States of Matter

Total marks: 17

Q1.

An ink is a mixture of coloured substances dissolved in water.

The particles in the ink in the flask can be shown as in Figure 10.

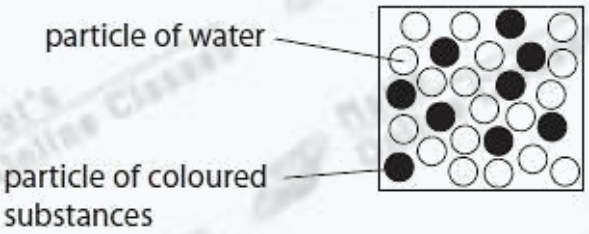
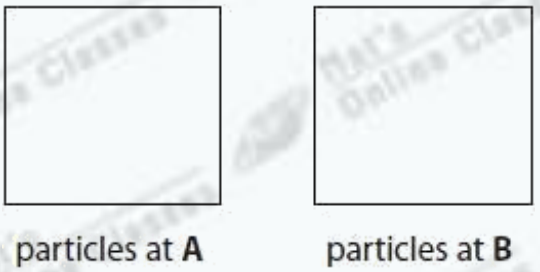


Figure 10

In the boxes below, draw the arrangement of particles that would be expected at **A** and **B** shown in Figure 9.

(2)



Q2.

A substance is heated at a constant rate and its temperature is taken every minute. During the heating, the substance undergoes one change of state.

The results are shown on the graph in Figure 5.

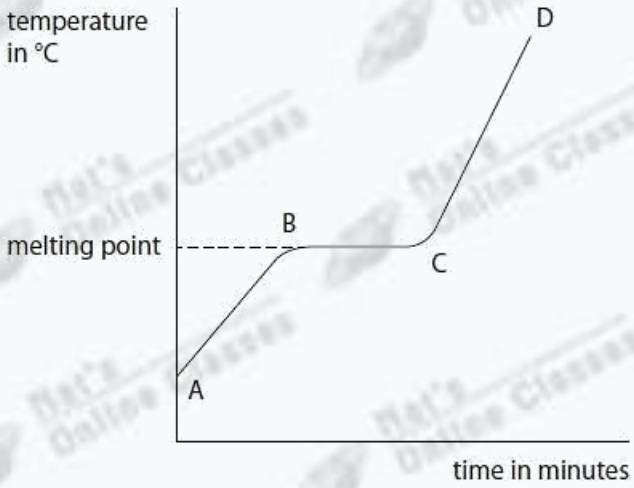


Figure 5

Explain the shape of the graph in terms of the changes in the movement and arrangement of the particles as the substance is heated.

(4)

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Q3.

An ink is a mixture of coloured substances dissolved in water.

Changes of state between the three states of matter are shown in Figure 11.

Figure 11

The changes shown are physical changes.

Explain why these changes are called physical changes rather than chemical changes.

(2)

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Q4.

Figure 3 shows a metal spoon and two test tubes being heated in a water bath.

One test tube contains a piece of chocolate, the other some liquid egg white.

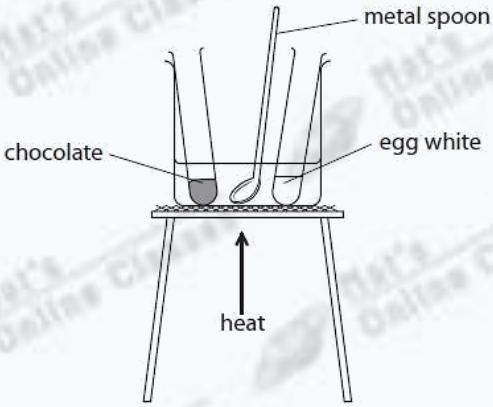

Figure 3

After heating, the spoon, the chocolate and the egg white are allowed to cool to room temperature.

Figure 4 shows the state of the three different substances before heating, when hot and after cooling.

substance	before heating	when hot	after cooling
metal spoon	solid	solid	solid
chocolate	solid	liquid	solid
egg white	liquid	solid	solid

Figure 4

Describe the differences in the arrangement and movement of the particles in a solid and in a liquid.

(2)

difference in arrangement of particles

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difference in movement of particles

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Q5.

Figure 5 shows the changes of state for gallium and the arrangement of particles in liquid gallium.

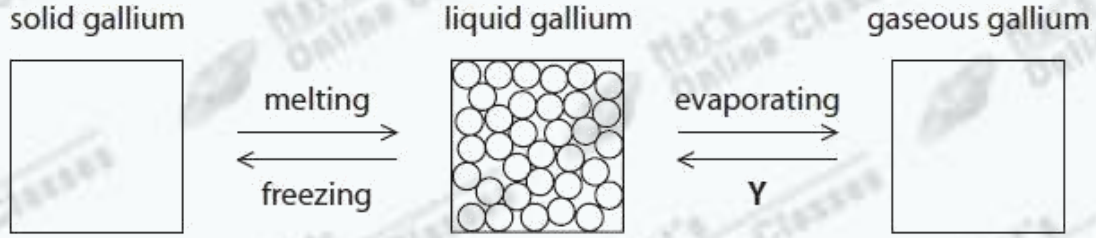

Figure 5

(i) Complete the boxes for solid gallium and gaseous gallium by drawing the arrangement of the particles in each of these physical states.

