Salt Lake Community College, Chemistry Department

Chem 1110 Workshop 9

Topic: <u>Gases Part II</u>

Objective:

- To be able to understand the ideal gas law to predict and explain how gases respond to changes in pressure and volume
- To be able to use the concept of partial pressures of gases

Ideal gas Law:

The relationships among the four variables *P, V, T,* and *n* for gases can be combined into a single expression called the ideal gas law. The constant R is called the gas constant. Its value depends on the units chosen for pressure.

$$R = 0.0821\ \text{L•atm/mol•K}$$

Table 8.3 A Summary of the Gas Laws

	Gas Law	Variables	Constant
Boyle's law	$P_1V_1 = P_2V_2$	P, V	n, T
Charles's law	$V_1/T_1 = V_2/T_2$	V, T	n, P
Gay-Lussac's law	$P_1/T_1 = P_2/T_2$	P, T	n, V
Combined gas law	$P_1V_1/T_1 = P_2V_2/T_2$	P, V, T	n
Avogadro's law	$V_1/n_1 = V_2/n_2$	V, n	P, T
Ideal gas law	$PV = nRT$	P, V, T, n	R

Partial Pressure and Dalton's Law:

In any mixture of gases, the total pressure is the sum of the partial pressures of each gas present. The pressure exerted by each gas is the same as if it were the only gas present.

$$P_{total} = P_{gas\ 1} + P_{gas\ 2} + P_{gas\ 3}$$

Practice problems:

1. Find the pressure exerted by 1.40 g of N_2 (g) in a 800 cm^3 container at 0°C?

2. The reaction of 75.0 g of iron (III) sulfide with excess of HCl will produce what volume of a gas at 0.993 atm and 293 K?

3. If 87.5 g of gas X exerts a pressure of 2.00 atm in a 30.0 L container at 27 °C (300 K), find the molecular weight of gas X?

4. A mixture of gases contains 1.25 moles of N_2, 2.05 moles H_2, and 3.63 moles NH_3. If the total pressure of the mixture is 2.35 atm, what is the partial pressure of each component?

5. Which of the assumptions of the kinetic-molecular theory best explains Dalton's law of partial pressures?
   a) Gas molecules move at random with no attractive forces between them.
   b) The velocity of gas molecules is proportional to their Kelvin temperature.
   c) The amount of space occupied by a gas is much greater than the space occupied by the actual gas molecules.
   d) In collisions with the walls of the container or with other molecules, energy is conserved.
   e) Collisions with the walls of the container or with other molecules are elastic.