Miscellaneous Exercise Question Bank

1.(B) At constant volume and temperature,

$$\frac{P_1}{n_1} = \frac{P_2}{n_2}$$

$$\frac{100}{12/120} = \frac{0.01}{n_2}$$

$$n_2 = \frac{0.01}{1000} = 1 \times 10^{-5}$$

Number of molecules left $= 6.02 \times 10^{23} \times 10^{-5} = 6.02 \times 10^{18}$ molecules

2.(B) Van der Waal's equation is $\left(P + \frac{a}{V^2}\right)(V - b) = RT$

At low pressure, volume correction (b) is negligible

$$\left[P + \frac{a}{V^2}\right]V = RT \quad \Rightarrow \quad PV + \frac{a}{V} = RT \quad \Rightarrow \quad PV = RT - \frac{a}{V}$$

3.(A) Average momentum change due to collision $= 2\,mu_{avg}$ & $u \propto \frac{1}{\sqrt{m}}$

$\therefore$ If molar mass increases average momentum change will increase.

4.(B) Solubility of gases in liquid increases with increase in pressure.

5.(B) $N_2O_4 \longrightarrow 2NO_2$

1	–
0.8	0.4

Total moles $= 0.8 + 0.4 = 1.2$

$$\frac{P_1}{T_1 n_1} = \frac{P_2}{T_2 n_2}$$

$$\frac{1}{300 \times 1} = \frac{P_2}{600 \times 1.2}$$

$$P_2 = 2.4\,\text{atm}$$

6.(BCD) Vander Waal's constant '*a*' is a measure of intermolecular attractive forces.

7.(CD) $Z = \frac{PV}{RT}$

Average kinetic energy of gas $= \frac{3}{2}kT$

8.(A)

9.(ACD) For ideal gas, $Z = 1$

10.(ABCD)

Under critical states, compressibility factor is $\frac{3}{8}$

$P_C = \frac{a}{27b^2}$ $\qquad$ $T_C = \frac{8a}{27Rb}$

$V_C = 3b$

$\therefore \quad Z = \frac{P_C V_C}{RT_C} = \frac{3}{8}$

11.(ABCD) Refer module

$V_C = 3b \quad ; \quad b = \frac{1}{3}V_C$

12.(AB) At constant temperature, $P \propto \frac{1}{V}$

As volume increases, pressure decreases

Kinetic energy of molecules depends only on temperature.

13.(AB) Critical temperature $T_C = \frac{8a}{27Rb}$

Critical volume $V_C = 3b$

Critical pressure $P_C = \frac{a}{27b^2}$

Inversion temperature $T_i = \frac{2a}{Rb}$

14.(C) $\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

$r_1 =$ rate of diffusion of hydrogen gas

$r_2 =$ rate of diffusion of mixture of C_2H_4 and CO_2

$M_2 =$ Molar mass of mixture

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$

$\frac{4r}{r} = \sqrt{\frac{M_{mix}}{2}}$

$16 = \frac{M_{mix}}{2} \quad \Rightarrow \quad M_{mix} = 32$

Let x be the mole fraction of C_2H_4 in the mixture

$32 = 28x + 44(1-x) \quad \Rightarrow \quad 32 = 28x + 44 - 44x$

$16x = 12 \quad \Rightarrow \quad \frac{3}{4}$

$1 - x = \frac{1}{4}$

Ratio : $\frac{x}{1-x} = 3 : 1$

15.(B) Since both the containers are in the same conditions of P, V and T,

$$\frac{r_{O_2}}{r_{mix}} = \sqrt{\frac{M_{mix}}{M_{O_2}}}$$

As the mixture contains three moles of He and 2 moles of N_2, the effective molecular weight of the mixture would be

$$\frac{3}{5} \times 4 + \frac{2}{5} \times 28 = 13.6 \qquad \therefore \qquad \frac{r_{O_2}}{r_{mix}} = \sqrt{\frac{13.6}{32}} = 0.652$$

Though this solution looks OK, there is one big flaw in it.

The error is that we have assumed that He and N_2 from vessel B would effuse out with the same rate. This assumption was made in because we have taken the composition of the gas mixture coming out of the vessel to be same as that of the mixture that was inside the vessel. It should be duly noted that the two mixtures (inside and the are that effused out) have different compositions. Therefore first we must find the composition of the gas mixture coming out of the vessel B.

$$\frac{r_{N_2}}{r_{He}} = \frac{2}{3}\sqrt{\frac{4}{28}} = \frac{2}{3}\sqrt{\frac{1}{7}} = 0.252$$

This means that initially the ratio of moles of N_2 to the moles of He coming out of the vessel are in the molar ratio of 0.252 and not $\frac{2}{3}$.

