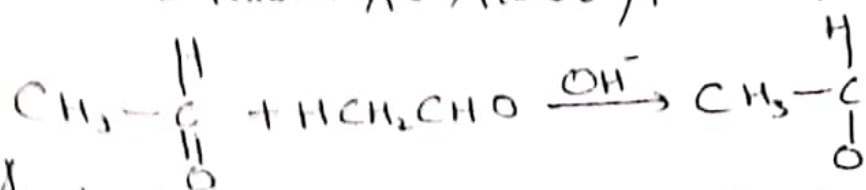
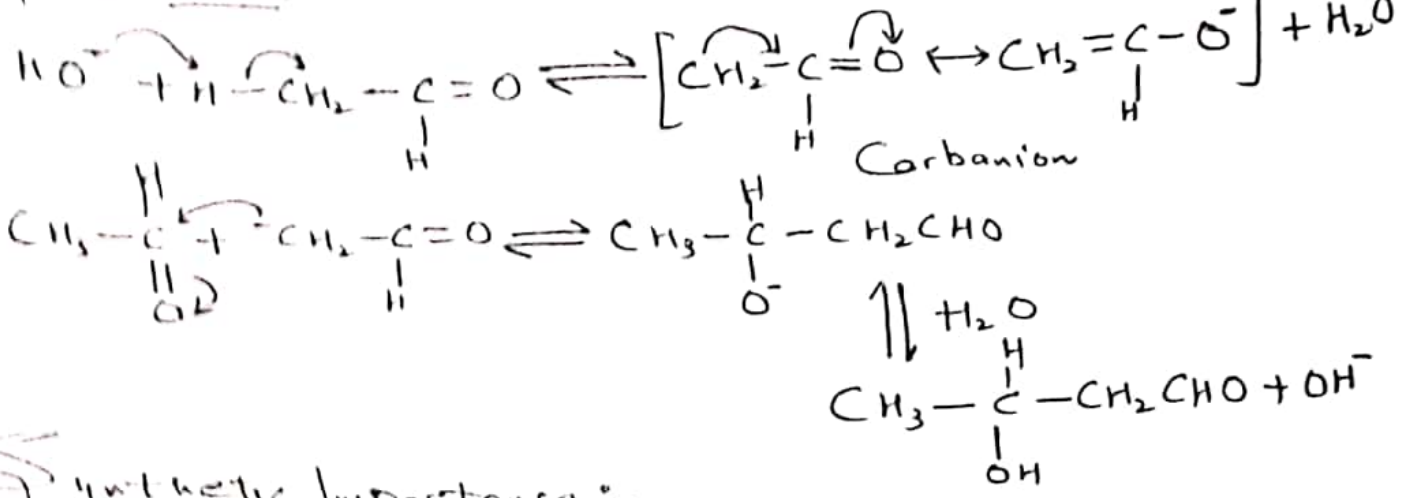
Imp

Aldol Condensation :- In the Pr. of dil. Base, two molecules of An Aldehyde and/or Ketone having α hydrogen atom Combine to form β-hydroxyaldehyde. This is known As Aldol And the Rx^n is Aldol Condensation.



Acetaldehyde — 3-Hydroxybutanal (Aldol)

Mechanism



Carbanion

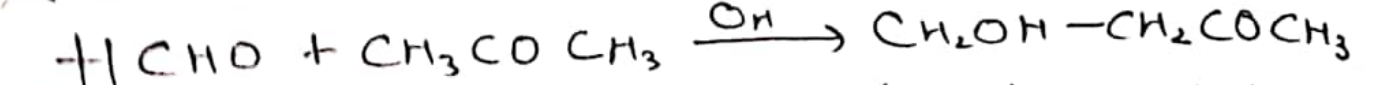
Synthetic Importance :-

The β-hydroxyaldehydes obtained from base catalysed Aldol Condensation are easily dehydrated On warming with acids.

Therefore, aldol Condensation commands Considerable Synthetic Importance. It can be employed for the Preparation of α,β-unsaturated Carbonyl Compounds, α,β-unsaturated alcohols etc.

Imp

Crossed Aldol Condensation :- Aldol Cond: takes place b/w two different aldehydes or ketones. Such aldol Condensation is referred as Cross. Aldol Condensation.



