Ideal Gas

O - I 8, 9, 10, 14, 15

S - I 8 - 12

10 He : 'O'

3 3

$$\boxed{\begin{array}{cc} He & : O_3 \\ 3\text{ mol} & 1 \end{array}}$$

$\frac{3}{4}P$ $\frac{1}{4}P$

14 $2A \longrightarrow 3B + 2C$

$1-\alpha$ $\frac{3\alpha}{2}$ α

Total moles $= 1+\frac{3\alpha}{2}$

$= 1.6$

$$P = \frac{nR}{V}T$$

$$P = \frac{1.6 \times 0.08}{0.16}T$$

$$P = 0.8T$$

Ideal Gas

He

1 lit

0.3 atm

3 lit

$P_{He} = 0.1$ atm

$P_{Ne} = 0.3$ atm

$$3O_2 \longrightarrow 2O_3$$

$$\frac{1}{2} - x \qquad \frac{2}{3}x$$

$$P_1V_1 = P_2V_2$$

$$0.3 \times 1 = P_{He} \times 3$$

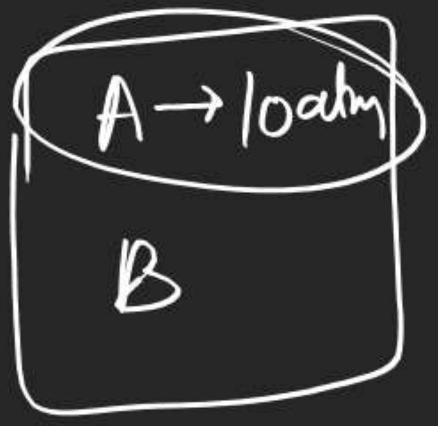
$$\underline{\underline{0.1}} = P_{He}$$

Ideal Gas

$$P_T = P_A + P_B$$

$$P_A = y_A P_T$$

$$P_A V = n_A R T$$



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Amagat law of partial volume :→

Total volume occupied by a mixture is equal to the sum of partial volume of each gas

V_A

V_B

$$\underline{V_{Total}} = V_A + V_B$$

Same P, T

Volume of gases is additive if they are measured at same T & P.

$$P_T V_A = n_A RT \quad \text{—} \; (1)$$

$$P_T V_B = n_B RT \quad \text{—} \; (2)$$

$$P_T V_T = (n_A + n_B) RT \quad \text{—} \; (3)$$

$$P_T V_T = P_T V_A + P_T V_B$$

$$\underline{V_T = V_A + V_B}$$

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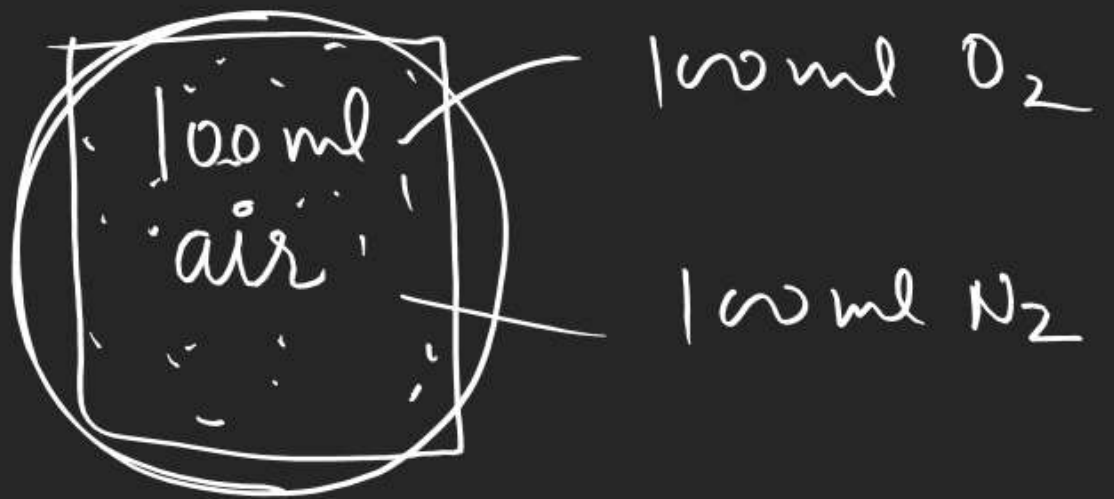
eq 1 $\div$ eq 3

