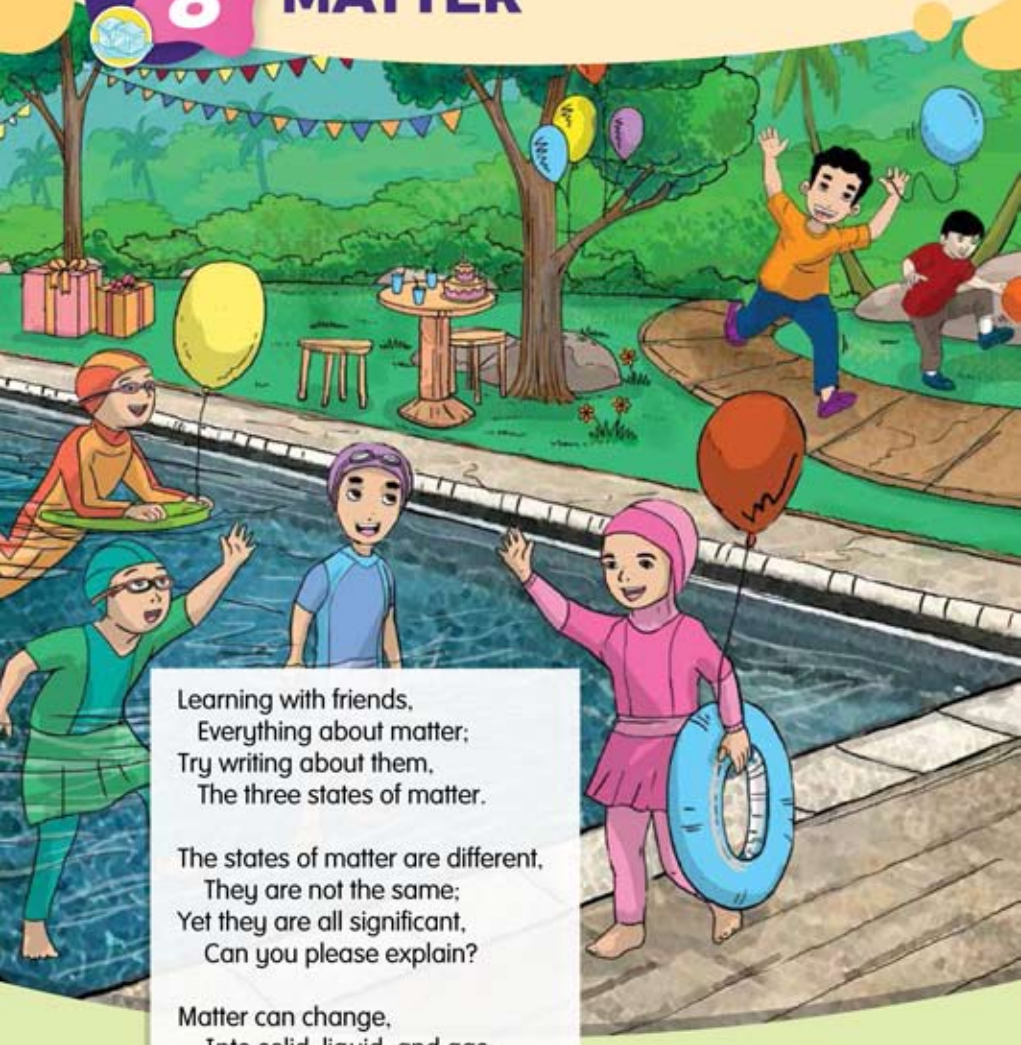
Unit 8

MATTER



Learning with friends,
Everything about matter;
Try writing about them,
The three states of matter.

The states of matter are different,
They are not the same;
Yet they are all significant,
Can you please explain?

Matter can change,
Into solid, liquid, and gas;
It's not so strange,
Let's discuss it in class.

SOLID, LIQUID, AND GAS

Matter can be found around us. Matter is any **substance that has mass and occupies space**. All living and non-living things consist of matter.

What are the states of matter that are found around us? Let's observe the situation below as examples.

Sand is matter in the **solid** state.

Seawater is matter in the **liquid** state.

The wind is matter in the **gas** state.

The three states of matter found on the beach are solid, liquid, and gas.