Formaldehyde — Acetone — 4-Hydroxy-2-butanone

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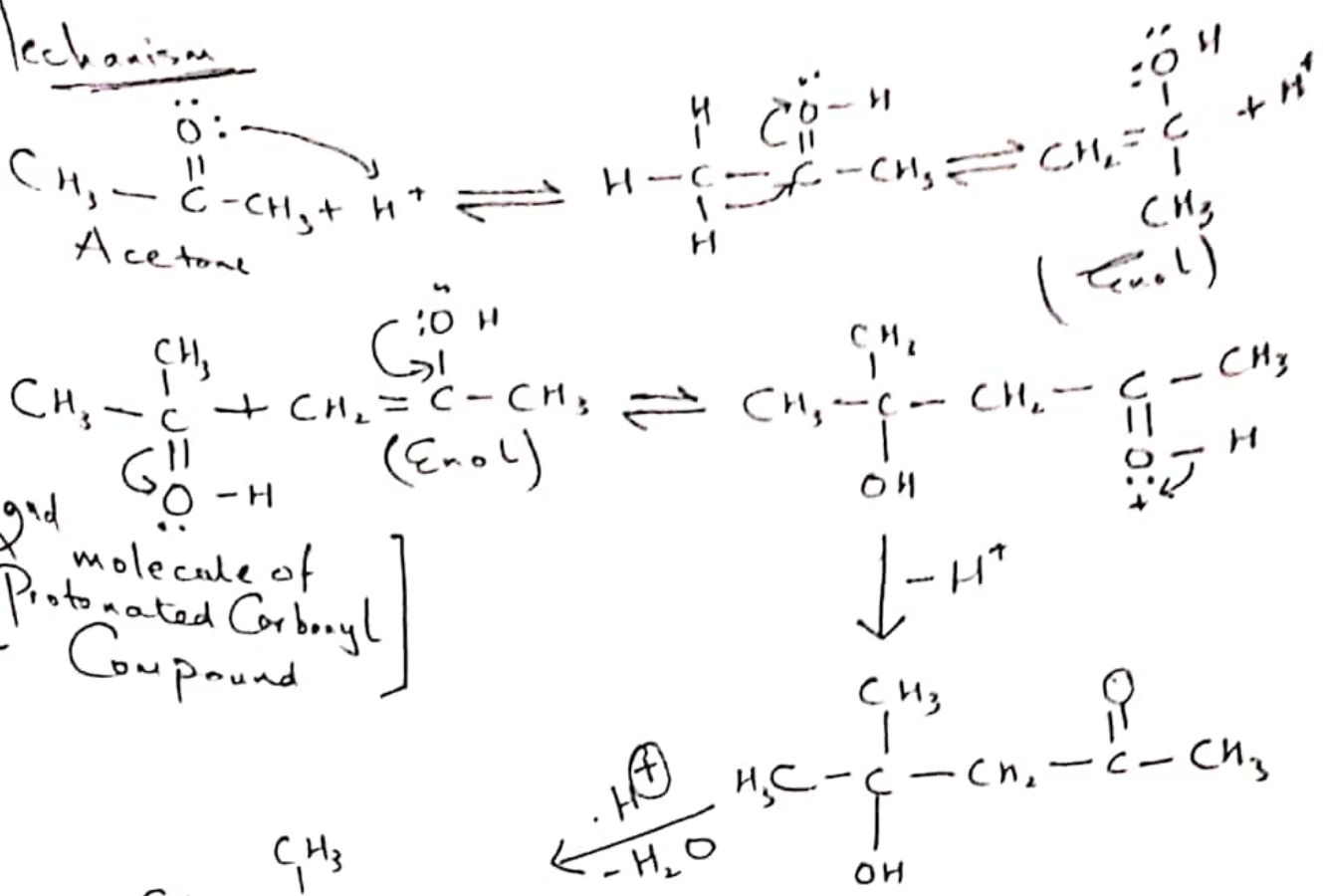
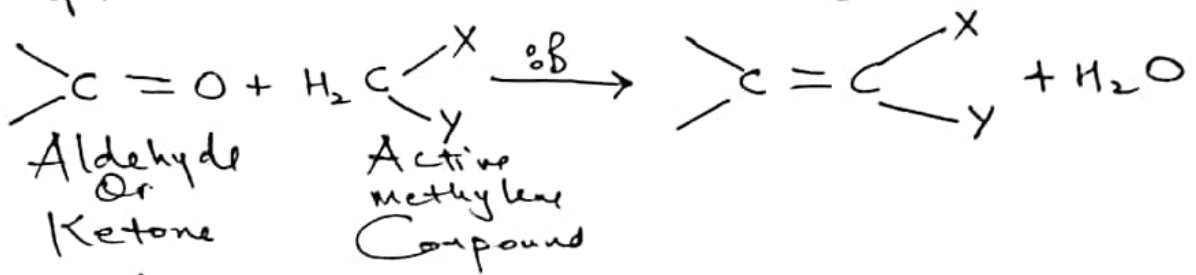
Mechanism

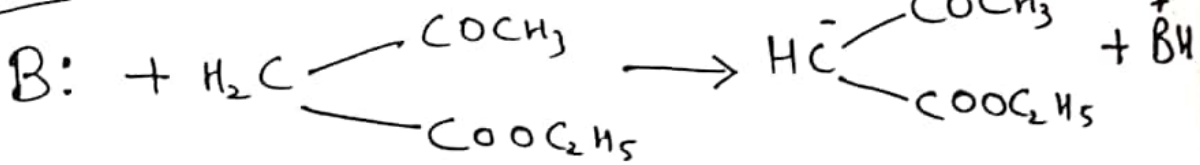


Knoevenagal Reaction :-

This is another Rx^n. closely Related to Aldol Condensation. It Involves the Condensation b/w Aldehyde or Ketone and a Compound having an active methylene group.



