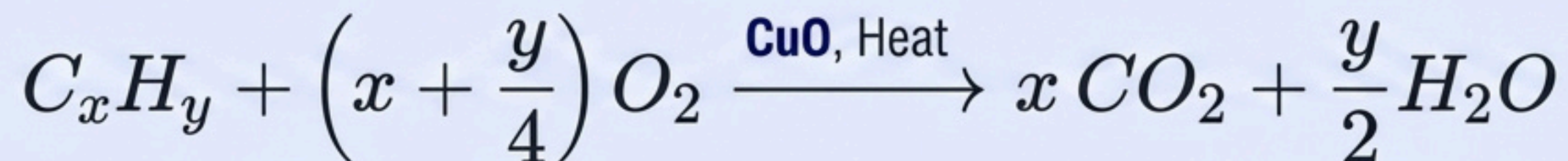
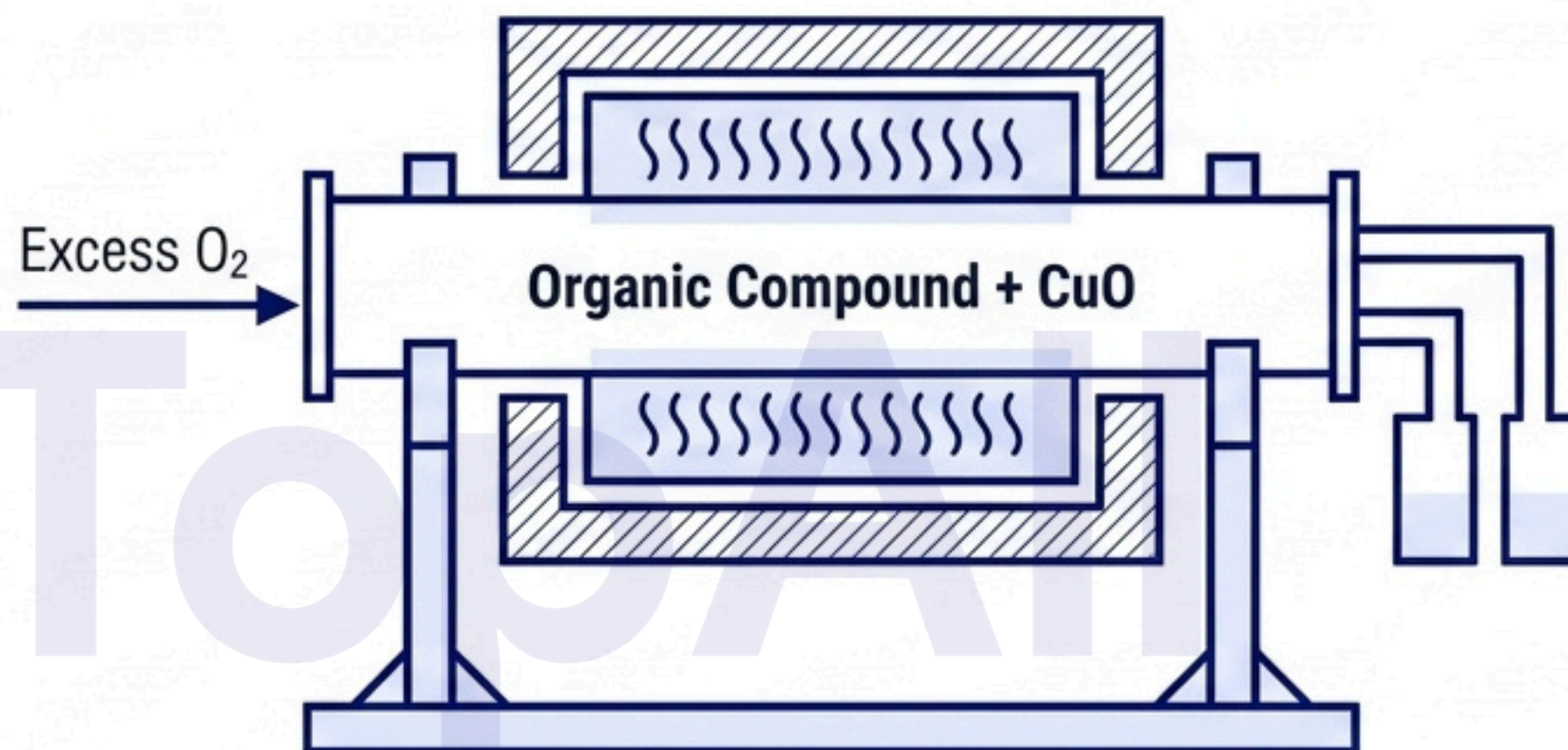


Liebig's Combustion Analysis

The fundamental principle of estimating Carbon and Hydrogen

A known mass (m) of an organic compound is strongly heated in the presence of excess oxygen and copper(II) oxide (CuO).

- Carbon is oxidized to Carbon Dioxide (CO₂).
- Hydrogen is oxidized to Water (H₂O).



Isolating Carbon: The KOH Trap

Capturing oxidized carbon to measure its mass

Combustion Gases

Unabsorbed Gases

Mechanism:

The gas mixture is passed through a U-tube containing a concentrated solution of Potassium Hydroxide (KOH). KOH reacts specifically with the acidic CO₂ gas.

