**Gas Laws Assignment #1**                            **Name** _____
**Kinetic-Molecular Theory and Graham's Law:**

1. Describe the 5 physical properties of gases (expansion, low density, fluidity, compressibility, diffusion) in terms of the Kinetic-Molecular Theory. It will probably take one paragraph for each property to relate each of the 5 assumptions to that property.

fluidity is....
The assumptions that explain fluidity are (1) gases are composed of tiny particles
(4) particles move constantly with no attractive or repulsive forces

**Gas Laws Assignment #2**                    **Name** _____
**Diffusion and Graham's Law**

1. Which gas would be expected to diffuse more quickly, $O_2$ or $N_2$? Do NOT use an equation to figure this out. Explain your response. Would you expect a large difference in their speeds? Why or why not?

2. For each of the following pairs of gases, state which one will diffuse more quickly? Explain your answers.

*use molar masses*

    A. $CO_2$ and $Br_2$                               B. $N_2$ and $HCl$

    C. $NO_2$ and $C_3H_8$                           D. $CCl_2F_2$ and $SO_3$

3. Compare the rate of diffusion of helium to argon.

*calculate*

4. Calculate the relative rate of diffusion of argon to radon.

$$Rn = 222 \frac{g}{mol} = m_2$$
$$Ar \sim 39.55 \frac{g}{mol} = m_1$$

$$\frac{\sqrt{m_2}}{\sqrt{m_1}} = \frac{V_1}{V_2} \qquad \frac{\sqrt{222}}{\sqrt{39.55}} = \frac{15.03}{6.02} = 2.38$$

*Ar, the lighter gas, diffuses 2.38 times faster than Rn, the heavier gas*

5. Find the ratio of the velocity of hydrogen molecules to the velocity of oxygen molecules when both gases are at the same temperature.

6. If the velocity of $O_2$ molecules is 0.0820 m/s at a certain temperature, what is the velocity of helium atoms at the same temperature?

**Gas Laws Assignment #3**                                    **Name** _____
**Variables and their Relationships; Pressure**

Write a well-thought-out response to each of the following questions. Your response should be a clear, meaningful explanation and should stand alone, without the reader's needing to look at the question to see what you were talking about.  Show  all work as conversion factors for each problem.

1.  How many atmospheres are equivalent to 720.mm Hg?

2.  What is the equivalent in mm Hg for 1.75 atmospheres?

3.   What is the equivalent in KPa of a pressure of  2.25 atm?

4.  What Kelvin temperature is equal to 25°C?

5.  What volume will 0.500 moles of any gas occupy at standard temperature and pressure?

6.  To measure changes in volume with pressure, which two variables must be held constant?

7.  To measure changes in volume with respect to temperature, which two variables must be held constant?

8.   Describe the conditions under which a real gas best behaves like an ideal gas.

**Gas Laws Assignment #4     Boyle's Law**          Name _____

Solve the following problems.  Write out all your work neatly, including a list of variables, the correctly rearranged equation (showing the unknown variable on one side of the equal sign, the equation with all variables plugged in,  and the final answer to the correct number of significant digits.

1.)  A gas has an initial volume of 200. mL and an initial pressure of 350. mm Hg.  The pressure changes and the final pressure is 700. mm Hg.  Calculate $V_2$.

2.)   4.31 Liters of a gas are collected at a pressure of 0.750 atm.  What volume will the same gas occupy at 1.00 atm when temperature is held constant?

3.)   A sample of oxygen gas is allowed to expand from 4.00 L to 8.00 L without the temperature changing, what will the final pressure of the gas be?

4.)  A mass of air occupies a volume of 5.70 L at a pressure of 0.52 atm.  What is the new pressure if the same mass of air at the same temperature is transferred to a 2.0 L flask?

5.) A 360.0 mL sample of hydrogen gas is collected when the pressure is 800.0 mm Hg.  What is the volume that the gas will occupy when the pressure is 720.0 mm Hg?

6. A balloon filled with helium gas has a volume of 500. mL at 1.00 atm. After the balloon is released, it reaches an altitude of 6.5 km where the pressure is 0.5 atm.  The temperature is the same at both altitudes.  What volume does the gas occupy at this height?

**Gas Laws Assignment #5**                                    Name _____
**Charles Law**

1.  A helium-filled balloon has a volume of 2.75 L at 20°C.  The volume of the balloon decreases to 2.46 L after it is placed outside on a cold day.  What is the outside temperature?

