AQA GCSE Physics | 8463

SPECIFICATION POINT 4.3.2.3

Changes of state and specific latent heat

Past-paper questions

Tier	**Higher**
Question groups	**9**
Available paper years	**2007–2025**

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.

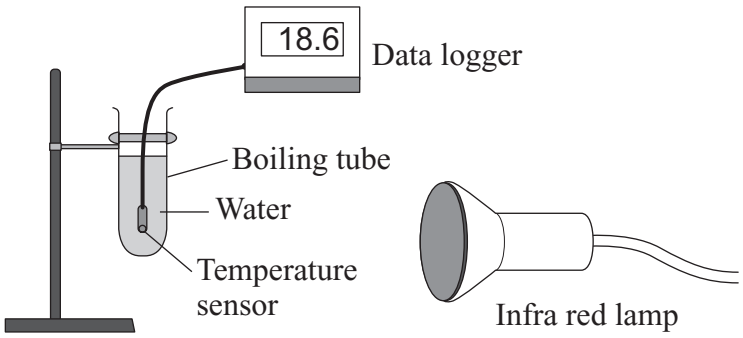
4.3.2.3 Changes of state and specific latent heat

Question 01

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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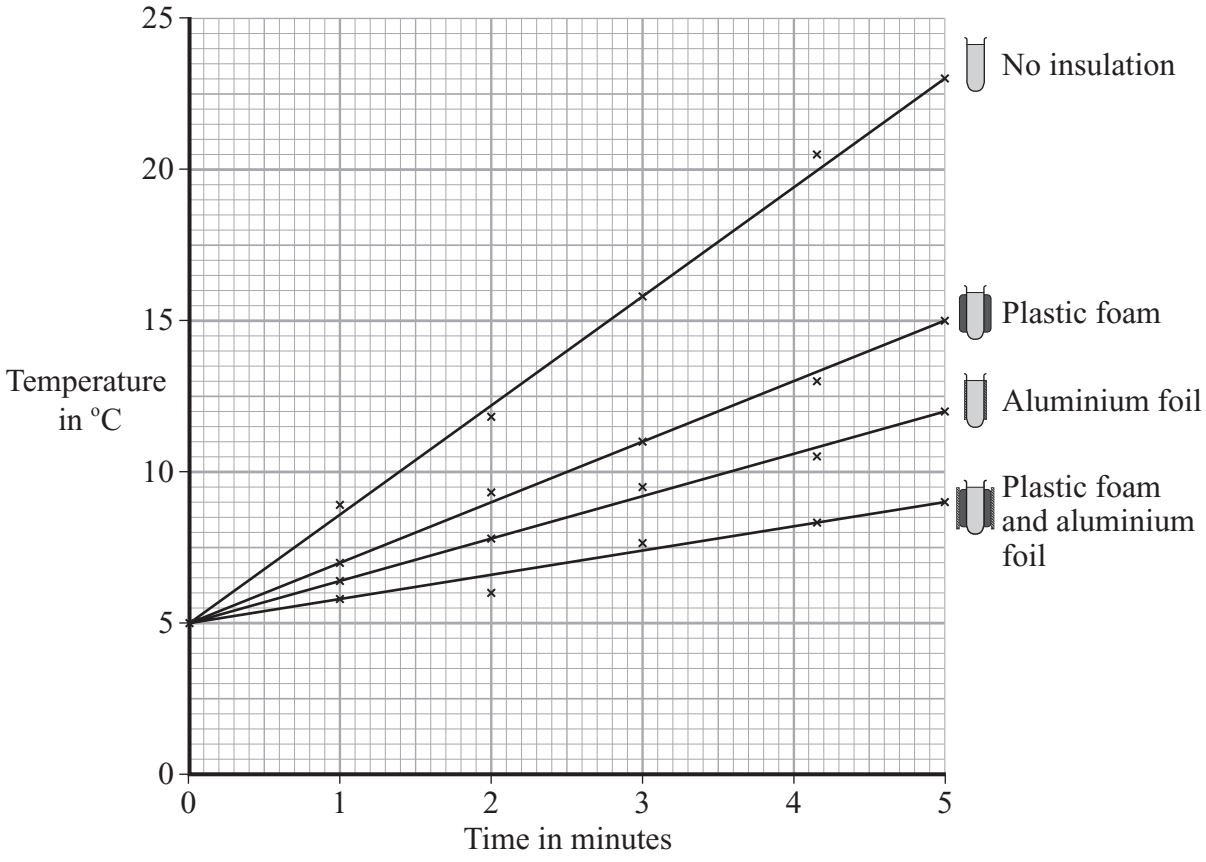
(1 mark)

4.3.2.3 Changes of state and specific latent heat

Question 01 · 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

4.3.2.3 Changes of state and specific latent heat

Question 01 · 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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.....

