Empirical Formula

- shows the smallest whole-number ratio of the atoms in the compound.

Example: H_2O_2 is hydrogen peroxide

HO is the empirical formula for hydrogen peroxide

⇒ H_2O_2 is the molecular formula - the actual # of each kind of atom present in a molecule of the compound.

Molecular Formula

- is either the same as its experimentally determined empirical formula, OR

it is a simple whole-number multiple of its empirical formula

efm ⇒ empirical formula mass

⇒ it's the MOLAR MASS of the empirical formula

WHAT is the empirical formula of the following compounds:

a) 36.1% Ca, 63.9% Cl

Because % means parts per 100, we can assume 36.1% means 36.1 g if we had 100 grams !!!

$$36.1\text{ g Ca}\left(\frac{1\text{ mol Ca}}{40.1\text{ g Ca}}\right) = \boxed{0.900\text{ mol Ca}}$$

$$63.9\text{ g Cl}\left(\frac{1\text{ mol Cl}}{35.5\text{ g Cl}}\right) = \boxed{1.80\text{ mol Cl}}$$

Divide each by smaller # of moles to get whole number ratio

$$\frac{0.900}{0.900} = 1\text{ mol Ca} \qquad \frac{1.80}{.900} = 2\text{ mol Cl}$$

so empirical formula is $\boxed{CaCl_2}$

b) 40.0% C, 6.7% H, 53.3% O

c) 3.7% H, 44.4% C, and 51.9% N

What is the molecular formula of a compound with the empirical formula CClN and a molar mass of 184.5 ?

efm = 12.0 + 35.5 + 14.0 = 61.5

$$\frac{\text{molar mass of compound}}{\text{efm}} = \frac{184.5}{61.5} = 3 = n$$

n(empirical formula) = molecular formula =

3(CClN) = $C_3Cl_3N_3$

Calculate the molecular formula of a compound whose molar mass is 60.0 g/mol and empirical formula is CH_4N