$GMW_{N2} = 2(14.0067) = 28.013$ g/mole

$$n = \frac{1.5\text{ g}}{28\text{ g/mole}} = 0.05357 \text{ or } 0.054 \text{ moles}$$

$GMW_{CO2} = 12.011 + 2(15.9994) = 44.01$

$$n = \frac{16\text{ g}}{44\text{ g/mole}} = 0.364 \text{ or } 0.36 \text{ moles}$$

6-12 Gram molecular weight of air

Given: 22.414 L volume of air at STP, $P_{O2} = 21.224$ kPa, $P_{N2} = 79.119$ kPa, $P_{Ar} = 0.946$ kPa, $P_{CO2} = 0.036$ kPa
Solution:

a. Compute number of moles of each gas

Oxygen

$$n = \frac{(P)(V)}{(R)(T)} = \frac{(21.224\text{ kPa})(10^3\text{ Pa/kPa})(22.414\text{ L})(10^{-3}\text{ m}^3\text{/L})}{(8.314)(273.15)}$$

$n = 0.209469$

Nitrogen

$$n = \frac{(P)(V)}{(R)(T)} = \frac{(79.119\text{ kPa})(10^3\text{ Pa/kPa})(22.414\text{ L})(10^{-3}\text{ m}^3\text{/L})}{(8.314)(273.15)}$$

$n = 0.78086$

Argon

$$n = \frac{(P)(V)}{(R)(T)} = \frac{(0.946\text{ kPa})(10^3\text{ Pa/kPa})(22.414\text{ L})(10^{-3}\text{ m}^3\text{/L})}{(8.314)(273.15)}$$

$n = 0.009336$

Carbon dioxide

$$n = \frac{(P)(V)}{(R)(T)} = \frac{(0.036\text{ kPa})(10^3\text{ Pa/kPa})(22.414\text{ L})(10^{-3}\text{ m}^3\text{/L})}{(8.314)(273.15)}$$

n = 0.000355

b. Compute mass of each gas

M_{O2} = (n)(M) = 0.209469(31.9988) = 6.703

M_{N2} = 0.78086(28.013) = 21.874

M_{Ar} = 0.009336(39.948) = 0.37296

M_{CO2} = 0.000355(44.0098) = 0.01562

c. Molecular weight of air

$M_{O2} + M_{N2} + M_{Ar} + M_{CO2}$ = 28.966 or 28.97 g/mole

6-13 Micrograms/m³ to ppm for SO_2

Given: 80 µg/m³ of SO_2, T = 25 °C, P = 101.325 kPa
Solution:

a. Compute GMW of SO_2

GMW = 32.06 + 31.9988 = 64.058

b. Convert to ppm using Eqn. 6-7

$$ppm = \frac{\left(\frac{80}{64.06}\right)(22.414)\left(\frac{298}{273}\right)\left(\frac{101.325}{101.325}\right)}{(1.0)(1{,}000)}$$

ppm = 0.030555 or 0.031

6-14 ppm to µg/m³ for NO_2

Given: 0.55 ppm of NO_2, T = 290 K, P = 100.0 kPa
Solution:

a. Compute GMW of NO_2

GMW = 14.0067 + 31.9988 = 46.0055

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