The objects found in our environment can be classified based on the states of matter that you have learned earlier. Let us conduct the activity below.

FUN ACTIVITY

CLASSIFYING MATTER

21ST Century Learning

GROUP ACTIVITY

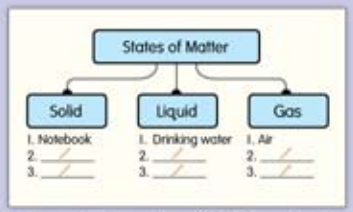
APPARATUS AND MATERIALS

Marker pen, adhesive tape, and flip chart paper.

STEPS

1. Observe the materials and objects found around the school.

2. Discuss the states of matter for the materials and objects that you have observed.



3. Construct a classification chart on the flip chart paper. Classify the materials or objects based on the states of matter that you have identified.

4. Display the chart in front of the class.

? How do you classify materials and objects found around the school based on their states of matter? Explain.

PROPERTIES OF MATTER

Matter found around us can be classified into three states that are known as solid, liquid, and gas. Each state of matter has different properties.

LET'S TEST

PROPERTIES OF SOLID

GROUP ACTIVITY

AIM To characterise the properties of solid.

APPARATUS AND MATERIALS Weighing scale, measuring cylinder, small stone, and water.

STEPS

1. Press a small stone with your hand and observe for any changes in its shape.

2. Weigh and take the reading of the mass of the stone.

3. Pour water into the measuring cylinder and record the initial volume of the water.

4. Put the stone into the measuring cylinder and record the final volume of the water.

5. Calculate the volume of the stone using the following formula.

Volume of small stone (mℓ) = reading of final volume of water (mℓ) − reading of initial volume of water (mℓ)

6. Record your observations in the table as shown below.

Small stone	Change in shape		Mass (g)	Volume (mℓ)
	Changed	No change		
	/	/	/	/

? (a) Name the state of matter of the small stone.
(b) Based on this activity, what are the properties of matter identified?

LET'S TEST

PROPERTIES OF LIQUID

GROUP ACTIVITY

AIM To characterise the properties of liquid.

APPARATUS AND MATERIALS Beaker, weighing scale, measuring cylinder, conical flask, cup, glass container, and coloured water.

STEPS

1. Weigh an empty beaker using a weighing scale and record the mass of the beaker.
2. Pour coloured water into the empty beaker and record its mass.
3. Calculate the mass of the coloured water using the following formula.

$$\text{Mass of coloured water (g)} = \text{Mass of beaker with coloured water (g)} - \text{Mass of empty beaker (g)}$$

4. Pour the coloured water from the beaker into the measuring cylinder and record the volume of the water.
5. Pour the same water from the measuring cylinder into the conical flask, cup, and glass container one at a time. Observe the shape of the water.
6. Record your observations in the table as shown below.

Water	Change in shape		Mass (g)	Volume (mℓ)
	Changed	No change		
	/	/	/	/

(a) Name the state of matter of water.
(b) Based on this activity, what are the properties of matter identified?

LET'S TEST

PROPERTIES OF GAS

GROUP ACTIVITY

AIM To characterise the properties of gas.

APPARATUS AND MATERIALS Adhesive tape, ruler, needle, syringe, thread, plastic glove, plastic bag, and balloon.

STEPS

1. (a) Observe the size of the balloon before the balloon is inflated.
   (b) Inflate the balloon and observe its size.

2. (a) Inflate two balloons of about the same size.

(b) Attach the adhesive tape to one of the balloons.

(c) Tie the middle part of the ruler using a thread. Then, hang the balloons, one at each end of the ruler.

(d) Hold the thread in the middle part of the ruler until both balloons are balanced.

(e) Pierce the balloon using a needle on the part that has the adhesive tape. Then, remove the needle and make an observation.

3. Inflate the plastic glove, plastic bag, and balloon. Observe for any changes.

4. (a) Pull the piston of the syringe completely.
   (b) Cover the tip of the syringe with your finger.
   (c) Push the piston slowly and observe.

