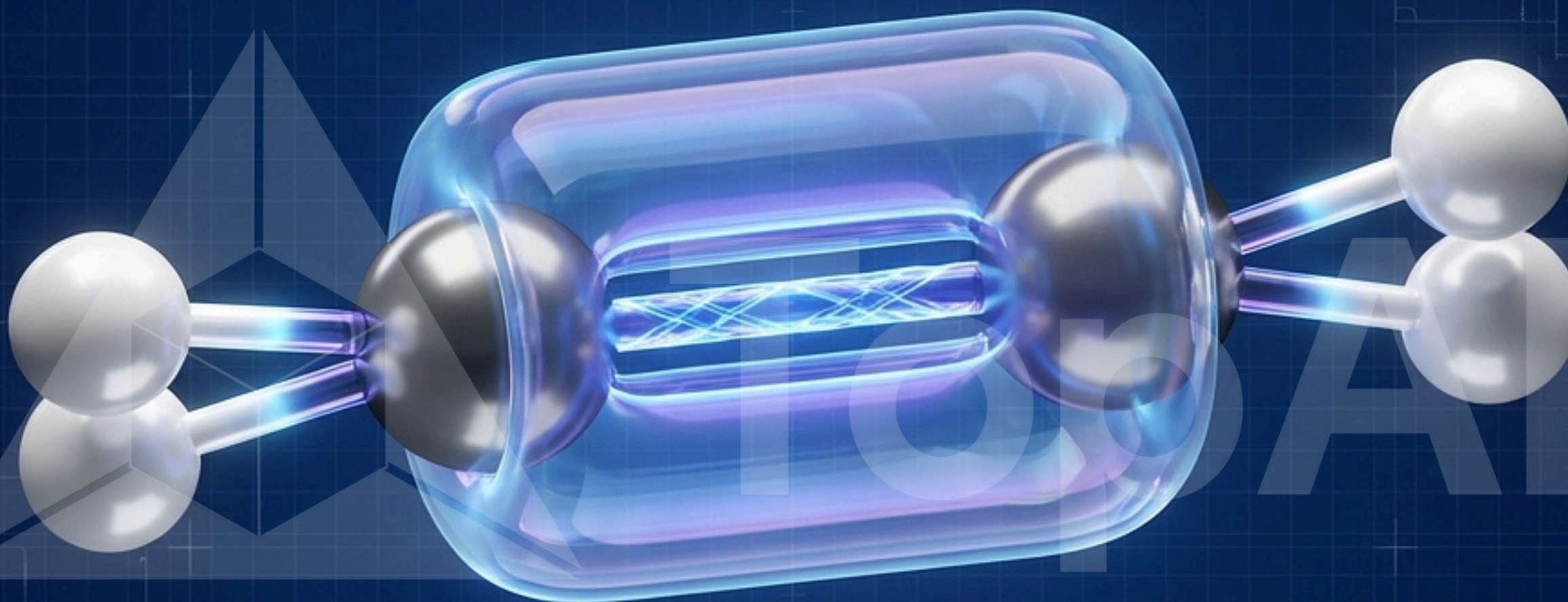


Chapter 9.4.3 • Hydrocarbons

Properties Of Alkynes



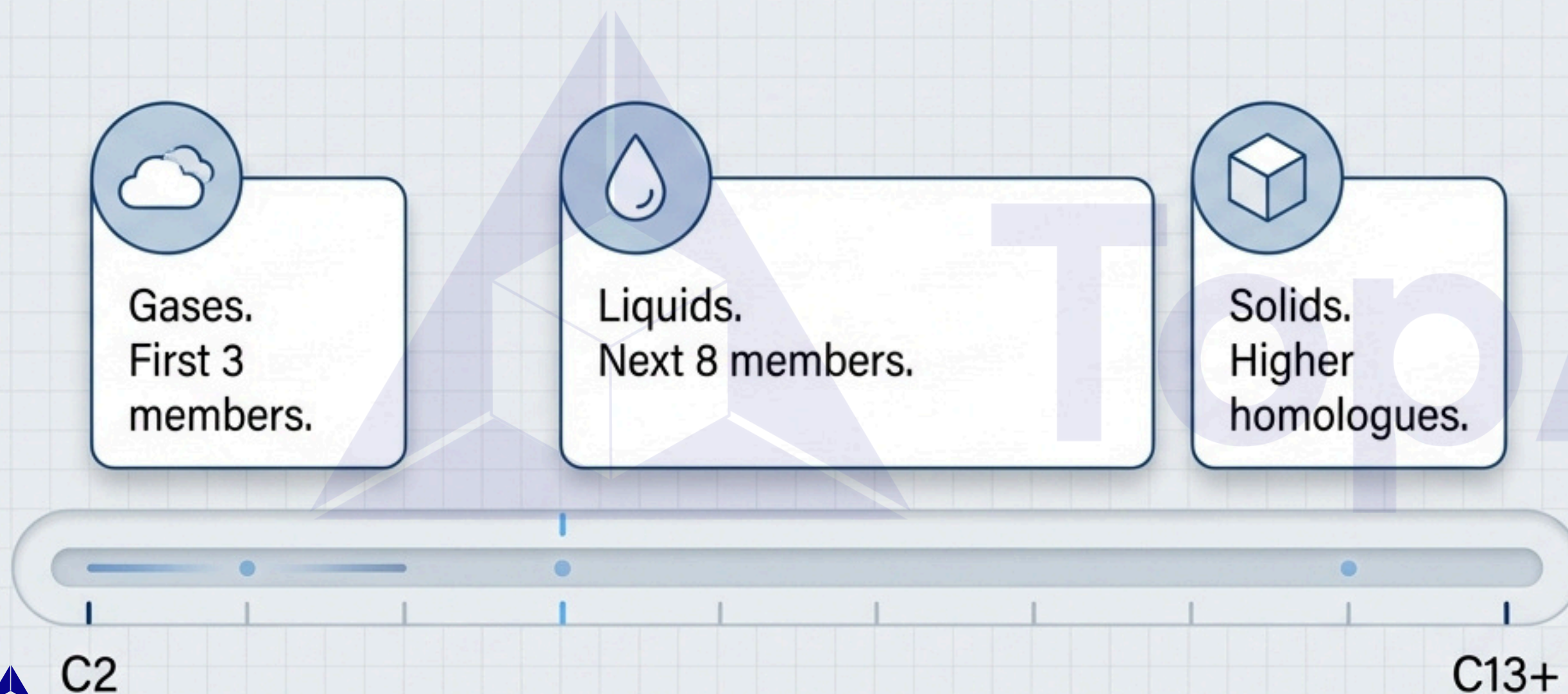
[Physical Profile]

[Addition Reactions]

[Acidic Character]

Physical Behavior

The Physical Profile Of Alkynes

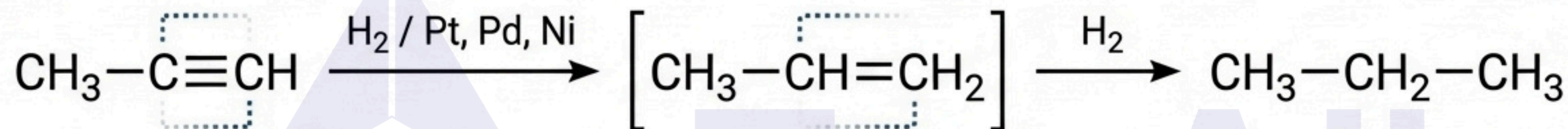


Nature & Solubility

- Colourless and weakly polar.
- Lighter than water and immiscible.
- Soluble in organic solvents (ethers, carbon tetrachloride, benzene).
- Note: Ethyne uniquely possesses a characteristic odour.

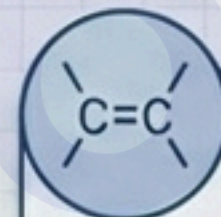
Electrophilic Addition

Sequential Hydrogenation



Alkyne → Alkene

First equivalent of H₂ breaks one π bond.