2.  A gas at 65°C occupies 4.22 L.  At what Celsius temperature will the volume be 3.87 L if the pressure stays constant?

3.  A sample of air has a volume of 140.0 mL at 67°C.  At what temperature will its volume be at 50.0 if the pressure stays constant?

4. A volume of 20.0 L of $O_2$ is warmed from -30.0°C to 85.0°C.  What is the new volume, if the pressure is kept constant?

5.  A sample of neon gas occupies a volume of 753 mL at 25°C.  What volume will the gas occupy at 50°C if the pressure remains constant?

6.  At standard temperature, a gas has a volume of 275 mL.  The temperature is then increased to 130.0° and the pressure is held constant.  What is the new volume?

**Gas Laws Assignment #6**                    Name _____
**Dalton's Law**

1. Three gases occupy a container. Gas A has a pressure of 1.25 atm. Gas B has a pressure of 0.3 atm. Gas C has a pressure of 0.85 atm. What is the total pressure of the gases in the container?

2. A seemingly empty 2-Liter bottle has a total pressure of 1.00 atm. The nitrogen inside has a pressure of 0.79 atm. The only other gas present in a significant quantity is oxygen. What is the partial pressure of the oxygen inside the bottle?

3. A mixture of breathing gas is at a total pressure of 6.0 atm. The partial pressure of nitrogen is 3.8 atm and the partial pressure of oxygen is 0.9 atm. What is the partial pressure of helium, the third gas?

4. A sample of a nitrogen is collected over water at 21.5°C. What is the partial pressure of the water vapor if the total pressure is 742 mm Hg? What is the partial pressure of the nitrogen?

5. Determine the partial pressure of a sample of oxygen gas collected over water at 25°C if the total pressure is 1.15 atm.

**Gas Laws Assignment #7**                                    Name _____
**Gay-Lussac's Law**

1.  A gas in a rigid container has a pressure of 2.5 atm at 25.0°C.  It is placed in a freezer at standard temperature.  What will the new pressure be?

2. A rigid container holds a gas at a pressure if 0.55 atm at a temperature of -100.°C.   What will the pressure be when the temperature is increased to 200.°C ?

3.  The gaseous contents in an aerosol can are under a pressure of 3.00 atm at 25.0°C.  Directions on the can caution the user to keep the can in a place where the temperature does not exceed 52°C.  What would the pressure of the gas in the aerosol can be at 52°C?

4.  On a cold winter morning when the temperature is -13°C, the air pressure is an automobile tire is 1.5 atm.  If the volume does not change, what will the pressure be after the tire has warmed to 13°C?

5.  An aerosol can contains gases under a pressure of 4.50 atm at 20.0°C.  if the can is left on a hot sandy beach the pressure of the gases increases to 4.80 atm.  What is the Celsius temperature on the sand at the beach?

**Gas Laws Assignment #8**                                  **Name** _____
**Combined Gas Laws**

1.  A 360.0 mL sample of hydrogen gas is collected when the pressure is 800.0 mm Hg at room temperature.  What is the volume that the gas will occupy when the pressure is 720.0 mm Hg and the temperature is 0°C?

2.  On a cold winter morning when the temperature is -13°C, the air pressure is an automobile tire is 1.5 atm.  If the volume does not change, what will the pressure be after the tire has warmed to 13°C?

3.  A gas collected when the temperature is 11°C and the pressure is 710.0 mm Hg measures 14.8 mL. Calculate the volume of the gas at 20.0 °C and 740.0 mm Hg.

4.  A sample of hydrogen with a volume of 800.00 mL exerts a pressure of 620.0 mm Hg at 5.00°C. What volume will it occupy at STP?

5.  A gas collected when the temperature is 11°C and the pressure is 710.0 mm Hg measures 14.8 mL. Calculate the volume of the gas at 20.0 °C and 740.0 mm Hg.

6.  A sample of hydrogen with a volume of 800.00 mL exerts a pressure of 620.0 mm Hg at 5.00°C. What volume will it occupy at STP?

7.  What is the volume at STP of a sample of $CO_2$ that has a volume of 75.0 mL at 30.0°C and 680. mm Hg?

**Gas Law Assignment #9**          **Name** _____
**Ideal Gas Law**

1. How many moles are in a sample of a gas that has a volume of 15.0 liters at 25ºC and 0.992 atm?

2. What is the volume of 1.5 moles of a gas at zero degrees Celsius and 2.00 atm?

3. Calculate the volume occupied by 12.0 g of carbon dioxide at 20.0°C and 740.0 mm Hg.