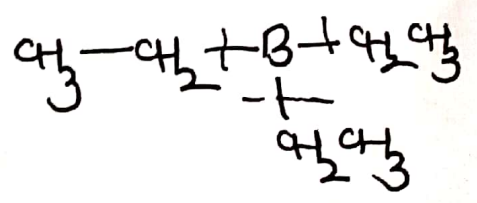
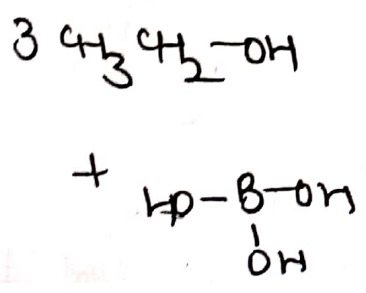
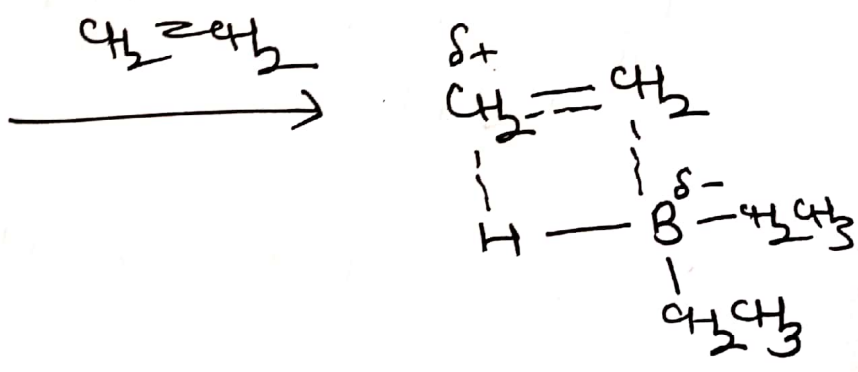
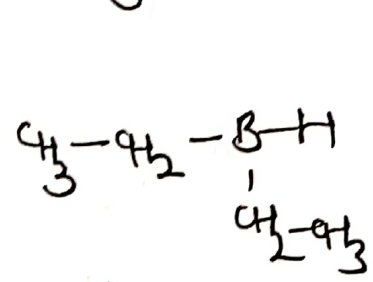
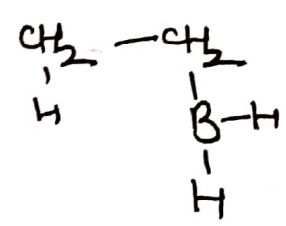
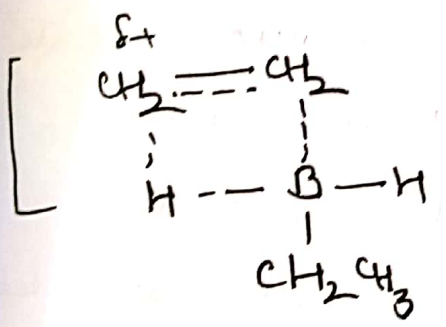
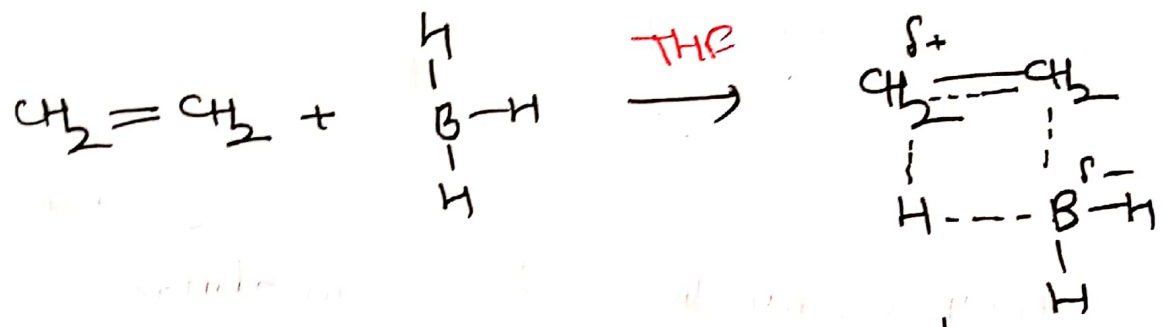


