Empirical Formula Problems – Set I

1. Determine the empirical formula of a compound consisting of :

   (a) 55.3%K, 14.6%P, and 30.1% O. (K_3PO_4)

   (b) 47.3% Cu and 52.7% Cl. ($CuCl_2$)

   (c) 52.14%C, 13.13%H, and 34.73% O. (C_2H_6O)

   (d) 40.0%C, 6.73%H and 53.3% O . (CH_2O)

2. In vanadium oxide, the mole ratio is calculated to be: 2.50 mol O/1 mol V. What is the simplest formula of vanadium oxide ? (V_2O_5)

3. Some phosphorus is heated in air to produced phosphorus oxide. The following data was collected:

mass of crucible (reaction vessel)	25.34 g
mass of crucible + phosphorus	27.19 g
mass of crucible + phosphorus oxide	29.58 g

   (a) Determine the empirical formula of phosphorus oxide. (P_2O_5)

4. Phosphorus forms two different compounds with chlorine. One compound contains 22.5 % P by mass, and the other contains 14.87 % P by mass. Determine the empirical formulas of the two compounds. (PCl_3 ; PCl_5)

5. An ace chemistry student carries out the following reaction in an attempt to determine the empirical formula of a copper oxide:

$$Cu_xO_{y(s)} + CH_{4(g)} + \text{heat} \rightarrow Cu_{(s)} + H_2O_{(g)} + CO_{2(g)}$$

Mass of empty test tube	24.25 g
Mass of empty test tube + copper oxide	26.26g
Mass of copper oxide	
Mass of test tube + solid copper(after heating)	25.85 g
Mass of copper (in copper oxide)	
Mass of oxygen (in copper oxide)	

Complete the above data table and determine the empirical formula of copper oxide.

6. An ace chemistry student heats a piece of iron(Fe) metal in a crucible. The reaction is: $Fe_{(s)} + O_{2(g)} \rightarrow Fe_xO_{y(s)}$.

Complete the data below. Determine the empirical formula of iron oxide. Show all your work.

mass of crucible	27.50 g
mass of crucible + Fe	28.62 g
mass of Fe	
mass of crucible + iron oxide	29.10 g
mass of iron oxide	
moles of Fe	
mass of oxygen	
moles of oxygen	

Empirical + Molecular Formula Problems – Set II

1. What is the empirical formula of the following compounds:

   (a) C_4O_{12} _____ (b) SiO_2 _____ (c) $N_4H_8Cl_2$ _____

2. A 10.00 g sample of vitamin C was analyzed and found to contain 4.092 g of C, 0.458 g of H, and 5.450 g of O. Given that the molar mass of the compound is 176g, determine the molecular formula of vitamin C. (answer: $C_6H_8O_6$)

3. Cyclobutane has the empirical formula CH_2. Its molar molar mass is 42g. What is its molecular formula? (answer: C_3H_6)

4. The amino acid Histidine has a molar mass of 154g. Is the molecular formula of Histidine C_3H_4NO or $C_6H_8N_3O_2$?

5. The major air pollutant of coal-burning power plants is a colorless, pungent gaseous compound containing only sulfur and oxygen. Chemical analysis of a 1.078 g sample of this gas showed that it contained 0.540 g of S and 0.538 g of O. What is the empirical formula of this compound? (answer: SO_2).

6. Determine the empirical formula of a compound containing: 29.2% N, 8.3% H, 12.5% C, and 50.0 % O. (answer: $N_2H_8CO_3$)

7. Benzene has the empirical formula CH. Its molar mass is 78g. What is its molecular formula? (answer: C_6H_6)