AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.1.2

Changes of state

Past-paper questions

Tier	**Higher**
Question groups	**19**
Available paper years	**2005–2025**

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:** _____

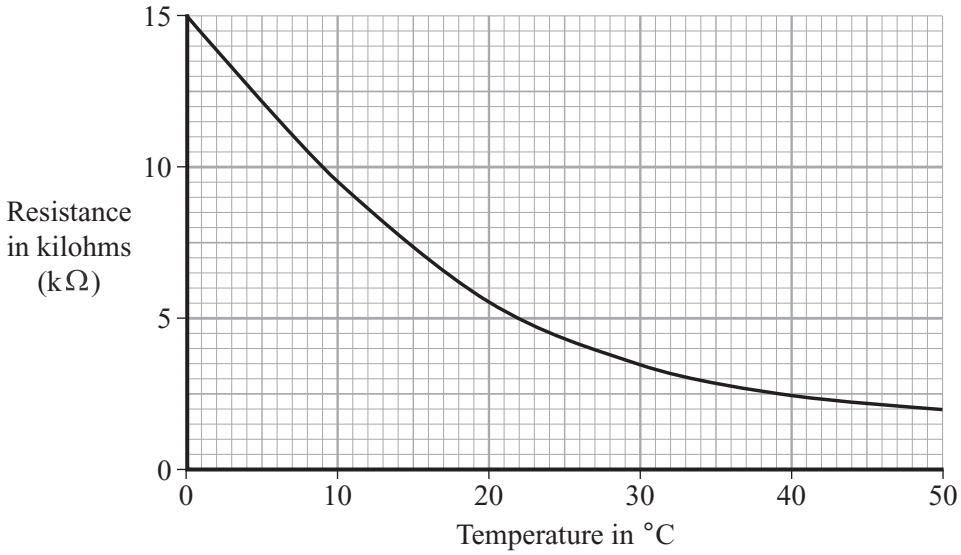
Whole questions are retained for context, so some parts assess other specification points. Current and legacy sources are labelled. Continue on extra paper if needed.

4.3.1.2 Changes of state

Question 01

June 2005 | 3451 | Original Q12 | Legacy

12 (a) The graph shows how the resistance of a thermistor changes with temperature.



Use the graph to find:

(i) the resistance, in kΩ, of the thermistor at 18 ºC;

Resistance = ... kΩ

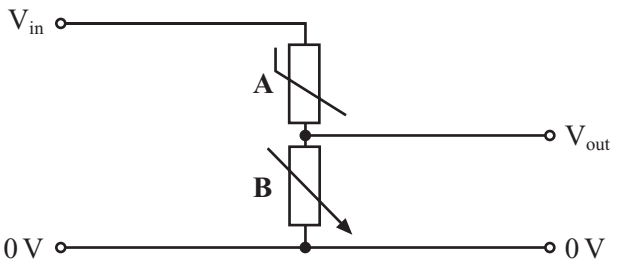
(1 mark)

(ii) the temperature, in ºC, when the resistance of the thermistor is 12 500 ohms (Ω).

Temperature = ... ºC

(1 mark)

(b) The diagram shows how a thermistor is used in part of an electronic circuit.



(i) Name the components **A** and **B**.

A is a ..... and **B** is a .....

(1 mark)

(ii) Name the part of the electronic circuit shown in the diagram.

.....

(1 mark)

4.3.1.2 Changes of state

Question 01 · continued

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(iii) What will happen to the value of V_{out} as the temperature increases from the freezing point of water to room temperature?

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(1 mark)

(iv) Explain your answer to part (b)(iii).

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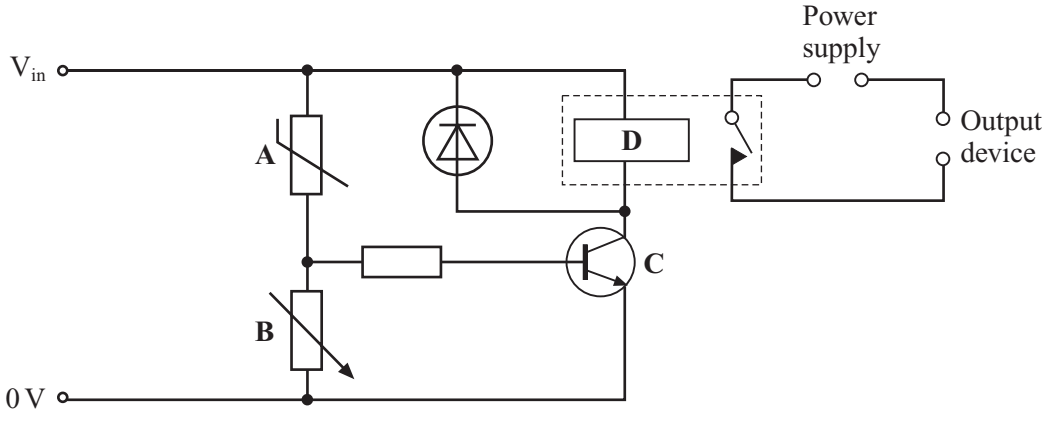
(2 marks)

(c) An electronic circuit switches on an output device when the temperature gets above a certain value. Name a suitable output device.

.....

(1 mark)

(d) The diagram shows an electronic circuit.



(i) Name components **C** and **D**.

C is a ..... and **D** is a .....

(2 marks)

(ii) The circuit is modified by adding a NOT gate. This makes the circuit switch on the output device when the temperature gets too low.

Describe where in the circuit the NOT gate would be put.

.....

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(1 mark)

Describe a use for this modified circuit.

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(1 mark)

12

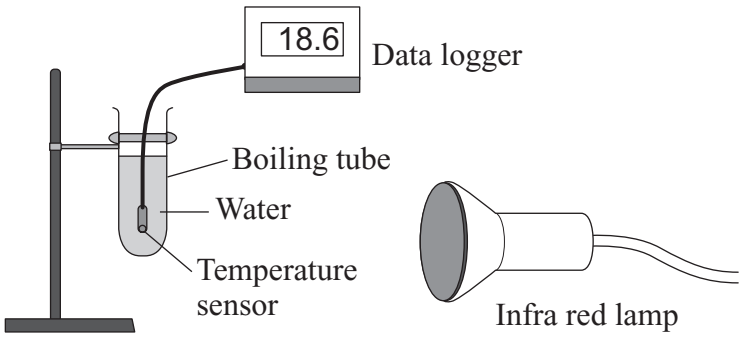
4.3.1.2 Changes of state

Question 02

January 2007 | PHY1H | Original Q1 | Legacy

1 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.