Mechanism



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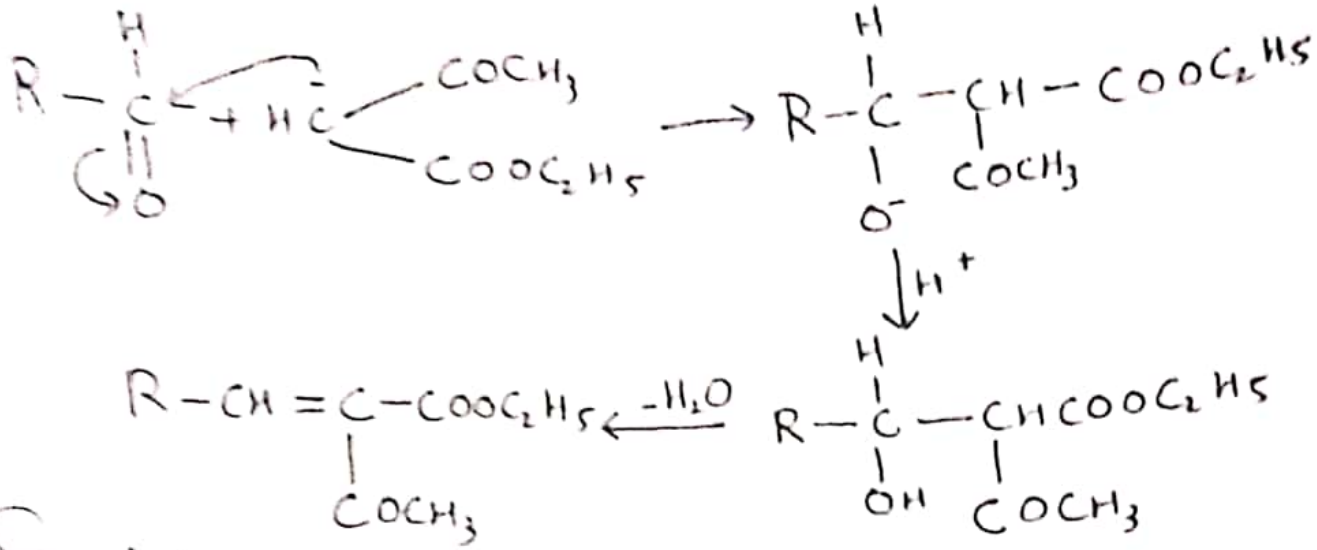
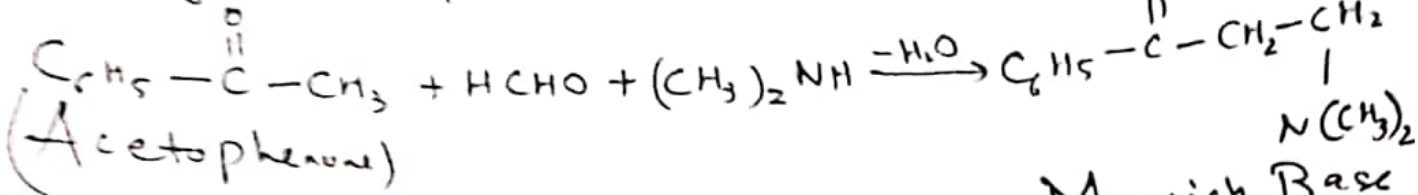


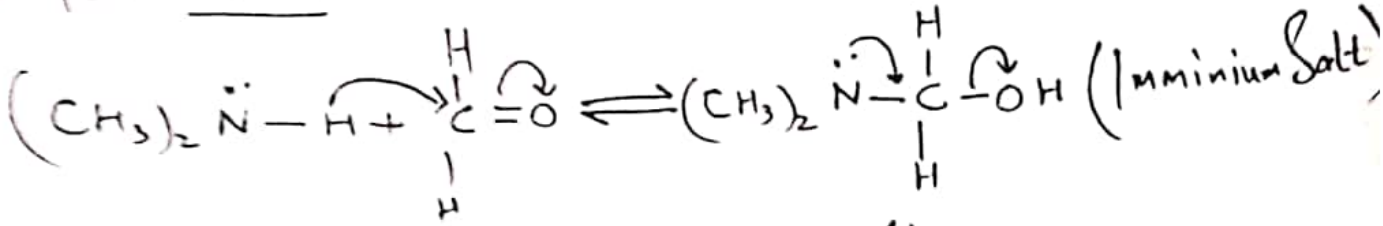
c) Mannich Rx^n :-

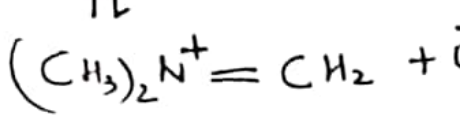
This is a Rx^n b/w Aldehyde, an amine and an active methylene Compound.



