1. In a tyre of 'BMW' car of Mr. AKK a tube having a volume of 12.3 litres is filled with air at a pressure of 4 atm at 300 K. Due to travelling the temperature of the tube and air inside it is raised to 360K. The porosity (number of pores per unit area) of the tube material is 5×10^5 pores/cm^2 and each pore can transfer air from inside to outside of tube with the rate of 6.023×10^{10} molecules per minute. Due to above factors pressure reduces to 3.6 atm in 20 minutes. Calculate the total surface area (m^2) of the tube, assuming volume of tube to be constant.

(R = 0.082 lit-atm/mole-K)

4 atm

300 K

4.8 atm $\longrightarrow$ 3.6 atm

360 K

2 mol

1.5 mol

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x mol   y mol

4. 2.0 g of a sample containing NaCl, NaBr and some inert impurity is dissolved in enough water and treated with excess of $AgNO_3$ solution. A 3.0g of precipitate was formed. Precipitate on shaking with aqueous NaBr gain 0.76 g of weight. Determine mass percentage of NaCl in the original sample.

[At. mass of Ag = 108, Na = 23, Cl = 35.5 , Br = 80]

NaCl $\rightarrow$ AgCl + NaBr $\rightarrow$ AgBr (ppt)

x   x mol   x mol

188 − 143.5 = 44.5 gm

NaBr $\rightarrow$ AgBr

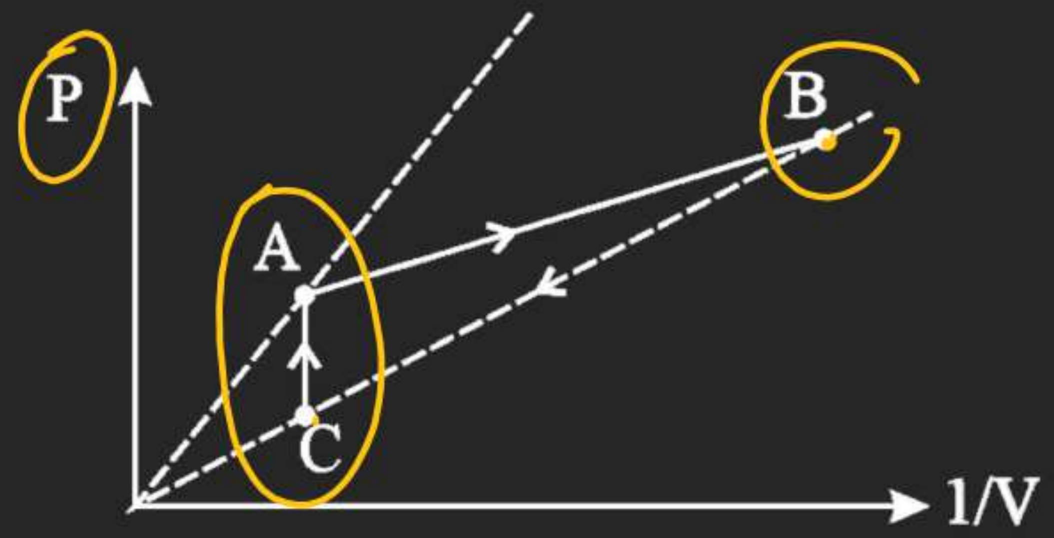
y mol

44.5 gm $\rightarrow$ 1 mol

0.76 $\rightarrow$ $\frac{1}{44.5} \times 0.76 = x$

7. Find the sum of molarity of all the ions present in an aqueous solution of 5M $NaNO_3$ and 3m $BeCl_2$. The specific gravity of the given solution is 1.665. Assume 100 % dissociation of each salt. (Atomic mass of Be : 9, Cl : 35.5, Na : 23)

9. For the following process involving fix moles of ideal gas select the correct statement (s) (d is density of gas)



(A) $T_A > T_B = T_C$

(B) $T_A < T_B = T_C$

(C) $d_A \neq d_B \neq d_C$

(D) $d_A = d_C < d_B$

$$p = nRT\frac{1}{V}$$

1. Assume isotope of chlorine present on the unknown planet are ^{34}Cl and ^{38}Cl. If average molecular weight of Cl is found to be 35. What is the sum of moles of proton and neutron in 7 gm of sample of chlorine

