Simple Kinetic Molecular Model of Matter

Mark Scheme 4

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 4

Time Allowed: **53 minutes**

Score: **/44**

Percentage: **/100**

1	**(a)**	**(i)**	(Force exerted when) molecules hit wall / surface / solid (and rebound) Allow (force) due to momentum change in collision	B1	
		(ii)	Molecules/atoms/particles collide with / push against walls more (often) (so) bigger force / push NOT collide faster	B1 B1 B1	
	(b)		$P_1V_1 = P_2V_2$ OR PV = constant $8.0 \times 10^5 \times 5000 = 1 \times 10^5 \times V_2$ $V_2 = 40\,000\ cm^3$ Volume escaped = $40\,000 - 5000 = 35\,000\ cm^3$	C1 C1 C1 A1	**[8]**
2	**(a)**	**(i)**	piston lower than original/single line below original lower face	B1	[1]
		(ii)	three points from: they OR air/gas molecules/particles move/collide ignore faster they OR air/gas molecules/particles collide with <u>piston/walls</u> ignore collisions between molecules force exerted on <u>piston</u> greater force/pressure on top (than bottom initially) number of collisions of <u>gas</u> molecules with piston increases piston moves until <u>pressures/forces</u> equal	B1 B1 B1	[3]
	(b)	**(i)**	piston higher than original/single line below above original lower face	B1	[1]
		(ii)	two points from: molecules of <u>gas</u> moving <u>faster</u> OR more momentum/KE more/harder collisions of gas molecules with piston/walls greater force/pressure on bottom (than top initially) piston moves <u>up</u> until <u>pressures/forces</u> equal	B1 B1	[2]

3 **(a (i)** (Molecules) move randomly / in random directions
(Molecules) have high speeds
(Molecules) collide with each other / with walls B1

(ii) (Force is caused by) collision (and rebound) of molecules (with the walls) o.w.t.t

(iii) $p = F/A$ OR (force =) pA OR 300 × 0.12 C1
OR 300 000 × 0.12
OR any other recognisable pressure × area
= 36 kN / 36 000 N A1

(b) $p_1V_1 = p_2V_2$ / 300 × 0.1 (× 0.12) = p_2 × 0.05 (× 0.12)
OR if V is halved, p is doubled OR vice versa C1

p_2 = 600 kPa A1

(ii) (molecules) collide <u>with walls</u> more often o.w.t.t.e.
OR more collisions <u>with walls</u> per second or per unit time o.w.t.t.e B1 [7]

4 **(a** molecules/atoms move more slowly B1
fewer collisions OR less hard collisions <u>with walls / balloon</u> B1
lower pressure B1 [3]

(b) larger surface area of walls OR atoms further apart OR atoms travel further B1
fewer collisions <u>with walls/balloon</u> (only penalise missing walls once in **(a)** or **(b)**) B1
lower pressure B1 [3]

5	**(a**	**(i)**	bombardment/collide by air molecules/particles/atoms		B1
		(ii)	lighter/very small/smaller than smoke particles/too small to be seen) fast-moving/high kinetic energy) any 2 random movement/movement in all directions)		B1+B1
	(b)		increases (builds up)		B1
		(ii)	air molecules/particles/atoms bombard/hit walls		B1
			molecules faster/higher energy when temperature raised (**ignore** vibrate faster)		B1
			greater force (per unit area) OR more collisions (per second)		B1

[Total: 7]

6	**(a**	Total penalty for use of 'particles' rather than 'molecules' is 1 mark.			
		(i)	idea of some molecules gaining more KE		B1
			mols overcome attractive forces OR mols break free of surface		B1
		(ii)	greater area		B1
			more mols escape (in given time)		B1
		(iii)	increase temperature / supply more heat / make hotter) blow air across surface, or equiv.) any 2 reduce humidity) decrease pressure)	B1 + B1	
	(b)		water evaporates from cloth / water OR faster / more energetic molecules evaporate) less energetic mols left behind) energy to evaporate taken from milk) any 3 evaporation produces cooling) idea of cloth always being damp by soaking up water)	B1 × 3	[9]