

1.5.2 Law of Definite Proportions

Joseph Proust's Principle of Fixed Mass Composition

NATURE



EXAM TRAP

Non-Stoichiometric Compounds. Be aware that some substances (e.g., certain metal oxides) may not strictly follow this law. They are known as Berthollides, contrasting with Proustides.

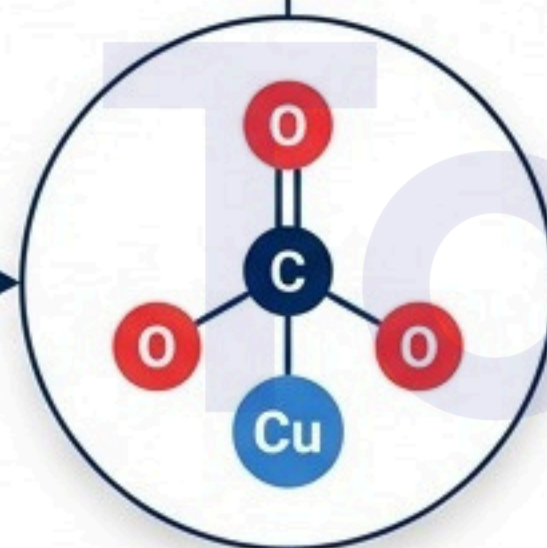


Natural Malachite
Formed through geological processes over time.

LABORATORY



Synthetic Cupric Carbonate
Created via controlled chemical synthesis.



Molecular Unity: CuCO_3

Composition Data

Sample Analysis (Mass %):

Element	Natural Sample	Synthetic Sample
Copper (Cu)	51.4%	51.4%
Carbon (C)	9.7%	9.7%
Oxygen (O)	38.9%	38.9%

✓ **KEY TAKEAWAY:** The ratio of elements by mass is always '51.4 : 9.7 : 38.9' for Cupric Carbonate, verifying Proust's Law.

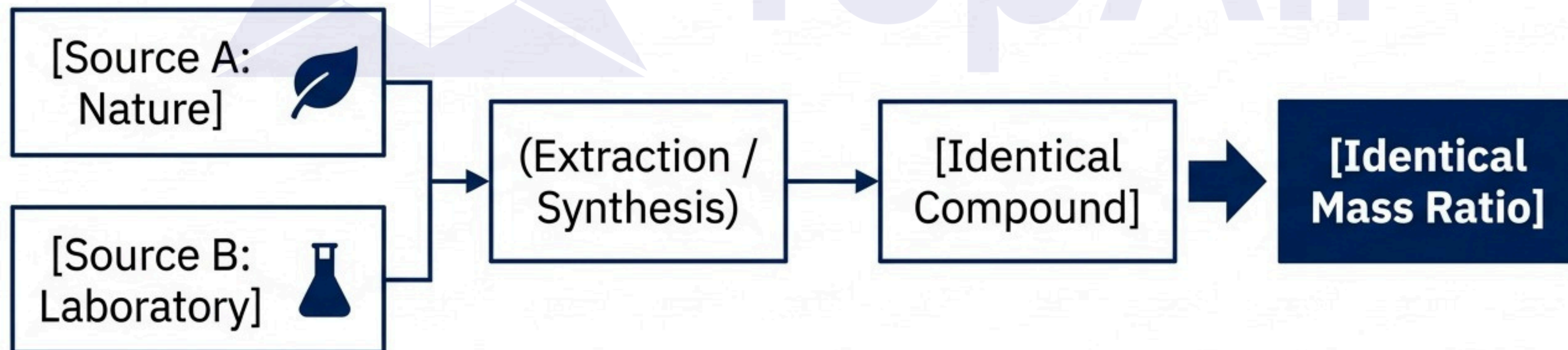


Core Concept: Fixed Composition by Mass

Theorem Box

“A given compound always contains exactly the **same proportion** of elements **by weight**.”

— Joseph Proust



Proust's Proof: Cupric Carbonate

Element	Natural Sample	Synthetic Sample
% of Copper	51.35	51.35
% of Carbon	9.74	9.74
% of Oxygen	38.91	38.91

Irrespective of origin, the mass composition remains fixed. (Also known as the Law of Definite Composition).



