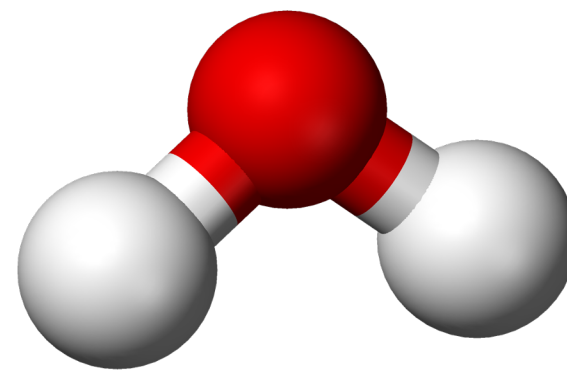


Percentage Composition

- Law of Definite Proportions
- Percentage Composition from Chemical Formula
- Empirical Formula from % Composition
- Molecular Formula
- Check Your Understanding Practice



Element	Mass	Moles	Mole Ratio	EF
Si	45.7	$n = \frac{45.7 \text{ g}}{28.09 \text{ g/mol}} = 1.62$	$= \frac{1.62}{0.814} = 2 \times 2 = 4$	$\text{Si}_4\text{H}_9\text{N}_2\text{S}_3$
H	3.7	$n = \frac{3.7 \text{ g}}{1.01 \text{ g/mol}} = 3.7$	$= \frac{3.7}{0.814} = 4.54 \times 2 = 9$	
N	11.4	$n = \frac{11.4 \text{ g}}{14.01 \text{ g/mol}} = 0.814$	$= \frac{0.814}{0.814} = 1 \times 2 = 2$	
S	39.2	$n = \frac{39.2 \text{ g}}{32.07 \text{ g/mol}} = 1.22$	$= \frac{1.22}{0.814} = 1.5 \times 2 = 3$	

Preview File

Please enjoy this preview of your Student Version of the presentation. Please note within this sample file:

- Some slides appear blank because they have been removed
- Student versions have portions of the text removed which is given in the teacher version and appear as _____ which the students are to fill in
- Other slides may have on them, this represents writing that has been removed on this sample

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Law of Definite Proportions

Over 200 years ago, scientists discovered that compounds contained elements in fixed mass proportions.

- For example, in 2009 scientists discovered traces of water on the moon. They found this water had the same composition as water on Earth.

$\text{MH}_2\text{O} = 18.02 \text{ g/mol}$

Looking at moles, 1 mol of water contains 2.02 g of hydrogen and 16.00 g of oxygen.

Law of Definite Proportions

We can calculate the mass percent of a compound using its chemical formula.

Example: Find the mass percent of hydrogen in H_2O

$$\text{Mass percent of H} = \frac{\text{Molar mass of H}}{\text{Molar mass of H}_2\text{O}} \times 100\%$$



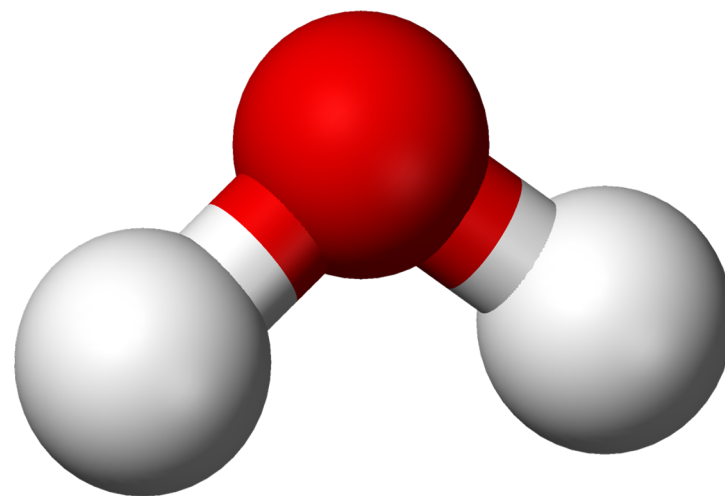
Percentage Composition

Example: H_2O

Mass percent of H = 11.2%

Mass percent of O = 88.8%

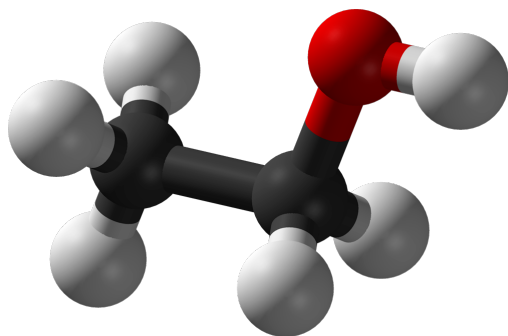
Total 100%



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Check Your Understanding

Determine the percentage composition of $\text{C}_2\text{H}_6\text{O}$:



$$M_{\text{C}_2\text{H}_6\text{O}} = 46.07 \text{ g/mol}$$

Empirical Formula from % Composition



To determine the empirical formula, we will assume that we have a **100 g** sample of the compound (elemental analysis).

What is the chemical formula for a compound with the following elemental analysis?

49.5% C

5.2% H

28.8%N

16.5% O

Check Your Understanding

What is the chemical formula for a compound with the following elemental analysis?

49.5% C 5.2% H 28.8% N 16.5% O

Step 1: Determine the number of moles for each element.

- $n_{\text{C}} = 4.125 \text{ mol}$
- $n_{\text{H}} = 5.14 \text{ mol}$
- $n_{\text{N}} = 2.06 \text{ mol}$
- $n_{\text{O}} = 1.03 \text{ mol}$

Step 2: Determine the mole ratios

To determine this, you divide everything by the lowest number of moles

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Example

Calculate the empirical formula of a compound containing 58.3 % C, 8.33 % H, and 33.3 % O.

Element	Mass	Moles	Mole Ratio	EF
C	58.3			
H	8.33			
O	33.3			

Mole Ratio
4.86/2.08 = 2.34
8.33/2.08 = 4
2.08/2.08 = 1

Decimal #	Multiply by	Result
.85 and above	N/A	round up
.8	5	Whole
.75	4	Whole
.66	3	Whole
.5	2	Whole
.33	3	Whole
.25	4	Whole
.20	5	Whole
.15 or less	N/A	round down

Check Your Understanding

Calculate the empirical formula for the compound containing:

C: 60.0%, H: 4.48%, O: 35.53%

Molecular Formula

- The formula for a compound that shows the number of atoms of each element that make up a molecule of that compound
- _____
- Dividing the molecular formula molar mass by the empirical formula molar mass determines a multiple that can be applied to the empirical formula

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Check Your Understanding

A compound with a molar mass of 180 g/mol is found to be composed of 40% carbon, 6.65% Hydrogen and 53.3% Oxygen. Determine the molecular formula. *Hint*: First find the empirical formula, then use the molecular mass to find the molecular formula.

Element	Mass	Moles	Mole Ratio	EF
C				
H				
O				

Putting it all together

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Element	Mass	Moles	Mole Ratio	EF
Si				
H				
N				
S				

Summary

- 1) Find the number of moles of each element
- 2) Divide by the lowest number of moles to find the ratio
 - The ratio must be all whole numbers
 - If the number is .85 or more round up, if it's .15 or less round down
- 3) To get the ratio into whole numbers multiply each one by a number (2, 3, 4 or 5)
- 4) _____
- 5) _____