Additional Problems For Self Practice (APSP)

PART - I : PRACTICE TEST PAPER

This Section is not meant for classroom discussion. It is being given to promote self-study and self testing amongst the Resonance students.

Max. Marks : 120 **Max. Time : 1 Hr.**

Important Instructions

1. The test is of **1 hour** duration.

2. The Test Booklet consists of **30** questions. The maximum marks are **120.**

3. Each question is allotted **4 (four)** marks for correct response.

4. Candidates will be awarded marks as stated above in Instructions No. 3 for correct response of each question. **¼ (one fourth)** marks will be deducted for indicating incorrect response of each question. No deduction from the total score will be made if no response is indicated for an item in the answer sheet.

5. There is only one correct response for each question. Filling up more than one response in any question will be treated as wrong response and marks for wrong response will be deducted accordingly as per instructions 4 above.

1. For two gases, A and B with molecular weights M_A and M_B, it is observed that at a certain temperature, T, the mean velocity of A is equal to the root mean square velocity of B. Thus the mean velocity of A can be made equal to the mean velocity of B, if

(1) A is at temperature, T_1 and B at T_2 $T_1 > T_2$

(2) A is lowered to a temperature $T_2 < T$ while B is at T

(3) Both A and B are raised to a higher temperature

(4) Both A and B are lowered in temperature.

2. At what temperature, the average speed of gas molecules be double of that at temperature, 27ºC?

(1) 120ºC (2) 108ºC (3) 927ºC (4) 300ºC

3. Two glass bulbs A and B at same temperature are connected by a very small tube having a stop-corck. Bulb A has a volume of 100 cm^3 and contained the gas while bulb B was empty. On opening the stop-corck, the pressure fell down to 20%. The volume of the bulb B is :

(1) 100 cm^3 (2) 200 cm^3 (3) 250 cm^3 (4) 400 cm^3

4. Match of following (where U_{rms} = root mean square speed, U_{av} = average speed, U_{mp} = most probable speed)

List I		List II	
(a)	U_{rms} / U_{av}	(i)	1.22
(b)	U_{av} / U_{mp}	(ii)	1.13
(c)	U_{rms} / U_{mp}	(iii)	1.08

(1) (a) → (iii), (b) → (ii), (c) → (i) (2) (a) → (i), (b) → (ii), (c) → (iii)

(3) (a) → (iii), (b) → (i), (c) → (ii) (4) (a) → (ii), (b) → (iii), (c) → (i).

5. 2 litres of moist hydrogen were collected over water at 26^0C at a total pressure of one atmosphere. On analysis, it was found that the quantity of H_2 collected was 0.0788 mole. What is the mole fraction of H_2 in the moist gas

(1) 0.989 (2) 0.897 (3) 0.953 (4) 0.967

6. When CO_2 under high pressure is released from a fire extinguisher, particles of solid CO_2 are formed, despite the low sublimation temperature (– 77ºC) of CO_2 at 1.0 atm. It is

(1) the gas does work pushing back the atmosphere using KE of molecules and thus lowering the temperature

(2) volume of the gas is decreased rapidly hence, temperature is lowered

(3) both (1) and (2)

(4) None of the above

7. At what temperature will the total KE of 0.3 mol of He be the same as the total KE of 0.40 mol of Ar at 400 K ?

(1) 533 K (2) 400 K (3) 346 K (4) 300 K

8. When a gas is compressed at constant temperature :

(1) the speeds of the molecules increase (2) the collisions between the molecules increase

(3) the speeds of the molecules decrease (4) the collisions between the molecules decrease

9. If a container contains only gas $A_4(g)$ and the following reaction takes place

$A_4(g) \rightarrow 4A(g)$ If A(g) is considered to be a real gas then :

(1) The value of 'b' decreases (2) The value of 'b' increases

(3) The value of 'b' constant (4) Cannot be predicted.

