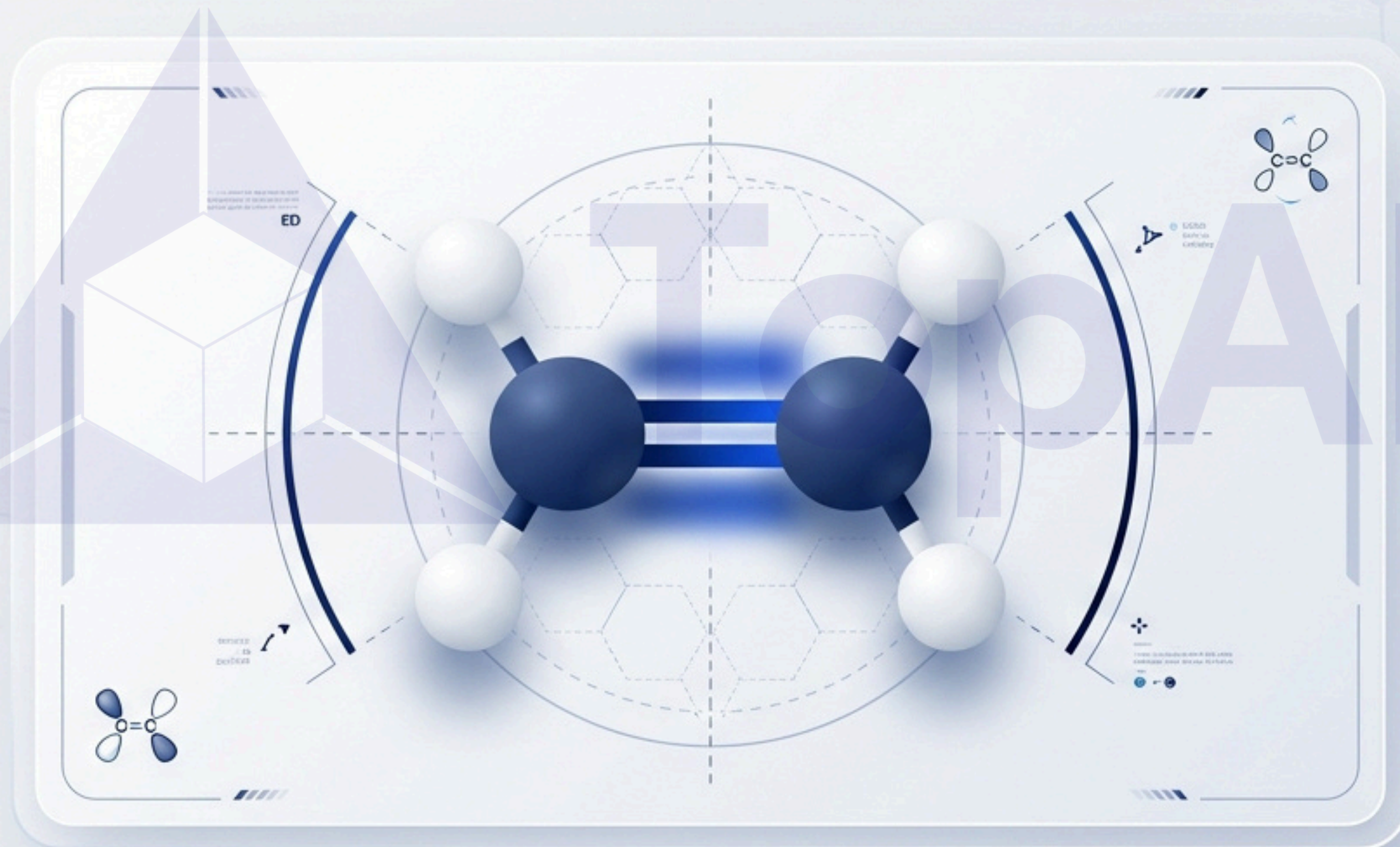


Properties Of Alkenes

The Carbon-Carbon Double Bond as a Reactive Hub



BASELINE CHARACTERISTICS

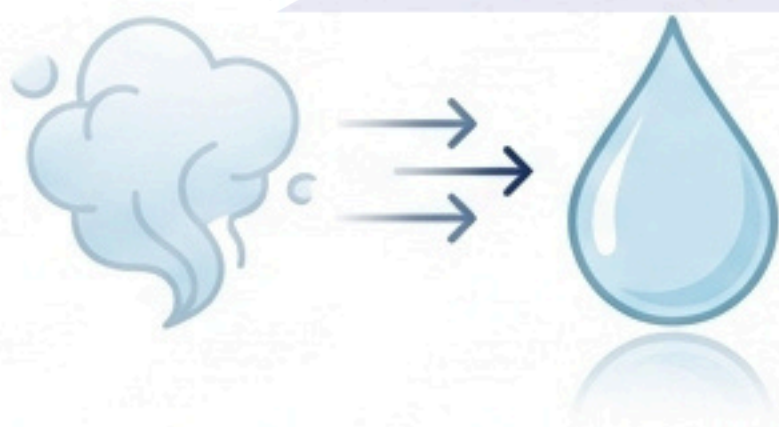
Physical Properties Of Alkenes

Physical State

C1–C3 are gases (e.g., Ethene has a faint sweet smell).

C4–C17 are liquids.

C18+ are solids.



The Hydrophobic Nature

Weak van der Waals forces.

Immiscible in water, but readily soluble in non-polar solvents (benzene, petroleum ether).



Thermal Properties

Boiling point increases by 20–30 K with every added $-\text{CH}_2$ group.

Straight-chain isomers boil at higher temperatures than branched counterparts.

