

Reactions Involving Cleavage of the C–O Bond in Alcohols



Key Vocabulary

Lucas Reagent

A mixture of concentrated HCl and ZnCl_2 used to diagnose alcohol classification.

Carbocation

The **positively charged** carbon intermediate that drives **C–O bond** cleavage.

Rate-Determining Step

The slowest step in a reaction mechanism, which definitively dictates overall reaction speed.

Lucas Test Spotlight: Time as the Diagnostic

3° (Tertiary)	2° (Secondary)	1° (Primary)
Immediate Turbidity.	Turbidity in minutes.	NO Turbidity at room temperature.

Context: Turbidity represents the formation of insoluble alkyl halides. The diagnostic is not *what* happens, but *when* it happens.



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

$$E=mc^2$$



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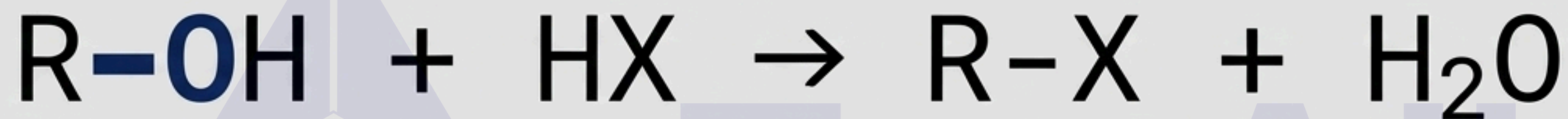
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Key Highlights

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General Equation: Hydrogen Halides



