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 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?

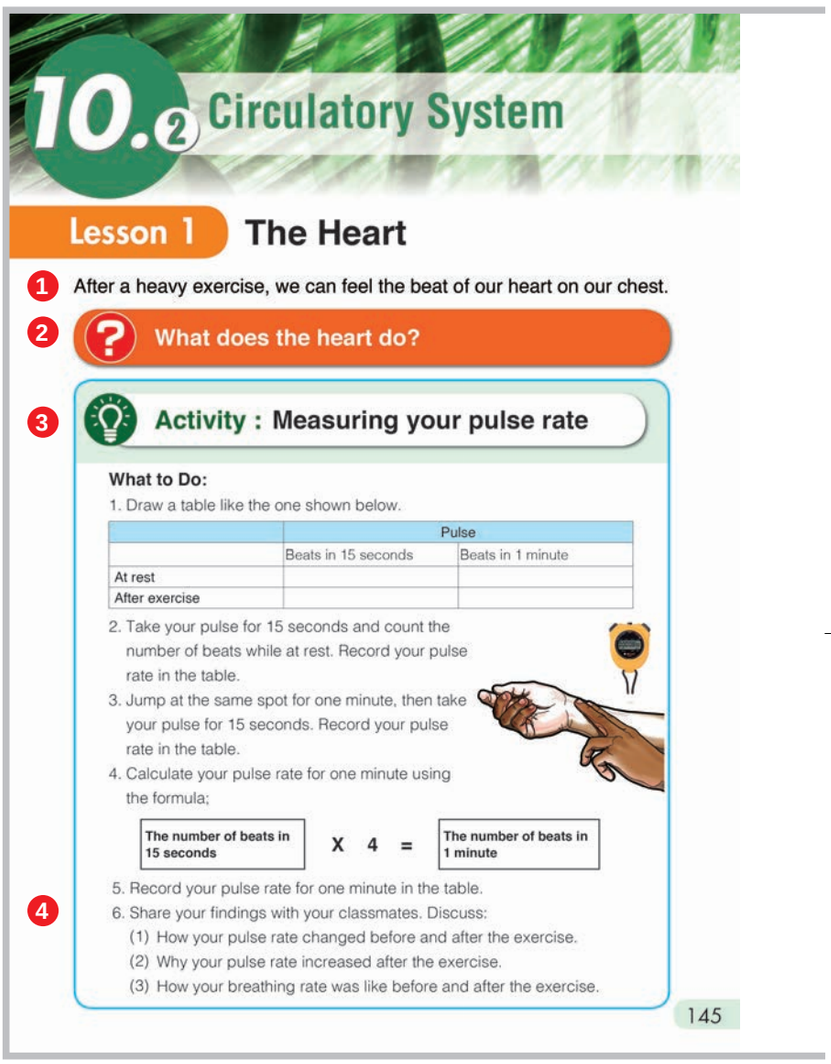
3 Activity (35 min.)

- 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.

(Continue)



10.2 Circulatory System

Lesson 1 The Heart

1 After a heavy exercise, we can feel the beat of our heart on our chest.

2 What does the heart do?

3 Activity : Measuring your pulse rate

What to Do:

1. Draw a table like the one shown below.

	Pulse	
	Beats in 15 seconds	Beats in 1 minute
At rest		
After exercise		

2. Take your pulse for 15 seconds and count the number of beats while at rest. Record your pulse rate in the table.
3. Jump at the same spot for one minute, then take your pulse for 15 seconds. Record your pulse rate in the table.
4. Calculate your pulse rate for one minute using the formula;

The number of beats in 15 seconds X 4 = The number of beats in 1 minute

4 5. Record your pulse rate for one minute in the table.
6. Share your findings with your classmates. Discuss:
(1) How your pulse rate changed before and after the exercise.
(2) Why your pulse rate increased after the exercise.
(3) How your breathing rate was like before and after the exercise.

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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

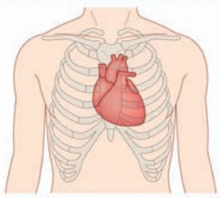
Students will be able to:
- Understand what a heart is.
- Identify the structures of a heart.
- Measure their pulse rates.

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.

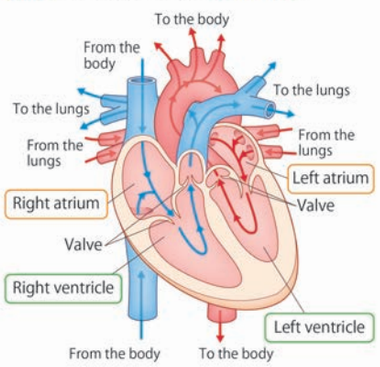
Summary

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 rates 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.

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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?

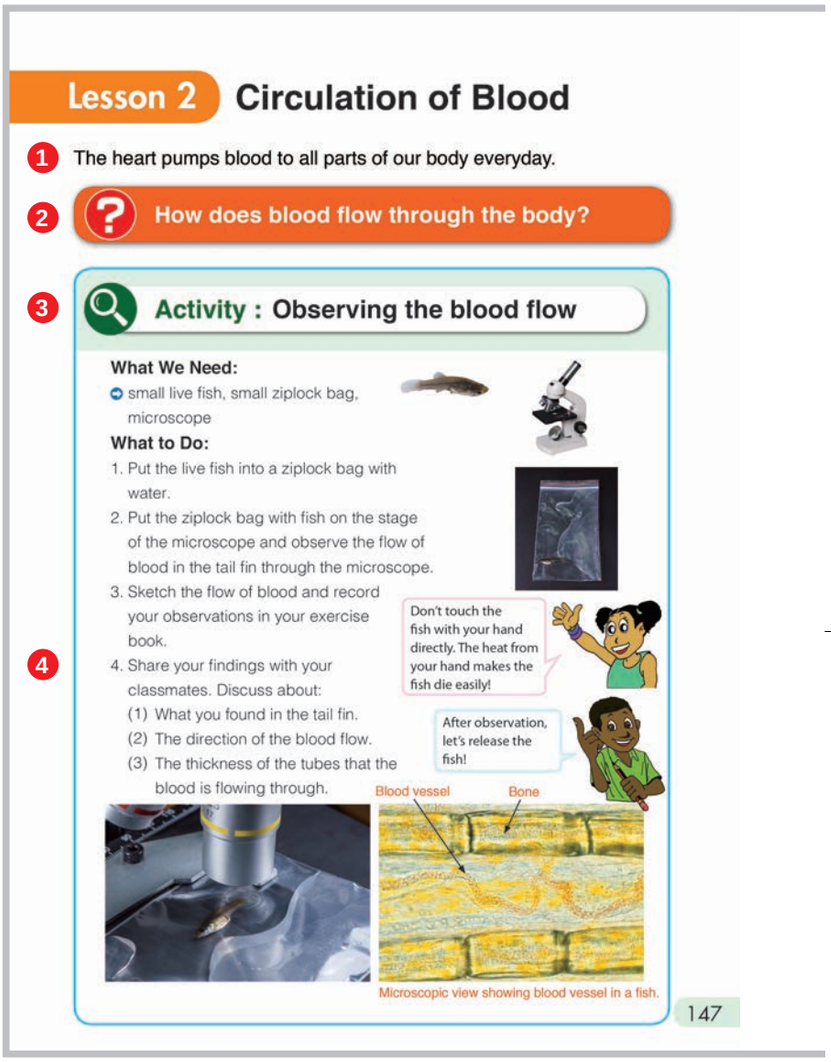
3 Activity (35 min.)

- Organise students in groups.
- Explain the steps of the activity.
- Demonstrates 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.