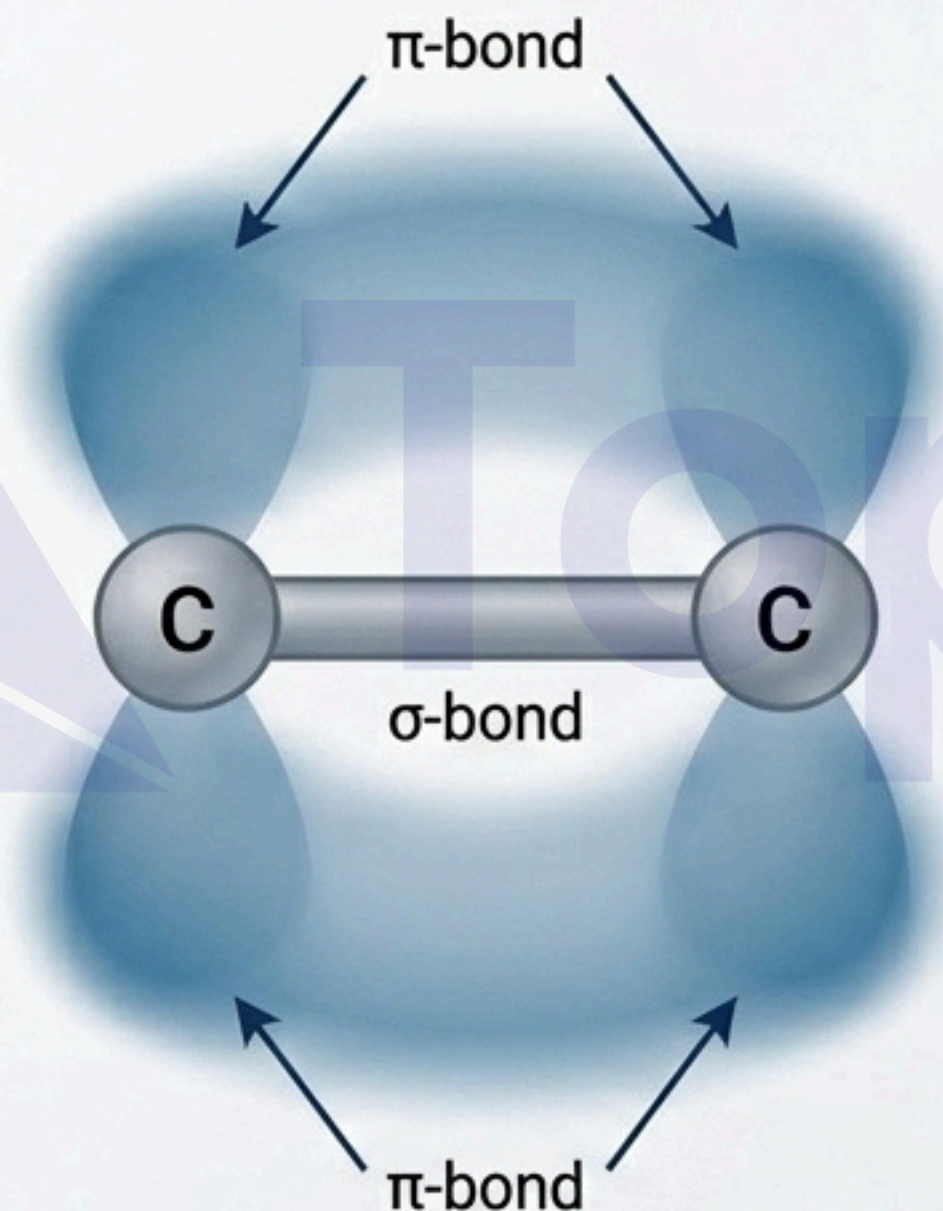


Electrophilic Addition Overview

Bond Anatomy

The double bond combines one strong σ -bond (397 kJ/mol) with one weak π -bond (284 kJ/mol).

Total enthalpy: 681 kJ/mol.



The Bait

The weak π -bond acts as a source of loosely held, mobile electrons.

Alkenes are highly susceptible to attack by Electrophiles (electron-seeking reagents).

The exposed π -bond breaks to form stable single bonds.

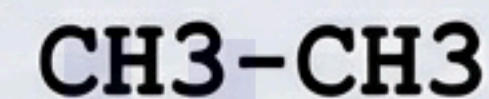
Addition Of Hydrogen (Hydrogenation)



[Pt]

[Pd]

[Ni]



Concept Card

Di-hydrogen adds across the double bond to yield an alkane.

Exam Recap Panel

Platinum (Pt) and Palladium (Pd) catalyze at room temperature. Nickel (Ni) requires higher temperature and pressure.

Real-world application: Industrial hardening of oils.



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ADDITION REACTION 02 & 03