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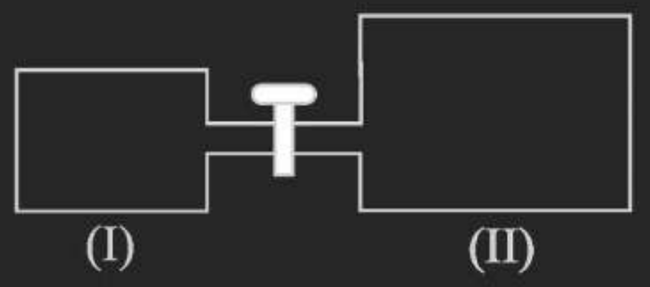
4. Two container (I) & (II) with volume 2 litre & 3 litre are separated through a stopcock as shown in the diagram. Container (I) contains three gases A, B, & C with mole ratio 1 : 2 : 3 and total pressure 30 atm. If stopcock is opened then calculate the pressure of gas C in container (II). (Assume temperature remains constant)



A	B	C
1	2	3
5	10	15

$$\frac{15 \times 2}{\cancel{RT}} = \frac{P_C \times 2}{\cancel{RT}} + \frac{P_C \times 3}{\cancel{RT}}$$

12. Select the correct statement(s) :

10 (A) Ratio of gm/litre & % w/v of a solution is independent of solute substance. T

(B) Ratio of % w/v and molarity of a solution depends on solute substance. T

(C) Ratio of % w/v and molarity of a solution depends on solvent substance F

(D) Ratio of % w/v & ppm for any solution is same F

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18. If all hydrogen atoms are present in its isotopic form of deuterium ($_1H^2$). Calculate percentage by mass of sulphur in 120% of one such oleum sample ($SO_3 + D_2SO_4$)

(A) 32% (B) 64% (C) 46.8% (D) 38.4%

120%

$D_2O + SO_3 \rightarrow D_2SO_4$

20 gm

1 mol 1 mol

80 gm

H D T

D_2SO_4	SO_3
20	80 gm
$\frac{20}{100}$	$\frac{80}{80}$
$= \frac{1}{5}$	1

$n_{sulphur} = \frac{6}{5}$

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Ideal Gas

0 0-2 27-36

32

$$\frac{r_{H_2}}{r_{O_2}} = \sqrt{\frac{32}{2}} = \frac{4}{1} = \frac{n_{H_2}}{n_{O_2}}$$

$$\frac{W_{H_2}}{W_{O_2}} = \frac{4 \times 2}{1 \times 32} = \frac{1}{4}$$

Ideal Gas

34

$$\frac{n_{He}}{n_{CH_4}} = \frac{4}{1}\sqrt{\frac{16}{4}}$$

35

$$\text{Vapour Density} = \frac{\text{Molar mass}}{2}$$

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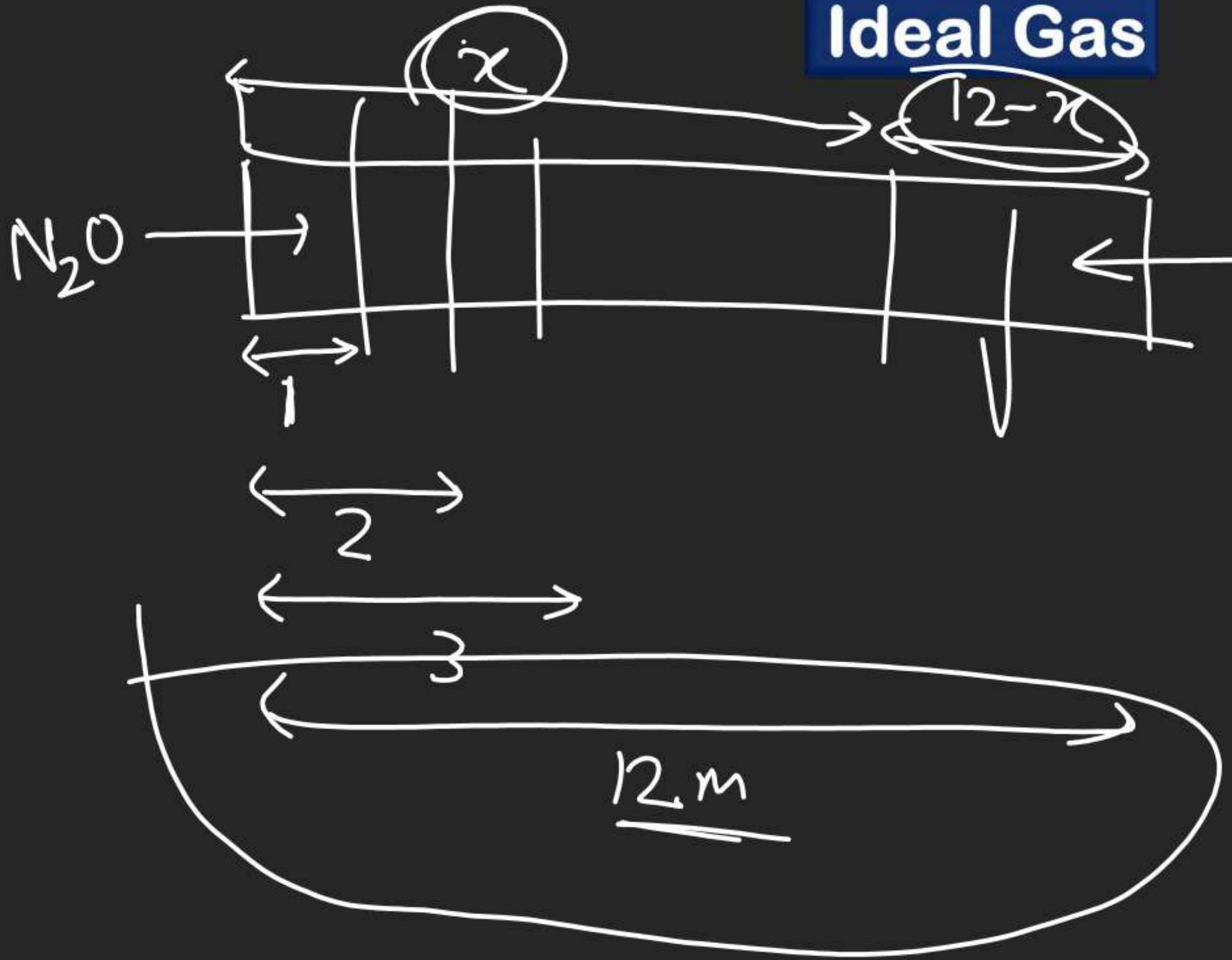
Ideal Gas

