EXERCISE – II   MULTIPLE CHOICE QUESTIONS

1. D

(A) $K.E. = \frac{F}{2}KT$

(B) $V_{mean} = 1.59\sqrt{\frac{KT}{m}}$

(C) $\Delta Q = \Delta U + \Delta W$

$(\Delta U \to 0)$ for isothermal

$\Delta W \to +ve$ so $K.E.\uparrow$

2. C

Momentum changes significantely on collision with the container walls Ans.C

3. C,D

Total K.E. remains conserved hence onlyC and D option possible

4. B

$V_{rms} = \sqrt{\frac{3RT}{M_0}} = \sqrt{\frac{3 \times 8.314 \times 300}{32 \times 10^{-3}}}$

$= 483.56 \simeq 484$ m/s (A) correct

5. A,B,C

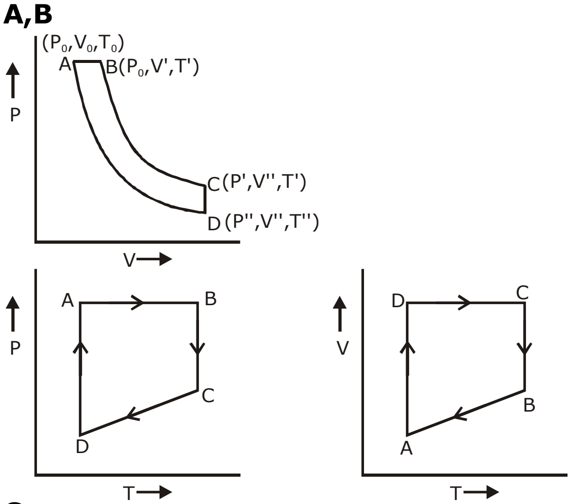
Avg. momentum/mol $\propto \sum V_x^{\,2}$

$\sum V_x^{\,2}$ is same at NTP

$(K.E.)_{avg} \propto T$

$(K.E.)/vol. \propto T$

6. A,B



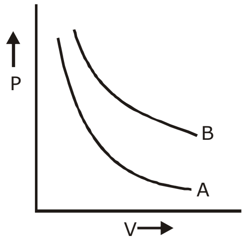
7. C

PV = Const

Slope of B > slope of A

$n_B > n_A$

$m_B > m_A$



8. A,D

$\frac{p^2}{\rho} = C \Rightarrow \quad \frac{p_1^2}{\rho_1} = \frac{p_2^2}{\rho_2}$

$\Rightarrow p_2^2 = p^2 \times \frac{1}{2} \Rightarrow p_2 = \frac{p}{\sqrt{2}}$

$pv = \frac{m}{w} \times RT = \frac{\rho v}{\omega}RT$

$p = \rho T\frac{R}{\omega} \Rightarrow \quad p_1 = \rho_1 T_1 R/\omega$

$p_2 = \rho_2 T_2 R/\omega$

$\frac{p_1}{p_2} = \frac{\rho_1 T_1}{\rho_2 T_2} \Rightarrow \sqrt{2} = 2\frac{T}{T_2}$

$\Rightarrow T_2 = \sqrt{2}T$

$\Rightarrow p = \rho\frac{TR}{\omega} \Rightarrow \frac{p^2}{\rho} = \frac{PTR}{\omega} = C$

$\Rightarrow P \times \frac{1}{T}$

9. B,D

$v_{rms} = 1.73\sqrt{\frac{KT}{m}}$

so v_{rms} does not change

$\frac{p_1}{n_1} = \frac{p_2}{n_2} \Rightarrow \frac{n_1}{n_2} = \frac{1}{2}$

10. A,C,D

At NTP

$\frac{p_1 v_1}{RT_1} = \frac{p_2 v_2}{RT_2}$

$\Rightarrow n_1 = n_2$

$v_{rms} = 1.73\sqrt{\frac{KT}{m}}$

$v_{1rms} \neq v_{2rms}$

$u = \frac{f}{2}nRT$ As temp^r is same

$u_1 = u_2$

At NTP v_{mean} is same for all molecule

11. D

$v_f = \eta v_0 \quad w_{gas} = RT_0 \ell n\eta$

$\omega_{atm} = pdv = pv(\eta - 1) = RT_0(\eta - 1)$

at const. temp^r $\Delta U = 0$

12. B,D

$\Delta W_A = P_1 \Delta V$

$\Delta W_D = P_2 \Delta V \{P_1 > P_2\}$

$\Delta Q_A = \Delta U_A + \Delta W_A$
$\Delta Q_D = \Delta U_D + \Delta W_D$
$\Delta Q_A - \Delta Q_D = \Delta U_A - \Delta U_D + \Delta W_A - \Delta W_D$
$\Delta Q_A - \Delta Q_D = \Delta W_A - \Delta W_D$
$\{\therefore \Delta U_A = \Delta U_D$
$Q_A > Q_D$