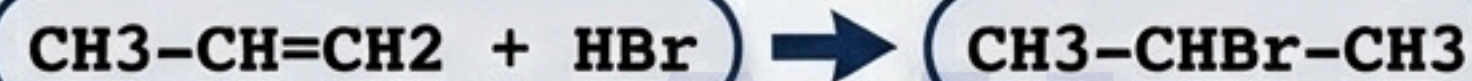
Addition Of Halogens & Hydrogen Halides

Halogens - X₂



Bromine Water Test: Confirms Unsaturation.

Hydrogen Halides - HX



Markovnikov's Rule: The negative part (Br-) attaches to the carbon with fewer hydrogen atoms. Driven by the stability of the secondary carbocation.

Reactivity order: HI > HBr > HCl.

The Kharash / Peroxide Effect: In the presence of organic peroxides, HBr (and ONLY HBr) adds Anti-Markovnikov via a free radical chain mechanism to form 1-Bromopropane.

Addition Of Water (Hydration)

Step 1: Acid Addition



Alkene reacts with cold, concentrated H_2SO_4 . The electrophilic addition strictly follows Markovnikov's rule.



Step 2: Hydrolysis



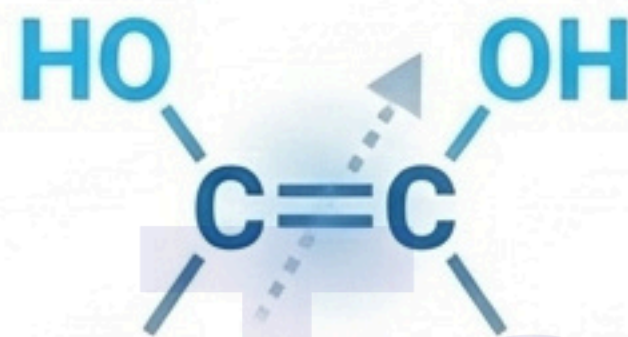
Warming the intermediate with water yields an alcohol (e.g., Propan-2-ol) and regenerates the acid.