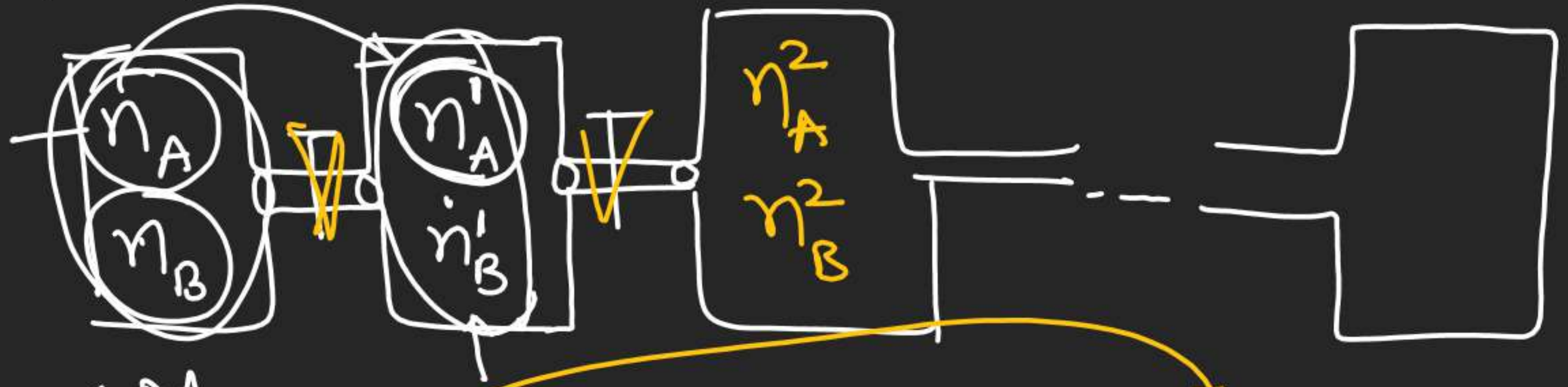


$$\frac{x}{12-x} = \sqrt{\frac{176}{44}} = 2$$

$$x = 8$$

Ideal Gas

No. of effusion steps



$$\boxed{\frac{n_A^n}{n_B^n} = \frac{n_A}{n_B}\left(\sqrt{\frac{M_B}{M_A}}\right)^n}$$

$M_A < M_B$

$$\left(\frac{n_A^1}{n_B^1}\right) = \frac{n_A}{n_B}\left(\sqrt{\frac{M_B}{M_A}}\right)^1$$

$$\frac{n_A^2}{n_B^2} = \frac{n_A^1}{n_B^1}\sqrt{\frac{M_B}{M_A}}$$

$$\frac{n_A^2}{n_B^2} = \frac{n_A}{n_B}\left(\sqrt{\frac{M_B}{M_A}}\right)^2$$

Q. find the no of effusion step required to obtain 4 : 1 mol ratio of He to CH_4 from 1 : 8 mole ratio.

$$\frac{n^n_{He}}{n^n_{CH_4}} = \frac{4}{1} = \frac{1}{8}\left(\sqrt{\frac{16}{4}}\right)^n$$

$$2^5 = 2^n$$

$$5 = n$$

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If rate of effusion is changing

