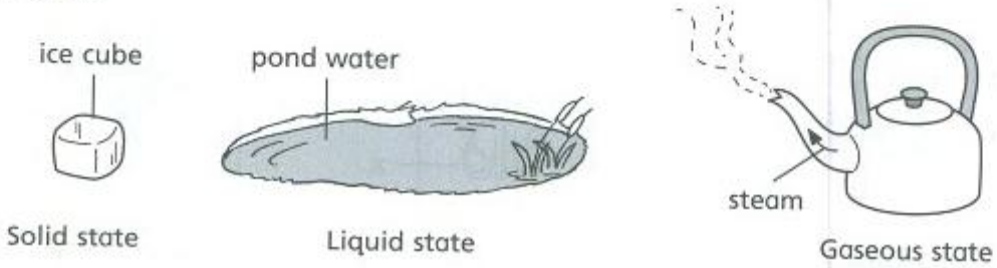
Notes

Fill in each blank with the correct word.

4.1 Three states of water

1. Water exists in _____ states — solid, liquid and gaseous states.



2. Water in the _____ and _____ states is visible while water in the _____ state is invisible.

Solid state

3. Water in the solid state has a definite _____ and a definite _____.

4. Ice and snow are examples of water in the _____ state.

5. Water is in the solid state when its temperature is at or below _____°C.

Liquid state

6. Water in the liquid state has no definite _____ but has a definite _____.

7. Tap water and seawater are examples of water in the _____ state.

8. Water is in the liquid state when its temperature is between _____°C and _____°C.

Gaseous state

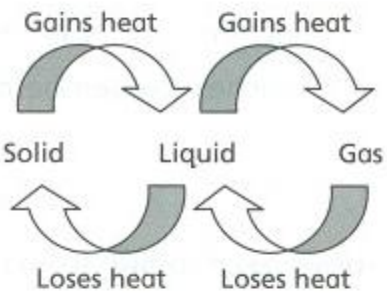
9. Water in the gaseous state has no definite _____ and no definite _____.

10. Water vapour and steam are examples of water in the _____ state.

11. Steam is formed when water boils at _____°C.

4.2 Changes in state of water

1. Water can change from one state to another state when it _____ or _____ heat.



Melting

2. Melting is the process of changing from the _____ state to the _____ state.

3. _____ occurs when water in the solid state (ice) gains heat to become water.

4. The temperature at which ice melts is the melting point. The melting point of ice is _____ °C.

5. When ice melts at room temperature, its temperature remains _____ at 0°C until all the ice has melted completely.

6. When all the ice has melted into water, the temperature of the water _____ until it reaches the room temperature.

Freezing

7. Freezing is the process of changing from the _____ state to the _____ state.

8. _____ occurs when water loses heat to become ice.

9. The temperature at which water freezes is the freezing point. The freezing point of water is _____ °C.

10. When water freezes in a freezer, its temperature remains _____ at 0°C until all the water has frozen.

11. When all the water has frozen, the temperature of the ice _____ until it reaches the temperature of the freezer.

Condensation

12. Condensation is the process of changing from the _____ state to the _____ state.

13. _____ occurs when water in the gaseous state (water vapour or steam) loses heat to become water.

14. Condensation occurs at _____ temperature.

15. When water vapour comes into contact with a cooler surface, it _____ heat to the surface and changes into water.

Boiling

16. Boiling is the process of changing from the _____ state to the _____ state at a fixed temperature.

17. Boiling occurs when water gains heat to become _____.

18. The temperature at which water boils is the boiling point. The boiling point of water is _____°C.

19. When water boils, its temperature remains _____ at 100°C until all the water becomes steam.

20. The steam loses heat to the cooler surrounding air and _____ to form tiny water droplets that appear as mist.

Evaporation

21. Evaporation is the process of changing from the _____ state to the _____ state at any temperature below the boiling point.

22. Evaporation occurs when water gains heat to become _____ _____.

23. _____ occurs only at the water surface.

4.3 Factors affecting the rate of evaporation

1. The rate of evaporation refers to how _____ water evaporates.

2. The _____ of evaporation depends on temperature, wind, exposed surface area and humidity.

Temperature

3. The _____ the surrounding temperature, the higher the rate of evaporation of water.

4. A higher _____ causes water to change into water vapour quickly.

Wind

5. The _____ the wind, the higher the rate of evaporation of water.

6. The _____ carries the water vapour away from the water surface and more water can evaporate into water vapour to occupy the space.