VII

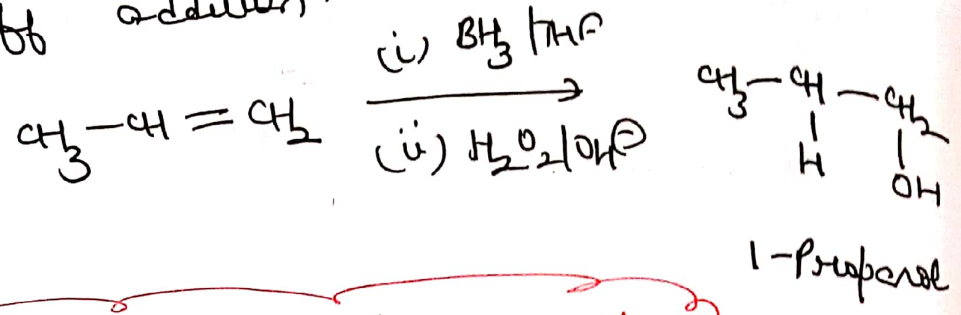
# Hydroboration-oxidation reaction of alkenes

Alkenes when treated with borane undergo hydroboration to form alkyl boranes. The alkyl boranes are then oxidized by  $H_2O_2 / NaOH$  to form alcohols.



# Orientation of hydroboration

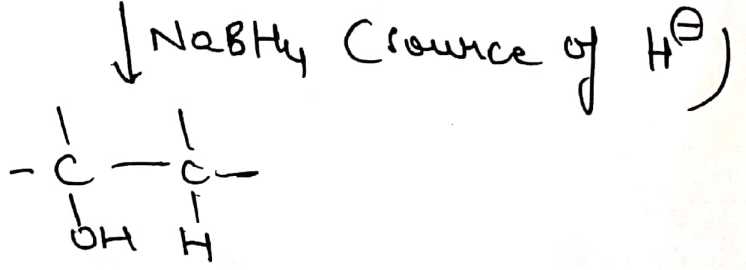
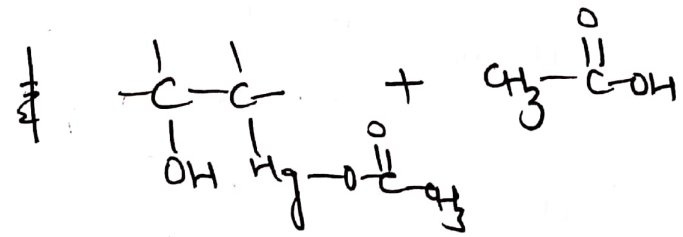
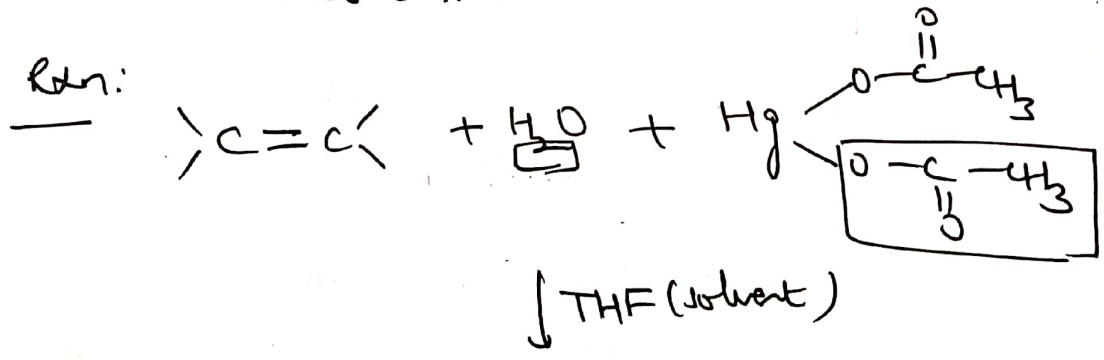
Hydroboration-oxidation reaction provides the alcohol as if addition of H<sub>2</sub>O to alkene takes place in anti-Markovnikov addition.



