AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.2.3

Changes of state and specific latent heat

Past-paper questions

Tier	**Foundation**
Question groups	**10**
Available paper years	**2007–2024**

Using this booklet

1. Answer the questions in order and show your working.
2. Original question numbers and marks are retained.
3. Print at actual size (100%) for measuring questions.
4. Use the companion answer booklet to check your work.

Name: _____ **Date:** _____

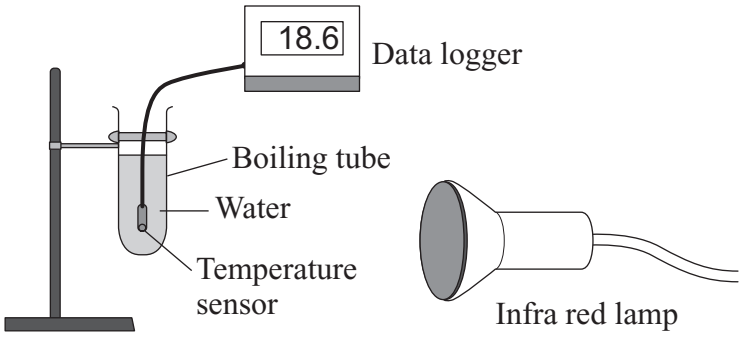
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.3.2.3 Changes of state and specific latent heat

Question 01

6 A student had read about a glacier that had been covered in insulating material. The idea was to slow down the rate at which the glacier melts in the summer.

She investigated this idea using the apparatus shown in the diagram.



(a) These are the steps taken by the student.

- Measure 30 cm^3 of cold water into a boiling tube.
- Place the boiling tube 25 cm from an infra red lamp.
- Record the temperature of the water.
- Switch on the infra red lamp.
- Record the temperature of the water every minute for 5 minutes.
- Repeat with boiling tubes covered in different insulating materials.

(i) Why did she use an infra red lamp?

.....

(1 mark)

(ii) Name **one** control variable in this investigation.

.....

(1 mark)

(iii) Give **one** advantage of using a temperature sensor and data logger instead of a glass thermometer to measure temperature.

.....

.....

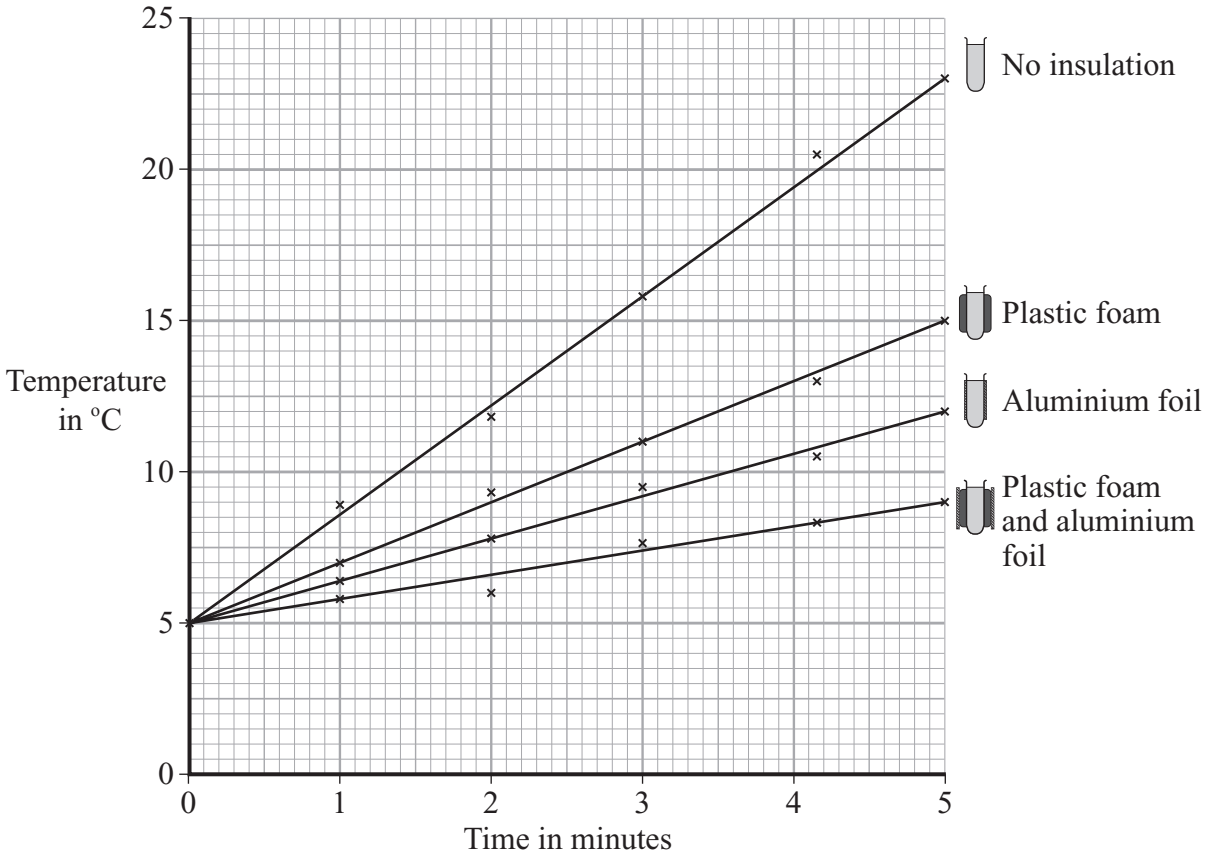
(1 mark)

