Chapter 3: Water

3.1 Water can change state

Student book answers (pages 48–49)

Check your learning 3.1

Remember and understand

1 Describe what happens to water when it:

a evaporates

When it evaporates, water changes from liquid to gas.

b condenses

When it condenses, water changes from gas to liquid.

c freezes.

When it freezes, water changes from liquid to solid.

2 By applying heat to liquid water, what could happen to its state?

By applying heat to liquid water, it can get hotter and some of it will evaporate into a gas – water vapour.

Apply and analyse

3 What is the:

a melting point of water?

0°C

b boiling point of water?

100°C

4 Refer to the table below. Which substance has the:

a lowest melting point?

Oxygen

b highest melting point?

Iron

c lowest boiling point?

Nitrogen

d highest boiling point?

Iron

Evaluate and create

5 A student claimed a frozen drink bottle was leaking because condensation had formed on the outside of the container. How would you explain to the student where the condensed water came from?

The condensed water has come from the air around the bottle. Water vapour in contact with the cool surface of the bottle has cooled and changed state from a gas to a liquid, forming the water droplets.

3.2 Water cycles through the environment

Student book answers (pages 50–51)

Check your learning 3.2

Remember and understand

1 Why is the movement of water around the environment called a cycle?

It is called a cycle because there is no start and no end to the process.

2 Give examples from the water cycle of:

a frozen water

Ice, snow, hail

b water gas

In the atmosphere (*not* clouds)

c liquid water.

Rain, ocean, rivers, run-off, tiny water droplets in clouds

Apply and analyse

3 Create a simple labelled diagram of the water cycle.

Student answers should show Figure 3.7 in a simplified form.

Evaluate and create

4 True or false? The same water you drank today could have been drunk by a dinosaur millions of years ago. Explain your answer.

True. Water is constantly being cycled and never disappears. Theoretically, the water you drank today could have been drunk by a dinosaur millions of years ago.

5 Research how much water on Earth is salt water. Can we drink salt water?

Approximately 97.5% of the water on Earth is salt water. If you drink it, salt water will make you very ill because it is too salty for the human body to digest.

3.3 Factors in nature affect the water cycle

Student book answers (pages 52–53)

Check your learning 3.3

Remember and understand

1 Describe how El Niño affects Australia.

In Australia, El Niño is associated with the warming of ocean currents, drier conditions and drought.

2 Describe how La Niña affects Australia.

La Niña is associated with cooler ocean currents, large fluctuations in temperatures and large-scale rain and flooding.

Apply and analyse

3 Are there any erupting volcanoes in Australia?

No

4 Research where and when the last big volcanic eruption occurred in the world.

Student answers will vary.

Evaluate and create

5 Draw a flow chart of how volcanic dust particles blocking sunlight affect the water cycle. Include all parts of the water cycle.

Student answers will vary.

3.4 Human management affects the water cycle

Student book answers (pages 54–55)

Check your learning 3.4

Remember and understand

1 What is the greenhouse effect?

The greenhouse effect is the absorption of heat energy by gases in the atmosphere, making the atmosphere warmer.

Apply and analyse

2 How does using too much water cause high salt levels in the soil?

Using too much water on crops increases the amount of groundwater. As the salty groundwater rises, it brings the salt to the surface with the water, increasing the salt content of the soil.

3 Why does desalination use a lot of energy?

In desalination, the water has to be heated until it boils and separates from the salt. It takes a lot of energy to boil water.

4 List three ways you have used water in the last 24 hours.

Student answers will vary but may include to drink, wash in, cook with, swim in etc.

Evaluate and create

5 Draw a water cycle and highlight where in the cycle the water you use comes from.

Student answers will vary.

6 Research where the water supplies you use come from.

Student answers will vary.

3.5 Science as a human endeavour: Water is a precious resource

Student book answers (pages 56–57)

Extend your understanding 3.5

1 Find out how rainwater tanks collect and purify water for use on the garden and in the home.

Rainwater tanks typically use gravity to collect rain from the roofs of houses. They often contain a filter that removes large particles from the water.

2 Find out how water-saving devices, such as shower heads, are able to reduce water flow.

Water-saving devices often contain a device that restricts the flow of water.

3 Find out more about grey water systems.

a What is grey water?

Grey water is the water from sinks, hand basins, showers and baths: any domestic waste water other than sewage.

b Which water from the home can be re-used?

Grey water from the home can be reused on the garden.

c How is grey water purified?