$$\frac{V_A}{V_T} = \frac{n_A}{n_A + n_B} = X_A$$

$$\boxed{V_A = X_A V_T}$$

$$\boxed{V_B = X_B V_T}$$

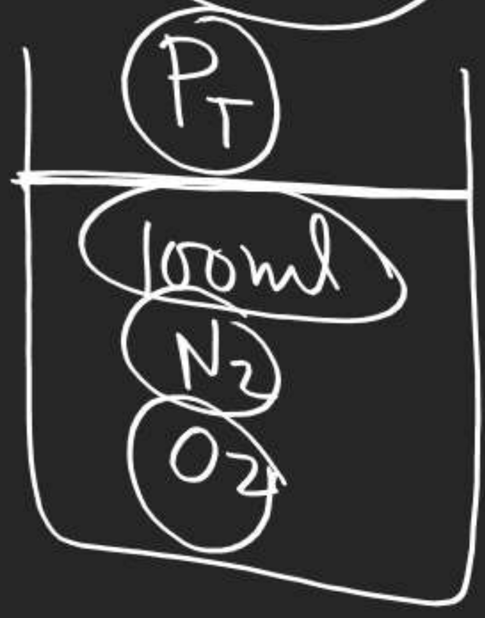
Ideal Gas

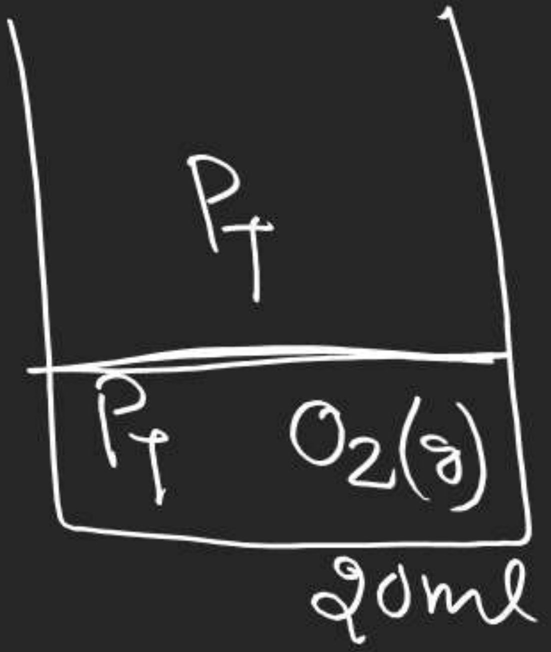


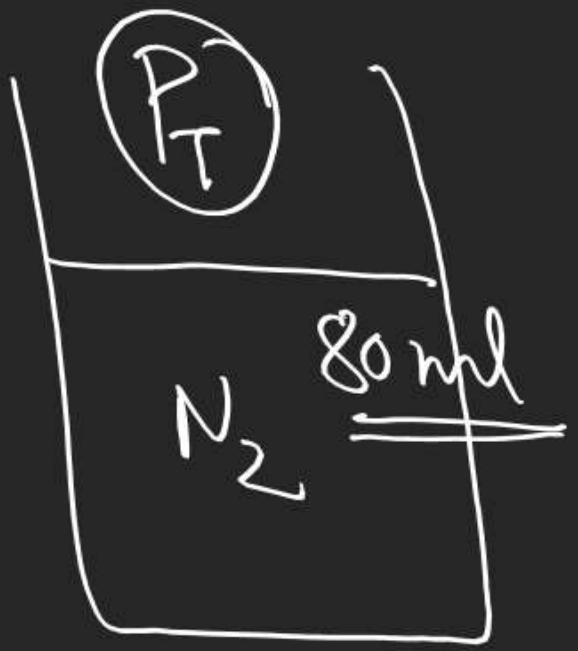
Partial volume :→ Volume occupied by a component of a gaseous mixture when it is present alone at same total pressure and temperature