(Continue)



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

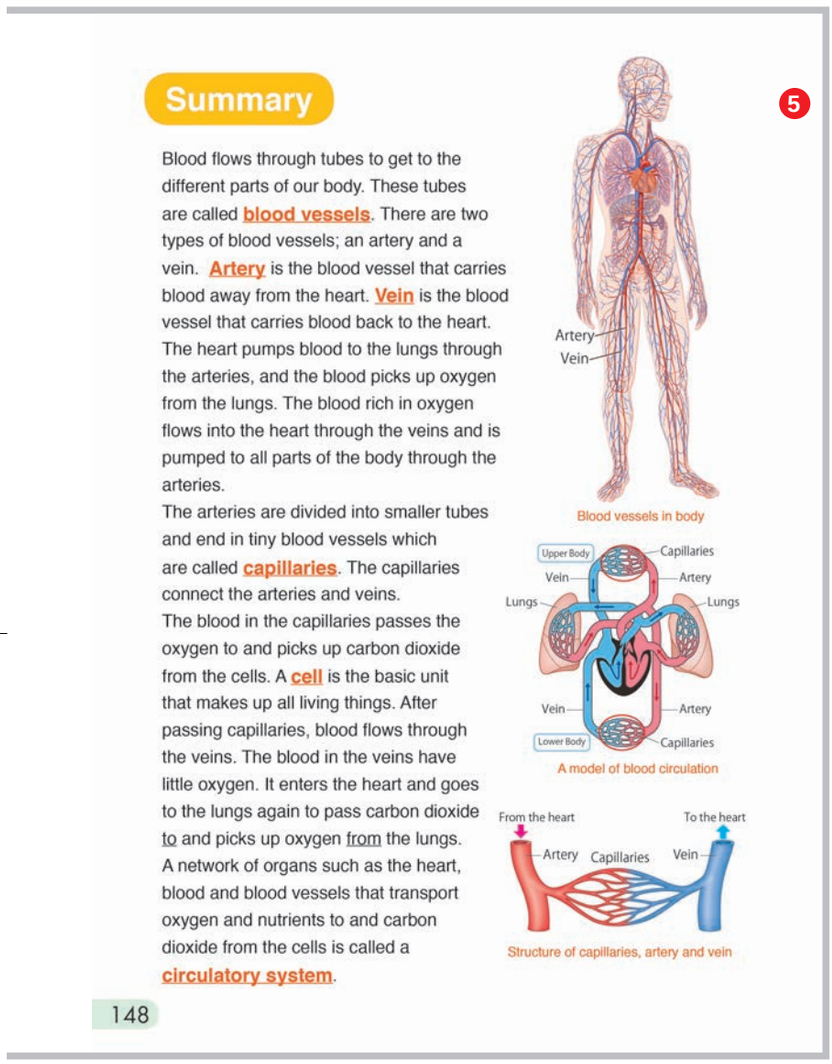
- If microscope or appropriate fish are not available teacher can use the picture in the text book to do the activity in this lesson.
- A mosquito fish can be used for this experiment and the fish should be released straight after the experiment.
- The lens of the microscope should be directly on the 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**.

Blood vessels in body

A model of blood circulation

Structure of capillaries, artery and vein

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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.

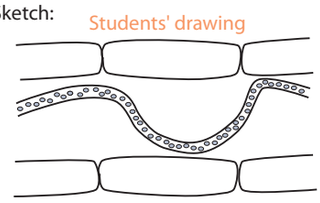
Sample Blackboard Plan

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...

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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

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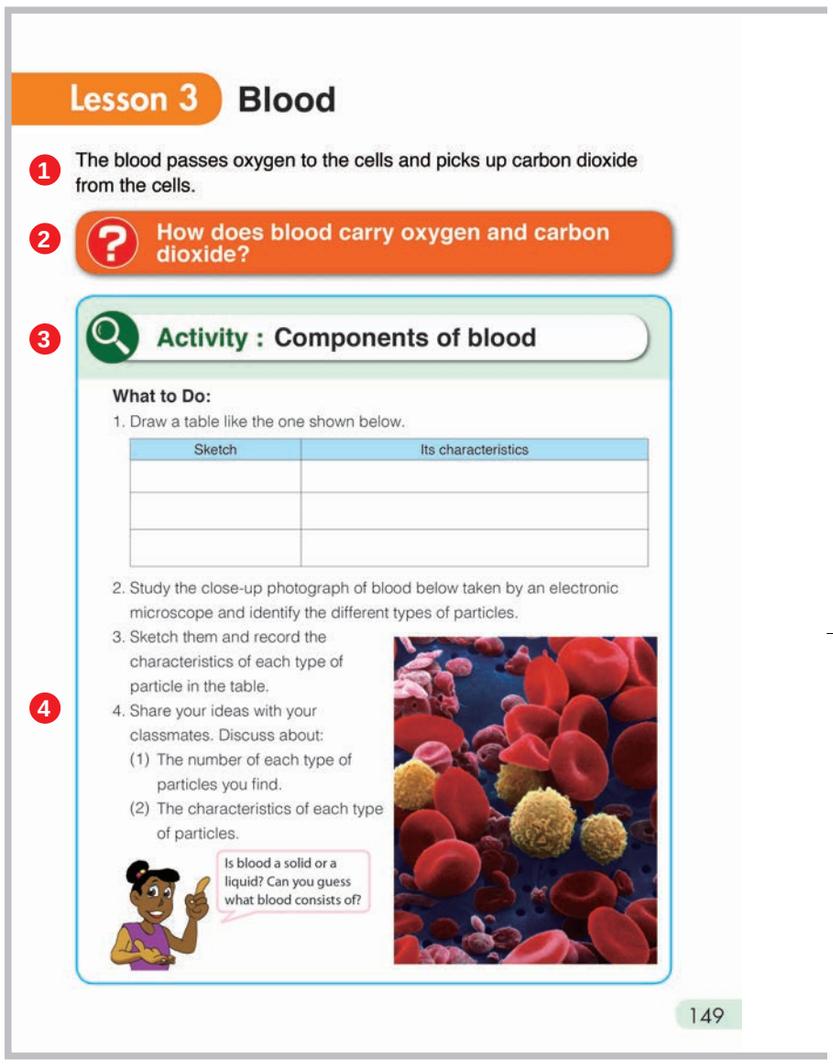

Lesson 3 Blood

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.

Is blood a solid or a liquid? Can you guess what blood consists of?

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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

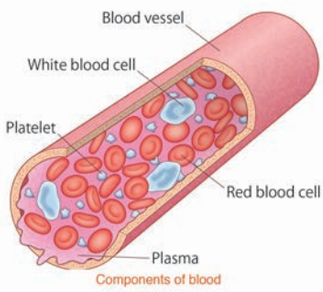
Students will be able to:
- Identify the components of blood.
- Understand the characteristics of each blood particles.

Assessment

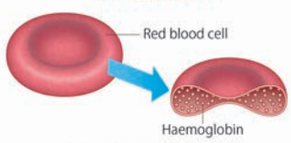
Students are able to:
- List the different components of the blood such as red cells, white cells, platelets and plasma.
- Describe how red cells, white cells, platelets and plasma work in blood.

Summary

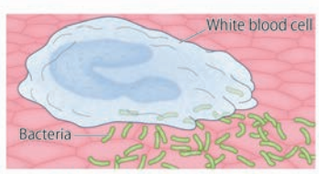
Blood carries oxygen, carbon dioxide, nutrients and wastes in our body. Blood is made up of solid and liquid parts. The solid parts of the blood are suspended in liquid.
The solid parts of the blood include **red cells**, **white cells** and **platelets**. The liquid part of the blood is called **plasma**. 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.



Components of blood

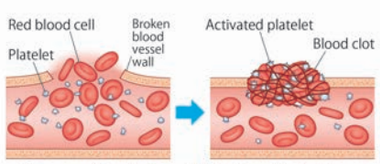


Cross section of red blood cell



White blood cell is attacking bacteria.

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.



The way red blood cells and platelets form blood clot.

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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.

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Lesson 7 / 8

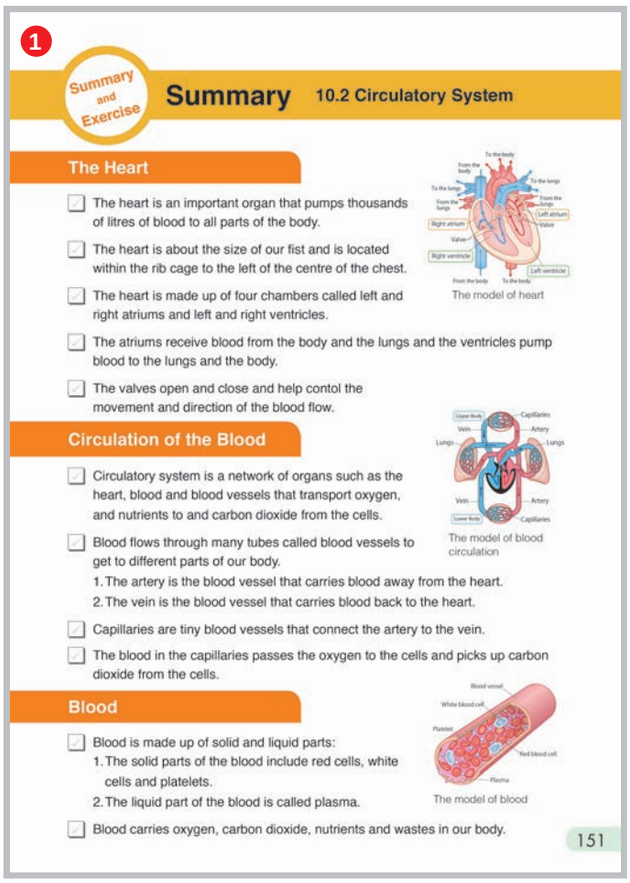
Lesson Title

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.