$$-\frac{dn}{dt} = \frac{P A_0}{(2\pi M R T)^{1/2}}$$

$$P = \frac{nRT}{V}$$

$$= \frac{RT A_0}{V(2\pi M R T)^{1/2}} \times n$$

$$= \frac{A_0}{V}\left(\frac{RT}{2\pi M}\right)^{1/2} n = C n$$

Const

$$\boxed{C = \frac{A_0}{V}\left(\frac{RT}{2\pi M}\right)^{1/2}}$$

$$\int_{n_0}^{n_t} \frac{dn}{n} = -C\int_0^t dt$$

$$[\ln n]_{n_0}^{n_t} = -ct$$

$$\ln\frac{n_t}{n_0} = -ct$$

$$n_t = n_0 e^{-ct}$$

no. of moles effuse) $= n_0 - n_t$

$$= n_0(1 - e^{-ct})$$

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$$n_t = n_0 e^{-ct}$$

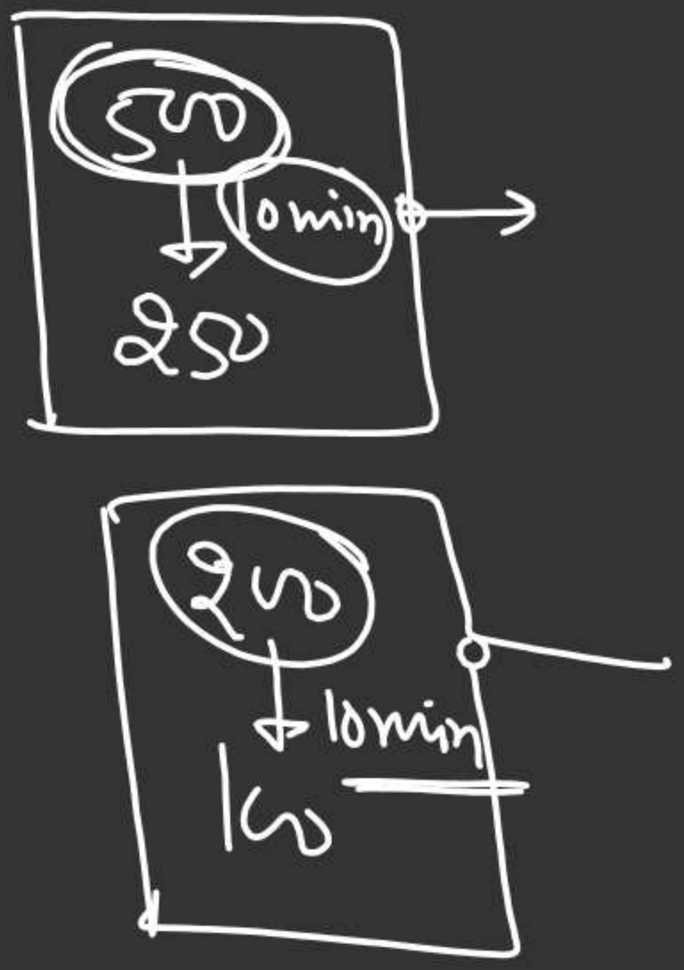
time to effuse out 50 % moles

$$\left(\frac{\cancel{n_0}}{2}\right) = \cancel{n_0}\, e^{-ct}$$

$$-\ln 2 = \ln \tfrac{1}{2} = -ct$$

$$\boxed{t_{1/2} = \frac{\ln 2}{c}}$$

$t_{1/2}$ is independent of initial moles



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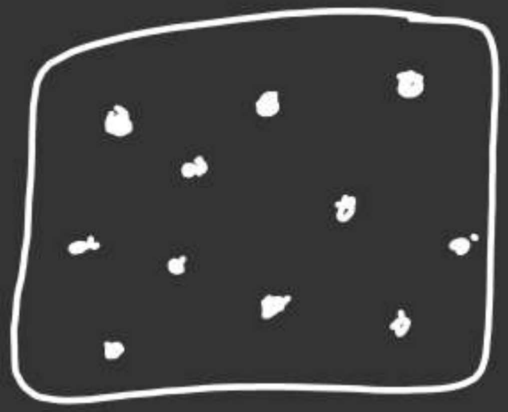
Kinetic theory gases :→ Postulates of KTG

(1) Size of gaseous molecules is quite negligible wrt the size of container.



this assumption can be justified by the fact that gases are highly compressible.

(2) Intermolecular forces betn molecules are negligible.

this ____ justified ____ gases occupy all the available space to them.

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O-I 37-38

S-I Upto 39

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U^{235} $\quad$ U^{238}

$UF_6(g)$ $\quad$ $UF_6(g)$