Key Takeaway Panel: The net result is the addition of H-OH across the double bond. The OH-group invariably attaches to the more substituted carbon.

Oxidation & Ozonolysis

Mild Oxidation

[Cold dil. KMnO_4]
(Baeyer's Reagent)

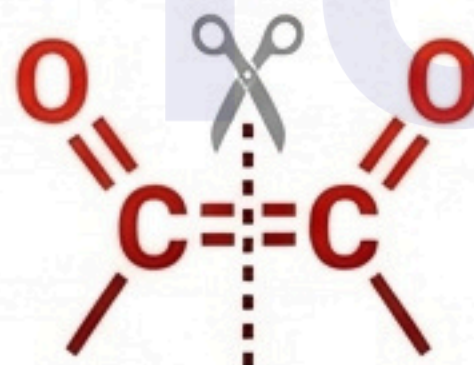


Forms Vicinal Glycols.

Diagnostic use: Decolorizes KMnO_4 to test for unsaturation.

Cleavage / Ozonolysis

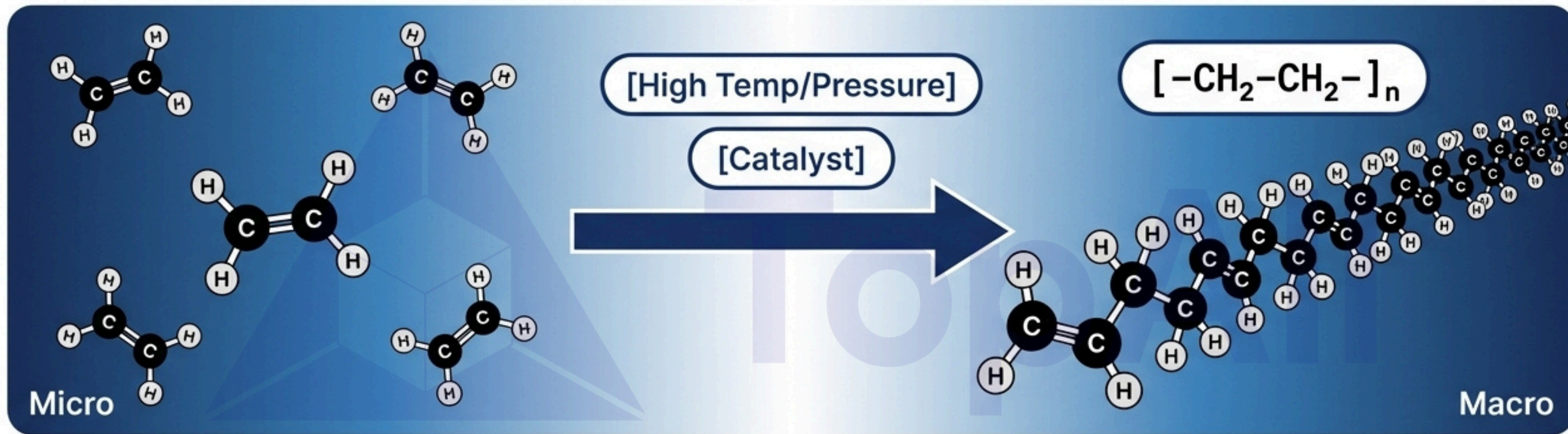
[1. O_3 2. $\text{Zn}/\text{H}_2\text{O}$]



Forms Aldehydes or Ketones.

Key Takeaway Panel: Ozonolysis is the ultimate “double-bond locator”. The products reverse-engineer exactly where the double bond originally was.