Let moles of the He coming out to be x

$\therefore$ Moles of N_2 coming out is 0.252 x

$$\therefore \qquad \frac{n_{N_2}}{n_{total}} = \frac{0.252\,X}{1.252\,X} = 0.2$$

$$\frac{n_{He}}{n_{total}} = 0.8 \Rightarrow M_{mix} = 0.2 \times 28 + 0.8 \times 4 = 8.85$$

$$\therefore \qquad \frac{r_{O_2}}{r_{mix}} = \sqrt{\frac{8.8}{32}} = 0.52$$

16.(A) $Cl_2 \longrightarrow 2\,Cl$

$t = 0 \qquad 1$

$t = eq \qquad 1 - \alpha \qquad 2\alpha$

$$\frac{r_{mix}}{r_{kr}} = \sqrt{\frac{M_{kr}}{M_{mix}}}$$

Given $\alpha = 0.14$

At equilibrium, $n_{Cl_2} = 0.86 \qquad n_{Cl} = 0.28$

$$M_{mix} = \frac{0.28 \times 35.5}{1.14} + \frac{71 \times 0.86}{1.14} = 62.28 \quad \Rightarrow \quad \frac{r_{mix}}{r_{kr}} = \sqrt{\frac{84}{62.28}} \approx 1.16$$

17.(B) Let 'x' g each of methane and hydrogen be taken.

$P_T = P_A + P_B$

$P_A =$ Partial pressure of methane gas $= X_{CH_4} P_T$

$P_B =$ Partial pressure of H_2 gas $= X_{H_2} P_T$

$n_{CH_4} = \frac{x}{16}$ $\qquad$ $n_{H_2} = \frac{x}{2}$

$$X_{H_2} = \frac{\frac{x}{2}}{\frac{x}{16} + \frac{x}{2}} = \frac{8}{9} \quad \Rightarrow \quad P_B = \frac{8}{9}P_T$$

18.(C) Dalton's law of partial pressure is applicable only for mixture of non-reacting gases.

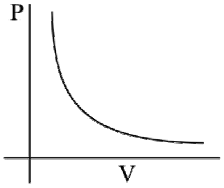
$$NH_3 + HCl \longrightarrow NH_4Cl$$

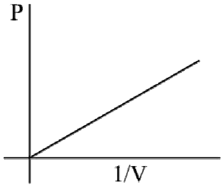
$\therefore$ Dalton's law does not hold good for NH_3 and HCl.

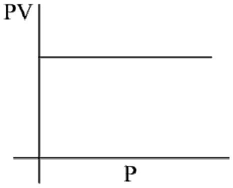
19.(D) At constant T, $V \propto$ mole % $= \frac{150}{300+200+100+150} \times 100 = \frac{150}{750} \times 100 = 20\%$

20.(B) According to Boyle's law,

$P \propto \frac{1}{V}$ (at const. T), $\qquad$ PV = constant







21.(B) $KE_T = \frac{3}{2}nRT$ at constant P and V

PV = K at constant T and mass

V = KT at constant P and mass

22.(B) $M_{mix} = X_{CH_4}M_{CH_4} + X_{C_2H_4}M_{C_2H_4}$

If mole ratio of CH_4 and ethene is $x : y$

$X_{CH_4} = \frac{x}{x+y}$ $\qquad$ $X_{C_2H_4} = \frac{y}{x+y}$

$$M_{mix} = \left(\frac{x}{x+y}\right)16 + \left(\frac{y}{x+y}\right)28 = 20$$

$$16x + 28y = 20(x+y)$$

$$x = 2y \qquad \text{...... (i)}$$

If mole ratio is $y : x$

$$M_{mix} = \left(\frac{y}{x+y}\right)16 + \left(\frac{x}{x+y}\right)28$$

$$16y + 28x = M'(x+y)$$

$$16y + 28x = M'(2y+y)$$

$$72y = M'(3y) \quad \Rightarrow \quad M' = 24$$

23.(B) Critical temperature is low due to weaker attractive forces

24.(C) Only frequency of collision $\propto \sqrt{T}$

25.(D) All molecules of ideal gas do not travel at same speed.

