3.2 Internal Energy & Energy Transfers

Question Paper

Course	AQA GCSE Physics
Section	3. Particle Model of Matter
Topic	3.2 Internal Energy & Energy Transfers
Difficulty	Medium

Time allowed: 60

Score: /44

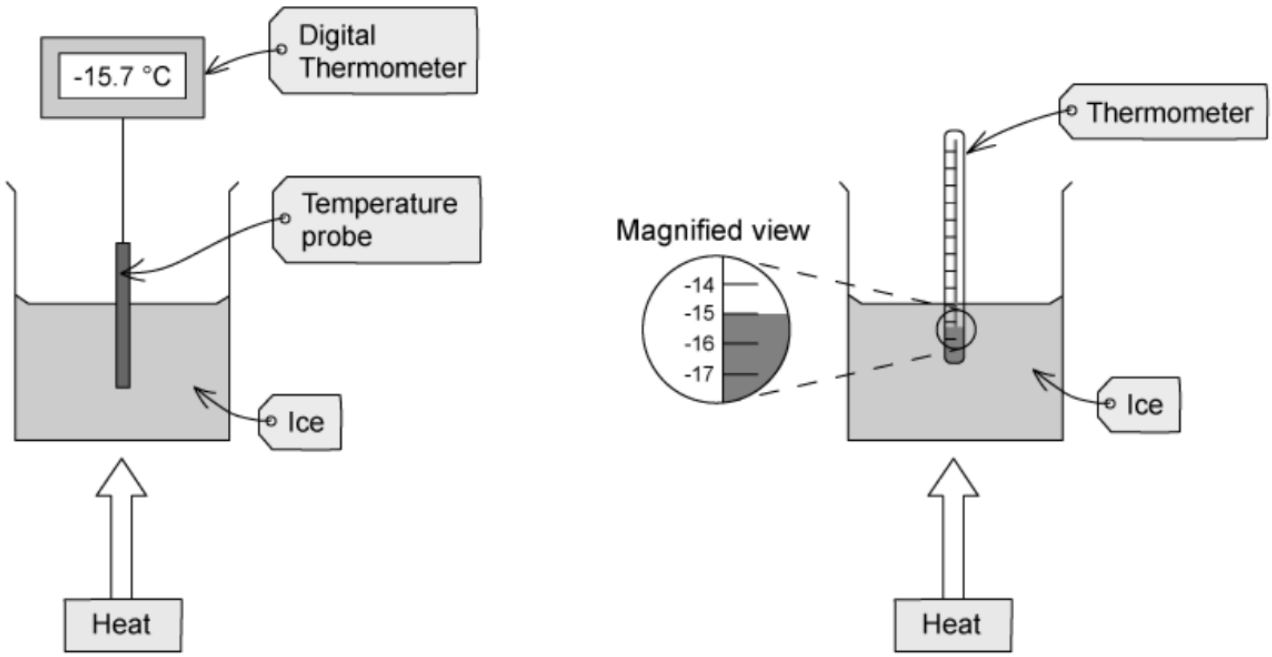
Percentage: /100

Question 1a

A student decides to compare two different methods for recording how the temperature of H_2O changes over a 30 minute period as it turns from ice to water.

Figure 1 shows the two sets of apparatus used by the student.

Figure 1



(a) State two advantages of using the digital thermometer rather than the analogue thermometer.

