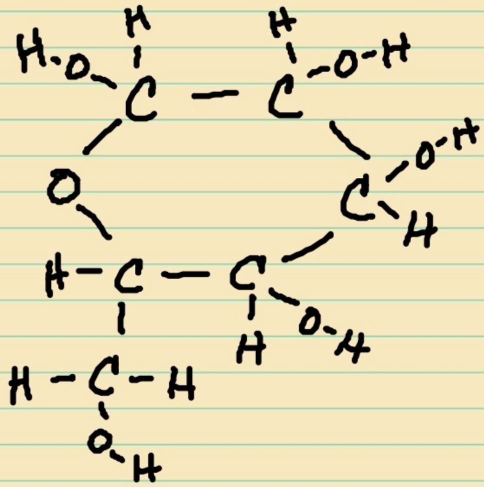
Molecular Formula vs Empirical Formula

glucose (Lewis structure):



molecular formula: $C_6H_{12}O_6$ $\times\ n$

empirical formula: CH_2O

(lowest ratio of elements in a compound)

Calculating empirical formula from % composition:

given

Pt: 65.02%   H: 2.02%

N: 9.34%   Cl: 23.63%

Step1: assume 100g

Step 2: find # of moles

Step 3: divide by smallest # of moles to find ratios

Pt: $\frac{65.02g}{} \left| \frac{1 \text{ mole}}{195.08g} \right. = \frac{.3333 \text{ mol Pt}}{.3333 \text{ mol}} = 1$

N: $\frac{9.34g}{} \left| \frac{1 \text{ mole}}{14.01g} \right. = \frac{.6667 \text{ mol N}}{.3333 \text{ mol}} = 2$

H: $\frac{2.02g}{} \left| \frac{1 \text{ mole}}{1.01g} \right. = \frac{2.004 \text{ mol H}}{.3333 \text{ mol}} = 6$

Cl: $\frac{23.63g}{} \left| \frac{1 \text{ mole}}{35.45g} \right. = \frac{.6666 \text{ mol Cl}}{.3333 \text{ mol}} = 2$

$PtN_2H_6Cl_2$

6

example #2:

A sample of a compound was completely decomposed into 0.3456 g of vanadium and 0.2784 g of oxygen. What is the compound's empirical formula?

$$\frac{0.3456\,g\,V}{} \left| \frac{1\,mol}{50.94\,g} \right. = \frac{0.006784\,mol}{.006784\,mol} = 1$$

$$\frac{0.2784\,g\,O}{} \left| \frac{1\,mol}{16.00\,g} \right. = \frac{0.0174\,mol}{.006784\,mol} = 2.5$$

double

V_2O_5

Calculating Molecular Formula from Empirical Formula and Molar Mass of Molecule:

example 1:

If a compound w/empirical formula P_2O_5 has a molar mass of 283.88g, what is its molecular formula?

$$P_2O_5 \times \cancel{n}\,2 = \underline{P_4O_{10}}$$

$$\underline{141.94g} \times \underline{2} = 283.88\ g$$

molar mass of empirical formula

molar mass of molecular formula