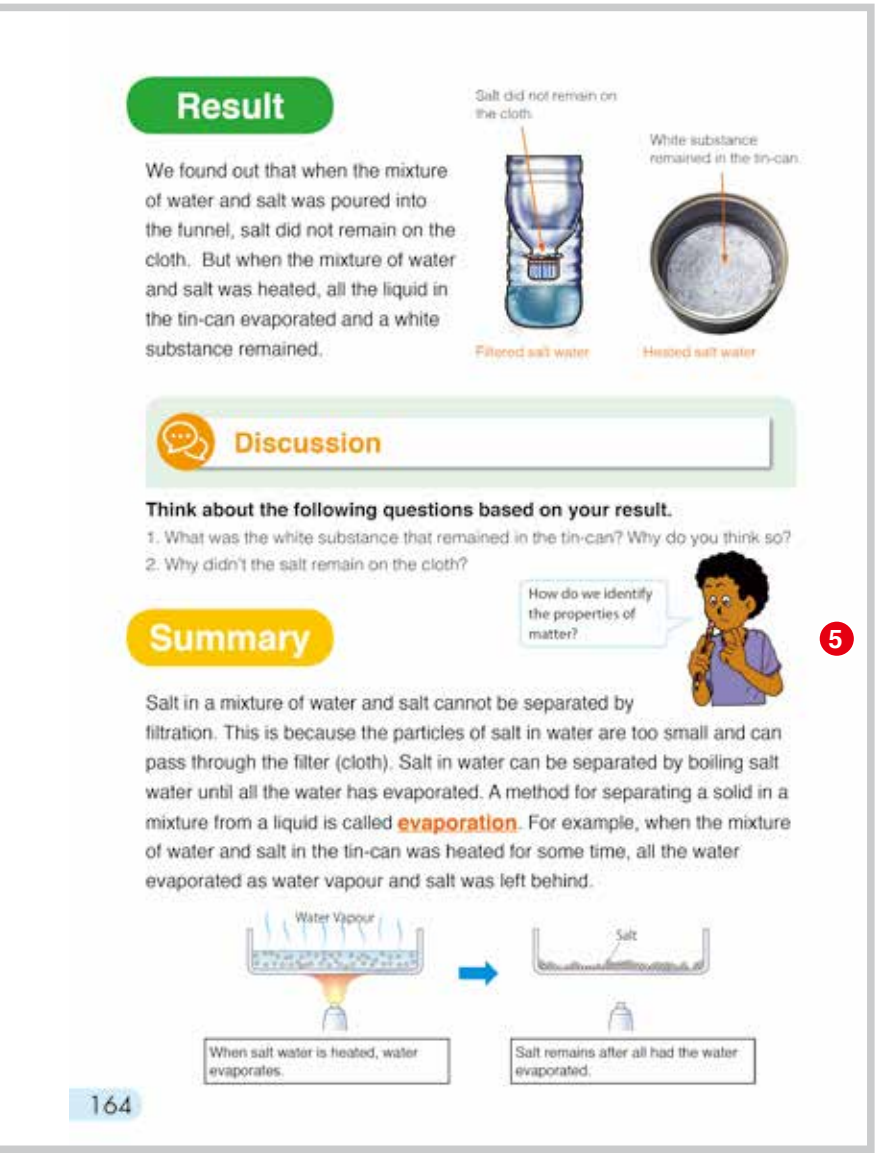
- Be very careful when using a match to light the stove.
- Always use a piece of cloth or tong to hold the heated tin-can.
- Do not look directly into the heated tinned of saltwater (mixture).

Lesson Objectives

Students will be able to:
- Describe how to separate saltwater.
- Understand why salt can be separated by evaporation.
- Show their eagerness in investigation.

Assessment

Students are able to:
- State how to separate saltwater in a way of evaporation.
- Explain the reason why salt can be separated by evaporation by relating the physical properties of salt.
- Show curiosity to find the way to separate saltwater.



Result

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

Discussion

Think about the following questions based on your result.

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

Summary

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

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

Q:Why didn't the salt remain behind the cloth? (Because of its particle size. It is so small that it passed through the cloth.)

Q:What was the white substance that remained in the tin-can? (Salt)

Q:Why do you think so? (The colour was still white as well as the taste was salty.)

Q:Why did the salt remained in the tin can? (The salt cannot be evaporated in the air.)

- Conclude the discussions.

5 Summary (10 min.)

- Ask students to open their textbooks to the summary page and explain.
- Summarise today's lesson on the blackboard.
- Ask these questions as assessment:
  Q: What is evaporation?
  Q: Why cannot we separate saltwater by filtration?
- Ask the students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Separating a Mixture 2**

Key question: How can we separate salt from water in a mixture?

Activity:
Separating a mixture of water and salt

	What happened to the mixture?
After filtration	When the mixture of salt and water was poured into the funnel, salt didn't remain behind the cloth
After heating the mixture	When a mixture of water and salt was heated, water evaporated leaving something white in the tin can.

Discussion

Q: Why didn't the salt remain behind the cloth? Because of its particle size is so small that it passed through the cloth.

Q: What was the white substance that remained in the tin-can? Salt

Q: Why do you think so? The colour was still white as well as the taste was salty.

Q: Why did the salt remained in the tin can?
The salt cannot be evaporated in the air.

Summary

- Salt in a mixture of water and salt cannot be separated by filtration because the particles of salt in water become so small that they pass through the cloth.
- Salt in water can be separated by heating salt water until all the water has evaporated.
- A method of separating a solid in a mixture from a liquid is called evaporation.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.1. Mixtures**	Total lesson No: 68 / 74 Textbook page: 165 - 166

Lesson 5 / 11

Lesson Title

Summary and Exercise

Tips of lesson

1 Summary (40 min.)

- Recap the main learning contents covered in this topic.
- Based on the main learning contents ask students the following questions.
  - What is a mixture?
  - What is a substance made of?
  - In what ways can mixtures be separated?
- 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 11.1 Mixtures

Mixtures and Substances

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

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

Types of Mixtures

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

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

Separating a Mixture 1 and 2

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

Evaporation

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

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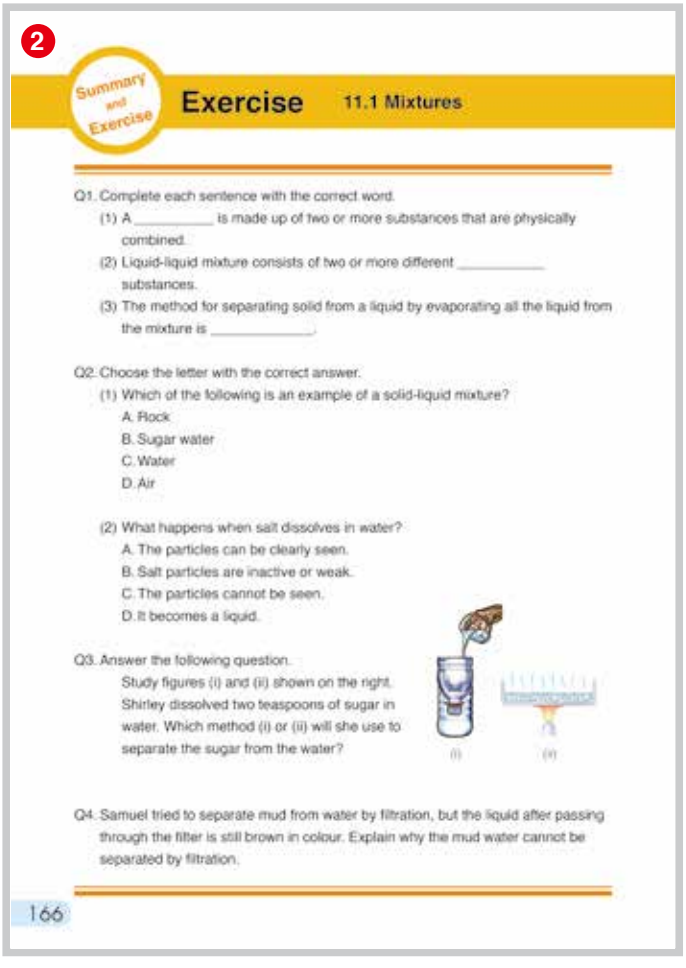
2 Exercise & Explanation (40 min.)