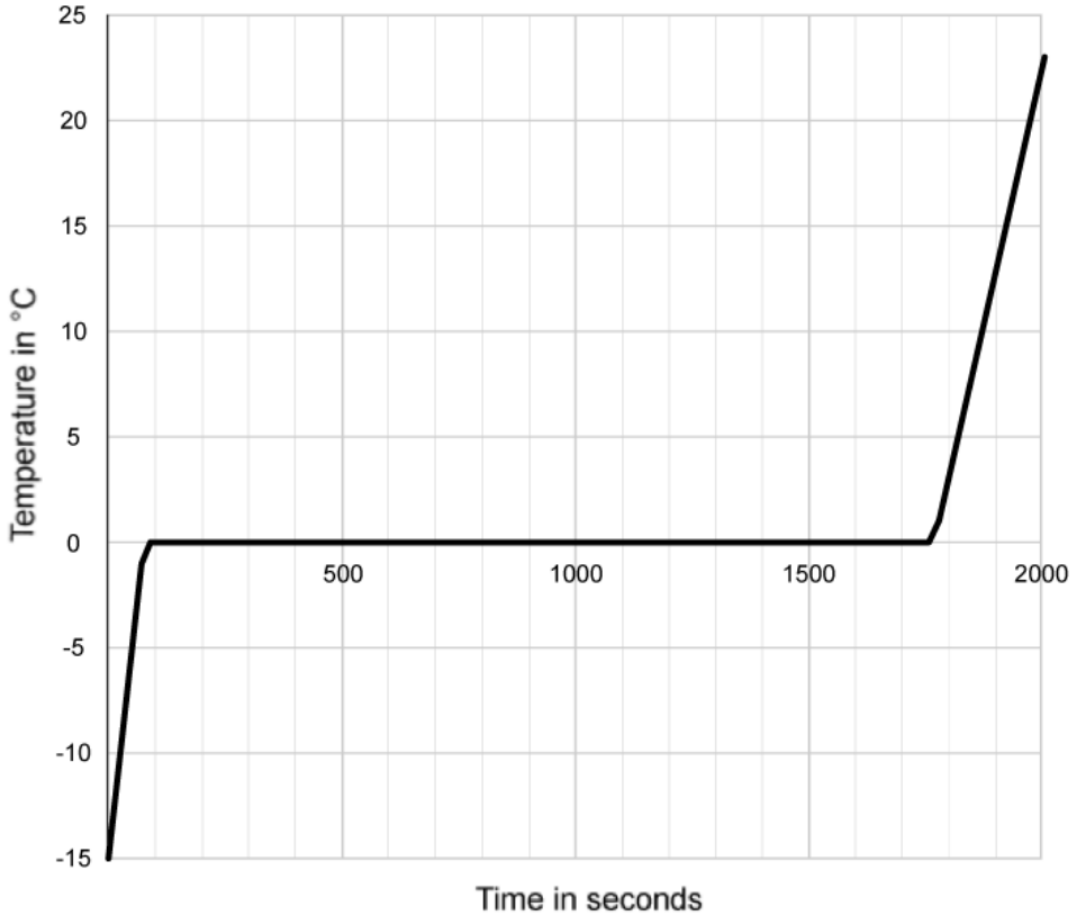
[2 marks]

[2 marks]

Question 1b

(b) The results obtained by the student are shown in **Figure 2**.

Figure 2



What was the change in temperature between 0 and 80 seconds?

[1 mark]

[1 mark]

Question 1c

(c) Using **Figure 2**, determine how long it took for the water to change from a solid to a liquid.

[1 mark]

Time = _____ seconds

[1 mark]

Question 1d

(d) Calculate the energy transferred to the ice as 0.25 kg of ice was heated from $-15°C$ to $0°C$.

The specific heat capacity of ice is 2050 J / kg °C.

[3 marks]

[3 marks]

Question 1e

(e) 83 500 J of energy was transferred to the ice as it changed from solid to liquid.

Calculate the latent heat of fusion of ice.

[3 marks]

[3 marks]

Question 1f

(f) After 1760 seconds the temperature of the water began to increase again.

Explain why.