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(2 marks)

9

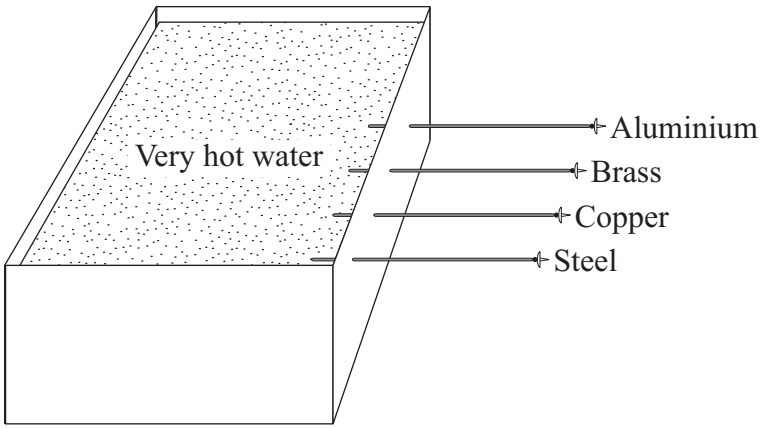
4.3.2.3 Changes of state and specific latent heat

Question 02

November 2009 | PHY1AP | Original Q3 | Legacy

QUESTION THREE

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.



3A 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

3B 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

3C 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

3D 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

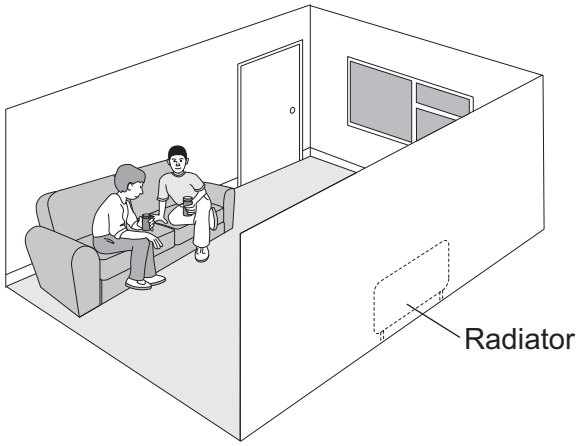
4 the reliability

4.3.2.3 Changes of state and specific latent heat

Question 03

January 2011 | PHY1H | Original Q5 | Legacy

5 (a) The diagram shows the position of a radiator inside a room. The radiator is made from metal and is painted white.



5 (a) (i) Heat is transferred from the hot water inside the metal radiator to the air touching the outside surface of the radiator.

What name is given to this method of heat transfer?

.....

(1 mark)

5 (a) (ii) Explain, in terms of the particles in the metal, how heat is transferred through the radiator.

.....

.....

.....

.....

(2 marks)

5 (a) (iii) What name is given to the main method by which heat is transferred from the radiator to the people on the other side of the room?

.....

(1 mark)

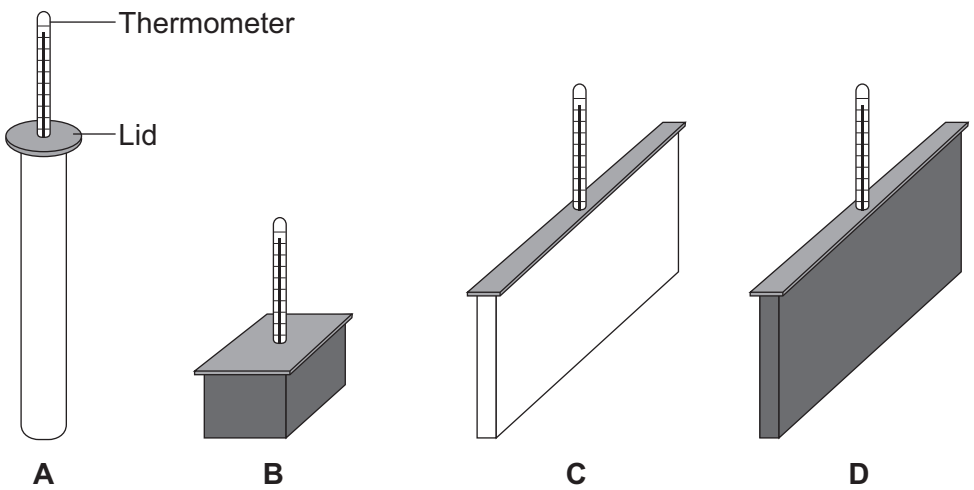
Question 5 continues on the next page

4.3.2.3 Changes of state and specific latent heat

Question 03 · continued

5 (b) A student investigated the effect of shape and colour on heat transfer.

