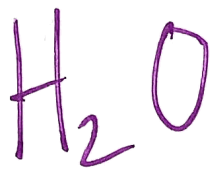


Molecular Calculations Organization Chart

Atomic Mass	
Molecular Mass Formula Mass	
Grams to Moles	
Moles to Grams	$\text{Moles} \times \frac{\text{MM (g)}}{1 \text{ mol}}$
Particles to Moles	
Moles to Particles	
Grams to Particles	
Particles to Grams	
Percent Composition	
Empirical Formula	
Molecular Formula	



Percent Composition (% Comp)

Mass percentage of each type of element (or atom) in a compound.

Ex: Calculate the % Comp of Nicotine ($\text{C}_{10}\text{H}_{14}\text{N}_2$)

$$\% \text{C} = \frac{10 \text{C} \times 12 \text{ g/mol}}{162 \text{ g/mol}} \times 100 = \frac{120}{162} \times 100 = 74.1\%$$

$$\% \text{H} = \frac{14 \text{H} \times 1 \text{ g/mol}}{162 \text{ g/mol}} \times 100 = \frac{14}{162} \times 100 = 8.6\%$$

$$\% \text{N} = \frac{2 \text{N} \times 14 \text{ g/mol}}{162 \text{ g/mol}} \times 100 = \frac{28}{162} \times 100 = 17.3\%$$

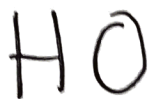
100%

① MM = 162 g/mol
of Nicotine

Percent Composition Worksheet

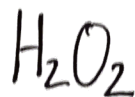
- 1) What is the percent composition of sulfur in sulfur dioxide (SO_2)?
- 2) What is the percent composition of carbon in methane (CH_4)?
- 3) What is the percent composition of oxygen in lithium hydroxide (LiOH)?
- 4) What is the percent composition of hydrogen in sulfuric acid (H_2SO_4)?
- 5) What is the percent composition of nitrogen in ammonium nitrate (NH_4NO_3)?

Empirical Formulas vs. Molecular Formulas



Lowest whole # ratio
of elements in a compd

* Can Find w/ % Comp.



How many atoms of each
element exist in the compd.

* Can find w/ Empirical Formula
& MM

$$\text{MM} = (\overset{\uparrow}{n})(\text{Emp. Form MM})$$

of moles

Ex: Find the Empirical Formula

$$47.25\% \text{ Cu} \xrightarrow{\textcircled{1}} 47.25\text{g Cu} \times \frac{1\text{mol}}{63.5\text{g Cu}} = 0.74\text{mol} / 0.74 = \textcircled{1}$$

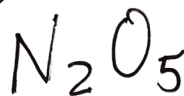
$$52.75\% \text{ Cl} \xrightarrow{\textcircled{1}} 52.75\text{g Cl} \times \frac{1\text{mol}}{35.5\text{g Cl}} = 1.49\text{mol} / 0.74 = \textcircled{2}$$



① Assume 100g sample

② Find # moles for each

③ Divide by the smallest
of moles



a.

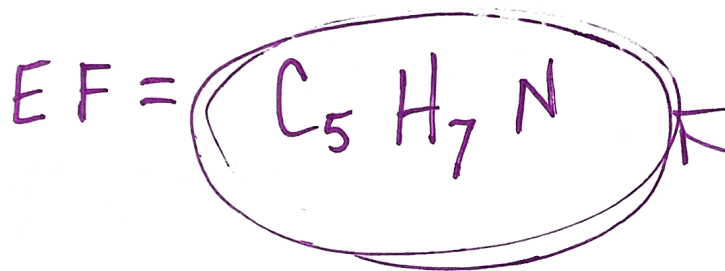
Nicotine is 74.1% carbon, 8.6% hydrogen, and 17.3% nitrogen by mass. Its molar mass is about 160 g/mol.

Ex: Finding Molecular Formula

$$\text{C} \quad 74.1\text{g} \times \frac{1\text{mol}}{12\text{gC}} = 6.2\text{molC}/1.2\text{mol} = 5$$

$$\text{H} \quad 8.6\text{g} \times \frac{1\text{mol}}{1\text{g/mol}} = 8.6\text{molH}/1.2\text{mol} = 7$$

$$\text{N} \quad 17.3\text{g} \times \frac{1\text{mol}}{14\text{g/mol}} = 1.2\text{molN}/1.2\text{mol} = 1$$



$$\frac{\text{MM}}{\text{MF}} = (n) \left(\frac{\text{EF}}{\text{mm}} \right)$$

$$160\text{g/mol} = (n)(81\text{g/mol})$$

$$n = 2$$

