

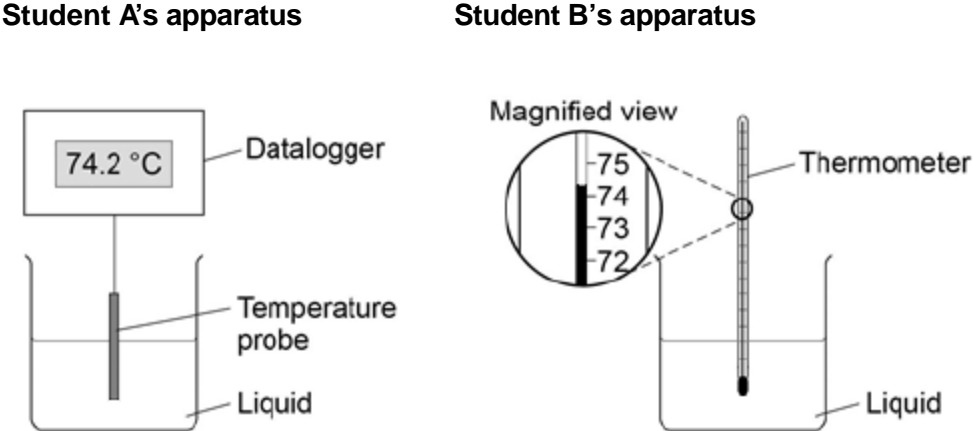
1

Two students investigated the change of state of stearic acid from liquid to solid.

They measured how the temperature of stearic acid changed over 5 minutes as it changed from liquid to solid.

Figure 1 shows the different apparatus the two students used.

Figure 1



(a) Choose **two** advantages of using student **A's** apparatus.

Tick **two** boxes.

Student **A's** apparatus made sure the test was fair.

Student **B's** apparatus only measured categoric variables.

Student **A's** measurements had a higher resolution.

Student **B** was more likely to misread the temperature.

(2)

- (b) Student **B** removed the thermometer from the liquid each time he took a temperature reading.

What type of error would this cause?

Tick **one** box.