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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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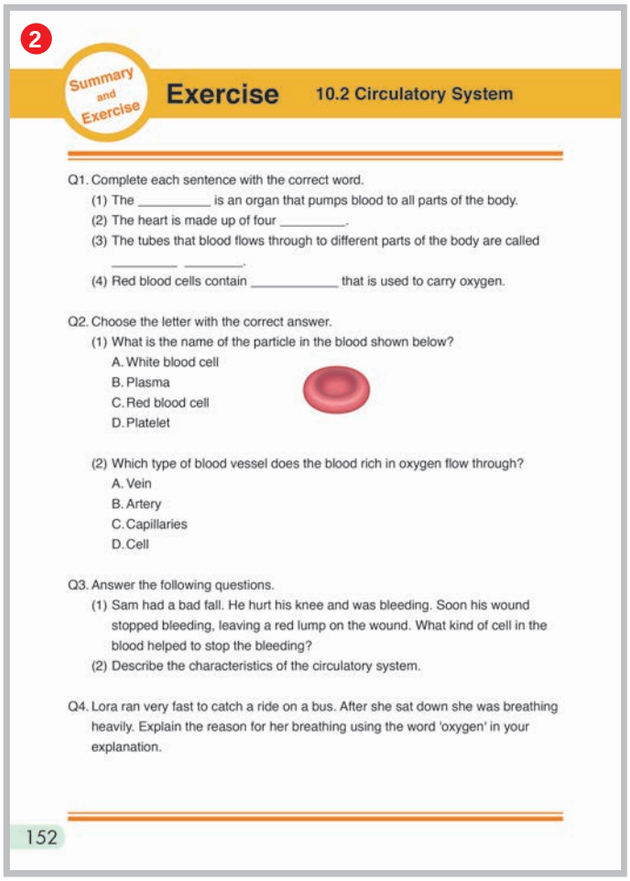
2 Exercise & Explanation (40 min.)

- 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.



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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**

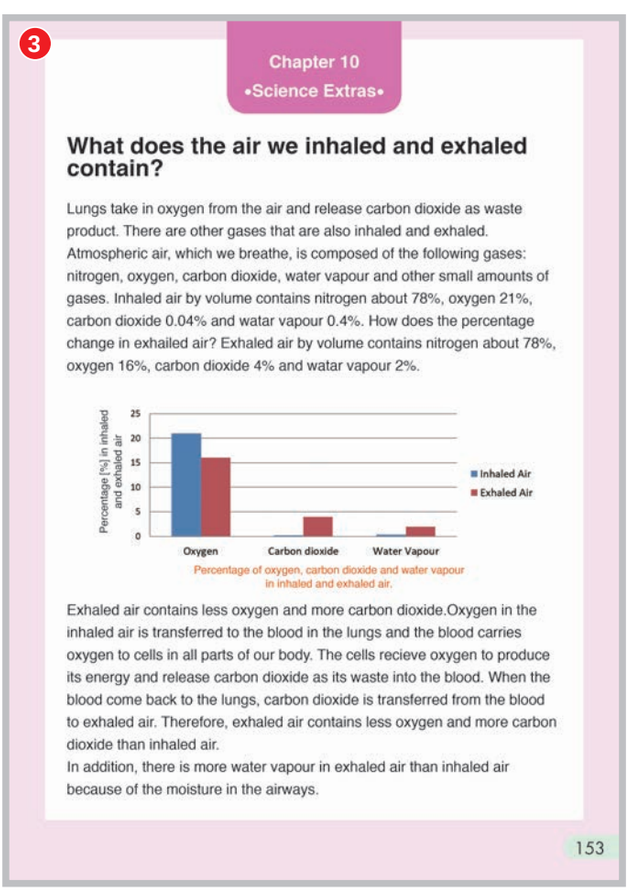
Q3.
(1) **Platelets**
(2) Expected answer
Circulatory system is a group of organs for transporting oxygen and carbon dioxide to and from the cells in our body.

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 exhailed 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.

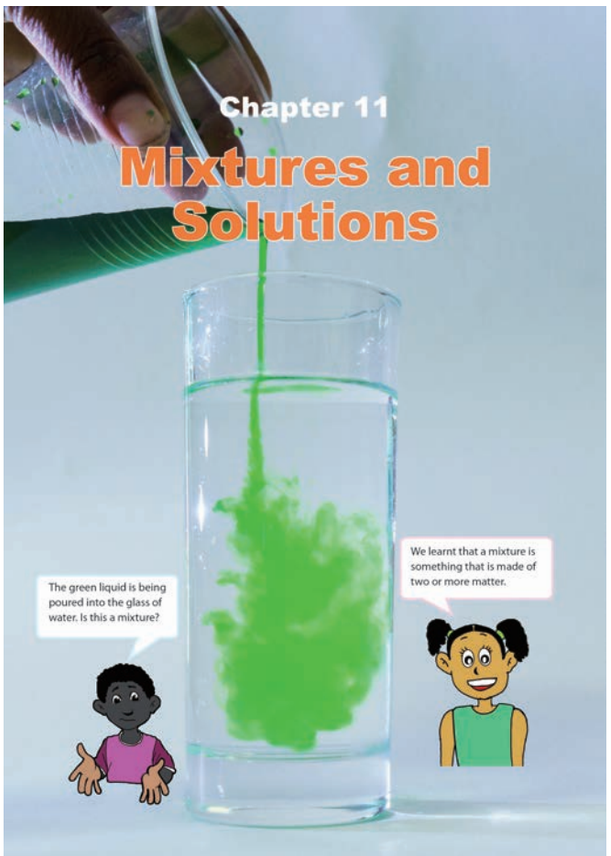
(Expected answer) During exercise, more oxygen are necessary for our muscle, so blood must carry oxygen to the muscle faster than when the body is resting. To meet these demands, the pulse rate increases.

Strand : PHYSICAL SCIENCE
Unit : MATTER

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.

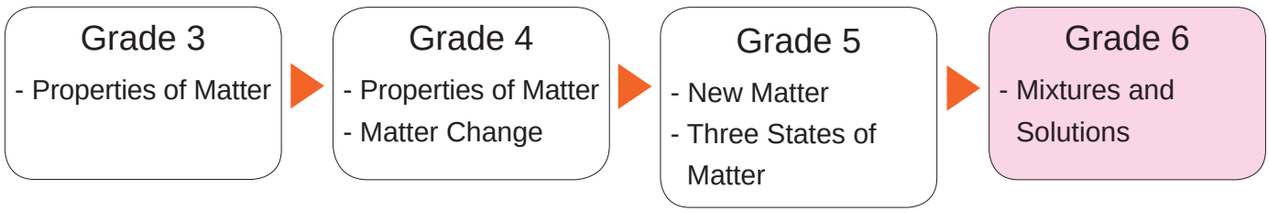
11.2 Solutions

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?

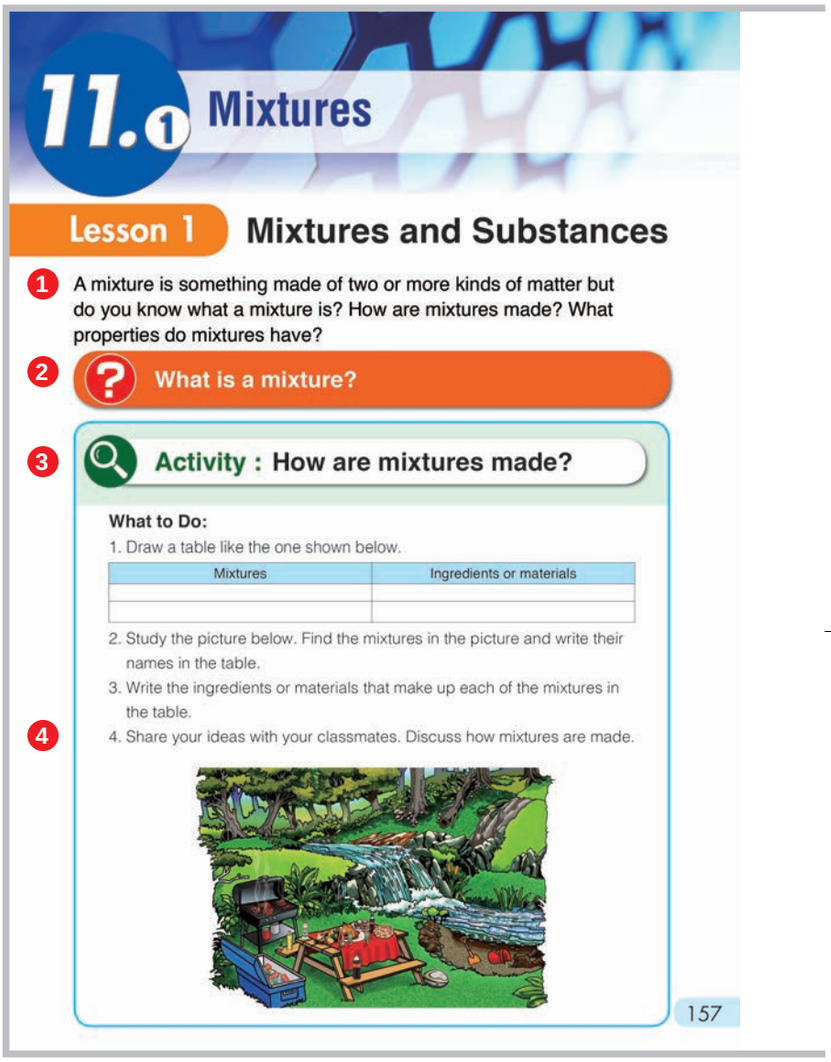
3 Activity (35 min.)

