

Alcohol :- in which hydroxyl is present. general formula  $R-OH$   
 where  $R$  is  $CH_3$ ,  $C_2H_5$

classification :- foll<sup>n</sup> categories

① classification based on hydroxyl grps :- three categories

① Monohydric alcohol The compound which contain one hydroxyl gr  
 eg  $CH_3OH$

② dihydric alcohol The compound which contain two hydroxyl  
 eg  $\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix}$  glycol

③ Trihydric alcohol The compound which contain three hydroxyl  
 eg  $\begin{matrix} CH_2OH \\ | \\ CH_2OH \\ | \\ CH_2OH \end{matrix}$  glycerol

classification based on alkyl grps

① primary alcohol :- which contain one alkyl grps is called primary alcohol

eg  $R-CH_2OH$

② Secondary alcohol :- which contain two alkyl grps is called secondary alcohol

eg  $R-\overset{\overset{R}{|}}{C}-OH$

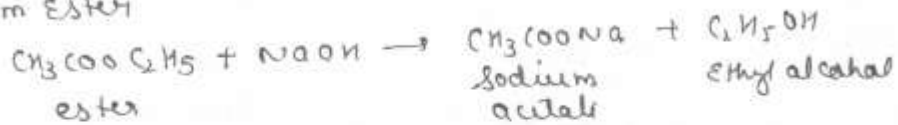
③ Tertiary alcohol :- which contain three alkyl grps is called tertiary alcohol

eg  $R-\overset{\overset{R}{|}}{\underset{\underset{R}{|}}{C}}-OH$

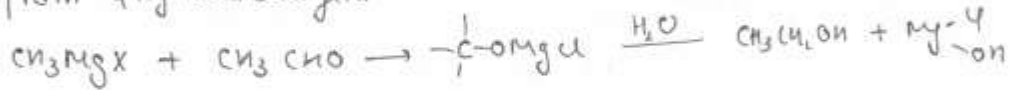
② Ethyl alcohol

Preparation :-

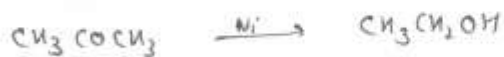
① from Ester



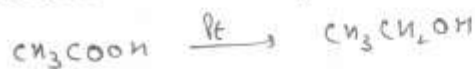
② from Grignard reagent



③ Reduction ketone



④ Reduction Carboxylic acid

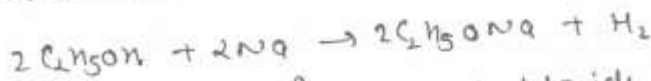


Property ① It is Colourless liquid

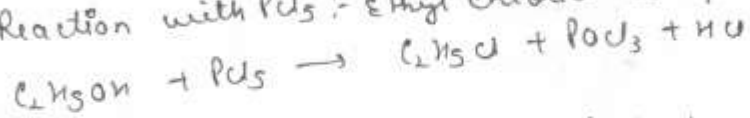
② B.P is  $78^\circ\text{C}$

Chemical property :-

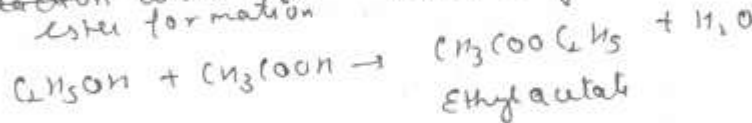
① Reaction with Na (Sodium) :- Sodium ethoxide is formed



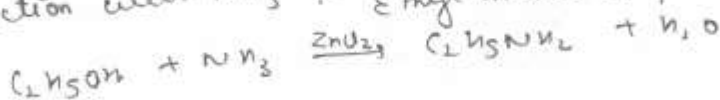
② Reaction with  $\text{PCl}_5$  :- Ethyl chloride is formed



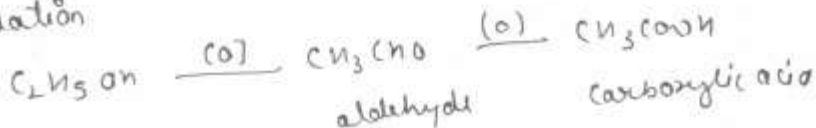
③ ~~Reaction with  $\text{NH}_3$~~  :- ester is formed



