IDEAL GAS LAW WORKSHEET Name:______________________________ Per:______

The Ideal Gas Law is usually written as $PV = nRT$. The value R in this equation is called the ideal gas law constant. Its value can be found by substituting values for the other four variables in the equation and solving for R: At STP: P = 1 atm, V = 22.4 L, T = 273 K and n = 1 mole

Substituting this values in the equation PV = nRT and solving for R gives:

$$R = \frac{PV}{nT} = \frac{1 \text{ atm X } 22.4}{1 \text{ mole X } 273 \text{ K}} = \frac{0.08205128 \text{ atm-L}}{\text{mole-K}} = \boxed{\frac{0.0821 \text{ atm-L}}{\text{mole-K}}}$$

If standard pressure is used as 760 mmHg, then:

$$R = \frac{PV}{nT} = \frac{760 \text{ mm Hg X } 22.4\text{L}}{1 \text{ mole X } 273 \text{ K}} = \frac{62.358974 \text{ mmHg-L}}{\text{mole-K}} = \boxed{\frac{62.4 \text{ mmHg-L}}{\text{mole-K}}}$$

Use the ideal gas law to calculate a value for P, T, V or n given values for the other three:
(show all work on separate paper)

1. Calculate the temperature in °C, at which 2.50 moles of H_2 occupies a volume of 55.0 liters at 1.35 atm.

2. What volume, in liters, is occupied by 0.126 mole of H_2 gas at 752 mm Hg and 22°C?

3. Using the ideal gas law, calculate the volume of 0.100 mole of O_2 gas at each of the following sets of conditions:
   a. STP b. 98°C and 1.21 atm c. 500. °C and 20.0 atm d. -7°C and 755 mmHg

4. A 5.00 L gas cylinder contains 2.00 mole of N_2 gas at 27°C. What is the pressure, in atmospheres, of this gas?

5. How many moles of SO_2 will be present in a 3.00 L cylinder if the temperature is 150°C and the pressure is 13.3 atm?

6. Calculate the volume, in liters, occupied by 1.73 moles of N_2 gas at 0.992 atm pressure and a temperature of 75°C.

7. What is the temperature in degrees Celsius, of a 1.23 mole sample of O_2 gas under a pressure of 4.00 atm in a 9.00 L container?

Some of the most useful calculations involving the ideal gas law equation are those in which the **mass**, **molecular weight**, or **densit**y of a gas is determined. Such calculations are performed by using modified forms of the ideal gas equation.

The number of moles of any substance is equal to the number of grams of the substance divided by the substance's molecular weight: $n = \frac{g}{Mwt}$ Replacing and substituting n in the equation gives: $PV = \frac{g\ RT}{MWt}$

Rearranging the equation again we can now solve for the mass, in grams (g) of a gas or the molecular weight (MWt) of a gas: $g = \frac{PV(MWt)}{RT}$ $MWt = \frac{g\ RT}{PV}$ ("dirty Pete) rearranging for Density: $\text{Density} = \frac{Mwt\ P}{RT}$

8. A 0.276 sample of oxygen gas (O_2) occupies a volume of 0.270 L at 739 mm Hg and 98°C. Calculate from these data the molecular weight of gaseous O_2.

9. Calculate the mass, in grams, of each of the following quantities of gas:
   a. 30.0 L of CH_4 at 1.25 atm and 31°C.
   b. 1.11 L of H_2 at 546 mm Hg and 123°C.
   c. 4.00 L of O_2 at STP
   d. 6.75 L of N_2 at 100 mmHg and -100 °C.

10. If 3.00 g of a gas occupies a volume of 6.00 L at 85°C and 1.11 atm pressure what is its molecular weight?

11. Calculate the mass, in grams, of 3.50 L of NO gas measured at 35°C and 835 mm Hg.

12. What is the density of SO_2 gas at 1.20 atm and 25°C?