Linear Polymerisation



Examples Panel

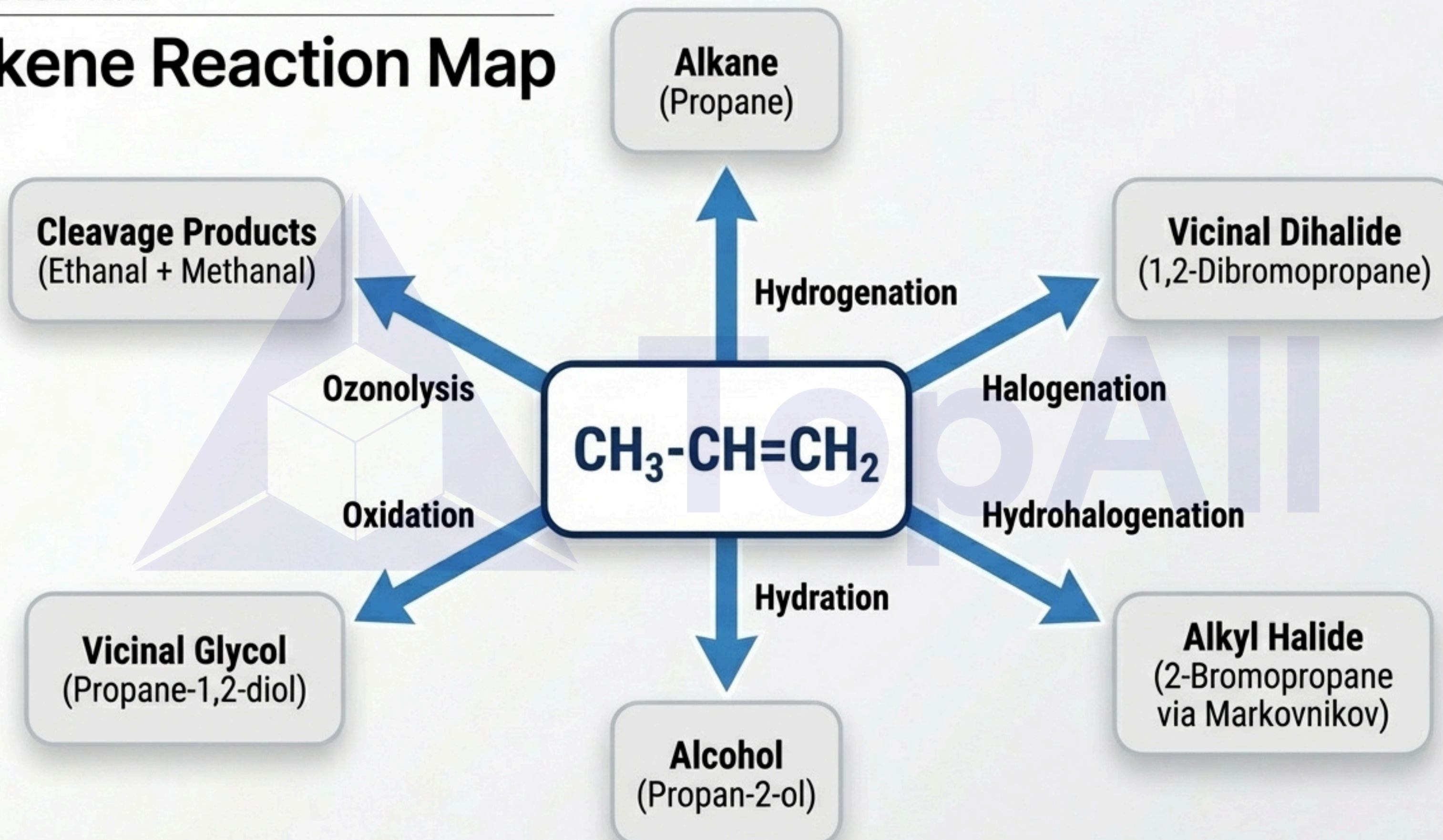
Ethene → Polythene

Plastic bags, squeeze bottles.

Propene → Polypropene

Milk crates, moulded plastics.

Alkene Reaction Map





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