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



2

Summary and Exercise

Exercise 11.1 Mixtures

Q1. Complete each sentence with the correct word.

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

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

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

Q2. Choose the letter with the correct answer.

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

A. Rock
B. Sugar water
C. Water
D. Air

(2) What happens when salt dissolves in water?

A. The particles can be clearly seen.
B. Salt particles are inactive or weak.
C. The particles cannot be seen.
D. It becomes a liquid.

Q3. Answer the following question.

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

(i) (ii)

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

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Exercise answers

Q1.
(1) **mixture**
(2) **liquid**
(3) **evaporation**

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

Q3. Expected answer
She should use evaporation method (ii).

Q4. Expected answer
Some particles of mud in the mud water are so small that they can pass through the filter. That is why the filter cannot stop all the particles of mud and the liquid after passing through the filter still contains particles of mud.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.2. Solutions**	Total lesson No: 69 / 74 Textbook page: 167 - 168

Lesson 6 / 11

Lesson Title

Mixtures and Solutions

Preparation

two drinking glasses, water, salt, sand, spoon

Lesson Flow

1 Introduction (5 min.)

- Revise the previous lesson. Ask:

Q:How are the methods for separating a mixture different from filtration and evaporation?

Q:How can salt be separated from water in a mixture?

- Encourage students to think about special type of mixtures by introducing the key question.

2 Introduce the key question

What is a solution?

3 Activity (35 min.)

- Organise the students into small groups.
- Explain the steps of the activity and ask them copy the table for recording their findings.
- Refer students to what the character is saying for their investigations.
- Have students do the activity.
- Facilitate each group activity and assist where necessary.
- Give enough time for students to do the experiments.
- Ask students to discuss their findings 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)

Teacher's Notes

What is a solution?

- A solution is a specific type of mixture where one substance is dissolved into another. A solution is the same, or uniform, throughout which makes it a homogeneous mixture.

A solution has certain characteristics:

- It is uniform, or 'homogeneous', throughout the mixture.
- It is stable and doesn't change over time or settle.
- The solute particles are so small they cannot be separated by filtering.
- The solute and solvent molecules cannot be distinguished by the naked eye.
- It does not scatter a beam of light.

Example of a Solution

Saltwater, cola or vinegar are the examples of a solution. They are mixture of water and other substances such as salt, sugar or acids. You cannot see the particles of them.

Parts of a Solution

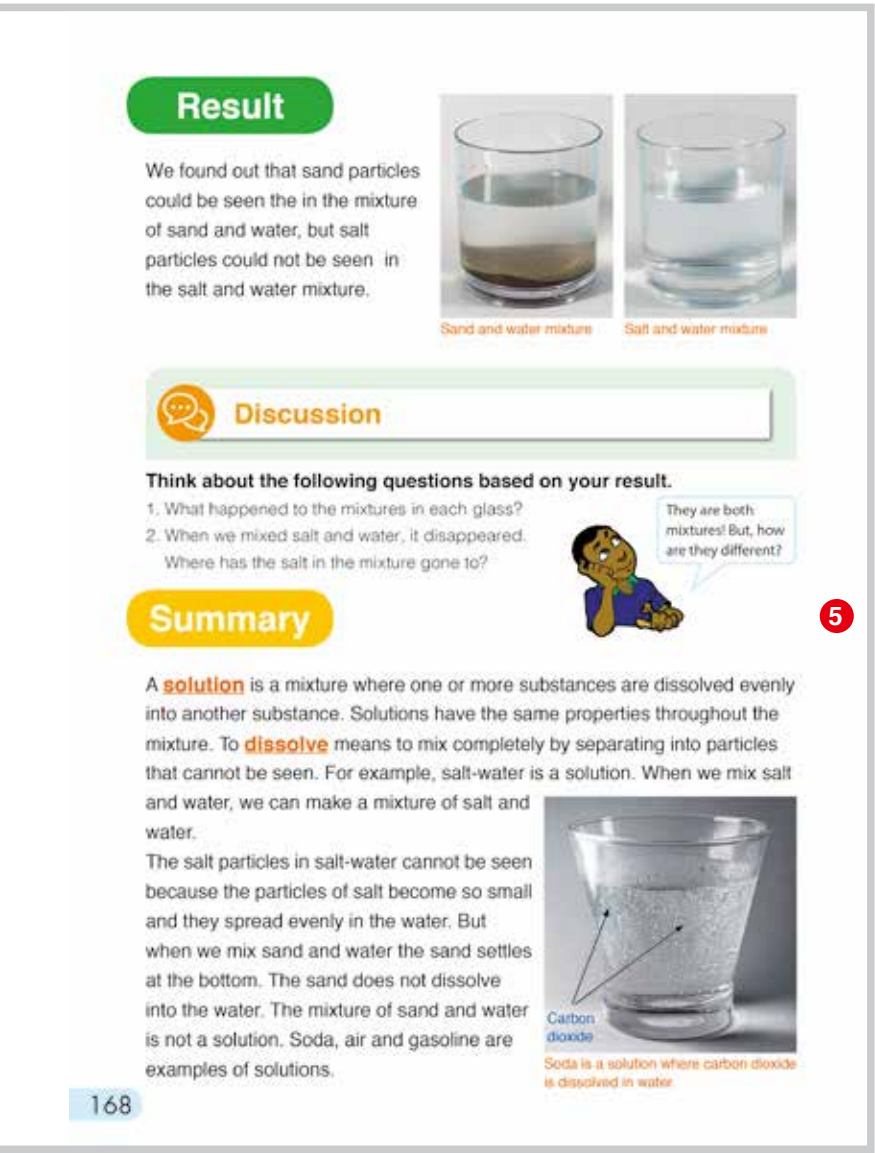
- Solute - The solute is the substance that is being dissolved by another substance. In the example above, the salt is the solute.
- Solvent - The solvent is the substance that dissolves the other substance. In the example above, the water is the solvent.

Lesson Objectives

Students will be able to:
- Define the word solution.
- Compare a mixture of sand and water with a mixture of salt and water.
- Communicate their ideas with others.

Assessment

Students are able to:
- State the definition of solution.
- Explain the difference between a mixture of sand and water and a mixture of salt and water.
- Express their ideas actively during discussion.



Result

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

Sand and water mixture

Salt and water mixture

Discussion

Think about the following questions based on your result.

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

They are both mixtures! But, how are they different?

Summary

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

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

Carbon dioxide

Soda is a solution where carbon dioxide is dissolved in water

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

Q:What happened to the mixture in each glass? (In the mixture of sand and water, sand did not dissolve in water instead settled at the bottom of the glass. In the mixture of salt and water, salt dissolved in water and it disappeared.)

Q:When we mixed salt with water, it disappeared. Where has the salt gone? (The salt dissolved in water, the salt has gone somewhere, the salt disappeared, etc)

- Conclude the discussions.

5 Summary (15 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 solution?
  Q: How are a mixture of sand and water and a mixture of salt and water different?
  Q: What does the word of 'dissolve' means?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Mixtures and Solutions

Key question:
What is a solution?

Activity: Comparing mixtures

	Your observation
A mixture of water and sand	The sand can be seen in the mixture Sand settle down, etc...
A mixture of water and salt	The salt cannot be seen in the mixture. The salt disappeared etc...

Discussion

Q: What happened to the mixture in each glass? In the mixture of sand and water, sand did not dissolve in water instead settled at the bottom of the glass. In the mixture of salt and water, salt dissolved in water and it disappeared.

Q: When we mixed salt with water, it disappeared. Where has the salt gone?
The salt dissolved in water,
The salt has gone somewhere,
The salt disappeared, etc...

Summary

- A solution is a mixture where one or more substances are dissolved evenly into another substance.
- A solution has the same properties throughout a mixture.
- Dissolve means to mix completely by separating into particles that cannot be seen.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.2. Solutions**	Total lesson No: 70 / 74 Textbook page: 169 - 170

Lesson 7 / 11

Lesson Title

Weight of Solution

Preparation

glass, water, salt, paper, scale.

Lesson Flow

1 Introduction (5 min.)

- Recap the previous lesson. Ask:

Q:What is a solution?

Q:How is a mixture of sand and water and a mixture of salt and water different?

Q:What does the word of 'dissolve' means?

- Encourage students to think about the weight of salt when it is mixed with water by asking;

Q:When salt is mixed with water, it seemed to disappear, how about its weight?

