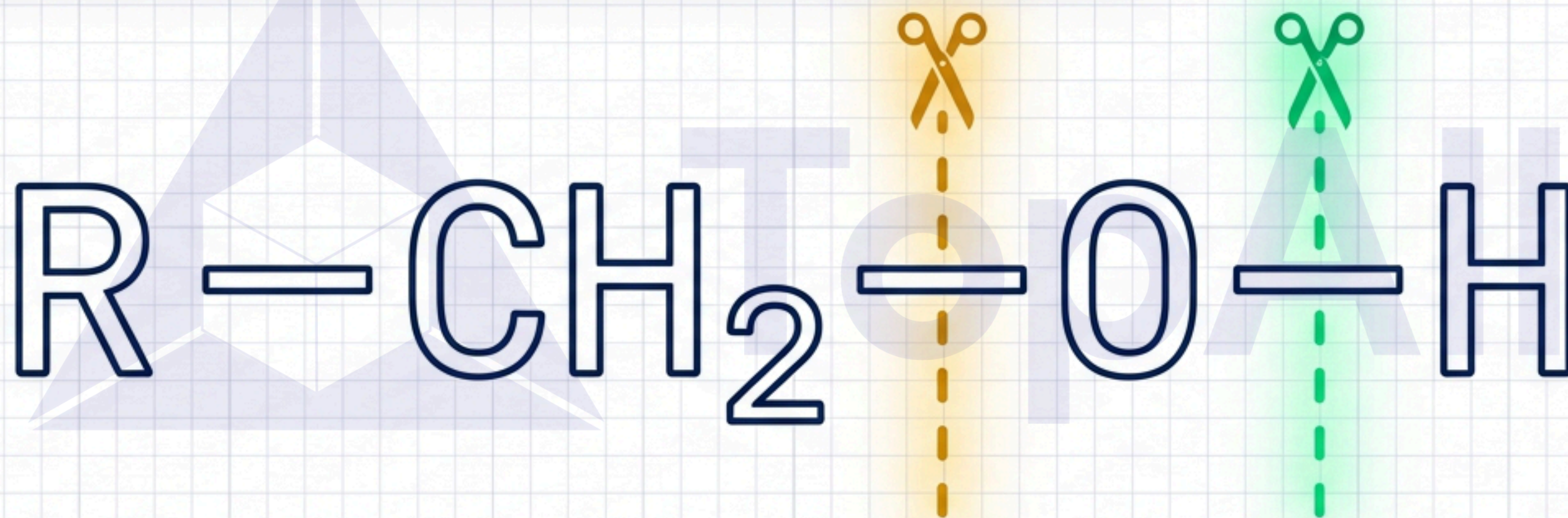


Break O-H or Break C-O?