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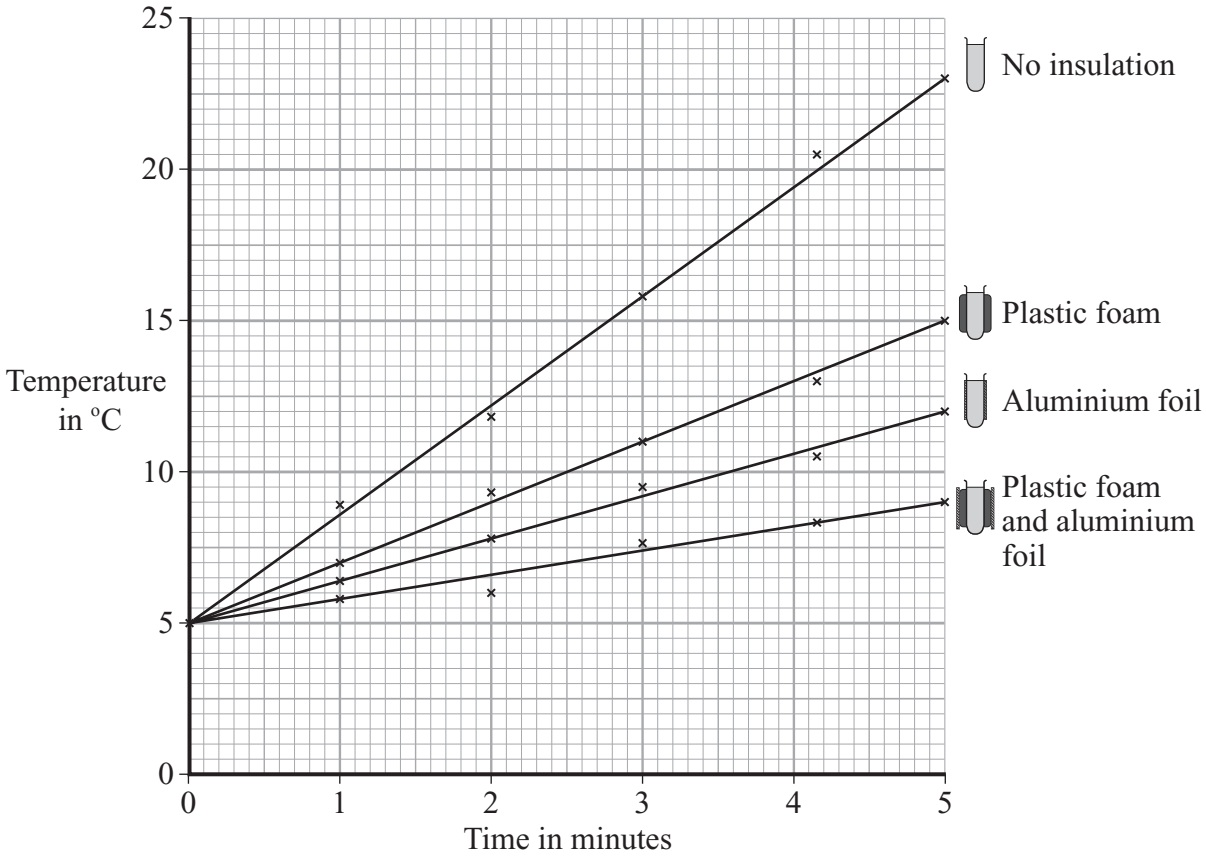
.....

(1 mark)

Question 02 · continued

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(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 1 continues on the next page

4.3.1.2 Changes of state

Question 02 · continued

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

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(2 marks)

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

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(2 marks)

9

4.3.1.2 Changes of state

Question 03

June 2007 | PHY1A | Original Q3 | Legacy

QUESTION THREE

A student investigated the question: Does the type of surface affect how an object loses or gains heat? She carried out two experiments.

In her first experiment, she filled two cans with boiling water. One can had a dull, black surface. The other can had a shiny, silver surface.

Later, she measured the temperature of the water in each can.

These are her results.

	Starting temperature of the water	Temperature of the water 15 minutes later
Can with dull, black surface	100 °C	74 °C
Can with shiny, silver surface	100 °C	93 °C

3A The student wanted her experiment to be a fair test.

Which row of the table is most likely to give a fair test?

	Volume of cans	Volume of water	Metal of the cans	Shape of cans
1	same	different	same	same
2	same	same	different	same
3	same	same	same	different
4	same	same	same	same

3B If her results are reliable, the experiment shows that, compared with a shiny, silver surface, a dull, black surface is a . . .

1 better absorber of thermal radiation.

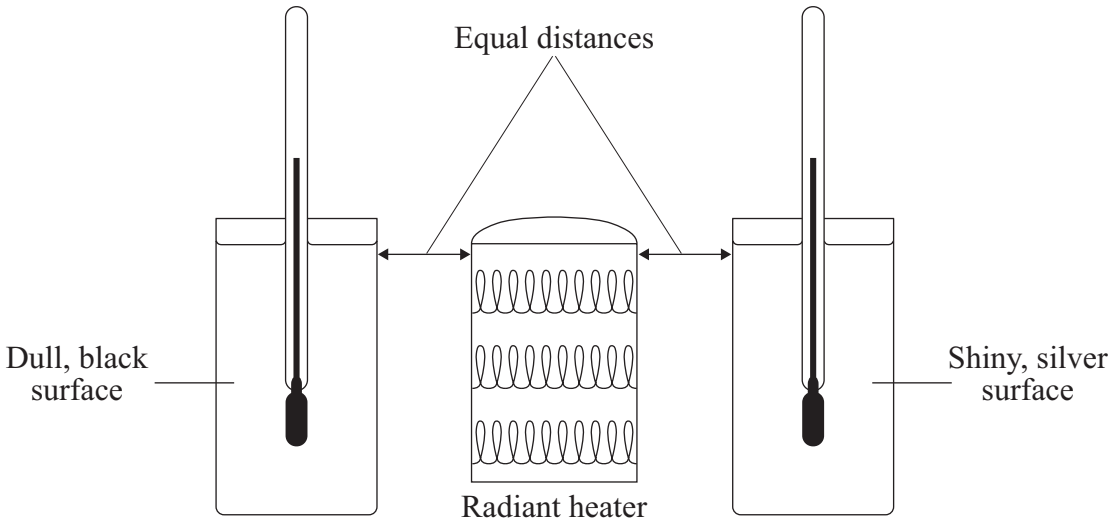
2 better conductor of thermal radiation.

3 better emitter of thermal radiation.

4 better reflector of thermal radiation

4.3.1.2 Changes of state

Question 03 · continued



In her second experiment, the student put cold water in each can. She put a heater (which is a source of thermal radiation) between the cans. She switched the heater on and, ten minutes later, she measured the temperature of the water in each can.

These are the results of her second experiment.

	Starting temperature of the water	Temperature of the water 10 minutes later
Can with dull, black surface	16 °C	37 °C
Can with shiny, silver surface	16 °C	23 °C

3C If her results are reliable, the second experiment shows that, compared with a shiny, silver surface, a dull, black surface is a . . .

1 better absorber of thermal radiation.

2 better conductor of thermal radiation.

3 better emitter of thermal radiation.

4 better reflector of thermal radiation.

3D What was the average (mean) rate of the rise in temperature of the water in the can with a dull, black surface?

1 0.9 °C per minute

2 2.1 °C per minute

3 9 °C per minute

4 21 °C per minute

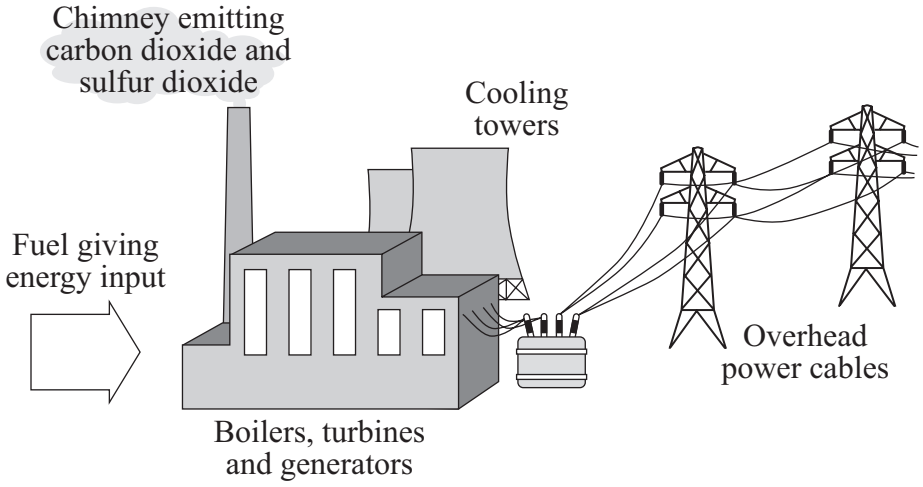
4.3.1.2 Changes of state

Question 04

June 2007 | PHY1A | Original Q5 | Legacy

QUESTION FIVE

The diagram shows a power station.



