

Solids Liquids and Gasses 2 Answers

- 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: B1
 they OR air/gas molecules/particles move/collide ignore faster
 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: B1
 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) atoms/molecules/particles move **or** collide (ignore with each other) B1
 atoms/molecules/particles collide with (inside) surface/wall M1
 force (exerted) on wall etc. **or** force/unit area **or** force spread-out A1
- (ii) fewer atoms/molecules/particles **and** fewer collisions (with wall) B1
- (b) (P =) $h\rho g$ **or** $25 \times 1.0 \times 10^3 \times 10$ C1
 $h\rho g + p_{\text{atm}}$ **or** $25 \times 1.0 \times 10^3 \times 10 + 10^5$ **or** 2.5×10^5 C1
 $3.5 \times 10^5 \text{ Pa}$ *Unit penalty applies A1 [7]

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- 4)
- (a)** (density =) mass/volume OR mass per unit volume
OR m/V with symbols explained B1
- (b) (i)** (vol =) mass/density OR $60.7/2.70$
 $= 22.48 \text{ cm}^3$ to 2 or more sig. figs C1
A1
- (ii)** $V = A \times$ (average) thickness OR thickness = V/A
OR $22.48 / (50 \times 30)$ C1
A1
 0.01499 cm to 2 or more sig. figs. e.c.f. **(b)(i)**
- (c) (i)** micrometer/screw gauge / (vernier/digital) callipers B1
- (ii)** check zero of device used / cut sheet into several pieces / detail of how to use device / fold sheet B1
- measure thickness of sheet in different places
OR measure thickness of several pieces together B1
calculate/obtain average thickness OR divide answer by number of measurements/
pieces/places B1
- [Total 9]**
- 5)
- (a) (i)** (pressure =) force/area OR force per unit area OR $(P =) F/A$ with symbols explained B1
- (ii)** molecules collide with/hit walls/surface (of box) B1
molecule(s) exert force on wall B1
pressure is total force / force of all molecules divided by (total) area of wall B1
- (b) (i)** $(P =) h\rho g$ OR in words OR $0.25 \times 13\,600 \times 10$ C1
 $34\,000 \text{ Pa}$ OR N/m^2 A1
allow 1 mark for $h = 250$ used and $3.4 \times 10^7 \text{ Pa}$ obtained
- (ii)** $(P = 1.02 \times 10^5 - 34\,000)$ B1
 $68\,000 \text{ Pa}$ or N/m^2
e.c.f. from **(b)(i)** only if **(b)(i)** is less than 1.02×10^5
- [Total 7]**
- 6)
- (a)** $V = W \times L \times D$ in any form words, symbols or numbers C1
use of $M = \rho V$ in any form OR ρV words, symbols or numbers C1
 $(M = 51 \times 20 \times 11 \times 1030 = 11\,556\,600 =) 1.2 \times 10^7 \text{ kg}$ A1 [3]
- (b)** $\rho = \rho g(\Delta)h$ in any form words, symbols or numbers C1
 $(\Delta h = 60\,000 / (1030 \times 10) =) 5.8(25) \text{ m}$ A1 [2]
- (c)** use of $F = pA$ in any form or pA words, symbols or numbers C1
 $(F = 60\,000 \times 32.8 \times 8.3 = 60\,000 \times 272.2 =) 1.6(33) \times 10^7 \text{ N}$ A1 [2]
e.c.f. from **(b)**
- [Total: 7]**

Solids Liquids and Gasses 2 Answers

- 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) $pV = \text{constant}$ 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)
- (a) (molecules) move in random directions / randomly / with constant random motion / zig-zag motion / in all directions B1
- (molecules) have random speeds OR a range of speeds OR move (very) fast / at (very) high speed B1
- any 1 from:
 (molecules) collide with each other
 (molecules) move in straight lines between collisions
 (molecules) change direction in collisions
 (molecules) collide with walls (of cylinder) B1
- (b) (i) pressure increases M1
- more frequent collisions between molecules and walls
 OR molecules collide with walls more often / at greater rate A1
- (ii) $pV = \text{constant}$
 OR $p_1V_1 = p_2V_2$ in any form
 OR $1.0 \times 10^5 \times 500 = p_2 \times 240$ C1
- $2.1 \times 10^5 \text{ Pa}$ to 2 or more sig. figs A1

[Total: 7]

Solids Liquids and Gasses 2 Answers

9)

- (a) (i) A **OR** left hand thermometer B1
- (ii) E **AND** longest length and smallest range/more length per degree/liquid moves more per degree/increases the most per degree B1
- (b) any two from:
 narrow bore/tube
 large amount of liquid/mercury/ethanol/alcohol/bulb
 liquid with large expansivity **OR** ethanol instead of mercury B2
- (c) 80 (°C) **OR** 80/120 **OR** 18/120 C1
- 12 cm A1

[Total: 6]

10)

- (a) (i) force/pressure greater on outside surface owtte B1
- (ii) $p = F/A$ in any form **OR** $(F =) pA$ C1
 $= (1.0 \times 10^5 - 6000) \times 0.12$ C1
 11280 N to at least 2 sig. figs. A1
- (b) (i) pressure of oil = pressure of water B1
- (ii) 1. $(p =) h\rho g$ C1
 $(= 0.25 \times 1000 \times 10 =) 2500 \text{ Pa}$ A1
2. $h\rho g = 2500$ C1
 $(\rho = 2500 / (0.32 \times 10) =) 781 \text{ kg/m}^3$ to at least 2 sig. figs. A1

[Total: 9]

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