- 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)



11.1 Mixtures

Lesson 1 Mixtures and Substances

1 A mixture is something made of two or more kinds of matter but do you know what a mixture is? How are mixtures made? What properties do mixtures have?

2 What is a mixture?

3 Activity : How are mixtures made?

What to Do:

1. Draw a table like the one shown below.

Mixtures	Ingredients or materials

2. Study the picture below. Find the mixtures in the picture and write their names in the table.
3. Write the ingredients or materials that make up each of the mixtures in the table.
4. Share your ideas with your classmates. Discuss how mixtures are made.

4

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Teacher's Notes

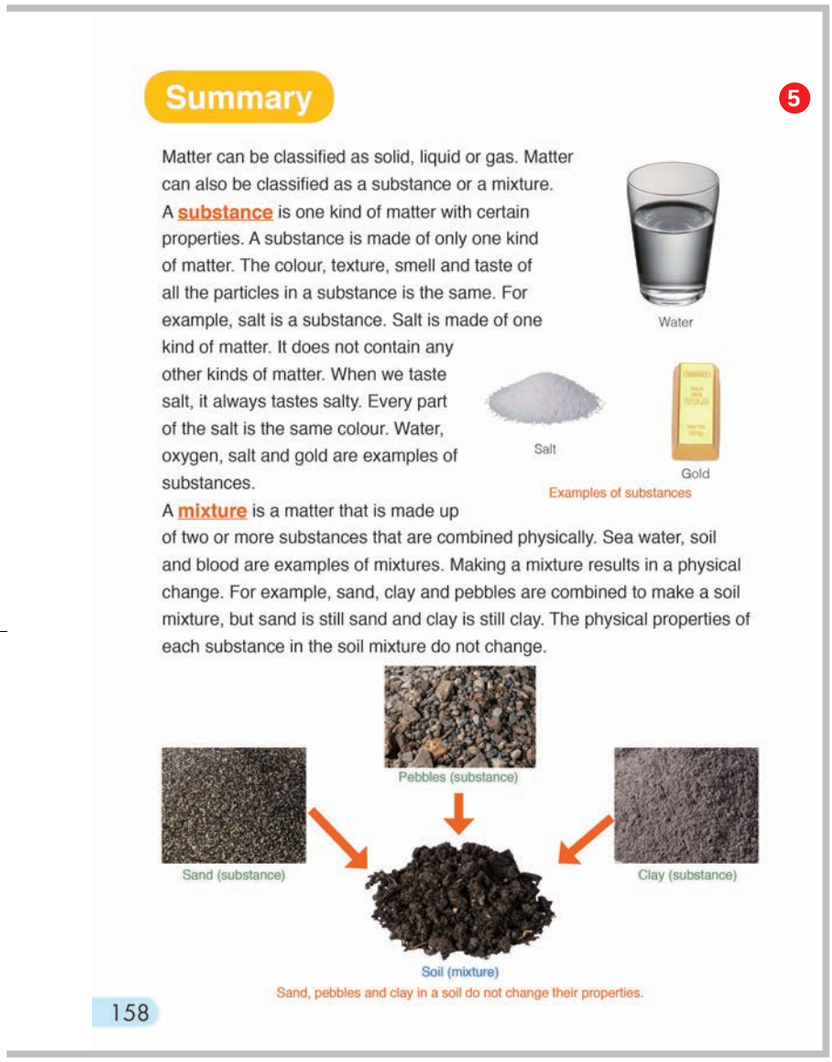
- 'Mixture and Substance' is once taught in lessons of 'Observing Mixture' and 'Separating Mixture' in Chapter 2, Grade 3. It is a must to review the lesson prior to this lesson. Particularly 'Teacher's Notes' for these lessons provides you key scientific concepts about mixture and substance as follows;
  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 ingredients or materials.
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

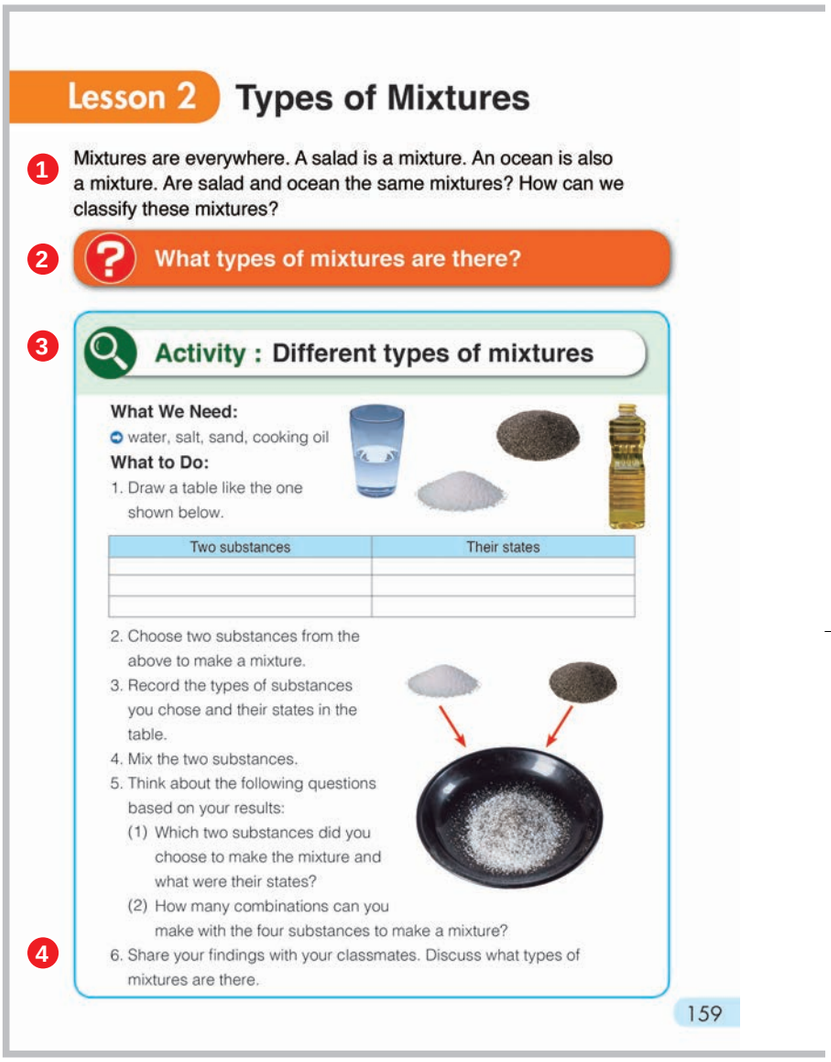
What types of mixtures are there?