[2 marks]

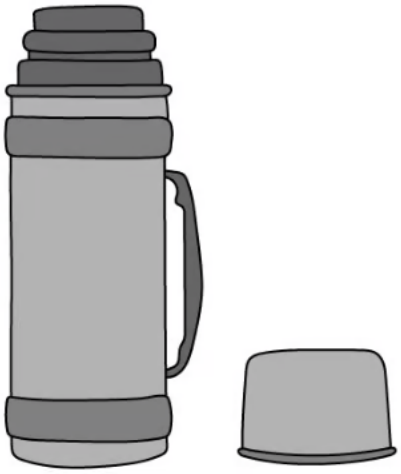
[2 marks]

Question 2a

A thermos flask, as shown in **Figure 3**, is designed to minimise the transfer of thermal energy between the contents and the surroundings.

The claim made by the manufacturer is that the thermos can keep hot water warm for up to 6 hours.

Figure 3



a) 14 800 J of energy are transferred from the thermos to the surroundings in 6 hours.

The mass of water in the flask is 360 g

The specific heat capacity of water is 4200 J / kg $°C$

The initial temperature of the water is $95°C$

Calculate the temperature of water in the flask after 6 hours, and state whether or not you agree with the manufacturer's claim.

[4 marks]

[4 marks]

Question 2b

b) By how much has the internal energy of the water in the flask changed?

[1 mark]

[1 mark]

Question 3a

a) What is meant by 'specific latent heat of vaporisation'?

[2 marks]

[2 marks]

Question 3b

b) When the water in a saucepan boils, 0.074 kg of water changes to steam.

Calculate the amount of energy required for this change.

Specific latent heat of vaporisation of water = 2.3×10^6 J / kg.

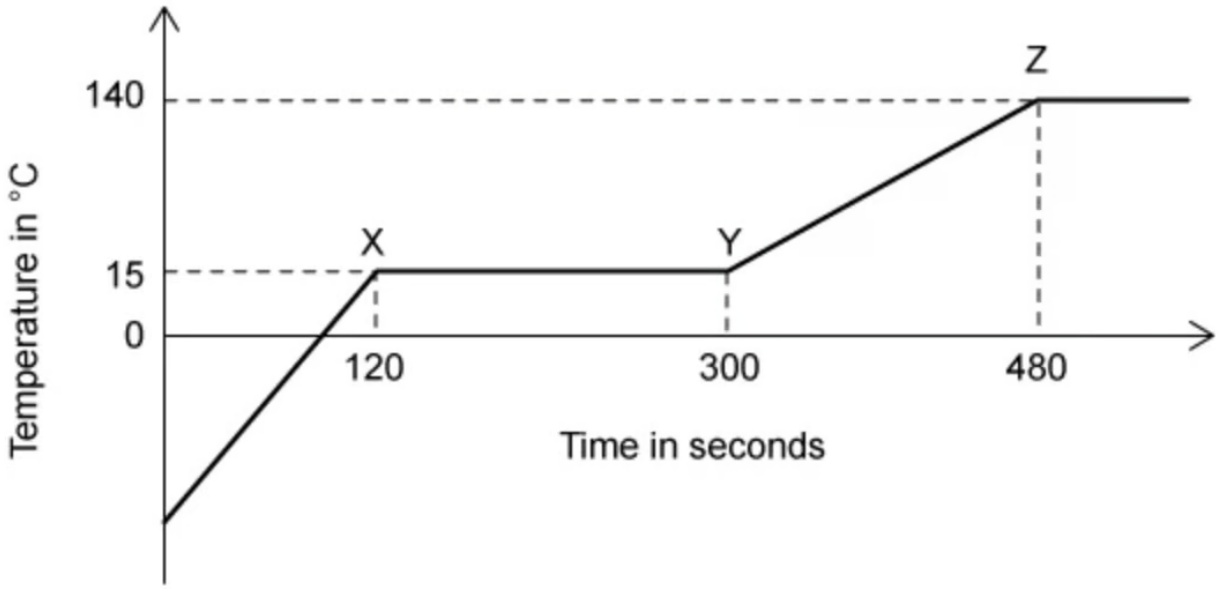
[2 marks]

[2 marks]

Question 3c

c) The graph in **Figure 4** shows how the temperature of a substance changes as it is heated.