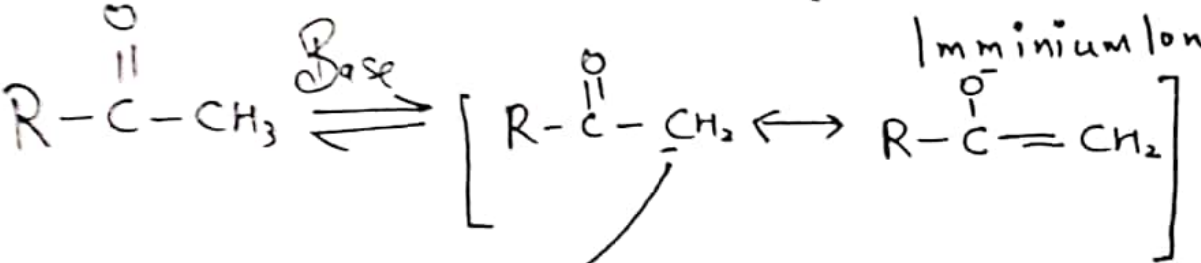
(Acetophenone) — Mannich Base

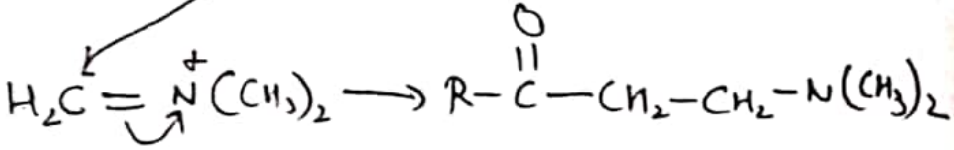
Mechanism





Imminium ion





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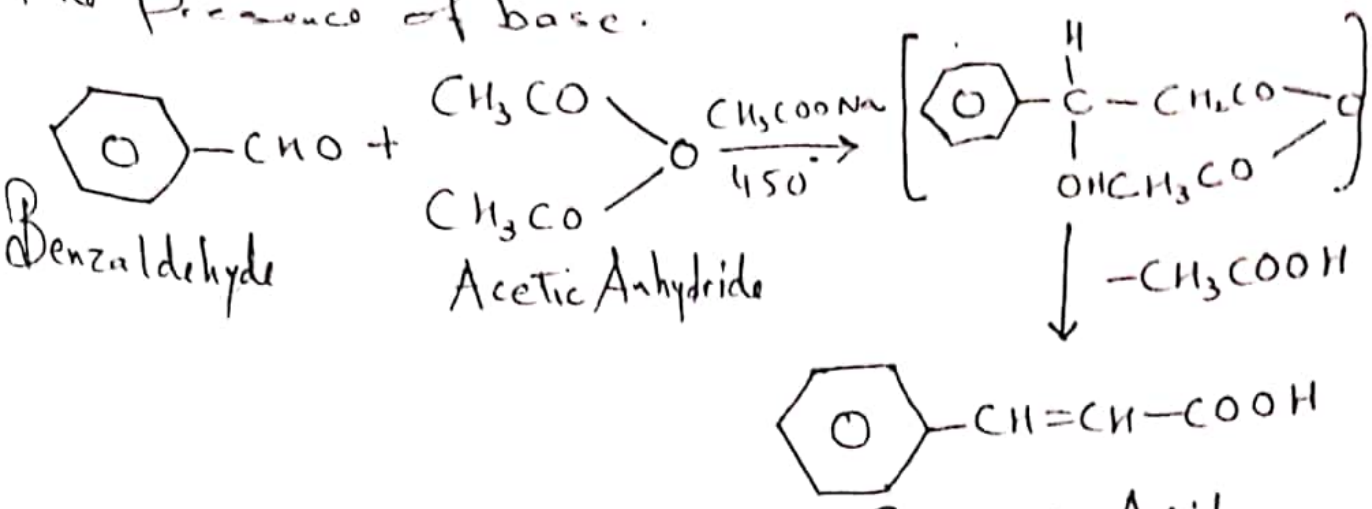
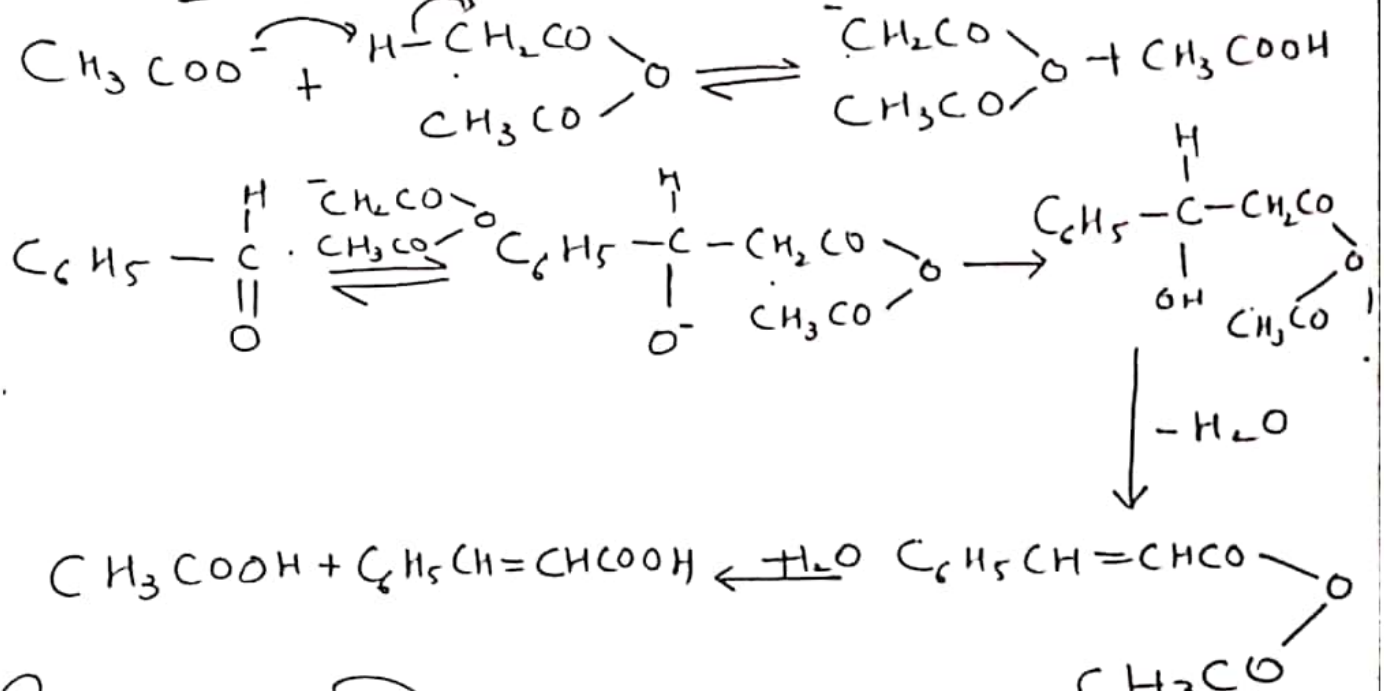
Perkin Reaction: It Involves the addition of Acid Anhydrides to Aromatic Aldehydes in the Presence of base.