10. A cylinder is filled with a gaseous mixture containing equal masses of CO and N_2 . The partial pressure ratio is :

(1) $P_{N_2} = P_{CO}$ (2) $P_{CO} = 0.875\,P_{N_2}$ (3) $P_{CO} = 2\,P_{N_2}$ (4) $P_{CO} = \frac{1}{2}\,P_{N_2}$

11. Helium atom is two times heavier than a hydrogen molecule at 298 k, the average kinetic energy of helium is :

(1) two times that of hydrogen molecule (2) same as that of the hydrogen molecule

(3) four times that of a hydrogen molecule (4) half that of a hydrogen molecule

12. Compressibility factor of methane gas at 300K and 1 atm is 0.8. The mass of methane gas present at 1 atm and 300K in 1 lit cylinder is [R = 0.08 lit atm $mol^{-1}K^{-1}$].

(1) 1.08 gm (2) 0.75 gm (3) 0.83 gm (4) 0.93 gm

13. Two flasks A and B have equal volumes. A is maintained at 300 K and B at 600 K, while A contains H_2 gas, B has an equal mass of CO_2 gas. Find the ratio of total K.E. of gases in flask A to that of B.

(1) 1 : 2 (2) 11 : 1 (3) 33 : 2 (4) 55 : 7

14. A quantity of gas is collected in a graduated tube over the mercury. The volume of gas at 18ºC is 50 ml and the level of mercury in the tube is 100 mm above the outside mercury level. The barometer reads 750 torr. Hence, volume at S.T.P. is approximately :

(1) 22 ml (2) 40 ml (3) 20 ml (4) 44 ml

15. 3 moles of N_2 gas at 27°C and 3 atm pressure has same volume as 5 mole of H_2 gas at 127°C. then the pressure of H_2 gas is

(1) $\frac{10}{3}$ atm (2) $\frac{5}{3}$ atm (3) 20 atm (4) $\frac{20}{3}$ atm

16. If equal weights of oxygen and nitrogen are placed in separate containers of equal volume at the same temperature, which one of the following statements is true?
(mol wt: N_2 = 28, O_2 = 32)
(1) Both flasks contain the same number of molecules.
(2) The pressure in the nitrogen flask is greater than the one in the oxygen flask.
(3) More molecules are present in the oxygen flask.
(4) Molecules in the oxygen flask are moving faster on the average than the ones in the nitrogen flask.

17. Which of the following is NOT a postulate of the kinetic molecular theory of gases?
(1) The molecules possess a volume that is negligibly small compared to the of the container
(2) The pressure and volume of a gas are inversely related
(3) Gases consist of discrete particles that are in random motion
(4) The average kinetic energy of the molecules is directly proportional to the temperature

18. At what temperature root mean square speed of N_2 gas is equal to that of propane gas at S.T.P. conditions.
(1) 173.7°C (2) 173.7 K (3) S.T.P. (4) – 40°C

19. At STP the order of mean square velocity of molecules of H_2, N_2, O_2 and HBr is -
(1) $H_2 > N_2 > O_2 > HBr$ (2) $HBr > O_2 > N_2 > H_2$ (3) $HBr > H_2 > O_2 > N_2$ (4) $N_2 > O_2 > H_2 > HBr$

20. The critical density of the gas CO_2 is 0.44 g cm^{-3} at a certain temperature. If 'r' is the radius of the molecule, r^3 in cm^3 is approximately.
(1) $\frac{25}{\pi N}$ (2) $\frac{100}{\pi N}$ (3) $\frac{6.25}{\pi N}$ (4) $\frac{25}{\pi}$

21. At STP, a container has 1 mole of Ar(argon), 3 moles of CO_2 ,3 moles of O_2 and 4 moles of N_2. Without changing the total pressure, if 1 mole of O_2 is removed the partial pressure of O_2.
(1) decreases by 26% (2) decrease by 50% (3) is unchaged (4) decrease by 45%

22. For 10 minute each, at 0ºC, from two identical holes nitrogen and an unknown gas are leaked into a common vessel of 4 litre capacity. The resulting pressure is 2.8 atm and the mixture contains 0.4 mole of nitrogen. What is the molar mass of unknown gas?
(1) 448 g mol^{-1} (2) 224 g mol^{-1} (3) 226 g mol^{-1} (4) None of these

23. At a low pressure of 0.25 atm, 2 mole of a real gas has Boyle's temperature 100 K. The approximate volume of gas at this temperature and pressure is :
(1) 66 litre (2) 33 litre (3) 44.8 litre (4) none

