Due: Wednesday, 3-October-2007 at the beginning of class. Please remember, this is to be your own work. I want to get the answers to you in time for the exam on Friday, 5-October-2007.

1) An organic compound contains C, H, N, and O. Combustion of 0.1023 g of the compound in excess oxygen yielded 0.2766 g of CO$_2$ and 0.0991 g of H$_2$O. A sample of 483.1 mg of the compound was analyzed for nitrogen by the Dumas method (shown below), and 27.6 mL of dry N$_2$ at STP was obtained. In a third experiment, the density of the compound as a gas was determined to be 4.02 g/L at 127ºC and 256 torr. What are the empirical and molecular formulas of the compound?

\[
\text{Compound} \xrightarrow{\text{CuO, heat}} \text{N}_2 + \text{CO}_2 + \text{H}_2\text{O}
\]

2) A sample of the breathing mixture, Helox, for divers contained 34.4% He, 51.6% N$_2$, and 14.0% O$_2$ (by mass). What is the density of this mixture at 17°C and 4.94 atm (the maximum recreational diving depth limit of 130 ft.)?

3) A 48.90-mL sample of a 0.2040 $M$ acid reacts with an excess of Na$_2$CO$_3$ to form 125.0 mL of CO$_2$ gas at 722 mm Hg and 17°C. If the acid is either HCl or H$_2$SO$_4$, which is it? Be sure to support your answers with equations and calculations as appropriate.

4) A chemist massed out 5.14 g of a mixture containing unknown amounts of BaO$_2$ and CaO$_2$ and placed the sample in a 1.50-L flask containing CO$_2(g)$ at 30.0°C and 750 torr. After the reaction to form BaCO$_3(s)$ and CaCO$_3(s)$ was completed, the pressure of CO$_2(g)$ remaining was 230 torr. Calculate the mass percentages of CaO$_2$ and BaO$_2$ in the mixture.

5) As you increase the temperature of a gas in a sealed, rigid container, what happens to the density of the gas? Would the result be the same if you did the same experiment in a container with a piston at constant pressure?