2 Introduce the key question

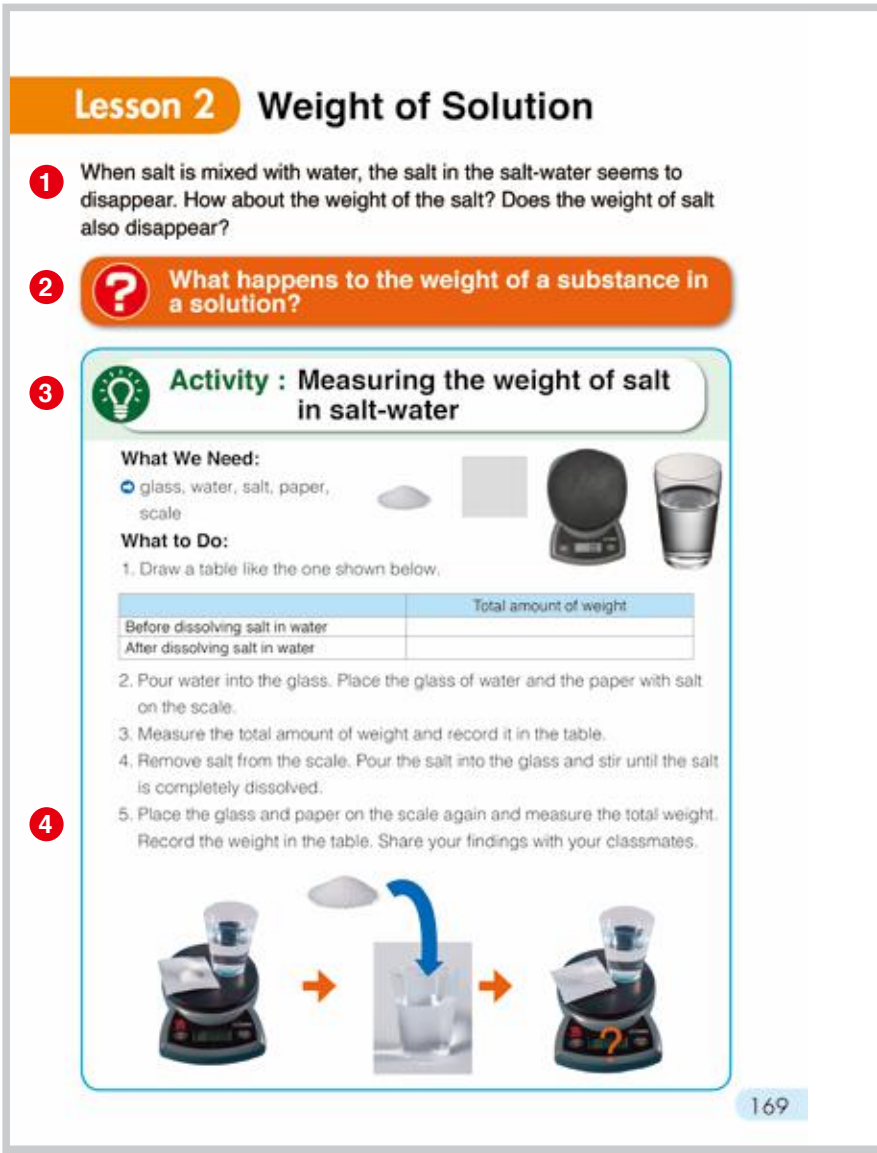
What happens to the weight of a substance in a solution?

3 Activity (35 min.)

- Organise the students into groups.
- Explain the steps of the activity.
- Ask students to predict what will happen to the weight of a substance in a solution.
- Refer students to the diagram below the activity to help facilitate the activity.
- Have students carry out the investigation and record their results in the table.
- Check students' activity and if necessary guide them towards their results.
- Ask them to share their results in their groups.

4 Discussion for findings (25 min.)

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



Lesson 2 Weight of Solution

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

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

3 Activity : Measuring the weight of salt in salt-water

What We Need:

glass, water, salt, paper, scale

What to Do:

1. Draw a table like the one shown below.

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

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

4

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Teacher's Notes

In a solution sometimes a solute does not cease to exist when it dissolves. If the water in the solution is evaporated, the solute is left behind. The total mass stays the same during dissolving. For example, if 1 g of salt is dissolved in 100 g of water, the mass of salt solution formed is 101 g (1 + 100). This is called conservation of mass.

Tips for the Activity

- Guide students well to measure weight of salt and water by referring to the Science Toolbox 'How to use a digital scale'.
- Answers provided on the blackboard plan are just examples; most importantly the weight of the substance dissolve in water should be equal to the sum of the weight of water and a substance to be dissolved.
- When measuring after dissolving salt in water, make sure to include the piece of paper too on the scale as shown in the textbook.

Lesson Objectives

Students will be able to:

- Realise that the weight of substance does not change before and after dissolving.
- Explain the relationship between the weight of solution with the sum of water and the substance dissolved in water.

Assessment

Students are able to:

- Describe that the weight of substance does not change before and after dissolving in water even if it looks disappeared.
- State that the weight of solution is equal to the sum of water and the substance dissolved in water.

Result

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

Sample of the result

Discussion

Think about the following questions based on your result.

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

Summary

5

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

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

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

Q:What was the total amount of weight before dissolving salt in water? (100 grams)

Q:What was the total amount of weight after dissolving salt in water? (100 grams)

Q:What happened to the weight of the salt before and after it is dissolved in water? (The weight of the salt before and after it was dissolved in saltwater does not change.)

- Conclude the discussions.

5 Summary (15 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 happened to the weight of solution before and after dissolving salt in water?
  Q: What can you say about the relationship among the weight of a solution, water and the substance dissolved in water?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Weight of Solution

Key question: What happens to the weight of a substance in a solution?

Activity:

Measuring the weight of salt in salt water.

Examples of Result

	Total amount of weight
Before dissolving salt in water	100 grams
After dissolving salt in water	100 grams

Discussion

Q: What was the total amount of weight before dissolving salt in water?

It was 100 grams

Q: What was the total amount of weight after dissolving salt in water?

It was 100 grams

Q: What happened to the weight of the salt before and after it is dissolved in water?

The weight of the salt before and after it was dissolved in the water does not changed

Summary

- When a substance is dissolved in water its weight does not change.
- Weight of a solution is always equal to the sum of the weight of water and a substance to be dissolved.
- A substance that dissolves in water cannot be seen but it is always present in the solution.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.2. Solutions**	Total lesson No: 71 / 74 Textbook page: 171 - 172

Lesson 8 / 11

Lesson Title

Amount of Substance Dissolved in Water 1

Preparation

glass cup, water, spoon, salt, A4 paper, scale

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson. Ask:

Q:What happen to the weight of solution before and after dissolving salt in water?

Q:What is the relationship among the weight of a solution, water and the substance dissolved in water?

- Encourage students to think about how much substance can be dissolved in water by asking:

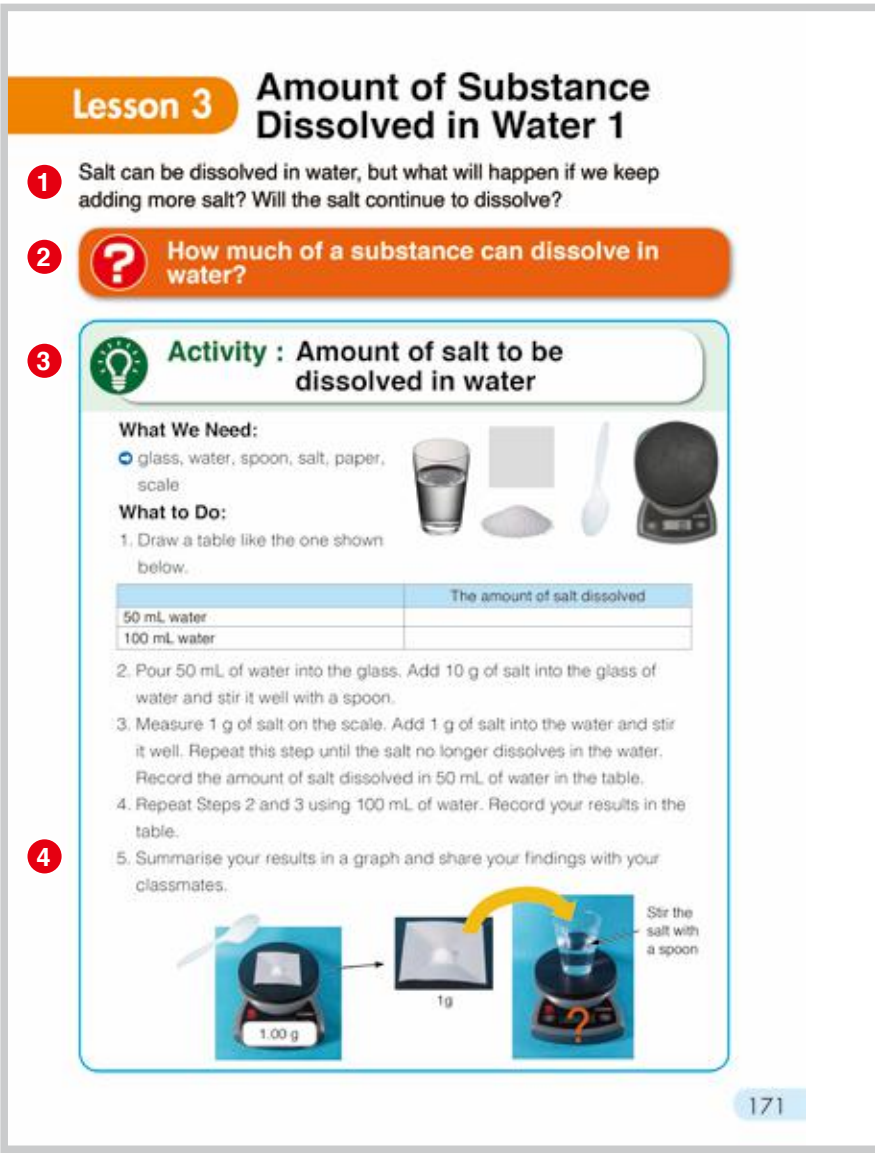
Q:What happens when a substance is continuously added to water?

2 Introduce the key question

How much of a substance can dissolve in water?

3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Ask students to predict how much of salt dissolves in 50 mL and 100 mL of water.
- Have students do their activity based on their predictions and record their results in their exercise books.
- Check students' activity and if necessary guide them towards their findings.
- Provide enough time to students for their investigations.
- Ask students to summarise the results in a graph.



Lesson 3 Amount of Substance Dissolved in Water 1

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

2 How much of a substance can dissolve in water?

3 Activity : Amount of salt to be dissolved in water

What We Need:

glass, water, spoon, salt, paper, scale

What to Do:

1. Draw a table like the one shown below.

	The amount of salt dissolved
50 mL water	
100 mL water	

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

4

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Teacher's Notes

Tips for the Activity

- When conducting this experiment, try not to use hot or warm water, this will be covered in the next lesson. Water in room temperature (cold water) is appropriate for this lesson to obtain the intended result.
- After adding the salt to the saltwater solution, use the scale to measure the amount of salt dissolved in 50mL and 100mL of water in Steps 2 and 3.
- Refer to the Science Toolbox 'How to Make a Graph'.Guide students well to summarise their results on a graph and know where to plot temperature of water and amount of salt on the correct axis of the graph (vertical and horizontal).

Additional Notes

- This lesson focuses on a special type of solution, called saturated solutions. Saturated solution is a solution that contains the maximum amount of solute (substance to be dissolved i.e. salt) that is capable of being dissolved. The maximum amount of solute varies substance by substance and temperature. The table below shows the maximum amount of sugar and salt to be dissolved in 100g of water by temperature. As it is shown in the table, there is a big difference in their amount and sugar can be dissolved much more than the salt. Therefore, sugar should not be used for this experiment.

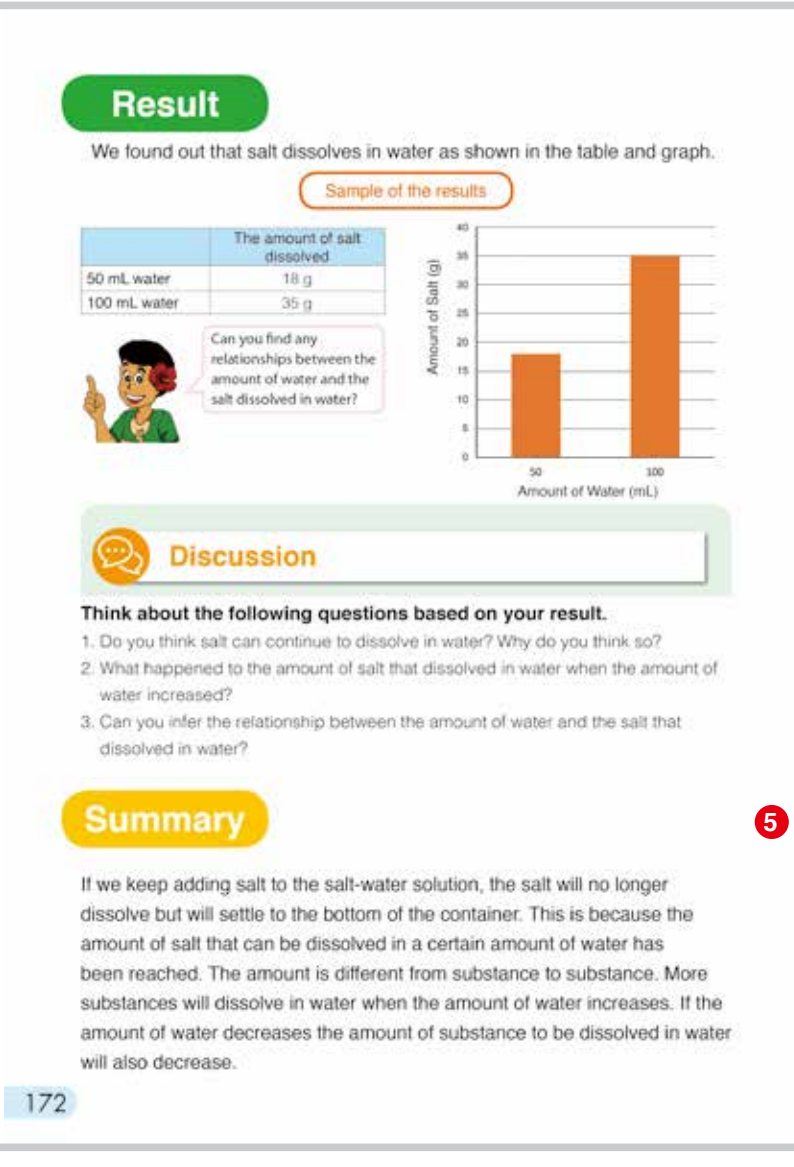
Temperature	0°C	20°C	40°C	60°C	80°C	100°C
Sugar	179 g	204 g	238 g	287 g	362 g	487 g
Salt	35.7 g	36.0 g	36.6 g	37.3 g	38.4 g	39. 8 g

Lesson Objectives

Students will be able to:
- Recognise that the amount of substance dissolved in water is decided.
- Infer the relationship between the amount of water and the salt that dissolved in water.

Assessment

Students are able to:
- Explain that the amount of salt that can be dissolved in water depends on the amount of water.
- State that the amount of salt that can be dissolved in water is proportional to the amount of water.



Result

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

Sample of the results

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

Discussion

Think about the following questions based on your result.

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

Summary

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

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4 Discussion for findings (25 min.)

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

Q:Do you think salt can continue to dissolve in water unlimitedly or not? (No)

Q:Why do you think so? (Because when we keep adding salt, the salt will no longer dissolve and settle at the bottom of the container.)

Q:What happened to the amount of salt that dissolved in water when the amount of water was increased? (The amount of salt dissolved in water increased.)

Q:What is the relationship between the amount of water and that of the salt dissolved in water? (More substance dissolves in water when the amount of water increases)

- Conclude the discussions.

5 Summary (15 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 dissolve more salt in water?
  Q: What is the relationship between the amount of water and that of a substance dissolve in water?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title:

Amount of Substance Dissolved in Water 1

Key question: How much of a substance can dissolve in water?

Activity:

Amount of salt to be dissolved in water

Examples of Result

Amount of water	Amount of salt dissolve.
50mL of water	18 g
100mL of water	35 g

Discussion

Q: Do you think salt can continue to dissolve in water unlimitedly or not? No

Q: Why do you think so? Because when we keep adding salt, the salt will no longer dissolve and settle at the bottom of the container.