Exposed surface area

7. The _____ the exposed surface area, the higher the rate of evaporation of water.

8. A bigger _____ _____ _____ allows more water to evaporate into water vapour.

Humidity

9. Humidity is the amount of _____ _____ in air.

10. The _____ the humidity, the higher the rate of evaporation of water.

11. When the _____ is low, it is easier for water to evaporate into water vapour.

Practice Questions

Section A: Multiple-choice questions

For each question, 4 options are given. One of them is the correct answer. Make your choice (1, 2, 3 or 4). Write your answer in the brackets provided.

1. Water can exist in _____ states.
   (1) one (2) two
   (3) three (4) four ( )

2. In which state(s) is water visible?
   A Solid
   B Liquid
   C Gaseous

   (1) A only (2) C only
   (3) A and B only (4) A, B and C ( )

3. What are the characteristics of water in the solid state?

	Shape	Volume
(1)	Definite	Definite
(2)	Definite	Indefinite
(3)	Indefinite	Definite
(4)	Indefinite	Indefinite

( )

4. At which of the following temperatures can water exist in the solid state?
   A −100°C B −50°C
   C 0°C D 100°C

   (1) C only
   (2) A and B only
   (3) C and D only
   (4) A, B and C only ( )

5. What are the characteristics of water in the liquid state?

	Shape	Volume
(1)	Definite	Definite
(2)	Definite	Indefinite
(3)	Indefinite	Definite
(4)	Indefinite	Indefinite

( )

6. At which of the following temperatures can water exist in the liquid state?

A 0°C
B 30°C
C 50°C
D 100°C

(1) A and D only
(2) B and C only
(3) B, C and D only
(4) A, B, C and D

( )

7. What are the characteristics of water in the gaseous state?

	Shape	Volume
(1)	Definite	Definite
(2)	Definite	Indefinite
(3)	Indefinite	Definite
(4)	Indefinite	Indefinite

( )

8. At which of the following temperatures can water exist in the gaseous state?

A –20°C
B 20°C
C 100°C
D 120°C

(1) D only
(2) C and D only
(3) B, C and D only
(4) A, B, C and D

( )

9. What are examples of water in the solid, liquid and gaseous states?

	Solid state	Liquid state	Gaseous state
(1)	Ice	Tap water	Snow
(2)	Snow	Rain	Water vapour
(3)	Steam	Water vapour	Seawater
(4)	Water vapour	Ice	Steam

( )

10. Which statement about changes in the state of water is **incorrect**?
    (1) Water can change from solid state to liquid state when it gains heat.
    (2) Water can change from liquid state to solid state when it gains heat.
    (3) Water can change from liquid state to gaseous state when it gains heat.
    (4) Water can change from gaseous state to liquid state when it loses heat. ( )

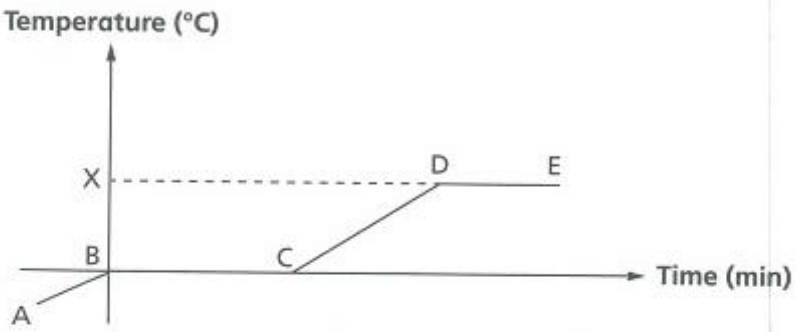
11. What is melting?
    (1) The process of changing from the solid state to the liquid state
    (2) The process of changing from the liquid state to the solid state
    (3) The process of changing from the liquid state to the gaseous state
    (4) The process of changing from the gaseous state to the liquid state ( )

12. Which statements about melting are correct?
    A The melting point of ice is 0°C.
    B Melting occurs when ice gains heat to become water.
    C The melting point of ice is the same as the freezing point of water.
    D The temperature of ice increases until all the ice has melted completely.