$80\% \, v/v \; N_2 = 80 ml$

$20\% \, v/v \; O_2 = 20 ml$







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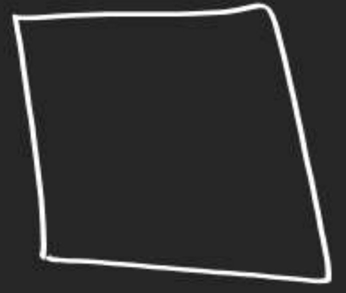
Problems related with containers

Container

- closed
  - rigid
  - non-rigid
- open



V = Const

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

P = Const

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$P = P_{ext} = \text{const}$

balloon

$$\frac{200}{300} = \frac{500}{T}$$

$$T = \frac{3}{2} \times 500$$

Q. A gas cylinder is filled upto 200 atm at 300K. ~~If~~ it is design to sustain 500 atm pressure, Due to the fire in the building temperature starts rising find the temperature at which it will burst.

Ideal Gas

Q. A balloon is inflated to $7/8^{th}$ of its max volume at 300 K. find the temperature at which it burst.

$\frac{7}{8}V \qquad V$

$$\frac{V_1}{T_1} = \frac{V_2}{T_2}$$

$$\frac{\frac{7}{8}V}{300} = \frac{V}{T} \Rightarrow T = 300 \times 8/7$$

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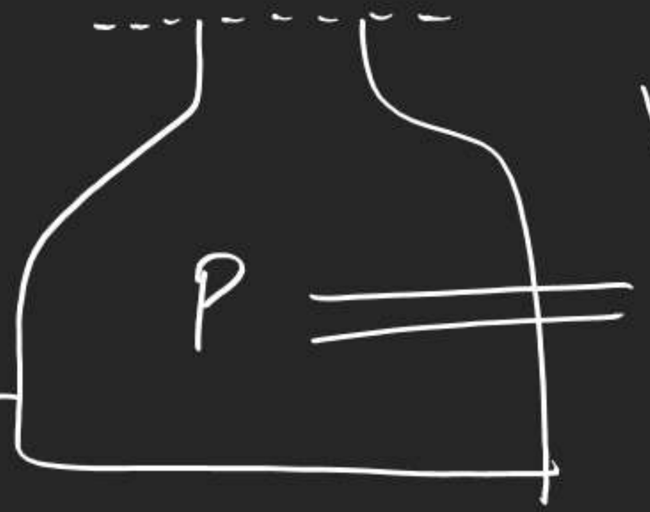
Open



$V = \text{Const}$

$P_{ext} = \text{Const}$

$$n_1 T_1 = n_2 T_2$$

$$\cancel{n} \times 300 = \frac{2}{3} \cancel{n} \times T$$

$$\underline{\underline{T = 450K}}$$

Q. An open container at 300K is heated such that 1/3rd moles present initially is left out. find final temperature.

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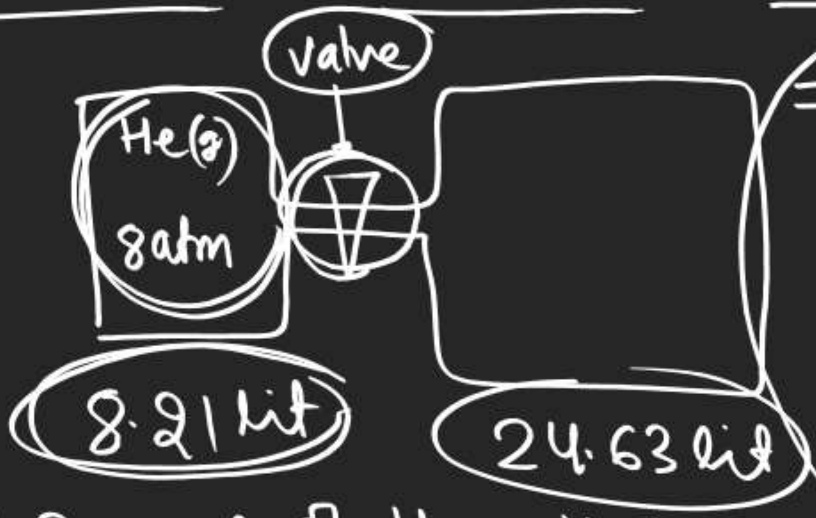
problems related with connected containers