④ Reaction with  $\text{NH}_3$  :- Ethyl amine is formed

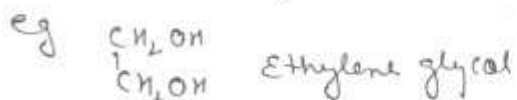


⑤ oxidation



glycol ③

The compound which atom contain 2 hydroxy gp on diff. C-atom are called Diol or dihydric alcohol. These are also known as glycol.

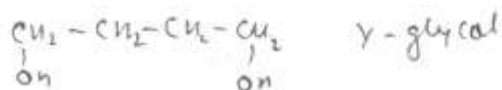
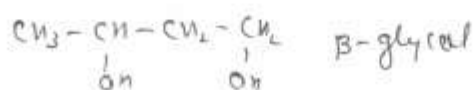
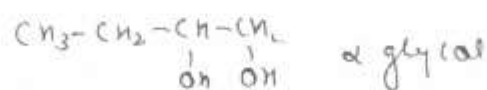


Classification of glycol:

It is classified in  $\alpha$ ,  $\beta$  and  $\gamma$  glycol.

1,2 glycol is known as  $\alpha$ , 1,3 glycol known as  $\beta$  &

1,4 glycol known as  $\gamma$

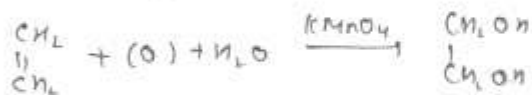


Preparation

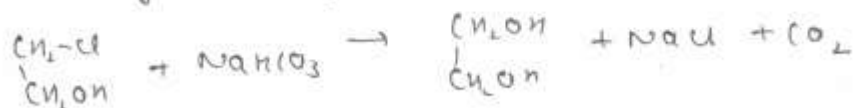
① from epoxide when Ethylene oxide react with water at  $200^\circ\text{C}$  then glycol is formed



② from Ethylene:- when Ethylene oxidised with dil  $\text{KMnO}_4$  then ethylene glycol is formed



③ from Ethylene chlorohydrin

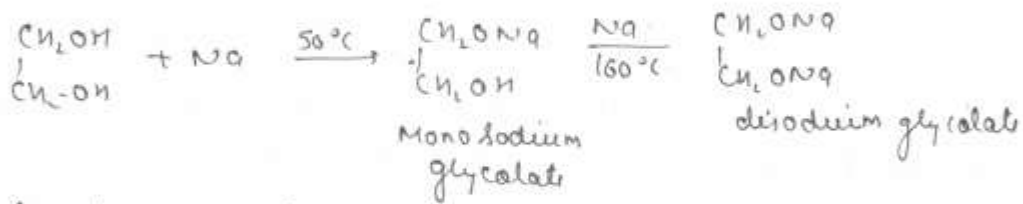


④ Property

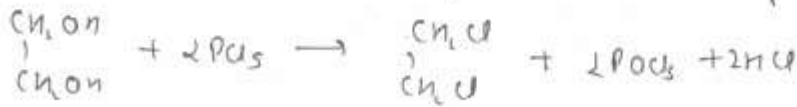
- ① It is colourless syrupy liquid
- ② It is sweet in taste
- ③ It B.P is 190°C & M.P 13°C

chemical property

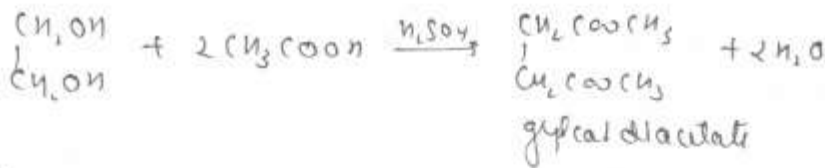
① Reaction with Sodium



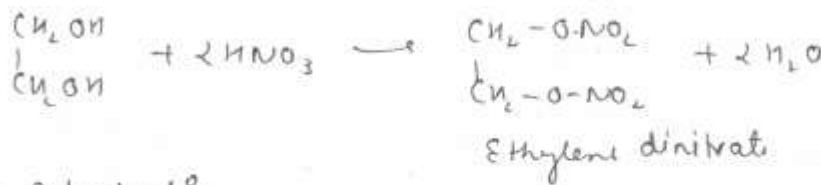
② Reaction with PCl5 :- Ethylene chloride is formed



