

UNIT 7 • ALCOHOLS, PHENOLS AND ETHERS



Preparation of Alcohols

A visual schematic of synthesis pathways, core mechanisms, and predictive rules for JEE & NEET.

The Synthesis Toolkit

Acid-Catalysed Hydration

Adds water (H & OH) across a double bond following Markovnikov's rule.

Hydroboration-Oxidation

Adds water across a double bond via an anti-Markovnikov pathway using diborane.

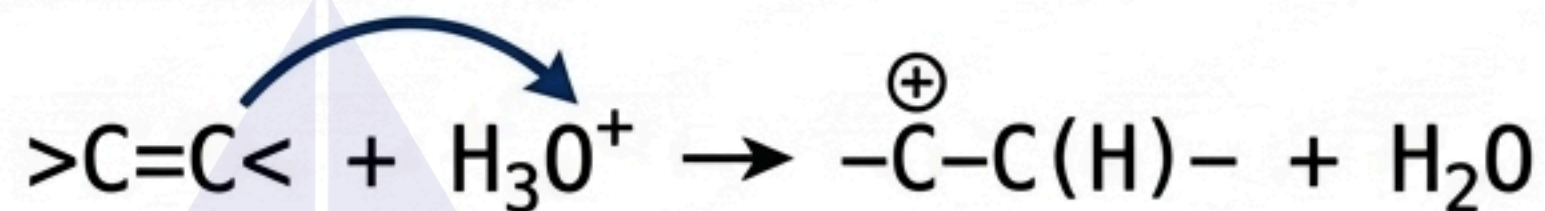
Grignard Reagent

An organometallic powerhouse (RMgX) that adds alkyl groups to carbonyls, forming new C-C bonds.

Blueprint: Acid-Catalysed Hydration Mechanism



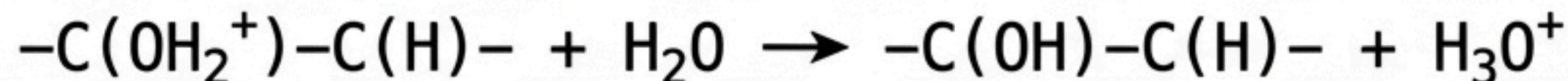
Step 1: Protonation



Step 2: Nucleophilic Attack



Step 3: Deprotonation



Notice how the acid (H^+) is consumed in Step 1 and regenerated in Step 3—acting as a true catalyst.



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

$$E=mc^2$$



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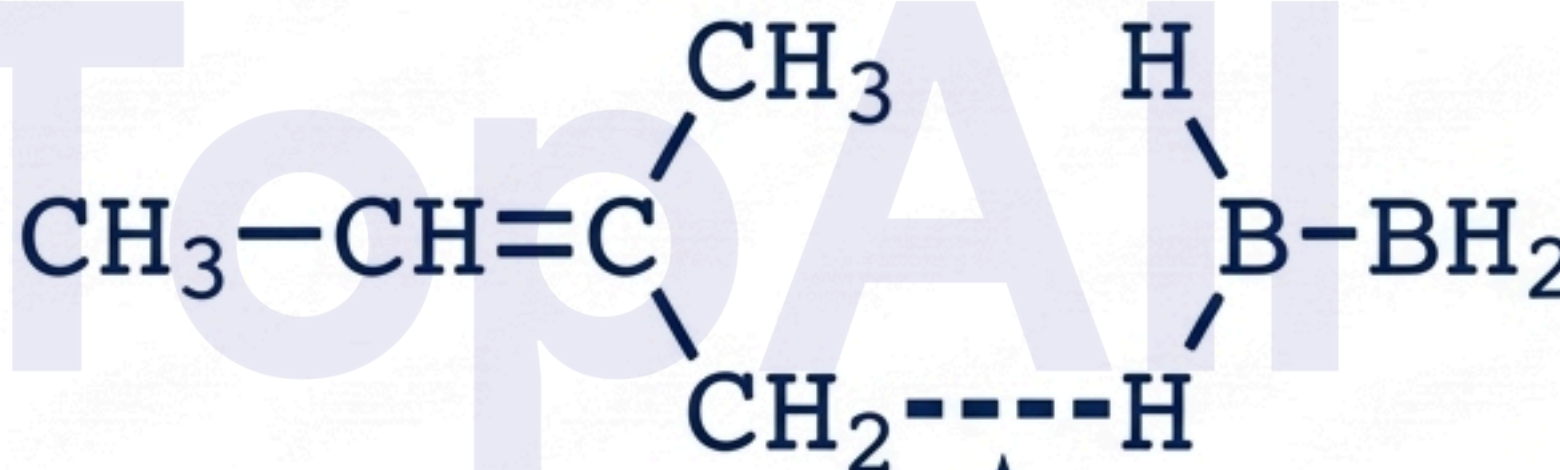
Key Highlights

