

From Percent Data to Formula

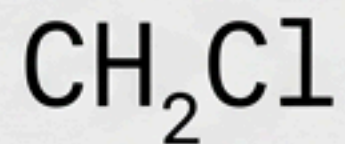
Unlocking Molecular Identities Using Stoichiometry



Two Ways to Define a Molecule

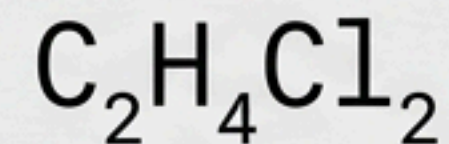
Empirical Formula

The simplest, whole-number ratio of various atoms present in a compound.



Molecular Formula

The exact, actual number of different types of atoms present in a single molecule.



The Conversion Algorithm



Finding the Ratio

Scaling the Molecule

[Step 1]

Assume 100g
sample
(Converts % to
grams)

[Step 2]

Divide by
Atomic Mass
(Converts grams
to moles)

[Step 3]

Divide by
Smallest
(Reveals the
molar ratio)

[Step 4]

Write
Empirical
Formula
(The baseline unit)

[Step 5]

Scale by 'n'
(Derives Molecular
Formula)

Case Study: Mass to Moles

A mystery compound contains 4.07% Hydrogen, 24.27% Carbon, and 71.65% Chlorine. Molar mass = 98.96 g.

Calculation Matrix

Element	[Step 1] Assume 100g	Atomic Mass	[Step 2] Moles
H	4.07g	1.008g	$4.07 / 1.008 = 4.04 \text{ mol}$
C	24.27g	12.01g	$24.27 / 12.01 = 2.021 \text{ mol}$
Cl	71.65g	35.453g	$71.65 / 35.453 = 2.021 \text{ mol}$



**You've Learned the Theory.
Let's Test Them Now.**

$$E=mc^2$$



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Normalizing the Molar Ratio

ALERT: Identify the smallest mole value to set the baseline ratio.

[Step 3] Divide by Smallest

$$\begin{array}{l} \text{Carbon: } 2.021 \div 2.021 = 1 \\ \text{Hydrogen: } 4.04 \div 2.021 = 2 \\ \text{Chlorine: } 2.021 \div 2.021 = 1 \end{array}$$

[Step 4] Empirical Formula Achieved: CH₂Cl

Finding the Scale Factor ('n')

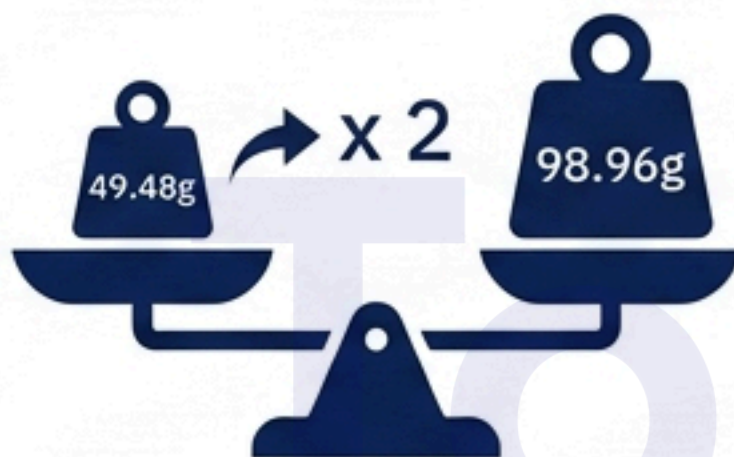
Empirical Data

Formula: CH_2Cl

Mass: $12.01 + 2(1.008) + 35.453 = 49.48 \text{ g}$

Given Molecular Data

Molar Mass: 98.96 g



[Step 5] Scale by 'n'

$$n = \text{Molar Mass} \div \text{Empirical Mass}$$

$$n = 98.96 \div 49.48 = 2$$

Deriving the Final Identity

Master Equation

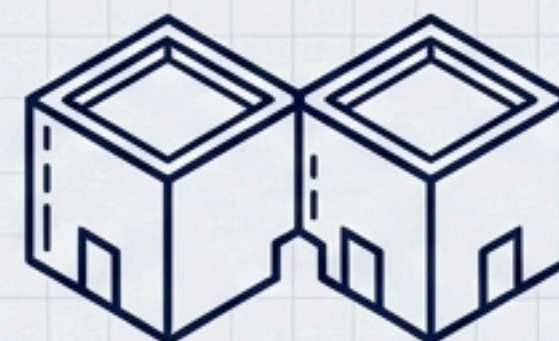
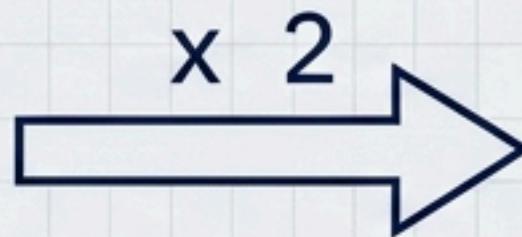
Molecular Formula = $n \times$ Empirical Formula

Molecular Formula = $2 \times (\text{CH}_2\text{Cl})$

Molecular Formula = $\text{C}_2\text{H}_4\text{Cl}_2$



CH_2Cl



$\text{C}_2\text{H}_4\text{Cl}_2$

The Power of Quantitative Analysis

Percentages unlock atomic ratios.
Ratios plus molar mass reveal the
true molecule.

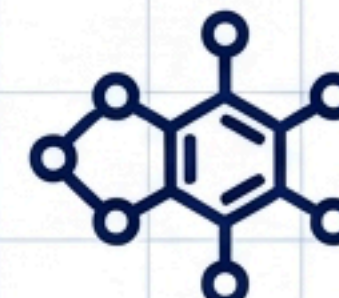


The Macro Mystery



1 : 2 : 1

The Empirical Baseline



The Microscopic Certainty



You've Learned the Theory.

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