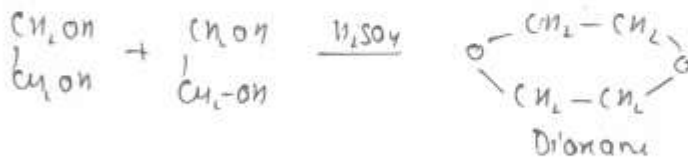
③ Ester formation



④ React<sup>n</sup> with Nitric acid



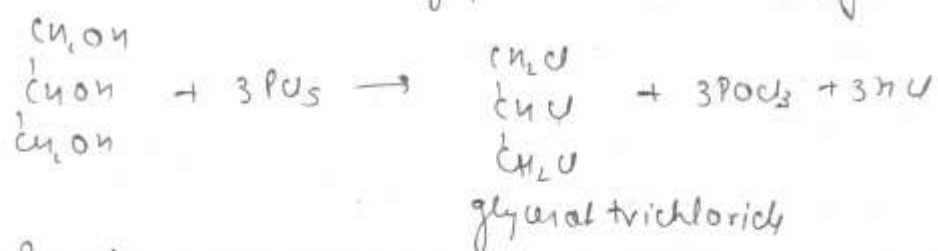
⑤ Dehydration



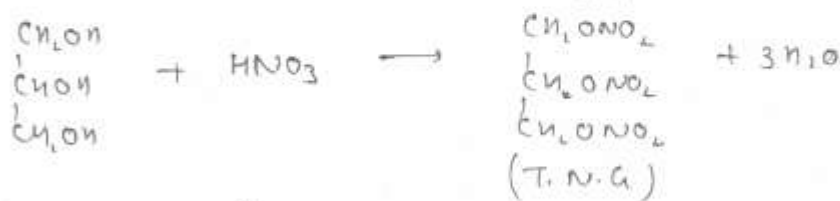
Use

- ① As a solvent
- ② As a preservative

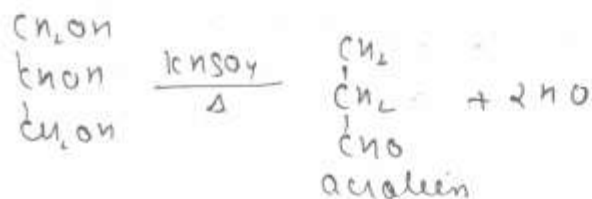
② Reaction with  $\text{PCl}_5$  glycerol trichloride is formed



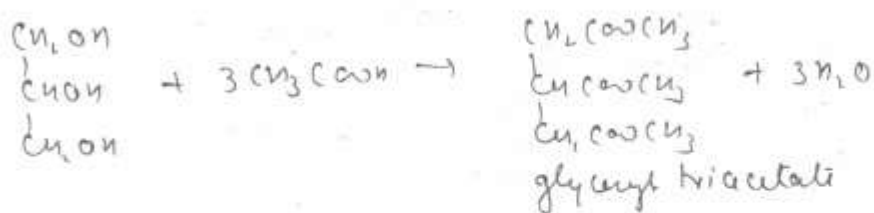
③ Reaction with Nitric acid :- glycerol trinitrate is formed.



