Formulas and Stoichiometry Problem Set

1. What is the simplest chemical formula for the following compound, which has this percent composition by weight?

carbon	39%
hydrogen	16%
nitrogen	45%

   a. C_2H_7N
   b. CH_5N
   c. $C_2H_6N_2$
   d. C_3H_9N

2. Now that we have obtained the empirical formula for the compound above, which of the following could serve as valuable steps toward obtaining its molecular formula?

   a. vaporizing a specific mass of the compound and measuring the volume of the gaseous product at a specific temperature and pressure.
   b. titrating the compound with a strong acid.
   c. performing nuclear magnetic resonance spectroscopy.
   d. more than of the above could be useful.

3. A scientist carries out the complete combustion in the air of 44 grams of the compound $C_aH_bO_c$. 36 grams of water vapor and 88 grams of carbon dioxide are produced. What is the molecular formula of the compound?

   a. $C_4H_8O_1$
   b. $C_2H_4O_1$
   c. $C_2H_5O_1$
   d. $C_4H_4O_1$

4. Which is the sum of the coefficients in the following equation when balanced?

$$HCl + Cr \longrightarrow CrCl_3 + H_2$$

   a. 6
   b. 14
   c. 13
   d. 9

5. Acetylene is produced produced in a reaction between calcium carbide and water.

$$CaC_2 + 2H_20 \longrightarrow CaOH_2 + C_2H_2\,(g)$$

   How many grams of C_2H_2 (acetylene) would be formed if 18 ml of water is consumed?

   a. 26 g
   b. 28 g
   c. 18 g
   d. 13 g