EMPIRICAL FORMULA OF A COMPOUND

- The simplest formula of a compound.

- The formula has the smallest whole number ratios of elements.

not $C_{0.5}HO$ or $C_2H_2O_2$ → a valid empirical formula is CH_2O

COMPARING EMPIRICAL AND MOLECULAR FORMULAS

Molecular Formula	n	Write the Empirical Formula
H_2O		
N_2O_4		
C_4H_{10}		
CH_4		
C_2H_6O		
$C_2H_6O_2$		
$C_6H_{12}O_6$		

"n" is a multiplication factor between the empirical formula and the molecular formula. It can be any integer from 1 – 100 or larger. This can be considered a common denominator in the molecular formula subscripts. Therefore, in the molecular formula given, find the largest common denominator and write that number in the "n" column.

Calculation of Empirical Formulas

What is the empirical formula of a compound that contains sodium, sulfur and oxygen atoms that gave 40.5% sulfur and 30.4% oxygen after analysis?

	Na $_x$	S $_y$	O $_z$
%			
grams			
Molar mass			
mol			
whole mol			
All whole mol x 2			

Empirical formula = $Na_xS_yO_z$

Empirical formula = Na___S___O___.

A compound is known to contain C and H and might also contain O. It is analyzed for C and H and found to contain 54.53% C and 9.15% H. What is the empirical formula?

Molecular formulas are a whole number multiple of the empirical formula
- How do you determine the multiplier (n)?
- By dividing the <u>MOLECULAR FORMULA MASS</u> by the <u>EMPIRICAL FORMULA MASS</u>
- MF = EF x n

STEPS: 3rd must be given, 1st, 2nd

determine MF = EF x n	MF mass	*calculate* EF mass	*calculate* n = (MF/EF)
$H_2O = H_2O \times 1$	18.02 amu	18.02 amu	1
$N_2O_4 = NO_2 \times 2$	92.02 amu	46.01 amu	2
_____? = C_2H_5 x___(n)	58.08 amu		
_____? = CH_4 x___(n)	16.04 amu		
_____? = C_2H_6O x___ (n)	46.07 amu		
_____? = CH_3O x ___(n)	62.07 amu		

- The multiplier can also be determined by dividing the mass of an element in one mole of the compound by the mass of the element in the empirical formula. For example:

If there are 96 grams of oxygen in one mole of a compound with an EF of CH_2O. What is the MF of the compound?

A compound made of only Si and H. 10 g is analyzed and found to contain 9.1 g Si. The molar mass of this compound is 122 g/mol. Determine the empirical and molecular formula.