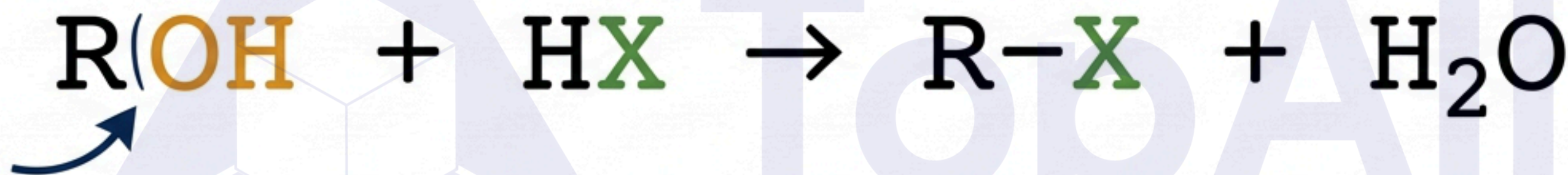


Replacing -OH with Halogen

Cleavage of the C-O Bond in
Alcohols and the Lucas Test

Cleaving the Carbon-Oxygen Bond



Alcohols react with hydrogen halides to form alkyl halides. This specific reaction is driven by the breaking of the C-O bond, replacing the hydroxyl group (-OH) with a halogen atom (-X).

The Diagnostic Tool: Lucas Reagent

conc. HCl
(Hydrochloric Acid)

+

ZnCl_2
(Anhydrous Zinc Chloride)

Lucas Reagent

This test utilizes the differential reactivity of the three classes of alcohols with hydrogen chloride to distinguish them from one another.

Important Note: ZnCl_2 acts as a crucial catalyst to facilitate the breaking of the strong C–O bond.



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$$E=mc^2$$



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Visualizing the Reaction: Turbidity



Clear Solution

Alcohols are highly soluble in the Lucas reagent. The initial mixture is completely transparent.



Turbid Emulsion

The newly formed alkyl halides ($R-X$) are **immiscible** (insoluble) in the aqueous solution, creating a cloudy, milky appearance known as turbidity.

Tertiary (3°) Alcohols: The Fastest Reaction



3° Alcohol + Lucas Reagent → Immediate Turbidity

Tertiary alcohols form alkyl halides almost instantaneously at room temperature.

Why so fast?

The reaction mechanism relies on the formation of a carbocation. **Tertiary carbocations are the most stable**, making tertiary alcohols the easiest and fastest to convert.

Secondary vs. Primary Alcohols

Secondary (2°) Alcohols



Reaction Time: **~5 Minutes**

Result: Turbidity appears slowly after a short delay at room temperature.

Primary (1°) Alcohols



Reaction Time: **None (at room temp)**

Result: Solution remains clear. Primary alcohols do not produce turbidity at room temperature without significant heating.

Lucas Test Summary Matrix

Alcohol Type	Reactivity Speed	Turbidity Result
Tertiary (3°)	Fastest	Immediate
Secondary (2°)	Moderate	~5 Minutes
Primary (1°)	Slowest	No reaction at room temp.

Key Takeaway: Relative ease of dehydration and C–O bond cleavage follows the strict order: Tertiary > Secondary > Primary.



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