

Name of the Student: _____

Max. Marks : 25 Marks

Time : 25 Minutes

Mark Schemes

Q1.

- (a) number of molecules in a gas is very large
duration of collision much less than time between collisions
total volume of molecules small compared with gas volume
molecules are in random motion
collisions are (perfectly) elastic
there are no forces between molecules (any four) **(4)**

(any 4)

- (b) (i) heat (energy) transferred to gas from warmer air outside
mean kinetic energy of gas molecules increases
or molecules move faster
momentum of molecules increases
more collisions per second
each collision (with container walls) transfers more momentum
force (per unit area) on container wall increases (any four) **(4)**

The Quality of Written Communication marks were awarded primarily for the quality of answers to this part.

- (ii) $T = 273 + 27 = 300\text{K}$ **(1)**

$$\text{mean kinetic energy} = \frac{3}{2}kT$$

$$= 1.5 \times 1.38 \times 10^{-23} \times 300 = 6.2 \times 10^{-21} \text{ J} \text{ (1)}$$

(allow e.c.f. for incorrect T)

(6)

[10]

Q2.

- (a) (i) correct p and V from graph **(1)**

$$n = \frac{8.0 \times 10^4 \times 2.00 \times 10^{-3}}{8.31 \times 300} \text{ (1) } (= 0.0064 \text{ mol})$$

- (ii) $V_2 = V_1 \frac{T_2}{T_1} = 3.3 \times 10^{-3} \text{ m}^3$ **(1)**

(3)

(b) (i) $\frac{3}{2} RT$ or $\frac{3}{2} N_A kT$ (1)

(ii) total kinetic energy $\left(= \frac{3}{2} nRT \right) = 1.5 \times 8.3 \times 0.064 \times 300$ (1) = 239 J (1)

molecules have no potential energy (1)
no attractive forces [or elastic collisions occur] (1)

(max 4)

(c) ΔQ = heat entering (or leaving) gas

ΔU = change (or increase) in internal energy

ΔW = work done

[(1) (1) for three definitions, deduct one for each incorrect or missing]

(i) $\Delta Q = \Delta U$ (1)
temperature rises but no work done (1)

(ii) $\Delta Q = \Delta U + \Delta W$ (1)
temperature rises and work done in expanding (1)

(max 5)

(d) (i) $\Delta U = \frac{3}{2} nR(500 - 300) = 159$ J (1) (= ΔQ)

(ii) $p\Delta V = 8.0 \times 10^4 \times (3.3 - 2.0) \times 10^{-3} = 104$ J (1)
 $\therefore \Delta Q = \Delta U + p\Delta V = 263$ J (1)

(3)

[15]