Mark scheme

Kinetic particle model

Physics 0625 · Questions from Paper 3 and Paper 4

Total marks

72

MARKS FOR EACH QUESTION

1	2	3	4	5	6	7	8	9	10	Total
4	6	6	10	6	6	8	8	9	9	**72**

Question 1 [4]

1(a)	Brownian (motion)	**B1**
1(b)	any **three** from: air molecules (air molecules) collide with (smoke particle) (air molecules) moving randomly (air molecules/collisions) cause change in direction (of smoke particle) (air molecules moving with) high speed idea of more collisions on one side (of particle at a given time)	**B3**

Question 2 [6]

2(a)	1. melting 2. boiling / evaporation 3. freezing / solidification	**B1** **B1** **B1**
2(b)	Any **three** from: (evaporation –) most energetic molecules escape from surface of liquid average KE of molecules remaining in liquid decreases temperature of liquid decreases energy transfers from water (on bench) to liquid (so water cools / freezes)	**B3**

Question 3 [6]

3(a)(i)	any **two** from: high speed moving freely random (motion) OR (moving in) any / all directions	**B2**
3(a)(ii)	collisions (of particles with walls of cylinder OR surface)	**B1**
3(b)	any **three** from: pressure increases (because) molecules are closer together / more densely packed OR area of cylinder decreases (so there are) more collisions per unit area (with walls of cylinder) pressure = force ÷ area	**B3**

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Question 4 [10]

4(a)(i)	conduction	**B1**
4(a)(ii)	1 80 (°C)	**B1**
	2 170 (°C)	**B1**
	3 26 (minutes)	**B1**

4(b)	(solid:) particles/molecules any **three** from: (are) fixed in place/position/arrangement regular spacing / pattern / arrangement vibrating close together	**B3**
	(gas:) particles/molecules any **three** from: (are) moving randomly at high speed colliding (with each other/walls) randomly arranged/no pattern (relatively) far apart	**B3**

Question 5 [6]

5	Solids – molecules in lattice arrangement	**B1**
	solids – strong forces between molecules	**B1**
	liquids – molecules not fixed in place OR molecules have an irregular arrangement OR molecules (slightly) further apart (on average) than in solids OR spaces between the molecules	**B1**
	liquids – (average) forces too weak to keep molecules in a definite pattern OR forces just enough to hold molecules in the bulk of the liquid	**B1**
	gases – molecules far apart	**B1**
	gases – weak / no forces between molecules (except during collisions)	**B1**

Question 6 [6]

6(a)	heated / hot(ter) / warm(er) air is less dense **OR** cool(er) air is more dense	**B1**
	heated / hot(ter) / warm(er) air rises (to ceiling displacing cooler air) **OR** cool(er) air falls (displaced by warm(er) air)	**B1**
6(b)(i)	speed / velocity (of particles) increases **OR** (they) move faster	**B1**
6(b)(ii)	(higher temperature means) particles collide (with rubber) harder / with more force / with greater momentum (change)	**B1**
	(larger volume means) particles collide (with rubber) less frequently **OR** (larger volume means) larger (surface) area (for particle collisions)	**B1**
	effect of larger volume cancels effect of increased temperature / owtte **OR** the effect of larger area cancels the effect of larger force / owtte **OR** $P = F / A$ so the two changes cancel each other / owtte	**B1**

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Question 7 [8]

7 **(a)** **(i)** any two of:
(gas) molecules further apart
greater PE
move singly / in straight lines
OR vice versa for. liquid molecules
(allow faster) B2

(ii) gases compressible OR liquids incompressible B1
forces between gas molecules weaker OR vice versa for liquid molecules B1

(b) **(i)** pV = constant OR $p_1V_1 = p_2V_2$ OR $2.6 \times 10^6 \times 0.035$ OR 91 000 C1
$2.6 \times 10^6 \times 0.035/1.0 \times 10^5$ OR $91\,000/1.0 \times 10^5$ C1
$0.91\ m^3$ A1

(ii) slower / less KE B1 [8]

Question 8 [8]

8(a)	liquid levels in the two limbs of the tube are equal	**B1**
8(b)	molecules collide with the walls (of the container)	**B1**
	momentum of molecules changes (reverses)	**B1**
	this causes a force AND force spread out (over area of walls)	**B1**
8(c)(i)	(p_2 =) $p_1V_1 / V_2 = 1.0 \times 10^5 \times 60 / 50$	**C1**
	1.2×10^5 Pa	**A1**
8(c)(ii)	$p_2 = p_{atm} + h\rho g$ OR $1.2 \times 10^5 - 1.0 \times 10^5$ OR 2.0×10^4 OR (ρ =) $2.0 \times 10^4 / (0.15 \times 10)$	**C1**
	1.3×10^4 kg m^{-3}	**A1**

Question 9 [9]

9(a)	molecules strike walls	**B1**
	momentum (of molecules) changes / momentum = mass × velocity	**B1**
	force = rate of change of momentum	**B1**
	pressure = (sum of) force(s) / area / pressure = rate of change of momentum / area	**B1**

9(b)(i)	(p_2=) p_1V_1 / V_2	**A2**
	$p_1V_1 = p_2V_2$	C1
9(b)(ii)	greater	**B1**
	molecules move faster / have greater KE / molecules have greater momentum	**B1**
	(leads to) more frequent / harder collisions (with walls) / great rate of change of momentum	**B1**

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Question 10 [9]

10(a)(i)	absolute zero	**B1**
10(a)(ii)	–196 (°C)	**A2**
	(absolute zero / 0 K) = –273 (°C)	C1
10(b)	increased (pressure)	**B1**
	particles of gas move faster **OR** have more KE / momentum / velocity	**B1**
	any **two** from from: • more frequent collisions of particles (with walls) • particles collide (with walls) with a larger force **OR** larger impulse • (greater change in momentum of particles) causes greater force (on walls) • pressure = force / area	**B2**
10(c)	(pressure =) 60 kPa **OR** 6.0×10^4 Pa	**A2**
	$p_1 V_1 = p_2 V_2$ **OR** (p_2 =) $p_1 V_1 / V_2$ **OR** pV = constant **OR** $p \propto 1 / V$ **OR** $1.2 \times 10^5 \times 0.5$ **OR** 6.0×10^n	C1

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