A systematic error

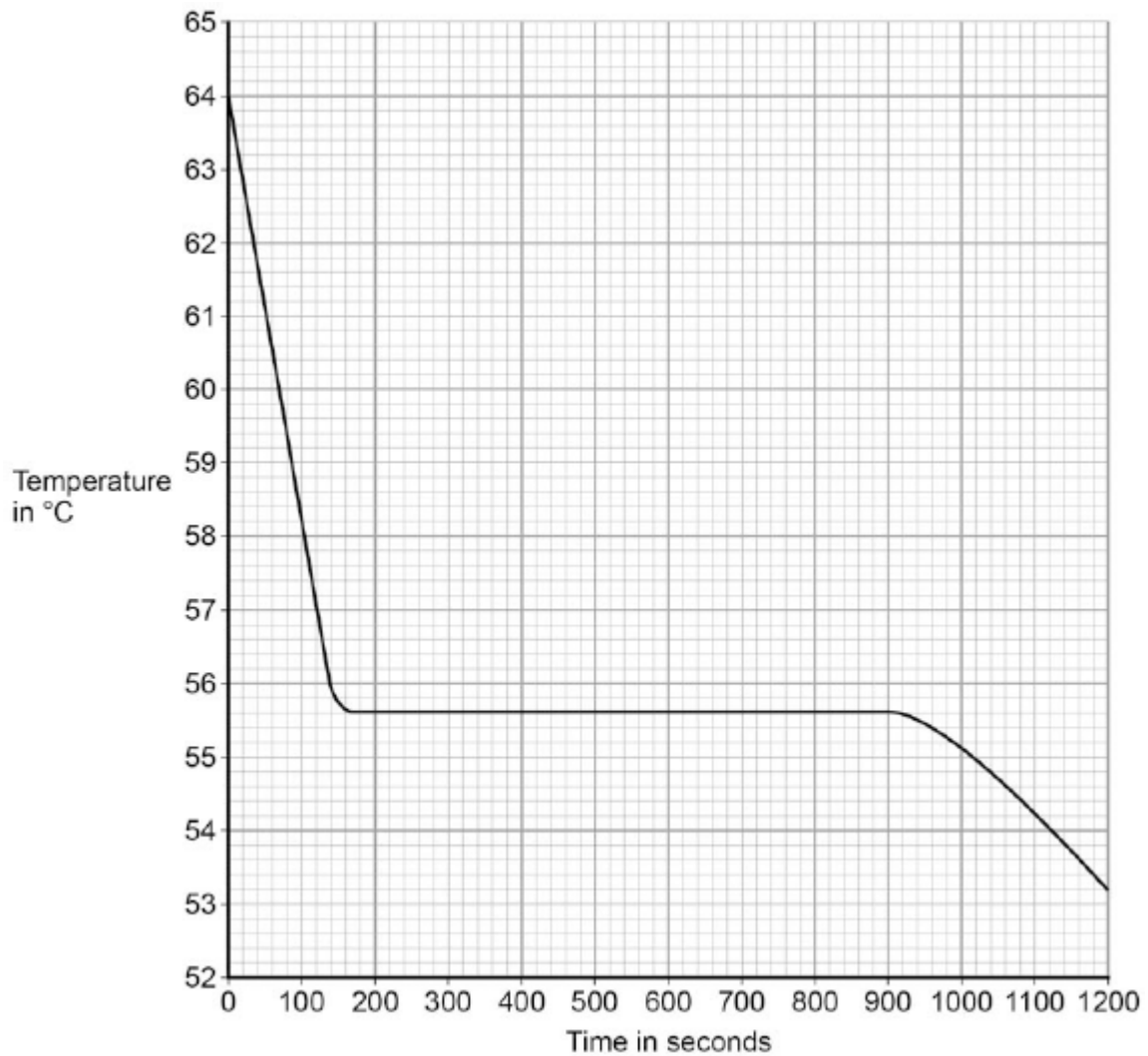
A random error

A zero error

(1)

- (c) Student **A**'s results are shown in **Figure 2**.

Figure 2



What was the decrease in temperature between 0 and 160 seconds?

Tick **one** box.

8.2 °C

8.4 °C

53.2 °C

55.6 °C

(1)

- (d) Use **Figure 2** to determine the time taken for the stearic acid to change from a liquid to a solid.

Time = seconds

(1)

- (e) Calculate the energy transferred to the surroundings as 0.40 kg of stearic acid changed state from liquid to solid.

The specific latent heat of fusion of stearic acid is 199 000 J / kg.

Use the correct equation from the Physics Equations Sheet.

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.....

Energy = J

(2)

- (f) After 1200 seconds the temperature of the stearic acid continued to decrease.

Explain why.

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(2)

(Total 9 marks)

2

Solid, liquid and gas are three different states of matter.

(a) Describe the difference between the solid and gas states, in terms of the arrangement and movement of their particles.

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(4)

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

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(2)

(c) While a kettle boils, 0.018 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.

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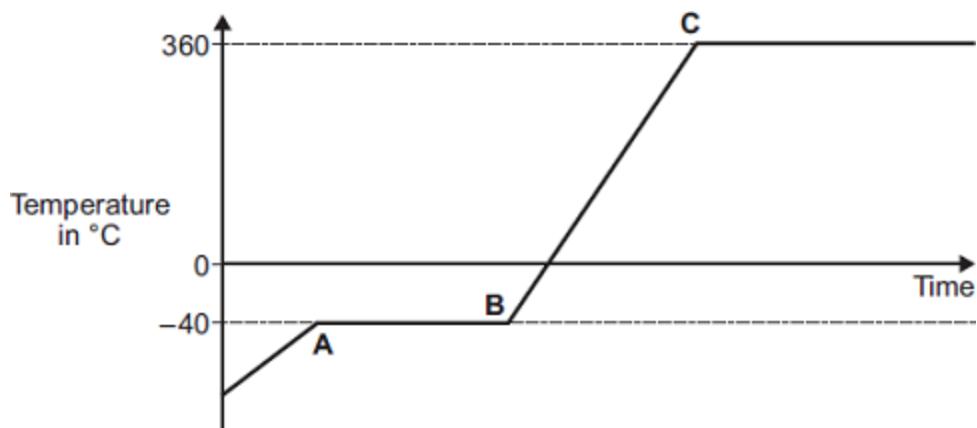
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Energy required = J

(2)

(d) The graph shows how temperature varies with time for a substance as it is heated.

The graph is **not** drawn to scale.



Explain what is happening to the substance in sections **AB** and **BC** of the graph.

Section **AB**

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Section **BC**

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(4)
(Total 12 marks)

Mark schemes

- 1**
- (a) Student A's measurements had a higher resolution 1
Student B was more likely to misread the temperature 1
- (b) a random error 1
- (c) 8.4 °C 1
- (d) 740 (seconds) 1
allow answers in the range 730 – 780
- (e) $0.40 \times 199\,000$ 1
79 600 (J) 1
accept 79 600 (J) with no working shown for 2 marks
- (f) stearic acid has a higher temperature than the surroundings 1
accept stearic acid is hotter than the surroundings
temperature will decrease until stearic acid is the same as the room temperature / surroundings 1
- [9]**
- 2**
- (a) **solid**
particles vibrate about fixed positions 1
closely packed 1
accept regular
- gas**
particles move randomly 1
accept particles move faster
accept freely for randomly
- far apart 1
- (b) amount of energy required to change the state of a substance from liquid to gas (vapour) 1

unit mass / 1 kg
dependent on first marking point

1

- (c) 41000 **or** 4.1×10^4 (J)
accept
41400 or 4.14×10^4
correct substitution of
 $0.018 \times 2.3 \times 10^6$ gains 1 mark

2

- (d) **AB**
changing state from solid to liquid / melting

1

at steady temperature
*dependent on first **AB** mark*

1

BC
temperature of liquid rises

1

until it reaches boiling point
*dependent on first **BC** mark*

1

[12]