1. Compute the relative rates of effusion of chlorine to krypton.

\[ \frac{r_{\text{Cl}_2}}{r_{\text{Kr}}} = \sqrt{\frac{M_{\text{Kr}}}{M_{\text{Cl}_2}}} = \sqrt{\frac{83.8}{71.0}} = 1.09 \]

Ans \(1.09\)

2. The rate of nitrogen effusion is 35 cm/s. Determine the rate at which hydrogen sulfide would travel under these same experimental conditions.

\[ \frac{r_{\text{H}_2\text{S}}}{r_{\text{N}_2}} = \sqrt{\frac{M_{\text{N}_2}}{M_{\text{H}_2\text{S}}}} \]

\[ \frac{r_{\text{H}_2\text{S}}}{35} = \sqrt{\frac{28.0}{34.1}} \]

Ans \(32\text{ cm/s}\)

3. A volume of chlorine effused through a pinhole at a rate of 56.3 mL/sec under given conditions of temperature and pressure. At what rate would the same volume of diborane, \(\text{B}_2\text{H}_6\), to effuse through the same hole under the same conditions?

\[ \frac{r_{\text{B}_2\text{H}_6}}{r_{\text{Cl}_2}} = \sqrt{\frac{M_{\text{Cl}_2}}{M_{\text{B}_2\text{H}_6}}} \]

\[ \frac{r_{\text{B}_2\text{H}_6}}{56.3} = \sqrt{\frac{71.0}{27.6}} \]

Ans \(90.3\text{ mL/sec}\)

4. \(\text{CH}_4\) effuses through a pinhole at a rate of 97.0 mL/sec at STP. An unknown gas effuses through the same hole under the same conditions at 46.19 mL/sec. What is the molar mass of the unknown gas?

\[ \frac{r_{\text{CH}_4}}{r_{\text{unk}}} = \sqrt{\frac{M_{\text{unk}}}{M_{\text{CH}_4}}} \]

\[ \frac{97.0}{46.19} = \sqrt{\frac{M_{\text{unk}}}{16}} \]

Ans \(70.69/\text{mol}\)

5. Oxygen effuses at a rate of 29.0 m/s. At what rate would \(\text{SF}_4\) effuse under the same conditions?

\[ \frac{r_{\text{SF}_4}}{r_{\text{O}_2}} = \sqrt{\frac{M_{\text{O}_2}}{M_{\text{SF}_4}}} \]

\[ \frac{r_{\text{SF}_4}}{29.0} = \sqrt{\frac{32.0}{108.1}} \]

Ans \(15.8\text{ m/s}\)

6. Nitrogen effuses through a pinhole in 0.0119 L/sec while an unknown gas diffuses through the same pinhole at 0.0313 L/sec. What is the molecular mass of the unknown gas? Identify the unknown gas

\[ \frac{r_{\text{N}_2}}{r_{\text{unk}}} = \sqrt{\frac{M_{\text{unk}}}{M_{\text{N}_2}}} \]

\[ \frac{0.0119}{0.0313} = \sqrt{\frac{M_{\text{unk}}}{28.0}} \]

Ans \(4.059/\text{mol}\)

7. For each of the following pairs of gases, state which will diffuse more rapidly under the same conditions of temperature and pressure? Circle your choice.

a) \(\text{CO}_2\) and \(\text{Br}_2\)  b) \(\text{NO}_2\) and \(\text{C}_2\text{H}_8\)  c) \(\text{N}_2\) and \(\text{HCl}\)  d) \(\text{CCl}_2\text{F}_2\) and \(\text{SO}_3\)

- [ ] \(\text{CO}_2\) and \(\text{Br}_2\)
- [ ] \(\text{NO}_2\) and \(\text{C}_2\text{H}_8\)
- [ ] \(\text{N}_2\) and \(\text{HCl}\)
- [ ] \(\text{CCl}_2\text{F}_2\) and \(\text{SO}_3\)
1. If carbon dioxide, nitrogen, and oxygen are in a container and exert a pressure of 760 torr, and the partial pressure of carbon dioxide is 0.285 torr, the partial pressure of nitrogen is 593.525 torr, what is the partial pressure of oxygen?

\[ P_T = P_{CO_2} + P_{N_2} + P_{O_2} \]

\[ 760 = 0.285 + 593.525 + P_{O_2} \]

\[ P_{O_2} = 166 \text{ Torr} \]

2. Blast furnaces give off many unpleasant and unhealthy gases. If the total air pressure is 0.99 atm, the partial pressure of carbon dioxide is 0.05 atm, and the partial pressure of hydrogen sulfide is 0.02 atm, what is the partial pressure of the remaining air?

\[ P_T = P_{CO_2} + P_{H_2S} + P_{\text{air}} \]

\[ 0.99 = 0.05 + 0.02 + P_{\text{air}} \]

\[ P_{\text{air}} = 0.92 \text{ atm} \]

3. A metal tank contains three gases: oxygen, helium, and nitrogen. If the partial pressures of the three gases in the tank are 35 atm of O₂, 5 atm of N₂, and 25 atm of He, what is the total pressure inside the tank?

\[ P_T = P_{O_2} + P_{He} + P_{N_2} \]

\[ P_T = 35 + 5 + 25 \]

\[ P_T = 65 \text{ atm} \]

4. A mixture of 2.00 moles of H₂, 3.00 moles of NH₃, 4.00 moles of CO₂ and 5.00 moles of N₂ exerts a total pressure of 800. torr. What is the partial pressure of each gas? (HINT: Determine total moles of gas. Determine % of each gas. Determine partial pressure of each gas.)

\[ 2.00 \text{ mol } H_2 = 14.39 \times 800 = 1140 \text{ Torr} \]

\[ 3.00 \text{ mol } NH_3 = 21.47 \times 800 = 1717 \text{ Torr} \]

\[ 4.00 \text{ mol } CO_2 = 28.69 \times 800 = 2287 \text{ Torr} \]

\[ 5.00 \text{ mol } N_2 = 35.37 \times 800 = 2868 \text{ Torr} \]

\[ 799 \text{ Torr total} \]