    (1) A and B only
    (2) C and D only
    (3) A, B and C only
    (4) A, B, C and D ( )

Study the following information and answer questions 13 and 14.

The graph below shows how the temperature of some ice cubes changed as they melted at a room temperature of 25°C.



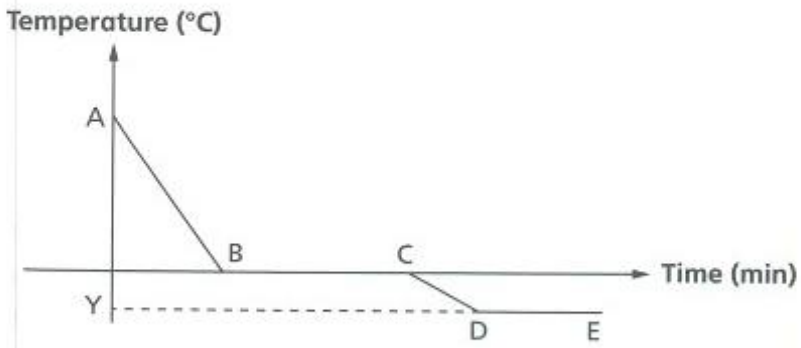
13. During which part of the graph were the ice cubes melting?
(1) Part AB
(2) Part BC
(3) Part CD
(4) Part DE ( )

14. What is the temperature at point X?
(1) 0°C
(2) 25°C
(3) 50°C
(4) 100°C ( )

15. When does freezing occur?
(1) Freezing occurs when ice loses heat to become water.
(2) Freezing occurs when ice gains heat to become water.
(3) Freezing occurs when water gains heat to become ice.
(4) Freezing occurs when water loses heat to become ice. ( )

Study the following information and answer questions 16 and 17.

The graph below shows how the temperature of a cup of water at 50°C changed when it was placed into a freezer of –5°C.



16. During which part of the graph was the cup of water freezing?
(1) Part AB
(2) Part BC
(3) Part CD
(4) Part DE
( )

17. What is the temperature at point Y?
(1) –5°C
(2) 0°C
(3) 25°C
(4) 50°C
( )

18. What is condensation?
(1) The process of changing from the solid state to the liquid state
(2) The process of changing from the liquid state to the solid state
(3) The process of changing from the liquid state to the gaseous state
(4) The process of changing from the gaseous state to the liquid state
( )

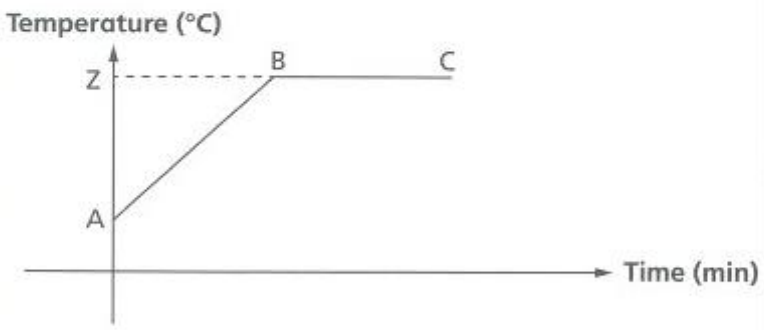
19. Which statements about condensation are correct?
    A Condensation can occur at room temperature.
    B Condensation is the reverse process of evaporation.
    C Condensation occurs when steam gains heat to become water.
    D When water vapour comes into contact with a cool surface, it condenses on the surface.

    (1) A and B only (2) C and D only
    (3) A, B and C only (4) A, B and D only ( )

20. When does boiling occur?
    (1) Boiling occurs when steam gains heat to become water.
    (2) Boiling occurs when steam loses heat to become water.
    (3) Boiling occurs when water gains heat to become steam.
    (4) Boiling occurs when water loses heat to become steam. ( )

Study the following information and answer questions 21 and 22.

The graph below shows how the temperature of a beaker of water at 30°C changes as it is heated to boiling.