Alkene → Alkane

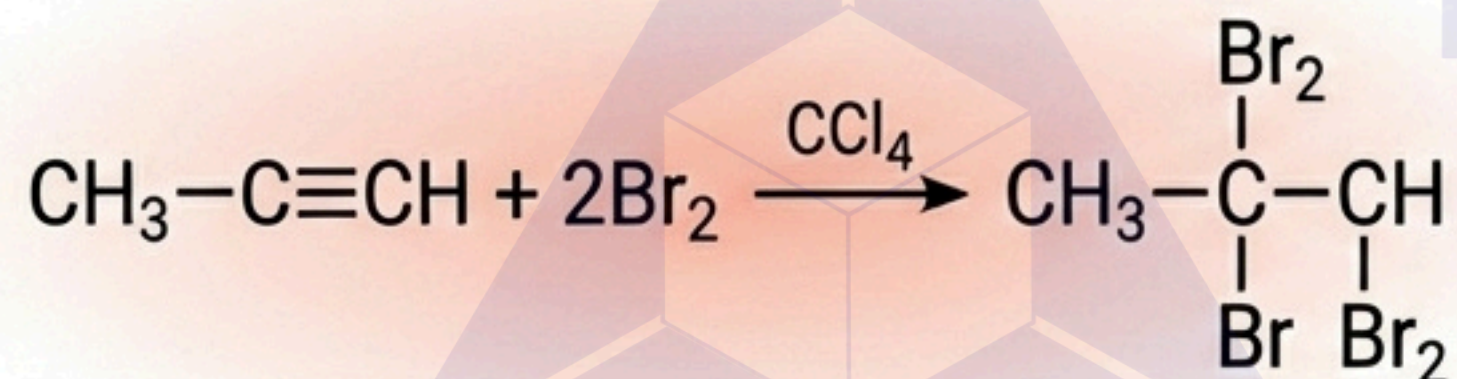
Second equivalent of H₂ breaks the final π bond to form a fully saturated alkane.

Exam Recap: Controlled partial reduction (stopping at alkene) requires poisoned catalysts like Lindlar's catalyst; otherwise, standard transition metals (Pt/Pd/Ni) drive the reaction completely to alkanes.

Electrophilic Addition

Halogenation & HX Addition

Halogen Addition

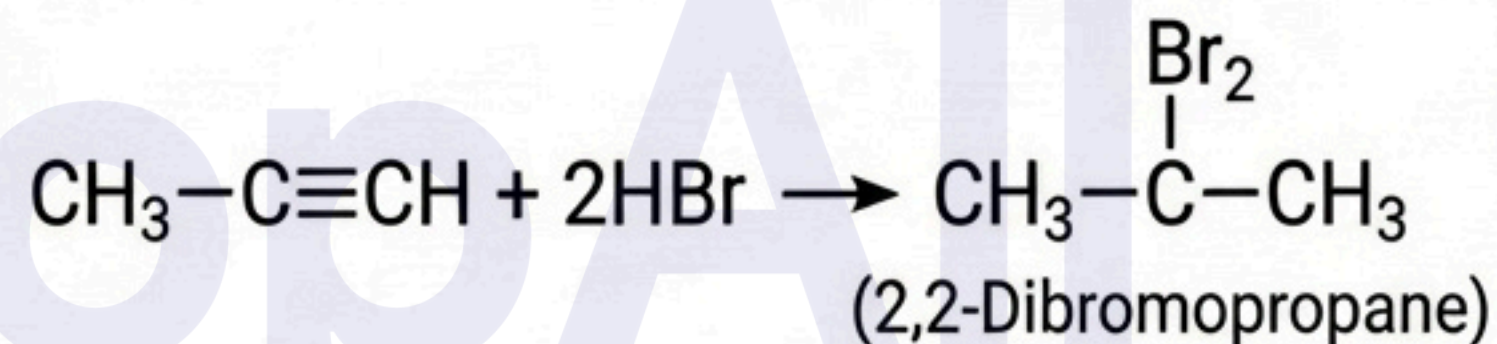


Reddish-orange Br_2 in CCl_4 is decolourised.
Forms tetra-halogenated products.

HX Addition



Markovnikov's Rule



Forms gem-dihalides. The negative part of the addendum goes to the carbon with fewer hydrogens.

Exam Recap: Bromine water test acts as a primary diagnostic for unsaturation.
HX addition rigidly follows Markovnikov's rule.