Mechanism



Wittig Reaction:

This is a reaction between aldehydes or ketones and a type of compound known as phosphorus ylides to form Substituted Alkenes

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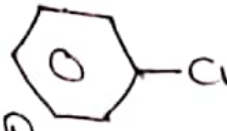
$$>C=O + (C_6H_5)_3P=CRR' \longrightarrow >C=CRR' + (C_6H_5)_3PO$$

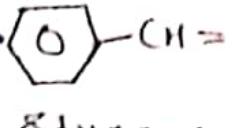
An Ylide

(Substituted Alkene) (Triphenyl Phosphine oxide)

Example :-



$$+ (C_6H_5)_3P=CH_2 \longrightarrow$$



$$+ (C_6H_5)_3PO$$

Benzaldehyde — Methylenetriphenyl Phosphorane — Styrene

Wittig Reagent :-

$$(C_6H_5)_3P + R-\underset{R'}{\overset{|}{C}}HX \longrightarrow [(C_6H_5)_3P^+-CHRR']X^-$$

(Triphenylphosphine) (Alkyl Halide)

Alkyl triphenyl Phosphinium Halide

$-H^+X^-$ | Base

$$(C_6H_5)_3P=CRR'$$

REDUCTION

a) Reduction to Alcohols :- Aldehydes can be reduced to 1° Alcohols and Ketones to 2° Alcohols either by halogenation or by using reducing Agents like ($LiAlH_4$) and ($NaBH_4$)