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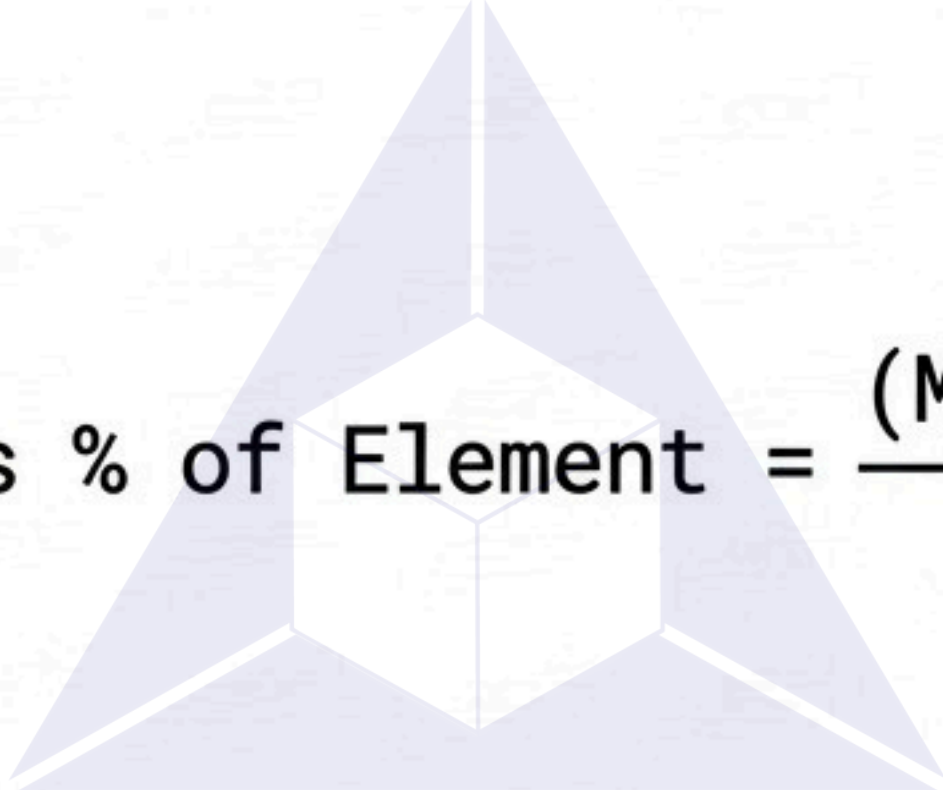
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Rule Bank: The Mass Percentage Formula


$$\text{Mass \% of Element} = \frac{(\text{Mass of Element in Compound})}{\text{Total Mass of Compound}} \times 100$$

Must be in grams (g)