24. Equal weight of three gases He, CH_4 and O_2 are mixed in a fixed volume container at room temperature then the fraction of total pressure exerted by CH_4 molecules is :
(1) $\frac{2}{11}$ (2) $\frac{8}{11}$ (3) $\frac{16}{11}$ (4) $\frac{1}{11}$

25. A 4 : 1 molar mixture of He and CH_4 gases is contained in a vessel at 20 bar pressure. Due to a hole in the vessel, the gas mixture leaks out. The ratio of number of moles of He to CH_4 in the mixture effusing out initially will be :
(1) 8 : 1 (2) 1 : 8 (3) 1 : 4 (4) 4 : 1

26. The rates of diffusion of two gases A and B are in the ratio 1 : 4. If the ratio of their masses present in the mixture is 2 : 3. The ratio of their mole fraction is :

(1) 1/12 (2) 5/24 (3) 1/24 (4) 1/6

27. If 'b' is van der Waal constant of argon then the molecular diameter of argon molecule can be represented by the expression :

(1) $\left(\frac{3b}{2\pi N_A}\right)^{1/3}$ (2) $\left(\frac{3b}{16\pi N_A}\right)^{1/3}$ (3) $\left(\frac{3b}{2\pi N_A}\right)^{3/2}$ (4) $\left(\frac{3b}{2\pi N_A}\right)^{1/2}$

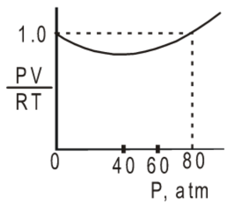
28. If density of vapours of a substance of molar mass 18 g/mole at 1 atm pressure and 500 K is 0.36 kg m^{-3}, then value of Z for the vapours is : (Take R = 0.082 L atm $mole^{-1}$ K^{-1})

(1) $\frac{41}{50}$ (2) $\frac{50}{41}$ (3) 1.1 (4) 0.9

29. The density of steam at 27°C and 8.314×10^4 pascal is 0.8 Kg m^{-3}. The compressibility factor would be

(1) 0.75 (2) 1 (3) 0.88 (4) 1.1

30. The Vander waal's equation of state for a non-ideal gas can be rearranged to give $\frac{PV}{RT} = \frac{V}{V-b} - \frac{a}{VRT}$ for 1 mole of gas. The constants a & b are positive numbers . When applied to H_2 at 80K, the equation gives the curve as shown in the figure. Which one of the following statements is correct :



(1) At 40 atm, the two terms V/(V − b) & a/VRT are equal.

(2) At 80 atm, the two terms V/(V − b) & a/VRT are equal.

(3) At a pressure greater than 80 atm, the term V/(V − b) is greater than a/VRT.

(4) At 60 atm, the term V/(V − b) is greater than $1+\frac{a}{VRT}$.

Practice Test (JEE-Main Pattern)

OBJECTIVE RESPONSE SHEET (ORS)

Que.	1	2	3	4	5	6	7	8	9	10
Ans.										
Que.	11	12	13	14	15	16	17	18	19	20
Ans.										
Que.	21	22	23	24	25	26	27	28	29	30
Ans.										

PART - II : PRACTICE QUESTIONS

1. A gaseous mixture of three gases A, B and C has a pressure of 10 atm. The total number of moles of all the gases is 10. If the partial pressure of A and B are 3.0 and 1.0 atm respectively and if C has mol. wt. of 2.0, what is the weight of C in g present in the mixture ?
(1) 6 (2) 8 (3) 12 (4) 3

2. Two vessels connected by a valve of negligible volume. One container (I) has 2.8 of N_2 at temperature T_1(K). The other container (II) is completely evacuated. The container (I) is heated to T_2(K) while container (II) is maintained at $T_2/3$ (K). Volume of vessel (I) is half that of vessel (II). If the valve is opened then what is the weight ratio of N_2 in both vessel (W_I/W_{II}) ?
(1) 1 : 2 (2) 1 : 3 (3) 1 : 6 (4) 3 : 1

3. Two glass bulbs A and B are connected by a very small tube having a stop cock. Bulb A has a volume of 100 cm^3 and contained the gas, while bulb B was empty. On opening the stop cock, the pressure fell down to 40%. The volume of the bulb B must be :
(1) 75 cm^3 (2) 125 cm^3 (3) 150 cm^3 (4) 250 cm^3