$\Rightarrow$ Pressure of He will be same in all the connected containers

$P_1V_1 = P_2V_2$

$$8 \times 8.21 = P \times (8.21 + 24.63)$$

$$8 \times 8.21 = P \times 8.21 \times 4$$

$$2 = P$$

$$n_i = n_1 + n_{II}$$

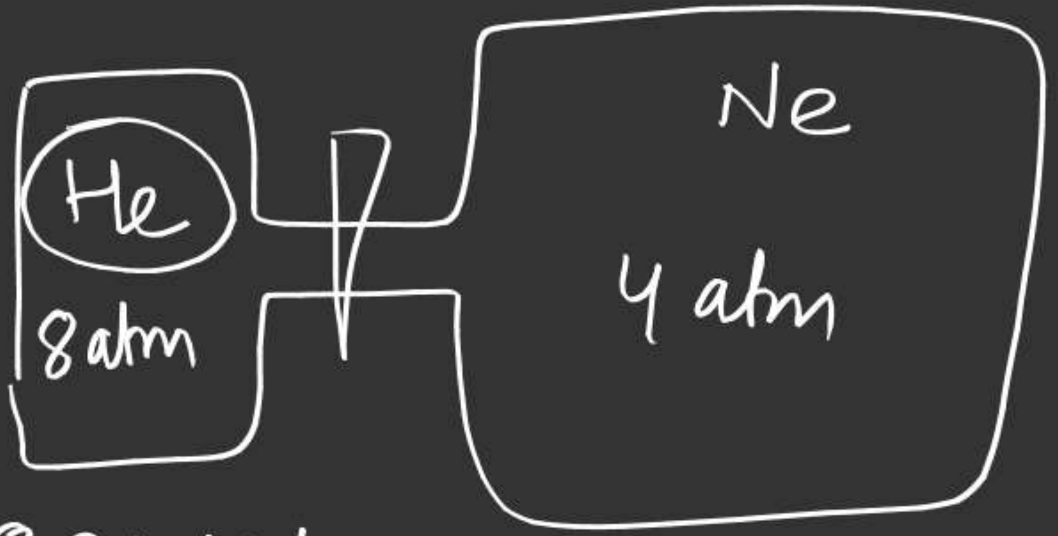
$\dfrac{P_iV_i}{\cancel{RT}} = \dfrac{P_f \times V_1}{\cancel{RT}} + \dfrac{P_f V_{II}}{\cancel{RT}}$