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

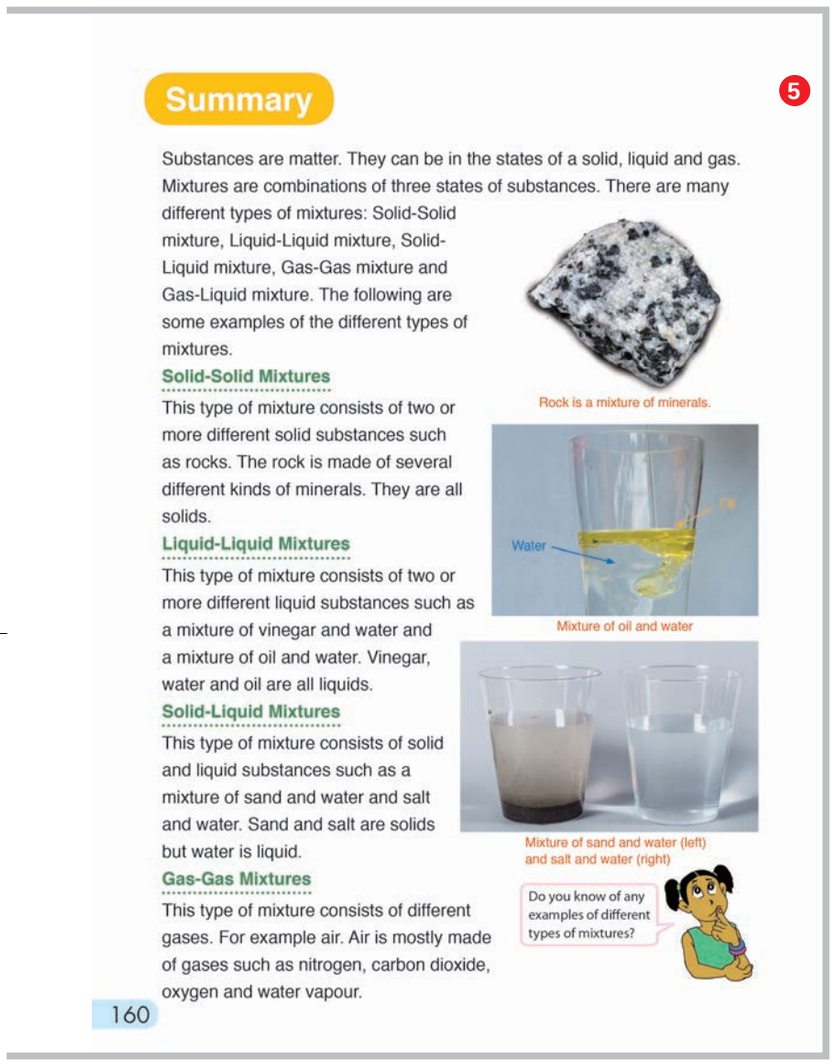
- For this activity students can freely choose any of the substances given to make up a mixture, for example oil and salt can be a mixture.
- A mixture can involve two or more substances of the same phase (state) or different phases. The textbook introduces (1) Solid-Solid mixture, (2) Liquid-Liquid 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' discusions.
- 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 in 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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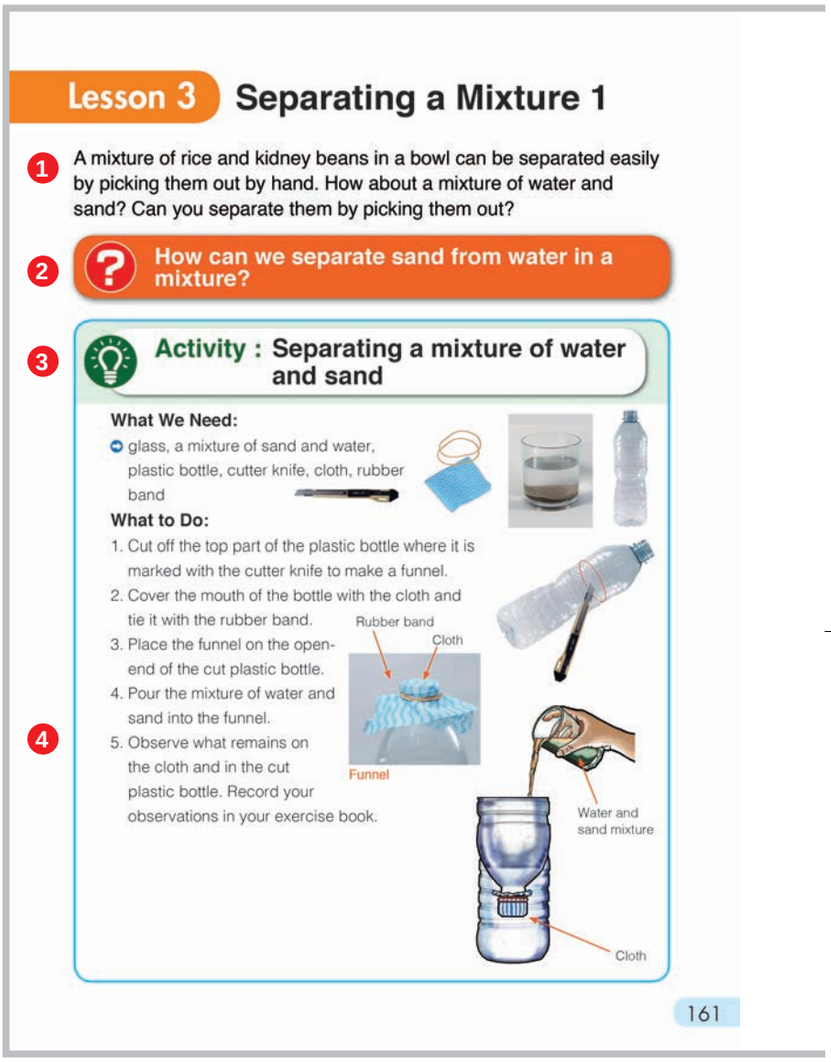


Teacher's Notes

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

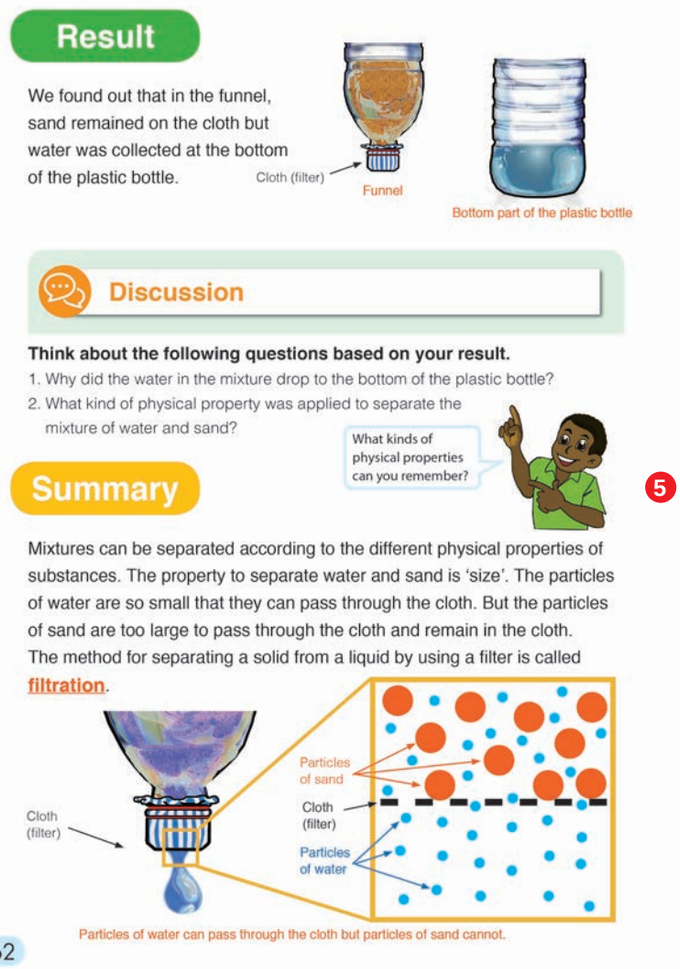
- Filtration is a physical process which separates solids from fluids (liquids or gases) by adding a medium through which only the fluid can pass. The fluid that passes through is called the filtrate. 'Heterogeneous mixtures' are more obviously mixtures to be applied for the separation than 'Homogenous 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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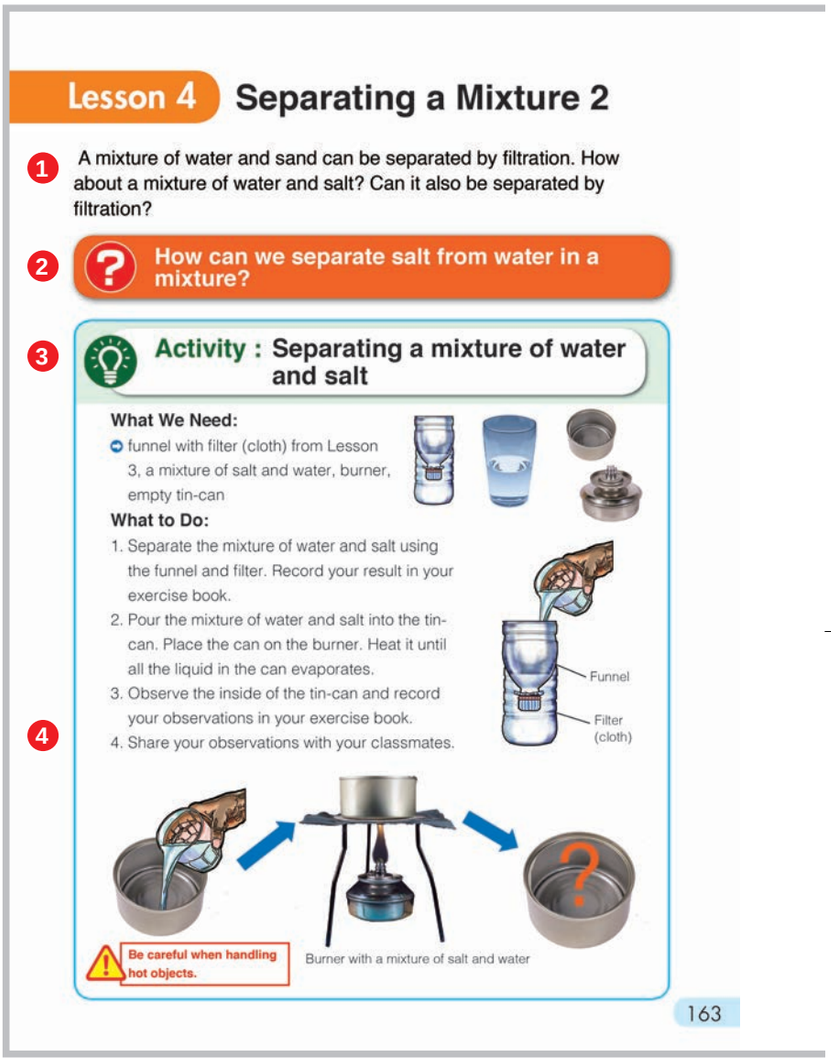