4. Two closed vessel A and B of equal volume containing air at pressure P_1 and temperature T_1 are connected to each other through a narrow open tube. If the temperature of one is now maintained at T_1 and other at T_2 (where $T_1 > T_2$) then that what will be the final pressure ?
(1) $\frac{T_i}{2P_1T_2}$ (2) $\frac{2P_1T_2}{T_1+T_2}$ (3) $\frac{2P_1T_1}{T_1-T_2}$ (4) $\frac{2P_1}{T_1+T_2}$

5. Calculate the compressibility factor for CO_2, if one mole of it occupies 0.4 litre at 300 K and 40 atm. Comment on the result.
(1) 0.40, CO_2 is more compressible than ideal gas (2) 0.65, CO_2 is more compressible than ideal gas
(3) 0.55, CO_2 is more compressible than ideal gas (4) 0.62, CO_2 is more compressible than ideal gas

6. The density of vapour of a substance (X) at 1 atm pressure and 500 K is 0.8 kg/m^3. The vapour effuses through a small hole at a rate of 4/5 times solwer than oxygen under the same condition. What is the compressibility factor (Z) of the vapour ?
(1) 0.974 (2) 1.35 (3) 1.52 (4) 1.22

7. For a real gas (mol. mass = 60) if density at critical point is 0.80 g/cm^3 and its $T_c = \frac{4\times10^5}{821}K$, then van der Waal's constant a (in atm L^2 mol^{-2}) is
(1) 0.3375 (2) 3.375 (3) 1.68 (4) 0.025

8. Which of the following relationship is false :
(1) Most probable velocity, $\propto = \sqrt{\frac{2RT}{M}}$ (2) PV = $\frac{1}{3}$ mnC_{rms}^2
(3) Compressibility factor Z = $\frac{PV}{nRT}$ (4) Average kinetic energy of a gas = $\frac{1}{2}$ kT

9. For every gas, there is a temperature called critical temperature
(1) above which it is not possible to liquefy a gas with the application of pressure.
(2) above which it is not possible to solidify a gas with the application of pressure.
(3) below which it is not possible to liquefy a gas with the application of pressure.

(4) below which it is not possible to solidify a gas with the application of pressure.

10. If the four tubes of a car are filled to the same pressure with N_2, O_2, H_2 and Ne separately, then which one will be filled first ?

(1) N_2 (2) O_2 (3) H_2 (4) Ne

11. At what temperature will the RMS of SO_2 be the same as that of O_2 at 303 K ?

(1) 273 K (2) 606 K (3) 303 K (4) 403 K

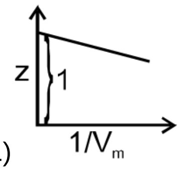
12. A 4.0 dm^3 flask containing N_2 at 4.0 bar was connected to a 6.0 dm^3 flask containing helium at 6.0 bar, and the gases were allowed to mix isothermally, then the total pressure of the resulting mixture will be **[Kerala PMT 2008]**

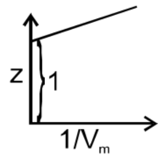
(1) 10.0 bar (2) 5.2 bar (3) 1.6 bar (4) 5.0

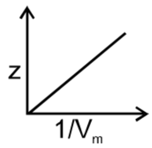
13. A vessel contains two gases A and B in the mass ratio 2 : 1 respectively. If the above gas mixture is allowed to diffuse through a hole, the molar composition of the mixture coming initially out of the hole is 1 : 4. Find the simplest whole number ratio of the moles of gases B and A present in the vessel in the beginning respectively.

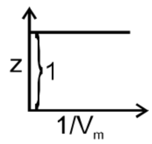
(1) 0.5 (2) 1.0 (3) 1.5 (4) 2.0

14. For a real gas under low pressure conditions, which of the following graph is correct ?

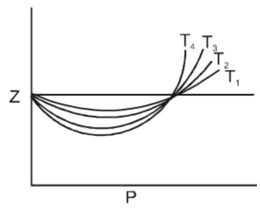
(1) 

(2) 

(3) 

(4) 

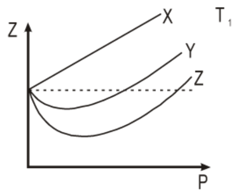
15. Which of the following is correct order of temperature shown in the following Z Vs P graph for the same gas:



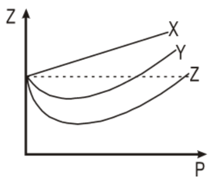
(1) $T_1 < T_2 < T_3 < T_4$ (2) $T_4 < T_3 < T_2 < T_1$

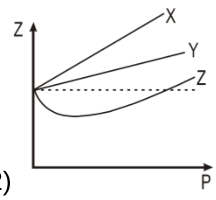
(3) $T_1 < T_3 < T_2 < T_4$ (4) $T_4 < T_2 < T_3 < T_1$

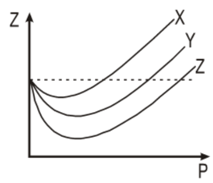
16. Z vs P graph is plotted for 1 mole of three different gases X, Y and Z at temperature T_1.

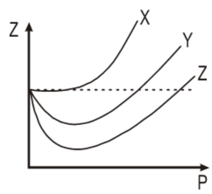


Then, which of the following graph is incorrect if the above plot is made for 1 mole of each gas at T_2 temperature ($T_2 < T_1$) :

(1) 

(2) 

(3) 

(4) 

17. One litre gas at 400 K and 300 atm pressure is compressed to a pressure of 600 atm and 200 K. The compressibility factor is changed from 1.2 to 1.6 respectively. Calculate the final volume of the gas.

(1) 2 litre (2) $\frac{2}{3}$ litre (3) $\frac{1}{3}$ litre (4) $\frac{4}{3}$ litre

APSP Answers

PART - I

1.	(2)	**2.**	(3)	**3.**	(4)	**4.**	(1)	**5.**	(4)
6.	(1)	**7.**	(1)	**8.**	(2)	**9.**	(1)	**10.**	(1)
11.	(2)	**12.**	(3)	**13.**	(2)	**14.**	(2)	**15.**	(4)
16.	(2)	**17.**	(2)	**18.**	(2)	**19.**	(1)	**20.**	(3)
21.	(1)	**22.**	(1)	**23.**	(1)	**24.**	(1)	**25.**	(1)
26.	(3)	**27.**	(1)	**28.**	(2)	**29.**	(1)	**30.**	(3)

PART - II

1.	(3)	**2.**	(3)	**3.**	(3)	**4.**	(2)	**5.**	(2)
6.	(3)	**7.**	(2)	**8.**	(4)	**9.**	(1)	**10.**	(3)
11.	(2)	**12.**	(2)	**13.**	(4)	**14.**	(1)	**15.**	(2)
16.	(2)	**17.**	(3)						

APSP Solutions

PART - I

1. Given $\sqrt{\frac{8RT}{\pi M_A}} = \sqrt{\frac{3RT}{M_B}}$ $\Rightarrow 8M_B = 3\pi\, M_A$

& $\sqrt{\frac{3RT_A}{M_A}} = \sqrt{\frac{3RT_B}{M_B}}$ $\Rightarrow \frac{T_A}{M_A} = \frac{T_B}{M_B}$ $\Rightarrow M_B \,.\, T_A = M_A \,.\, T_B$

$\Rightarrow \frac{3\pi}{8}$ $M_A \,.\, T_A = M_A \,.\, T_B$ $\Rightarrow T_B > T_A$ Hence (2)

2. $\sqrt{\frac{8RT}{\pi M}} = 2\sqrt{\frac{8 \times R \times 300}{\pi \quad M}}$ $\Rightarrow T = 1200\text{ K} = 927^oC$

3. 100 P = 0.2 P × 100 + 0.2 P × V

$\frac{1000}{2} = 100 + V$

V = 400 ml

4. $U_{MPS} = \sqrt{\frac{2RT}{M}}$; $U_{RMS} = \sqrt{\frac{3RT}{M}}$

$U_{av} = \sqrt{\frac{8RT}{\pi M}}$

5. $n_{Total} = \frac{PV}{RT} = \frac{1 \times 2}{0.0821 \times 299} = 0.081$ moles

$X_{H_2} = \frac{n_{H_2}}{n_{total}} = \frac{0.0788}{\frac{0.0821}{2} \times 299} = 0.967$

6. K.E. Temperature

7. $\left[\frac{3}{2}nRT\right]_{He} = \frac{3}{2}nRT$

0.3 T = 0.4 × 400

T = 533 K

8. (2) Frequency of collision will increase.