5A What type of power station is this?

1 coal-burning

2 gas-burning

3 geothermal

4 nuclear

5B Which part transforms kinetic energy into electrical energy?

1 boiler

2 cooling tower

3 generator

4 turbine

4.3.1.2 Changes of state

Question 04 · continued

5C After steam has passed through the turbines, it is passed upwards through the cooling towers. Here, the steam condenses to form water vapour.

What types of pollution are caused by the cooling towers?

1 chemical and noise

2 noise and thermal

3 thermal and visual

4 visual and chemical

5D A fossil-fuel power station is going to be built in a part of the country that does not have a power station.

Which one of the following is **not** an advantage to the local economy?

1 Carbon dioxide from the power station can be used in local commercial greenhouses.

2 More jobs will be created.

3 The power station will be connected to the National Grid.

4 Waste heat can be used in nearby buildings.

4.3.1.2 Changes of state

Question 05

June 2009 | PHY1AP | Original Q9 | Legacy

QUESTION NINE

The following information is from a leaflet produced by a double-glazing company.

Change your single-glazed windows to our energy-efficient double glazed windows and save a massive £167 a year

total cost	=	number of kilowatt-hours	×	cost per kilowatt-hour

9A The company assumes that energy costs 11p per kWh.

How much energy does the company claim would be saved each year by fitting its double-glazing?

1 15.2 kWh

2 1 520 kWh

3 1 837 kWh

4 183 700 kWh

9B Double glazing for a house costs £4000. A householder saves £200 in the first year after installing the double-glazing. Fuel prices rise steadily during that year.

The pay-back time is likely to be . . .

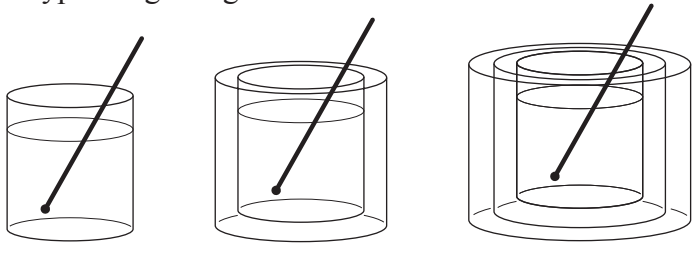
1 exactly 20 years.

2 more than 20 years if fuel prices continue to rise.

3 less than 20 years if fuel prices continue to rise.

4 less than 20 years if fuel prices fall steadily over the next few years.

9C Some students investigated the effectiveness of double and triple glazing. They let 100 cm^3 of boiling water cool in a glass beaker for 20 minutes. They repeated the cooling with the beaker placed inside another one and then inside two beakers. The students also looked up the U-value of different types of glazing on the Internet.



Single glazing | Double glazing | Triple glazing

Question 05 · continued

The results are shown in the table.

	Single glazing	Double glazing	Triple glazing
Temperature in °C after 20 minutes	68	81	88
U-value	1.0	0.5	0.3

Which of these conclusions should the students draw from their results?

1 Double glazing is more effective than triple glazing and a greater U-value means a larger heat loss.

2 Double glazing is more effective than triple glazing and a greater U-value means a smaller heat loss.

3 Triple glazing is more effective than double glazing and a smaller U-value means a larger heat loss.

4 Triple glazing is more effective than double glazing and a smaller U-value means a smaller heat loss.

9D One student stated that the investigation was not realistic. He said that:

- there is a difference between the area of a window and the surface area of the beakers
- the temperature difference across a window is different from the temperature difference across the beakers.

The table compares a window with the beakers in the experiment.

Which row in the table is correct?

	Surface area of window		Temperature difference across window	
	Compared with the beaker	**Effect on rate of heat transfer**	**Compared with the beaker**	**Effect on rate of heat transfer**
1	larger	slower	larger	slower
2	smaller	slower	larger	faster
3	larger	faster	smaller	slower
4	smaller	faster	smaller	faster

END OF TEST

4.3.1.2 Changes of state

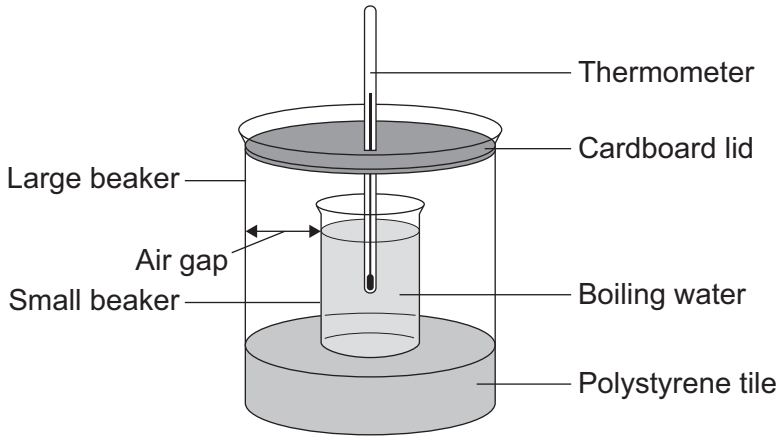
Question 06

November 2011 | PHY1AP | Original Q4 | Legacy

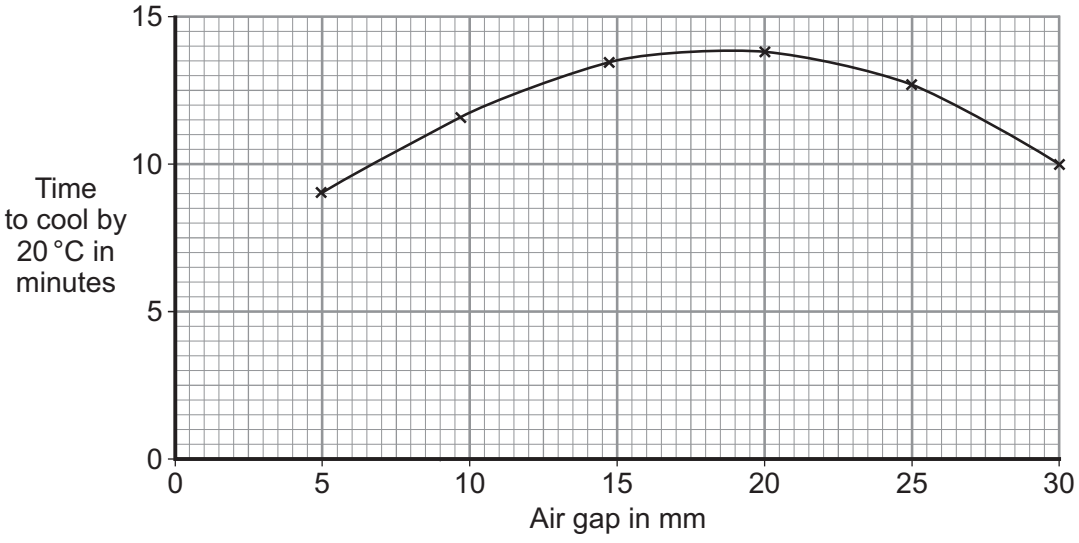
QUESTION FOUR

A student wanted to find out if the width of the air gap in a double-glazed window affects the rate of heat transfer through the window.