## VIII

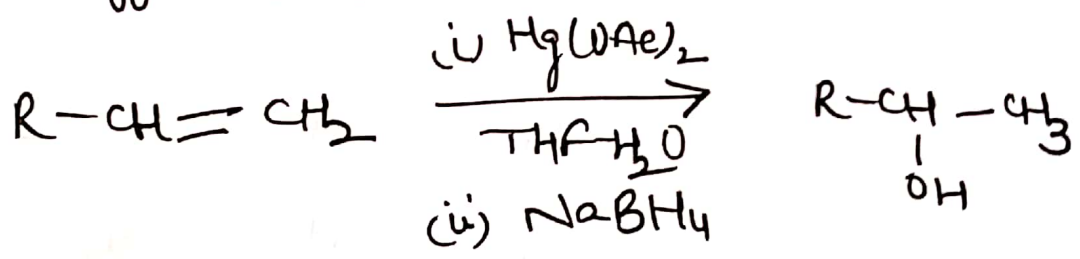
### Oxymercuration - Demercuration

When treated with mercuric acetate in a water-THF solution, alkenes form hydroxy mercurial compounds. These mercurial compounds are reduced by sodium borohydride to provide alcohols.

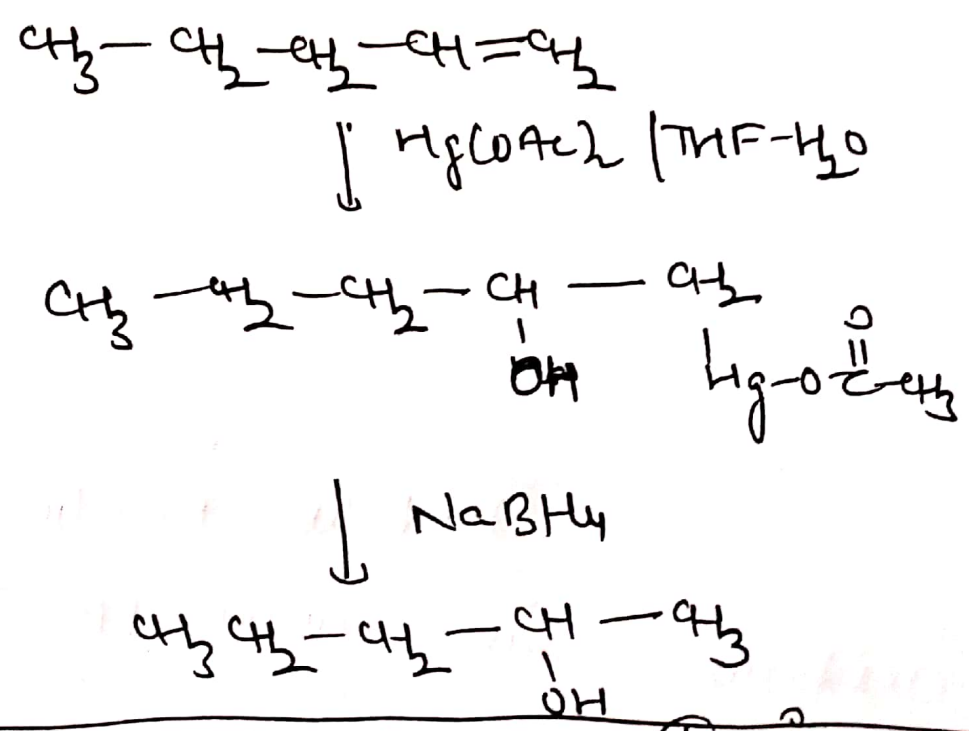


In the first step, water & mercuric acetate add to the double bond. This is known as oxymercuration. In the second step  $\text{NaBH}_4$  reduces the compound and mercuri-acetate group gets replaced by hydrogen. This step is known as demercuration.

