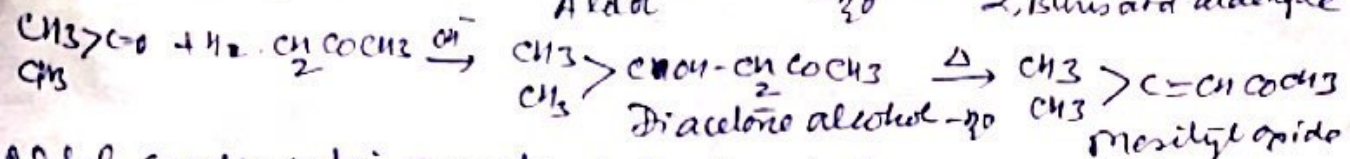
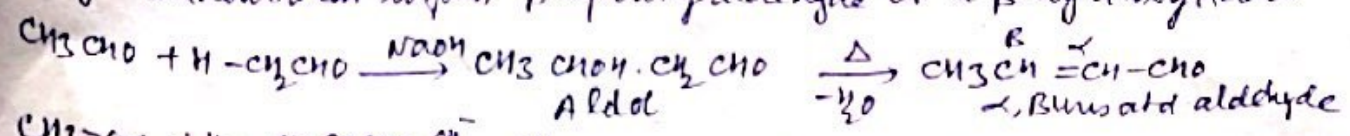
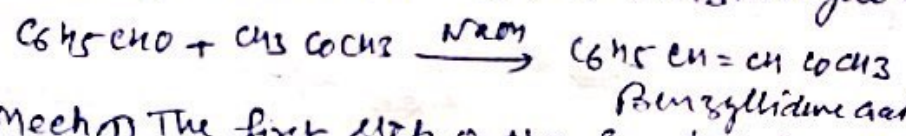


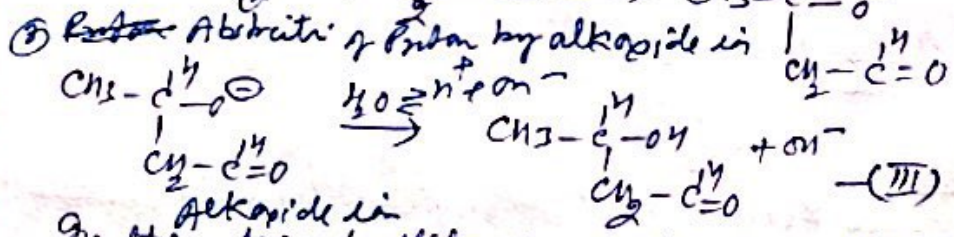
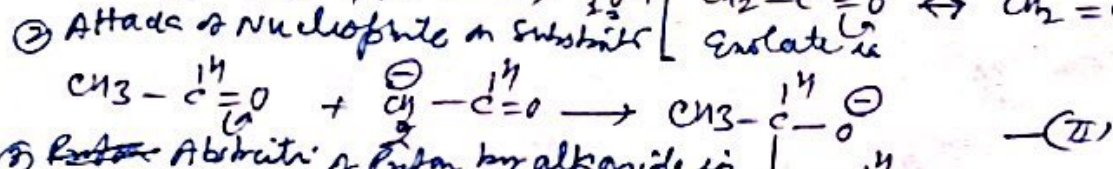
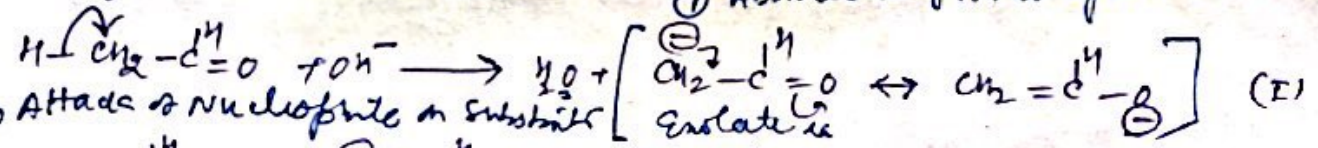
① Aldol Condensation Aldehydes and ketones having α -hydrogen atoms undergo condensation to form β -hydroxy aldehyde or a β -hydroxy ketone



Aldol condensation can also take place between an aldehyde and a ketone, This is known as Crossed aldol condensation (Claisen-Schmidt-reaction). The carbonyl group of ketone has less additive power than aldehyde, when aldehyde condenses with a ketone it serves as a substrate for the ketone. Similarly an aldehyde that has no α -hydrogen may undergo condensation with enolisable ketone e.g. Condensation between benzaldehyde and acetone



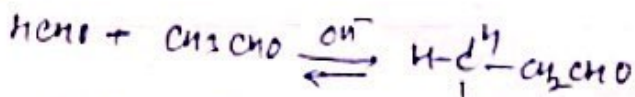
Mech ① The first step of the reaction is the formation of enolate ion by interaction with a base -