He predicted that the wider the air gap, the lower the rate of heat transfer. To test his prediction, he set up the following experiment.



- He put a small beaker inside a large beaker.
- He put 80 cm^3 of boiling water into the small beaker.
- He put a cardboard lid on the large beaker.
- He used a stopwatch to measure the time taken for the water to cool by 20 °C.
- He measured the diameter of each beaker and calculated the width of the air gap.
- He used different sizes of large beaker to change the width of the air gap. Each time, he used the same small beaker and the same thermometer.
- He plotted his results on a graph.



4.3.1.2 Changes of state

Question 06 · continued

4A Which was the independent variable in the experiment?

1 the time taken for the water to cool by 20 °C

2 the size of the small beaker

3 the size of the cardboard lid

4 the width of the air gap

4B Which of these helped to make the test fair?

1 He used the same small beaker each time and changed the large beaker.

2 He used the same large beaker each time and changed the small beaker.

3 He changed the size of both beakers to keep the same width of air gap each time.

4 He changed the size of both beakers to change the width of air gap every time.

4C The results did not support the student's prediction.

What should he do to improve the reliability of the experiment?

1 join the points on the graph dot to dot

2 repeat each measurement and calculate the mean

3 use a more accurate stopwatch

4 use a more accurate thermometer

4D Which of these conclusions can be made from the student's results?

1 The rate of cooling is greatest when the air gap is between 15 mm and 22 mm.

2 The wider the air gap, the faster the water cools.

3 The narrower the air gap, the faster the water cools.

4 The rate of cooling is least when the air gap is between 15 mm and 22 mm.

4.3.1.2 Changes of state

Question 07

June 2012 | PH1HP | Original Q4 | Legacy

4 Warm air inside a house contains water in the form of a gas. The water condenses onto cold surfaces such as windows. This leaves liquid water on the inside of the glass.

4 (a) Explain what happens to the particles when water changes from a gas to a liquid.

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(2 marks)

4 (b) Many houses in the UK have double-glazed windows.

Section through double-glazed window



U-value = 2.8 W/m^2 °C

Section through single-glazed window



U-value = 5.0 W/m^2 °C

If the window is double-glazed rather than single-glazed there is less condensation on the inside of the glass.

Explain why.

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(2 marks)

Question 4 continues on the next page

Question 07 · continued

4 (c) Double glazing can be made using two pieces of normal glass with an air gap between them. Better insulating glass (Superglaze or G-type) can be used instead of normal glass. The size of the air gap can also be increased to improve insulation.

A company making double glazing provides some information about their products.

U-values for different types of double glazing

	Normal glass	Superglaze	G-type
6 mm air gap	3.1	2.7	2.6
12 mm air gap	2.8	2.2	2.0
16 mm air gap	2.7	2.0	1.8

For the same size window, under the same temperature conditions, the energy loss halves if the U-value is halved.

Cost of double glazing in £ per m^2

	Normal glass	Superglaze	G-type
6 mm air gap	90	110	160
12 mm air gap	100	130	185
16 mm air gap	110	155	210

4.3.1.2 Changes of state

Question 07 · continued

4 (c) (i) The data the double glazing company produced is checked and confirmed independently by other scientists.

Suggest why it is important to confirm the data independently.

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(1 mark)

4 (c) (ii) A homeowner is going to replace his old single-glazed windows with new double-glazed windows.

Discuss the cost of fitting double glazing using better insulating glass compared with double glazing using normal glass.

Use the information given in the tables.

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(3 marks)

8

4.3.1.2 Changes of state

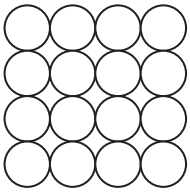
Question 08

January 2013 | PH1HP | Original Q7 | Legacy

7 According to kinetic theory, all matter is made up of small particles. The particles are constantly moving.

Diagram 1 shows how the particles may be arranged in a solid.

Diagram 1



7 (a) One kilogram of a gas has a much larger volume than one kilogram of a solid.

Use kinetic theory to explain why.

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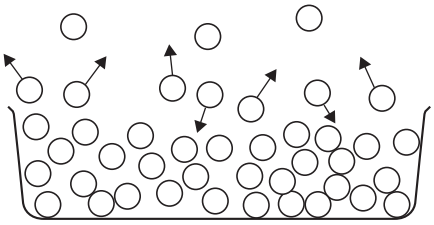
(4 marks)

4.3.1.2 Changes of state

Question 08 · continued

7 (b) **Diagram 2** shows the particles in a liquid. The liquid is evaporating.

Diagram 2



7 (b) (i) How can you tell from **Diagram 2** that the liquid is evaporating?

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(1 mark)

7 (b) (ii) The temperature of the liquid in the container decreases as the liquid evaporates.

Use kinetic theory to explain why.

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(3 marks)

8

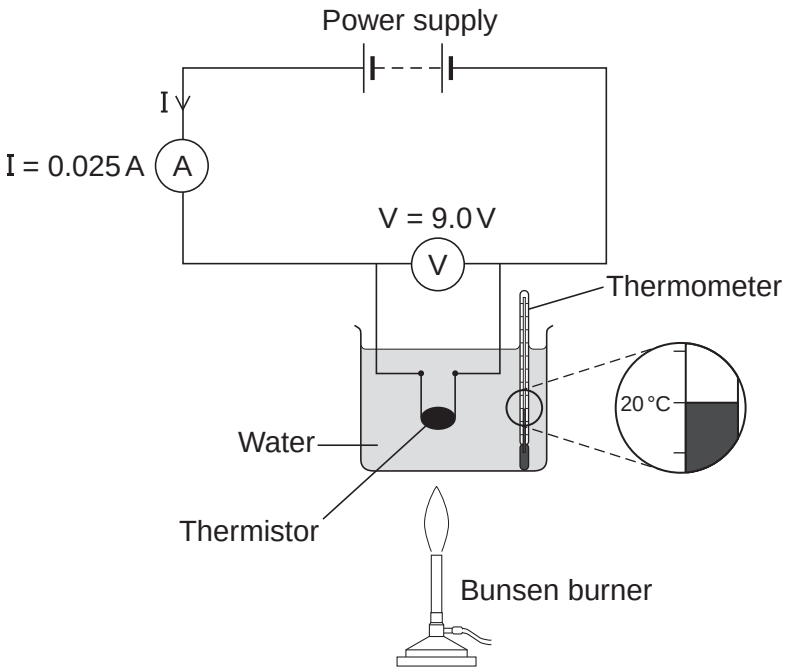
4.3.1.2 Changes of state

Question 09

June 2014 | PH2HP | Original Q4 | Legacy

4 (a) **Figure 4** shows the apparatus used to obtain the data needed to calculate the resistance of a thermistor at different temperatures.

Figure 4



4 (a) (i) In the box below, draw the circuit symbol for a thermistor.

[1 mark]

4 (a) (ii) Use the data given in **Figure 4** to calculate the resistance of the thermistor at 20 °C.

Use the correct equation from the Physics Equations Sheet.

