Simple Kinetic Molecular Model of Matter

Mark Scheme 1

Level	IGCSE
Subject	Physics
ExamBoard	CIE
Topic	Thermal Physics
Sub-Topic	Simple Kinetic Molecular Model of Matter
Paper Type	(Extended) Theory Paper
Booklet	Mark Scheme 1

Time Allowed: **58 minutes**

Score: **/48**

Percentage: **/100**

Question	Answer	Mark
1(a)	Gas molecules (very) far apart OR empty space between gas molecules Molecules of liquid (very) close together / compact OR are touching (each other)	**B1** **B1**
(b)(i)	Faster / more energetic water molecules evaporate / escape / leave Slower / less energetic molecules remain (so temperature is lower)	**B1** **B1**
(b)(ii)	Water in wide container AND has water with larger surface (area) Rate of evaporation higher / faster / quicker OR higher chance of evaporation	**B1** **B1**
		Total: 6

Question	Answer	Mark
2(a)	One of 1, 2 or 3: 1 Molecules move faster OR have more k.e. / momentum 2 Molecules hit walls more often / more frequently 3 Molecules hit walls with greater force / impulse / harder	**B1**
(b)	1 mark for each of 1, 2 and 3 in **(a)** not given as answer to **(a)**	**B2**
(c)(i)	PV = constant OR $P_1V_1 = P_2V_2$ OR $98 \times 4800 = P \times 7200$ 65 kPa	**C1** **A1**
(c)(ii)	To prevent the balloon bursting (as its volume increases) OR to reduce the pressure inside the balloon OR pressure difference between inside and outside balloon rises	**B1**
		Total: 6

3 **(a) (i)** P × V values are 7500 or about 7500
OR If P / pressure doubles, V / volume halves OR vice versa — B1
(so) PV = constant OR P α 1 / V OR either in words — B1

(ii) temperature — B1

(b) (i) P = hdg OR 5.0 × 10 × 1000 — C1
50 000 Pa or 50 kPa — A1

(ii) Volume of bubble increases
Mass of gas stays the same — B2
Density of gas decreases

[Total: 7]

4 **(a) (i)** any one from:
(molecules) move randomly / in random directions
(molecules) have high speeds
(molecules) collide with each other / with walls — [max 1]

(ii) collisions with walls/rebounding causes change in momentum (of molecules) — [1]
force is rate of change of momentum / force needed to change momentum — [1]

(b) (i) $p_1V_1 = p_2V_2$ OR 300 × 100 (× 0.12) = p_2 × 0.40 (× 0.12) — [1]

750 kPa — [1]

(ii) (molecules) collide with walls more often owtte
OR more collisions with walls per second or per unit time owtte — [1]
greater force per unit area — [1]

5 **(a (i)** any 2 from: max. B2

- liquid molecules not in fixed positions / can move about / move past each other OR solid molecules have a fixed position
- liquid molecules have random arrangement OR solid molecules arranged regularly / in patterns / layers / lattice
- liquid molecules are (slightly) further apart (than solid molecules) OR reverse argument

(ii) energy / work / thermal energy / (latent) heat required
AND
to break bonds (between molecules) / to overcome attractive forces (between the molecules) / to increase the potential energy of the molecules B1

(b) (i) $E = ml$ in any form OR ml OR $1.65 \times 330\,000$ C1
$= 540\,000$ J OR 544 500 J A1

(ii) chemical (energy in body) converted to thermal / internal (energy) B1

[Total: 6]

6 **(a** $p_1V_1 = p_2V_2$ in any form OR (p_1 =) $p_2V_2 \div V_1$ C1

$p_1 \times 470 = 800 \times 60$ OR (p_1 =) $800 \times 60 \div 470$

102 OR 100 kPa A1

(b) molecules would move faster/have more KE B1

more (frequent)/harder collisions with walls/cylinder/piston B1

pressure increases B1

(c) use of $p = F \div A$ in any form OR (F =) pA C1

(F =) 4400 N A1

7 **(a** any **two** of motion of smoke particles:
random / haphazard / unpredictable movement;
sudden changes of direction / zig-zag motion;
appear / disappear from view OR go out of / come into focus; B2

any **two** of conclusions about air molecules:
collide with smoke particles OR smoke particles collide with / moved by air molecules;
air molecules fast(er);
air molecules small(er) / light(er);
move randomly; B2

(b) (i) 1 (the piston) moves to the right / out(wards) / is pushed away B1
2 (the pressure of the gas) remains constant B1

(ii) (pressure of the gas) increases B1
more frequent collisions (of gas molecules) with piston / walls / container
OR (gas molecules) collide with piston / walls / container with great(er) force B1

[Total: 8]