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	

H_2O

Percent Composition (% Comp)

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

Ex: Calculate the % Comp of Nicotine ($C_{10}H_{14}N_2$)

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

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

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

$$100\%$$

① MM of Nicotine = 162 g/mol

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

Empirical Formulas

HO

Lowest whole # ratio of elements in a cmpd

* Can Find w/ % Comp.

Molecular Formulas

H_2O_2

How many atoms of each element exist in the cmpd.

* Can find w/ Empirical Formula & MM

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

n = # of moles

Ex: Find the Empirical Formula

47.25% Cu ① → $47.25\text{g Cu} \times \frac{1\text{mol}}{63.5\text{g Cu}} = 0.74\text{mol}$ ② / 0.74 = ① ③

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

$CuCl_2$

① Assume 100g sample
② Find # moles for each
③ Divide by the smallest # of Moles

$NO_{2.5}$ N_2O_5

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

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

H $8.6\,g \times \frac{1\,mol}{1\,g/mol} = 8.6\,mol\,H / 1.2\,mol = 7$

N $17.3\,g \times \frac{1\,mol}{14\,g/mol} = 1.2\,mol\,N / 1.2\,mol = 1$

EF = C_5H_7N

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

$160\,g/mol = (n)(81\,g/mol)$

$n = 2$

$\times EF$

$C_{10}H_{14}N_2$

CO_2 A

C_2O_4 B

C_4O_8 C

C_6O_{12} D