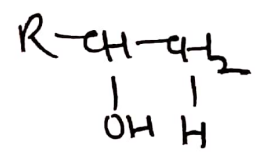
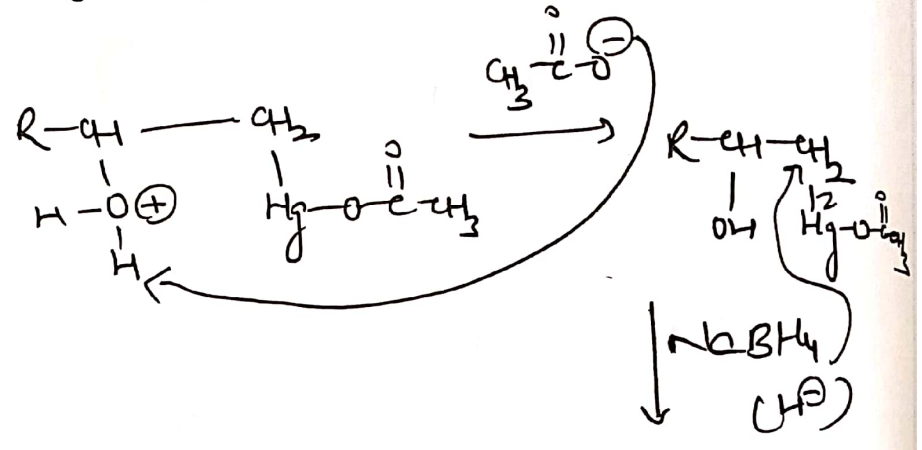
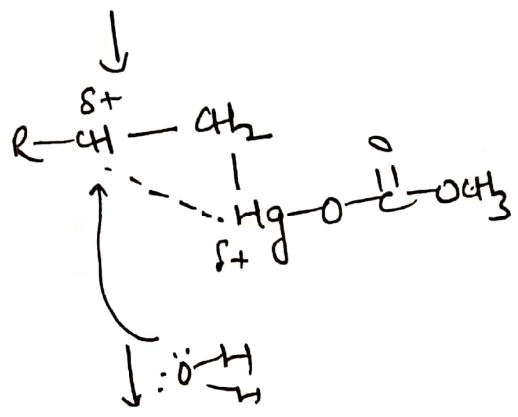
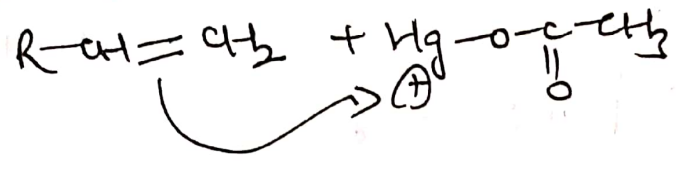
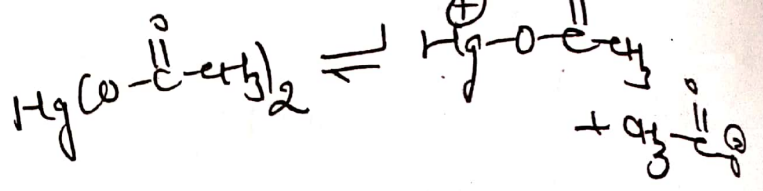
This reaction is highly regioselective and the alcohol is formed in accordance with Markownikoff's rule.