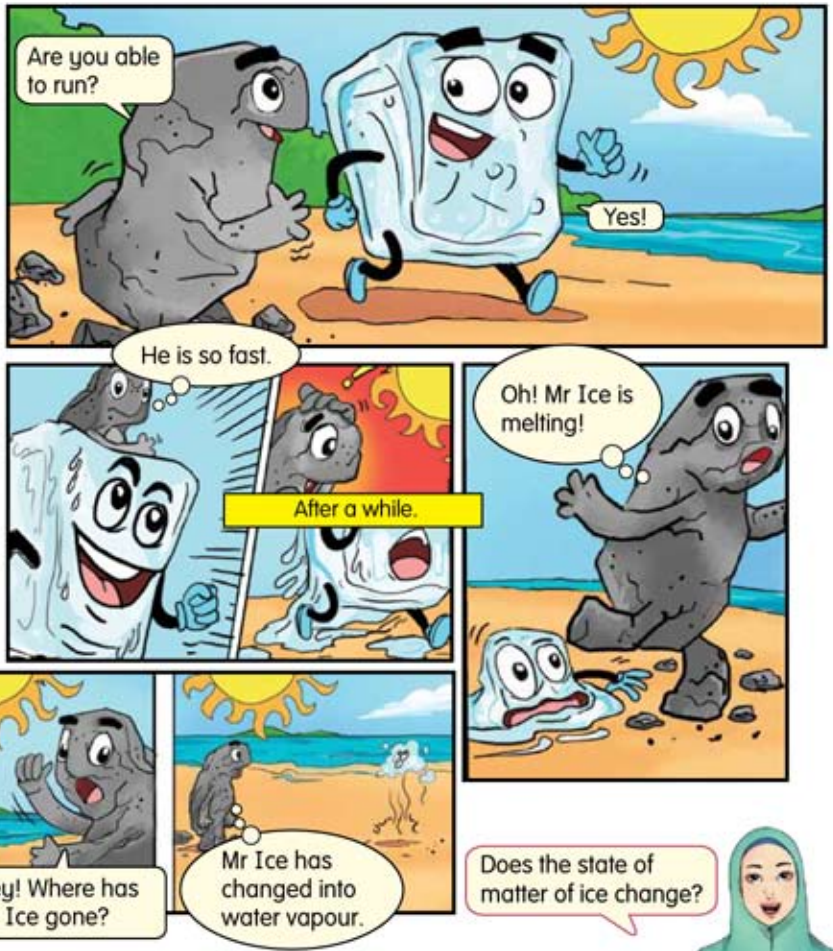
5. Record your observations and inferences in the table as shown below.

	Step	Observation	Inference
Air	Step 1	/	/
	Step 2	/	/
	Step 3	/	/
	Step 4	/	/

(a) Name the state of matter of air.
(b) Based on this activity, what are the properties of matter identified?

THREE STATES OF MATTER OF WATER

Mr Ice invited his friend, Mr Rock to a race one afternoon.
Let us read the story of these two friends.



What happened to Mr Ice? Explain.

Water exists in three states of matter that are known as **solid**, **liquid**, and **gas**.
Water in the **solid** state is known as **ice**.
Water in the **liquid** state is known as **water**.
Water in the **gas** state is known as **water vapour**.


ice


water


water vapour

LET'S TEST

THREE STATES OF MATTER OF WATER

GROUP ACTIVITY

AIM To investigate the three states of matter of water.

APPARATUS AND MATERIALS Crucible, Bunsen burner, tripod stand, wire gauze, stopwatch, and ice cubes.

STEPS

1. Place an ice cube in the crucible. Record the state of matter of the ice.
2. Prepare the apparatus as shown in the picture.
3. Start the stopwatch and heat the crucible containing the ice cube for two minutes. Then, observe the changes.
4. Continue heating until the water is almost dried up. Turn off the Bunsen burner.
5. Record your observations in the table as shown below.

Be careful when handling the Bunsen burner.

Step	Observation
Step 1	
Step 3	
Step 4	

(a) What are the changes in the states of matter of the water that can be observed?
(b) What can you summarise from the above activity?
(c) Name the three states of matter of water.

CHANGES IN THE STATE OF MATTER OF WATER

Water changes from one state of matter to another. Observe the changes of the ice cream below.

What causes the state of the ice cream to change?

How does the state of matter of the ice cream change?

Particles of matter in the solid state are very closely packed and are uniformly arranged.