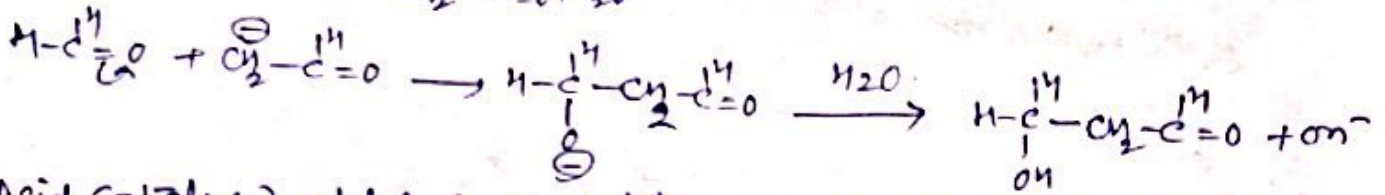
In the second step the carbanion attacks the 2nd molecule of aldehyde or ketone (as the case may be) to form aldol

A kinetic study of the aldol condensation between acetaldehyde and formaldehyde has shown that the concentration of formaldehyde does not affect the rate of reaction. It follows that the rate determining step of the reaction involves only acetaldehyde and as soon as its anion is formed it attacks rapidly the carbonyl carbon of the formaldehyde.

Contd)

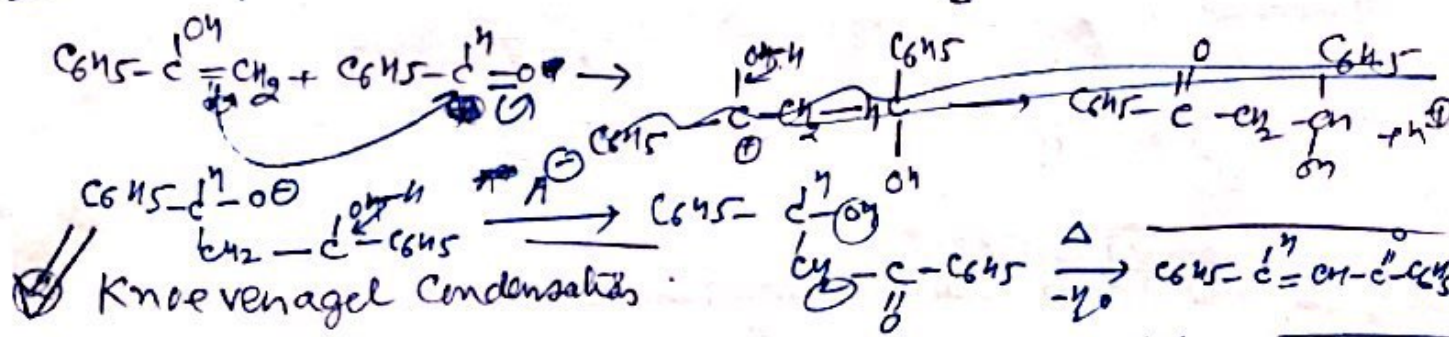
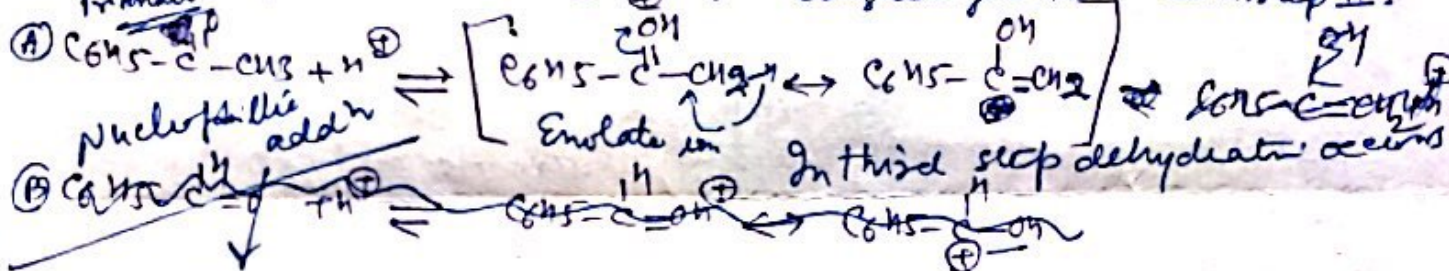


$$Rate \propto [CH_3CHO][OH^-]$$

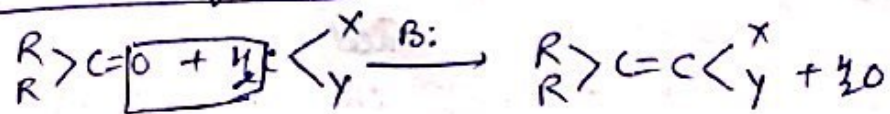


Acid catalysed aldol condensation (Clausen Schmidt Reaction)

Aldol condensations are also catalysed by acids. The reaction of benzaldehyde with acetophenone in presence of acid was found to be first order in both the reactants. It appears that acid catalyses the conversion of acetophenone into enol form, which then reacts with the protonated benzaldehyde. This enolate ion acts as nucleophile for benzaldehyde molecule in step II.



