

UNIT 7 • ALCOHOLS, PHENOLS AND ETHERS

Preparation of Ethers

A diagnostic blueprint for reaction conditions and exam traps.

The Core Lexicon

Williamson synthesis

The universal laboratory method for symmetrical and unsymmetrical ethers via alkyl halides and sodium alkoxides.

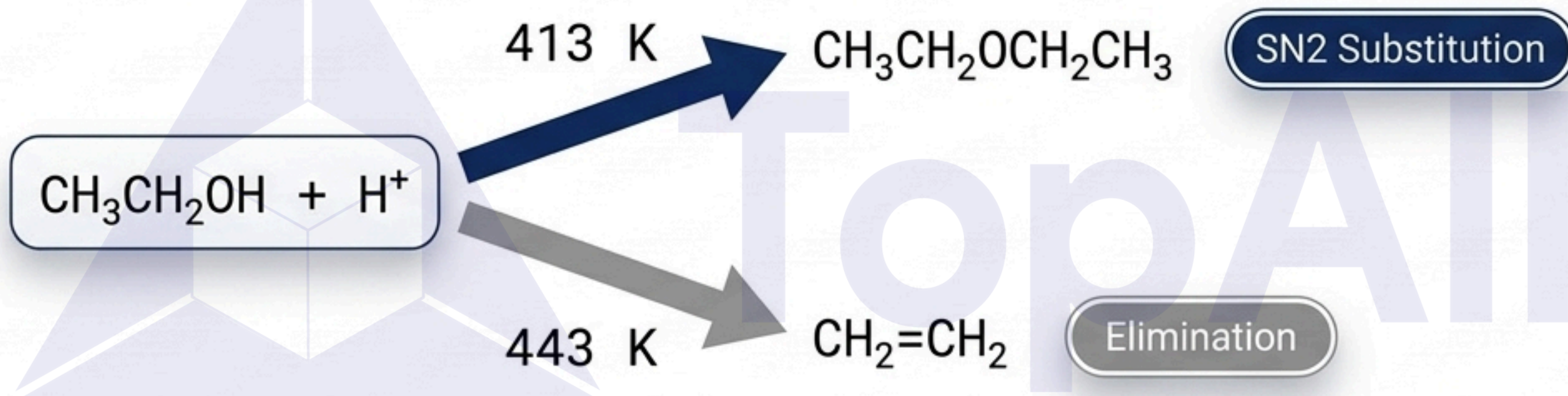
SN2

Bimolecular nucleophilic substitution. A single-step backside attack that demands unhindered, primary carbon targets to succeed.

SN1

Unimolecular substitution involving a carbocation intermediate. In ether synthesis, this pathway often loses the battle to elimination.

Rule 1: Temperature-Dependent Dehydration



Dehydration-to-ether is highly fragile. It succeeds only for unhindered primary alcohols kept at strictly controlled low temperatures.



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Let's Test Them Now.**

$$E=mc^2$$



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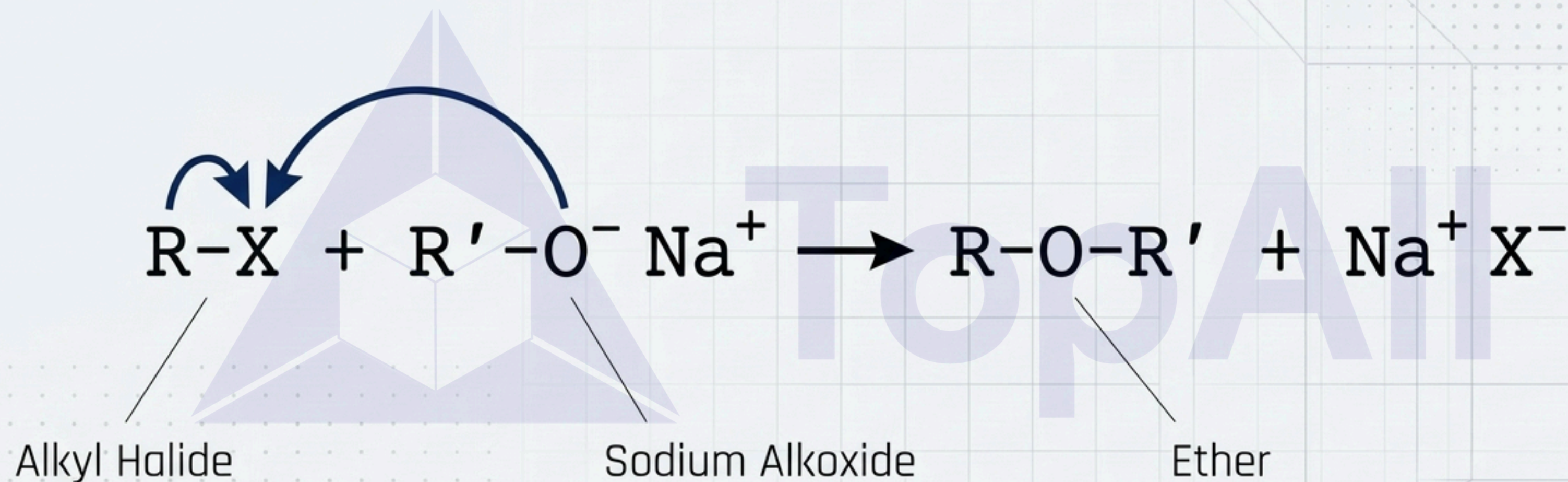
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Key Highlights