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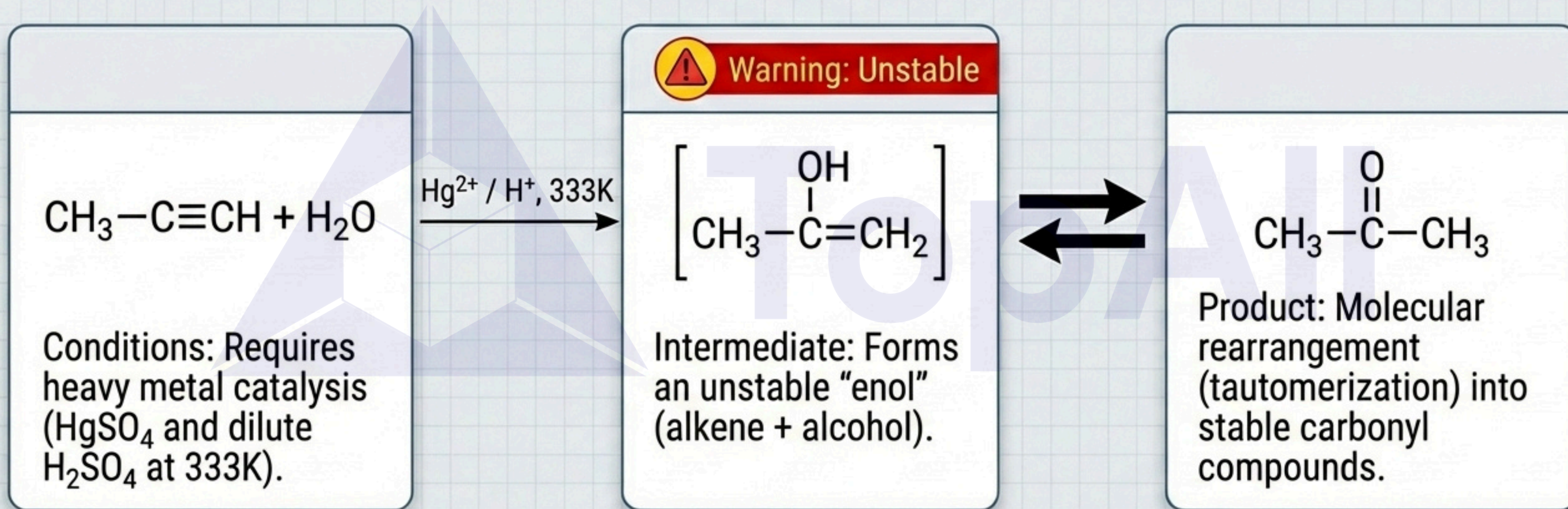
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Addition of Water

Hydration And Tautomerization



Exam Recap: Except for ethyne (which uniquely forms ethanal), all terminal and internal alkynes yield ketones upon hydration.

Acid-Base Chemistry

The sp Carbon And Acidity

Ethane (sp^3)	Ethene (sp^2)	Ethyne (sp)
• 25% s-character • Low electronegativity • Non-acidic	• 33% s-character • Moderate electronegativity • Non-acidic	• 50% s-character • Highest electronegativity • Acidic protons

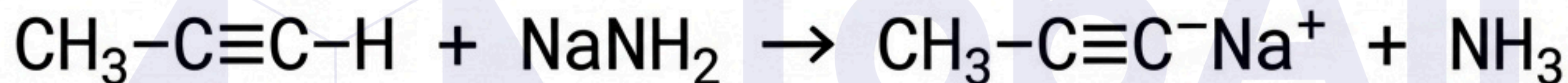
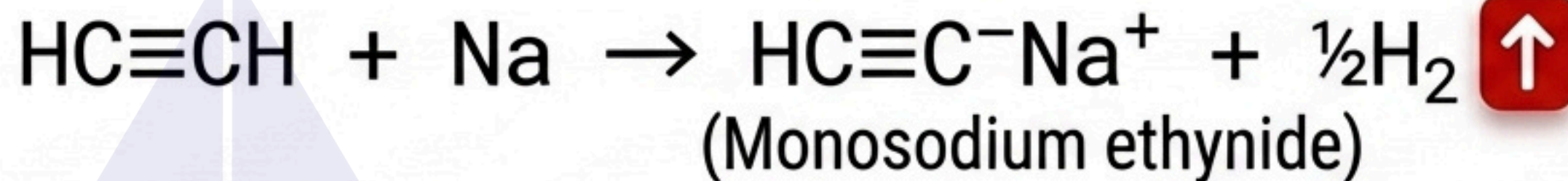
Key Takeaways

The maximum s-character (50%) in sp hybridized carbon strongly attracts the shared C-H electron pair, allowing the H atom to be liberated easily as a proton (H^+).

Exam Recap: Acidic strength trend: $HC\equiv CH > H_2C=CH_2 > CH_3-CH_3$.