$$8 \times 8.21 = P_f(V_1 + V_2)$$

$$= P_f(8.21 + 24.63)$$

$$2\,atm = P_f$$

Q



8.21 lit

24.63 lit

$P_{He} = ?$ $\quad P_{Ne} = ?$

$= 2\text{ atm}$

for Ne

$$4 \times (8.21 \times 3) = P_{Ne} \times 8.21 + P_{Ne} \times 24.63$$

$$4 \times \cancel{8.21} \times 3 = P_{Ne} \cancel{\times 8.21} \times 4$$

$$3\text{ atm} = P_{Ne}$$

$$P_{Total} = 2+3$$

$$= 5$$

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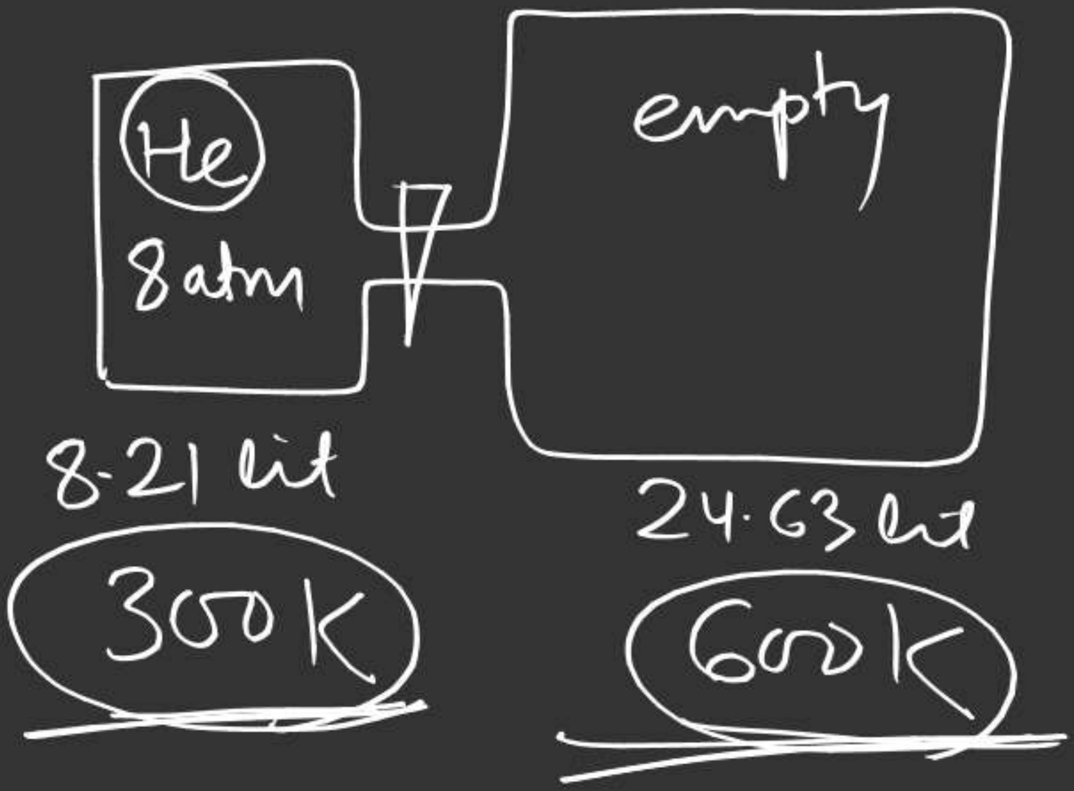
Q.



After opening the valve

$$\frac{P_i V_i}{T_1} = \frac{P_f V_1}{T_1} + \frac{P_f V_2}{T_2}$$

$$\frac{8 \times \cancel{8.21}}{300} = P_f\left(\frac{\cancel{8.21}}{300} + \frac{\cancel{8.21} \times 3}{600}\right)$$

$$\frac{8}{\cancel{300}} = \frac{P_f}{\cancel{300}}\left(1 + \frac{3}{2}\right)$$

