

Percent Composition
- percent of the mass of
an element in a compound

$$\text{Percent} = \frac{\text{Part}}{\text{whole}} \times 100$$

Element

Formula mass

Example: Determine percent
Composition of KMnO_4
↓
158.04 g/mol

$$\text{K} : \frac{39.10}{158.04} \times 100 = 24.74\%$$

$$\text{Mn} : \frac{54.94}{158.04} \times 100 = 34.76\%$$

$$O: \frac{(16.00 - 4)}{158.04} \times 100 = 40.50\%$$

Determine %c. for
Sodium carbonate



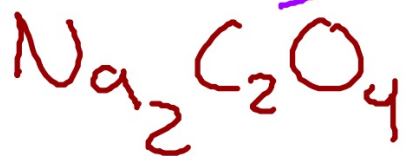
Na: 43.38%

C: 11.33%

O: 45.29%



C H O
52.13% 12.13% 34.73%



Na C O
34.31% 17.93% 47.76%

What is the mass of
Bromine in 50.0g of KBr

K: 32.9%

Br: 67.1%

$$0.671 \times 50.0 = 33.6 \text{ g Br}$$

Calculate mass of nitrogen
in $C_6H_{14}N_2O_2$ of 85.0mg

N: .19177

$$0.1917 \times 85.0 = 16.3 \text{ mg N}$$

Hydrates

- Salt compound that have a particular number of water molecules bound

Use prefix + hydrate



Copper(II) Sulfate pentahydrate



Anhydrous
- salts with no
water

Calculate the percent of
water in Sodium carbonate
decahydrate



$$105.99 \text{ g/mol}$$

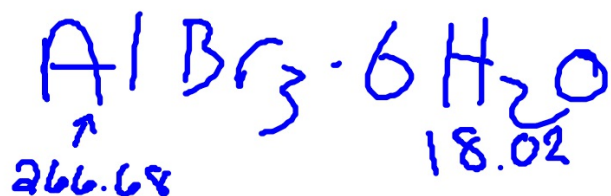
$$18.02 \text{ g/mol}$$

$$(18.02 \times 10)$$

$$\frac{(18.02 \times 10)}{(105.99 + (18.02 \times 10))} \times 100 =$$

$$62.97\%$$

Calculate percent water in
Aluminum Bromide hexahydrate



$$\frac{(18.02 \times 6)}{(266.68 + (18.02 \times 6))} = 28.5\%$$

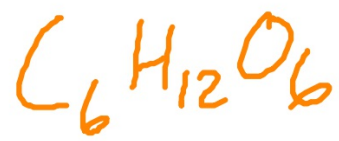
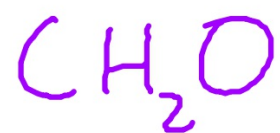
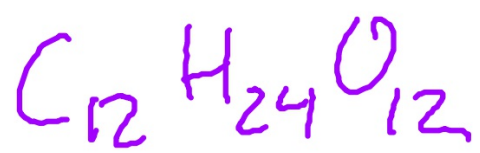
Empirical Formula

A formula written with the smallest whole number

ratio

Molecular Formula

A formula written with the number of elements.



Calculating Empirical

- 1.) Determine mass (grams)
- 2.) convert to moles
- 3.) Divide by smallest amount of moles
- 4.) Multiply to get whole numbers

An oxide of aluminum is formed with 4.151g of Al and 3.692g of oxygen.

1.) Al - 4.151g
O - 3.692g

2.) $4.151\text{g Al} \times \frac{1\text{ mol}}{26.98\text{g}} = 0.1539\text{ mol Al}$
 $3.692\text{g O} \times \frac{1\text{ mol}}{16.00\text{g}} = 0.2308\text{ mol O}$

$$\frac{0.1539 \text{ mol Al}}{0.1539 \text{ mol Al}} = 1 \times 2 = 2$$

$$2 \times 2 = 1$$

$$0.93 = 1$$

$$1.5 \times 2 = 3$$

3.)

$$\frac{0.2308 \text{ mol}}{0.1539 \text{ mol}}$$

$$0.1539 \text{ mol}$$

4.)



Aniline is composed of C, H, N.
From the combustion of
aniline CO_2 , H_2O , N_2 are formed.
9.71g of aniline is combusted to
form 6.63g H_2O , 1.46g N_2 .
What is aniline empirical formula?

$$1.) \text{H}_2\text{O} - 6.63$$

$$\text{N}_2 - 1.46$$

$$\text{H} - 0.743 \text{g}$$

$$\text{N} - 1.46$$

$$\text{C} - 9.71 - (1.46 + 0.743)$$

$$= 7.51 \text{g}$$

$$\frac{2.02}{18.02} \times 100 = 11.2\%$$

$$\text{H} - 1.01 \times 2 = 2.02$$

$$\text{O} - 16.00 = 16.00$$

$$\hline 18.02$$

$$0.112 \times 6.63 =$$

$$0.742$$

$$2.) \quad 0.743 \text{ g H} \times \frac{1 \text{ mol}}{1.01 \text{ g}} = 0.735 \text{ mol H}$$

$$1.46 \text{ g N} \times \frac{1 \text{ mol}}{14.01 \text{ g}} = 0.104 \text{ mol N}$$

$$7.51 \text{ g C} \times \frac{1 \text{ mol}}{12.01 \text{ g}} = 0.625 \text{ mol C}$$

$$3.) \frac{0.104}{0.104} = 1 \text{ N}$$

$$\frac{0.735}{0.104} = 7.07 \text{ H} \approx 7$$

$$\frac{0.625}{0.104} = 6 \text{ C}$$



If there are %

- 1.) Pretend you have a 100g
- 2.) convert to moles
- 3.) divide
- 4.) solve

Nylon is made up of
63.38% C, 12.98% N, 9.80% H,
14.14% O. What is empirical formula

$$\text{C} - 63.38\text{g} \times \frac{1\text{mol}}{12.01\text{g}} = 5.28\text{mol C}$$

$$\text{N} - 12.98 \times \frac{1\text{mol}}{14.01\text{g}} = 0.9265\text{mol N}$$

$$\text{H} - 9.80 \times \frac{1\text{mol}}{1.01\text{g}} = 9.70\text{mol H}$$

$$\text{O} - 14.14 \times \frac{1\text{mol}}{16.00\text{g}} = 0.8838\text{mol O}$$

$$\frac{0.8838}{0.8838} = 1:0$$

$$\frac{9.70}{0.8838} = 11 \quad C_6H_{11}NO$$

$$\frac{0.9265}{0.8838} = 1$$

$$\frac{5.25}{0.8838} = 6$$