MELTING PROCESS
solid → liquid

Ice melts into water when ice gains heat from the surrounding.

MELTING PROCESS

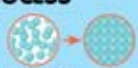
GAINS HEAT

LOSES HEAT

FREEZING PROCESS

SOLID

FREEZING PROCESS
liquid → solid



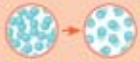
Water freezes into ice when water loses heat to the surrounding.

Particles of matter in the liquid state are not in orderly manner and are less packed.

EVAPORATION PROCESS
liquid → gas

Evaporation of water occurs at any temperatures below the boiling point of water. Water evaporates into water vapour when it gains heat from the surrounding.

BOILING PROCESS
liquid → gas



Water vapour is formed when water boils at the temperature of 100°C. Boiling occurs when water gains heat from the surrounding.

LIQUID

Mr Borhan's spectacles become foggy as he got out of his air-conditioned car. What caused this situation to occur? Explain.

EVAPORATION PROCESS/BOILING PROCESS

GAINS HEAT

LOSES HEAT

CONDENSATION PROCESS

CONDENSATION PROCESS
gas → liquid

Condensation of water occurs when water vapour loses heat to the surrounding.

Particles of matter in the gas state are not in orderly manner and are spread out.

GAS

LET'S TEST

MATTER CHANGES ITS STATE

GROUP ACTIVITY

ACTIVITY 1

AIM

To describe the changes in the state of matter of water during freezing process.

APPARATUS AND MATERIALS

Polystyrene box with its lid, dropper, test tube, ice cubes, salt, water, and food colouring.

STEPS

1. Fill the polystyrene box with some ice cubes until it is half-full and mix with 200 g of salt.
2. Put 10 drops of water and three drops of food colouring into the test tube.
3. Shake the solution of water and food colouring in the test tube.
4. Put the test tube into the polystyrene box containing the mixture of ice and salt.
5. Close the polystyrene box using the lid and leave it for 30 minutes.
6. Observe the state of the water in the test tube after 30 minutes.
7. Discuss the result of the observation and make a conclusion.

(a) What are the states of matter of the water in the test tube at the beginning and the end of the activity?
(b) What is the change in the state of matter of the water in this activity? State the process involved.
(c) Give an inference for your observation.

ACTIVITY 2

AIM To describe the changes in the state of matter of water during melting process.

GROUP ACTIVITY

APPARATUS AND MATERIALS Petri dish and ice cubes.

STEPS

1. Place a few ice cubes in the petri dish.
2. Observe the ice cubes after 10 minutes.
3. Discuss the result of the observation and make a conclusion.

(a) What is the state of matter of the water in the petri dish at the beginning and the end of the activity?
(b) What is the change in the state of matter of the water in this activity? State the process involved.
(c) Give an inference for your observation.

ACTIVITY 3

GROUP ACTIVITY

AIM To describe the changes in the state of matter of water during boiling process.

APPARATUS AND MATERIALS Beaker, Bunsen burner, tripod stand, wire gauze, wooden board, and water.

STEPS

1. Pour 150 mℓ of water into the beaker.
2. Prepare the apparatus as shown in the diagram.
3. Heat the water until it boils.
4. Observe the water while it is boiling.
5. Discuss the result of the observation and make a conclusion.

Be careful when handling the Bunsen burner.

(a) What are the states of matter of the water in the beaker at the beginning and the end of the activity?
(b) What is the change in the state of matter of the water in this activity? State the process involved.
(c) Give an inference for your observation.

8.2.1, 8.2.4

ACTIVITY 4

GROUP ACTIVITY

AIM To describe the changes in the state of matter of water during evaporation process.

APPARATUS AND MATERIALS Petri dish, dropper, and water.

STEPS

1. Put two drops of water into the petri dish.
2. Leave it for 20 minutes under the sunlight.
3. Observe the water after 20 minutes.
4. Discuss the result of the observation and make a conclusion.

(a) What are the states of matter of the water in the petri dish at the beginning and the end of the activity?
(b) What is the change in the state of matter of the water in this activity? State the process involved.
(c) Give an inference for your observation.

ACTIVITY 5

GROUP ACTIVITY

AIM To describe the changes in the state of matter of water during condensation process.

