

Changes of state

Q1.(2018)

Please refer to the marking instructions on page 4 of this mark scheme for guidance on how to mark this question.

Level 3 (5–6 marks)

Detailed description AND explanation of the graph including the change of state and EITHER the rate of temperature decrease at different points OR conclusion drawn about the material's properties.

There is a well-developed line of reasoning which is clear and logically structured. The information presented is relevant and substantiated.

Level 2 (3–4 marks)

Description AND explanation of the graph which may include EITHER change of state OR rate of temperature decrease at different points OR conclusion drawn about the material's properties.

There is a line of reasoning presented with some structure. The information presented is relevant and supported by some evidence.

Level 1 (1–2 marks)

Simple description OR explanation of the graph which may include change of state OR the temperature change for two sections of the graph OR some conclusion drawn about the material's properties.

There is an attempt at a logical structure with a line of reasoning. The information is in the most part relevant.

0 marks

No response or no response worthy of credit.

Q2.(2018)

In solids the atoms/molecules are close together/in a lattice structure ✓

In liquids atoms/molecules are closer than in a gas BUT more spread out than in a solid ✓

In gases the atoms/molecules are spread out ✓

solids are denser than liquids **AND** liquids are denser than gases / ORA ✓

6

1x3.1a
4x3.2a
1x3.2b

PLEASE CHECK GRAPH AS STATEMENTS ON THE GRAPH NEED TO BE CONSIDERED AS PART OF THE MARKING
AO3.1a Analyse information to interpret the graph

- Graph is horizontal / levels out at 42°C +/- 2°C
- Temperature decreases (rapidly) at first and at the end
- The rate of temperature decrease falls prior to the change of state / after the change of state

AO3.2a Analyse information to make judgements about what the graph shows

- Graph shows two states of matter
- Material could be changing from liquid to solid
- Material could be changing from gas to liquid
- The temperature is constant when energy is being used to change the state of the material
- Material gives out energy as it cools
- Material does not release energy when it changes state (or higher level answers in terms of latent heat)
- Material cools more rapidly when there is a greater temperature difference between it and the surroundings

AO3.2b Analyse information from the graph to draw conclusions about the material's properties.

- the melting / boiling / freezing / condensing point is 42°C
- Material is not water

4

1.1

ALLOW correct particle model drawing of a solid

1.1

ALLOW correct particle model drawing of a liquid

1.1

ALLOW correct particle model drawing of a gas

1.1

ALLOW correct ideas of particles moving closer together or further apart when changing state
ALLOW correct higher level ideas about kinetic energy of particles or forces of attraction between particles

Q3.(2019)

D

Q4.(2020)

B

Q5.a(2020)

A ✓

Q5.b(2020)

42 (°C) ✓

Q5.c(2020)

B ✓

Q5.d(2020)

Break ✓**Stays the same** ✓**Stays the same** ✓**Stays the same** ✓

Q5.e(2020)

 $(20 \div 1000) = 0.02 \text{ (kg)}$ ✓

Q5.f(2020)

FIRST CHECK THE ANSWER ON ANSWER LINE**If answer = 897 (J) award 2 marks**

Selection of (no mark):

Thermal energy for a change in state =

Mass × specific latent heat capacity

(E =) 0.01×89700 ✓

(E =) 897 (J) ✓

Q6.(2021)

A ✓

Q7.a(2021)

FIRST CHECK THE ANSWER ON ANSWER LINE**2****If answer = 169 200 (J) award 2 marks**(E =) $0.2 \times 846\,000$ ✓

(E =) 169 200 (J) ✓

Q7.b(2021)

Increasing temp (of 1kg of water by 1°C) only requires molecules to move faster ✓	2	2 × 2.1	ALLOW increases the kinetic energy of molecules
Evaporation requires intermolecular forces to be overcome ✓			ALLOW to break (intermolecular) bonds

Q8.(2022)