The student used metal containers with the same volume but with different shapes and outside colour. The containers were each filled with water at 100 °C.
After 20 minutes the temperature of the water inside each container was measured.



The results from the investigation are given in the table.

Container	Colour	Temperature after 20 minutes in °C	Temperature fall in °C
A	White	86	14
B	Black	86	14
C	White	73	27
D	Black	60	40

5 (b) (i) The student uses the results in the table to see if shape has affected heat transfer.

Which containers should the student compare to do this?

.....

Give a reason for your answer.

.....

.....

(1 mark)

4.3.2.3 Changes of state and specific latent heat

Question 03 · continued

5 (b) (ii) Explain why the temperature of the water in both containers **A** and **B** fell by the same amount.

.....

.....

.....

.....

(2 marks)

5 (b) (iii) A central heating system has several radiators joined together. The hot water goes from the boiler, through each radiator in turn and then back to the boiler for reheating.

Give **one** reason, other than appearance, why it might **not** be a good idea to paint radiators black.

.....

.....

(1 mark)

8

4.3.2.3 Changes of state and specific latent heat

Question 04

0 8 A student investigated the thermal conductivity of different metals.

This is the method used:

1. Measure the mass of an ice cube.
2. Put the ice cube on a metal block which is at room temperature.
3. Measure the mass of the ice cube after one minute.
4. Repeat with other blocks of the same mass made from different metals.

Figure 10



Table 3 shows the student's results.

Table 3

Metal	Initial mass of ice cube in grams	Final mass of ice cube in grams	Change in mass of ice cube in grams
Aluminium	25.85	21.14	4.71
Copper	26.20	20.27	5.93
Lead	25.53	21.97	3.56
Steel	24.95	19.45	5.50

4.3.2.3 Changes of state and specific latent heat

Question 04 · continued

0 8 . 1 The initial temperature of each ice cube was –15 °C

Why was it important that the initial temperature of each ice cube was the same?

[1 mark]

Tick (✓) **one** box.

- Initial temperature was a continuous variable. ☐
- Initial temperature was a control variable. ☐
- Initial temperature was the dependent variable. ☐
- Initial temperature was the independent variable. ☐

0 8 . 2 Which metal had the highest thermal conductivity?

Give a reason for your answer.

[2 marks]

Metal: _____

Reason: _____

_____

_____

0 8 . 3 Suggest **one** source of random error in the student's investigation.

[1 mark]

_____

_____

_____

_____

4.3.2.3 Changes of state and specific latent heat

Question 04 · continued

0 8 . 4 An ice cube has a temperature of –15.0 °C

The total thermal energy needed to raise the temperature of this ice cube to 0.0 °C and completely melt the ice cube is 5848 J

specific heat capacity of ice = 2100 J/kg °C
specific latent heat of fusion of ice = 334 000 J/kg

Calculate the mass of the ice cube.

[5 marks]

Mass of ice cube = _____ kg

9

4.3.2.3 Changes of state and specific latent heat

Question 05

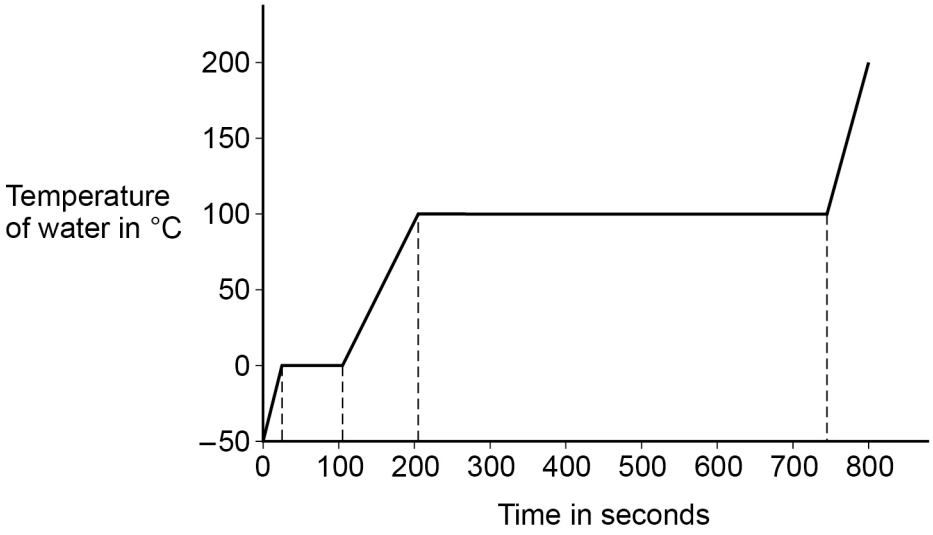
1 1 A student investigated how the temperature of a lump of ice varied as the ice was heated.