Lesson 4 Separating a Mixture 2

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:

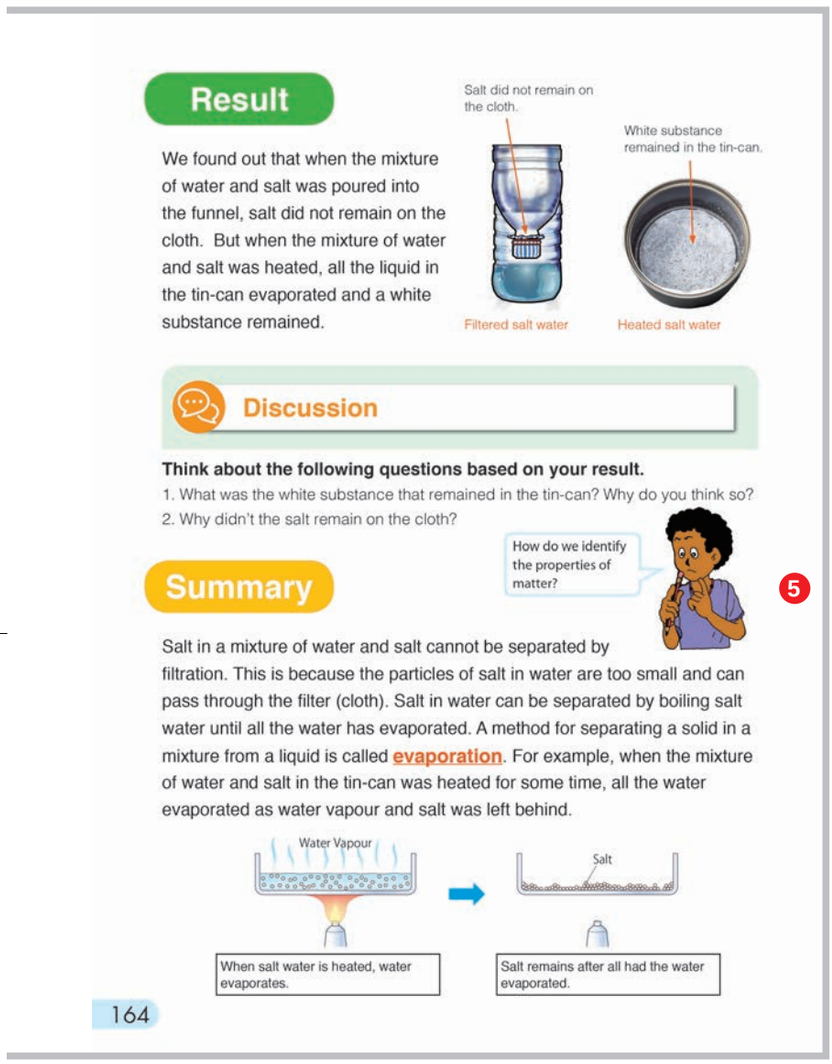
- Be very careful when using a match to light the stove.
- Always use a piece of cloth or tong to hold the heated tin-can.
- Do not look directly into the heated tinned of saltwater (mixture).

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.



- 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

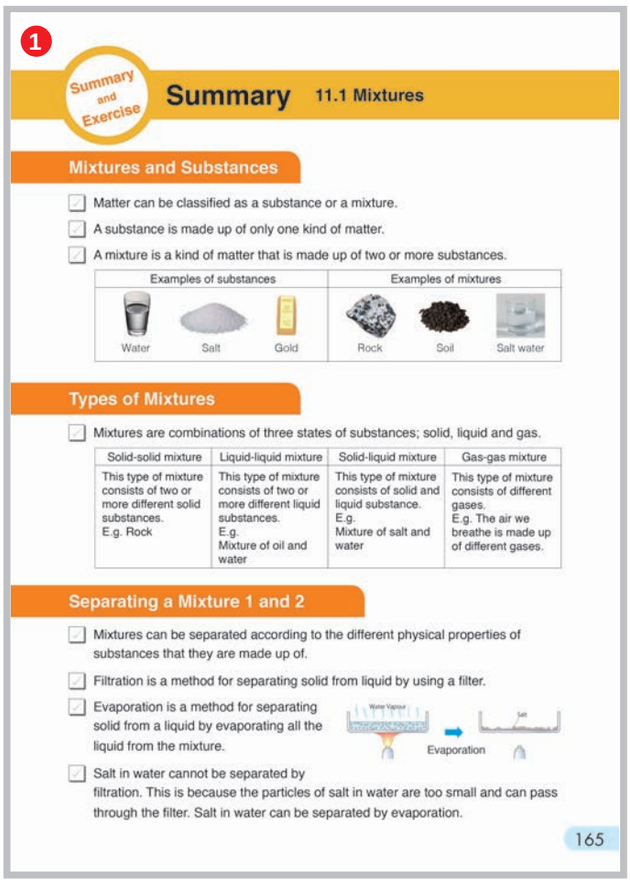
Lesson Title

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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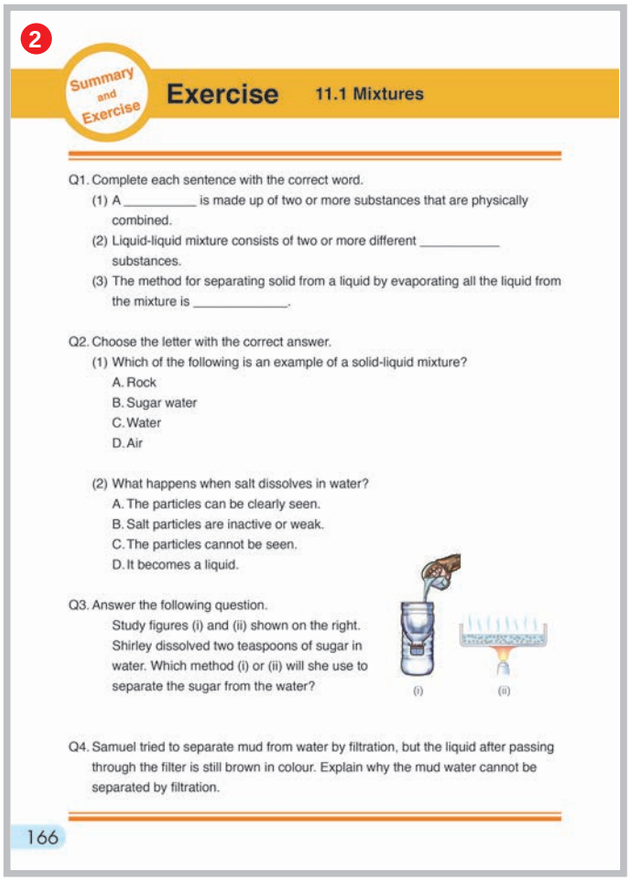
2 Exercise & Explanation (40 min.)

- 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.

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?