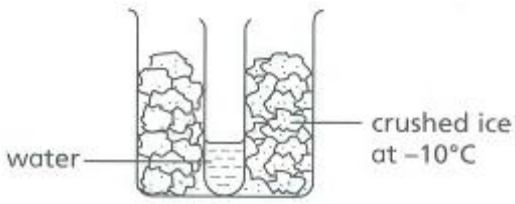
21. What are the temperatures at points A and Z?

	A	Z
(1)	0°C	30°C
(2)	0°C	100°C
(3)	30°C	0°C
(4)	30°C	100°C

( )

22. In which state(s) does water exist during part BC of the graph?
(1) Liquid state only
(2) Gaseous state only
(3) Solid state and liquid state
(4) Liquid state and gaseous state ( )

23. Study the experimental set-up below.



What would happen to the water in the test tube after the test tube was placed in the crushed ice for 15 minutes?
(1) The water would freeze.
(2) The water would evaporate.
(3) The water would increase in mass.
(4) The water would remain as a liquid. ( )

24. Which statements about evaporation are correct?
A Evaporation is the reverse process of boiling.
B Evaporation occurs only at the water surface.
C Evaporation occurs when water gains heat to become water vapour.
D Evaporation is the change from the gaseous state to the liquid state below the boiling point.

(1) A and D only (2) B and C only
(3) B, C and D only (4) A, B, C and D ( )

25. Which of the following conditions has a different effect to the rate of evaporation of water from the other conditions?
(1) High humidity
(2) Presence of wind
(3) High temperature
(4) Large exposed surface area ( )

26. Evangeline conducted the following experiment.

Step 1: She filled three similar beakers with the same amount of water.
Step 2: She placed one beaker in a refrigerator, one beaker on a table and one beaker under the Sun.
Step 3: After five hours, she measured the amount of water left in each container.

What was the aim of Evangeline's experiment?

(1) To find out whether wind affects the rate of evaporation of water
(2) To find out whether humidity affects the rate of evaporation of water
(3) To find out whether temperature affects the rate of evaporation of water
(4) To find out whether exposed surface area affects the rate of evaporation of water ( )

Section B: Open-ended questions

Write your answers in the spaces provided.

1. Water is matter. It can exist in the solid, liquid and gaseous states.

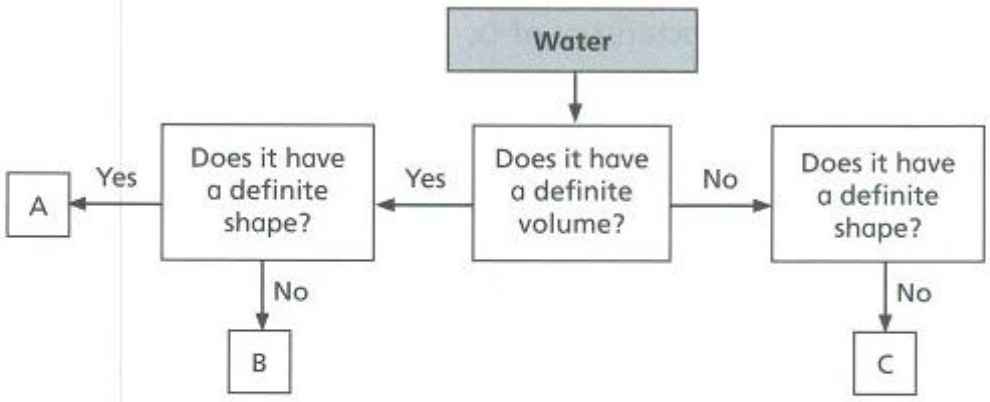
(a) Complete the following table to show the characteristics of water in the three different states by writing 'Yes' or 'No'.

	Solid state	Liquid state	Gaseous state
Has a definite shape?			
Has a definite volume?			

(b) Some examples of water in the three different states are given below. For each group, give an appropriate heading.

_____ state	_____ state	_____ state
Steam Water vapour	Ice Snow Hailstone	Rain River water Drinking water

2. Study the flow chart below.



(a) Which states do A, B and C exist in?

A: _____

B: _____

C: _____

(b) Is C visible? Explain your answer.