Q: What happened to the amount of salt dissolved in water when the amount of water was increased? The amount of salt dissolved in water increased.

Q: What is the relationship between the amount of water and that of the salt dissolved in water?

More substance dissolves in water when the amount of water increases and less substance dissolves in water when the amount of water decreases.

Summary

- Amount of substance that can dissolve in water is often decided.
- The amount is different from substance to substance.
- More substance will dissolve in water when the amount of water increases.
- Less substance will dissolve in water when the amount of water decreases.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.2. Solutions**	Total lesson No: 72 / 74 Textbook page: 173 - 174

Lesson 9 / 11

Lesson Title

Amount of Substance Dissolved in Water 2

Preparation

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

Lesson Flow

1 Introduction (5 min.)

- Review the previous lesson: Ask:

Q:How can we dissolve more salt in water?

- Motivate students to think about another way to dissolve more salt in water and ask the question:

Q:Do you have any ideas on how to dissolve more substance in water?

2 Introduce the key question

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

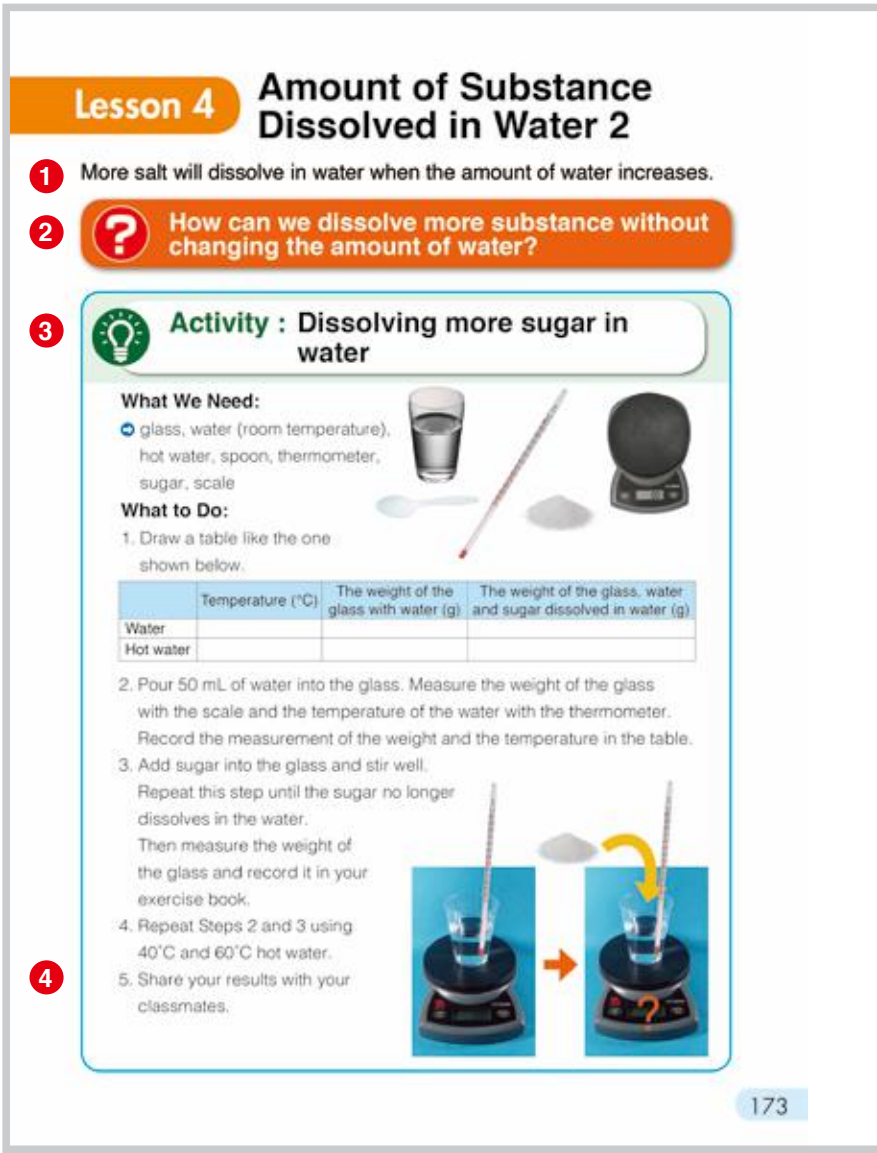
3 Activity (35 min.)

- Organise students into groups.
- Explain the steps of the activity.
- Remind the students of how to use and read a thermometer.
- Ask students to predict what will happen to the sugar if the temperature of water changes.
- Let students do the activity based on their predictions and record their results in their exercise books.
- Check students' activity and if necessaryguide them towards their results.
- Ask the students to discuss their results in their groups.

4 Discussion for findings (25 min.)

- Ask students to present their results from the activity.

(Continue)



Lesson 4 Amount of Substance Dissolved in Water 2

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

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

3 Activity : Dissolving more sugar in water

What We Need:

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

What to Do:

1. Draw a table like the one shown below.

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

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

4

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Teacher's Notes

Tips for the Activity

- After recording the weight and temperature of the water in Step 1, gently remove the thermometer from the glass then proceed to Step 2.
- Consider that answers provided on the blackboard plan are just examples as a guide for teacher.

Effect of heating on solubility

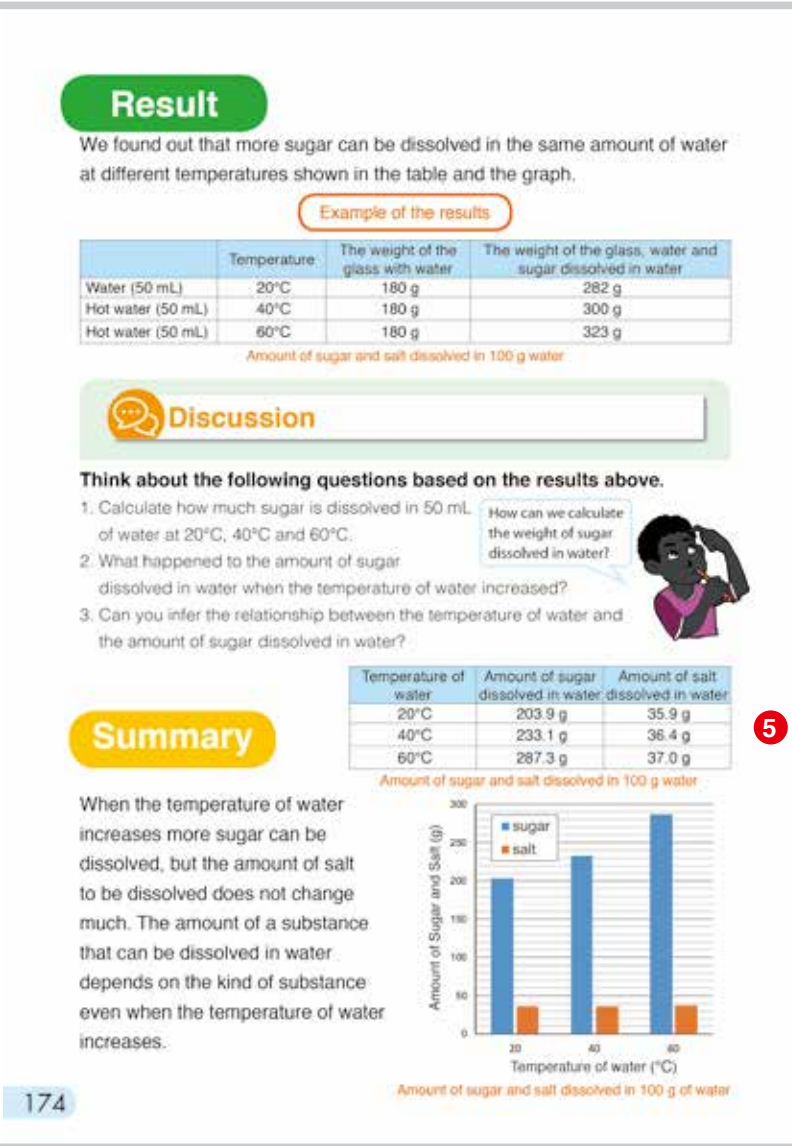
- Students may noticed that or ask why so much sugar dissolves at a higher temperatures compared to salt. There are so many factors involved that it is difficult to explain why the solubility of one substance is affected more than another by an increase in temperature. All substances are made up of different atoms, ions and molecules. They are held together differently and interact with water differently. Hence, the changing temperature also affects the motion (movement) of the atoms, ions and molecules of the substance together with the interaction between the molecules of water and the particles of the substance.
- Data for salt and sugar dissolving in water by different temperatures is available in 'Teacher's Notes' in the previous lesson.