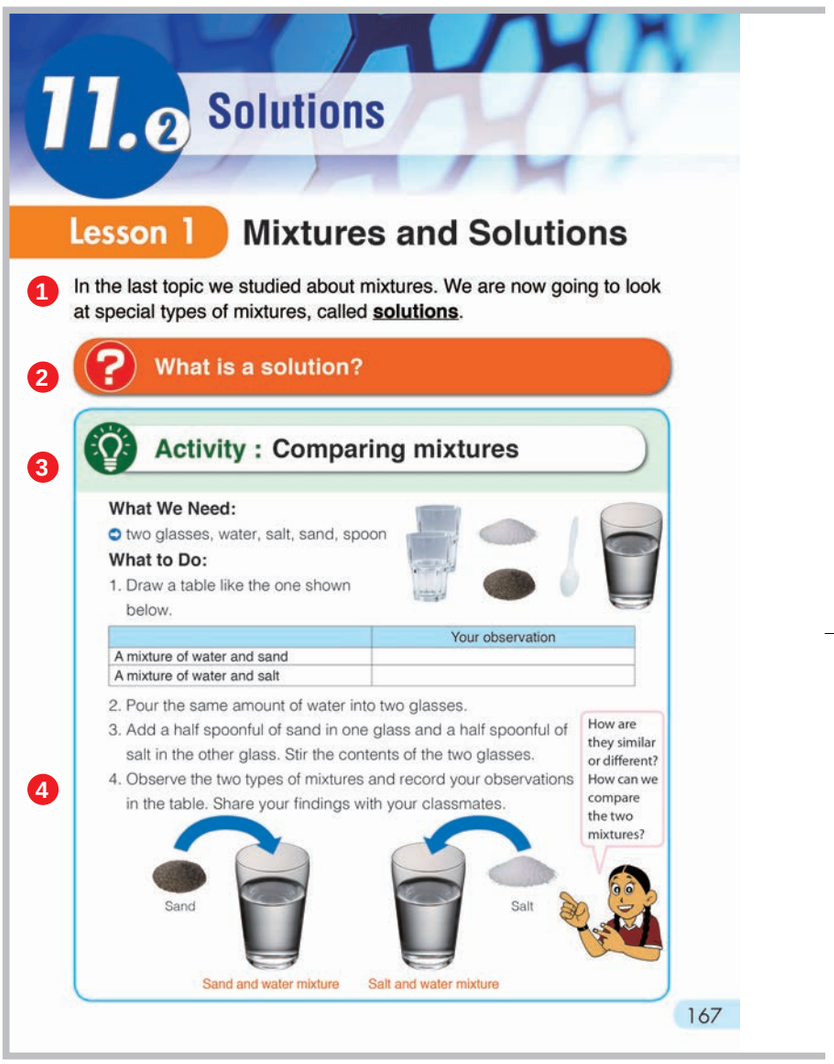
3 Activity (35 min.)

- 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)



11.2 Solutions

Lesson 1 Mixtures and Solutions

1 In the last topic we studied about mixtures. We are now going to look at special types of mixtures, called **solutions**.

2 What is a solution?

3 Activity : Comparing mixtures

What We Need:

two glasses, water, salt, sand, spoon

What to Do:

1. Draw a table like the one shown below.

	Your observation
A mixture of water and sand	
A mixture of water and salt	

2. Pour the same amount of water into two glasses.
3. Add a half spoonful of sand in one glass and a half spoonful of salt in the other glass. Stir the contents of the two glasses.
4. Observe the two types of mixtures and record your observations in the table. Share your findings with your classmates.

How are they similar or different? How can we compare the two mixtures?

Sand

Salt

Sand and water mixture

Salt and water mixture

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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

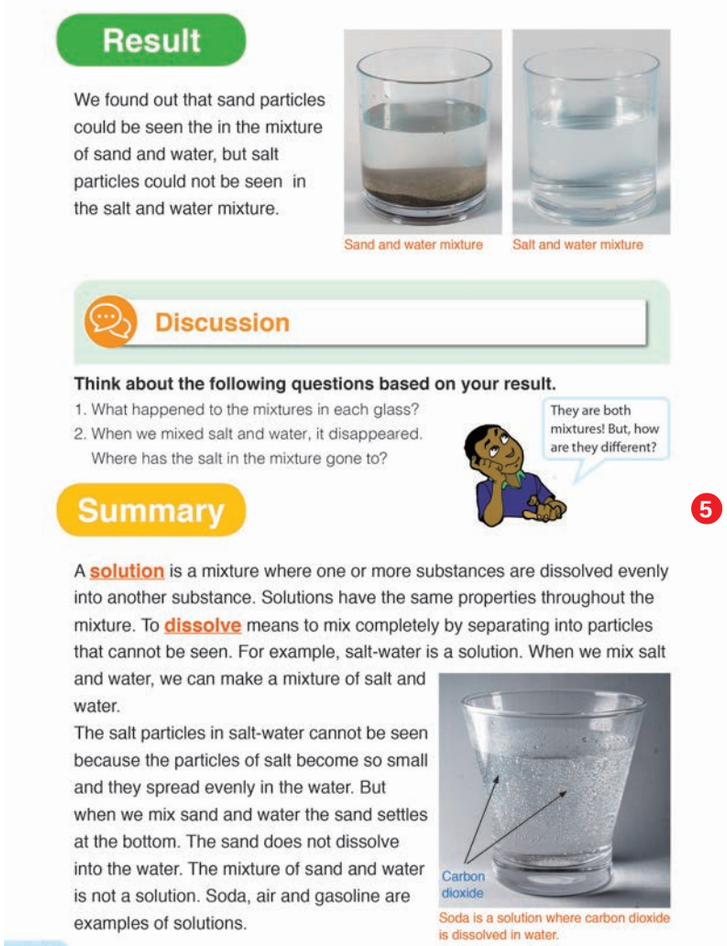
- Solute - The solute is the substance that is being dissolved by another substance. In the example above, the salt is the solute.
- Solvent - The solvent is the substance that dissolves the other substance. In the example above, the water is the solvent.

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

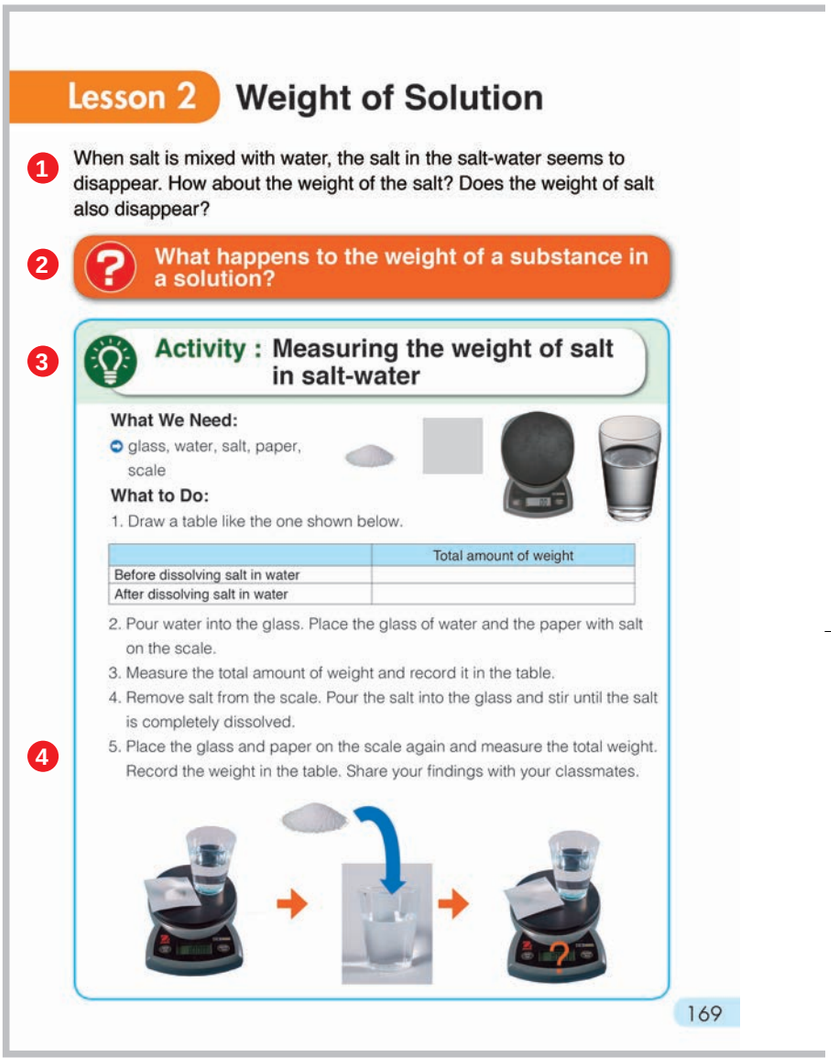
What happens to the weight of a substance in a solution?