Grey water is usually purified just by filtration.

d Why don’t more people install grey water systems in their homes?

Student answers will vary.

e What is ‘black water’? Where does ‘black water’ go?

Black water is water from flush toilets. Black water goes into the sewage system, finally ending up in sewage treatment plants.

4 Certain plants can act as effective filters of rainwater. When it rains, some water ends up in the underground water table and can be pumped up for use elsewhere. Find out more about plants as filters.

Student answers will vary.

Review 3

Student book answers (pages 58–59)

Remember and understand

1 What are the three states in which water can be found?

Solid, liquid and gas

2 What is transpiration?

Transpiration is the process where water is lost from the leaves of plants.

3 What are clouds made of?

Clouds are made from tiny water droplets.

4 What percentage of the Earth’s water is suitable for drinking?

2.5%

5 Where is fresh water stored on Earth?

Fresh water is stored on Earth in lakes and dams.

6 How can the way we live affect the water cycle?

Student answers will vary.

7 What natural factors can affect the water cycle?

Student answers will vary.

8 What is the difference between melting point and boiling point?

Melting point is the temperature at which a substance changes from a solid to a liquid. Boiling point is the temperature at which a substance changes from a liquid to a gas.

9 What is the gas state of water and how does it form?

The gas state of water is water vapour. It forms when liquid water is heated.

10 List three places from which water evaporates as part of the water cycle.

Water on Earth can evaporate from oceans, lakes, rivers, dams, swamps and from the land.

Apply and analyse

11 Salt water has a lower melting point than fresh water. In America, salt is spread over the footpaths in winter. Why do they do this?

Salt reduces the melting point of ice making the ice melt below 0°C. This means it needs to be colder than 0°C before ice will form on the roads.

12 What factor may affect the ability of soil to grow plants?

The water-holding ability of soil may affect its ability to grow plants.

13 Working in a small group, investigate the advantages and disadvantages of desalination plants. Make a poster that lists the advantages and disadvantages of these plants.

Student responses will vary but advantages may include: a reliable source of fresh water; the technology has been used successfully in many other countries; a realistic solution to deal with fresh water shortages. Disadvantages may include: requires a lot of energy to operate; more expensive than recycling or other water saving initiatives; energy production may lead to greenhouse gases; disturbs sea life near the desalination plant.

14 Why should you water the roots of a plant and not the leaves?

Plants absorb water through their roots and lose water through their leaves via transpiration.

15 How would an El Niño event affect your life?

Student answers will vary but, typically in Australia, El Niño is associated with the warming of ocean currents, drier conditions and drought.

16 In the eighteenth century, Captain James Cook embarked on several voyages to the Pacific Ocean, exploring new lands including Australia. Despite being surrounded by water, his crew was constantly at risk of dying of thirst. How can you explain this?

His crew was surrounded by salt water! If drunk, salt water will make you very ill because it is too salty for the human body to digest.

Ethical understanding

17 Your neighbour waters their garden whenever they like for as long as they like. Is there a certain time of day when it is better to water plants? Are there restrictions in your area about when you can water the garden?

Water restrictions will vary depending on the location. In general, watering before sunrise or in the late afternoon is best. Watering before sunrise gives the water time to soak into the soil without evaporating, and provides the plants with a water supply during the heat of the day. Watering late in the afternoon gives water plenty of time to soak in, but leaves should not be left wet overnight in order to reduce the risk of fungal diseases.

Evaluate and create

18 Create a model of the water cycle. What could you use to represent the three stages of water? Show how each stage is connected to the others.

Student answers will vary.

19 Make a list of the different categories of water-saving devices currently available. If you could choose only three devices to install in your house, which three would you choose and why? Write a short description of each of the three water-saving devices you have chosen. Include an image for each one and indicate how it helps save water. What things does your family do to save water around your house?

Student answers will vary.

20 As lack of water becomes a bigger national problem, more people will be required to work in the water industry. This includes hydrologists, environmental scientists and environmental engineers. Choose one of these professions and investigate the following:

a What work does this person do?

Student answers will vary.

b What subjects should be studied in school in order to enter into this career?

Student answers will vary.

21 Much of the area around Queenstown, on the western coast of Tasmania, is now barren and lifeless (Figure 3.23). Research what happened here to cause the devastation. Explain in detail why this land hasn’t been rehabilitated and why the area will take many thousands of years to recover.

Student answers will vary but should mention tree removal, the fumes from smelting and the high rainfall that have all contributed to the erosion of the hills surrounding the town.