Mark scheme

States of matter

Chemistry 0620 · Questions from Paper 3 and Paper 4

Total marks

84

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
5	6	9	7	8	11	9	10	9	10	**84**

Question 1 [5]

1(a)(i)	melt(ing)	1
1(a)(ii)	sublimation / sublime	1
1(a)(iii)	condensing / condensation	1
1(b)	overcome / break the attractive forces	1
1(c)	**E AND** particles hit the walls (of the container) more often	1

Question 2 [6]

2(a) — **2**

number of electrons	36
number of neutrons	48

2(b) — **2**

change	effect on the volume of krypton
temperature is decreased	decreases
pressure is increased	decreases

2(c) — **2**

separation: close together / touching / packed / not separated (1)

motion: sliding over each other / random (1)

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Question 3 [9]

3(a)	1 mark each for any two of: • has a definite volume / fixed volume • takes the shape of its container • flows over a surface / can be poured over a surface	2
3(b)	A: freezing (1) B: evaporation / boiling (1)	2
3(c)	liquid bromine: arrangement: irregular / no (particular) arrangement (1) motion: sliding / moving (over each other) (1) bromine gas: arrangement: irregular / no (particular) arrangement (1) motion: fast / rapid / move everywhere (1)	4
3(d)	volume increases	1

Question 4 [7]

4 **(a)** 112 (^{o}C) [1]

liquid [1]

(b) arrangement: go from regularly to irregularly arranged / become more irregularly arranged / go from regular to random [1]
ALLOW: idea of becoming less packed / less arranged / not so close together (but not implication of particles being apart from each other)
NOTE: do not allow implication of particles being 'apart' in solid
motion: start moving / start sliding over each other / go from no movement to movement / go from just vibrating to moving (over each other) [1]
ALLOW: idea of greater movement

(c) Any three of: [3]

(crystal) dissolves / idea of dissolving
particles (in crystal) become separated / solvent molecules get in between particles / mixing of particles / spreading out of particles
diffusion
movement of particles (in solution)
random (movement of particles)
particles collide
ALLOW: particles move from concentrated to dilute solution

[Total: 7]

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Question 5 [8]

5(a)(i)	**S**	1
5(a)(ii)	**S**	1
5(a)(iii)	**V**	1
5(b)	any value in the range 130–145 °C	1
5(c)	sublimation	1
5(d)(i)	Brownian motion	1
5(d)(ii)	nitrogen / oxygen / carbon dioxide / air molecules hit / bombard the smoke particles	1
	(the bombarding particles) move randomly	1

Question 6 [11]

6(a)	1 mark for each correct row State / touching / random movement / regularly arranged Gas / ✔ / ✔ / Liquid / ✔ / ✔ / Solid / ✔ / / ✔	3
6(b)(i)	boiling happens at a specific temperature (1) boiling has bubbles (1)	2
6(b)(ii)	condensation (1) sublimation (1)	2
6(c)	one horizontal line level with Y (1) two separate decreases before and after horizontal line (1)	2
6(d)(i)	dissolving	1
6(d)(ii)	precipitation	1

Question 7 [9]

7(a)(i)	Brownian (motion)	1
7(a)(ii)	molecules	1
	nitrogen / N_2 / N **OR** oxygen / O_2 / O	1
7(a)(iii)	nitrogen **OR** oxygen (particles) collide with / bombard / hit the dust (particles)	1
	(the bombarding particles) move **randomly**	1
7(b)(i)	diffusion	1
7(b)(ii)	Br_2 has an M_r of 160 **AND** Cl_2 has an M_r of 71 / bromine has an A_r of 80 **AND** chlorine has an A_r of 35.5	1
	(heavier) bromine (molecules / particles) diffuses more slowly	1
7(b)(iii)	particles have more energy / move faster	1

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Question 8 **[10]**

8 **(a)** **(i)** 6e between two nitrogen atoms (can be any combination of dots or crosses) [1]
1 lone pair on each nitrogen atom [1]

(ii)

	SOLID	GAS	
PATTERN	regular / lattice (**not** fixed)	random / irregular / no pattern	[1]
DISTANCE	close	far apart / spread out	[1]
MOVEMENT	vibrate / fixed / no motion	moving / translational	[1]

(b) **(i)** **particles/molecules** have more energy / move faster [1]
collide harder / collide more frequently / more collisions / collide with more force (with the walls) [1]

(ii) (1) nitrogen has small**er** M_r / light**er** molecules / low**er** density [1]
nitrogen **molecules** / **particles** **move** fast**er** (than chlorine molecules) [1]

(2) at higher temperature nitrogen **molecules or particles** (not atoms) move faster / have more energy [1]

[Total: 10]

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Question 9 [9]

9 **(a)** explanation of evaporation e.g. particles (or molecules) with a lot of energy leave the liquid / bromine particles break free from each other / forces or bonds between bromine molecules broken / molecules (in liquid) have weak forces holding them together / weak intermolecular forces / Van der Waals forces between molecules (don't have to be stated as weak) / (weak intermolecular forces alone scores this mark);
allow: particles (or molecules) of bromine escape from liquid [1]

diffusion / diffuse / movement of particles; [1]

explanation of diffusion involving qualified movement of molecules / particles
i.e. random movement of molecules / particles move in all directions; [1]

(b) air more dense / heavier / higher M_r than hydrogen; [1]
hydrogen diffuses faster (than air diffuses out); [1]
accept: diffusion in is faster than out (without naming gases)
pressure inside pot is greater (than outside); [1]
air less dense / lighter / lower M_r than carbon dioxide; [1]

air diffuses / moves faster (than carbon dioxide); [1]
accept: diffusion out is faster than in (without naming gases)

pressure inside pot less (than outside); [1]

ORA in both parts

[Total: 9]

Question 10 [10]

10(a)	80(°C) (1)	**1**
10(b)	horizontal line from end of graph at minute 9 to minute 11 (1)	**1**
10(c)	energy is used to break bonds / overcome attraction (1) between molecules (1)	**2**
10(d)	vibrations (1) increase (1)	**2**
10(e)	melting point decreases (1) boiling point increases (1)	**2**
10(f)	decrease from 120 °C to 80 °C and horizontal line at 80 °C (1) decrease from horizontal line to finish at 20 °C at 8 mins (1)	**2**

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