Simple Kinetic Molecular Model of Matter

Mark Scheme 5

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 5

Time Allowed: **79 minutes**

Score: **/66**

Percentage: **/100**

1	**(a)**	(pushing rubber cover) volume reduced	M1	
		(when volume reduce), pressure goes up	A1	
	(b)	$1 \times (10^5) \times 60 = 1.5 \times (10^5) \times V$	C1	
		40 (cm^3)	C1	
		reduction in volume = 20 cm^3 or 1/3	A1	
	(c)	(ave) speed of mols/particles/atoms greater at high temp NOT energy/KE	B1	
		stronger/more collisions with walls OR greater pressure	B1	
				[7]
2	**(a)**	pV = const in any form, words or recognisable symbols	B1	
		NOT p proportional to 1/V, NOT p =1/V, any mention of T gets B0		
	(b)	p × V is the same each time OR when p is doubled, V is (always) halved	M1	
		so if gas obeys the law, the temperature must have been constant	A1	
	(c)	$p_1V_1 = p_2V_2$	C1	
		$1.2 (\times 10^5) \times 75 (\times A) = 3.0 (\times 10^5) \times l (\times A)$	C1	
		l = 30 mm	C1	
		distance moved = 45 mm e.c.f.	A1	
				[7]
3	**(a)**	typical random path drawn, at least 3 abrupt changes of direction	B1	
	(b)	air molecules hit dust particles in all directions/move it in all directions	B1	
		just as likely to be up as down	B1	
		(allow marks scored on diagram)		
	(c)	random movements smaller OR slower movement		
		OR less energy OR movement decreases	B1	[4]

4	(a	(i)	random	B1
			high speed (between collisions)	B1
		(ii)	hit walls	B1
			many hits/unit area OR hit hard OR large force OR high energy OR many hits/s OR hit very often	B1
	(b)		particles vibrate (more) OR electrons gain energy	B1
			particle to particle transfer OR flow of free electrons	B1
	(c)		75 × 3200 OR ml	C1
			240 000 J OR 240 kJ OR 2.4 × 10^5J	A
				[Total: 8]

5	**(a)**	air molecules hit particles or vice versa air molecules have speed/moment/energy hits uneven or from all directions hits (by small molecules) can move a large particle or moves particles small distances	B1 B1 B1 B1	**4**
	(b) **(ii)**	most energetic/fastest molecules need energy to overcome forces/break bonds/separate mols. so work must be done/energy used as work	B1 B1 B1	**3** **[7]**

6	**(a) (i)**	random	**B1**	
	(ii)	hit and rebound	**B1**	**[2]**
	(b) (i)	increase or further apart	**B1**	
	(ii)	increase or move faster	**B1**	**[2]**
	(c)	random, fast in gas to vibration in solid	**B1**	
	(ii)	long way apart in gas to very close or touching	**B1**	**[2]** **Total [6]**

7	(a		Water molecules at higher temps. have higher (av) k.e. / energy	B1	
			Higher energy molecules (have greater chance to) escape the surface	B1	
			Higher energy molecules have energy to break liquid "bonds" or separate liquid molecules or more evaporation at 85°C (lowers level)	B1	3
	(b)		Heat for evaporation = 34 500 – 600 = (33 900)	C1	
			Sp. latent heat of evaporation = heat/mass evap. or 33 900 / 15	C1	
			2260 J/g (method and working correct, but no heat loss used, 2/3)	A1	
			(600 added or 34 500 used can score **2 max**)		3

8	(a)	(i)	any suitable random motion	1	
			molecules hit walls	1	
		(ii)	**1.**		
			rebound/bounce back or many hits per unit area or per unit time or collisions create force	1	
			2.		
			(av) k.e./speed of molecules increases	1	
			more hits(/sec) or harder hits	1	5
	(b)		$p_1v_1 = p_2v_2$ quoted or any recognisable substitution	1	
			$2 \times 10^5 \times 0.35 = 5 \times 10^5 \times v$	1	
			volume = 0.14 (m^3)	1	
					(8)

9	(a)	air molecules hit dust particles	M1	
		hits continuously/unevenly/hits cause movement in all directions	A1	
		air molecules fast moving/high energy	B1	3
	(b)	any attempt to use p x v = constant or correct	C1	
		proportion	C1	
		fraction 2 x 80/25 seen	A1	3
		p = 6.4 x 10 (Pa)		
				[6]

10	**(a)**	Some have extra/more energy than others	**B1**	
		most energetic leave surface/ break liquid bonds etc	**B2**	**M2**
	(b)	evaporation occurs strictly at the surface/at all temperature	**B1**	
		boiling occurs throughout liquid/ at one temperature (at normal at. pr.)/100°C	**B1**	**2**
	(c)	energy supplied = Wt /60 x 120	**C1**	
		sp.latent heat = energy/mass evaporated or 60 x 120/3.2	**C1**	
		value is 2250 J/g	**A1**	**3**
				[7]