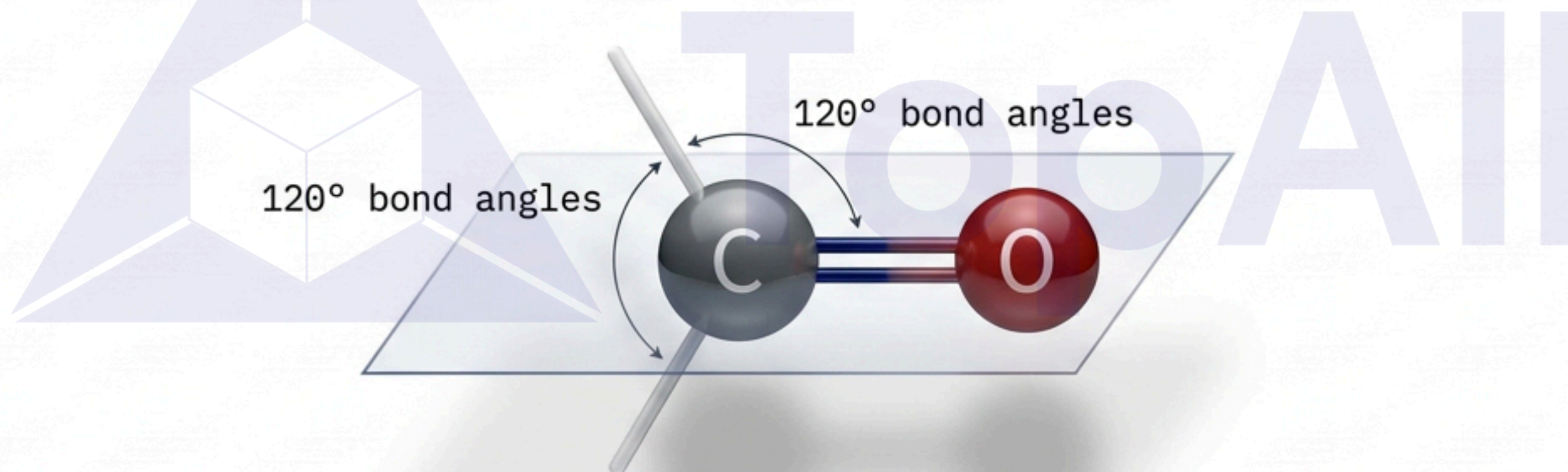


8.2.1 Preparation of Aldehydes and Ketones

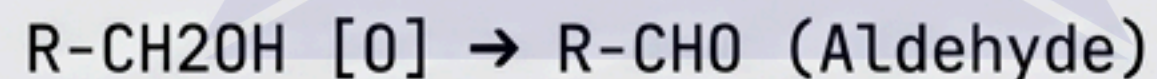
The definitive guide to synthesizing carbonyl compounds from alcohol and hydrocarbon precursors.



Oxidation of Alcohols

1° Alcohol

Requires controlled oxidation to prevent further conversion into carboxylic acids.



2° Alcohol

Ketones resist further oxidation, making this a highly efficient and stable synthetic route.



Exam-Smart Tip: Primary alcohols yield aldehydes;
Secondary alcohols yield ketones.

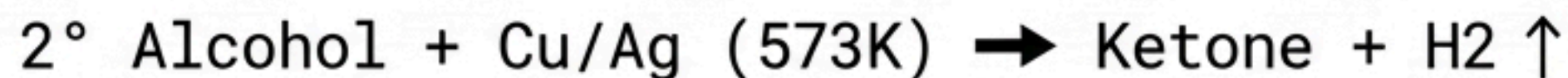
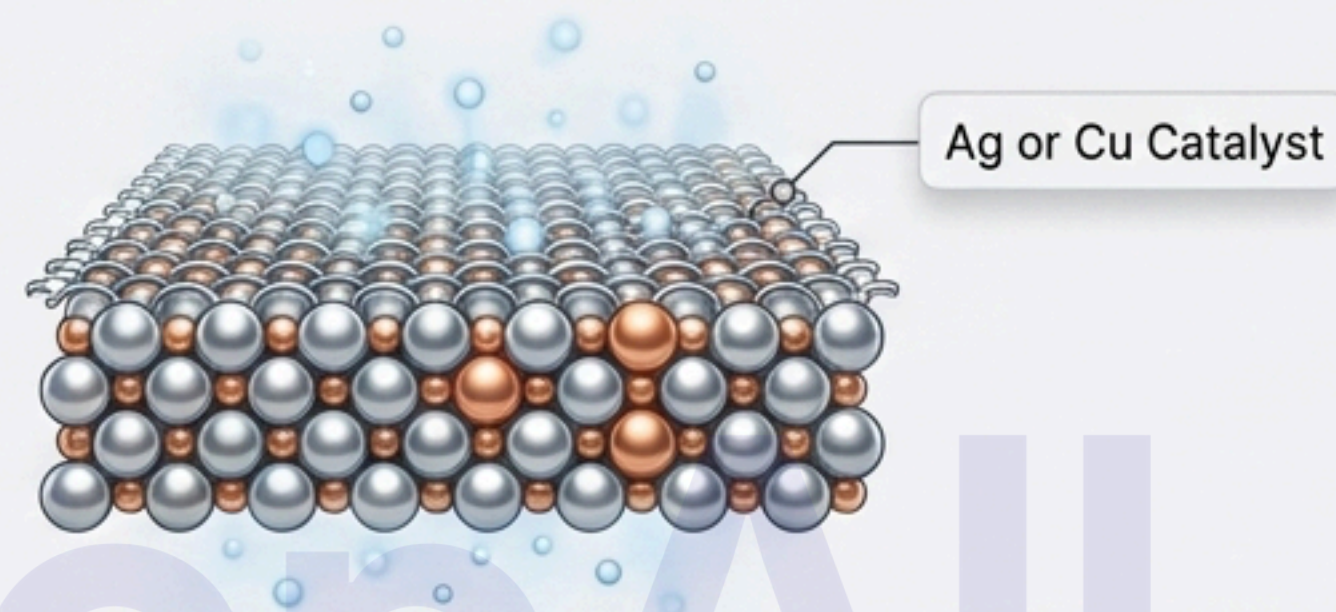
Catalytic Dehydrogenation of Alcohols

