

Percentage Composition

Determining the mass per cent of elements in a compound.

Element A: 40%

Element B: 45%

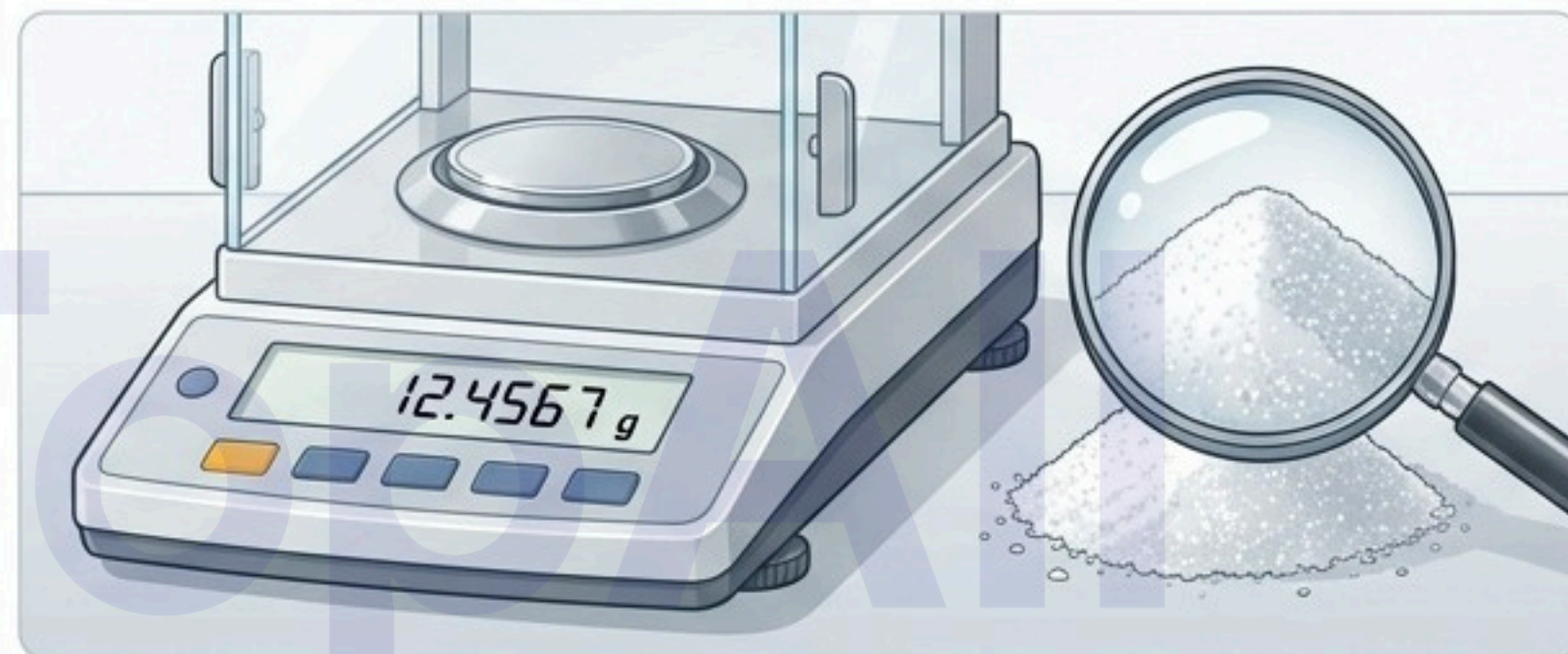
Element
C: 15%

The Core Concept: Mass Percentage

The What

Percentage Composition is the percentage by mass of each element in a given compound.