Lesson Objectives

Students will be able to:
- Measure the temperature of water and the weight of solution.
- Infer the relationship between the temperature of water and the substance that dissolved in water.
- Communicate their ideas with others.

Assessment

Students are able to:
- Record the temperature of water and the weight of solution in the table.
- Discover the relationship between the temperature of water and the sugar that dissolved in water based on the result of the activity.
- Participate in the discussions actively.



Result

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

Example of the results

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

Amount of sugar and salt dissolved in 100 g water

Discussion

Think about the following questions based on the results above.

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

How can we calculate the weight of sugar dissolved in water?

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

Amount of sugar and salt dissolved in 100 g water

Summary

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

Amount of sugar and salt dissolved in 100 g of water

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

Q:Calculate how much of sugar dissolved in 50 mL at 20°C, 40°C and 60°C. (20°C – 102g, 40°C – 120 g and 60°C – 143 g)

Q:What happened to the amount of sugar dissolved in water when the temperature of water increased? (More sugar was dissolved in water when its temperature increased.)

Q:Can you infer the relationship between the temperature of water and the amount of sugar dissolved in water? (The higher the temperature of water, the more sugar can be dissolved in water etc...)

- Conclude the discussions.

5 Summary (15 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 dissolve more salt in water?
  Q: What is the relationship between the amount of water and that of a substance dissolve in water?
- Ask students to copy the notes on the blackboard into their exercise books.

Sample Blackboard Plan

Title: **Amount of Substance Dissolve in Water 2**

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

Activity: Dissolving more sugar in water

	Temp (°C)	Weight of glass with water (g)	Weight of glass, water and sugar (g)
Water	20°C	180	282
Hot water	40°C	180	300
	60°C	180	323

Examples of Result

Discussion

Q: Calculate how much of sugar dissolved in 50mL at 20°C, 40°C and 60°C.

20 °C: 282 – 180 = 102g

40 °C: 300 – 180 = 120g

60 °C: 323 – 180 = 143g

Q: What happened to the amount of sugar dissolved in water when the temperature of water increased?

More sugar was dissolved in water when its temperature increased.

Q: Can you infer the relationship between the temperature of water and the amount of sugar dissolved in water? The higher the temperature of water, the more sugar can be dissolved in water etc...

Summary

- When the temperature of water increases more sugar can be dissolved.
- The amount of salt to be dissolved does not change much.
- The amount of a substance that can be dissolved in water depends on the kind of substances despite of increased temperature of water.

Unit: **Matter**	Chapter : **11. Mixtures and Solutions** Topic : **11.2. Solutions**	Total lesson No: 73 / 74 Textbook page: 175 - 177

Lesson 10 / 11

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 content learnt ask students the following questions.
  - What is a solution?
  - Why is a substance that exists in a solution cannot be seen?
  - How can you make more substance dissolve in water?
- 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 11.2 Solutions

Mixtures and Solutions

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

Weight of Solutions

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

Water 100 g + Salt 5 g = Salt-Water (solution) 105 g

Amount of Substance Dissolved in Water

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

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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 11.2 Solutions

Q1. Complete each sentence with the correct word.

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

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

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

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

Q2. Choose the letter with the correct answer.

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

A. Mixture of salt and water.
B. Mixture of oil and water.
C. Mixture of sugar and water.
D. Soda water.

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

A. Less sugar will dissolve in water.
B. More sugar will dissolve in water.
C. The amount of dissolved sugar does not change.
D. The volume of water will decrease.

Q3. Answer the following questions.

Study and compare the picture shown on the right.

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

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

A mixture of sand and water | A mixture of salt and water

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

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Exercise answers

Q1.
(1) **solution**
(2) **properties**
(3) **small**
(4) **sum**

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

Q3.
(1) **Grains of the sand can be seen while the particles of salt cannot be seen.**
(2) **1) Temperature of water 2) amount of water.**

Q4. Expected answer
The weight of solution is equal to the sum of water and the substance to be dissolved.
200 g + 50 g

Explanation of Science Extras

3 Science Extras (10 min.)

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

3

Chapter 11
•Science Extras•

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

Let's make sugar crystal from sugar solution

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

Crystal of sugar

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Lesson 11 / 11

Lesson Title

Chapter Test

Answers of the Chapter Test

Chapter Test

11. Mixtures and Solutions

Q1 Complete each sentence with the correct word.

(1) Air is a mixture of gases such as nitrogen, carbon dioxide.
(2) A solution has the same properties throughout the mixture.
(3) To dissolve means to mix matter completely into the liquid by separating into particles that cannot be seen.
(4) A mixture is a combination of two or more substances.
(5) Mixtures can be separated using their physical properties.

Q2 Choose the letter with the correct answer.

(1) Which of the following is the correct explanation about filtration?
A. Let the water evaporate from the mixture.
B. Use filter paper to trap the solid from the mixture.
C. Use tweezers to pick out the solid from the mixture.
D. Use a magnet to attract the solid from the mixture.

(2) Sugar dissolved in water is an example of which type of mixture?
A. Liquid-solid mixture.
B. Gas-liquid mixture.
C. Liquid-liquid mixture.
D. Solid-liquid mixture.

(3) What happens to the weight of a substance in a solution? The weight of the solution
A. does not change.
B. increases.
C. disappears.
D. decreases.

(4) What is the correct method used to separate salt from water?
A. By evaporation
B. By condensation
C. By expansion
D. By filtration

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Q3

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

A

A.

Heat gently
(Evaporate)

B.

By handpicking

C.

Filtration

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

a. Increase the amount of water to make more salt dissolve in water.

b. Increase the temperature of water to make more salt dissolve in water.

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

The salt dissolved in the water.

Q4

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

(Expected answer) Because of the particle size of the sand that made it to pass through the screen unlike the gravel its particle size is bigger.

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

(Expected answer) The weight of the saltwater (solution) is equal to the sum of the weight of water and the substance to be dissolved.

Science Tool Box

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

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

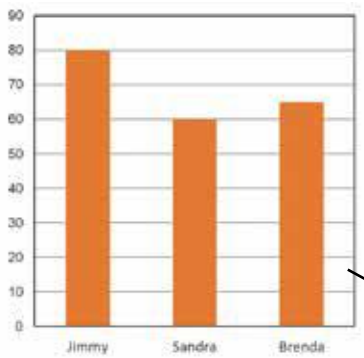
Tape measure

Compass

Thermometer

Digital scale

Microscope



Bar graph

How to use a Thermometer

1. What is a thermometer?

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

2. Measuring temperature

STEP 1:

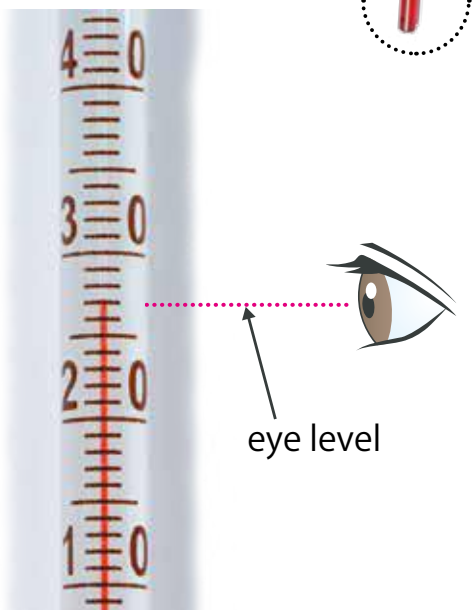
Place the bulb in the place where you want to measure the temperature. Make sure that there are no bright lights or direct sunlight shining on the bulb.