4.3.2.3 Changes of state and specific latent heat

Question 01 · continued

BLANK

(b) The results of the investigation are shown in the graph.



(i) Why did the student use a boiling tube with no insulation?

.....

.....

(1 mark)

(ii) From her results, what should she recommend is used to insulate the glacier?

.....

(1 mark)

Question 6 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 01 · continued

BLANK

(iii) Explain why the insulation recommended by the student will reduce the heat transfer from the Sun to the glacier.

.....

.....

.....

.....

.....

(2 marks)

(c) Explain, in terms of particles, how heat is transferred through the glass wall of a boiling tube.

.....

.....

.....

.....

(2 marks)

9

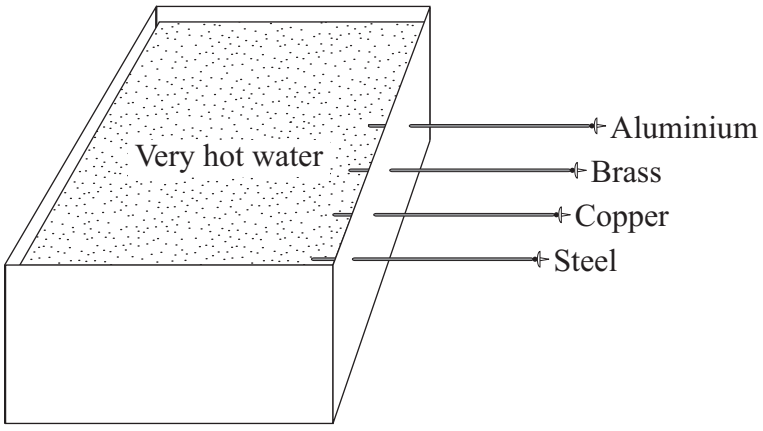
4.3.2.3 Changes of state and specific latent heat

Question 02

November 2009 | PHY1AP | Original Q8 | Legacy

QUESTION EIGHT

A student did an experiment to find out which of four metals is the best conductor of heat. He used rods of equal length and thickness. The student used wax to stick a drawing pin to the end of each rod. Very hot water was poured into the tank. The times taken for the wax to melt and the drawing pins to fall off were measured.



8A Which was the independent variable in the experiment?

1 the final temperature of the water

2 the initial temperature of the water

3 the length of the rods

4 the type of metal

8B Which of these is a control variable in the experiment?

1 the final temperature of the water

2 the length of the rods

3 the type of metal

4 the time taken for the drawing pin to fall off

4.3.2.3 Changes of state and specific latent heat

Question 02 · continued

8C The table shows the student's results.

Which metal is the best conductor of heat?

	Metal	Time taken for the drawing pin to fall off in seconds
1	Aluminium	59
2	Brass	110
3	Copper	32
4	Steel	188

8D The student wanted to improve the results. He repeated the experiment twice and calculated the mean times for the drawing pins to fall off.

What has the student improved by doing this?

1 the calibration

2 the fairness

3 the precision

4 the reliability

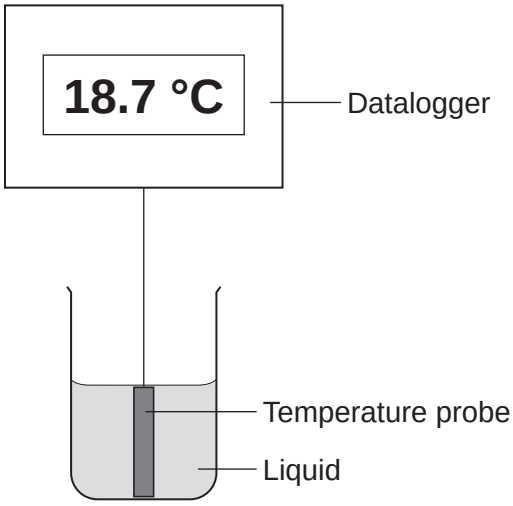
4.3.2.3 Changes of state and specific latent heat

Question 03

4 A student investigated the cooling effect of evaporation.

She used the equipment (datalogger and probe) in **Figure 5** to measure how the temperature of a liquid changed as the liquid evaporated.

