CHEM-1110 **GASES**

1. A sample of hydrogen sulfide gas was collected in a 250 mL flask at a pressure of 740 mm Hg and 37°C. What volume would it occupy at 3.65 atm and 313 K? (67.3mL)

2. A certain gas was found to have a density of 2.94 g/L at 150°C and a pressure of 720 torr. What is the molar mass of the gas? (108 g/mol)

3. Find the density of N_2O at

   a) STP (1.96 g/L) b) 27°C and 748 torr (1.76 g/L)

4. An organic compound contains C, H, N, and O. Combustion of 0.1023 g of the compound yielded 0.2766 g of CO_2 and 0.0991 g of H_2O.
   Use this information to find %, by mass, of C and H.
   (73.74% C, 10.76 % H)

   Another sample of the compound weighing 0.4831 g yielded 27.6mL of N_2 gas at STP. Use this data to find % N by mass.
   (7.14% N)

   In a third experiment, density of the compound as a gas was found to be 4.02 g/L at 400 K and 256 mmHg. Calculate molar mass of the gas. (392g/mol)

   What are the empirical formula and the molecular formula of the above compound? (MF= $C_{24}H_{42}N_2O_2$)

5. Pressures of 10^{-6} mm Hg are easily attainable in high vacuum systems in research labs. Calculate the number of molecules present per millilitre at 0°C and this pressure.
   (3.53×10^{10} molecules/mL)

6. A 2.92 g sample of a KCl-$KClO_3$ mixture is decomposed by heating. 89.8 mL of O_2(g) is collected by displacement of water at a temperature of 22°C and 727 mmHg. What is the mass percent of KCl in the mixture? The reaction is

$$2\ KClO_3(s) \rightarrow 2\ KCl(s) + 3\ O_2(g)$$ (90.3% KCl)

7. The explosive decomposition of nitroglycerin is given by the reaction

$$4\ C_3H_5(NO_3)_3(l) \rightarrow 12\ CO_2(g) + 10\ H_2O(g) + 6\ N_2(g) + O_2(g)$$

a) If the energy released during the explosion heated the reaction products to 2500 °C, what pressure must a 1.000 L container be able to withstand so that 5.00 g of nitroglycerin would not rupture it? (36.4 atm)

b) Calculate the partial pressure of each of the gases produced in part (a)

(CO_2=15.1, H_2O=12.6, N_2=7.53, and O_2=1.26)

8. A 3.0 L bulb containing He at 145 mm Hg is connected by a valve of negligible volume to a 2.0 L bulb containing Ar at 0.50 atm. Calculate the partial pressure of each gas and the total pressure after the valve between the bulbs is opened. Assume the temperature remains constant.

(He=87.0, Ar=152 and total pressure is 239 mmHg)

9. If an unknown gas effuses at a rate that is only 0.468 times that of O_2 at the same temperature, what is its molar mass? (146 g/mol)

10. Calculate the molecular mass of a gas if a given volume of the gas effuses through an apparatus in 300 s and the same volume of CH_4(g), under the same conditions of temperature and pressure, effuses through the same apparatus in 219 s? (30.0g/mol)

11. Consider a mixture of 3 gases: A, B, and C, enclosed in a container at a total pressure of 4 atm. The following is given:
-the mole fraction of gas A = 0.30
-the total number of moles = 60 moles
-gas C is in fact 792.2 g of CO_2(g)

Find the partial pressure of gas B. (1.60atm)

12. Dinitrogen monoxide, which is usually called nitrous oxide, is used as an anasthetic and as a propellant gas in whipped cream dispensers. It is made by heating ammonium nitrate. What mass of ammonium nitrate is required to produce 3.50 L of N_2O gas at 255°C and 1.00 atm?

(6.46g)