Molar mass of the entire molecule

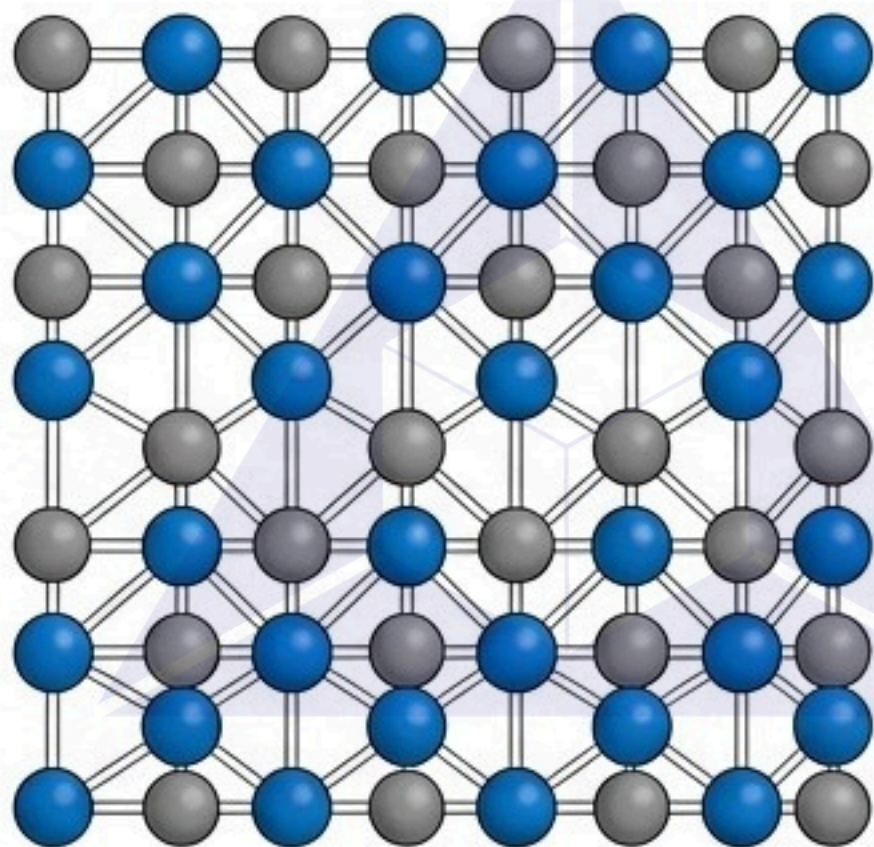
Converts ratio to percentage

Same Compound → Same Mass Percentage of Constituents

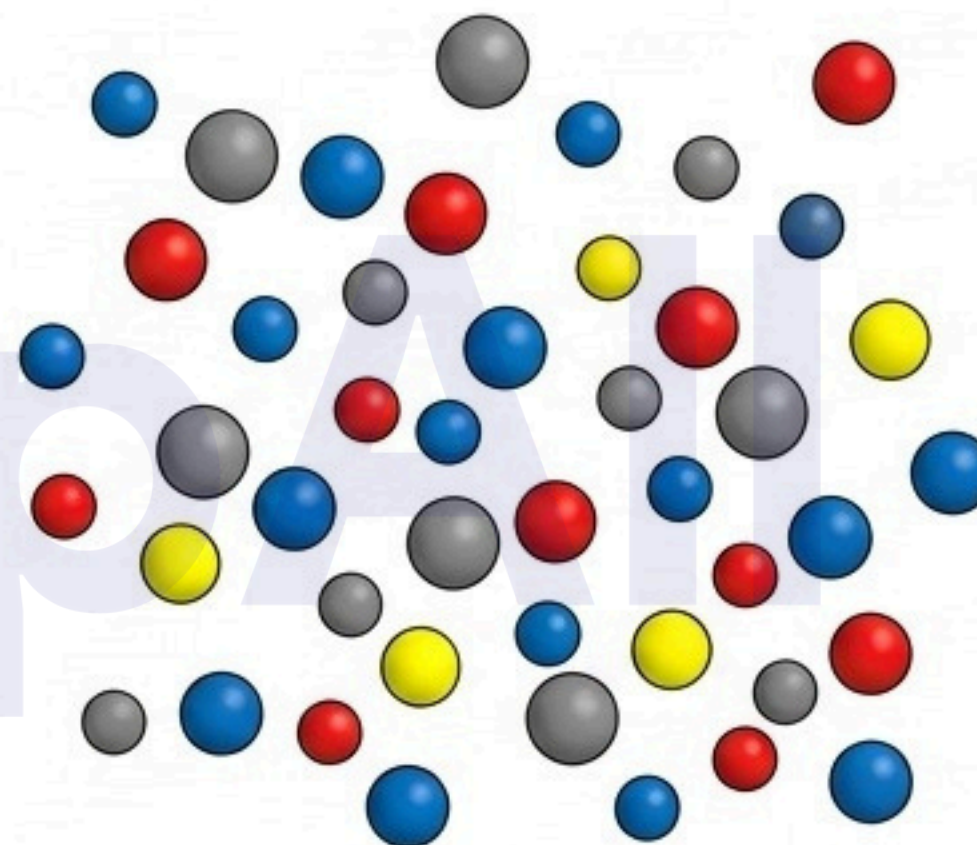
⚠ JEE TRAP ALERT

Applying the law to mixtures instead of pure compounds.

Pure Compound



Mixture



The Law of Definite Proportions strictly applies to **PURE COMPOUNDS**.
It does **NOT** apply to mixtures, where the ratio of components can vary infinitely.

Mini Application: Compare Two Samples

SCENARIO

Sample A of CO_2 is collected from human respiration. It contains 27.27% Carbon and 72.73% Oxygen by mass.

Sample B of CO_2 is created in a lab by burning graphite.

DEDUCTION

What is the mass of Oxygen in exactly 100g of Sample B?

72.73g



Because it is the same compound (CO_2), the mass percentage is universally fixed regardless of the source.

Revision Card: Law of Definite Composition



- ✓ **The Law:** A pure compound always contains the exact same elements in the exact same proportion by mass.
- ✓ **The Rule:** Origin / Source of the compound does not change its chemical composition.
- ✓ **The Proof:** Proust's natural vs. synthetic Cupric Carbonate experiment (Cu: 51.35%, C: 9.74%, O: 38.91%).
- ✓ **The Boundary:** Applies strictly to **pure compounds, not mixtures.**



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