Acid-Base Chemistry

Proving Acidity: Acetylide Formation



The Reagents

Alkynes react with strong bases like Sodium metal (Na) or Sodamide (NaNH_2).

The Proof

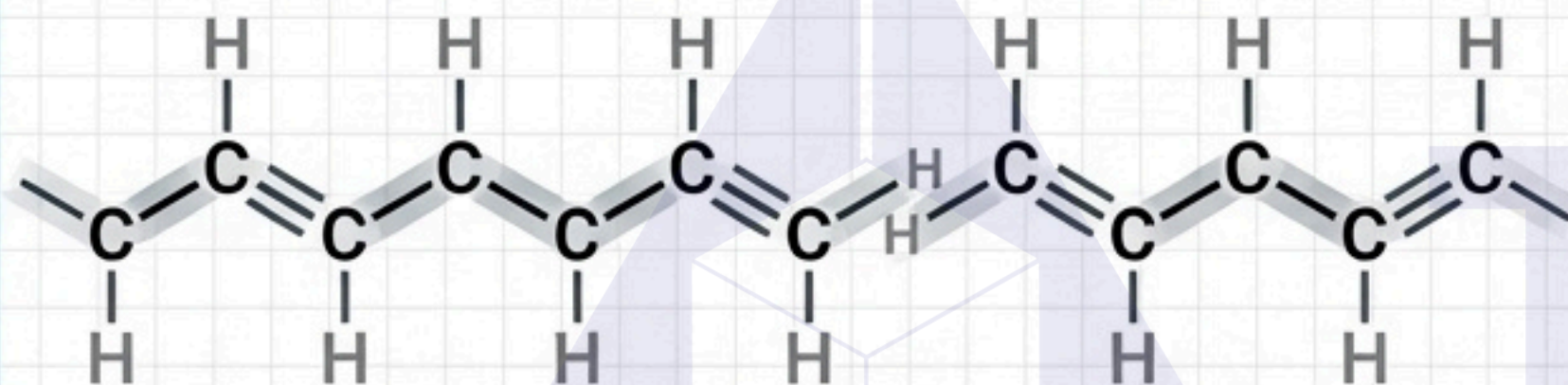
Liberation of hydrogen gas confirms the acidic nature of the terminal hydrogen.

Exam Recap: These reactions are NOT shown by alkanes or alkenes, making them the standard chemical test to distinguish terminal alkynes.

Structural Assembly

Linear Vs. Cyclic Polymerisation

Linear Polymerisation

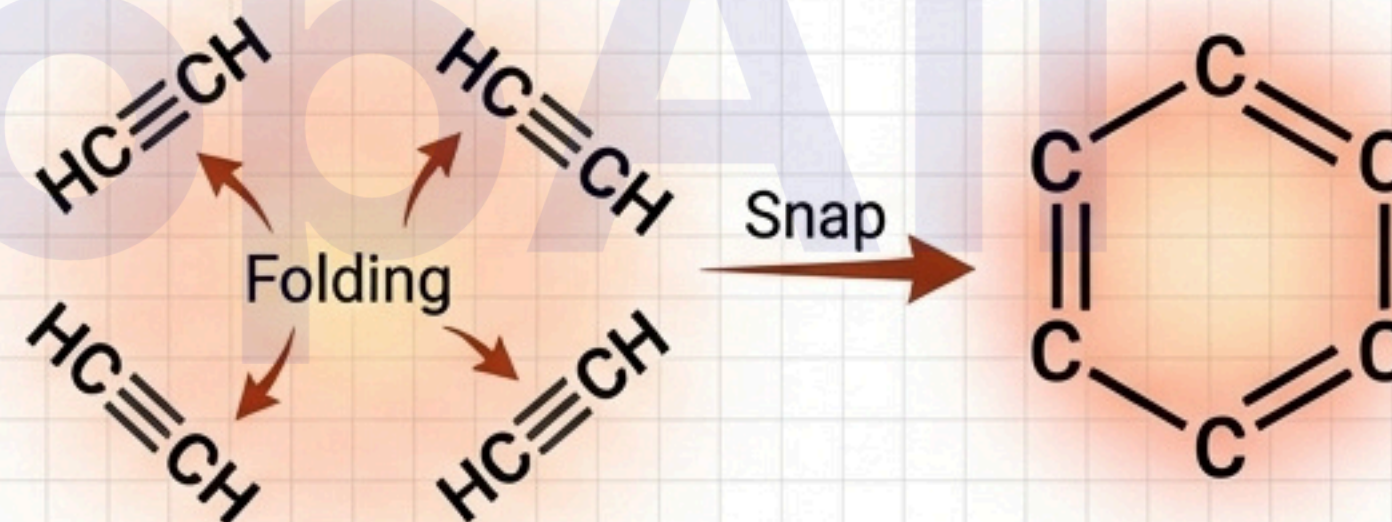
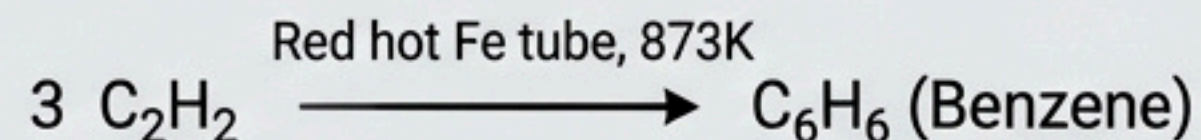