SHC is the energy needed to raise the temperature of (1kg of) a substance by 1 degree (C or K) ✓	2	2 × 1.1	ALLOW energy (per kilogram) to raise the temperature by 1 degree (C or K)
SLH is the energy needed to change the state of (1kg of) a substance ✓			ALLOW specific examples of change from one state to another e.g. SLH is the energy needed to change a substance from solid to liquid ALLOW SHC is for change of temperature but SLH is for change of state for a maximum 1 mark ALLOW heat for energy IGNORE equations

Q9.a(2022)

As SHC increases, temperature (rise) decreases / ORA ✓	1	3.1a	ALLOW inversely related / as one goes up the other one goes down / inversely proportional / indirectly proportional IGNORE if the SHC is higher then the change in temperature will need more energy IGNORE negative correlation IGNORE any qualifications e.g. (decreases) at a decreasing rate
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Q9.b(2022)

FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 36 – 39 (°C) award 2 marks	2	2 × 3.2a	
Attempt to extrapolate graph ✓			IGNORE horizontal line drawn from graph to y axis
Temperature rise = 36 – 39 (°C) ✓			

Q9.c(2022)

Topic [1]: [Matter]

<p>Any one from:</p> <p>Power of heater is the same / time heater is switched on is the same / energy (supplied) is the same ✓</p> <p>Mass or amount of liquid is the same ✓</p> <p>Temperature of the room is the same ✓</p> <p>Same container used ✓</p> <p>No changes of state have occurred ✓</p>	1	1.2	<p>ALLOW assumptions about graph continuing the trend e.g. the rise (in the graph) would stay constant gradient would stay constant line continues on (as a straight line) temperature rises at the same rate temperature changes steadily temperature (rise) continues to go up temperature (rise) higher at 1600 than 1800 trend stays the same</p> <p>IGNORE the lower SHC the higher the temperature (rise) / ORA</p> <p>DO NOT ALLOW line continues as a horizontal / temperature rise stays constant / same liquid</p>
<p>Q10.a(2023)</p> <p>Stopwatch / stopclock ✓</p>	1	1.2	<p>ALLOW timer/chronometer IGNORE watch/clock/mobile phone</p>
<p>Q10.b(2023)</p> <p>First check the answer on answer line If answer = 42 000 (J) award 2 marks</p> <p>(Energy transferred = mass × SHC × temperature rise) (Energy transferred =) $0.2 \times 4200 \times 50$ ✓ (Energy transferred =) 42 000 (J) ✓</p>		2	
<p>Q10.c(2023)</p> <p>FIRST CHECK THE ANSWER ON ANSWER LINE If answer = 200 (W) award 2 marks</p> <p>(Power =) $40\,000 \div 200$ ✓ (Power =) 200 (W) ✓</p>		2	
<p>Q10.d(2023)</p> <p>Steeper line / bigger gradient / bigger slope / takes the least/less time to reach 50°C ✓</p>	1	3.1b	<p>ALLOW takes less time to heat up / gets hot faster / increases in temperature more quickly IGNORE it/line is steep / it/line increases in shorter time / it/line is higher</p>
Q10.e(2023)			

They used too much water ✓

1

3.2a

If more than one box ticked = 0 marks

Q11.a(2024)

Wrap insulation around the funnel ✓

1

Q11.b(2024)

(1), 4, 3, 2 ✓

1

Q11.c(2024)

First check the answer on the answer line
If answer = 0.06 (N) award 2 marks

2

(W =) 0.006 × 10 ✓

(W =) 0.06 (N) ✓

Q11.d(2024)

First check the answer on the answer line
If answer = 2250 (J) award 2 marks

2

(E =) 15 × 150 ✓

(E =) 2250 (J) ✓

Q11.e(2024)

First check the answer on the answer line
If answer = 334 000 (J / kg) award 3 marks

3

(Rearrange) ($l =$) $E \div m$ ✓($l =$) $5010 \div 0.015$ ✓($l =$) 334 000 (J / kg) ✓

1.2

2.1

2.1

ALLOW ($l =$) energy ÷ mass