④ Dehydration :- acrolein is formed



⑤ Ester formation

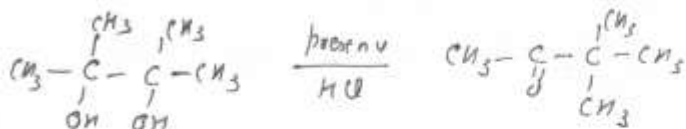


Uses

- ① As a Sweetening agent
- ② To produce plastic
- ③ To making explosive eg dynamite (T.N.G.)
- ④ In making formic acid etc

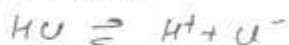
# Pinacol - Pinacolone Rearrangement

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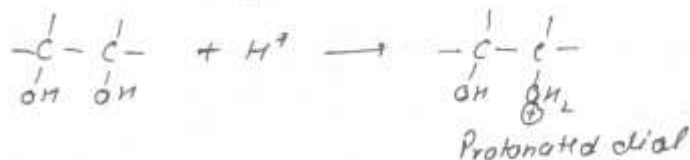


Mechanism

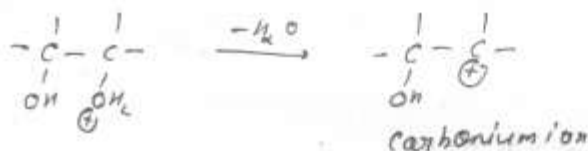
Step I. HCl dissociates



Step II. Protonation of 1,2 diol



Step III. Protonated diol loses water to form carbocation



Step IV. Carbocation rearrangement by 1,2 shift protonated ketone

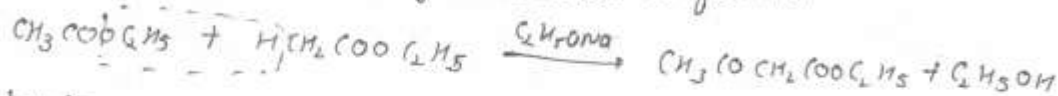


Step V. This protonated ketone loses proton to form ketone



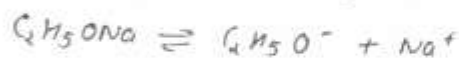
## ⑧ Claisen Rearrangement

When ethyl acetate condenses in presence of sodium ethoxide the ethyl acetoacetate is formed

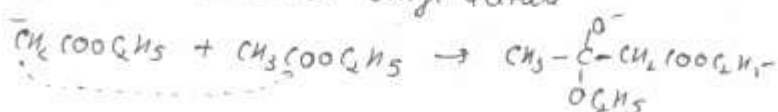


Mechanism

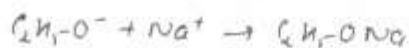
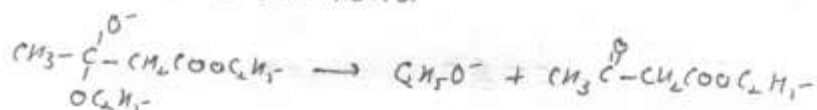
Step 1 Ethoxide ion attack on ethyl acetate to give ethyl alcohol and ester anion



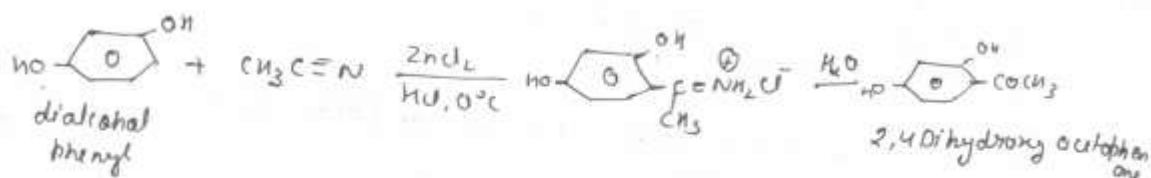
Step 2 Ester anion attack on ethyl acetate



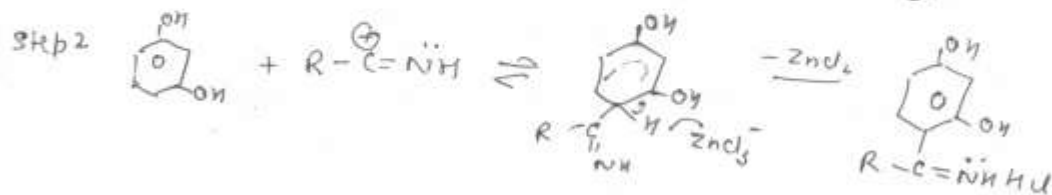
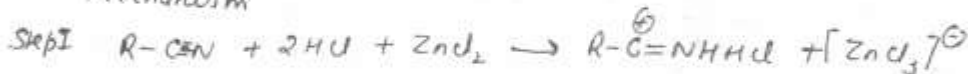
Step 3 Ethoxide ion is eliminated