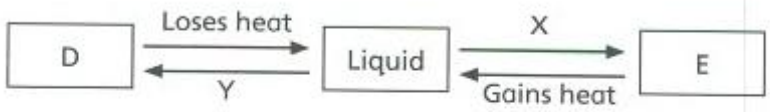
_____

_____

(c) If C is steam, arrange A, B and C in order of their temperature, starting with the water at the lowest temperature.

_____

3. The diagram below shows how water can change from one state to another state.



(a) Does a liquid gain or lose heat during X and Y?

X: _____

Y: _____

(b) State two characteristics of D.

_____

_____

(c) Can E be water vapour? Explain your answer.

_____

_____

4. Study the diagram below.

(a) What is process F?

_____

(b) Name the process of changing water from the liquid state to the solid state.

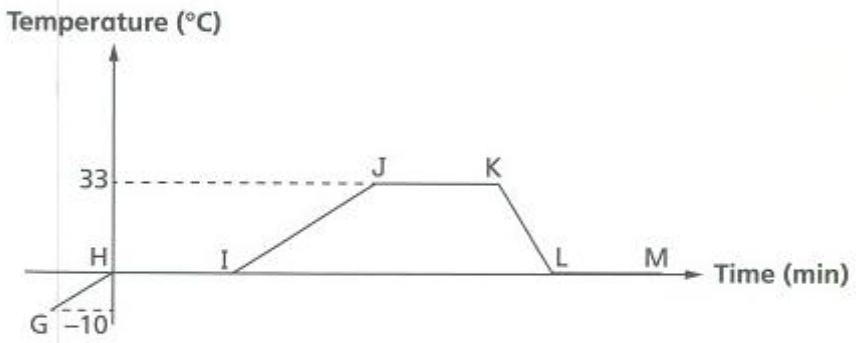
_____

(c) For pure water, at what temperature do the processes in (a) and (b) take place?

_____

5. Vincent took out a tray of ice cubes made of pure water from a freezer. After using some of the ice cubes, he forgot to place the remaining ice cubes back into the freezer. After one hour, his mother placed the tray of water back into the freezer.

The graph below shows how the temperature of the unused ice cubes changed.



(a) How did the state of the ice cubes change? Write your answer in the boxes provided below.

(b) During which part(s) of the graph did the ice cubes gain heat?

_____

(c) What was the difference in temperature between the temperature in the freezer and the room temperature?

_____

6. Study the diagram below.

(a) What is process N?

_____

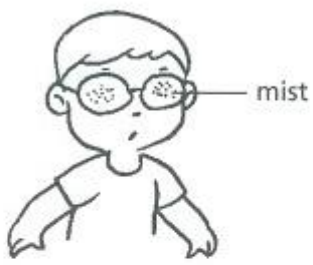
(b) Name two processes that can change a liquid into a gas.

_____

(c) Which process in (b) takes place at a higher temperature?

_____

7. A boy alights from a bus. The lenses of his spectacles become misty as shown in the diagram below.



(a) What is the state of the mist on the lenses?

_____

(b) How does the mist form on the lenses?

_____

_____

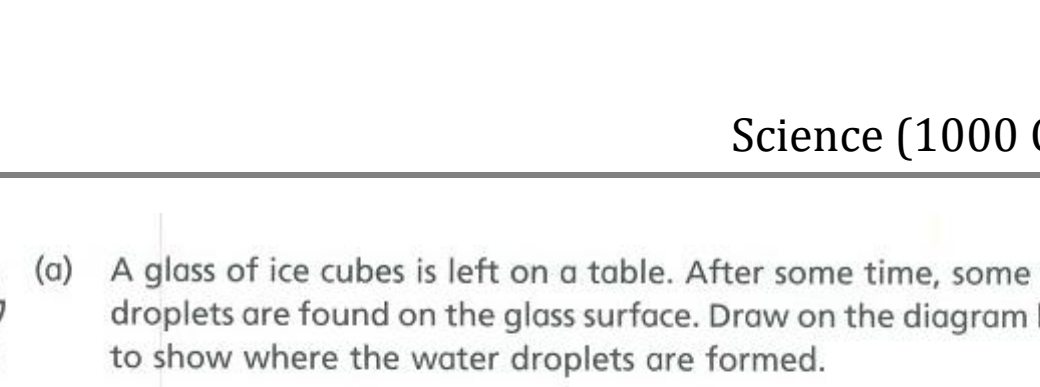
8. (a) A glass of ice cubes is left on a table. After some time, some water droplets are found on the glass surface. Draw on the diagram below to show where the water droplets are formed.