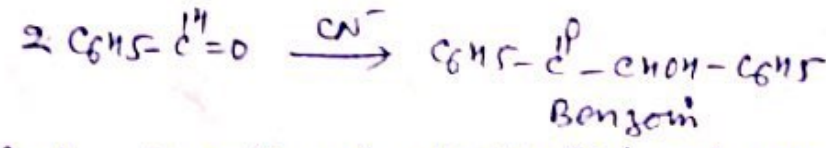
Base Catalysed Condensation between an aldehyde or ketone and any compound having reactive methylene group (malonic ester) is known as Knoevenagel Condensation. Sometimes decarboxylation also occurs during the condensation, then it is known as Doebner modification.



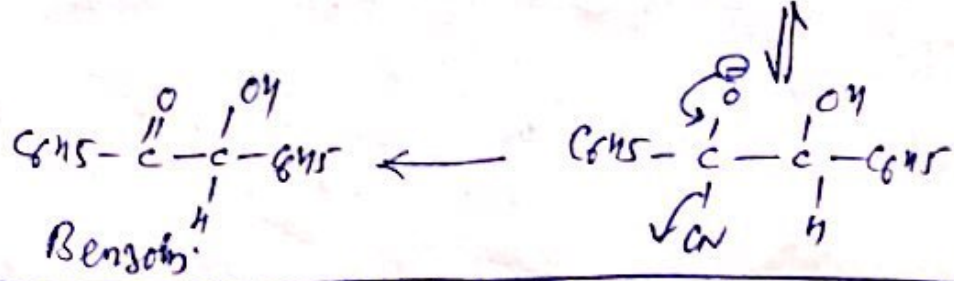
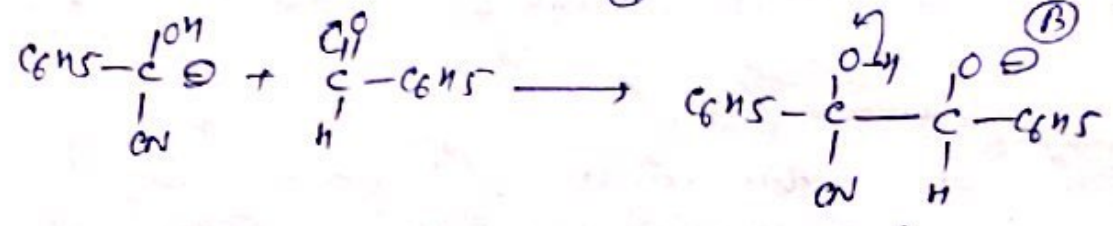
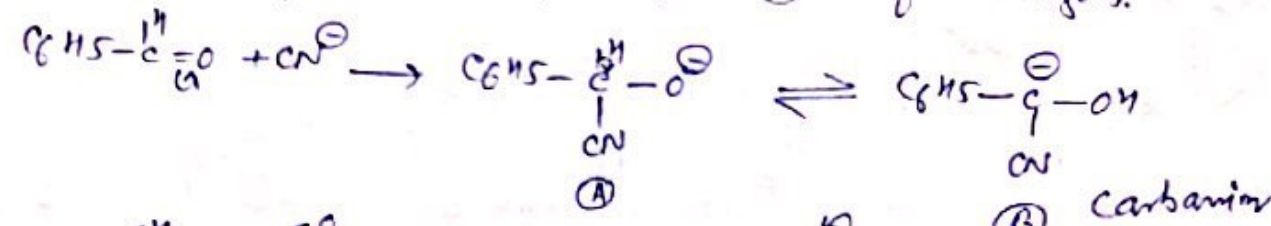
The basic catalyst employed is usually an amine. The function of the base is only abstraction of proton from active methylene compd.

3/ Benzoin Condensation

The self condensation of aromatic aldehydes (having no α -hydrogens) in presence of cyanide ion as a catalyst to α -hydroxy ketone (Benzoin) is called Benzoin Condensation.



Mech. Cyanide ion attacks carbonyl group to give (A). Cyanide group due to its electron withdrawing nature makes aldehyde hydrogen more acidic to get (A) into (B). The anion (B) attacks another aldehyde carbon for the fusion. The deprotonation-protonation steps form (C) and finally cyanide ion departs from (C) to form benzoin.

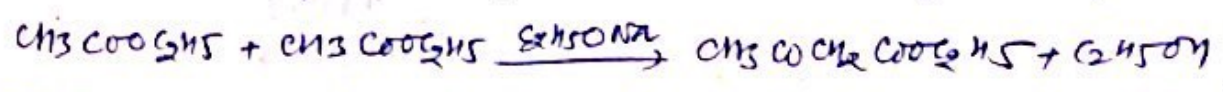


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4/ Claisen Condensation

The base catalysed condensation of an ester containing α hydrogen atom with another molecule of the same or different ester to give β -keto ester is called Claisen Condensation.

The well known example is the condensation of two molecules of ethyl acetate in presence of Sodium Ethoxide to give ethyl aceto acetate



The base commonly used is Sodium alkoxide. Corresponding to the OR of the ester function to avoid ester interchange, which leads to mixed ester from transesterification.