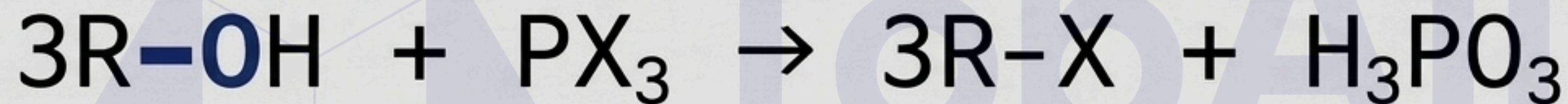
3° > 2° > 1°



Reactivity Order of Alcohols with HX

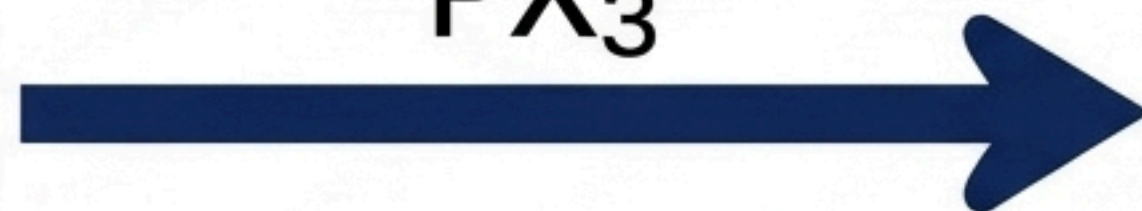
The Synthetic Alternative

Phosphorus Trihalides (PX₃) Cleavage



Alcohol

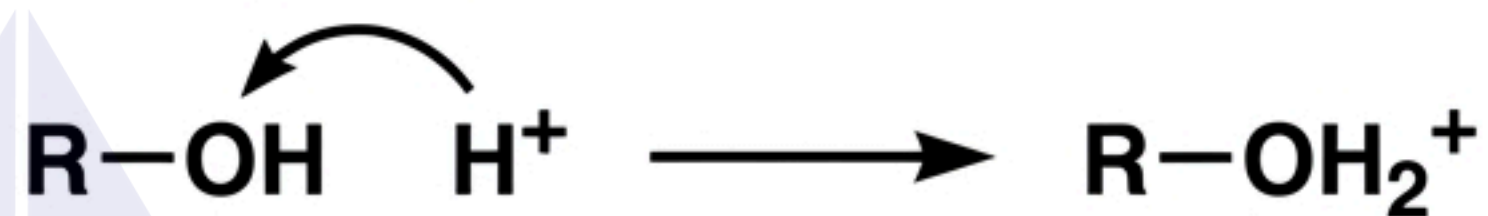
PX₃



Alkyl Bromide

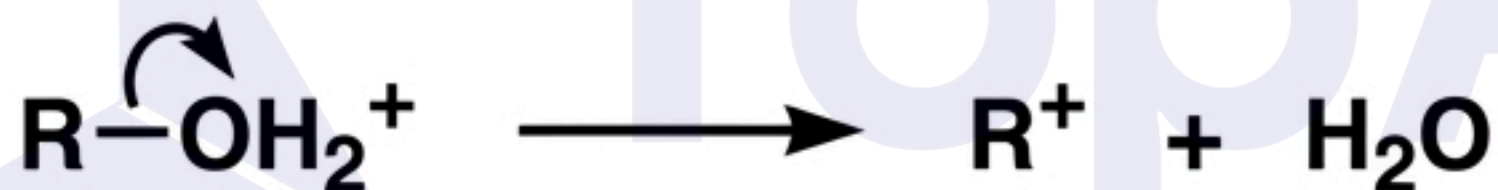
The 3-Step E1 Dehydration Mechanism

Step 1: Protonation (Fast)

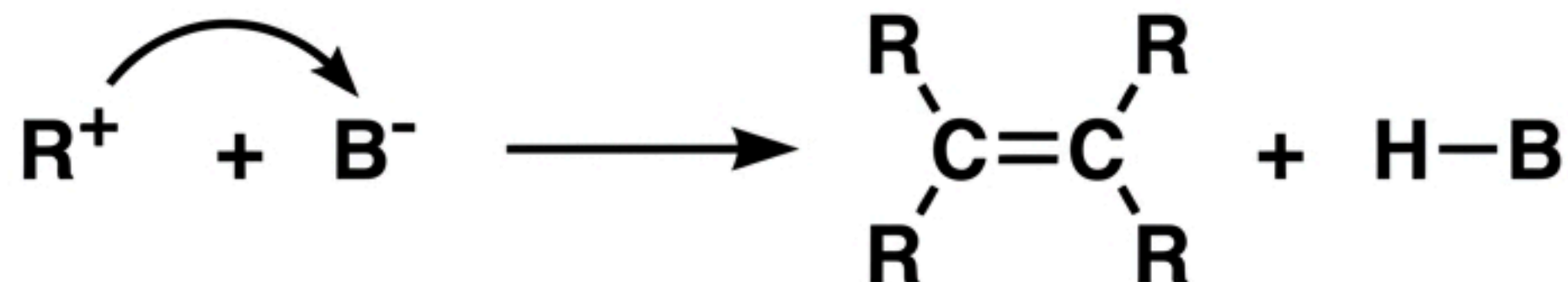


Step 2: Carbocation Formation

SLOWEST / RATE-DETERMINING STEP



Step 3: Elimination (Fast)



The Conceptual Payoff

Empirical Observation

Dehydration Ease



BECAUSE

Mechanistic Reality

Carbocation Stability



Watch For This: The Lucas Test Trap

Students often memorize the Lucas test as “Primary alcohols don't react.” **This is incomplete.** Primary alcohols do not produce turbidity *at room temperature*.

The Lucas test is a timed diagnostic, not a binary toggle. The timing itself (Immediate vs. Minutes vs. None at room temp) is the diagnostic answer. **Never ignore the time factor when evaluating multiple-choice options.**

Key Takeaways

- The Lucas test differentiates degrees of alcohols purely by the *timing* of turbidity (alkyl halide formation).
- In C–O bond cleavage reactions (like dehydration and HX substitution), the formation of the carbocation is the rate-determining step. This singular fact dictates the universal $3^\circ > 2^\circ > 1^\circ$ reactivity order.



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Jump in while the concept is still fresh in your head

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