Examples :



Mechanism

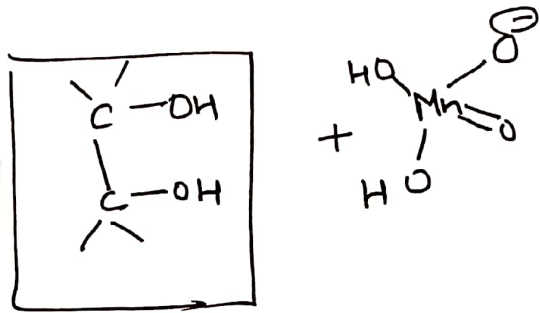
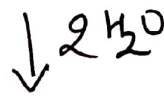
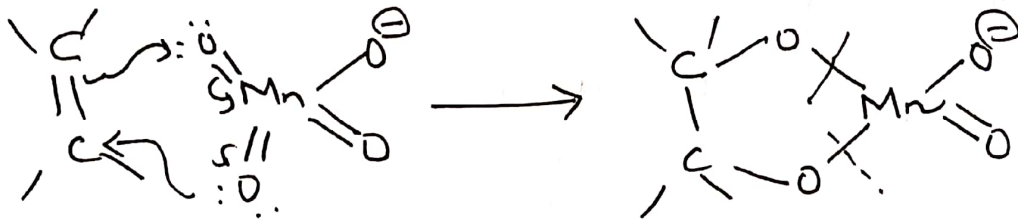
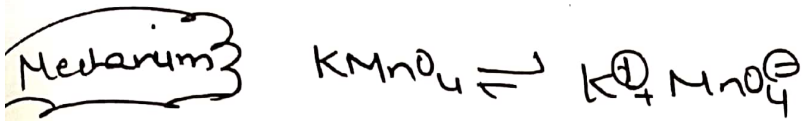
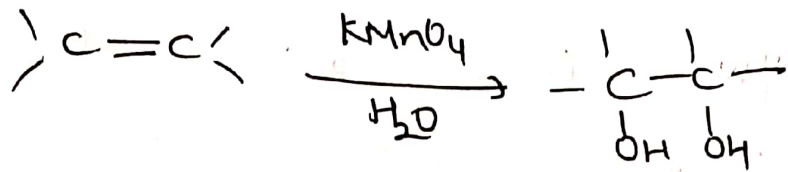


Oxidation Reactions

(I) Oxidation with aqueous KMnO<sub>4</sub>

When alkenes are treated with dilute aqueous potassium permanganate, a hydroxy group is added to each of the doubly bonded carbon atoms resulting in formation of vicinal glycols.



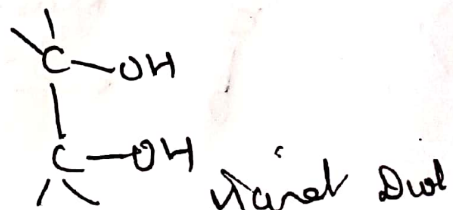
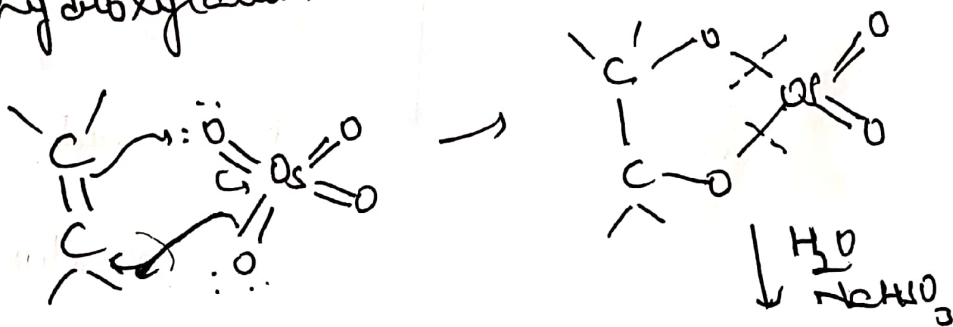


syn-vicinal diols

II

Oxidation with  $OsO_4$  (Osmium tetroxide)