$$R-CH=O \xrightarrow[LiAlH_4]{H_2, Ni} RCH_2OH$$

1° Alcohol

$$R-CO-R' \xrightarrow{LiAlH_4} R-CHOH-R'$$

Sec. Alcohol

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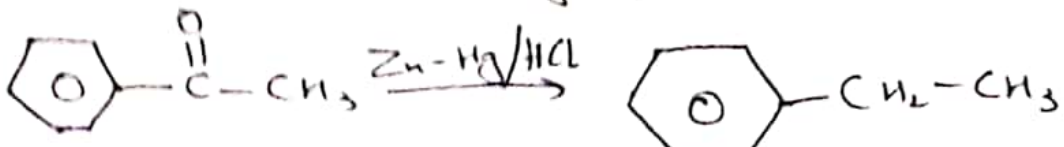
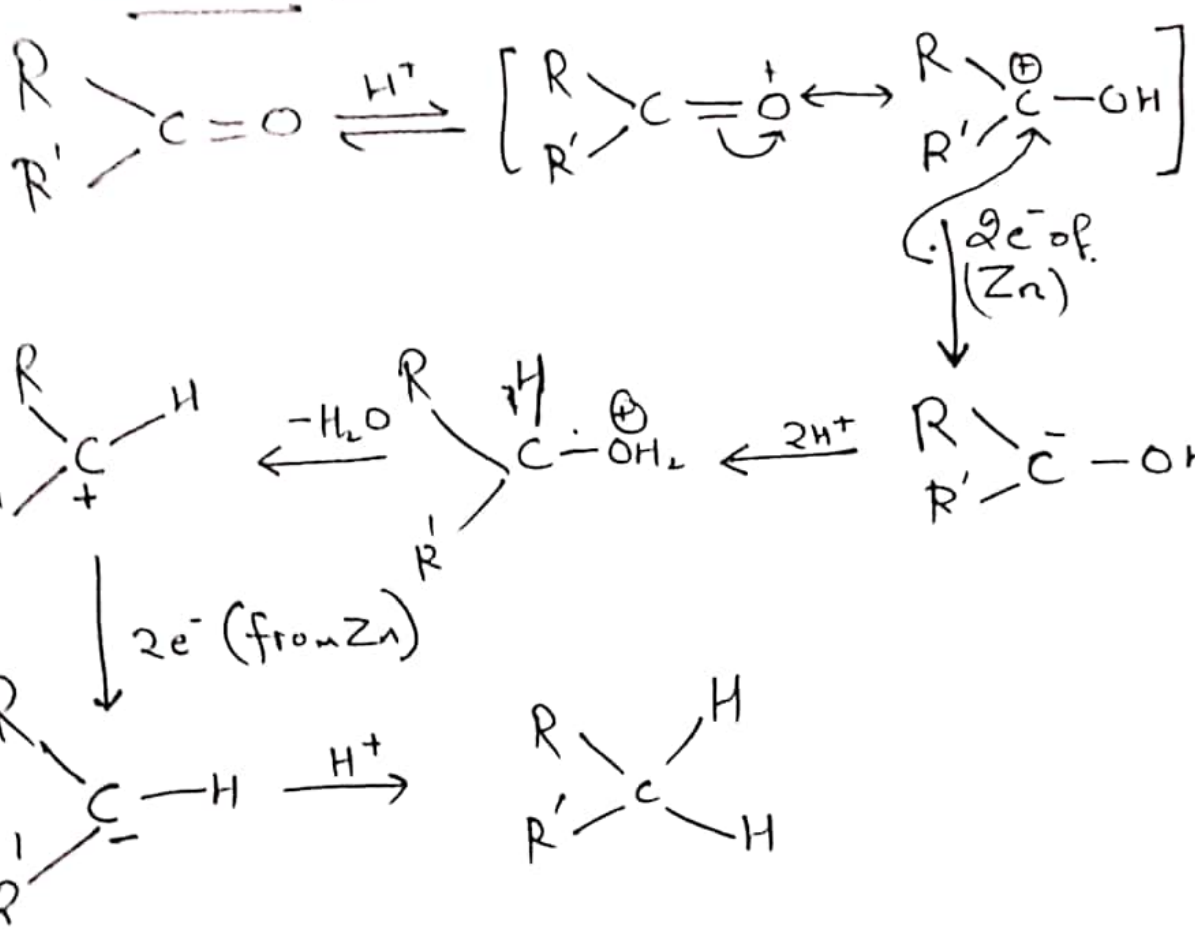
c) Red^{n} to Methylene Group :- The Carbonyl Gp i.e. Aldehydes and Ketones can also be reduced to methylene Gp to form hydrocarbons.

a) Clemmensen Red^{n} : This works well for Ketones but not for Aldehydes.



Acetophenone. Ethyl Benzene

Mechanism :-



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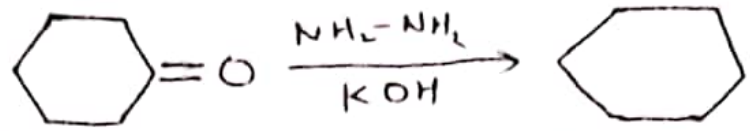
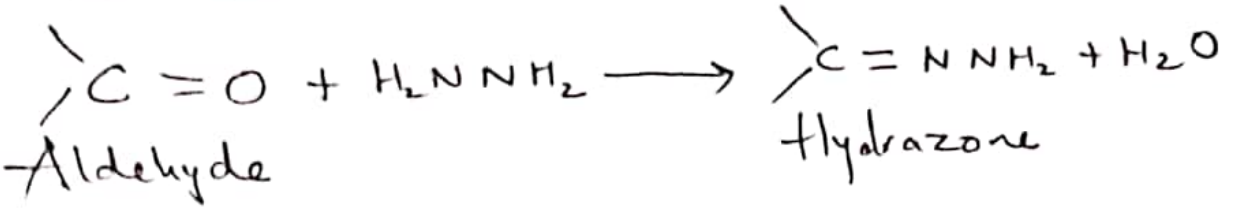
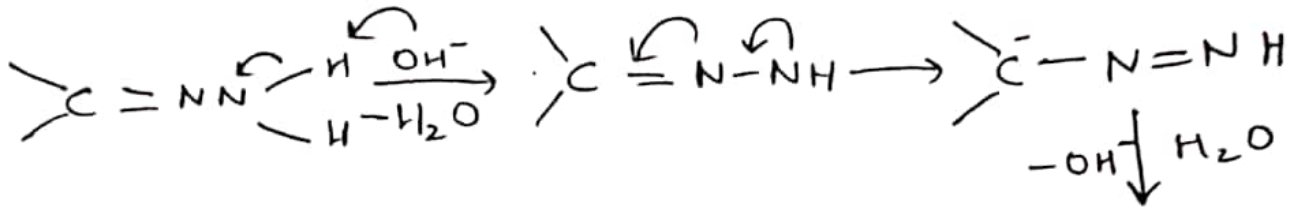
Wolff-Kishner Red :- In this method Ketone or Aldehyde is heated with hydrazine and a strong base like Potassium hydroxide.

