Gas Law Problems

Honors Chemistry

1. Methane burns according to the following equation

$$CH_{4(g)} + 2\ O_{(g)} \rightarrow CO_{2(g)} + 2\ H_2O_{(g)}$$

The combustion of 4.50 L of CH_4 consumes how many liters of O_2, both volumes measured at 25.0 ^oC and 740 torr? (Hint: Recall Avogadro's principle concerning the number of molecules in a fixed volume of gas at a given temperature and pressure.)

2. Butane (C_4H_{10}) is the fuel in cigarette lighters. It burns in oxygen according to the equation

$$2\ C_4H_{10(g)} + 13\ O_{2(g)} \rightarrow 8\ CO_{2(g)} + 10\ H_2O_{(g)}$$

How many milliliters of O_2 at 35^oC and 725 torr are needed to react completely with 75.0 mL of C_4H_{10} measured at 45^oC and 760 torr?

3. Radon, a radioactive gas, is formed in one step of the natural radioactive decay sequence of U-235 to Pb-207. Radon usually escapes harmlessly through the soil to the atmosphere. When the soil is frozen or saturated with water the escape route is through cracks in the basements of houses and other buildings. In order to detect radon in a residence, would you place the sensor in the attic, ground floor living area or the basement. Justify your answer. (density of air is 1.29 g/L)

4. Sulfur dioxide is a gas that has been used in commercial refrigeration, but not in residential refrigeration because it is toxic. If your refrigerator used SO_2, you could be injured if it developed a leak. What is the density of SO_2 gas measured at -20^oC and a pressure of 96.5 kPa?

5. A gaseous compound of phosphorus and fluorine with an empirical formula of PF_2 has a density of 5.60 gL^{-1} at 23.0 C and 750 torr. Determine the molecular formula of this compound. (Hint: Calculate the molar mass from the density.)

6. Suppose a mixture containing 2.15 g H_2 and 34.0 g NO has a total pressure of 2.05 atm. What are the partial pressures of both gases in the mixture?

7. What is the mole fraction and the mole percent of oxygen in exhaled air if P_{O2} is 116 torr and P_{total} is 760 torr?

8. Bromine has two isotopes with masses of 78.9 and 80.9 respectively. What is the expected ratio of the rate of effusion of Br-81 compared to Br-79?