## HOUBEN-HOESCH REACTION

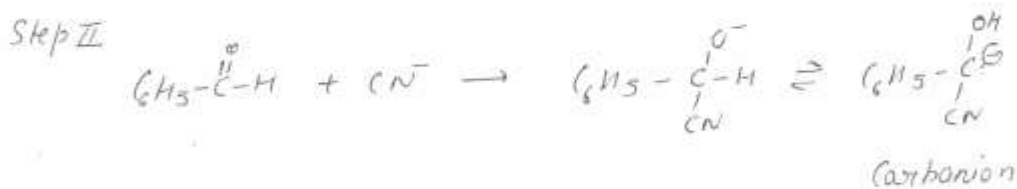
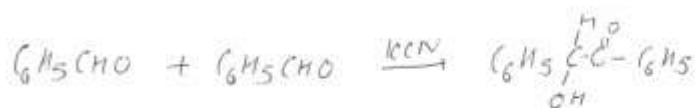


Mechanism

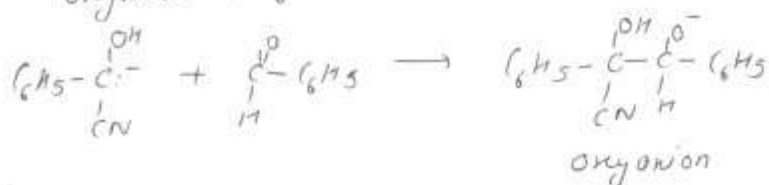


## Benzoin Condensation

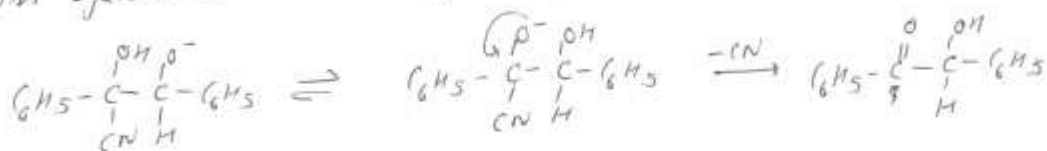
When two mol<sup>n</sup> of Benzaldehyde react in the presence of KCN then Benzoin is obtained.



Step III Carbanion react with another molecule of Benzaldehyde. Oxyanion is formed.

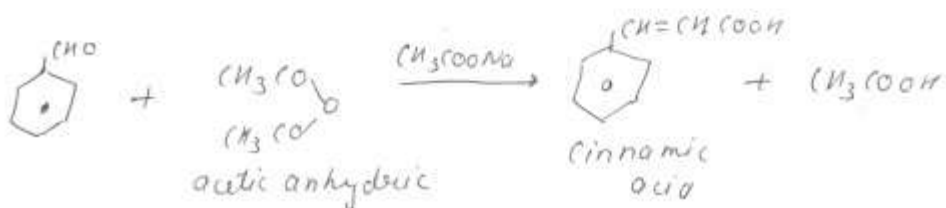


Step IV Due to proton transfer to give another oxyanion which has loss cyanide ion then Benzoin is formed

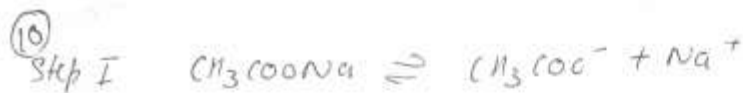


## Perkin Reaction

When Benzaldehyde acetic anhydride in the presence of sodium acetate the Cinnamic acid is formed