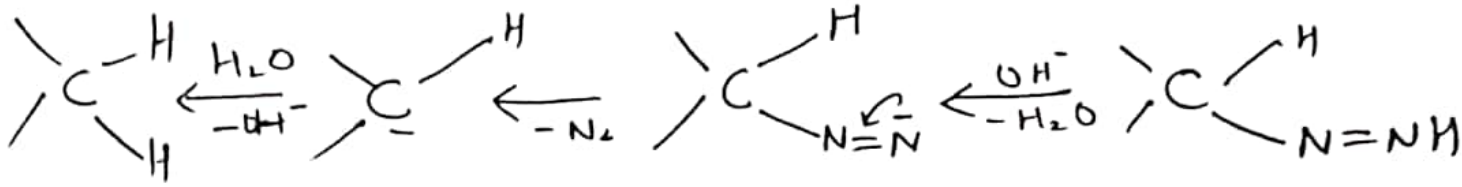


Cyclohexanone → Cyclohexane

Mechanism







Baeyer-Villiger Oxidation :-

This reaction involves the conversion of Ketones into Esters by Reaction with per acids. The formation of Esters takes Place due to the introduction of an oxygen atom between Carbonyl Carbon and α-Carbon

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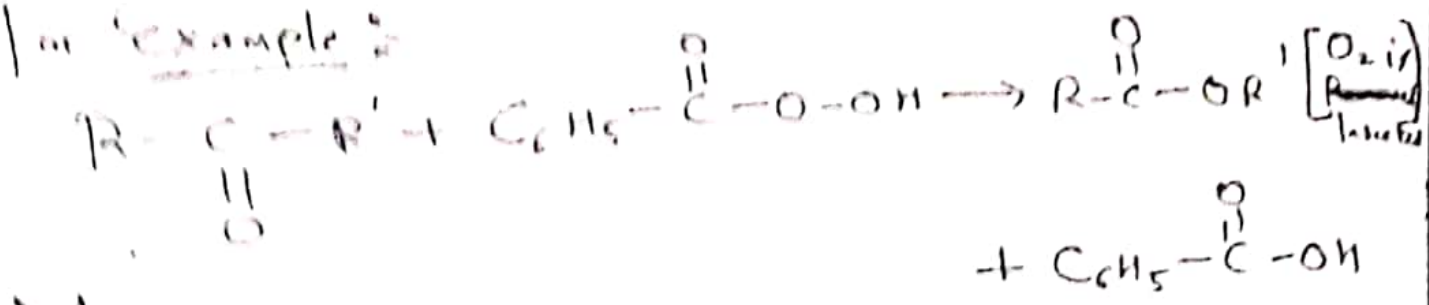
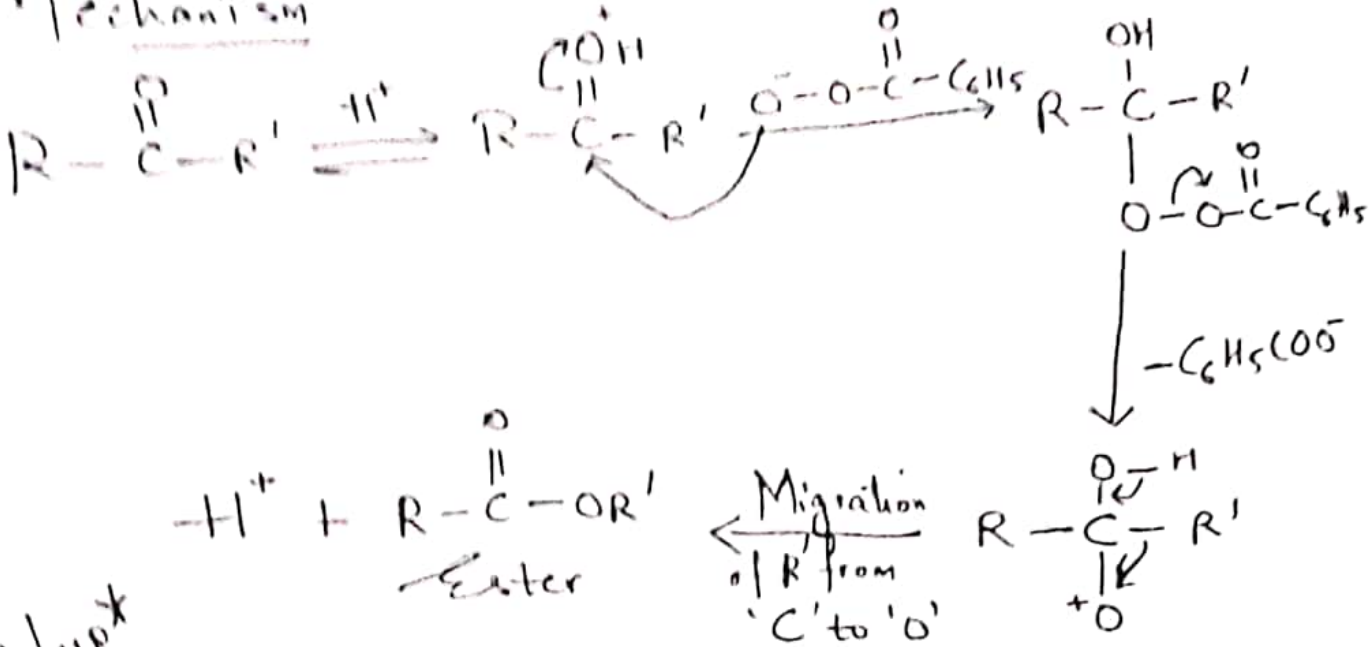
In 'example' :-



