Chem E-1a
Friday Review Problems
Chapter 3

1. A compound was found to contain 27.7% magnesium, 23.6% phosphorus, and 48.7% oxygen by mass. Calculate the empirical formula of this compound.

2. A certain compound containing only carbon, hydrogen, and oxygen is found to have a molar mass of approximately 145 g/mol. When 2.36 grams of this compound is subjected to combustion analysis, 5.76 g of CO_2 and 2.35 g of H_2O are produced. Determine this compound's empirical and molecular formula.

3. a) Solid dinitrogen pentoxide reacts with water to produce aqueous nitric acid. Write and balance the equation for this process.

b) A 5.734-gram sample of dinitrogen pentoxide is dissolved in excess water. What mass of nitric acid is produced?

4. Carbon tetrachloride, CCl_4, was once used as a dry-cleaning solvent, but its toxicity has put an end to that use.

   a) CCl_4 can be destroyed by reaction with Cr_2O_3:

   $$Cr_2O_3 + CCl_4 \rightarrow CrCl_3 + CO_2 + COCl_2$$

   Balance this chemical equation using the smallest whole-number coefficients. (Hint: Balance the Cr first.)

   b) What is the maximum mass of $CrCl_3$ that could be prepared from 100.0 g of Cr_2O_3 and 100.0 mL of liquid CCl_4? (Density of CCl_4 is 1.587 g/mL)

4. (cont.)
   c) What mass of Cr_2O_3 and CCl_4 will remain if this reaction proceeds to completion?

5. A certain potent alcoholic beverage contains only ethanol (C_2H_6O) and water (H_2O). This mixture is flammable. When a sample of this beverage is completely combusted, the ethanol burns as expected, producing carbon dioxide and water, and the water present in the original mixture simply evaporates. A 10.00-gram sample of this beverage is completely combusted. The total mass of water collected (from combustion and evaporation) is 11.27 grams. Calculate the mass of ethanol and the mass of water in the original sample.

5. (*continued – space for additional work)*