Grahams Law of Effusion

1. Which gas moves faster across the room, NH_3 or He? Why?

2. What is the relative rate of diffusion of NH3 compared to He?

3. Under the same conditions of temperature and pressure, how many times faster will hydrogen effuse compared to carbon dioxide?

4. An unknown gas diffuses 0.25 times as fast as He. What is the molar mass of the unknown gas?

5. The rate of diffusion of an unknown gas is 4.0 times faster than the rate of oxygen gas. What is the molar mass and name of the unknown gas?

6. Ammonia, NH_3, and alcohol, C_2H_6O, are released together across a room. Which will you smell first? Why?

7. At a certain temperature and pressure, chlorine molecules have an average velocity of 324 m/s. What is the average velocity of sulfur dioxide molecules under the same conditions? Ans: 341 m/s

Grahams Law of Effusion

1. Which gas moves faster across the room, NH_3 or He? Why? NH_3 (17.04 g/mol) He (4.00 g/mol)

He (lighter) - moves faster

2. What is the relative rate of diffusion of NH3 compared to He?

$$\frac{rate_{He}}{rate_{NH_3}} = \sqrt{\frac{MM_{NH_3}}{MM_{He}}} = \sqrt{\frac{17.04\ g/mol}{4.00\ g/mol}} = 2.06$$

He diffuses 2.06X faster than NH_3

3. Under the same conditions of temperature and pressure, how many times faster will hydrogen effuse compared to carbon dioxide?

$$\frac{rate_{H_2}}{rate_{CO_2}} = \sqrt{\frac{MM_{CO_2}}{MM_{H_2}}} = \sqrt{\frac{44.01\ g/mol}{2.02\ g/mol}} = 4.67$$

H_2 diffuses 4.67 X faster than CO_2

4. An unknown gas diffuses 0.25 times as fast as He. What is the molar mass of the unknown gas?

$$\frac{rate_X}{rate_{He}} = \sqrt{\frac{MM_{He}}{MM_X}} \qquad .25 = \sqrt{\frac{4.00\ g/mol}{X}} \qquad (.25)^2 = \frac{4.00\ g/mol}{X}$$

$X = 64\ g/mol$

5. The rate of diffusion of an unknown gas is 4.0 times faster than the rate of oxygen gas. What is the molar mass and name of the unknown gas?

$$\frac{rate_X}{rate_{O_2}} = \sqrt{\frac{MM_{O_2}}{MM_X}} \qquad .4 = \sqrt{\frac{32.00\ g/mol}{X}} \qquad (4)^2 = \frac{32.00}{X}$$

$X = 2.00\ g/mol$

H_2

6. Ammonia, NH_3, and alcohol, C_2H_6O, are released together across a room. Which will you smell first? Why?

NH_3 - lighter (less mass) (moves faster)

7. At a certain temperature and pressure, chlorine molecules have an average velocity of 324 m/s. What is the average velocity of sulfur dioxide molecules under the same conditions? Ans: 341 m/s

$$\frac{rate_{Cl_2}}{rate_{SO_2}} = \sqrt{\frac{MM_{SO_2}}{MM_{Cl_2}}} \qquad \frac{324\ m/s}{rate_{SO_2}} = \sqrt{\frac{64.07\ g/mol}{70.90\ g/mol}}$$

$$\frac{324\ m/s}{rate_{SO_2}} = .9506$$

$341\ m/s = rate_{SO_2}$