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]

4.3.2.3 Changes of state and specific latent heat

Question 05 · continued

1 1 . 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]

1 1 . 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

4.3.2.3 Changes of state and specific latent heat

Question 05 · 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

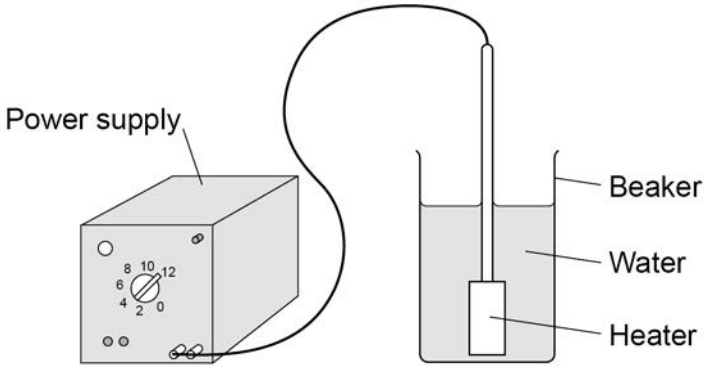
4.3.2.3 Changes of state and specific latent heat

Question 06

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 ☐

4.3.2.3 Changes of state and specific latent heat

Question 06 · 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

4.3.2.3 Changes of state and specific latent heat

Question 06 · 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

4.3.2.3 Changes of state and specific latent heat

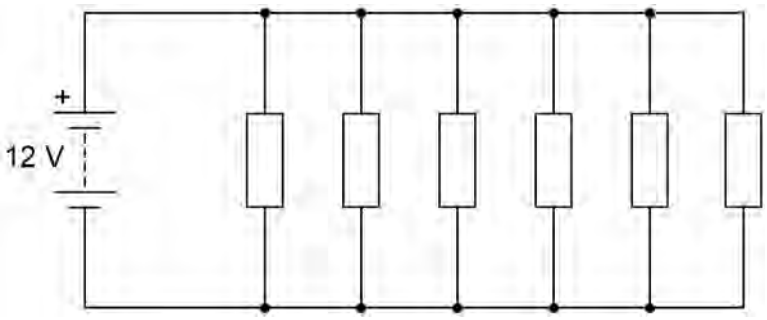
Question 07

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.

$E = \frac{V}{Q}$ ☐

$E = QV$ ☐

$E = \frac{Q}{V}$ ☐

$E = \frac{V^2}{Q}$ ☐

4.3.2.3 Changes of state and specific latent heat

Question 07 · 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

4.3.2.3 Changes of state and specific latent heat

Question 07 · 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

4.3.2.3 Changes of state and specific latent heat

Question 08

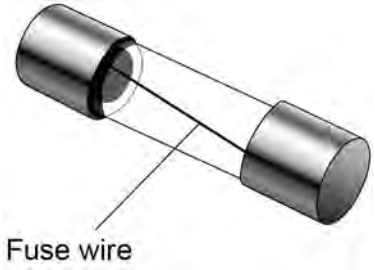
June 2024 | 8463/1H | Original Q10

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]

4.3.2.3 Changes of state and specific latent heat

Question 08 · continued

10.3 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

10.4 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

4.3.2.3 Changes of state and specific latent heat

Question 08 · 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

4.3.2.3 Changes of state and specific latent heat

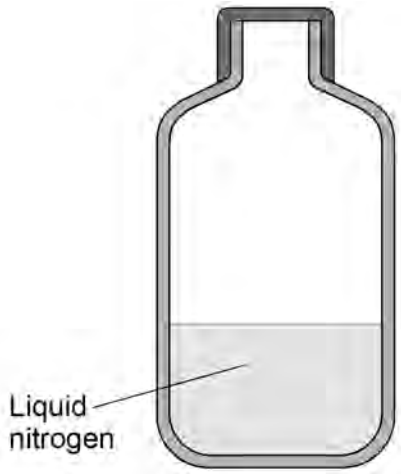
Question 09

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

4.3.2.3 Changes of state and specific latent heat

Question 09 · 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