[2 marks]

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Resistance = ... ohms

Question 4 continues on the next page

4.3.1.2 Changes of state

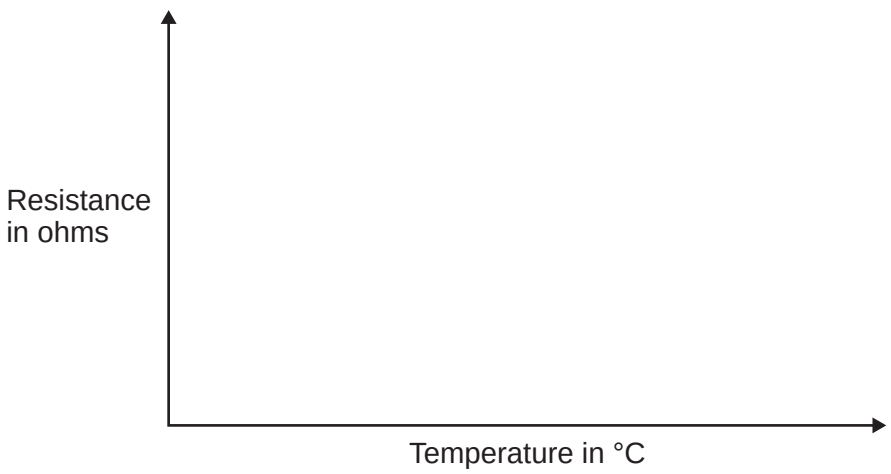
Question 09 · continued

4 (a) (iii) **Figure 5** shows the axes for a sketch graph.

Complete **Figure 5** to show how the resistance of the thermistor will change as the temperature of the thermistor increases from 20 °C to 100 °C.

[1 mark]

Figure 5



4 (a) (iv) Which **one** of the following is most likely to include a thermistor?

Tick (✓) **one** box.

[1 mark]

An automatic circuit to switch a plant watering system on and off. ☐

An automatic circuit to switch an outside light on when it gets dark. ☐

An automatic circuit to switch a heating system on and off. ☐

4 (b) The ammeter used in the circuit has a very low resistance.

Why is it important that ammeters have a very low resistance?

[1 mark]

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.....

4.3.1.2 Changes of state

Question 09 · continued

4 (c) **Table 2** gives the temperature of boiling water using three different temperature scales.

Table 2

Temperature	Scale
100	Celsius (°C)
212	Fahrenheit (°F)
80	Réaumur (°Re)

Scientists in different countries use the same temperature scale to measure temperature.

Suggest **one** advantage of doing this.

[1 mark]

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4 (d) A student plans to investigate how the resistance of a light-dependent resistor (LDR) changes with light intensity.

The student starts with the apparatus shown in **Figure 4** but makes three changes to the apparatus.

One of the changes the student makes is to replace the thermistor with an LDR.

Describe what other changes the student should make to the apparatus.

[2 marks]

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9

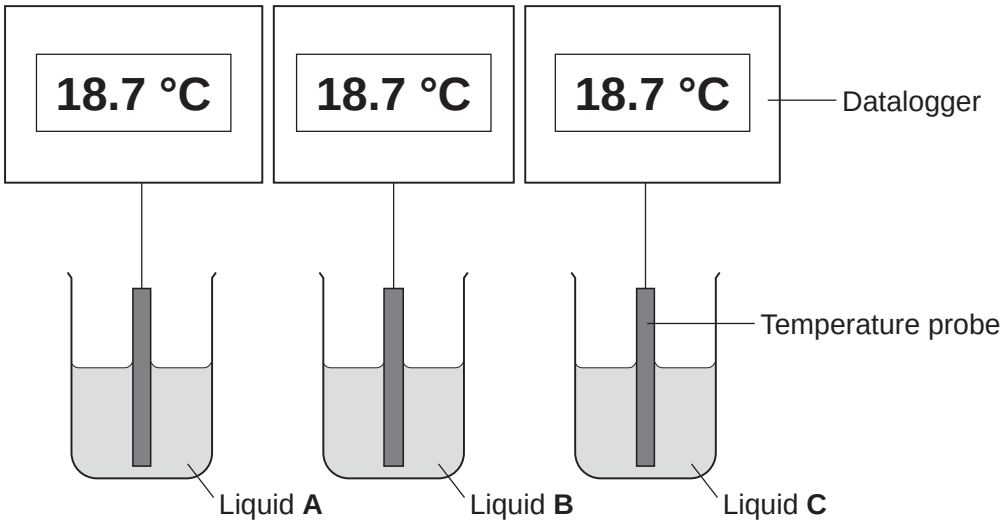
4.3.1.2 Changes of state

Question 10

June 2016 | PH1HP | Original Q7 | Legacy

7 A student investigated the cooling effect of evaporation.
She used the equipment in **Figure 6** to measure how the temperature of three different liquids changed as the liquids evaporated.

Figure 6



7 (a) The temperature and volume of each liquid was the same at the start of the investigation.

State **one** further control variable in this investigation.

[1 mark]

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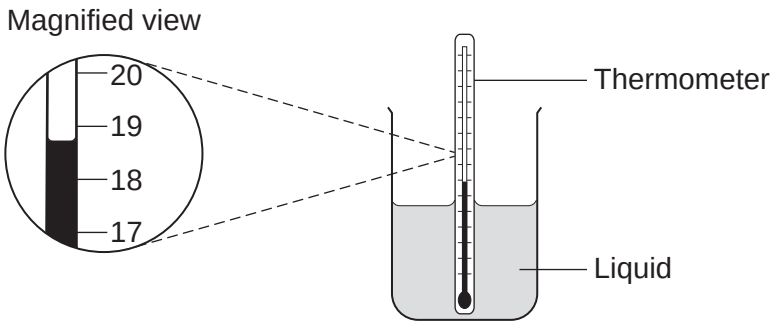
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4.3.1.2 Changes of state

Question 10 · continued

7 (b) Give **two** advantages of using dataloggers and temperature probes compared to using the thermometer shown in **Figure 7**.

Figure 7



[2 marks]

1 _____

_____

2 _____

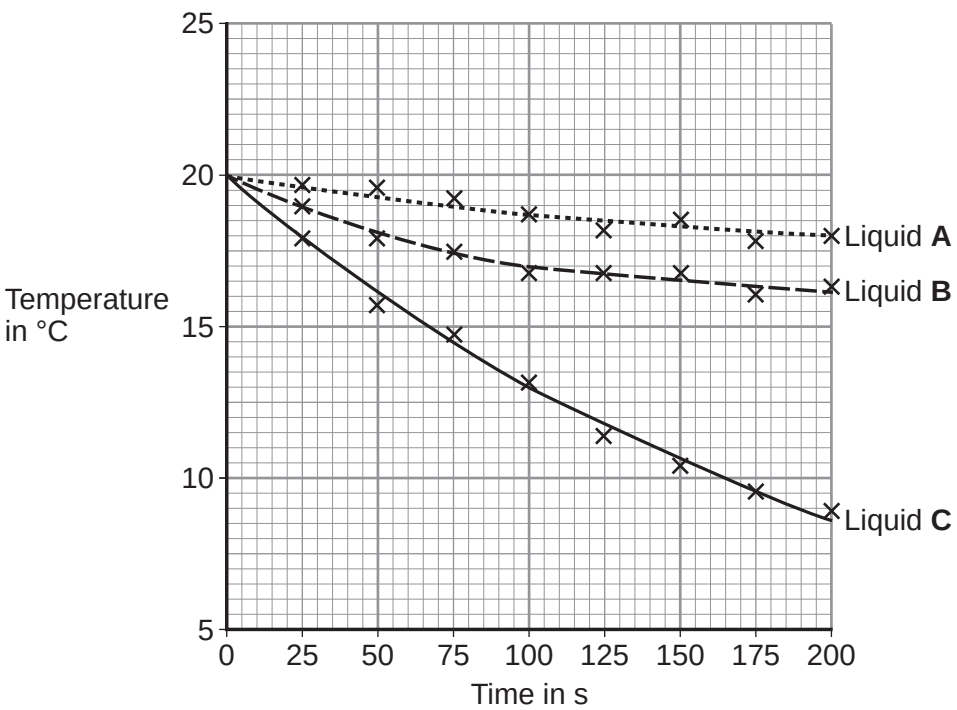
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Question 7 continues on the next page

Question 10 · continued

7 (c) The student's results are shown in **Figure 8**.

