**Dalton's Law of Partial Pressures**

**Learning Target: To confirm the relationship between pressures of two individual gases at constant temperature and volume to the pressure of mixture of both gases at the same conditions of volume and temperature, based on the results of a simulation.**

**Dalton's Law of Partial Pressures:** ***At constant temperature, the pressure of a mixture of gases is the sum of the pressures of the gases, measured separately, in the same container.***

**Pre-Phase:** Access the University of Colorado – Boulder PhET website. Select "Play with Sims" and click on "Chemistry" on the left hand side of the next page. Seek the "Gas Properties" program. Select constant "Temperature". Place the ruler below the gas box and read the length of the box as volume. Make sure the volume stays the same as you read pressure readings.

**Experimental Phase**:

1. Read and record the temperature (K) and the volume (L) settings (controlled variables):

   Temperature _____ Volume _____

2. Add 25 heavy gas particles and, in the data table below, record the related pressure.

| **Heavy Gas Particles** | | **25** | **50** | **100** |
|---|---|---|---|---|
| **Pressure Exerted by Heavy Particles →** | | | | |
| **Light Gas Particles** | **Pressure Exerted by Light Particles** | ////////////////////// ////////////////////// | ////////////////////// ////////////////////// | ////////////////////// ////////////////////// |
| **25** | | | | |
| **50** | | | | |
| **100** | | | | |

3. Increase the number of heavy gas particles to 50 and record the related pressure. Repeat the measurement with 100 heavy gas particles.

4. Zero the heavy gas particles and place 25 light gas particles in the gas box [Notice that, at the same temperature, the kinetic energy (K.E. = ½ $mv^2$) of the heavy and the light particles are the same. Therefore, the lighter particles must move faster than the heavy particles to compensate for the lower mass!]. Record the related pressure in the column to the right of the number of light gas particles column. Increase the number of light gas particles to 50 and 100, recording the pressure for each condition.

5. Zero the light particles. In the set of the nine possible combinations of light and heavy gas particles in the matrix of the table, place the required number of light and heavy gas particles in the box and record the pressure of the combined gas particles.

**Post-Phase**:

1. Based on the pressure information in the data table, how are the pressures of light and heavy particles related to the pressures of the mixed particles?

2. Does the pressure depend on the mass of the particles? Explain.

3. The pressure of a 1-L nitrogen gas sample at 25 °C is 0.30 atm. The pressure of a 1-L oxygen gas sample at the same temperature is 0.25 atm. The oxygen gas sample is added to the nitrogen container. Argon gas is added to the mixture until the total pressure of the 1-L container reaches 1.00 atm, and the temperature is adjusted to 25 °C. According to Dalton's Law of Partial Pressures, the contribution of each gas to the total pressure of the gas mixture is: Nitrogen _____ Oxygen _____ Argon _____