(b) A glass of hot water is left on a table. After some time, some water droplets are observed to form on the glass. Draw on the diagram below to show where the water droplets are formed.

(c) Through which process are the water droplets in (a) and (b) formed?

_____

9. Study the flow chart below.



(a) Other than the change in state, give a similarity between processes P and Q.

_____

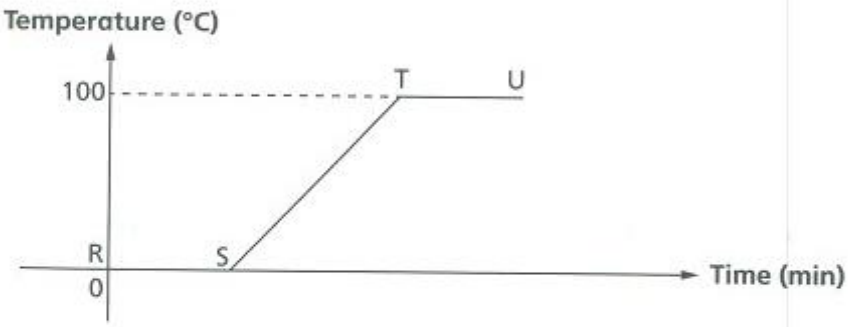
(b) Other than the temperature, give a difference between processes P and Q.

_____

(c) Identify X and Y.

X: _____ Y: _____

10. A beaker of ice cubes at 0°C was heated to 100°C. The graph below shows how the temperature of the ice cubes changed.



(a) What processes did the ice cubes undergo during parts RS and TU of the graph?

RS: _____ TU: _____

(b) What were the states of the water at parts RS, ST and TU of the graph? Write your answer in the table provided below.

	RS	ST	TU
State(s) of water			

(c) The heat source was turned off and the water was left to cool to room temperature. Draw on the graph above to show how the temperature of the water changed.

11. Study the diagram below.

(a) Identify processes W, X, Y and Z.

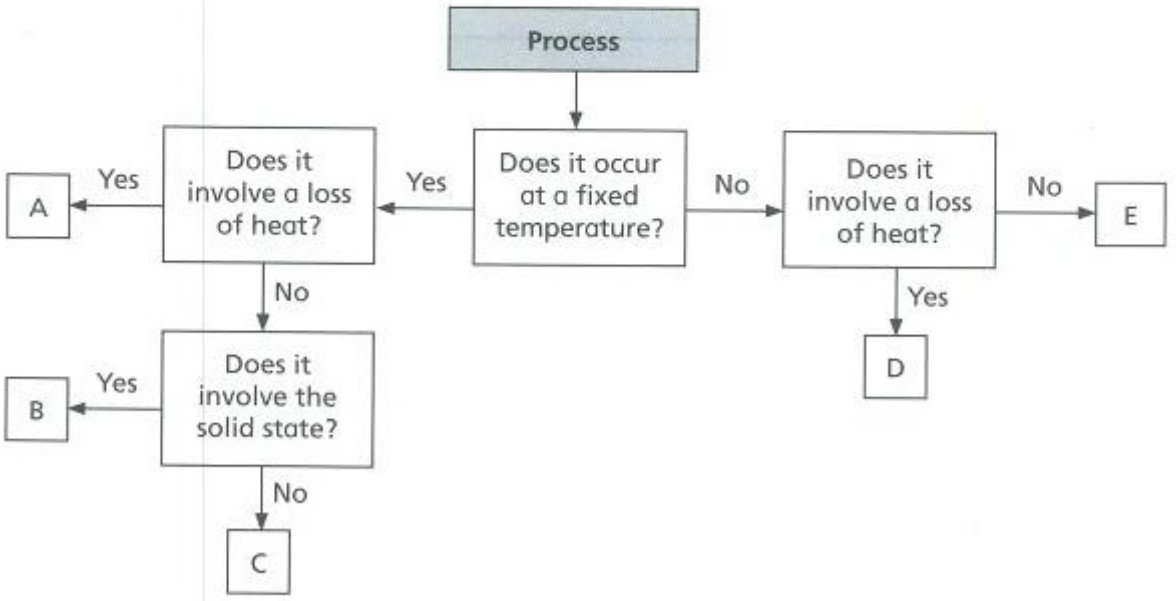
W: _____ X: _____

Y: _____ Z: _____

(b) Complete the table below to show whether heat is gained or lost during processes W, X, Y and Z.