Figure 4



Explain what is happening to the substance in sections **XY** and **YZ** of the graph.

[4 marks]

[4 marks]

Question 3d

d) State what change of state is taking place from point **Z** onwards.

[1 mark]

[1 mark]

Question 3e

e) Explain whether the specific heat capacity of the substance in **Figure 1** is greater for its solid or liquid form.

[2 marks]

[2 marks]

Question 3f

f) The heater used to heat the substance in **Figure 1** outputs a power of 1.2 kW mass of substance being heated = 0.060 kg

Use information from **Figure 1** to calculate the specific latent heat of fusion of the substance.

[5 marks]

[5 marks]

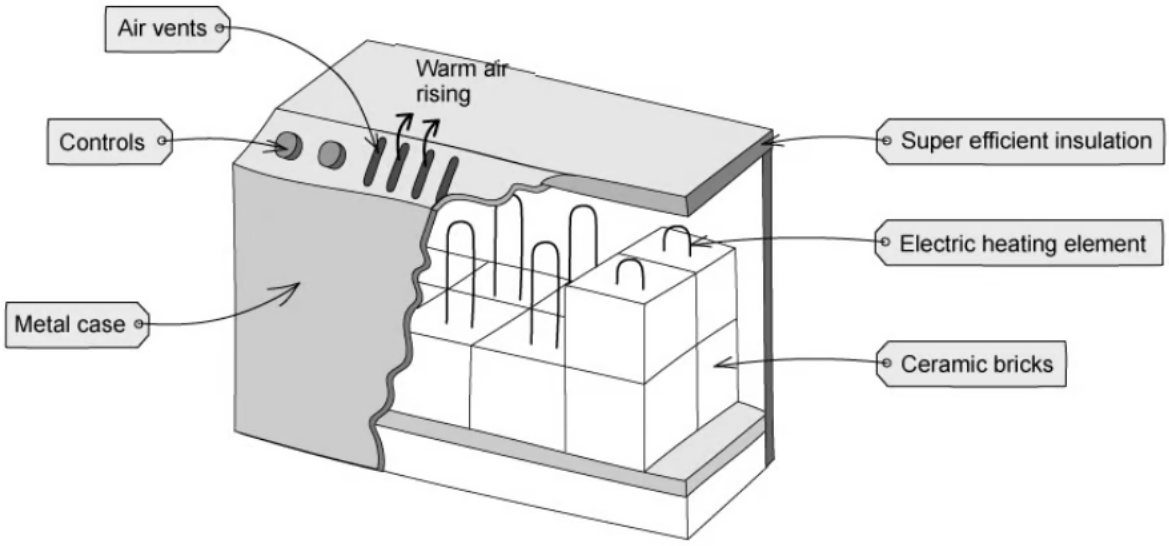
Question 4a

Figure 5 shows how an old-fashioned storage heater is constructed.

There are ceramic bricks inside, which are heated by the heating element during the night.

During the daytime, the heating element is switched off and the blocks transfer their stored internal energy to the room.

Figure 5



The reason for heating the room in this way is that electricity can be bought at a lower price between midnight and 7am.

a) The heating elements in the storage heater have a power output of 2.1 kW.

Calculate the amount of energy that will be transferred to the blocks between the hours of midnight and 7am.

[2 marks]

[2 marks]

Question 4b

b) By 7am the temperature of the blocks has risen from $20\,°C$ to $750\,°C$.

Calculate the total mass of the blocks inside the heater.

Specific heat capacity of the blocks = 800 J / kg °C.

[3 marks]

[3 marks]

Question 5a

A student wants to carry out an investigation to calculate the specific latent heat of fusion of water.

She uses a 250 ml beaker to hold the water.

a) Suggest what other apparatus she would need to carry out the investigation.

[3 marks]

[3 marks]

Question 5b

b) Describe the measurements the student would have to take to determine the specific latent heat of fusion of water, and explain how she would determine its value.

[3 marks]

[3 marks]