26.(A) Van der waal constant a determines intermolecular force of attraction.

27.(D) Z can be greater than or less than 1

28.(C) SO_2 is easily liquefied because of higher value of 'a'

29.(C) Statement II is incorrect

Due to intermolecular force of attraction, pressure exerted by real gas is less than ideal gas.

30.(D) Unit of Vander waal's constant b is $L\ mol^{-1}$

31.(D) $V \propto$ temperature in kelvin. **32.(A)**

33. $\mathbf{A \to p, r, t\ ;\ B \to q\ ;\ C \to s\ ;\ D \to p, r, t}$

$T_c = \frac{8a}{27Rb}$ $\therefore$ T_c depends 'a' and 'b' greater the value of a, more is the T_c.

34. $\mathbf{A \to p, s\ ;\ B \to q, s\ ;\ C \to p\ ;\ D \to r, t}$

35. $$\frac{PV}{RT} = \frac{P_1V_1}{RT} + \frac{P_2V_2}{RT}$$

$P \times 6 = 2 \times 2 + 2 \times 4 \quad \Rightarrow \quad P = 2\,atm$

36. Total pressure is $4.57\,atm$ at 50°C

$P_{H_2O}(g) = \frac{90}{100} \times 0.5 = 0.45$

$P_{dry\ air} = 4.57 - 0.45 = 4.12\,atm$

At 25°C

$$\frac{P_2}{T_2} = \frac{P_1}{T_1}$$

$$\frac{P}{298} = \frac{4.12}{323} \quad \Rightarrow \quad P_{dry\ air} = 3.8\,atm$$

$P_{H_2O}(g)$ at 25°C $= \frac{20}{100} \times 0.1 = 0.02$

$P_{total} = 3.8 + 0.02 = 3.82\,atm$

37.(B) For gas, $\frac{P_1V_1}{T_1} = \frac{P_2V_2}{T_2}$

$\frac{760 \times 91.9}{273} = \frac{P_2 \times 100}{288} \quad \Rightarrow \quad P_2 = 736.8\,mm$ of Hg

$P_{Total} = P_2(g) + V.P. \quad \Rightarrow \quad V.P. = 750 - 736.8 = 13.2$ mm of Hg

38.(A) $$\frac{r_1}{r_2} = \frac{P_1}{P_2}\sqrt{\frac{M_2T_2}{M_1T_1}}$$

$\frac{n}{x} = \frac{1}{0.25}\sqrt{\frac{4}{64} \times \frac{546}{273}} \quad \Rightarrow \quad x = \frac{n}{\sqrt{2}}$

39.(B) Given $P = 10\,\text{atm}$,

Total numbers of moles ; $n_A + n_B + n_C = 10$

$P_A = 3\,\text{atm},\ P_B = 1\,\text{atm},\ n_A = 3,\ n_B = 1$

$\because \quad P_A = x_A \times P_{(\text{total})} = \dfrac{n_A}{n_A + n_B + n_C} \times 10 = \dfrac{n_A}{10} \times 10$

$n_A = 3$

Similarly, $P_B = x_B \times P_{(\text{total})}$

So, $n_B = 1$

$\therefore \quad n_C = 10 - (n_A + n_B) = 10 - 4 = 6$

Weight of $C = 6 \times 2 = 12\,g$

40.(D) $U_{rms} = \sqrt{\dfrac{U_1^2 + U_2^2 + U_3^2 + U_4^2}{4}} = \sqrt{\dfrac{54}{4}} = \dfrac{\sqrt{54}}{2}$

41.(A) Moles of each gas $= \dfrac{6.02 \times 10^{22}}{N_A} = 0.1$

So mass of mixture $= 0.1 \times M_{N_2} + 0.1 \times M_{O_2} + 0.1 \times M_{H_2}$

$= 0.1 \times 28 + 0.1 \times 32 + 0.1 \times 2 = 6.2$ grams

42.(C) $V_i / T_i = V_f / T_f$ (at constant pressure)

$V_i = V/2,\ T_i = 300\,K,\ V_f = V$

$T_f = V_f \times \dfrac{T_i}{V_i} = V \times \dfrac{300}{V/2} = 600K$

43.(A) On heating a gas in an open container (P and V constant) moles of gas go out