Figure 5



4 (a) Which type of variable was the temperature in this investigation?

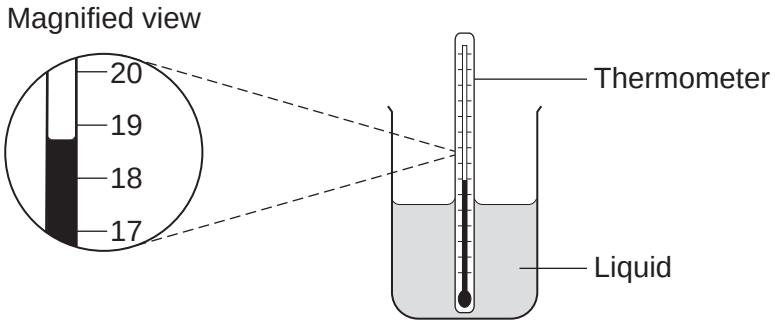
[1 mark]

Tick (✓) **one** box.

	Tick (✓)
control	
dependent	
independent	

4 (b) The student could have used the thermometer shown in **Figure 6**.

Figure 6



How does the resolution of the equipment in **Figure 5** compare with the resolution of the thermometer?

[1 mark]

Tick (✓) **one** box.

	Tick (✓)
The equipment has a better resolution.	
The equipment has a worse resolution.	
The equipment has the same resolution.	

4 (c) Before the investigation started, the student checked the accuracy of three different temperature probes. The student put the probes in a beaker of boiling water that had a temperature of 100.0 °C.
Figure 7 shows the readings from the three temperature probes.

Figure 7

Probe A	Probe B	Probe C
99.8	**100.1**	**103.2**

Which **one** of the temperature probes, **A**, **B** or **C**, was **least** accurate?

[2 marks]

Write the correct answer in the box.

Give a reason for your answer.

_____

_____

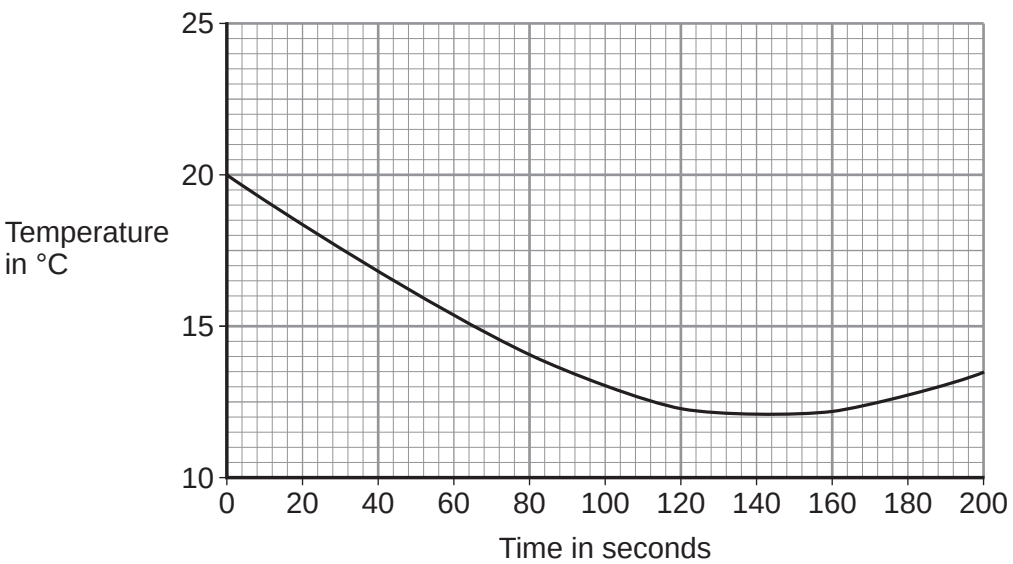
Question 4 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 03 · continued

4 (d) **Figure 8** shows how the temperature recorded changed during the investigation.

Figure 8



4 (d) (i) Use **Figure 8** to determine the lowest temperature recorded as the liquid evaporated.

[1 mark]

Temperature = _____ °C

4 (d) (ii) Use **Figure 8** to determine how long it took for all the liquid to evaporate.
Give a reason for your answer.

[2 marks]

Time = _____ seconds

Reason: _____

_____

4 (d) (iii) How would increasing the starting temperature of the liquid above 20 °C affect the rate of evaporation of the liquid?