Application

Ideal for industrial-scale conversion of volatile alcohols.

Mechanism

Heat and metal catalysts drive the removal of hydrogen (H₂) gas, avoiding the need for chemical oxidants.



Key Takeaway: Dehydrogenation eliminates H₂ rather than adding O, perfectly mirroring the product outcomes of standard oxidation.



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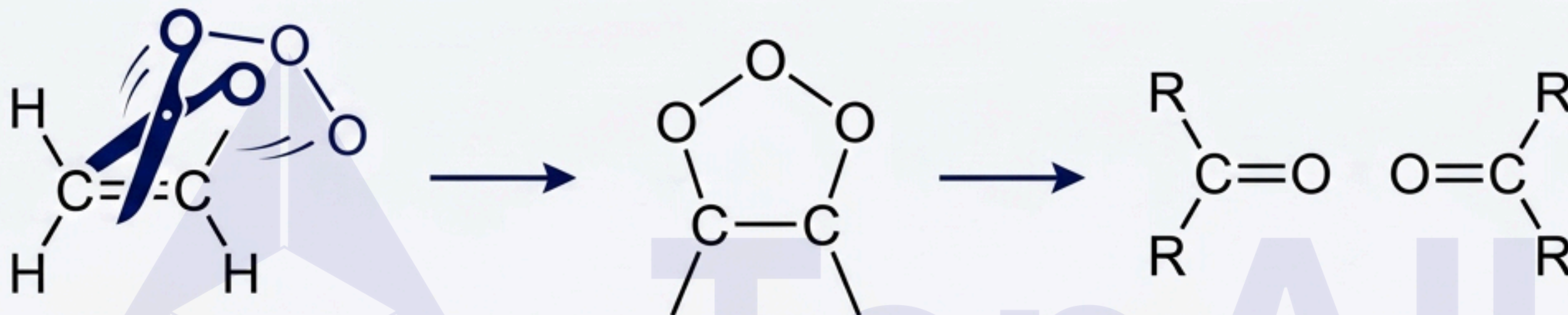
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Method 3 • Hydrocarbon Precursors

Ozonolysis of Alkenes



Step 1: Addition

Ozone (O_3) adds across the double bond to form an unstable ozonide intermediate.

Step 2: Cleavage

Reductive cleavage using Zinc dust and water ($\text{Zn}/\text{H}_2\text{O}$) splits the intermediate.

Alkene + 1) O_3 2) $\text{Zn}/\text{H}_2\text{O}$ $\rightarrow$ Aldehydes, Ketones, or Mixture

Exam-Smart Takeaway: Product Logic: The exact mixture of aldehyde/ketone products depends entirely on the substitution pattern of the starting alkene carbon atoms.

