

Compound Stoichiometry

How to calculate the percent of various elements from the compound formula and how to calculate the empirical formula from the percent of the elements.

Definition:

Stoichiometry is the use of ratios in calculations involved in chemistry.

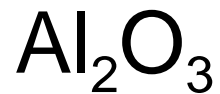
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- the types of atoms present in the compound and
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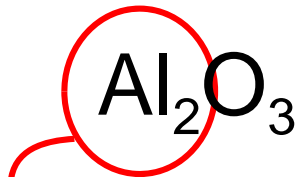
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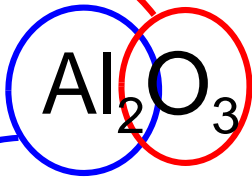


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There are two atoms (or moles) of aluminum for every three atoms(or moles) of oxygen

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Calculate the percent of each element in Al_2O_3 .

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To get started, assume 1 mole of Al_2O_3 . (After all, do the percents depend upon the total amount?)

To make the problem clear, set up a table:

element	moles /mol	molar mass /g mol ⁻¹	grams /g	percent
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To make the problem clear, set up a table:

element	moles /mol	molar mass /g mol ⁻¹	grams /g	percent
Al	2	26.98	53.96	
O	3	16.00	48.00	
Al_2O_3			101.96	

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To make the problem clear, set up a table:

element	moles /mol	molar mass /g mol ⁻¹	grams /g	percent
Al	2	26.98	53.96	52.92 %
O	3	16.00	48.00	47.08 %
Al_2O_3			101.96	

To reverse this process, first assume 100 g of compound.

Example:

Determine the formula for a compound that is:
42.1 % Na, 18.9 % P and 39.0 % O.

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Again set up a table:

element	mass /g	molar mass /g mol ⁻¹	moles /mol	ratio*
Na	42.1	23.0	1.83	
P	18.9	31.0	0.610	
O	39.0	16.0	2.43	

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element	mass /g	molar mass /g mol ⁻¹	moles /mol	ratio*
Na	42.1	23.0	1.83	3.00
P	18.9	31.0	0.610	1
O	39.0	16.0	2.43	3.98

*Ratios were obtained by dividing by the smallest, that is, 0.610 mol.

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This ratio is about 3:1:4 or for the formula: Na_3PO_4

But why not $\text{Na}_6\text{P}_2\text{O}_8$ or $\text{Na}_9\text{P}_3\text{O}_{12}$ or

There is no way to tell since they all have the same ratio.

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Na_3PO_4 , however, is the simplest so it is called the “simplest” or “empirical” formula.

THE END