9.

	Au(g)	4A(g)
Take radius	R	r
vol.	$\frac{4}{3}\pi R^3$	$4.\frac{4}{3}\pi r^3$

$\therefore \quad \frac{4}{3}\pi R^3 = 4.\frac{4}{3}\pi r^3 \qquad \left(\frac{r}{R}\right)^3 = \frac{1}{4}$

b for A_4(g) = $4.N_A.\frac{4}{3}\pi R^3$

b' for A(g) = $4.N_A.\frac{4}{3}\pi r^3$

Hence b' decreased.

10. $\frac{P_{N2}}{P_{CO}} = \frac{X_{N2}}{X_{CO}} = \frac{n_{N2}}{n_{co}} = \frac{x\times 28}{28\times x} = 1 \qquad P_{N2} = P_{co}$

Where x_{n2}, x_{co} is mole fraction of N_2 & CO and x is wt. of N_2 & CO taken.

11. Average K.E. = $\frac{3}{2}$ RT and T is constant 298 K

K.E. is same for all gases at same Temperature.

12. PV = Z × $\frac{w}{M}$ × RT

1 × 1 = 0.8 × $\frac{w}{16}$ × 0.08 × 300 $\Rightarrow$ w = 0.83 gm.

13. $\frac{n_A T_A}{n_B T_B} = \frac{m}{2} \times \frac{44}{m} \times \frac{300}{600}$

14. Net pressure of gas = P_{gas}

P_{gas} = 650 mm.

$\frac{P_1V_1}{T_1} = \left(\frac{P_2V_2}{T_2}\right)_{STP}$; $\frac{650\times 50}{291} = \frac{760\times V_2}{273}$

V_2 = 40.11 ml

P_1 = 9 atm $\qquad P_2$ = 6 atm

$V_1 = 5\ell \qquad V_2 = 10\ \ell$

15. $\frac{n_1 \; T_1}{P_1} = \frac{n_2 \; T_2}{P_2} \Rightarrow \frac{3\times 300}{3} = \frac{5\times 400}{P_2}$ $\qquad P_2 = \frac{20}{3}$ atm

16. $n_{N_2} > n_{O_2}$ where 'n' is no of moles of gases. $\Rightarrow$ $P_{N_2} > P_{O_2}$ because $P_{gas} \alpha$ n.

18. Let Temp (T) where V_{rms} of N_2 = V_{rms} of C_3H_8 at STP

$= \sqrt{\frac{3RT_1}{M_{N2}}} = \sqrt{\frac{3RT_2}{M_{C_3H_8}}} = \sqrt{\frac{3\times 8.314\times 273}{44\times 10^{-3}}} = \sqrt{\frac{3RT_1}{M_{N2}}} = 393.38$

T_1 = 173.72 K

19. $V_{rms} \propto \frac{1}{\sqrt{M}}$ 'M' is Molecular wt.

order of M.wt. = $H_2 < N_2 < O_2 <$ HBr

∴ order of $V_{rms} = H_2 > N_2 > O_2 >$ HBr.

20. $V_c = 3b$

$d_c = \frac{44}{3b}$ ⇒ $\frac{44}{3 \times 4 \times N \times \frac{4}{3}\pi r^3} = 0.44$ ⇒ $r^3 = \frac{6.25}{\pi N}$

21. Initially $P_{O_2} = \frac{3}{11}$ P (total pressure)

after removal of one mole

$P'_{O_2} = \frac{2}{10}P = \frac{P}{5}$

% decreases = $\frac{\frac{3}{11}P - \frac{P}{5}}{\frac{3}{11}P} \times 100 = 26.66\ \%$

22. $\frac{n_{N_2}}{n_x} = \sqrt{\frac{m_x}{M_{N_2}}}$ ....(i)

$P_T V_T = n_T RT$ ....(ii)

$n_T = \frac{2.8 \times 4}{0.0821 \times 273} = 0.5$

$n_x + n_{N_2} = 0.5$

$n_x = 0.1$

From (1)

$\frac{0.4}{0.1} = \sqrt{\frac{M_x}{28}}$; $M_x = 448$.