Figure 8



7 (c) (i) Calculate the average rate of temperature decrease of liquid **C** between 0 and 100 seconds.

[2 marks]

Average rate of temperature decrease = _____ °C / s

7 (c) (ii) Give **one** conclusion that can be made about the rate of temperature decrease of **all three** liquids from the results in **Figure 8**.

[1 mark]

4.3.1.2 Changes of state

Question 10 · continued

7 (c) (iii) Which liquid had the lowest rate of evaporation? Give a reason for your answer.

[1 mark]

Liquid _____

Reason _____

_____

7 (c) (iv) A second student did the same investigation but using a smaller volume of liquid than the first student.

All other variables were kept the same.

What effect would this have on the results of the second student's investigation?

[1 mark]

_____

_____

7 (d) Explain how the evaporation of a liquid causes the temperature of the remaining liquid to decrease.

[3 marks]

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11

4.3.1.2 Changes of state

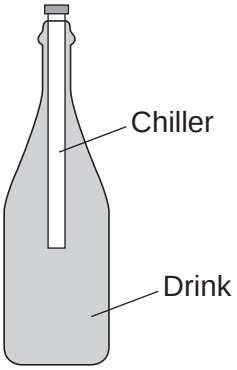
Question 11

June 2017 | PH1HP | Original Q8 | Legacy

8 **Figure 9** shows a drink chiller in use.

The cold drink chiller is inserted into a warm bottle of drink, so the temperature of the drink decreases.

Figure 9



8 (a) Explain how a convection current is formed in the drink in the bottle.

[4 marks]

4.3.1.2 Changes of state

Question 11 · continued

8 (b) As the chiller warms, the drink cools.

State how the rate of energy transfer from the drink to the chiller changes as the chiller warms.

Give a reason for your answer.

[2 marks]

8 (c) As the drink bottle cools down, water vapour in the air condenses on the outside of the bottle.

Explain why.

[3 marks]

9

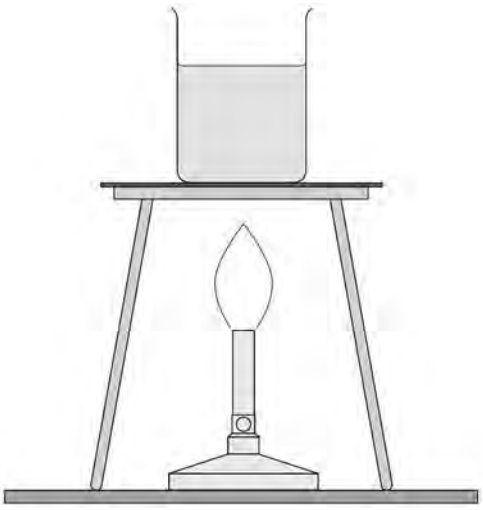
4.3.1.2 Changes of state

Question 12

June 2019 | 8463/1H | Original Q11

1 1 **Figure 14** shows a Bunsen burner heating some water in a beaker. Eventually the water changes into steam.

Figure 14



1 1 . 1 Explain how the internal energy of the water changes as it is heated from 20 °C to 25 °C

[2 marks]

1 1 . 2 How is the particle model used to explain the difference in density between a liquid and a gas?

[1 mark]

Tick (✓) **one** box.

- Particles in a gas have less kinetic energy than particles in a liquid. ☐
- Particles in a gas have more potential energy than particles in a liquid. ☐
- Particles in a liquid are further apart than particles in a gas. ☐
- Particles in a liquid are larger than particles in a gas. ☐

4.3.1.2 Changes of state

Question 12 · continued

11.3 A student measured the mass of boiling water that was turned into steam in five minutes.

Explain how the student could use this information to estimate the power output of the Bunsen burner in watts.

[4 marks]

7

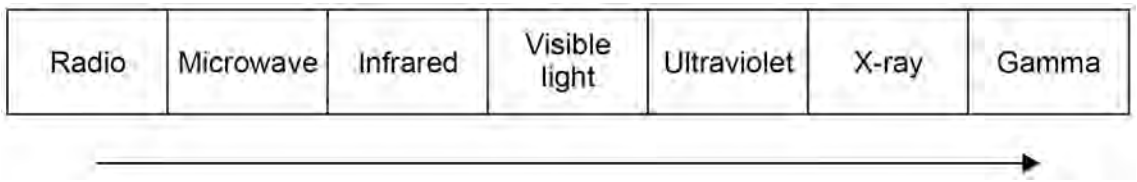
4.3.1.2 Changes of state

Question 13

June 2019 | 8463/2H | Original Q7

0 7 . 1 **Figure 12** shows the electromagnetic spectrum.

Figure 12



Which statement is correct for the direction of the arrow in **Figure 12**?

[1 mark]

Tick (✓) **one** box.

- The wavelength decreases and the wave speed in air increases. ☐
- The frequency increases and the wavelength increases. ☐
- The frequency increases and the wave speed in air stays the same. ☐
- The wavelength increases and the wave speed in air increases. ☐

0 7 . 2 Explain how the properties of X-rays make them suitable for the medical imaging of bones.

[2 marks]

Question 7 continues on the next page

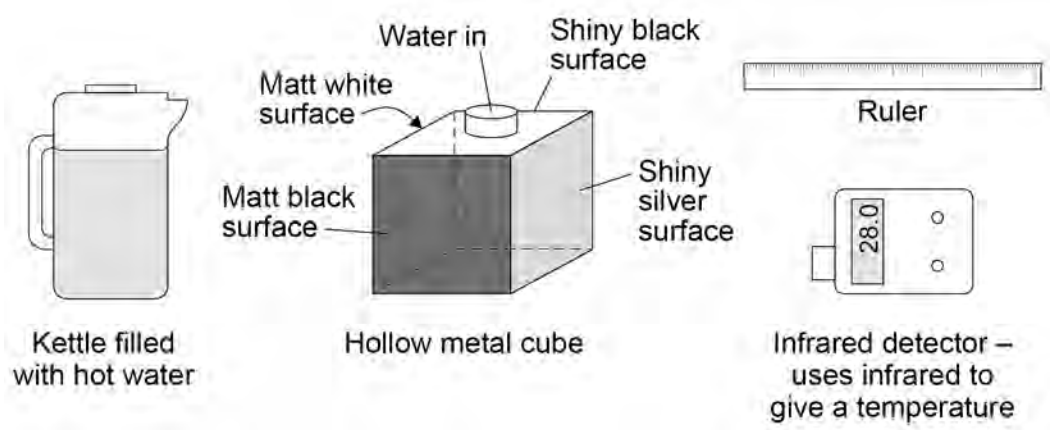
Question 13 · continued

A student investigated the infrared radiation emitted from the sides of a hollow metal cube.

The sides of the cube are different colours or textures.

Figure 13 shows the equipment used.

Figure 13



Boiling water was poured into the cube. The amount of infrared radiation emitted from each vertical surface was then measured.

0 7 . 3 Boiling water is a hazard in this investigation.

Suggest how the risk of harm could be reduced in this investigation.

[1 mark]

0 7 . 4 What is the control variable in this investigation?

[1 mark]

Question 13 · continued

Table 2 shows the results.