[1 mark]

_____

_____

8

4.3.2.3 Changes of state and specific latent heat

Question 04

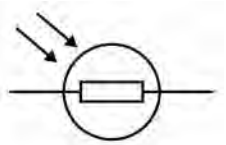
June 2018 | 8463/1F | Original Q7

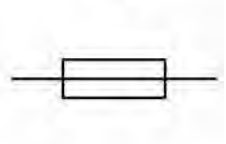
0 7 The plug of an electrical appliance contains a fuse.

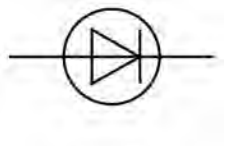
0 7 . 1 What is the correct circuit symbol for a fuse?

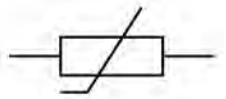
Tick **one** box.

[1 mark]


☐


☐


☐


☐

0 7 . 2 The appliance is connected to the mains electrical supply. The mains potential difference is 230 V.

Calculate the energy transferred when 13 C of charge flows through the appliance.

Use the equation:

energy transferred = charge flow × potential difference

[2 marks]

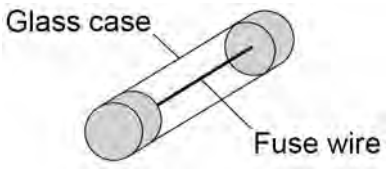
Energy transferred = _____ J

4.3.2.3 Changes of state and specific latent heat

Question 04 · continued

Figure 9 shows the structure of a fuse.

Figure 9



0 7 . 3 Write down the equation that links charge flow, current and time.

[1 mark]

0 7 . 4 The fuse wire melts when 1.52 coulombs of charge flows through the fuse in 0.40 seconds.

Calculate the current at which the fuse wire melts.

[3 marks]

Current = _____ A

0 7 . 5 The mass of the fuse wire is 0.00175 kg. The specific latent heat of fusion of the fuse wire is 205 000 J/kg.

Calculate the energy needed to melt the fuse wire.

Use the Physics Equations Sheet.

[2 marks]

Energy = _____ J

9

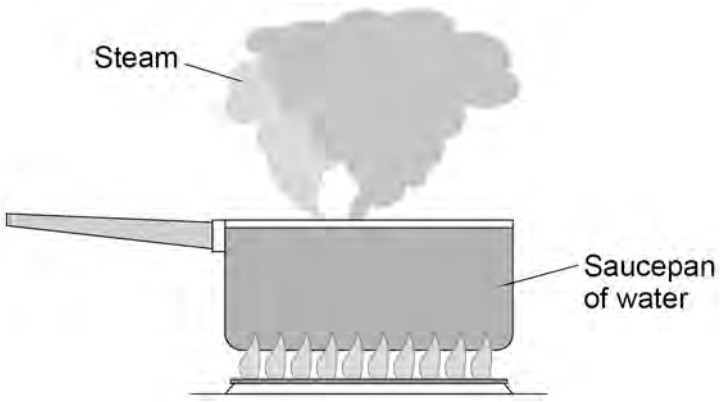
4.3.2.3 Changes of state and specific latent heat

Question 05

June 2019 | 8463/1F | Original Q1

0 1 **Figure 1** shows water being heated. Eventually the water changed into steam.

Figure 1



0 1 . 1 Complete the sentences.

Choose answers from the box.

Each answer may be used once, more than once or not at all.

[2 marks]

greater than	**less than**	**the same as**

The distance between the particles in steam is _____ the distance between the particles in liquid water.

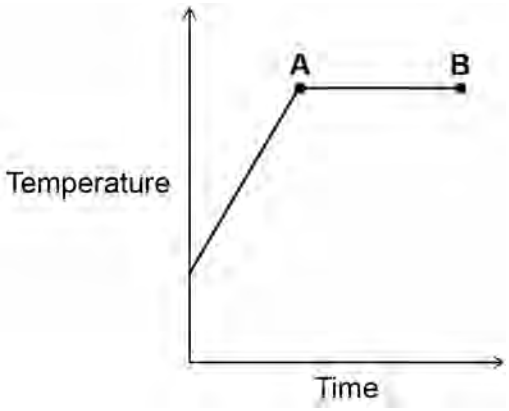
The density of steam is _____ the density of liquid water.

4.3.2.3 Changes of state and specific latent heat

Question 05 · continued

Figure 2 shows how the temperature of the water varied with time.

Figure 2



0 1 . 2 What is the name of the process that is taking place between points **A** and **B**?

Give a reason for your answer.

[2 marks]

Process _____

Reason _____

_____

0 1 . 3 A mass of 0.063 kg of water was turned into steam.

The specific latent heat of vaporisation of water is 2 260 000 J/kg

Calculate the thermal energy transferred to the water to turn it into steam.