STEP 2:

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

STEP 3:

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



How to use a Compass

Compass

1. What is a compass?

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

2. Finding directions

STEP 1:

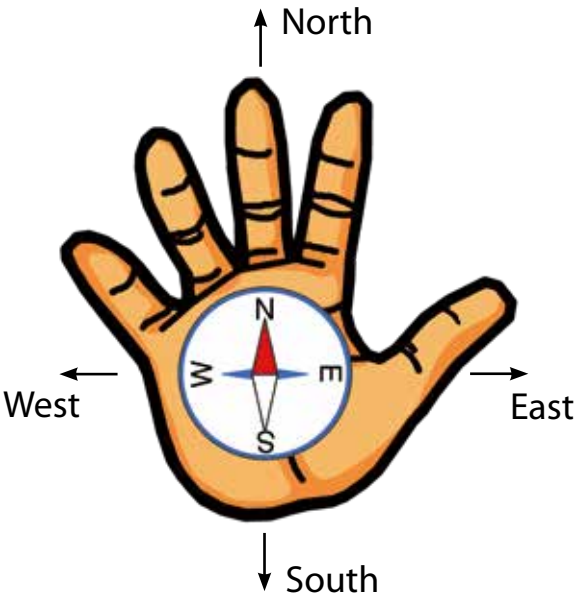
When you want to face North, place the compass flat on your palm and hold your palm in front of your chest as shown in the picture on the right.

STEP 2:

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

STEP 3:

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



How to use a Tape measure

1. What is a Tape Measure?

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

2. Finding the circumference around your partners head

STEP 1:

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

STEP 2:

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

STEP 3:

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

STEP 4:

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

How to use a Microscope

1. What is a Microscope?

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

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

2. Observe some sugar grains

STEP 1:

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

STEP 2:

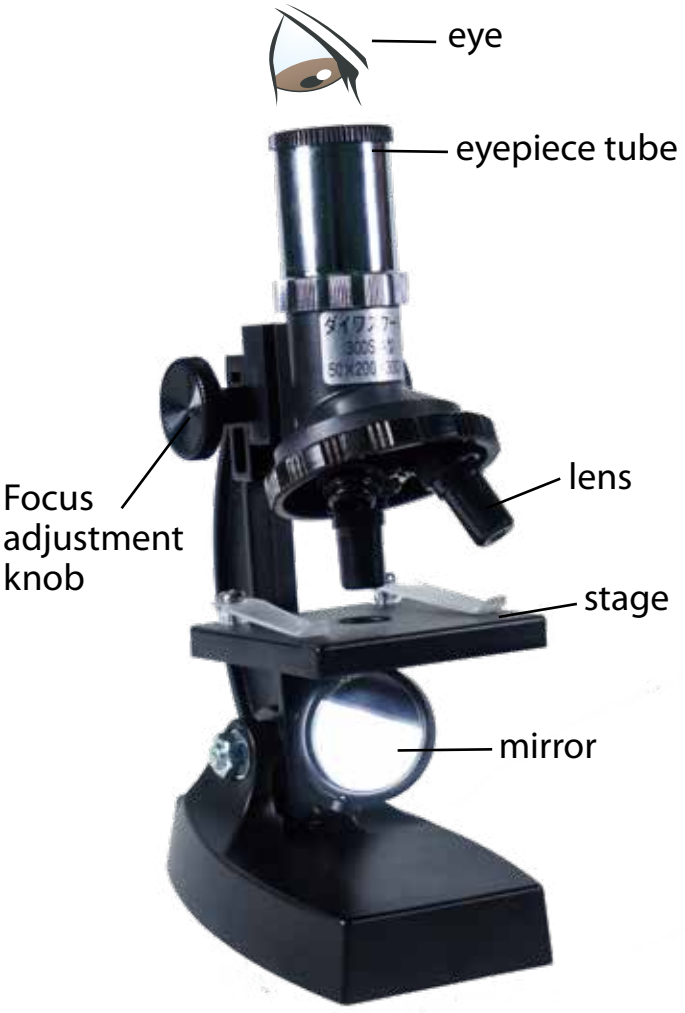
Put a few grains of sugar on the slide.Then put the slide containing the sugar grains on the stage of the microscope.

STEP 3:

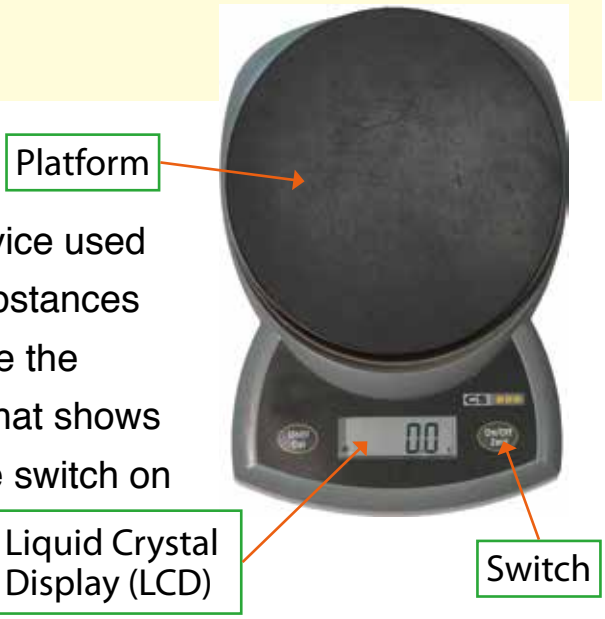
Look through the eyepiece.Turn the adjustment knob on the side of the microscope to bring the sugar grains to focus.

STEP 4:

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



How to use a Digital Scale



1. What is a Digital Scale?

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

2. Measuring Weight

STEP 1:

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

STEP 2:

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

STEP 3:

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

How to read and make a Bar Graph

1. What is a Bar Graph?

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

2.1 Reading a Bar Graph

STEP 1:

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

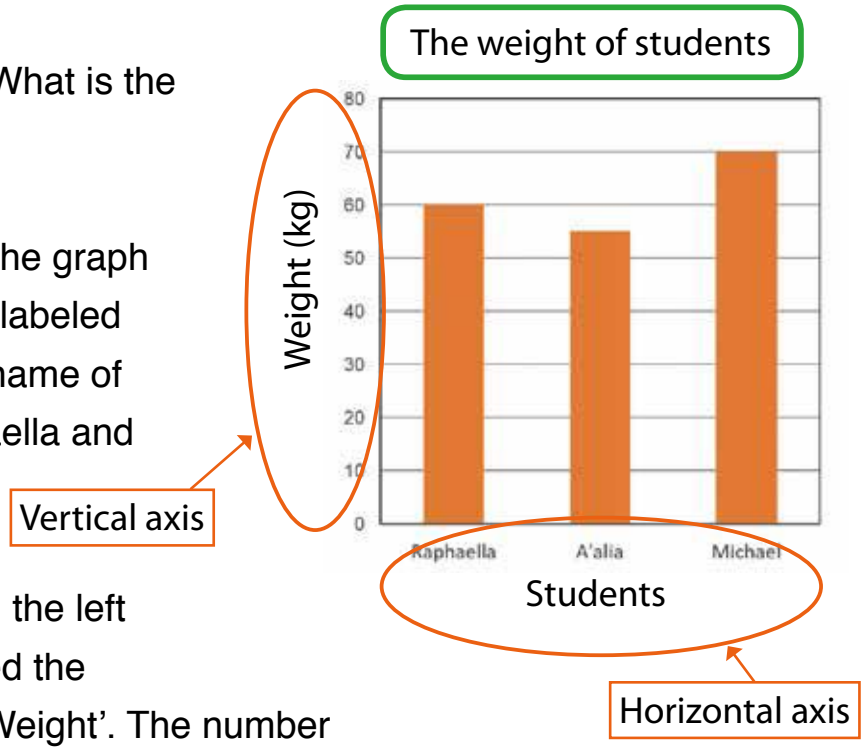
STEP 2:

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

STEP 3:

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

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



STEP 4:

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

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

2.2 Making a Bar Graph

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

Student	Weight (kg)
Jimmy	80
Sandra	60
Brenda	65

STEP 1:

Title the graph. The title should help the reader understand what the graph describes.

STEP 2:

Choose a scale and mark equal intervals. The vertical scale should include the least value and the greatest value in the set of data.