Thus $n_1T_1 = n_2T_2$

or $n_1 \times 300 = n_2 \times 400$

$n_2 = \dfrac{3n_1}{4}$

$\therefore$ Fraction of moles of gas left $= \dfrac{n_2}{n_1} = \dfrac{3n_1}{4n_1} = \dfrac{3}{4}$

44.(C) Using $PV = \dfrac{w}{m}RT$ or $P = \dfrac{d}{m}RT$

For gas A $P_A = \dfrac{3}{m_A} \times R \times T$; $P_B = \dfrac{1.5}{m_B} \times R \times T$

$\therefore \quad \dfrac{P_A}{P_B} = \dfrac{2 \times m_B}{m_A} = \dfrac{2 \times 2 \times m_A}{m_A} = 4$

45.(C) $\frac{V_1}{T_1} = \frac{V_2}{T_2}$

$$\frac{300}{27+273} = \frac{V}{-3+273} = V = 270\,\text{mL}$$

46.(C) $R = \frac{PV}{nT}$

Unit of R is litre − atm/K/mole

47.(B) For hydrogen we know that

$$PV = \frac{w}{M}RT = \frac{0.184}{2} \times R \times 290$$

For unknown gas $PV = \frac{3.7}{M} \times R \times 298$

Equating both the equation

$$\frac{3.7}{M} \times R \times 298 = \frac{0.184}{2} \times R \times 290 \quad \Rightarrow \quad M = 41.33$$

48.(B) $\frac{r_1}{r_2} = \sqrt{\frac{M_{SO_2}}{M_{\text{hydrocarbon}}}}$

$$\frac{180/15}{120/20} = \sqrt{\frac{64}{M}} \quad \Rightarrow \quad 2 = \sqrt{\frac{64}{M}} = M = 16$$

49.(C) $\sqrt{\frac{3RT}{M_{H_2}}} = \sqrt{\frac{3R \times 300}{M_{N_2}}}$

$$\frac{T}{M_{H_2}} = \frac{300}{M_{N_2}} \quad \Rightarrow \quad \frac{T}{2} = \frac{300}{28} \quad \Rightarrow \quad T = 21.43\,\text{K}$$

50.(D) Number of moles of $N_2 = \frac{7}{28} = \frac{1}{4}$ moles

Number of moles of $H_2 = 1$ mole

Number of moles of $SO_2 = \frac{1}{8}$ moles

Total moles $= \frac{1}{4} + 1 + \frac{1}{8} = \frac{11}{8}$

$$P = \frac{nRT}{V} = \frac{11}{8} \times \frac{0.0821 \times 300}{6} = 5.64 \approx 5.7\,\text{atm}$$

51.(B) $V_1 = V,\ T_1 = 300\,K,\ T_2 = 500\,K,\ V_2 = ?$

At constant pressure $V_1T_2 = V_2T_1$

$\therefore \quad V_2 = \frac{V_1T_2}{T_1} = \frac{V \times 500}{300} = \frac{5V}{3}$

$\therefore$ Volume of air escaped = final volume − initial volume $= \frac{5V}{3} - V = \frac{2V}{3}$

$\therefore$ % of air escaped $= \frac{2V/3}{5V/3} \times 100 = 40\%$

52.(C) $P(V-b)=RT;\ P=\dfrac{RT}{(V-b)};$

$$P=\left(\frac{R}{(V-b)}\right)T+0$$

53.(A) $d=\dfrac{PM}{RT}=\dfrac{6\times 16}{0.0821\times 523}=2.236$

54.(D) $v_{MPS}:v_{AV}:v_{RMS}=\sqrt{2}:\sqrt{8/\pi}:\sqrt{3}$

55.(D) $Z=\dfrac{PV}{nRT};\ 1.90=\dfrac{1\times 800}{n\times R\times 330}$

$$n=\frac{1\times 800}{1.90\times R\times 330}$$

$$Z=1.10=\frac{V\times 200}{n\times R\times 570}$$

$$1.10=\frac{V\times 200\times 1.90\times R\times 330}{800\times R\times 570}\quad\Rightarrow\quad V=4\,L$$

56.(D) $\dfrac{5.6}{22.4}=\dfrac{11}{M.wt}$

$M.wt.=44=N_2O$

57.(C) $\dfrac{r_x}{r_{O_2}}=\sqrt{\dfrac{M_{O_2}}{M_x}}=\left(\dfrac{4}{5}\right)^2=\dfrac{32}{M_x}$

$M_x=50$

$d_x=0.80\,kg/m^3$

$$V_m=\frac{1000}{800}\times 50=62.5\,L$$

$$Z=\frac{PV_m}{RT}=\frac{1\times 62.5}{0.0821\times 500}=1.52$$

58.(B) $V=\dfrac{nRT}{P}=\dfrac{2.8}{28}\times\dfrac{0.0821\times 300}{0.821}=3\,litre$

59.(D) $T_C=\dfrac{8a}{27Rb}$

So, for highest critical temperature, the value of '*a*' should be highest.