Use the equation:

thermal energy for a change of state = mass × specific latent heat

[2 marks]

_____

_____

_____

Energy = _____ J

4.3.2.3 Changes of state and specific latent heat

Question 05 · continued

0 1 . 4 The mass of the steam was 0.063 kg

The volume of the steam was 0.105 m^3

Calculate the density of steam.

Use the equation:

$$\text{density} = \frac{\text{mass}}{\text{volume}}$$

Choose the unit from the box.

[3 marks]

kg	m^3 / kg	kg / m^3

Density = _____ Unit _____

9

4.3.2.3 Changes of state and specific latent heat

Question 06

November 2020 | 8463/1F | Original Q7

0 7 A student heated water in an electric kettle.

0 7 . 1 Water has a high specific heat capacity.

Complete the sentence.

Choose answers from the box.

[2 marks]

°C	**J**	**kg**	**s**	**W**

The specific heat capacity of a substance is the energy needed to raise the

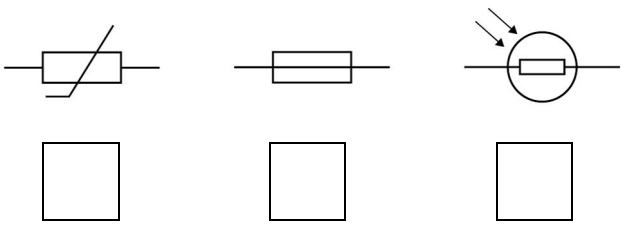
temperature of 1 _____ of the substance by 1 _____.

0 7 . 2 The kettle circuit contains a thermistor which is used to switch the kettle off when the water reaches 100 °C.

What is the correct symbol for a thermistor?

[1 mark]

Tick (✓) **one** box.



4.3.2.3 Changes of state and specific latent heat

Question 06 · continued

0 7 . 3 The resistance of the heating element in the kettle is 15 Ω.

The current in the heating element is 12 A.

Calculate the power of the heating element.

Use the equation:

$$\text{power} = (\text{current})^2 \times \text{resistance}$$

[2 marks]

Power = _____ W

Question 7 continues on the next page

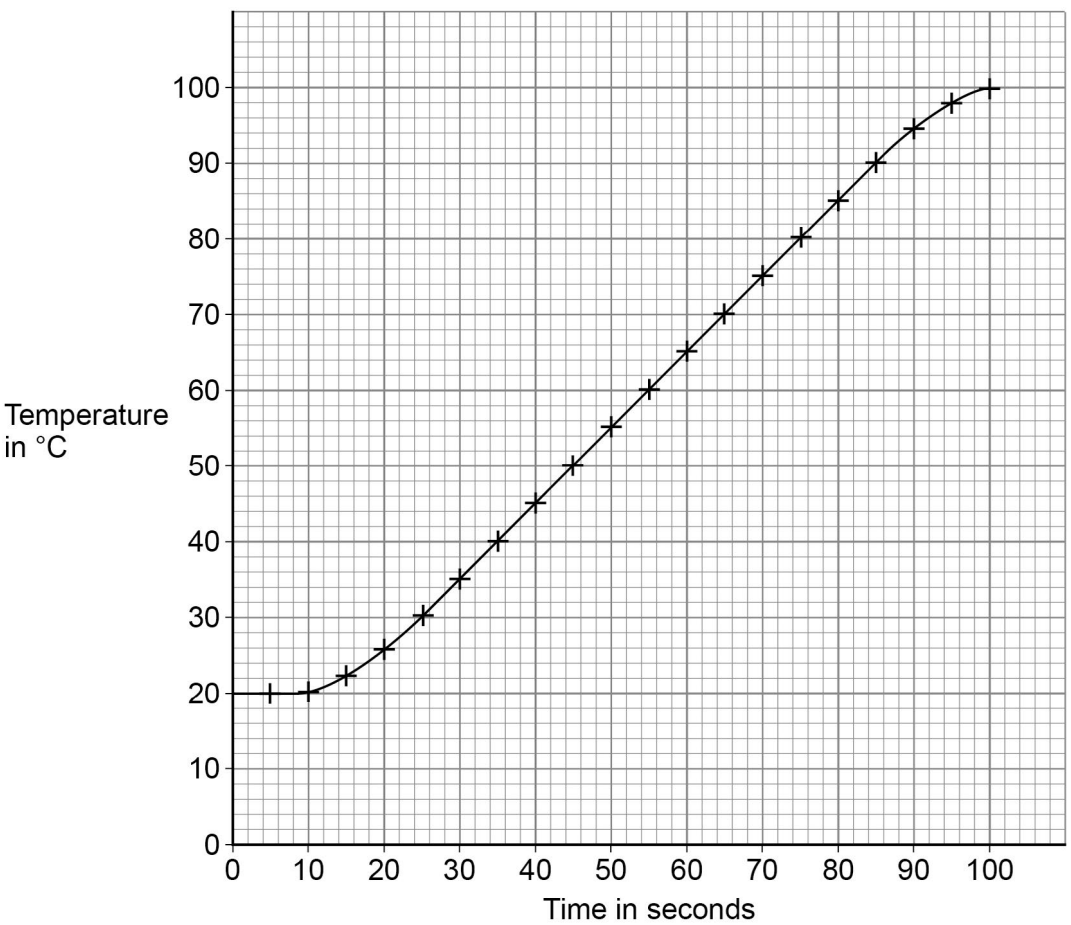
4.3.2.3 Changes of state and specific latent heat