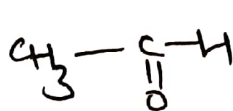
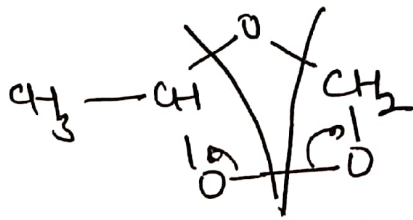
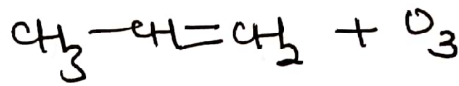
$OsO_4$  can also be used to bring about hydroxylation.



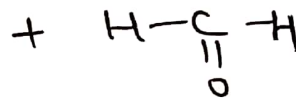
# Ozonolysis

Alkenes undergo cleavage with  $O_3$  (ozone) to yield aldehydes or ketones.

For example,

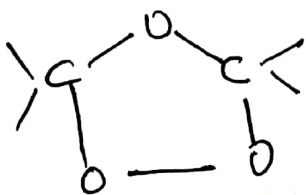
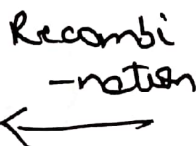
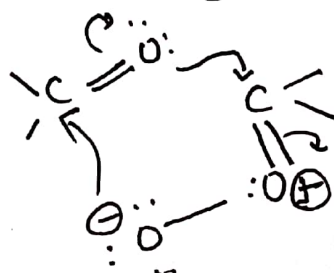
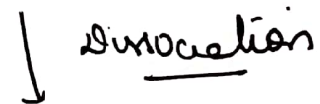
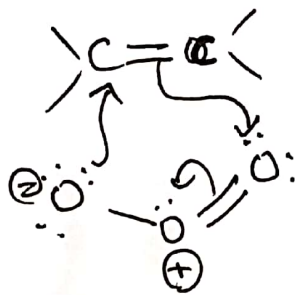


Acetaldehyde



Formaldehyde

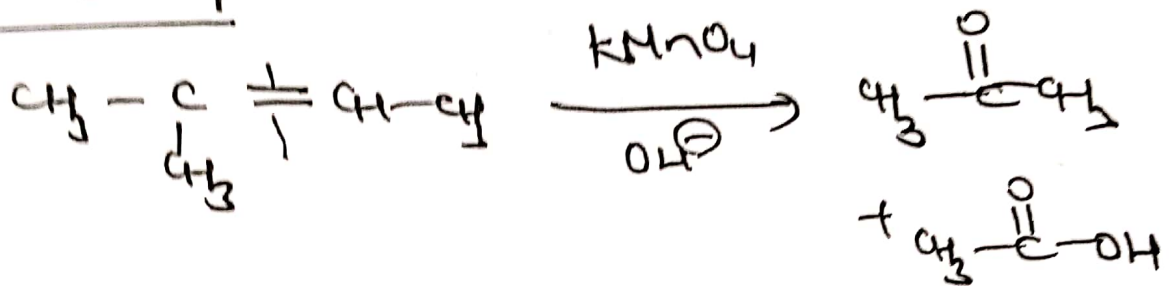
## Mechanism



## Action of Hot Concentrated Solution of $\text{KMnO}_4$

oxidation of alkenes with hot conc. solution of  $\text{KMnO}_4$  in presence of alkali brings about cleavage of the molecule.

For example



## Points to be remembered

- With hot  $\text{KMnO}_4$  /  $\text{OH}^-$ ,  $=\text{CH}_2$  of alkene is oxidized to ~~the~~  $\text{CO}_2$  &  $\text{H}_2\text{O}$
- $=\text{CH}-\text{R}$  part of alkene is oxidized to  $\text{RCOOH}$
- $=\overset{\text{R}'}{\underset{|}{\text{C}}}-\text{R}$  part is oxidized to  $\text{R}-\overset{\text{R}'}{\underset{|}{\text{C}}}=\text{O}$