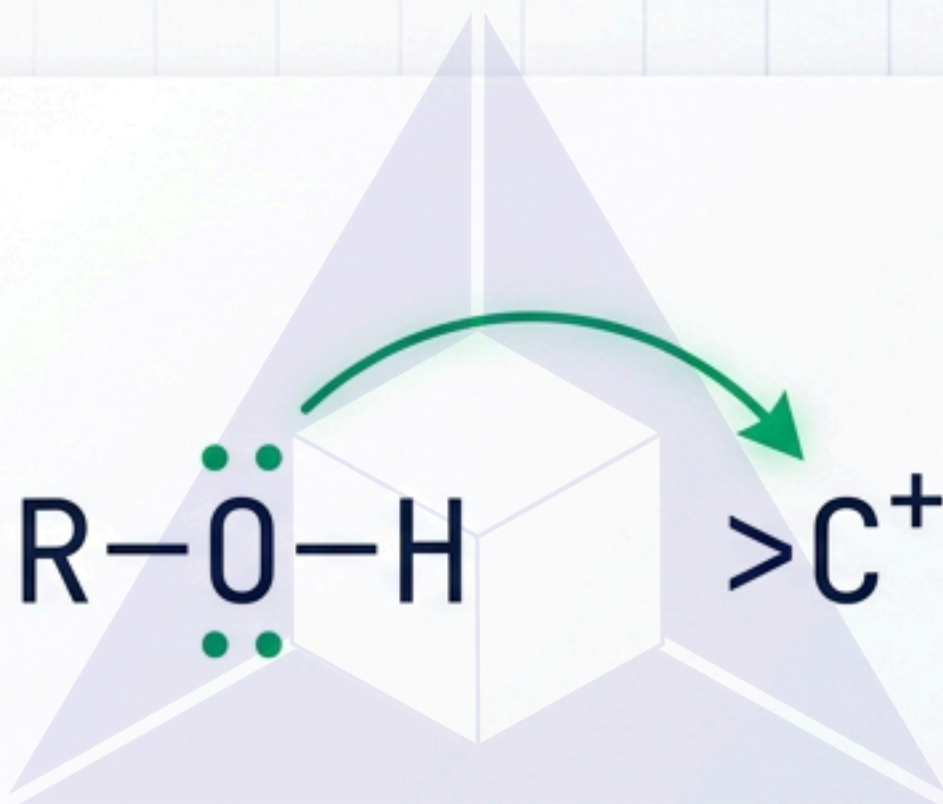
The Chemical Behaviour of Alcohols



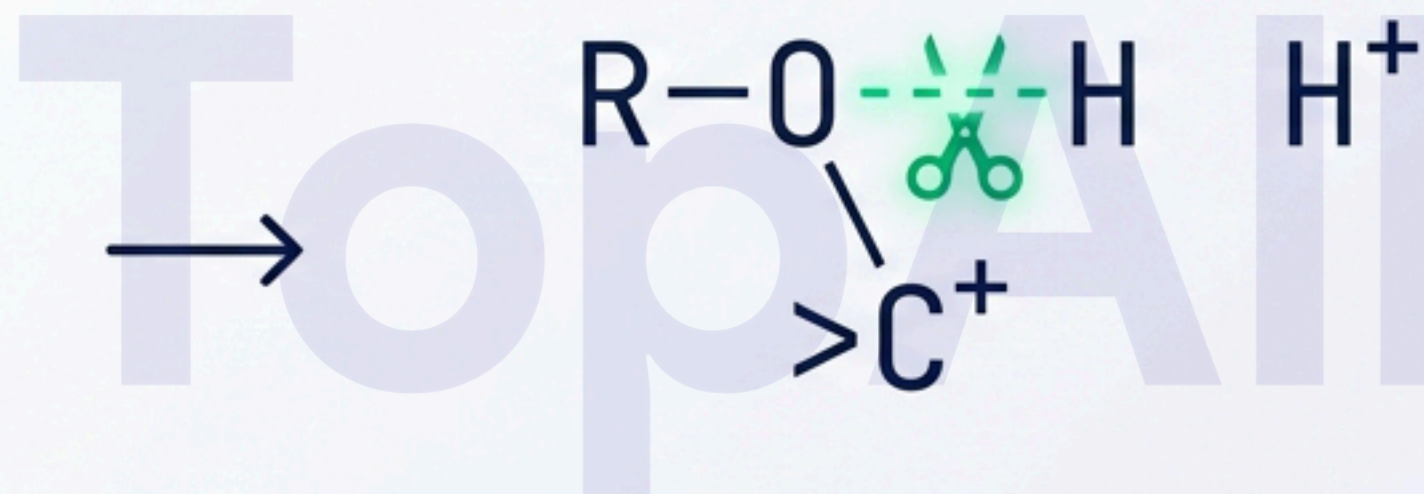
A structural guide to
molecular reactivity.

Alcohols as Nucleophiles

O-H Bond Breaks: When alcohols react as nucleophiles, the bond between O and H is cleaved.



Oxygen's unshared electron pairs make alcohols effective nucleophiles, seeking positive charge.



The resulting nucleophilic attack forces the cleavage of the O-H bond to stabilize the molecule.

Protonated Alcohols as Electrophiles

Protonation Required: The C–O bond is only broken when reacting as electrophiles in a protonated state.

Stable (Poor Leaving Group)

