

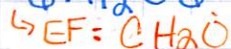
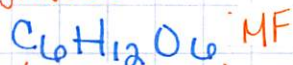
Empirical & Molecular Formulas

Empirical Formulas - simplified chemical formulas

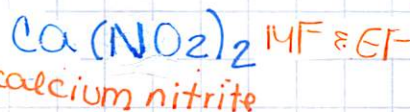
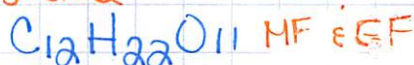
Molecular Formulas - actual, real chemical formulas

Can you determine which formulas are empirical & which are molecular?

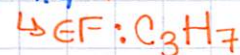
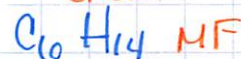
glucose



sucrose



hexane



Steps for an empirical formula (EF)

(1) Convert % to grams.

Assume you have 100g of the substance.

(2) Convert grams to moles.

Divide grams by the atomic mass of each element.

(3) Find the smallest answer, divide all answers by the smallest answer (ratio of 1 element to another) Get whole #'s or close to whole #'s? Those are your subscripts for the EF.

(4) Did you get a # with a decimal b/w .25 ↔ .75? You can't round that to whole #. So, multiply all answers by a # that will make the decimal a whole #.

Ex A compound is found to consist of 89.14% Au and 10.80% O. Find the E.F.

$$\frac{89.14 \text{ g Au}}{196.97 \text{ g/mol}}$$

$$\frac{10.80 \text{ g O}}{16.00 \text{ g/mol}}$$

$$= \frac{.4525 \text{ mol Au}}{.4525 \text{ mol}}$$

$$= \frac{.675 \text{ mol O}}{.4525 \text{ mol}}$$

$$= (1 \text{ Au})_2$$

$$= (1.5 \text{ O})_2$$



Steps for a molecular formula (MF)

- (1) Find the empirical formula (EF)
- (2) Find the molar mass of the EF
- (3) Divide the molar mass of the MF (given in the question) by the molar mass of the EF found in step 2.
- (4) Take the # from step 3 & multiply it into the subscripts of the EF to get the MF

Ex) An unknown compound consists of 47.0% K, 14.5% C, and 38.5% O. The molar mass of the molecular formula is ~ 166.22 g. What is the MF?

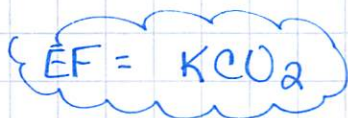
$$\begin{array}{ccc} \frac{47.0 \text{ g K}}{39.10 \text{ g/mol}} & \frac{14.5 \text{ g C}}{12.01 \text{ g/mol}} & \frac{38.5 \text{ g O}}{16.00 \text{ g/mol}} \end{array}$$

$$\begin{array}{ccc} = \frac{1.2020 \text{ mol K}}{1.2020 \text{ mol}} & = \frac{1.2073 \text{ mol C}}{1.2020 \text{ mol}} & = \frac{2.4063 \text{ mol O}}{1.2020 \text{ mol}} \end{array}$$

$$= 1 \text{ K}$$

$$= 1 \text{ C}$$

$$= 2 \text{ O}$$



MM (EF)

$$\begin{array}{l} \text{K } 1 \times 39.10 \text{ g} = 39.10 \text{ g} \\ \text{C } 1 \times 12.01 \text{ g} = 12.01 \text{ g} \\ \text{O } 2 \times 16.00 \text{ g} = 32.00 \text{ g} \\ \hline 83.11 \text{ g} \end{array}$$

$$\frac{166.22 \text{ g}}{83.11 \text{ g}} = 2$$