(2)

(ii) Give the name of the change of state labelled **Y** in Figure 5.

(1)

.....

Q6.

If liquid water is cooled below 0 °C it turns into the solid, ice.

(i) Give the name for the change of state from liquid to solid.

(1)

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(ii) Here are five statements about ice and water.

Place ticks in boxes by the **two** statements that are correct.

(2)

the molecules move faster in water than in ice	
the molecules are more randomly arranged in ice than in water	
the molecules start moving when water becomes ice	
the molecules are arranged regularly in ice but not in water	
the molecules have more energy in ice than in water	

Q7.

The three states of matter are solid, liquid and gas.

What is the name of the change of state when a liquid changes into a solid?

(1)

☒ **A** condensation

☒ **B** evaporation

☒ **C** freezing

☒ **D** melting

Mark Scheme

Q1.

Question Number	Answer	Additional guidance	Mark
	particles at A: white circles only, none touching (1) particles at B: white circles only, randomly arranged, more circles than in A (1)	 reject 'strings' of particles if black circles are present in both boxes allow 1 mark if arrangement of particles in both boxes is otherwise correct.	**(2)** AO 2 1

Q2.

Question Number	Answer	Additional guidance	Mark
	An explanation linking from B to C: graph flat because • particles in solid use energy to {break out of lattice / break (intermolecular) bonds (between particles) / particles becoming randomly arranged / turn solid to liquid} (1) and any three from from A to B: graph rises because • particles in solid in a lattice / fixed (mean) positions (1) • vibrate more (rapidly) (as temperature increases) (1) from C to D: graph rises because • particles in liquid move past one another / randomly (1) • particles move more (rapidly) (as temperature increases) (1)	 may be shown as a diagram / on graph may be shown as a diagram / on graph ignore references to gas / evaporation / boil	**(4)** AO 3 2a AO 3 2b

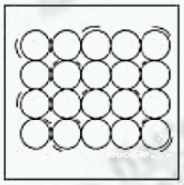
Q3.

Question Number	Answer	Additional guidance	Mark
	An explanation linking • physical changes do not result in formation of a new substance / chemical change results in formation of a new substance (1) • physical change is easily reversed / chemical change is not easily reversed (1)	 allow no chemical **reaction** has taken place ignore you can see the change	**(2)** AO 1 1

Q4.

Question number	Answer	Additional guidance	Mark
	<u>Arrangement – 1 mark max</u> in a solid (particles are): • regularly arranged/ close(r) / in lattice / fixed (position) (1) OR in a liquid (particles are): • randomly arranged / further apart (1) **<u>Movement – 1 mark max</u>** in a solid (particles): • vibrate / do not move (around) (1) OR In a liquid (particles): • move (1)	answer for one state will be taken to imply opposite for other; but if both given, both must be correct OR one correct and one an ignore allow uniformly arranged / in a fixed shape / (tightly) packed together / in lines / in layers / in rows / ordered / organised ignore compact(ed) / attached / bonded / particles touching allow spread out / space between particles reject do not move much "They" is assumed to mean particles allow suitable diagrams allow answers in either space	**(2)** **AO1-1**

Q5.

Question number	Answer	Additional guidance	Mark
(i)	 solid (1) (regular arrangement and touching)  gas (1) (widely spaced, fewer shown)		(2)

Question number	Answer	Additional guidance	Mark
(ii)	condensing / condensation		(1)

Q6.

Question number	Answer	Additional guidance	Mark
(i)	freezing / solidifying / solidification	ignore frozen	(1) AO1

Question number	Answer	Mark
(ii)	<table><tr><td>the molecules move faster in water than in ice</td><td>✓ (1)</td></tr><tr><td>the molecules are more randomly arranged in ice than in water</td><td></td></tr><tr><td>the molecules start moving when water becomes ice</td><td></td></tr><tr><td>the molecules are arranged regularly in ice but not in water</td><td>✓ (1)</td></tr><tr><td>the molecules have more energy in ice than in water</td><td></td></tr></table> Allow any marks in the boxes. If three boxes are ticked, give **one** mark **only** if **both** correct boxes are ticked If four or five boxes ticked, no marks awarded	(2) AO1

Q7.

Question number	Answer	Mark
	C freezing The only correct answer is C. A is incorrect because condensation is when a gas changes into a liquid. B is incorrect because evaporation is when a liquid changes into a gas. D is incorrect because melting is when a solid changes into liquid.	(1)