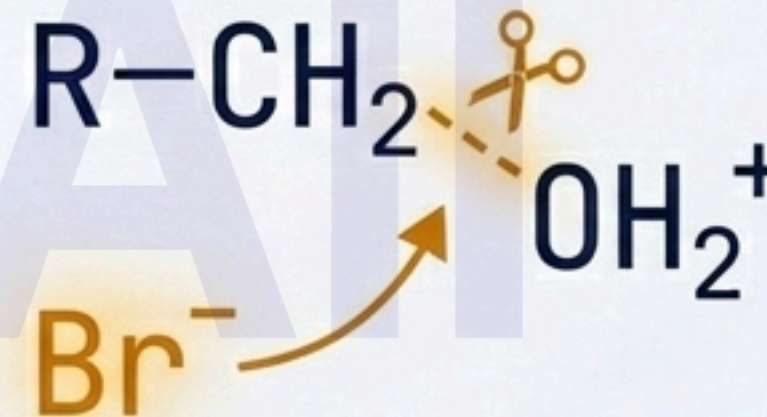


1. Un-protonated alcohols are poor electrophiles.

Acid Catalyst / Protonation



2. Addition of H^+ creates a good leaving group (H_2O).



3. The weak C–O bond is easily broken by a nucleophile.



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$$E=mc^2$$



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Key Highlights

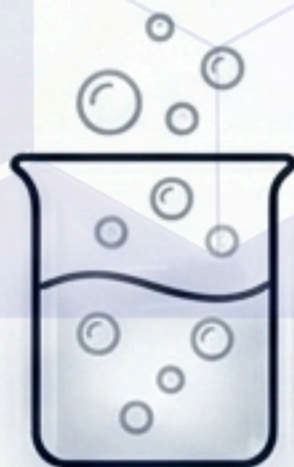
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O-H Bond Cleavage Reactions

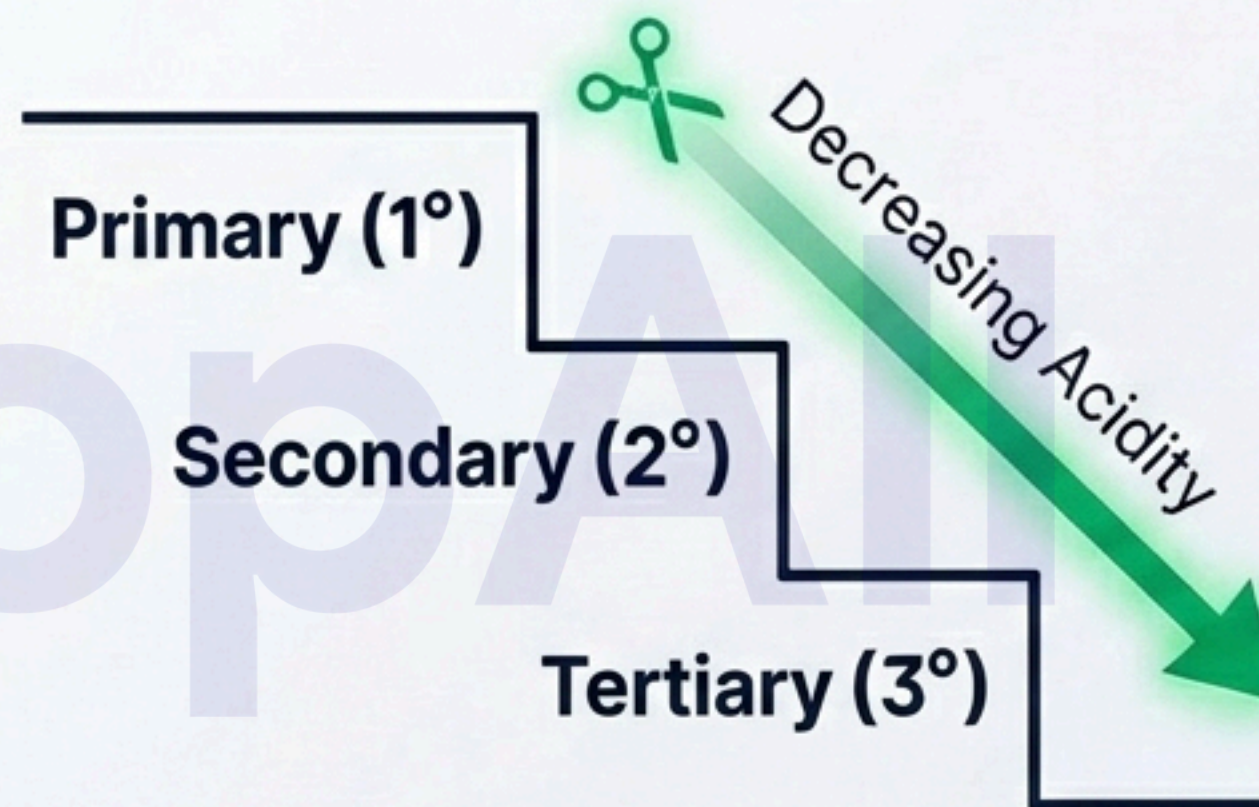
Reaction

Brønsted Acids: Alcohols donate a proton to stronger bases.