60.(C) $P_{H_2O}=22.8\,mm\ of\ Hg$

$V=827\,L$

$T=300\,K$

$$\therefore\qquad n_{H_2O}=\frac{PV}{RT}=\frac{(22.8/760)\times 827}{0.0821\times 300}\Rightarrow n_{H_2O}=1\ mole$$

So, mass of H_2O in gaseous form = 18 g

61.(B) The volume of the gas in the bubble remains constant, so that $n_1 = n_2$. To calculate the final volume, V_2

$$V_2 = V_1 \times \frac{P_1}{P_2} \times \frac{T_2}{T_1} = 2.0\,\text{mL} \times \frac{6.0\,\text{atm}}{1.0\,\text{atm}} \times \frac{298\,\text{K}}{281\,\text{K}} = 12.72\,\text{mL}$$

62.(C) $Z = \frac{PV}{nRT} = \frac{V}{n} = \frac{0.9 \times 0.0821 \times 273}{9} = 2.24\,\text{litre / mol}$

$\therefore$ Volume of 1 mili-mole of gas $= 2.24\,\text{mL}$

63.(A) Given $m_A = 2\,m_B$

$\therefore$ Mol. wt. of $A = 2 \times$ mol. wt. of B .... **(i)**

Given u_{rms} of $A = 2 \times u_{rms}$ of B .... **(ii)**

Also number of molecules of A = number of molecules of B .... **(iii)**

For gas A $P_A V_A = \frac{1}{3} M_A\, u^2_{rms\,A}$

For gas B $P_B V_B = \frac{1}{3} M_B\, u^2_{rms\,B}$

$\therefore$ $\frac{P_A V_A}{P_B V_B} = \frac{M_A}{M_B} \times \frac{u_A^2}{u_B^2}$ .... **(iv)**

Given $V_A = V_B$ .... **(v)**

$\therefore$ By equation (i), (ii), (iv) and (v)

$$\frac{P_A}{P_B} = 2 \times (2)^2 = 8$$

$\therefore$ $P_A = 8P_B$

64.(B) If the intermolecular attraction disappears suddenly, pressure of real gas increases i.e. $P_{real} = P_{ideal}$

65.(AD) Critical temperature is the temperature above which gas cannot be liquefied.

66.(C) Critical temperature (T_C) is the temperature above which a gas cannot be liquefied whatsoever be the pressure applied.

$$T_C = \frac{8a}{27Rb}$$

67.(A) Boyle's Temperature, $T_b = \frac{a}{Rb} = 290$ K

$\therefore$ $T_i = 2T_b = 580\,\text{K}$

So, the gas is being expanded adiabatically at 600 K which is more than its inversion temperature (T_i)

68.(C) Vander waal's equation :

$$\left(P + \frac{an^2}{V^2}\right)(V - nb) = nRT$$

Here Vander waal's constant 'a' provides the correction for molecular forces.

69.(B) Greater the value of a, more is the intermolecular force of attraction, more is the boiling point.

70.(D) $T_c = \dfrac{8a}{27Rb}$

Greater is the value of (a / b), more is the critical temperature.

71.(B) $(P) \rightarrow P >> \dfrac{an^2}{V^2}$

$\therefore \quad (P)(V_m - b) = RT + Pb \quad \Rightarrow \quad PV_m = RT + Pb$

$(R) \rightarrow V >> nb$

$\therefore \quad \left(P + \dfrac{a}{V_m^2}\right)(V_m) = RT \quad \Rightarrow \quad PV_m = RT - \dfrac{a}{V_m}$

$(S) \rightarrow$ At low temperature and high pressure, the gas behaves ideally.

$\therefore \quad PV_m = RT$

72.(C) At Boyle's temperature (T_b), the gas behaves ideally over an appreciable range of pressures.