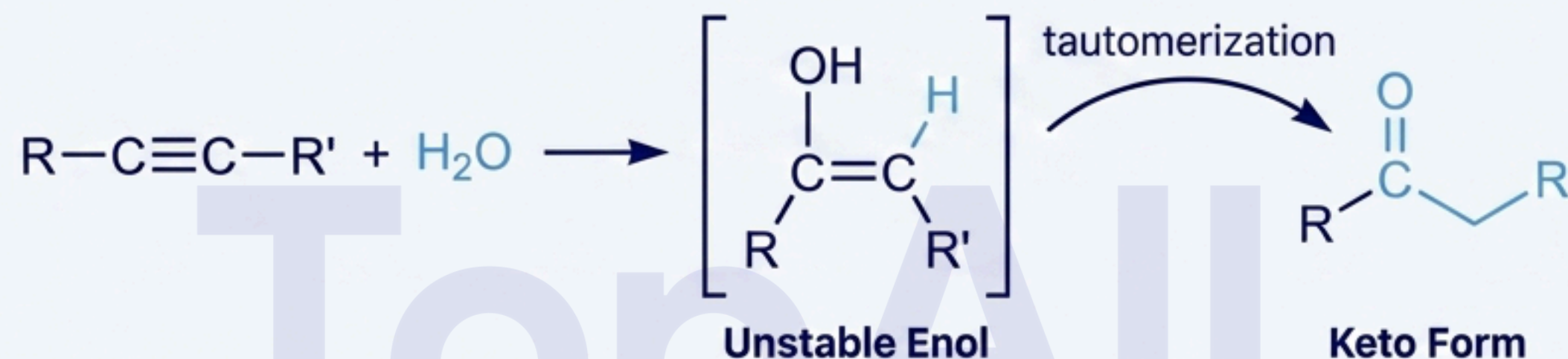
Hydration of Alkynes

Reagents

Requires specific heavy-metal catalysis:
Sulfuric acid (H_2SO_4) combined with
Mercuric sulfate (HgSO_4).

Mechanism

Follows Markovnikov addition, meaning
terminal alkynes inherently form internal
carbonyls (ketones).



Ethyne + H_2O (Hg^{2+} , H^+) $\longrightarrow$ Acetaldehyde (Aldehyde)

Other Alkynes + H_2O (Hg^{2+} , H^+) $\longrightarrow$ Ketones

Exam-Smart Takeaway

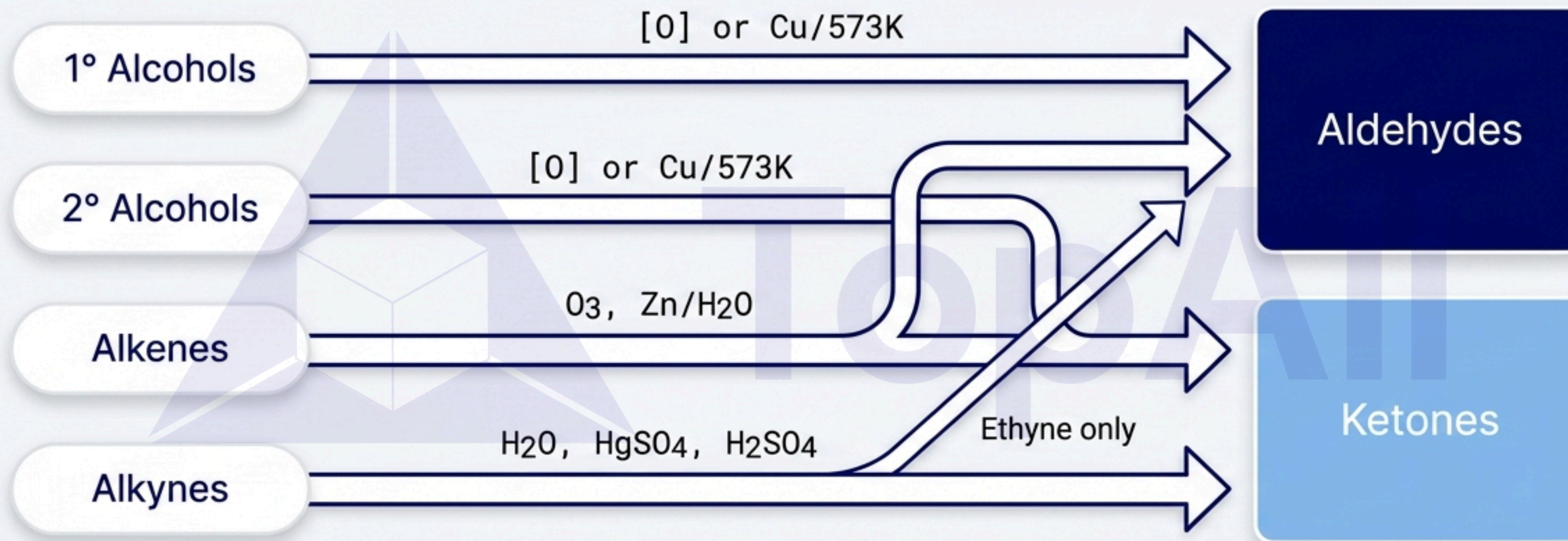
The Ethyne Exception: Ethyne is the ONLY alkyne that yields an aldehyde. All other alkynes exclusively yield ketones.

Predicting the Carbonyl Product

Precursor	Reaction Method	Yields Aldehyde?	Yields Ketone?
1° Alcohol	Oxidation or Dehydrogenation	Yes (Primary product)	No
2° Alcohol	Oxidation or Dehydrogenation	No	Yes (Primary product)
Ethyne	Hydration (Hg_2^+/H^+)	Yes (Acetaldehyde)	No
All Other Alkynes	Hydration (Hg_2^+/H^+)	No	Yes
Alkenes	Ozonolysis (O_3 , $\text{Zn}/\text{H}_2\text{O}$)	Yes (if unsubstituted C)	Yes (if substituted C)

Exam-Smart Tip: Use this matrix to reverse-engineer target molecules. Look at the target carbonyl and work backward to the allowed precursors.

The Carbonyl Synthesis Map



Exam-Smart Takeaway

Mastery Check: The carbon skeleton of your starting material determines the viable pathways; your chosen reagent dictates the final functional group.



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