Table 2

Type of surface	Temperature in °C
Matt black	68.0
Matt white	65.5
Shiny black	66.3
Shiny silver	28.0

0 7 . 5 The four temperature values in **Table 2** cannot be used to show that the infrared detector gives precise readings.

Give the reason why.

[1 mark]

0 7 . 6 The student looked at the data in **Table 2** and concluded:

'A black surface always emits more infrared radiation than a white surface.'

Explain how using an infrared detector with a resolution of 1 °C would have affected the student's conclusion.

[2 marks]

4.3.1.2 Changes of state

Question 13 · continued

Albedo is a measure of the amount of solar radiation reflected by an object compared to the total solar radiation incident on the object.

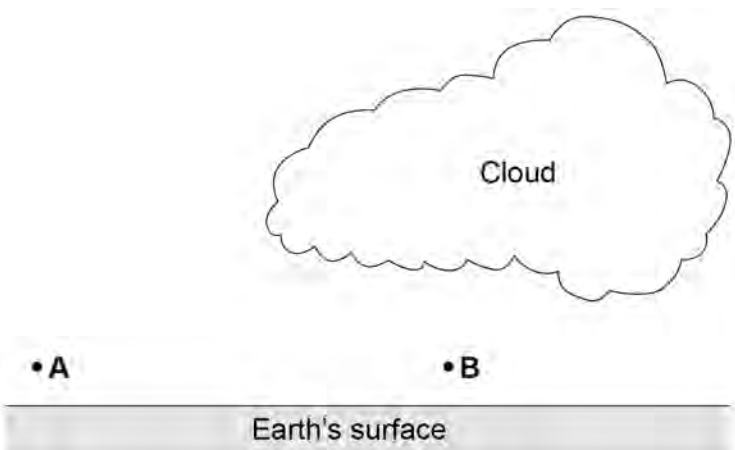
A perfect reflector has an Albedo value of 1.0
A perfect absorber has an Albedo value of 0.0

0 7 . 7 What is the Albedo value of a perfect black body?

[1 mark]

0 7 . 8 **Figure 14** shows two points, **A** and **B**, just above the Earth's surface.

Figure 14



The average Albedo value of the Earth's surface is 0.3
The Albedo value of thick cloud varies between 0.6 and 0.9

At night the air at point **A** cools faster than the air at point **B**.

Explain why.

[3 marks]

12

4.3.1.2 Changes of state

Question 14

November 2021 | 8463/1H | Original Q11

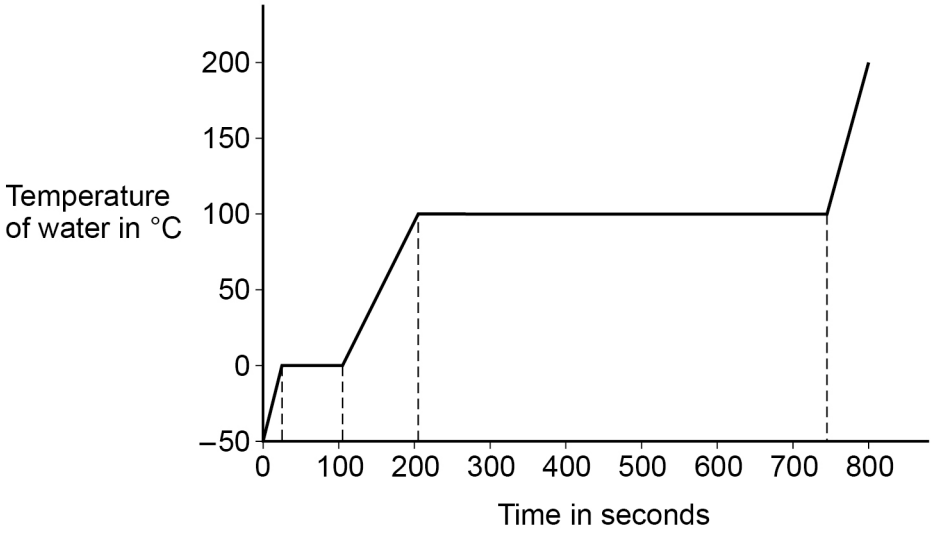
1 1 A student investigated how the temperature of a lump of ice varied as the ice was heated.

The student recorded the temperature until the ice melted and then the water produced boiled.

Figure 17 shows the student's results.

The power output of the heater was constant.

Figure 17



1 1 . 1 The specific heat capacity of ice is less than the specific heat capacity of water.

Explain how **Figure 17** shows this.

[2 marks]

4.3.1.2 Changes of state

Question 14 · continued

11.2 The specific latent heat of fusion of ice is less than the specific latent heat of vaporisation of water.

Explain how **Figure 17** shows this.

[2 marks]

11.3 A second student did the same investigation and recorded the temperature until the water produced boiled.

In the second student's investigation more thermal energy was transferred to the surroundings.

Describe **two** ways the results of the experiment in **Figure 17** would have been different.

[2 marks]

1

2

Question 11 continues on the next page

4.3.1.2 Changes of state

Question 14 · continued

11.4 When the water was boiling, 0.030 kg of water turned into steam.

The energy transferred to the water was 69 kJ.

Calculate the specific latent heat of vaporisation of water.

Give the unit.

[5 marks]

Specific latent heat of vaporisation = _____

Unit _____

11

4.3.1.2 Changes of state

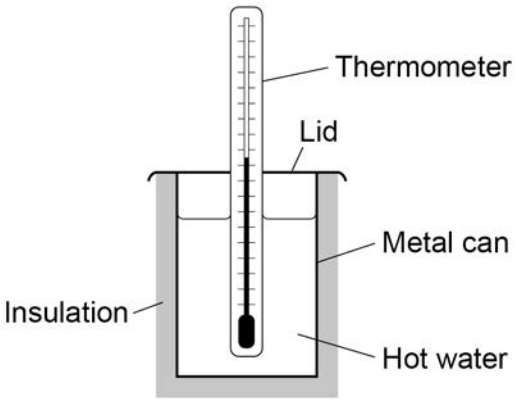
Question 15

June 2022 | 8463/1H | Original Q4

0 4 A student investigated the insulating properties of different materials.

Figure 4 shows some of the equipment used by the student.

Figure 4



This is the method used:

1. Wrap insulating material around the can.
2. Put a fixed volume of boiling water in the can.
3. Place the lid on the top of the can.
4. Measure the time taken for the temperature of the water to decrease by a fixed amount.
5. Repeat steps 1–4 using the same thickness of different insulating materials.

0 4 . 1 Identify the independent variable and the dependent variable in this investigation.

[2 marks]

Independent variable _____

Dependent variable _____

The student used two different types of thermometer to measure the temperature changes.

Figure 5 shows a reading on each thermometer.

Figure 5



0 4 . 2 What is the resolution of thermometer **B**?

[1 mark]

Resolution = _____ °C

0 4 . 3 Thermometer **A** is more likely to be misread.

Give **one** reason why.

[1 mark]

_____

_____

_____

Question 4 continues on the next page

4.3.1.2 Changes of state

Question 15 · continued

0 4 . 4 For one type of insulating material, the temperature of the water decreased from 85.0 °C to 65.0 °C.

The energy transferred from the water was 10.5 kJ.

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

Calculate the mass of water in the can.

Use the Physics Equations Sheet.

[3 marks]

Mass = _____ kg

4.3.1.2 Changes of state

Question 15 · continued

0 4 . 5 **Table 2** shows the results for two insulating materials.

Table 2

Material	Time for temperature to decrease by 20 °C in seconds
X	450
Y	745

Explain how the results in **Table 2** can be used to compare the thermal conductivity of the two materials.

