Chapter 3 HW #2

Empirical/Molecular Formula Review
Answer the following questions that relate to the analysis of chemical compounds.
1. Elemental analysis of this unknown compound yields the following percentages by weight: H = 9.74%; C = 38.70%; O = 51.56%. Determine the empirical formula of the compound.

2. Assume that you have a gas with the following elementary analysis: C, 85.7%; H, 14.3%. Each gas has a molecular weight of 56. What is the molecular formula for the compound?

3. A hydrocarbon is found to contain 93.46% carbon and 6.54% hydrogen. Calculate the empirical formula of the unknown hydrocarbon.

4. Two volatile compounds Y and Z each contain element Q. The percent by weight of element Q in each compound was determined. Some of the data obtained are given below.

Compound	Percent by Weight of Element Q	Molecular Weight
Y	73.0%	104.
Z	59.3%	64.0

(a) Determine the mass of element Q contained in 1.00 mole of each of the compounds.
(b) Calculate the most probable value of the atomic weight of element Q.
(c) Compound Z contains carbon, hydrogen, and element Q. When 1.00 gram of compound Z is oxidized and all of the carbon and hydrogen are converted to oxides, 1.37 grams of CO_2 and 0.281 gram of water are produced. Determine the most probable molecular formula of compound Z.

5. Elemental analysis of an unknown pure substance indicates that the percent composition by mass is as follows: Carbon - 49.02%, Hydrogen - 2.743%, Chlorine - 48.23%. Determine the empirical formula of the unknown substance.

6. An unknown compound contains only the three elements C,H, and O. A pure sample of the compound is analyzed and found to be 65.60 percent C and 9.44 percent H by mass. Calculate the empirical formula of the unknown hydrocarbon.

7. Answer the following questions about acetylsalicylic acid, the active ingredient in aspirin. The amount of acetylsalicylic acid in a single aspirin tablet is 325 mg, yet the tablet has a mass of 2.00 g. Calculate the mass percent of acetylsalicylic acid in the tablet.

8. In an experiment, a sample of an unknown, pure gaseous hydrocarbon was analyzed. Results showed that the sample contained 6.000 g of carbon and 1.344 g of hydrogen. Determine the empirical formula of the hydrocarbon.

9. Answer the following questions about a pure compound that contains only carbon, hydrogen, and oxygen. A 0.7549 g sample of the compound burns in $O_2(g)$ to produce 1.9061 g of $CO_2(g)$ and 0.3370 g of $H_2O(g)$.
      (i) Calculate the individual masses of C, H, and O in the 0.7549 g sample.
      (ii) Determine the empirical formula for the compound.