# Exercise 5.7

## Dalton, KMT, & Graham

Name: _____

Date: _____ Per: _____

Dalton's Law states that the sum of the partial pressures in a mixture of gases will equal the total pressure. This is often shown in the following way:

$$P_{total} = P_A + P_B + P_C + \ldots$$

So, what this shows is that the total pressure, $P_{total}$, is based on the total number of moles of gas. And that number of total moles of gas is made up of at least two or more different gases that make up the mixture. So, each individual gas imparts a partial pressure to the system. All those partial pressures will sum up to equal the total pressure.

Total Pressure of a system is counting all the gas particles, no matter what kind they are. They all contribute to the overall pressure, $P_{total}$.

Partial Pressure of a system is counting a specific type of gas particle from the mixture. The partial pressure of gas A in a mixture of A, B, and C has nothing to do with B and C. Find the amount of A (atoms, molecules, or moles) and it will be directly used for $P_A$. The same holds true for gases B and C.

Any units will work here for pressure as long as the units are the same for each partial pressure.

***DIRECTIONS: Answer the following in the space provided.***

1. A container with two gases, helium and argon, is 30.0% by volume helium. Calculate the partial pressure of helium and argon if the total pressure inside the container is 4.00 atm.

2. A tank contains 480.0 grams of oxygen and 80.00 grams of helium at a total pressure of 7.00 atmospheres. Calculate the following.
   a. How many moles of $O_2$ are in the tank?
   b. How many moles of He are in the tank?
   c. Total moles of gas in tank.
   d. Mole fraction of $O_2$.
   e. Mole fraction of He.
   f. Partial pressure of $O_2$.
   g. Partial pressure of He.

3. A mixture of 14.0 grams of hydrogen, 84.0 grams of nitrogen, and 2.0 moles of oxygen are placed in a flask. When the partial pressure of the oxygen is 78.00 mm of mercury, what is the total pressure in the flask?

4. A flask contains 2.00 moles of nitrogen and 2.00 moles of helium. How many grams of argon must be pumped into the flask in order to make the partial pressure of argon twice that of helium?

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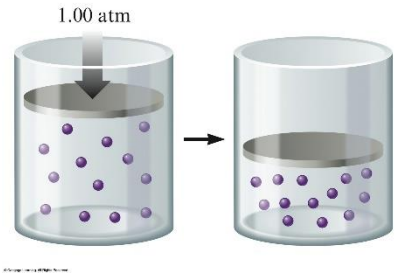
5. You have a gas in a container fitted with a piston and you change one of the conditions of the gas such that a change takes place as shown below:




State two distinct changes you can make to accomplish this and explain why each would work.

a. _____

_____

b. _____

_____

Graham's Law of Diffusion/Effusion says in concept that less massive (or sometimes stated as less dense) gases will diffuse/effuse faster than more massive (or denser) gases. The rates at which two gases diffuse/effuse relative to one another can be found by taking the square root of the inverse ratio of their masses (or densities).

$$\frac{v_1}{v_2} = \sqrt{\frac{m_2}{m_1}}$$

*Where,* $v_1$ = rate of diffusion/effusion of $gas_1$, $v_2$ = rate of diffusion/effusion of $gas_2$, $m_1$ = molar mass of $gas_1$, $m_2$ = molar mass of $gas_2$.

The calculated answer represents how quickly $gas_1$ diffuses/effuses compared to $gas_2$. Answers less than 1.00 indicate that $gas_1$ diffuses/effuses more slowly than $gas_2$ and answers greater than 1.00 indicate that $gas_1$ diffuses/effuses faster than $gas_2$. An answer of 2.16, for example, indicates that $gas_1$ diffuses/effuses 2.16 times faster than $gas_2$.

6. What is the molecular weight of a gas which diffuses 1/50 as fast as hydrogen?

7. Two porous containers are filled with hydrogen and neon respectively. Under identical conditions, 2/3 of the hydrogen escapes in 6 hours. How long will it take for half the neon to escape?

8. If the density of hydrogen is 0.090 g/L and its rate of diffusion is 6 times that of chlorine, what is the density of chlorine?

9. $2.278 \times 10^{-4}$ mol of an unidentified gaseous substance effuses through a tiny hole in 95.70 s. Under identical conditions, $1.738 \times 10^{-4}$ mol of argon gas takes 81.60 s to effuse. What is the molar mass of the unidentified substance?

10. A compound composed of carbon, hydrogen, and chlorine diffuses through a pinhole 0.411 times as fast as neon. Select the correct molecular formula for the compound:
    a. $CHCl_3$
    b. $CH_2Cl_2$
    c. $C_2H_2Cl_2$
    d. $C_2H_3Cl$