APPARATUS AND MATERIALS Beaker, Bunsen burner, tripod stand, wire gauze, wooden board, mirror, test tube holder, and water.

STEPS

1. Prepare the apparatus as shown in the diagram.
2. Pour 100 mℓ of water into the beaker and bring it to a boil.
3. Turn off the Bunsen burner when the water has boiled.
4. Place the mirror on the beaker and leave it for a while.
5. Use the test tube holder to lift up the mirror from the beaker.
6. Observe the surface of the mirror.
7. Discuss the result of the observation and make a conclusion.

Be careful when handling the Bunsen burner.

(a) What are the states of matter of the water on the surface of the mirror at the beginning and the end of the activity?
(b) What is the change in the state of matter of the water in this activity? State the process involved.
(c) Give an inference for your observation.

FUN ACTIVITY

SIMULATION OF THE ARRANGEMENT OF PARTICLES

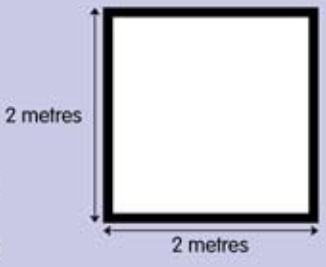
GROUP ACTIVITY

APPARATUS AND MATERIALS

Coloured adhesive tape and simulation cards.

STEPS

1. Form a square with the size of 2 metres × 2 metres on the floor. Mark the measurement using coloured adhesive tape.
2. The group representative will take a simulation card from set A and set B each.
3. Discuss the arrangement of particles that need to be simulated based on the instructions written in the simulation cards.
4. Move into the square space with your group members.
5. Perform the simulation that has been discussed.



State whether the change in the state of matter of water below is "gaining heat" or "losing heat". Explain the change in the arrangement of the particles involved.

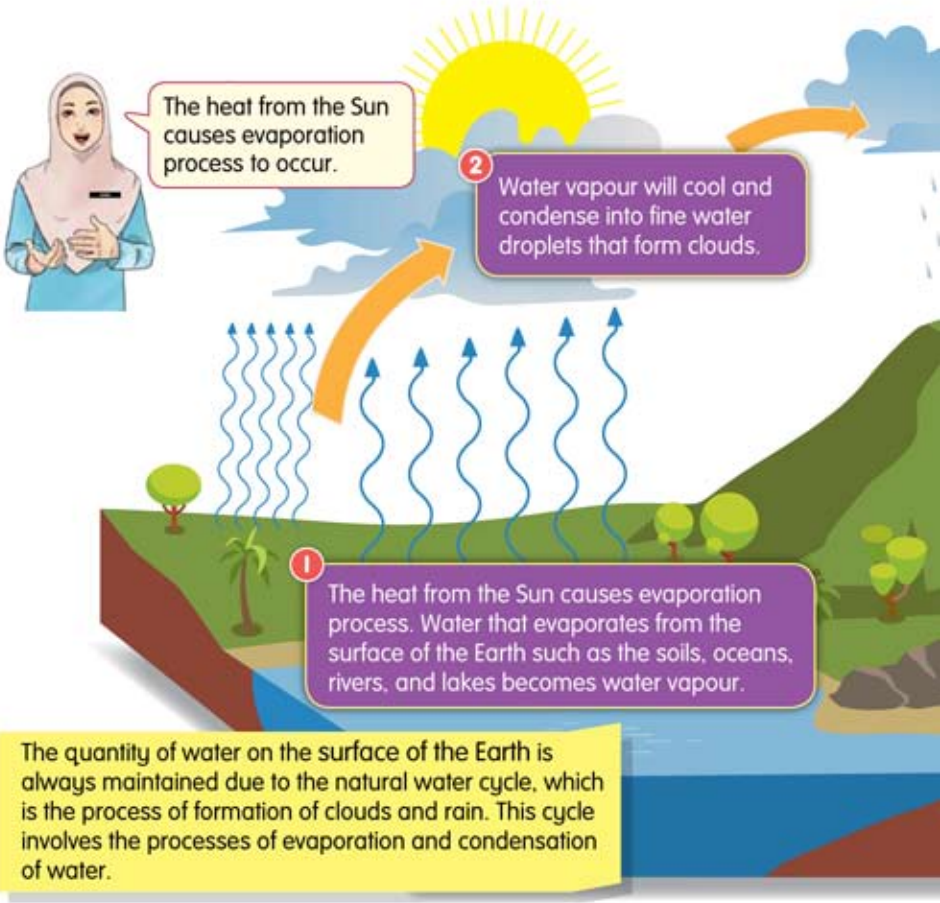
(a) Solid to liquid.
(b) Liquid to solid.
(c) Gas to liquid.
(d) Liquid to gas.