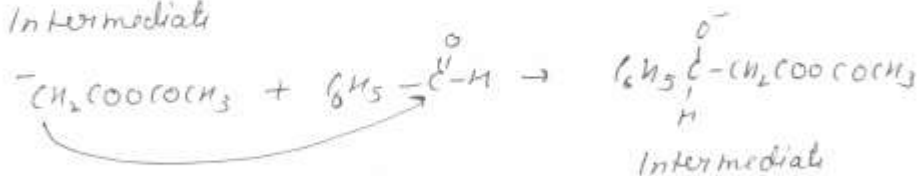




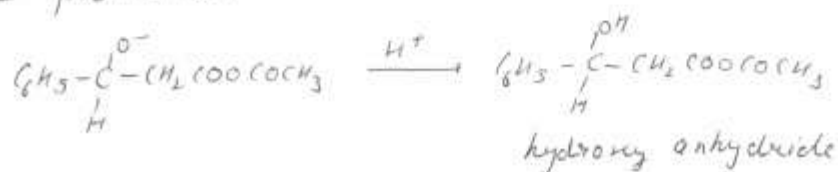
Step II formation of Carbanion



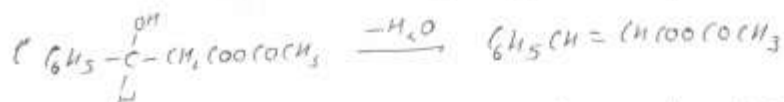
Step III Carbanion attack mol<sup>n</sup> of Benzaldehyde to form Intermediate



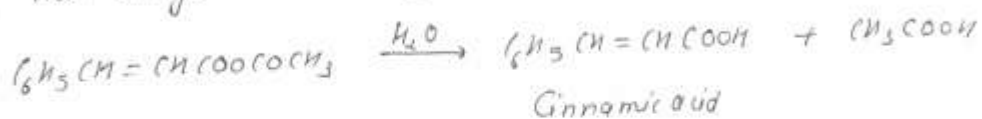
Step IV Protonation



Step V This anhydride on hydrolysis to give Cinnamic acid

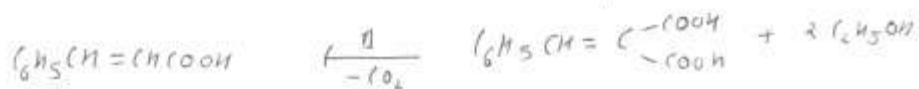
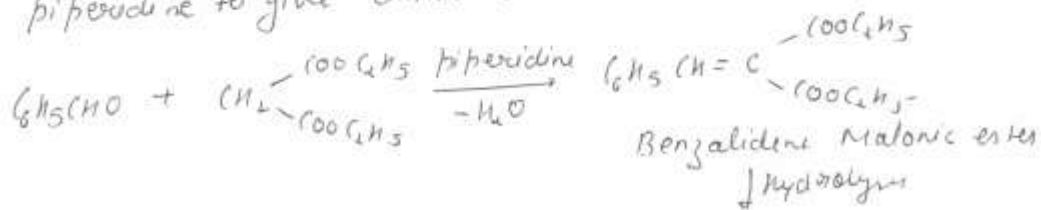


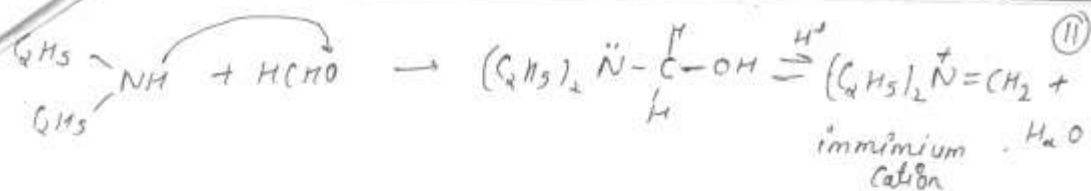
Step VI This anhydride on hydrolysis to give Cinnamic acid



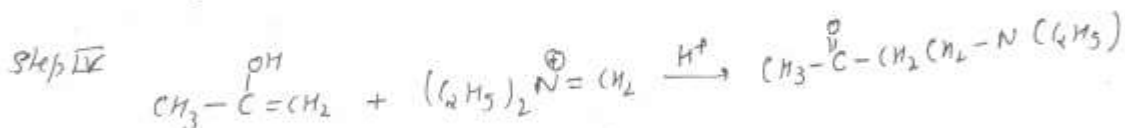
### Knoevenagel Condensation

Benzaldehyde react with Malonic ester in presence of piperidine to give Cinnamic acid.