- » Free Study Material, Videos & Infographics
- » Push Your Limits with Level-Based Challenges
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- » Get Clear Explanations, Not Just Marks
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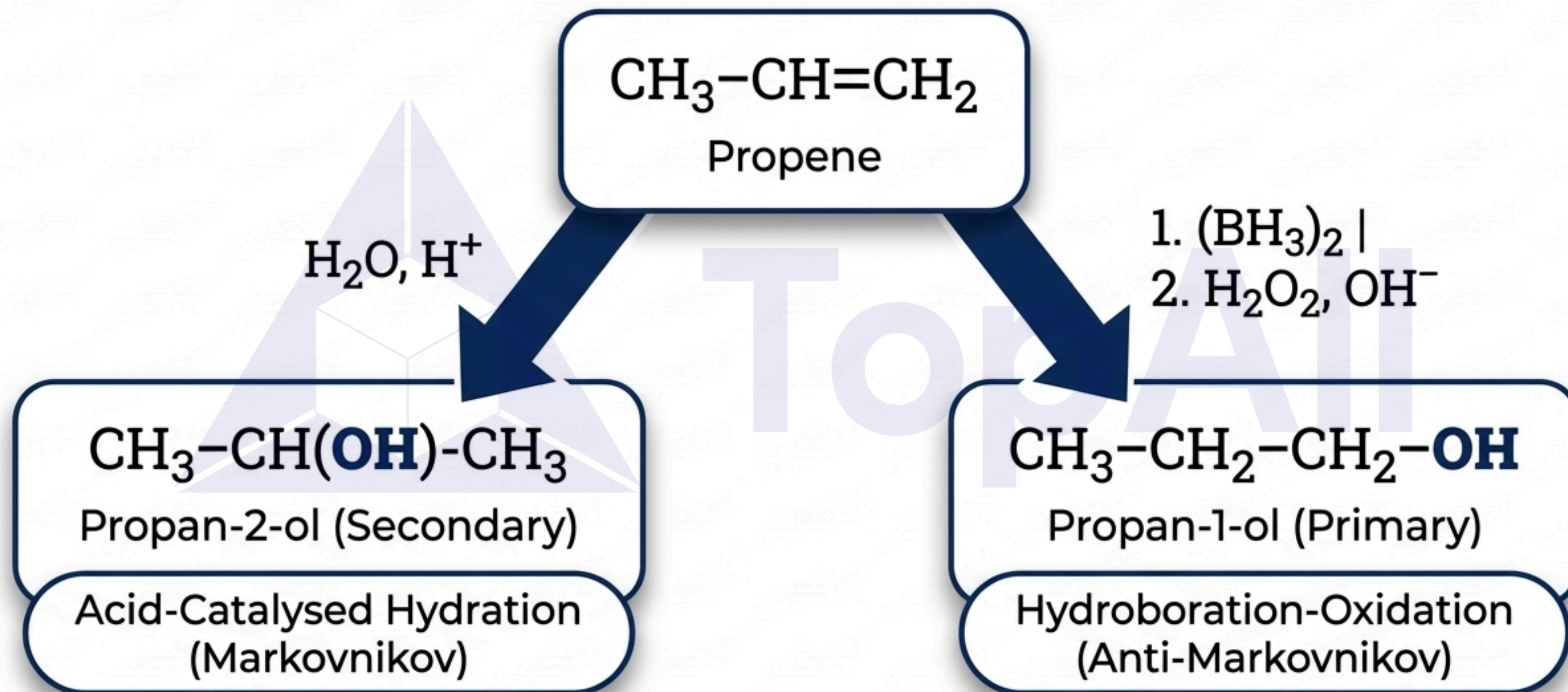
Hydroboration-Oxidation Spotlight

Diborane (BH_3)₂ reacts differently than water. The Boron atom physically targets the sp^2 carbon that carries the greater number of hydrogen atoms. This structural preference is the secret to its unique outcome.



Boron attaches here -> Alcohol forms here.

The Divergence: Reagent Dictates Regiochemistry



Same alkene. Opposite products. The reagent is the architect.