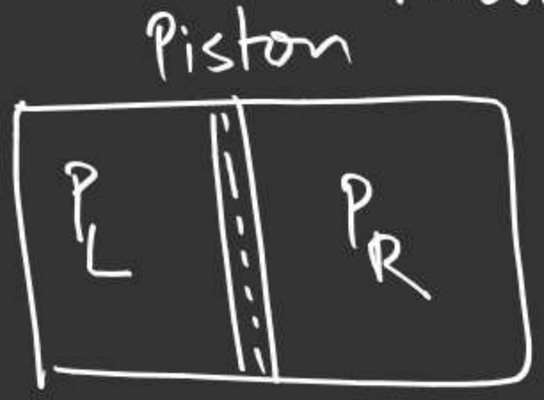
$$= P_f \times 5/2$$

$$16/5 = P_f$$

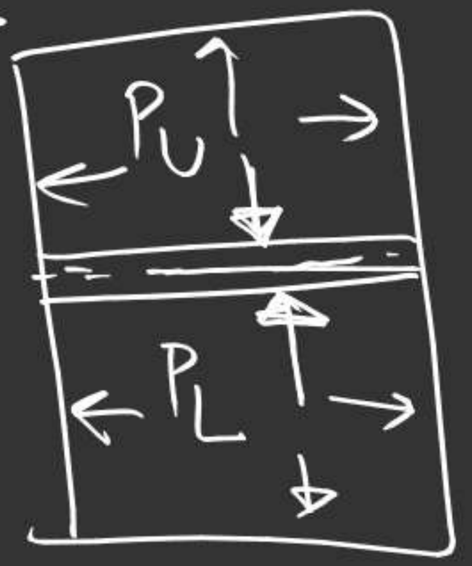
Problems related with piston: →

Piston

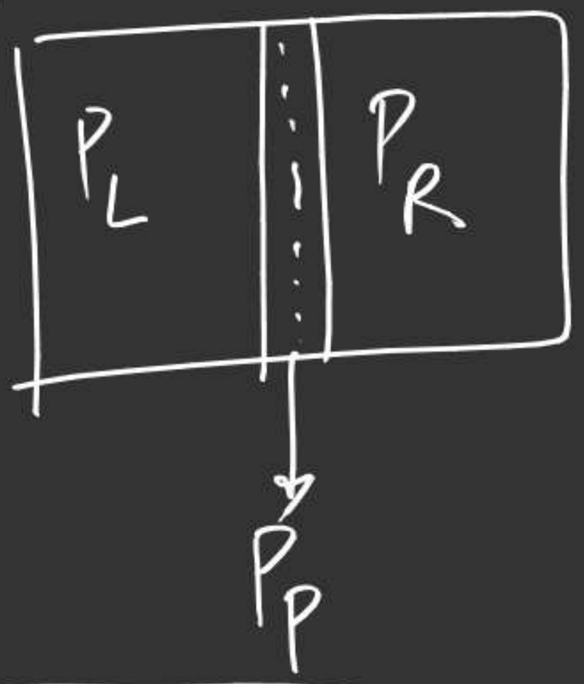
- massless
- having mass



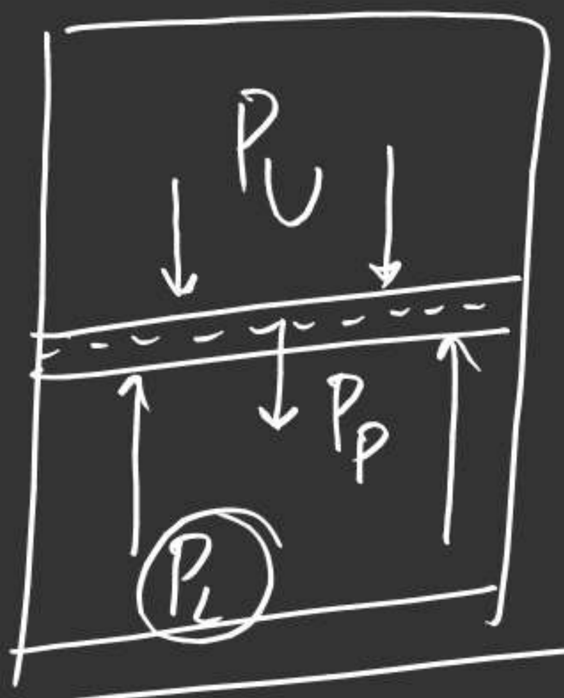
$$\boxed{P_L = P_R}$$



$$\boxed{P_U = P_L}$$



$$\boxed{P_L = P_R}$$



$$\boxed{P_U + P_P = P_L}$$

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0 - I 20 - 22, 24

S - I 16 - 20