23. At Boyle's temperature a gas behave like an ideal gas at low pressure region.

∴ $PV = nRT_B$

V = 66 litre

24. $P_{CH_4} = X_{CH_4} . P_{total}$

⇒ $X_{CH_4} = \frac{P_{CH_4}}{P_{total}}$ ⇒ $X_{CH_4} = \frac{x/16}{\frac{x}{4} + \frac{x}{16} + \frac{x}{32}} = \frac{1}{4 + 1 + \frac{1}{2}} = \frac{2}{11}$

25. Molar ratio of He & CH_4 = 4 : 1

∴ partial pressures $P_{He} = \frac{4}{5} \times 20 = 16$ bar

partial pressures $p_{CH_4} = \frac{1}{5} \times 20 = 4$

∴ $p_{He} : p_{CH_4} = 16 : 4$

time of diffusion is same hence

$\frac{r_{He}}{r_{CH_4}} = \frac{n_{He}}{n_{CH_4}} = \frac{p_{He}}{p_{CH_4}} \times \sqrt{\frac{M_{CH_4}}{M_{He}}} = \frac{16}{4} \times \sqrt{\frac{16}{4}} = 4 \times 2 = 8 : 1$

26. $\frac{r_1}{r_2} = \frac{1}{4}$, $\frac{w_1}{w_2} = \frac{2}{3}$

$\frac{r_1}{r_2} = \sqrt{\frac{M_2}{M_1}}$ $\Rightarrow$ $\frac{M_2}{M_1} = \frac{1}{16}$

mole ratio $\frac{n_1}{n_2} = \frac{W_1}{W_2} \times \frac{M_2}{M_1} = \frac{2}{3} \times \frac{1}{16} = \frac{1}{24}$.

28. Volume of one mole of given vapour = $\frac{18}{0.36}$ L =50 L

volume of one mole of an ideal gas = $\frac{RT}{P} = \frac{0.082 \times 500}{1}$ = 41 L

so value of Z = $\frac{V_m,\text{real}}{V_m,\text{ideal}} = \frac{50}{41}$

29. $Z = \frac{PV}{nRT} = \frac{\frac{PV}{\frac{w}{M}}}{RT} = \frac{PM}{d\ \ RT} = \frac{8.314 \times 10^4 \times 18 \times 10^{-3}}{0.8 \times 8.314 \times 300} = \frac{18 \times 10}{300 \times 0.8} = \frac{3}{4} = 0.75$

30. Clearly, from the graph at 80 K = $\frac{PV}{RT}$ = 1 and at 60K, Z < 1

PART - II

1. Pressure of Total mixture = 10 atm

$P_A + P_B + P_C = 10$

$3 + 1 + P_C = 10$ $\Rightarrow$ $P_C = 6$ atm

Total moles of mixture = 10

$n_A + n_B + n_C = 10$

$\frac{P_A}{P_B} = \frac{n_A}{n_B} = \frac{3}{1}$ $\Rightarrow$ $\frac{P_B}{P_C} = \frac{n_B}{n_C} = \frac{1}{6}$

Let $n_A = K$ $\Rightarrow$ $n_B = \frac{K}{3}$ $n_C = \frac{1}{6}$ $n_B = 2K$

$\Rightarrow$ $K + \frac{K}{3} + 2K = 10$ $\Rightarrow$ $\frac{K}{3} = \frac{n_C}{6}$ $n_C = 2K$

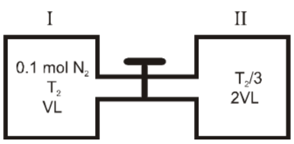
$\Rightarrow$ $K\left(\frac{10}{3}\right) = 10$ K =3, $\Rightarrow$ $n_A = 3$

$n_B = 1$

$n_C = 6$

weight of 'C' in mixture = $2 \times 6 = 12$.

2.



Let x moe of N_2 present into vessel II and P is final pressure of N_2

$P(2V) = xR(T_2/3)$ and $P(V) = (0.1 - x)RT_2$

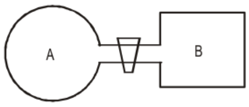
$\Rightarrow$ $2 = \frac{x}{3(0.1 - x)}$

$\Rightarrow$ x = 0.6/7 mole,

$\frac{0.6}{7} \times 28\text{ g} \Rightarrow 2.4\text{ g } N_2$

II has 2.4 g N_2 and I has 0.4 g of N_2 ;

$\frac{W_I}{W_{II}} = \frac{0.4}{2.4} \Rightarrow 1:6$

3. 

