Empirical Formula

the **simplest formula** for a compound
(the lowest term ratio)

Ex: **CH_2O** is **empirical**

Ex: **$C_6H_{12}O_6$** and **$C_{11}H_{22}O_{11}$** are **not** empirical
(but they have the same empirical formula - CH_2O)

**Knowing the percent composition,
the empirical formula can be determined**

Ex: A compound contains 40.0% carbon,
6.71% hydrogen and 53.3% oxygen.
What is this compound's empirical formula?

1. Assume you have 100 grams of the compound.
You would have: 40.0 g C 6.71 g H 53.3 g O

2. Convert these amounts to moles.

$$\frac{40.0\text{ g C}}{}\left|\frac{\text{mol}}{12.0\text{ g}}\right. = 3.33 \qquad \frac{6.71\text{ g H}}{}\left|\frac{\text{mol}}{1.01\text{ g}}\right. = 6.64 \qquad \frac{53.3\text{ g O}}{}\left|\frac{\text{mol}}{16.0\text{ g}}\right. = 3.33$$

3. Divide each mole amount by the smallest value.
(usually will give you a whole number ratio)

$$\frac{3.33}{3.33} = 1 \qquad \frac{6.64}{3.33} = 2 \qquad \frac{3.33}{3.33} = 1$$

CH_2O

Actual molecular formula could be:
CH_2O $C_2H_4O_2$ $C_3H_6O_3$ ...

Molecular Formulas

- States the number and kind of each atom present in the molecule
- Ex: $C_6H_{12}O_6$ is the molecular formula for glucose

**Knowing the empirical formula
and molecular (molar) mass,
molecular formula can be determined.**

Ex: The empirical formula for a compound is $AgCO_2$.
Its molecular mass is 304 g/mol. What is its molecular formula?

1. Find the mass of the empirical formula
$AgCO_2$ 107.9 + 12.0 + 32.0 = 151.9 g/mol
2. Divide the molecular mass by this mass

$$\frac{304}{151.9} = 2$$

3. Multiply each subscript in the empirical formula by this number.
$Ag_2C_2O_4$ is the molecular formula.