STEP 3:

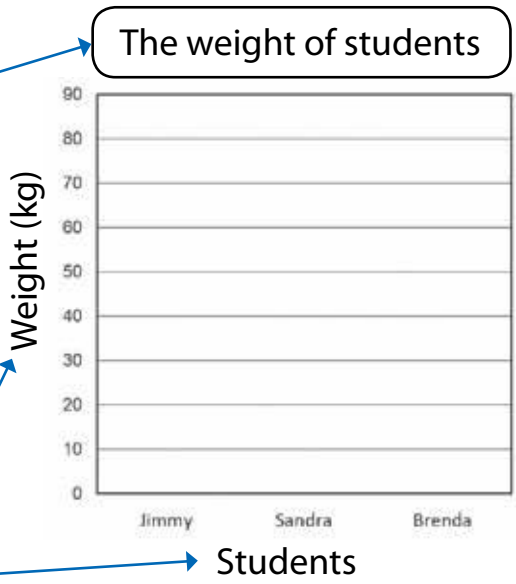
Label the vertical axis 'Weight' (kg) and horizontal axis 'Students'. Space the students' names equally.

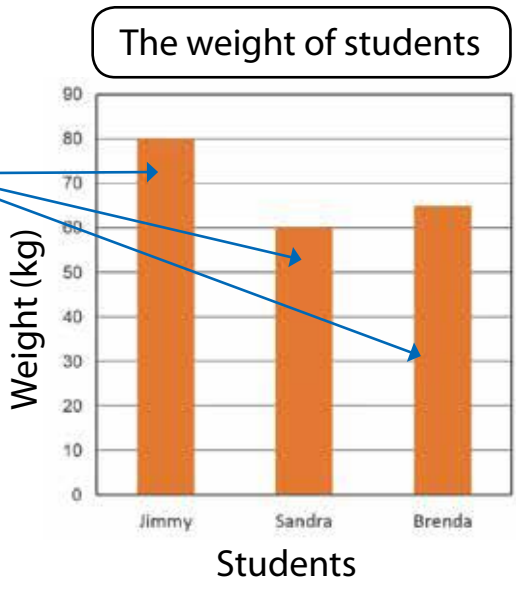
STEP 4:

Carefully draw the graph using the data. Depending on the interval you choose, some weights may appear between numbers.

STEP 5:

Check each step to make sure that the data in the table matches the bars you have made with the correct weights.





Glossary

Anther is the male reproductive part that produces and stores pollen grains. 70
Artery is the blood vessel that carries blood away from the heart. 148
Atrium is a heart chamber that receives blood from the body or the lungs. 146
Axis is an imaginary line at which a body rotates. 116
Aveoli are the millions of tiny balloon-like air sacs in the lungs. 140
Bacteria are single – celled organisms that are not a plant or an animal. 18
Blood vessels are tubes that the blood flows through to get to the different parts of our body..... 148
Breathing is the process of taking air in and out of the body. 140
Capillaries are the smaller and tiny vessels that connects the arteries and veins. 148
Carnivore is an animal that eats only animals. 12
Cell is the basic structure that makes up all living things. 148
Chambers are the spaces that consist two atriums and two ventricles of the heart. 146
Chemical energy are energy stored in foods, batteries and fuels. 100
Circulatory system is a network of organs that transport oxygen and nutrients to and carbon dioxide from the cells throughout our body. 148
Constellation is a group of stars that form a particular pattern. 88
Consumers are animals that consume other plants and animals in a food chain. 12
Contact forces are forces that take place when two objects are physically interacting with each other by touching. 48
Decomposer are organisms that break down dead animals and plants. 18
Deposition is the dropping of sediments moved by water, wind and ice. 30
Diaphragm is a muscle that helps to makes our lungs larger and smaller as we breathe air in and out. 142
Direction is the way or path something moves..... 52
Dissolve is to become broken up or absorbed by a liquid until it cannot be seen to form a mixture. 168
Earthquake is a sudden movement of Earth's surface often causing severe damage. 32
Ecosystem is a community of living things and non-living thing interacting together to support each other..... 16
Electromagnet is a type of magnet in which magnetic field is produced by an electric current flowing in a coil. 125

Glossary

Organ is a part of the body that has a specific form and function. 140
Ovary is the female reproductive part that produces and contains the eggs. 70
Ovule is the structure that gives rise to and contains the female reproductive cells. 70
Pistil is the female reproductive part of a flower. 150
Plasma is the component of blood which is consist of liquid. 150
Platelets are tiny cells of blood that help blood clot in order to stop bleeding, to heal cuts and other injuries. 150
Point of application is the location at which a force is applied to an object. 52
Pollen grains are microscopic structures that carry the male reproductive cell of plants. 70
Pollen tube is the tube through which sperm from the pollen reaches the egg cells and fertilises the plant to form seeds. 74
Pollination is the transfer of pollen grains from the anther to the stigma of a flower. 71
Predator is an animal that hunts and eats other animals. 12
Prey is an animal that is hunted and eaten by other animals. 12
Producers are living things that produce their own food. 12
Red cells are the red disc shaped cells in the blood containing haemoglobin to carry oxygen from the lungs to all parts of the body. 150
Respiratory system is a group of organs in our body that enables us to breathe. 140
Revolution is the movement of an object in a circular or elliptical course around another. 116
Rotation is the action of rotating on an axis or centre. 116
Sedimentary rocks are rocks that are formed from layers of sediments call strata, usually at the bottom of rivers, lakes and ocean. 39
Sediments are the materials that are carried by water or wind and deposited on the surface of the land or the seabed and may in time become into rocks. 26
Solution is a mixture where one or more substances are dissolved evenly into another substance. 168
Stamen is the male reproductive part of a flower 70
Star is a giant ball of hot gases. 84
Stigma is the female reproductive part where pollen grains fall on 70
Strata is the horizontal layers of sediment. 36
Style is the long stalk that connects the stigma to the ovary. 70

Glossary

Page number corresponds to Grade 5 Textbook

Accelerate is to increase in speed. 24

Adaptation is the use of body part or a behaviour that helps an organism survive in its environment or a new environment. 148

Boiling point is the temperature at which a liquid changes into a gas. 76

Carbon dioxide is a colourless and odourless gas produced by people or animals when they breathe out. 12

Chemical change is a change that produces new kinds of matter..... 58

Condensation is the process that causes a matter to change from gas to liquid. 76

Core is the hottest, innermost layer of the Earth. 114

Cotyledon is the part of a plant that stores food. 164

Crust is the thinnest outer layer of the Earth. 114

Decelerate is to reduce in speed or slow down. 24

Degrees Celsius is the unit of measurement used to measure temperature. 192

Desert is a large, hot, dry area of land with very little water and very few plants. ... 150

Electric current is the flow of electricity. 98

Embryo in animals is an early developmental stage of an animal while it is within the mother's womb (uterus) or in the egg. 88

Embryo in plants is the tiny plant inside the seed. 164

Energy pyramid is a representation of the flow of energy from one energy level to another. 16

Evaporation is the process that causes a matter to change from liquid to a gas. ... 76

Food web consists of several food chains linked to each other. 16

Fossil is the remains of once a living thing. 124

Freezing is the process that causes a matter to change from a liquid to a solid. ... 76

Freezing point is the temperature at a certain point where liquids start to change to solid. 74

Freshwater habitats are natural water sources that do not contain salt. 136

Friction is the force that occurs when two surface of objects rub against each other from opposite directions. 24

Germination is the process of the seed growing into a seedling. 165

Grassland habitat is an area mostly covered by grasses with few or no trees. ... 141

Habitat is the part of a natural environment where a plant or an animal lives. 134

Igneous rock is a rock formed when melted rock from inside the Earth cools and hardens. 118

Page number corresponds to Grade 5 Textbook

Basic Science Instruments

Basic science instruments introduced in the textbook are listed below.

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15

1. Magnifying lens
2. Measuring tape
3. Beaker
4. Thermometer
5. Burner
6. Compass
7. Microscope
8. Beam balance
9. Spring balance
10. Digital scale
11. Enamel wire
12. Cell holder
13. Switch
14. Wire
15. Bar magnet

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The Science Teacher's Manual was developed by Curriculum Development Division (CDD), Department of Education in partnership with Japan International Cooperation Agency (JICA) through the Project for Improving the Quality of Mathematics and Science Education (QUIS-ME Project). The following stakeholders have contributed to manage, write, validate and make quality assurance for developing quality Textbook and Teacher's Manual for students and teachers of Papua New Guinea.

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