Ethyne polymerizes into polyacetylene.
Contains repeating $(\text{CH}=\text{CH}-\text{CH}=\text{CH})_n$ units.

Application Badge

Conductive Materials — Used as thin-film electrodes in batteries.

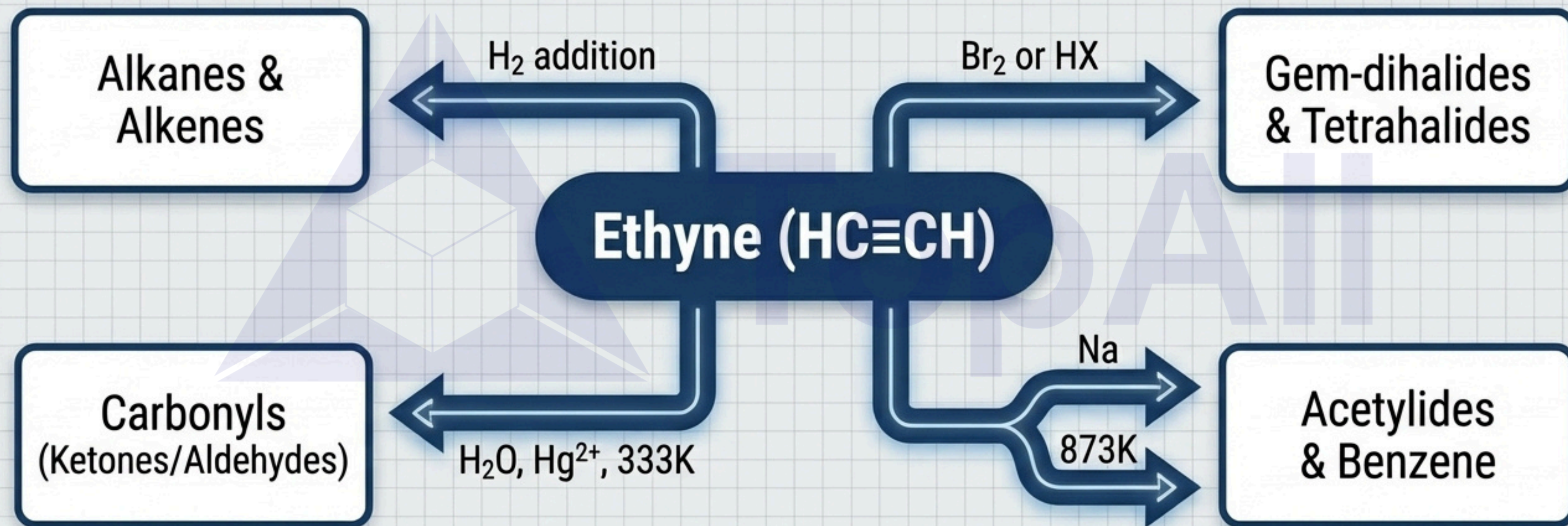
Cyclic Polymerisation



Trimerization occurs when passed through an iron tube at extreme heat.

Chapter Synthesis

Triple Bond Behavior Map



Exam Recap: The alkyne's reactivity is entirely defined by two features: its highly exposed pi-electrons (driving electrophilic addition) and its highly electronegative sp-carbon (driving acidity).



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