3 – Particle Model of Matter

Total mark – 17

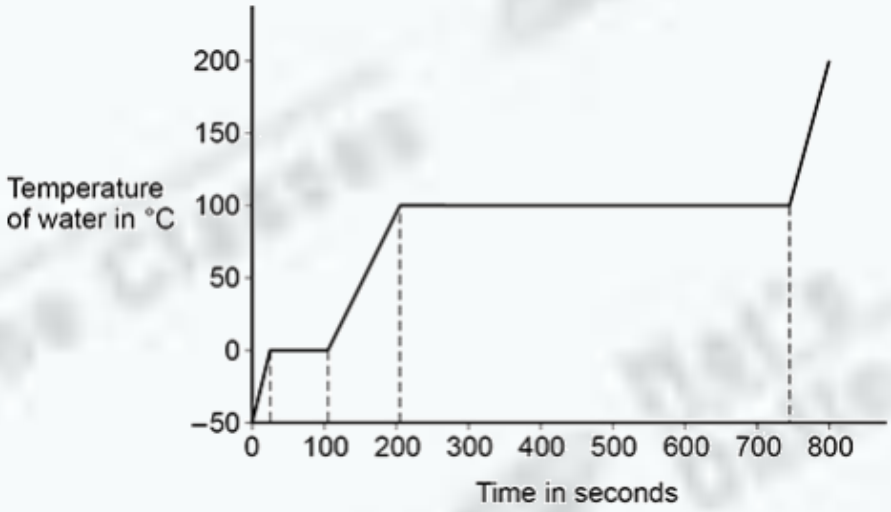
Question: 1

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.

The figure below shows the student's results.

The power output of the heater was constant.



(a) The specific heat capacity of ice is less than the specific heat capacity of water.

Explain how the figure above shows this.

_____

_____

_____

_____

(2)

(b) The specific latent heat of fusion of ice is less than the specific latent heat of vaporisation of water.

Explain how the figure above shows this.

_____

_____

_____

_____

(2)

(c) 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 the figure above would have been different.

(2)

(d) 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.

_____

_____

_____

_____

_____

_____

_____

Specific latent heat of vaporisation = _____

Unit _____

(5)

Question: 2

A student investigated the density of different fruits.

The table below shows the results.

Fruit	Density in g/cm^3
Apple	0.68
Kiwi	1.03
Lemon	0.95
Lime	1.05

(a) The student determined the volume of each fruit using a displacement can and a measuring cylinder.

What other piece of equipment would the student need to determine the density of each fruit?

_____

(1)

(b) Write down the equation which links density (ρ), mass (m) and volume (V).

_____

(1)

(c) The mass of the apple was 85 g.

The density of the apple was 0.68 g/cm^3.

Calculate the volume of the apple.

Give your answer in cm^3.

_____

_____

_____

_____

_____

Volume = _____ cm^3

(3)

(d) The student only measured the volume of each fruit once.

The volume measurements **cannot** be used to show that the method to measure volume gives precise readings.

Give the reason why.

_____

_____

_____

(1)

Mark Scheme

Question: 1

(a) the gradient for ice is steeper than the gradient for water (liquid)

allow the temperature of the ice increased faster than the temperature of the water

1

which means that less energy is needed to increase the temperature by a fixed amount

1

(b) water took more time to vaporise than the ice took to melt

1

which means that less energy is needed to change the state from solid to liquid (than from liquid to vapour)

1

(c) any **two** from:

- ice/water would take more time to increase in temperature

  allow gradients would be less steep
- ice/water would take more time to change state
- the change in temperature with time would not be linear

  allow horizontal lines would be longer

2

(d) E = 69 000 (J)

1

69 000 = 0.030 × L

allow a correct substitution of an incorrectly/not converted value of E

1

$$L = \frac{69\,000}{0.030}$$

allow a correct rearrangement using an incorrectly/not converted value of E

1

L = 2 300 000
or
L = 2.3×10^6

allow a correct calculation using an incorrectly/not converted value of E

1

J/kg

allow a unit consistent with their numerical answer
eg 2300 kJ/kg

1

Question: 2

(a) balance / scales

1

(b) $\text{density} = \frac{\text{mass}}{\text{volume}}$

or

$\rho = \frac{m}{V}$

1

(c) $0.68 = \frac{85}{V}$

1

$V = \frac{85}{0.68}$

1

$V = 125\ (\text{cm}^3)$

1

(d) repeat readings (of volume) need taking (of each fruit) to show that the readings are close together

allow 'the same' for 'close together'

1