$$W_B = PdV = \int_{v_1}^{v_2} \frac{k}{v} dv = k\ell n \frac{v_2}{v_1}$$

$$W_C = k\ell n \frac{v_2}{v_1}$$

hence $W_B - W_C = 0 \Rightarrow Q_B > Q_C$
$Q_A > Q_B > Q_C > Q_D$

13. D

$\Delta Q = \Delta W + \Delta U$
$\Delta Q_{AB} = 40 + \Delta U_{AB}$
$\Delta U_{AB} = 150 - 40 = 110$ J
$\Delta U_{AB} + \Delta U_{BC} + \Delta U_{CA} = 0$
$\Delta U_{CA} = -160$ J

14. D

$(p_0, v_0) \to (p_0, 2v_0)$

$$\Delta U_1 = \frac{3}{2} nR\Delta T \;;\; \Delta U_2 = \frac{5}{2} nR\Delta T$$

$\Delta U_2 > \Delta U_1$; $\Delta W_1 = \Delta W_2$
$\Delta Q_1 - \Delta Q_2 = \Delta U_1 - \Delta U_2$
$\Delta U_2 + \Delta W_2 > \Delta U_1 + \Delta W_1$

15. A

PV = nRT Along AB V↓ T↓
Along BC P↑ T↑

Along CA $\frac{p}{(1/v)}$ = const U = const

$$w = \int P dv = \int \frac{k dv}{v} = k\,\ell n(v_i / v_f) = -ve$$

16. A,B,D

$W = Q_1 - Q_2$

$$\eta = \frac{W}{Q_1} = \frac{Q_1 - Q_2}{Q_1} = 1 - \frac{Q_2}{Q_1}$$

17. A,B

$$\Delta Q = \frac{f}{2} nR\Delta T$$

$$f = \frac{2 \times 3 \times 4.2}{1 \times 8.3 \times 1} \quad \begin{cases} n = 1 \\ R = 8.3 \end{cases}$$

$\Delta T = 1$

$$= \frac{6 \times 4.2}{8.3} \cong 3$$

gas must bc monoatomic

18. A,B

$$C_P - C_V = R = \frac{8.3}{4.2} \cong 2$$

19. A,D

$$n_1 = \frac{7}{28}; \quad n_2 = \frac{11}{44}$$

So $n_1 + n_2 = \frac{1}{4} + \frac{1}{4} = \frac{1}{2}$

$$m_0 = \frac{18\text{kg}}{(1/2)} = 36\text{kg}$$

$$C_{V\,mix} = \frac{\frac{1}{4} \times \frac{5}{2} R + \frac{1}{4} \times 3R}{\frac{1}{4} + \frac{1}{4}} = \frac{11}{4} R$$

$$C_{P\,mix} = \frac{11}{4} R + R = \frac{15}{4} R$$

$$r = \frac{C_P}{C_V} = \frac{15}{11} = \frac{45}{33} \cong \frac{47}{35}$$

20. B

Average velocity will be same for same temp^r.

21. B

$$\frac{p}{v} = \frac{nRT}{v^2}$$

so $\frac{T_1}{T_2} = \frac{kv_1^2}{kv_2^2} = \frac{1}{4} \Rightarrow T_2 = 1200\,K$

$\Delta T = 1200 - 300 = 900$ K
$\Delta U = 2 \times 3/2\ R \times 900 = 2700\ R$

22. C,D

Suddenly → nearly adiabatic
conductivity is good enough then may be iso-thermal.

23. C,D

In adiabatic process

$\Delta U \neq 0$ $\quad$ $\Delta T \neq 0$
pv^r = const.

24. B,C

Slope of × > slope of y
During expansion
$W_y > W_x$
$U_y > U_x \Rightarrow C_{v_2} > C_{v_1}$ $\quad$ $f_2 > f_1$