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

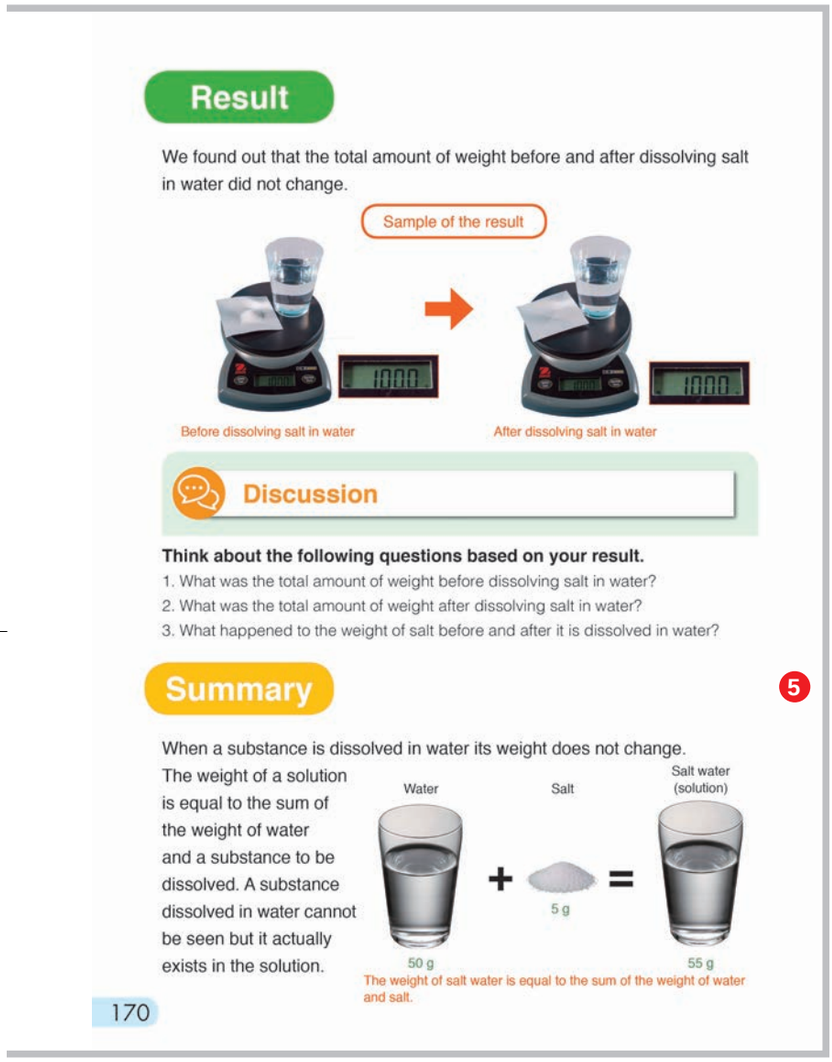
- Guide students well to measure weight of salt and water by referring to the Science Toolbox 'How to use a digital scale'.
- Answers provided on the blackboard plan are just examples; most importantly the weight of the substance dissolve in water should be equal to the sum of the weight of water and 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

Before dissolving salt in water

After dissolving salt in water

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.

Water | Salt | Salt water (solution)

5 g

50 g | 55 g

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:

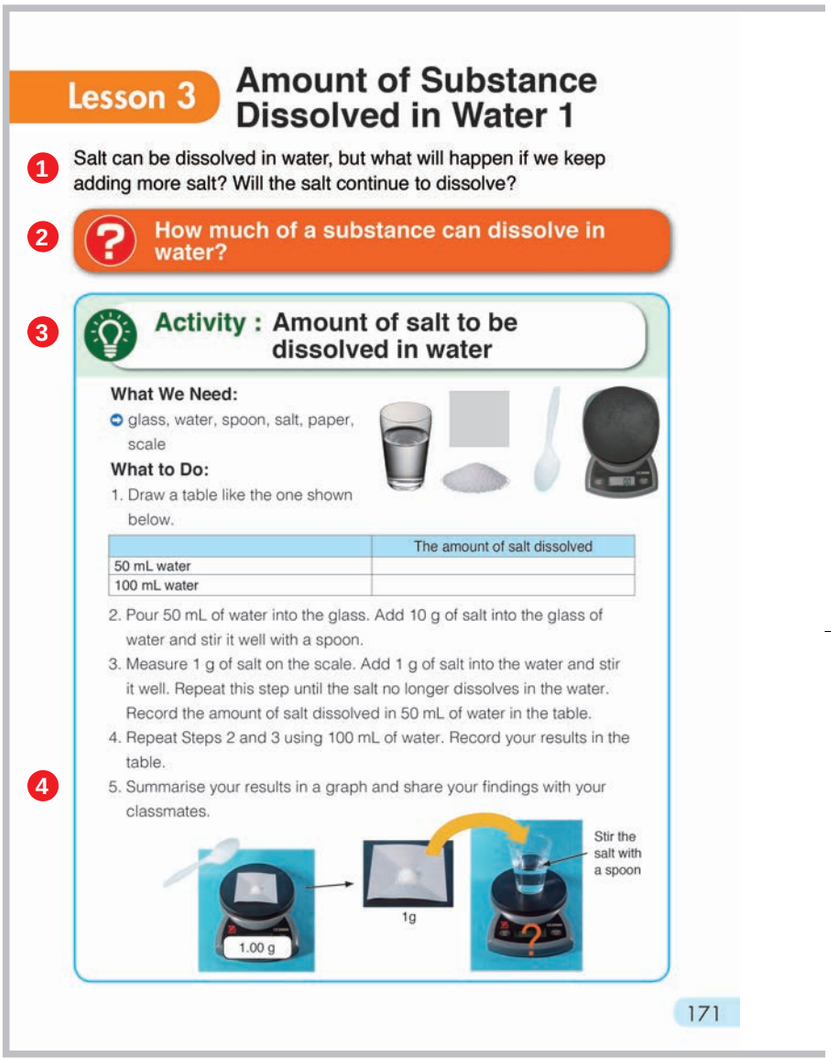
Q:What happens when a substance is continuously added to water?

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 use for this experiment.

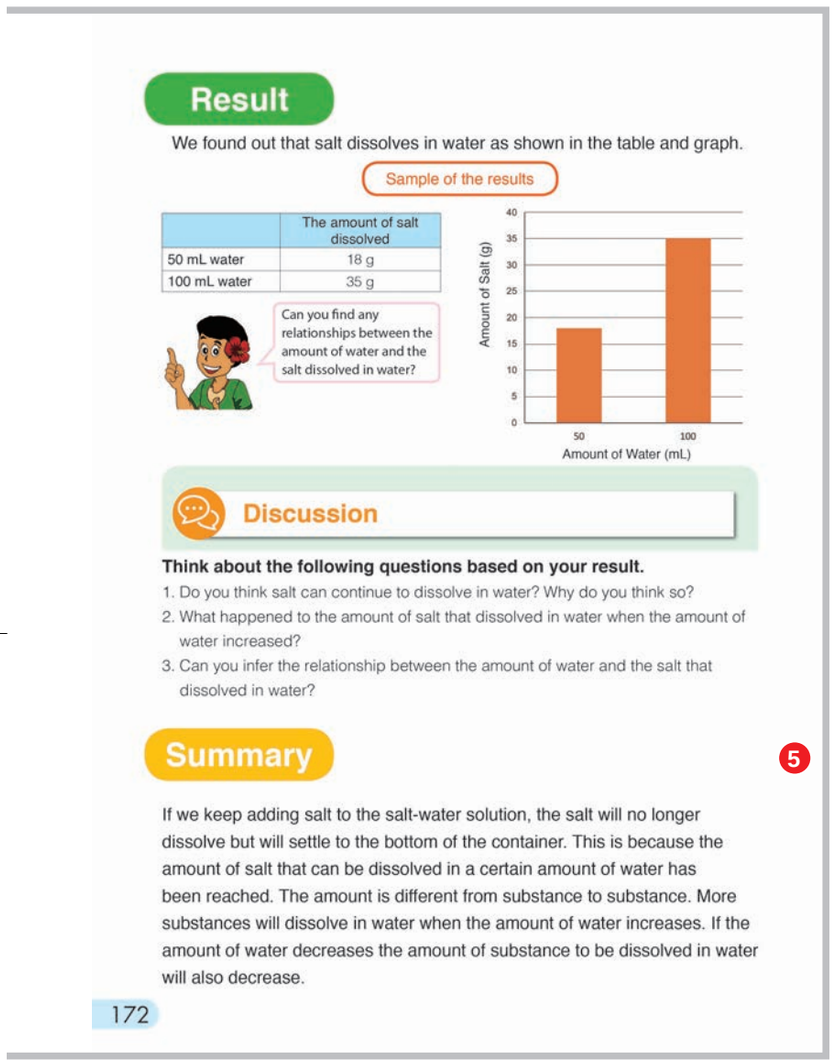
Temperature	0°C	20°C	40°C	60°C	80°C	100°C
Sugar	179 g	204 g	238 g	287 g	362 g	487 g
Salt	35.7 g	36.0 g	36.6 g	37.3 g	38.4 g	39. 8 g

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 contiune 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.