

- 1 (a) (i) (Force exerted when) molecules hit wall / surface / solid (and rebound) B1
 Allow (force) due to momentum change in collision
- (ii) Molecules/atoms/particles collide with / push against walls B1
 more (often) B1
 (so) bigger force / push B1
- NOT collide faster
- (b) $P_1V_1 = P_2V_2$ OR $PV = \text{constant}$ C1
 $8.0 \times 10^5 \times 5000 = 1 \times 10^5 \times V_2$ C1
 $V_2 = 40\,000 \text{ cm}^3$ C1
 Volume escaped = $40\,000 - 5000 = 35\,000 \text{ cm}^3$ 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 B1
 they OR air/gas molecules/particles collide with piston/walls
 ignore collisions between molecules B1
 force exerted on piston B1
 greater force/pressure on top (than bottom initially)
 number of collisions of gas molecules with piston increases
 piston moves until pressures/forces equal [3]
- (b) (i) piston higher than original/single line below above original lower face B1 [1]
- (ii) two points from:
 molecules of gas moving faster OR more momentum/KE B1
 more/harder collisions of gas molecules with piston/walls B1
 greater force/pressure on bottom (than top initially)
 piston moves up until pressures/forces equal [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 $300\,000 \times 0.12$
OR any other recognisable pressure \times area
= 36 kN / 36 000 N A1
- (b) $p_1V_1 = p_2V_2 / 300 \times 0.1 (\times 0.12) = p_2 \times 0.05 (\times 0.12)$ C1
OR if V is halved, p is doubled OR vice versa
 $p_2 = 600$ kPa A1
- (ii) (molecules) collide with walls more often o.w.t.t.e.
OR more collisions with walls 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 with walls / balloon B1
lower pressure B1 [3]
- (b) larger surface area of walls OR atoms further apart OR atoms travel further B1
fewer collisions with walls/balloon (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 B1 + B1
 reduce humidity)
 decrease pressure)
- (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 B1 × 3
 evaporation produces cooling)
 idea of cloth always being damp by soaking up water) [9]