[2 marks]

9

4.3.1.2 Changes of state

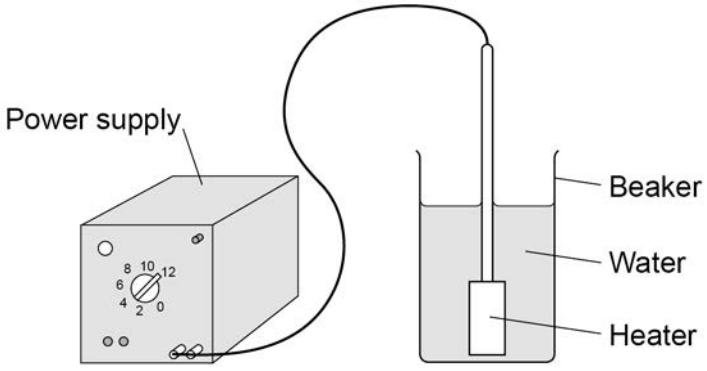
Question 16

June 2022 | 8463/1H | Original Q8

0 8 A student determined the specific latent heat of vaporisation of water.

Figure 9 shows some of the equipment used.

Figure 9



This is the method used:

1. Put 50 cm^3 of water in a beaker.
2. Measure the mass of the beaker and water.
3. Use a heater to boil the water and keep it boiling for 600 seconds.
4. Measure the mass of the beaker and water after 600 seconds.

0 8 . 1 What measuring instrument should be used to measure the volume of water?

[1 mark]

0 8 . 2 What is a hazard in the student's investigation?

[1 mark]

Tick (✓) **one** box.

- burns ☐
- boiling water ☐
- heatproof gloves ☐
- safety goggles ☐

Question 16 · continued

0 8 . 3 The initial mass of the beaker and water was 0.080 kg.

The final mass of the beaker and water was 0.071 kg.

The energy transferred by the immersion heater as the water boiled was 25 200 J.

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

Give the unit.

Use the Physics Equations Sheet.

[5 marks]

Specific latent heat of vaporisation = _____ Unit _____

Question 8 continues on the next page

4.3.1.2 Changes of state

Question 16 · continued

0 8 . 4 Some thermal energy was transferred to the surroundings while the water was being heated.

Explain how this affected the student's value for the specific latent heat of vaporisation of water.

[2 marks]

0 8 . 5 Some of the water evaporated before its temperature reached 100 °C.

Explain how this affected the student's value for the specific latent heat of vaporisation of water.

[2 marks]

11

4.3.1.2 Changes of state

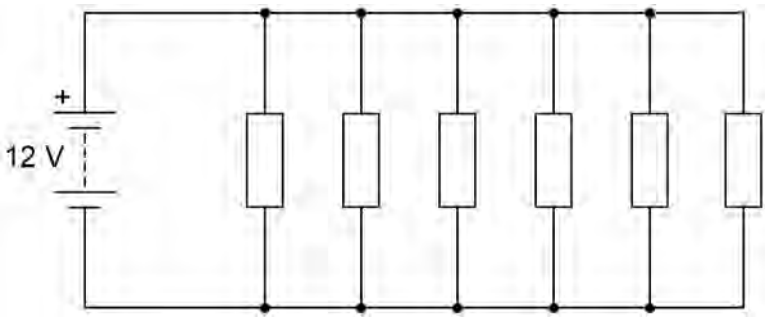
Question 17

June 2023 | 8463/1H | Original Q3

0 3 **Figure 4** shows an electrical circuit used to heat the windscreen of a car.

Each resistor in the circuit represents a heating element.

Figure 4



0 3 . 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 **03.2** and **03.3**.

0 3 . 2 Which equation links charge flow (Q), energy (E) and potential difference (V)?

[1 mark]

Tick (✓) **one** box.

$E = \frac{V}{Q}$ ☐

$E = QV$ ☐

$E = \frac{Q}{V}$ ☐

$E = \frac{V^2}{Q}$ ☐

4.3.1.2 Changes of state

Question 17 · continued

0 3 . 3 Calculate the charge flow through the 12 V battery when the battery transfers 5010 J of energy.

[3 marks]

Charge flow = _____ C

0 3 . 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

4.3.1.2 Changes of state

Question 17 · continued

0 3 . 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

4.3.1.2 Changes of state

Question 18

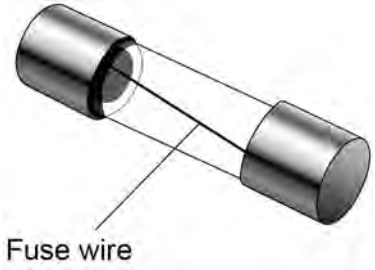
June 2024 | 8463/1H | Original Q10

1 0 The live wire in a three-core cable is connected to a fuse inside a plug.

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

Figure 17 shows a fuse.

Figure 17



1 0 . 1 What colour is the insulation covering the live wire in a three-core cable?

[1 mark]

1 0 . 2 Draw the circuit symbol for a fuse in the box below.

[1 mark]

4.3.1.2 Changes of state

Question 18 · continued

1 0 . 3 The fuse wire melts when there is a charge flow of 2.0 C for 400 ms.

Calculate the current in the fuse wire.

Use the Physics Equations Sheet.

[4 marks]

Current = _____ A

1 0 . 4 When the fuse wire is at its melting point, the additional energy needed to melt the wire is 1.02 J.

specific latent heat of fuse wire = 60 kJ/kg

Calculate the mass of the fuse wire.

Use the Physics Equations Sheet.

[4 marks]

Mass = _____ kg

Question 10 continues on the next page

4.3.1.2 Changes of state

Question 18 · continued

1 0 . 5 The calculation in Question **10.4** assumes there is no energy transferred to the surroundings.

How would the time taken for the wire to melt be affected if some energy was transferred to the surroundings?

Give a reason for your answer.

[2 marks]

Tick (✓) **one** box.

Time taken would decrease ☐

Time taken would stay the same ☐

Time taken would increase ☐

Reason _____

_____

_____

12

4.3.1.2 Changes of state

Question 19

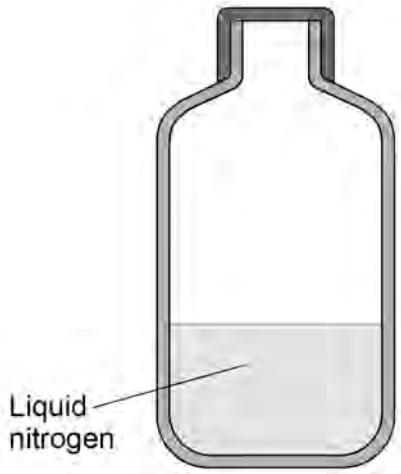
June 2025 | 8463/1H | Original Q8

0 8 A scientist poured some liquid nitrogen into a container.

The container was then sealed.

Figure 10 shows the container.

Figure 10



0 8 . 1 The liquid nitrogen was at its boiling point.

When 9950 J of thermal energy was transferred to the liquid nitrogen, 50 g of the nitrogen turned into a gas.

Calculate the specific latent heat of vaporisation of nitrogen.

Use the Physics Equations Sheet.

[4 marks]

Specific latent heat of vaporisation = _____ J/kg

4.3.1.2 Changes of state

Question 19 · continued

0 8 . 2 Explain how the internal energy of the nitrogen changed as the nitrogen turned from a liquid to a gas.

[3 marks]

0 8 . 3 After the nitrogen had boiled, the temperature of the gas increased.

Explain how the pressure in the container changed as the temperature increased.

[4 marks]

11