Question 06 · continued

The student investigated how quickly the kettle could increase the temperature of 0.50 kg of water.

Figure 10 shows the results of the investigation.

Figure 10



4.3.2.3 Changes of state and specific latent heat

Question 06 · continued

0 7 . 4 The temperature of the water did **not** start to increase until 10 seconds after the kettle was switched on.

What is the reason for this?

[1 mark]

Tick (✓) **one** box.

- Energy is transferred from the surroundings to the kettle. ☐
- The charge flows slowly through the kettle circuit. ☐
- The heating element in the kettle takes time to heat up. ☐
- The power output of the kettle increases slowly. ☐

0 7 . 5 Describe a method the student could have used to obtain the results shown in **Figure 10**.

[6 marks]

Question 7 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 06 · continued

0 7 . 6 The mass of water in the kettle was 0.50 kg.

The temperature of the water increased from 20 °C to 100 °C.

specific heat capacity of water = 4200 J/kg °C

Calculate the energy transferred to the water.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

0 7 . 7 The water in the kettle boiled for a short time before the kettle switched off.

During this time 5.0 g of water changed to steam.

specific latent heat of vaporisation of water = 2 260 000 J/kg

Calculate the energy transferred to change the water to steam.

Use the Physics Equations Sheet.

[3 marks]

Energy = _____ J

18

4.3.2.3 Changes of state and specific latent heat

Question 07

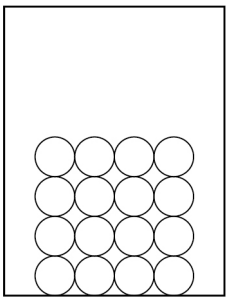
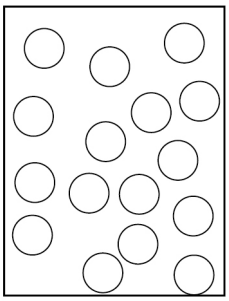
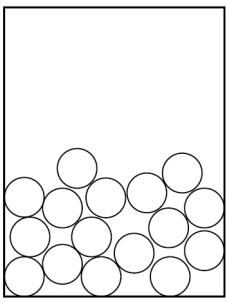
November 2021 | 8463/1F | Original Q1

0 1 . 1 A student investigated the three states of matter.

The arrangement of particles in the three states of matter are different.

Draw **one** line from each particle arrangement to the state of matter.

[2 marks]

Particle arrangement	State of matter
	Solid
	Liquid
	Gas

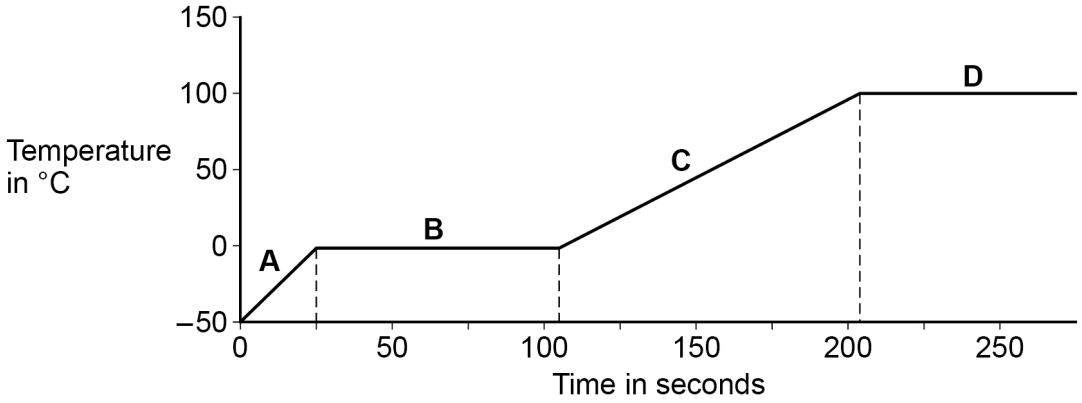
4.3.2.3 Changes of state and specific latent heat

Question 07 · continued

A large lump of ice was heated and changed state.

