

Practice Question Set For A-Level
Subject : Physics
Paper-2 Topic: Thermal Physics

Name of the Student: _____

Max. Marks : 26 Marks

Time : 26 Minutes

Mark Schemes

Q1.

- (a) mass of one atom = $\frac{0.21}{6.0 \times 10^{23}} = 3.5 \times 10^{-25} \text{ kg}$ **(1)**
- (b) energy supplied = $23 \times 10^3 \times 3.5 \times 10^{-25}$ **(1)**
 $= 8.1 \times 10^{-21} \text{ J}$ **(1)** ($8.05 \times 10^{-21} \text{ J}$)
(allow C.E. for value from (i))
- (c) (use of $\frac{1}{2}mv^2 = E_K$ gives) $\frac{1}{2} \times 3.5 \times 10^{-25} \times v^2 = 8.1 \times 10^{-21}$
 $v = \left(\frac{2.0 \times 8.1 \times 10^{-21}}{3.5 \times 10^{-25}} \right)^{1/2} = 220 \text{ m s}^{-1}$ **(1)** (215 m s^{-1})
($E_K = 8.05 \times 10^{-21}$ gives $v = 214 \text{ m s}^{-1}$) (allow C.E. for value of E_K from (ii))

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Q2.

- (a) p : pressure and V : volume **(1)**
 N : number of molecules **(1)**
 m : mass of one molecule / particle / atom **(1)**
 $\overline{c^2}$: mean square speed **(1)**
- (b) (i) molecules have a range of speeds **(1)**
they have no preferred direction of movement **(1)**
- (ii) elastic collisions
intermolecular forces are negligible (except during collisions)
volume of molecules negligible (compared to volume of container)
time of collisions negligible (compared to time between collisions)
all molecules identical
laws of statistics apply or large number of molecules
Newtonian laws apply any two **(1) (1)**
- (c) molecules collide (with the walls) **(1)**
walls exert a force on the molecules **(1)**
molecules exert an (equal) force (on the walls) **(1)**
creating pressure **(1)**
molecule momentum changes

4

max 3

max 4

[11]

Q3.

- (a) adequate scale **(1)**
points plotted correctly **(1)**
best fit line (at least a point to right and left of line) **(1)**

3

- (b) use of triangle for at least half line **(1)**

$$\text{gradient } \left(= \frac{11.6}{208} \right) = 0.056 \pm 0.004 \text{ (}^{\circ}\text{C / s)} \text{ (1)}$$

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- (c) $(P = \frac{Q}{t} = \frac{mc\Delta T}{t})$ gives $48 = c \times (1.0) \times 0.056$ **(1)**

$$c = 860 \pm 60 \text{ J kg}^{-1}\text{K}^{-1} \text{ (or J kg}^{-1} \text{ }^{\circ}\text{C}^{-1}) \text{ (1)}$$

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- (d) (use of $E_{\text{th}} = ml$ gives) $48 \times 200 = 32 \times 10^{-3} \times l$ **(1)**
 $l = 3.0 \times 10^5 \text{ J kg}^{-1}$ **(1)**

sensible assumption, e.g. no heat lost to surroundings or temperature does not change or heat is transferred to ice **(1)**

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[10]