	W	X	Y	Z
Heat gain/loss				

12. The flow chart below shows the processes involved in the changes of state.



(a) State a difference between processes A and D.

_____

(b) State two similarities between processes B and C.

(c) Can process E be evaporation? Explain your answer.

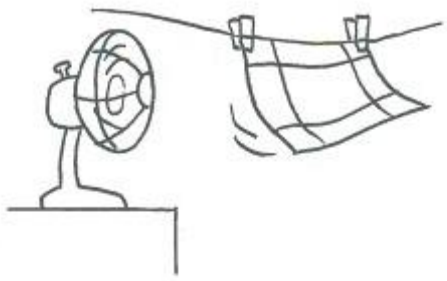
13. The rate of evaporation is the speed at which water evaporates. State how the following conditions affect the rate of evaporation.

(a) Low temperature

(b) Low humidity

(c) Small exposed surface area

14. Marcus soaked three identical pieces of cloths with 100 m/ of water each and subjected them to different wind speeds using a fan.



Marcus recorded the time taken for all the water in each piece of cloth to evaporate in a table as shown below.

Cloth	Wind speed	Time taken for all the water to evaporate (min)
F	Low	50
G	Medium	33
H	High	18

(a) Using information from the table, how did wind affect the rate of evaporation of water?

_____

_____

(b) Explain how wind affected the evaporation of water.

_____

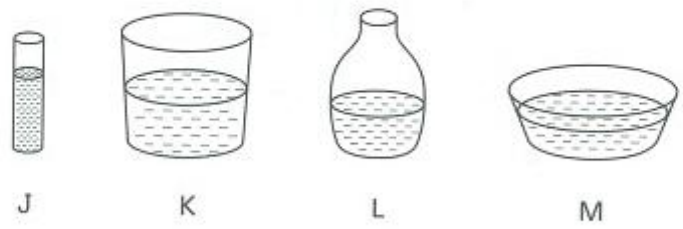
_____

(c) State two other variables that Marcus should keep the same for the experiment to be fair.

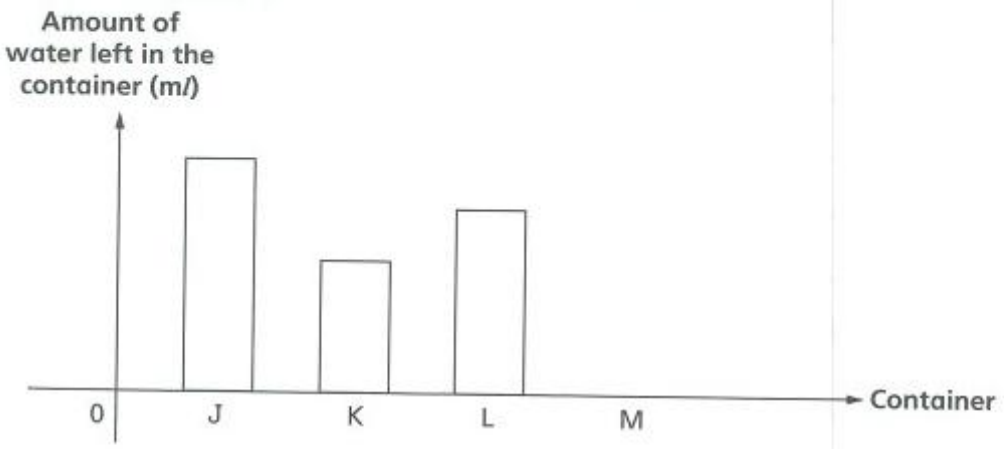
_____

_____

15. Victoria filled four different containers with the same amount of water as shown below.



Victoria placed the four containers under the Sun for five hours before she measured the amount of water left in each container. She plotted her results in the bar graph below.



(a) What was the aim of Victoria's experiment?

_____

_____

(b) Predict how much water would be left in container M by drawing a bar on the graph above.