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Rule 2: Williamson Synthesis

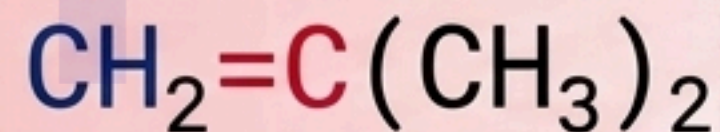
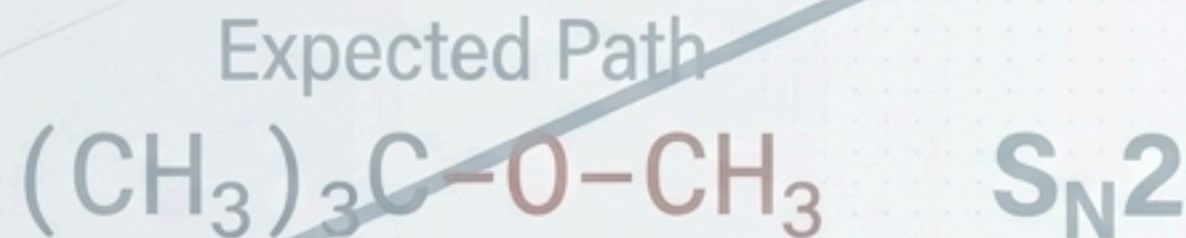


Key Insight: The definitive laboratory method. Alkoxide ions perform a clean S_N2 attack on an alkyl halide to yield symmetrical or unsymmetrical ethers.

The Elimination Override

Watch for this: Alkoxides are strong bases as well as nucleophiles.

Tertiary Alkyl Halide + Sodium Methoxide

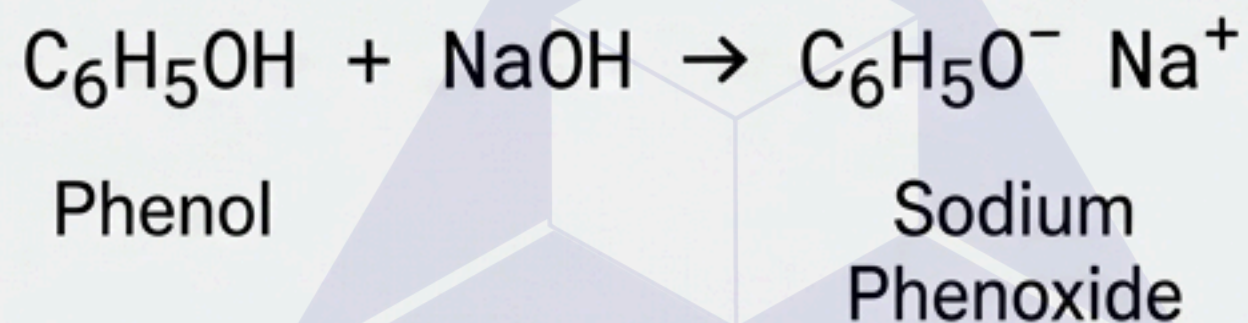


Elimination Wins

If the halide is tertiary and crowded, the $\text{S}_{\text{N}}2$ attack fails. Elimination entirely overpowers substitution, yielding only alkenes—no ether.

The Aromatic Workaround

Step 1



Step 2



Key Insight: To synthesize an aromatic ether, the bulky aromatic ring must reside on the oxygen (forming a phenoxide). You cannot use an aryl halide due to bond stability.

JEE Trap Alert: Unbalanced Bulk

Watch for this MCQ Trick: Goal: Synthesize **t-butyl ethyl ether**



t-butyl bromide (tertiary) + sodium ethoxide $\rightarrow$ Alkene

Triggers elimination due to crowded halide.



ethyl bromide (primary) + sodium t-butoxide $\rightarrow$ Ether

Triggers clean S_N2 .

The ALKYL HALIDE must be primary, regardless of which side supplies the alkoxide.

Key Takeaways

- Acidic dehydration of alcohols yields ethers strictly at lower temperatures (413K) and is viable only for unhindered primary alcohols.
- Williamson synthesis is an S_N2 reaction. To prevent basic elimination, the alkyl halide must always be primary; the alkoxide can be secondary, tertiary, or aromatic.



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