<u>**CONCEPT:**</u> EMPIRICAL FORMULA

Empirical Formula vs. Molecular Formula

● **Empirical Formula**: related to the mass percentage of its constituent elements using the *mole concept*.

    □ The **Molecular Formula** gives the _____ number of atoms in a compound.

    □ The **Empirical Formula** gives the _____ number of atoms and represents the most *simplified* form.

    □ By convention, any formula must contain whole numbers of each atom called the _____ ratio.

Molecular Formula	Empirical Formula
$C_3H_6O_3$	
$C_{10}H_{14}N_2$	
$C_{12}H_{22}O_{11}$	

Calculating the Empirical Formula

● Empirical Formula: can be calculated from the _____ or _____ of elements within a compound.

> **EXAMPLE**: Determine the empirical compound of a compound that is 57.47% sodium, 40.01% oxygen and 2.52% hydrogen.

STEP 1: Write down the _____ for each element in the question.

STEP 2: Write down the _____ (in grams) of each element given.

    □ Convert all _____ into grams by assuming there are 100 grams of the compound.

STEP 3: Convert all the masses into _____.

   □ To avoid rounding errors, make sure the values have at least 4 decimal places

STEP 4: Divide each mole answer by the smallest mole value in order to obtain whole numbers for each element.

**STEP 5:** If you get a value of _____ or _____ then you can round to the nearest whole number.

    □ If you can't round we multiply by a factor to create whole numbers.

PRACTICE: Determine the simplest form of a compound made up of carbon, hydrogen, nitrogen and oxygen if it is made of 49.48% C, 5.19% H and 16.48% O.

a) $C_4H_{12}NO_2$

b) $C_4H_5N_2O$

c) $C_2H_4NO_7$

d) CHN_3O_5
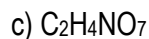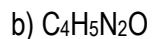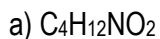
PRACTICE: A chemist wishing to identify a compound determines the masses of its elements as: 1.445 g S and 6.391 g Cl. Determine its empirical formula.

a) SCl

b) S_2Cl_8

c) SCl_4

d) SCl_6
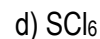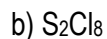
PRACTICE: A compound composed of potassium, manganese and oxygen contains 3.12 g potassium and 1.922×10^{23} oxygen atoms. If a sample of the compound weighs 12.61 g determine its empirical formula?

a) $KMnO_4$

b) $KMnO_2$

c) KMn_2O_9

d) $K_2M_4O_2$