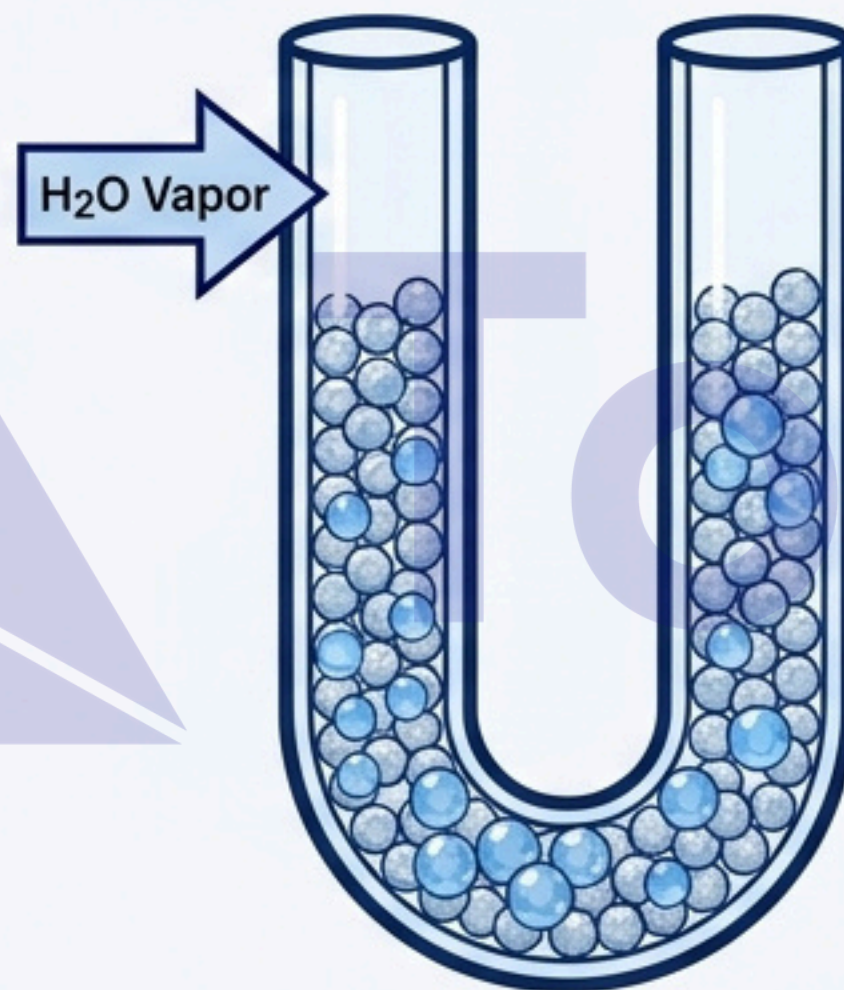


The increase in the mass of the KOH U-tube exactly equals the mass of CO₂ produced (m₂).

Isolating Hydrogen: The CaCl_2 Trap

Capturing oxidized hydrogen (moisture) to measure its mass

Mechanism: The combustion gases pass through a U-tube packed with anhydrous Calcium Chloride (CaCl_2). It acts as a powerful desiccant, physically absorbing water vapor to form hydrated complexes.



The **increase in the mass of the CaCl_2 U-tube** exactly equals the mass of H_2O produced (m_1).

Critical Experimental Note: The CaCl_2 tube must be placed BEFORE the KOH tube. If reversed, the aqueous KOH would absorb the moisture intended for the CaCl_2 trap, ruining the m_1 measurement.

Calculating Percentage Carbon (%C)

Deriving the final mass percentage of Carbon in the organic sample

Mass of organic compound = m g

Mass of CO₂ formed = m_2 g

Step 1: Mass of pure C in m_2 g of CO₂ = $\frac{12}{44} \times m_2$ g

Step 2: %C = $\left(\frac{\text{Mass of C}}{\text{Total mass of compound}} \right) \times 100$

$$\%C = \frac{12}{44} \times \frac{m_2}{m} \times 100$$



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Calculating Percentage Hydrogen (%H)

Deriving the final mass percentage of Hydrogen in the organic sample

Mass of organic compound = m g

Mass of H₂O formed = m_1 g

Step 1: Mass of pure H in m_1 g of H₂O = $\frac{2}{18} \times m_1$ g

Step 2: %H = $\left(\frac{\text{Mass of H}}{\text{Total mass of compound}} \right) \times 100$

$$\%H = \frac{2}{18} \times \frac{m_1}{m} \times 100$$

The Stoichiometric Logic

How product U-tube masses translate to elemental masses

Carbon Dioxide (CO₂)



- Molar mass of CO₂ = 44 g/mol
- Contains 1 atom of Carbon = 12 g/mol
- Conversion Factor: Every 44 g of CO₂ yields 12 g of pure Carbon.

12 / 44

Water (H₂O)



- Molar mass of H₂O = 18 g/mol
- Contains 2 atoms of Hydrogen = 2 × 1 = 2 g/mol
- Conversion Factor: Every 18 g of H₂O yields 2 g of pure Hydrogen.

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Quantitative Analysis: C & H Summary

One-page screenshot framework for Liebig's Method

Element	Oxidized Product	Absorbing Reagent	Mass % Formula
Carbon (C)	Carbon Dioxide (CO ₂)	Conc. Potassium Hydroxide (KOH)	$\%C = \frac{12}{44} \times \frac{m_2}{m} \times 100$
Hydrogen (H)	Water Vapor (H ₂ O)	Anhydrous Calcium Chloride (CaCl ₂)	$\%H = \frac{2}{18} \times \frac{m_1}{m} \times 100$

Where m = mass of organic compound, m_1 = mass of H₂O trap increase, m_2 = mass of CO₂ trap increase.



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