$V_A = 100$ ml $\quad V_B = V$ ml

$P_A V_A = P_A' V'$ $\quad$ Where $V' = V_A + V_B = (V_A + V)$ ml

$P_A\, 100 = \frac{2}{5} P_A \times V'$ $\quad$ $P_A = \frac{P_A \times 40}{100} = \frac{2}{5} P_A$

$250 = V'$ $\quad$ $\Rightarrow V_A + V = 250$ ml

$V = 150$ ml

4. Let $T_1 > T_2$; final pressure will be same, Let x mole transfer from to A to B vessel.

$\therefore \quad P_A V = (n - x) RT$ and $P_A V = (n + x) RT_2$

$\therefore \quad x = \frac{n(T_1 - T_2)}{T_1 + T_2}$;

finally $P_1 \times 2V = 2nRT_1$; $V = \frac{nRT}{P_1}$

$\therefore \quad P_A \times \frac{nRT_1}{P_1} = \left(n - \frac{n(T_1 - T_2)}{(T_1 + T_2)}\right) RT_1$

5. $Z = \frac{(PV)_{real}}{(PV)_{ideal}}$

6. $\frac{r_x}{r_{O_2}} = \sqrt{\frac{M_{O_2}}{M_x}} = \left(\frac{4}{5}\right)^2 = \frac{32}{M_x} = 50$

$d_x = 0.80$ kg/m^3.

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

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

7. $V_c = \frac{60}{0.80}$ **= 75 cm³ mol⁻¹ ;** $b = \frac{V_c}{3}$ = 25 cm^3 mol^{-1} = 0.025 L mol^{-1}

$\therefore \quad T_c = \frac{8a}{27\ Rb}$

$\frac{4 \times 10^5}{821} = \frac{8 \times a}{27 \times 0.0821 \times 0.025}$

$\Rightarrow \quad a = 3.375$

8. Average kinetic energy of a gas/ molecule = $\frac{3}{2}$ KT.

9. Critical temperature is a temperature above which it is not possible to liquefy a gas with the applicatoin of pressure.

10. Lower the density of the gas, faster it will be filled. As H_2 has lowest density, it will be filled first.

11. $u = \sqrt{\frac{3RT}{M}}$

When $u_{SO_2} = u_{O_2}$, then $\frac{T_{SO_2}}{M_{SO_2}} = \frac{T_{O_2}}{M_{O_2}}$

or $\frac{T_{SO_2}}{64} = \frac{303}{32}$ $T_{SO_2} = 606$ K.

12. At constant temperature,

$P_1 V_1 + P_2 V_2 = P_3 (V_1 + V_2)$

$(4.0 \text{ bar}) (4.0 \text{ dm}^3) + (6.0 \text{ bar}) (6.0 \text{ dm}^3) = P_3 (4.0 + 6.0 \text{ dm}^3)$

or $P_3 = \frac{16+36}{10} = \frac{52}{10} = 5.2$ bar.

13. $\frac{r_A}{r_B} = \frac{n_A}{n_B} \times \sqrt{\frac{M_B}{M_A}}$

$$\therefore \frac{(\text{Moles of A coming out initially})/\Delta t}{(\text{Moles of B coming out initially})/\Delta t} = \left(\frac{\frac{2x}{M_A}}{\frac{1x}{M_B}}\right) \times \sqrt{\frac{M_B}{M_A}}$$

14. At low pressure vander waal's equation for a real gas is given as

$Z = 1 - \frac{a}{RTV}$

intercept = 1

slop = –ve

16. $T_4 < T_3 < T_2 < T_1$

17. $Z_1 = \frac{P_1V_1}{RT_1}$

$Z_2 = \frac{P_2V_2}{RT_2}$

$\frac{Z_1}{Z_2} = \frac{P_1}{P_2} \times \frac{T_2}{T_1} \times \frac{V_1}{V_2}$

$V_2 = \frac{1}{3}$ litre