73. **(A) → q, s; (B) → r ; (C) → r ; (D) → q, s**

(A) H_2 gas at NTP

$Z > 1$

So $V_m > 22.4L$

Gas is less compressible w.r.t. ideal gas

(B) Applying PM = dRT

At ideal condition, density of O_2 gas $\dfrac{10}{7} g / L$

For $d > \dfrac{10}{7}, \ Z < 1$

Gas is more compressible

(C) At ideal conditions, $d = \dfrac{20}{7} g / L$

At $d > \dfrac{20}{7}, \ Z < 1$

(D) At ideal conditions, density of He gas $= \dfrac{1}{5.6} g / L$

At $d < \dfrac{1}{5.6}, \ Z > 1$

$V_m > 22.4\,L$

Gas is less compressible w.r.t Ideal gas.

74. **(A) → q, r; (B) → p, s ; (C) → q, r ; (D) → p, s**

(A) At low pressure, attractive forces are dominant. So, $Z < 1$ and the gas is more compressible.

(B) At high pressure, repulsive forces are dominant. So, $Z > 1$ and the gas is less compressible.

(C) At low density of gas, $Z < 1$

(D) For H_2 and He, $Z > 1$ always.

75.(B) Vander waal's equation of state is applicable only above critical temperature, T_c.

76.(D) At 300 K, the state will be liquid at $P > 20\,atm$

At 500 K, the state will be liquid at $P > 50\,atm$

77. **A – Q, S ; B – R ; C – P, T; D - T**

$T_2 \rightarrow$ Critical temperature.

Above T_2 , the gas cannot be liquefied.

At T_1, curve AB represents gaseous state, curve BD represents equilibrium between gaseous & liquid states and curve DE represents liquid state.

78.(C) $1000 = \sqrt{\dfrac{3RT}{M}}; 10^3 = \left[\dfrac{3 \times 8.314 \times T}{10^{-26} \times 6 \times 10^{23}}\right]^{1/2}$

$$T = \frac{10^6 \times 10^{-26} \times 6 \times 10^{23}}{3 \times 8} = 250\,K$$

79.(5) $b = 4 \times$ Volume of 1 mole of gas molecules.

$$\Rightarrow \quad 4\pi \times 10^{-4} L/mol = 4 \times \frac{4}{3}\pi \times (z \times 10^{-9})^3 \times 10^{-3} L \times 6.022 \times 10^{23} \quad \Rightarrow \quad z = 5$$

80.(2) Molar excluded volume, $b = 4 \times \frac{4}{3}\pi r^3 \times N_A$

$$\Rightarrow \quad 3.2\pi \times 10^{-3} = 4 \times \frac{4}{3}\pi r^3 \times 6 \times 10^{23} \quad \Rightarrow \quad r = 10^{-9} m$$

$\therefore$ Diameter, $2r = 2 \times 10^{-9} m$ or 2 nm

81.(B)

82. $CaCO_3(s) \longrightarrow CaO(s) + CO_2(g)$

$n_{CaCO_3} = \frac{25}{100} = \frac{1}{4} = n_{CaO} = n_{CO_2}$

$m_{CaO} = \frac{1}{4} \times 56 = 16\,g$

$V_{CaO} = \frac{16}{3.3} = 4.84\,mL$

Volume of CO_2 gas $= 504.2 - 4.84 = 499.3\,mL$

Solving $\left(P + \dfrac{an^2}{V^2}\right)(V - nb) = nRT$

we get $P = 62\,atm$

83.(BCD) Gas can be liquified below T_c

84.(D) $Z = 1$, gas behaves ideally

$Z < 1$, intermolecular forces of attraction dominates i.e. $V_{real} < V_{ideal}$, real gas can be easily liquefied owing to dominant intermolecular attraction.

85.(B) For $Z > 1$

$V_{real} > V_{ideal}$

At 1atm, $V_{real} > 22.4\,L$

$\therefore$ As pressure is increased, volume of gas decreases and approaches 22.4 L

86.(A) T_B is a temperature at which gas behaves like an ideal gas meaning attractive and repulsing force just offset each other.

87.(B) A gas can be liquefied only if its temperature is lower than its critical temperature Hence, (B) is the correct answer.