Reaction with active metals (Na, K, Al) yields alkoxides and hydrogen gas.

Acidity Trend

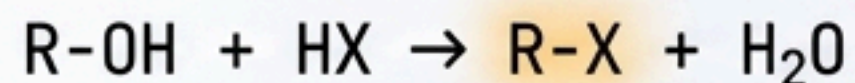


Electron-releasing alkyl groups decrease O-H polarity. Primary alcohols are the most acidic; tertiary are the least.

C-O Bond Cleavage Reactions

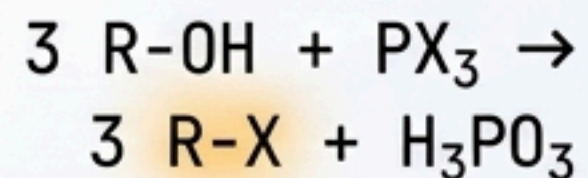
Reactivity Order: $3^\circ > 2^\circ > 1^\circ$
(Tertiary carbocations form easiest).

Hydrogen Halides



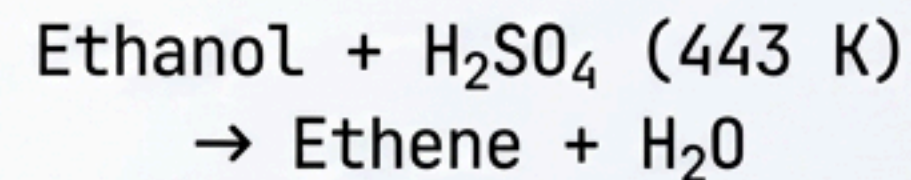
Distinguishes 1° , 2° , 3° alcohols based on turbidity speed (Lucas Test).

Phosphorus Trihalides



Direct conversion of the alcohol to an alkyl bromide.

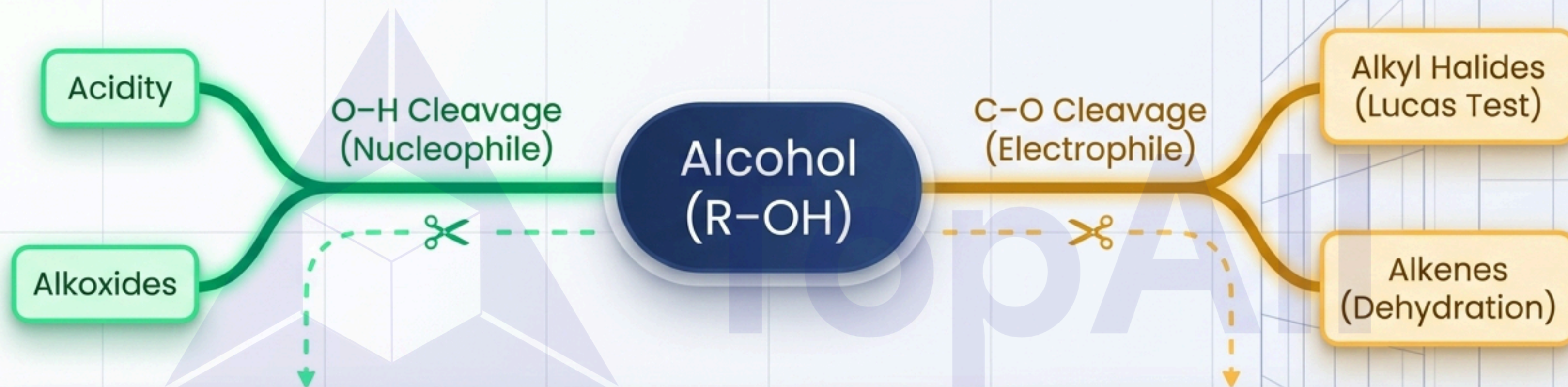
Dehydration



Requires a protic acid catalyst. Removes water to form alkenes.

Reaction Map Summary

The dual nature of alcohols defined by bond cleavage.



Reactivity Inversion Matrix

$1^\circ > 2^\circ > 3^\circ$ (Acidity)

$3^\circ > 2^\circ > 1^\circ$ (Dehydration/Halides)

The elegant symmetry of alcohol chemistry: structural factors that hinder O-H cleavage actively promote C-O cleavage.



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