TEACHER'S NOTES

Prepare two sets of simulation cards with instructions for this activity. Set A consists of three cards written "solid", "liquid", and "gas". Set B consists of two cards written "gaining heat" and "losing heat". Put set A and set B into two different boxes.

CLOUDS AND RAIN

The movement of water from the surface of the Earth to the air forms clouds that eventually falls back as rain. This process is always repeated and known as the natural water cycle. Do you know that the formation of clouds and rain is a result from the processes of changes in the state of matter of water?

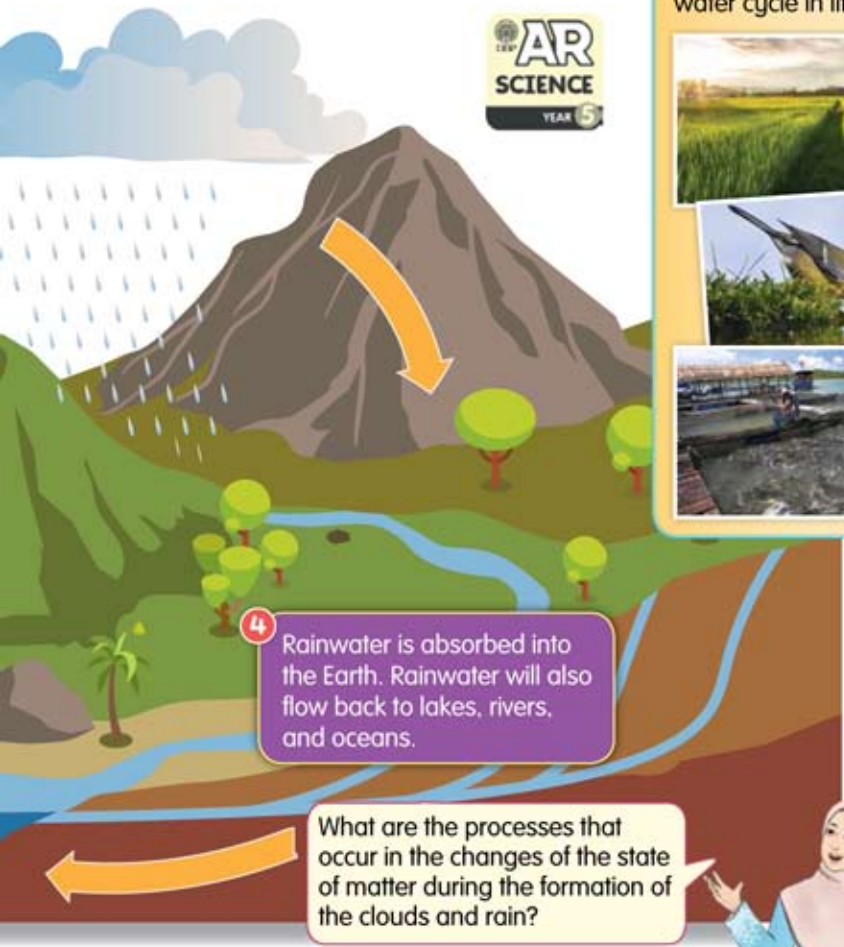


The quantity of water on the surface of the Earth is always maintained due to the natural water cycle, which is the process of formation of clouds and rain. This cycle involves the processes of evaporation and condensation of water.

3 When clouds rise further above the sky, cold air causes the water droplets to combine into bigger clouds. The clouds then become heavy and the water droplets in the clouds will fall back to the surface of the Earth as rain.

The processes of evaporation and condensation are very important to ensure that the natural water cycle continues. Observe the pictures below and discuss the effects of the natural water cycle in life.