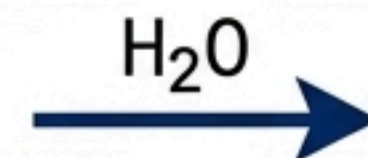
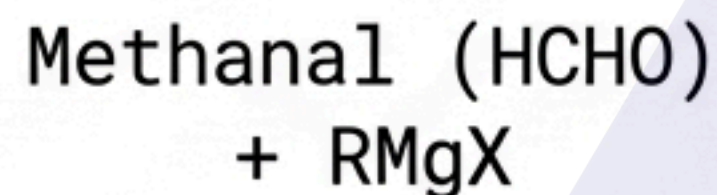
Mapping Matrix: Carbonyl Reductions

[Input Carbonyl]	[Reagent / Catalyst]	[Alcohol Output Degree]
Aldehyde (RCHO)	H_2/Pd or NaBH_4 or LiAlH_4	1° Alcohol
Ketone (RCOR')	H_2/Pd or NaBH_4 or LiAlH_4	2° Alcohol
Carboxylic Acid (RCOOH)	LiAlH_4 ONLY	1° Alcohol

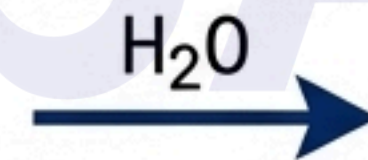
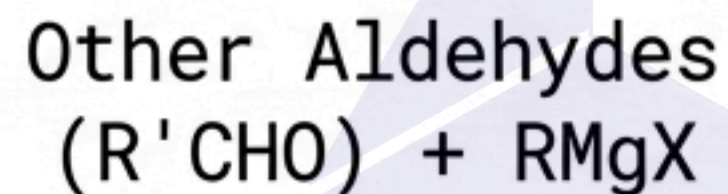
***LiAlH_4** is expensive and strictly required to reduce stubborn carboxylic acids directly to primary alcohols.*

Grignard Reagent Architectures

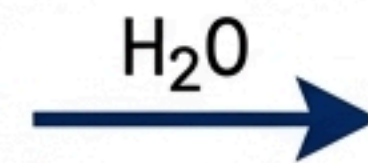
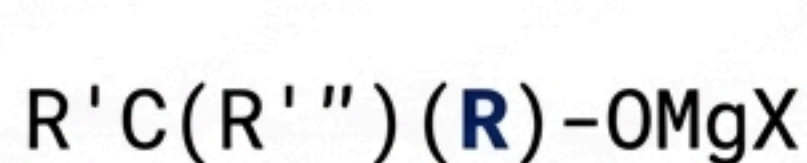
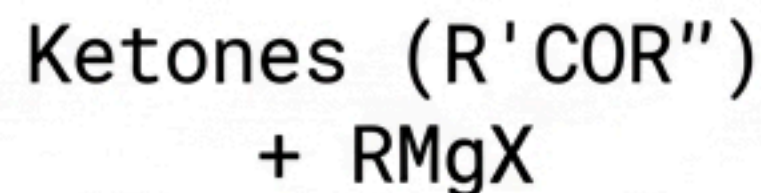
Grignard Reagents (RMgX) add new carbon chains to carbonyls, pushing the alcohol degree higher based on the starting material.



**Primary (1°)
Alcohol**



**Secondary (2°)
Alcohol**



**Tertiary (3°)
Alcohol**

JEE Trap Alert

Watch for this pattern: The Anti-Markovnikov Trap

Examiners will frequently ask for the synthesis of a primary alcohol from a terminal alkene (e.g., Propene $\rightarrow$ Propan-1-ol).

Direct Hydration ($\text{H}_2\text{O}/\text{H}^+$)

Fails for this goal. It will ALWAYS yield the secondary alcohol (Propan-2-ol) due to Markovnikov's rule.

Propene $\rightarrow$ Propan-2-ol ❌

Hydroboration-Oxidation

This is the ONLY direct hydration equivalent that reverses the rule to yield the primary (anti-Markovnikov) alcohol.

Propene $\rightarrow$ Propan-1-ol ✅

Summary & Key Principles

Key Takeaways: Alcohol Synthesis

- ✓ **Reagent selection dictates regiochemistry.** For alkenes, acid-catalysed hydration builds Markovnikov alcohols, while hydroboration-oxidation specifically builds anti-Markovnikov alcohols.
- ✓ **Input selection dictates alcohol degree.** When reducing or reacting with Grignard reagents, the starting carbonyl (methanal vs. aldehyde vs. ketone) strictly determines whether you get a 1°, 2°, or 3° alcohol.



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