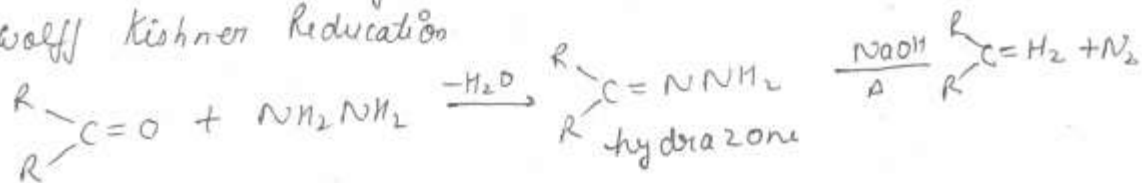


Step II

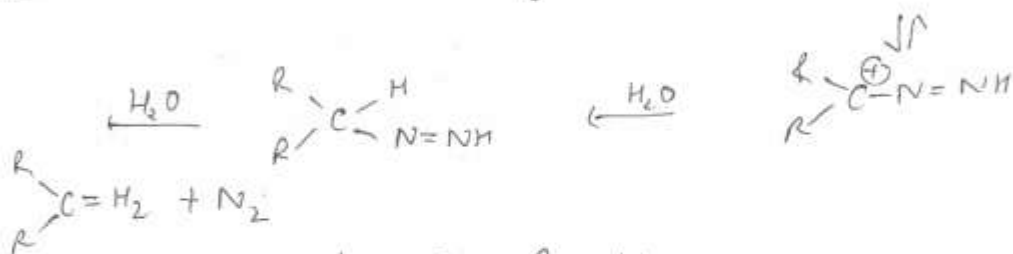
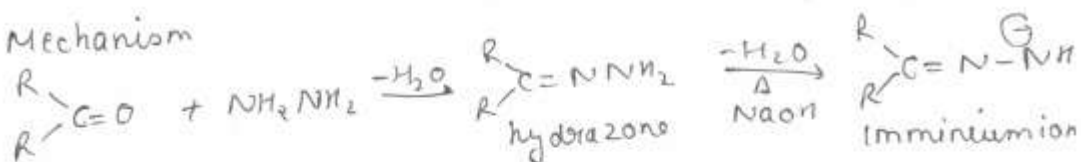


### Wolff Kishner Reduction

When ketone reacts with hydrogen in presence of strong base then alkene is formed this reaction is known as Wolff Kishner Reduction.

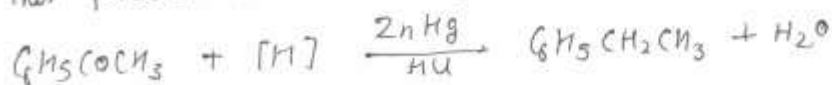


Mechanism



### Clemmensen Reaction

When carbonyl group is reduced in presence of Zn/Hg and this process is known as Clemmensen Reaction.



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Baeyer Villiger Oxidation

Oxidation of ketones to esters by peracids is called Baeyer Villiger Oxidation. The reaction is catalysed by acids.



For symmetrical ketones, the approximate order of Migration R' is  $3^\circ \text{alkyl} > 2^\circ \text{alkyl} > 1^\circ \text{alkyl} > \text{Methyl}$

Mercuric Potassium Verley (MPV)

This is a common method for the reduction of Carbonyl Compounds, particularly of unsaturated aldehydes and ketones. This reagent attacks only carbonyl compounds.

When ketone is dissolved in a solution of isopropyl alcohol containing aluminium isopropoxide, ketone is reduced to corresponding alcohol.

An equimolar amount of isopropyl alcohol is change into acetone. This method which is very selective. It is known as Mercuric Potassium Verley