Mechanism



Imp*

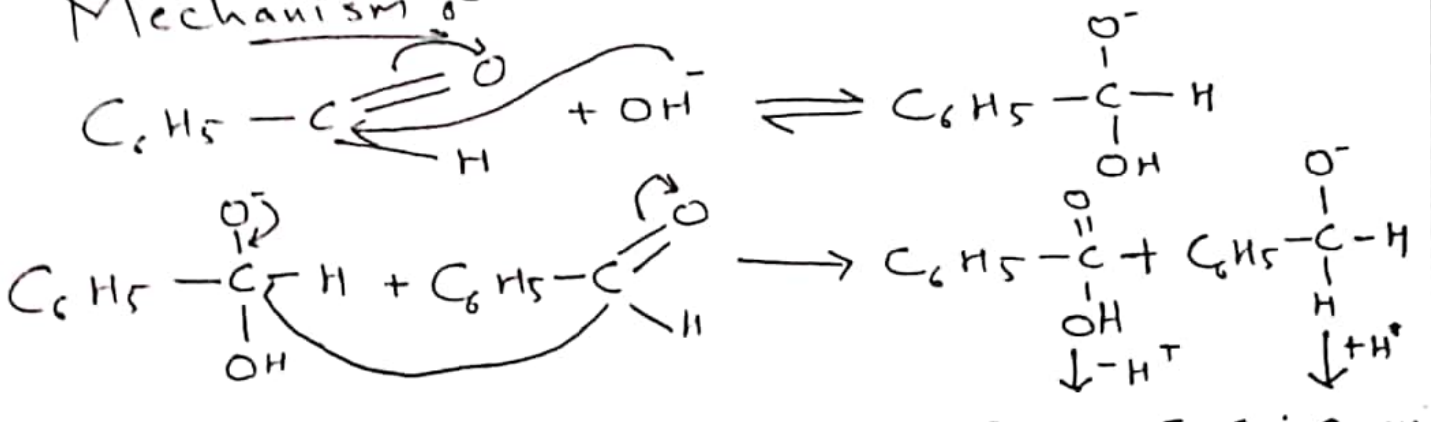
Cannizzaro Reaction :-

This is self oxidation and reduction or disproportionation rx^n. which is undergone by aldehydes having no α-hydrogen.

$$2HCHO + NaOH \longrightarrow CH_3OH + HCOONa$$

Formaldehyde (Conc. Sol^n) — Methyl Alcohol

Mechanism :-



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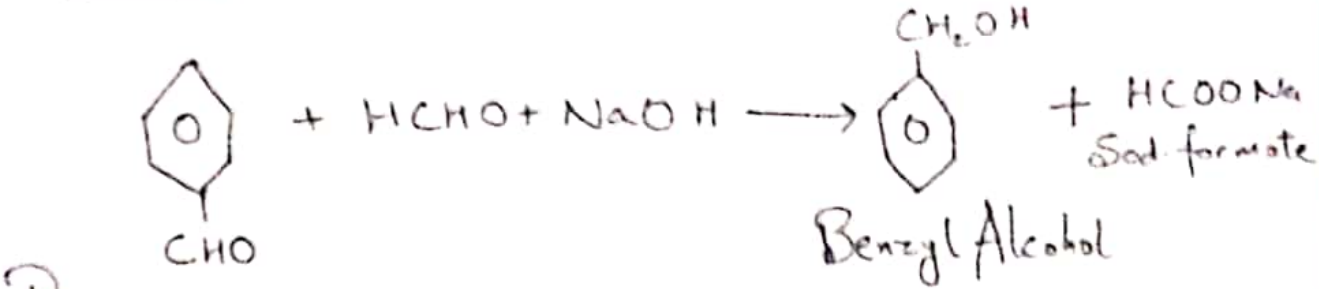
Crossed Cannizzaro Reaction:

It can take place b/w two different aldehydes not having α-hydrogen. It is known as Crossed Cannizzaro Reaction and can lead to the formation of four different Products

For Example:-



Benzaldehyde

Benzyl Alcohol

———— X

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