Figure 1 shows how the temperature varied with time.

Figure 1



0 1 . 2 Which part of **Figure 1** shows when the ice was melting?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

0 1 . 3 Which part of **Figure 1** shows when the water was boiling?

[1 mark]

Tick (✓) **one** box.

A ☐ **B** ☐ **C** ☐ **D** ☐

Question 1 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 07 · continued

0 1 . 4 Which property of the water particles changes as the temperature of the water increases?

[1 mark]

Tick (✓) **one** box.

The kinetic energy of the particles ☐

The mass of each particle ☐

The number of particles ☐

0 1 . 5 Calculate the thermal energy needed to melt 0.250 kg of ice at 0 °C.

specific latent heat of fusion of water = 334 000 J/kg

Use the equation:

thermal energy = mass × specific latent heat

[2 marks]

Thermal energy = _____ J

4.3.2.3 Changes of state and specific latent heat

Question 07 · continued

0 1 . 6 Complete the sentence.

Choose the answer from the box.

[1 mark]

condenses	**evaporates**	**ionises**	**sublimates**

A substance is heated and changes directly from a solid to a gas.

The substance _____ .

8

Turn over for the next question

4.3.2.3 Changes of state and specific latent heat

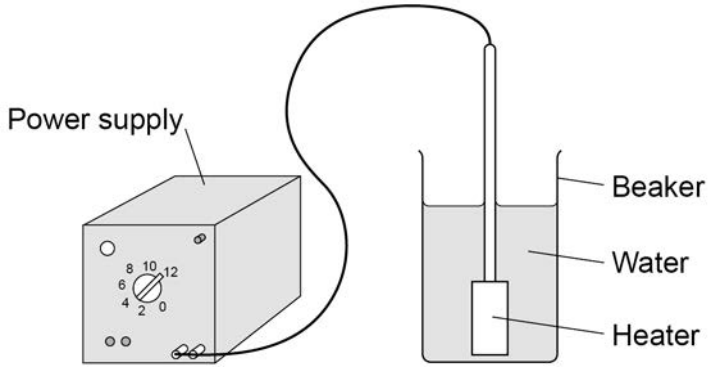
Question 08

June 2022 | 8463/1F | Original Q5

0 5 A student determined the specific latent heat of vaporisation of water.

Figure 6 shows some of the equipment used.

Figure 6



0 5 . 1 The student measured a mass of water and put it into the beaker.

What measuring instrument should the student have used to measure the mass of the water?

[1 mark]

Tick (✓) **one** box.

- balance ☐
- joulemeter ☐
- newtonmeter ☐
- thermometer ☐

4.3.2.3 Changes of state and specific latent heat

Question 08 · continued

0 5 . 2 The power output of the heater stayed the same throughout the experiment.

What type of variable was the power output of the heater?

[1 mark]

Tick (✓) **one** box.

- Categoric variable ☐
- Control variable ☐
- Dependent variable ☐
- Independent variable ☐

0 5 . 3 The student turned on the heater and heated the water until it reached boiling point.

The student continued to heat the water so that it boiled for several minutes.

The mass of the water remaining in the beaker was measured again.

Give **one** way the beaker of boiling water could be moved safely to measure its new mass.

[1 mark]

Question 5 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 08 · continued

0 5 . 4 The mass of water that turned into steam was 0.0090 kg.

The heater transferred 25 200 J of energy to the water to turn it into steam.

Calculate the specific latent heat of vaporisation of water given by the student's data.

Use the Physics Equations Sheet.

Choose the unit from the box.

[4 marks]

J	kg	J/kg

Specific latent heat of vaporisation = _____ Unit _____

0 5 . 5 What was a source of error in the student's experiment?

[1 mark]

Tick (✓) **one** box.

- The transfer of thermal energy from the heater to the water ☐
- The transfer of thermal energy from the surroundings to the water ☐
- The transfer of thermal energy from the water to the heater ☐
- The transfer of thermal energy from the water to the surroundings ☐

8

4.3.2.3 Changes of state and specific latent heat

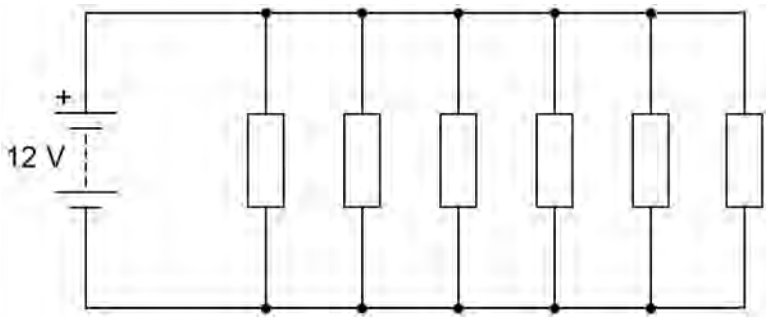
Question 09

June 2023 | 8463/1F | Original Q10

1 0 **Figure 14** shows an electrical circuit used to heat the windscreen of a car.