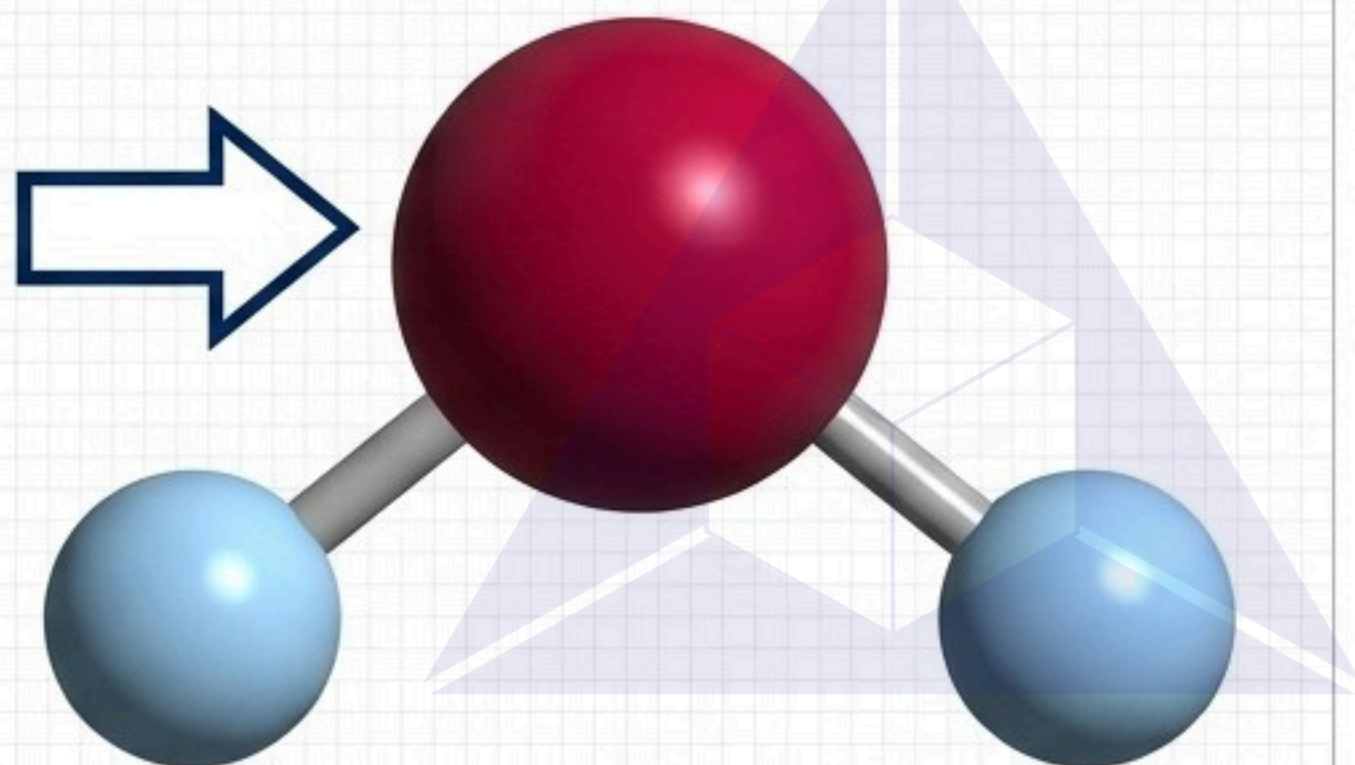
The Why



- Identifies unknown laboratory compounds.
- Required to determine empirical and molecular formulas.
- Verifies the purity of a sample against theoretical values.

The Atom Count vs. Mass Paradox

Atom Count Ratio - 2:1
in favor of Hydrogen



Mass Composition Bar

Total Molar Mass = 18.02 g



Paradox: Hydrogen has **twice the** atoms, but **Oxygen has almost 8x the mass**. Percentage composition is strictly about mass contribution, not atom quantity.



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Formula Bank

$$\text{Mass \%} = \frac{(\text{mass of element in compound})}{(\text{molar mass of compound})} \times 100$$

- mass of element in compound = Atomic mass of the element $\times$ number of atoms of that element in the molecule.
- molar mass of compound = The sum of all atomic masses in the entire molecule.

Common Calculation Error

JEE TRAP ALERT: Forgetting the Subscript!

The Trap: Using the mass of a single atom instead of accounting for how many times the element appears in the chemical formula.

Wrong Way (H ₂ O)	Right Way (H ₂ O)
Mass of Hydrogen = 1.008 g (Failed to multiply by 2) 	Mass of Hydrogen = 2 × 1.008 g = 2.016 g 

Always check the subscript before plugging the elemental mass into the numerator!

Mini Application: Carbon in Ethanol



Calculate the mass percentage of Carbon in Ethanol ($\text{C}_2\text{H}_5\text{OH}$).

Step 1: Total Mass

$$\text{Molar mass of } \text{C}_2\text{H}_5\text{OH} = (2 \times 12.01) + (6 \times 1.008) + 16.00 = 46.068 \text{ g}$$

Step 2: Isolate Element

$$\text{There are 2 Carbon atoms. Mass} = 2 \times 12.01 = 24.02 \text{ g}$$

Step 3: Apply Formula

$$(24.02 / 46.068) \times 100 = 52.14\%$$

Carbon (52.14%)

Oxygen (34.73%)

Hydrogen
(13.13%)

Concept Summary

Key Takeaways

ΣM

The Formula: Mass % links an individual element's mass contribution to the total molar mass of the compound.



The Pitfall: Always multiply the atomic mass by the element's subscript in the molecular formula before calculating.



The Application: Comparing theoretical mass percentages against experimental laboratory data is the standard method to confirm a compound's identity and purity.



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