AR SCIENCE YEAR 5



4 Rainwater is absorbed into the Earth. Rainwater will also flow back to lakes, rivers, and oceans.

What are the processes that occur in the changes of the state of matter during the formation of the clouds and rain?

FUN ACTIVITY

RAINING IN A GLASS CONTAINER

GROUP ACTIVITY

APPARATUS AND MATERIALS

Glass container, small clear plastic container, spoon, hot water, salt, plastic food wrap, and ice cubes.

STEPS

1. Pour hot water into the glass container until it is almost full. Then, add six tablespoons of salt and stir the solution.

2. Place the small clear plastic container as shown in the picture. Then, cover the top of the glass container with plastic food wrap.

3. Place ice cubes on the top of the plastic food wrap.

4. Observe after 10 minutes.

5. Discuss the results of the observation.

(a) What are the processes involved in this activity?
(b) State the changes in the state of matter that occur in the small clear plastic container.

Predict what will happen if the water that evaporates from the surface of the Earth does not fall as rain.

FUN SCIENCE

SKEWER CRYSTAL

Produce skewers of crystals using a cooking stove, small pot, spatula or ladle, plastic cup, dropper, cloth pegs, skewer sticks, 150 mℓ of water, 300 g of sugar, and food colouring.

STEPS

1. Heat 150 mℓ of water in the small pot.

2. Add 300 g of sugar and stir until it dissolves. Then, leave the solution to cool for a while and pour it into the plastic cup.

3. Add some drops of food colouring into the sugar solution.

4. Clamp the skewer stick with the cloth peg.

5. Put the skewer stick into the plastic cup and leave it for five days.

6. The skewers of crystals are formed by evaporation process.

Be careful when handling the hot cooking stove.

MIND REFLECTION

1. Matter exists in three states that are known as solid, liquid, and gas.
2. Matter can be classified into solid, liquid, and gas based on its properties.
3. Properties of solid, liquid, and gas are as follows:

State of Matter / Property	Solid	Liquid	Gas
Have mass	yes	yes	yes
Occupy space	yes	yes	yes
Volume	fixed	fixed	not fixed
Shape	fixed	not fixed	not fixed

4. Water can exist in three states of matter that are known as solid, liquid, and gas.
5. Water in solid state is known as ice. Water in liquid state is known as water while water in gas state is known as water vapour.
6. The state of matter of water changes when:

Water gains heat	
solid → liquid	melting process
liquid → gas	boiling process
liquid → gas	evaporation process
Water loses heat to the surrounding	
liquid → solid	freezing process
gas → liquid	condensation process

7. The movement of water vapours from the surface of the Earth to the air forms clouds. It will eventually fall back to the surface of the Earth as rain. This process is constantly repeated and known as the natural water cycle. The natural water cycle that forms clouds and rain maintains the quantity of water on the surface of the Earth. This cycle involves the processes of evaporation and condensation of water.

MIND TEST

Answer all questions in the Science exercise book.

1. Give two examples of matter in solid, liquid, and gas states found in your surrounding.
2. Observe the list below. Classify the materials and objects based on their states of matter.

oxygen	carbon dioxide	paper clip	sweat	soy sauce
dice	water vapour	spoon	palm oil	biscuit

3. Observe the pictures below. List the properties of the following materials.

(a)

(b)

4. (a)

(i) What is the state of matter of the drink in the picture?

(ii) Why do the ice cubes become smaller in size after a few minutes?

(b)

Based on the picture on the left:

(i) State the change in the state of matter of water after some time.

(ii) What is the process involved?

(iii) Why does this process occur?

5. State the processes involved when the states of matter change in the given situations.

Situation	Process involved when the state of matter changes	Change in the state of matter
(a) Ice cubes in the water become smaller in size.		
(b) Wet floor becomes dry after 20 minutes.		
(c) Formation of dew on leaves in the morning.		
(d) The water heated in the kettle releases water vapour.		
(e) Ice cubes formed from the water that is placed in a freezer.		

6. Observe the situations below and answer the questions.

Based on the situations above:

(a) What is the change in the state of matter that occurred when the clothes become dry?

(b) State the process involved for the change in the state of matter.

(c) How does this process occur?

7. Explain the changes in the state of matter that occur during the formation of clouds and rain by sketching a diagram.