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Gas laws – Partial Pressure (Dalton's Law)

1) Determine the partial pressures and total pressure in a 2.50L container of the following gases at 15.8°C. 2.9g He, 1.8g H_2. $PV = nRT$. $P = \frac{nRT}{V}$ $+273$

He: $2.9\text{g He} \times \frac{1\text{mol}}{4.0\text{g He}} = 0.725\text{mol}$ $\therefore P = 0.725\text{mol} \times \frac{0.08206\text{L atm} \times 288.8}{\text{mol K} \quad 2.5\text{L}}$

$P_{He} = 6.876\text{atm}$

H_2: $1.8\text{g } H_2 \times \frac{1\text{mol}}{2\text{g } H_2} = 0.9\text{mol}$ $\therefore P = 0.9\text{mol} \times 9.48$ → (9.48)

$P_{H_2} = 8.532\text{ atm}$

$P_{total} = P_{He} + P_{He} = (6.876 + 8.532)\text{atm} = 15.41\text{ atm}$

2) A 1.00L sample of dry air at 25°C contains 0.0319mol N_2, 0.00856mol O_2 and 0.000381mol Ar and 0.00002mol CO_2. Calculate the partial pressure of N_2 in the mixture.

$PV = nRT$ $\quad P_{N_2} = \frac{n_{N_2}RT}{V}$

$25 + 273$

$= 0.0319\text{mol} \times 0.0821 \frac{\text{L atm}}{\text{mol K}} \times 298\text{K} \times 1.00\text{L}$

$P_{N_2} = 0.780\text{ atm}$

3) The main components of dry air are N_2: 78.08%, O_2: 20.95%, Ar: 0.93% and CO_2: 0.04%. What is the partial pressure of each gas at 1.000 atm?

N_2	78.08%	= 0.7808 mol	× 1.000 atm	= 0.7808 atm
O_2	20.95%	= 0.2095 mol	× 1.000 atm	= 0.2095 atm
Ar	0.93%	= 0.0093 mol	× 1.000 atm	= 0.0093 atm
CO_2	0.04%	= 0.0004 mol	× 1.000 atm	= 0.0004 atm