Each resistor in the circuit represents a heating element.

Figure 14



1 0 . 1 The 12 V battery supplies direct potential difference.

What is meant by 'direct potential difference'?

[1 mark]

Use the Physics Equations Sheet to answer questions **10.2** and **10.3**.

1 0 . 2 Which equation links charge flow (Q), energy (E) and potential difference (V)?

[1 mark]

Tick (✓) **one** box.

$E = \frac{V}{Q}$ ☐

$E = QV$ ☐

$E = \frac{Q}{V}$ ☐

$E = \frac{V^2}{Q}$ ☐

4.3.2.3 Changes of state and specific latent heat

Question 09 · continued

10.3 Calculate the charge flow through the 12 V battery when the battery transfers 5010 J of energy.

[3 marks]

Charge flow = _____ C

10.4 Ice forms on the windscreen at a temperature of 0 °C.

The electrical circuit transfers 5010 J of energy to the ice.

A mass of 0.015 kg of ice melts.

Calculate the specific latent heat of fusion of water.

Use the Physics Equations Sheet.

[3 marks]

Specific latent heat of fusion of water = _____ J/kg

4.3.2.3 Changes of state and specific latent heat

Question 09 · continued

10.5 The electrical circuit was left switched on while the ice changed from a solid to a liquid and increased in temperature to 5 °C.

Explain the changes in the arrangement **and** movement of the particles as the ice melted and the temperature increased to 5 °C.

[6 marks]

14

4.3.2.3 Changes of state and specific latent heat

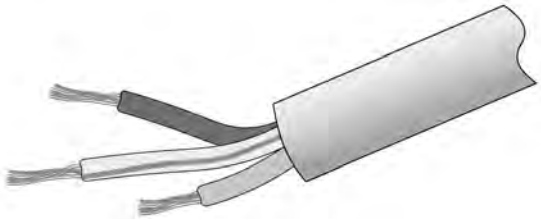
Question 10

June 2024 | 8463/1F | Original Q7

0 7 An electrical appliance is connected to the mains electricity supply using a three-core cable.

Figure 13 shows a three-core cable.

Figure 13



0 7 . 1 What colour is the insulation covering the live wire inside the cable?

[1 mark]

Tick (✓) **one** box.

- Blue ☐
- Brown ☐
- Green and yellow ☐
- Orange ☐

0 7 . 2 What colour is the insulation covering the neutral wire inside the cable?

[1 mark]

Tick (✓) **one** box.

- Blue ☐
- Brown ☐
- Green and yellow ☐
- Orange ☐

Question 10 · continued

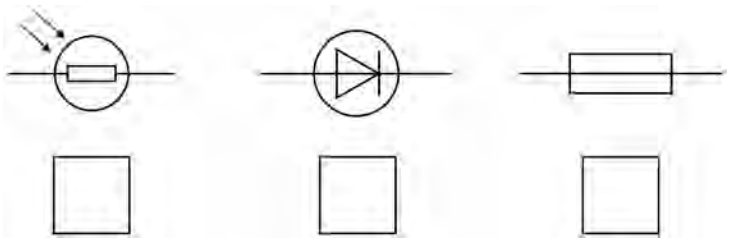
The plug connected to the cable contains a fuse.

A fuse contains a wire that is designed to melt when the current is too great.

0 7 . 3 What is the circuit symbol for a fuse?

[1 mark]

Tick (✓) **one** box.



0 7 . 4 The wire in the fuse melts when there is a charge flow of 2.0 C in a time of 0.40 s.

Calculate the current in the wire when it melts.

Use the equation:

$$\text{current} = \frac{\text{charge flow}}{\text{time}}$$

[2 marks]

Current = _____ A

Question 7 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 10 · continued

0 7 . 5 The mass of the wire is 0.016 g.

specific latent heat of fusion of the wire = 60 000 J/kg

Calculate the change in thermal energy needed to melt the wire.

Use the Physics Equations Sheet.

[3 marks]

Change in thermal energy = _____ J

0 7 . 6 The fuse transfers some energy to the surroundings as it melts.

How does transferring energy to the surroundings affect the total energy needed to melt the fuse?

[1 mark]

Tick (✓) **one** box.

- The total energy will be smaller. ☐
- The total energy will be the same. ☐
- The total energy will be greater. ☐

9