88.(B)

89.(D) $P'_{N_2} + P'_{H_2O} = 1\,\text{atm}$

$P'_{H_2O} = 0.3\,\text{atm}$

$P'_{N_2} = 0.7\,\text{atm}$

Now new pressure of N_2 in another vessel of volume V/3 at same temperature T is given by

$P''_{N_2} \times \frac{V_1}{3} = 0.7V \quad \therefore \quad P''_{N_2} = 2.1\,\text{atm}$

Since aqueous tension remains constant, and thus total pressure in new vessel

$= P''_{N_2} + P'_{H_2O} = 2.1 + 0.3 = 2.4$ atm

90.(B) $(U_{AV})_A = \sqrt{\frac{8RT}{\pi M_A}}$ and $(U_{rms})_B = \sqrt{\frac{3RT}{M_B}}$

$\therefore \quad \frac{8}{3\pi} = \frac{M_A}{M_B}$

For $\quad A(U_{AV}) = \sqrt{\frac{8RT_2}{\pi M_A}}$ for $B(V_{AV}) = \sqrt{\frac{8RT}{\pi M_B}}$

$\frac{T_2}{T} = \frac{M_A}{M_B} = \frac{8}{3\pi} \quad \therefore \quad T_2 = \frac{8}{3\pi}T$ or $T_2 < T$

91.(C) $\because$ 100 ml blood has 0.02 g O_2 and 0.08 g CO_2

$\therefore$ 10,000 ml blood has 2 g O_2 and 8 g CO_2

Using PV = nRT

For O_2, $1 \times V_{O_2} = \frac{2}{32} \times 0.0821 \times 310 \quad \Rightarrow \quad V_{O_2} = 1.59$ litre

For CO_2, $1 \times V_{CO_2} = \frac{8}{44} \times 0.0821 \times 310 \quad \Rightarrow \quad V_{CO_2} = 4.62$ litre

92.(C) Mass of 1 lt water vapour = V ×d = 1000 × 0.0006 = 0.6g

$\therefore$ Volume of liquid water $= \frac{0.6}{1} = 0.6\,\text{cc}$

93.(A) $KE = \frac{3}{2}RT;\ T = -123 + 273 = +150\,K$

$\frac{3}{2} \times R \times 150 = 3 \times 8.314 \times 75 = xJ = 225 \times 8.314 = xJ$

At 27°C = 27+ 273 = 300K

KE for = 2x Joule = $\frac{3}{2} \times 8.314 \times 300$

N molecules

$\therefore$ x Joule = 3 × 8.314 × 75

In both the cases x Joules correspond to N molecules.

94.(D) **(i)** Density of a gas $(\rho) = \frac{PM}{RT}$

Since $\frac{M_B}{T_B} = \frac{M_A}{T_A}$,

$\therefore$ At the same pressure $\rho_A = \rho_B$.

But if pressure is different then $\rho_A \neq \rho_B$.

(ii) Pressure of the gases would be equal if their densities are equal other wise not.

KE per mol $= \frac{3}{2}RT$

$\therefore$ It will be different for the two gases.

(iii) $V_{rms} = \sqrt{\frac{3RT}{M}}$, since $\frac{T_A}{M_A} = \frac{T_B}{M_B}$; V_{rms} of $A = V_{rms}$ of B

95.(B) The average kinetic energy of an atom is given as $\frac{3}{2}kT$.

$\therefore$ It does not depend on mass of the atom.

96.(B) H_2 and Cl_2 reacts to form HCl; Dalton's law of partial pressure is valid only for the gases which don't react at ordinary conditions.

97.(C) $\frac{P_1V_1}{P_2V_2} = \frac{n_1RT_1}{n_2RT_2} = \frac{n_1T_1}{n_2T_2}$

As, $V_1 = V_2$ & $T_1 = T_2$

$$\frac{P_1}{P_2} = \frac{n_1}{n_2}$$

$$\frac{P_{H_2}}{P_{CO_2}} = \frac{n_{H_2}}{n_{CO_2}} \Rightarrow \frac{P_{H_2}}{1} = \frac{44/2}{44/44} = 22\,\text{atm}$$

98.(A) Mass of the filled balloon = 50 + 685.2 = 735.2 kg

Pay load = Mass of displaced air – Mass of balloon = 5108 – 735.2 = 4372.8 kg

99.(B) PV = k constant

New volume = 0.95 V

$\therefore$ $P_1V = P_2 \times 0.95V$

$$P_2 = \frac{P_1}{0.95} = 1.0526\,P_1$$

$\therefore$ Increase in pressure $= 1.0526\,P_1 - P_1 = 0.0526\,P_1 = 5.26\%$ of P_1

100.(D) Number of molecules in one mole of a gas viz. 6.023×10^{23} is independent of pressure.