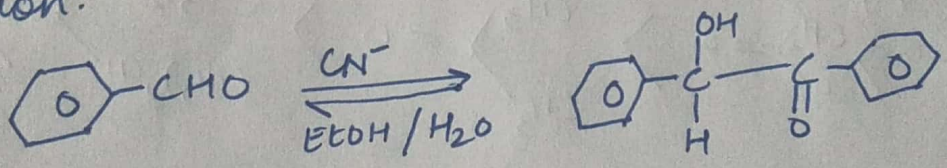
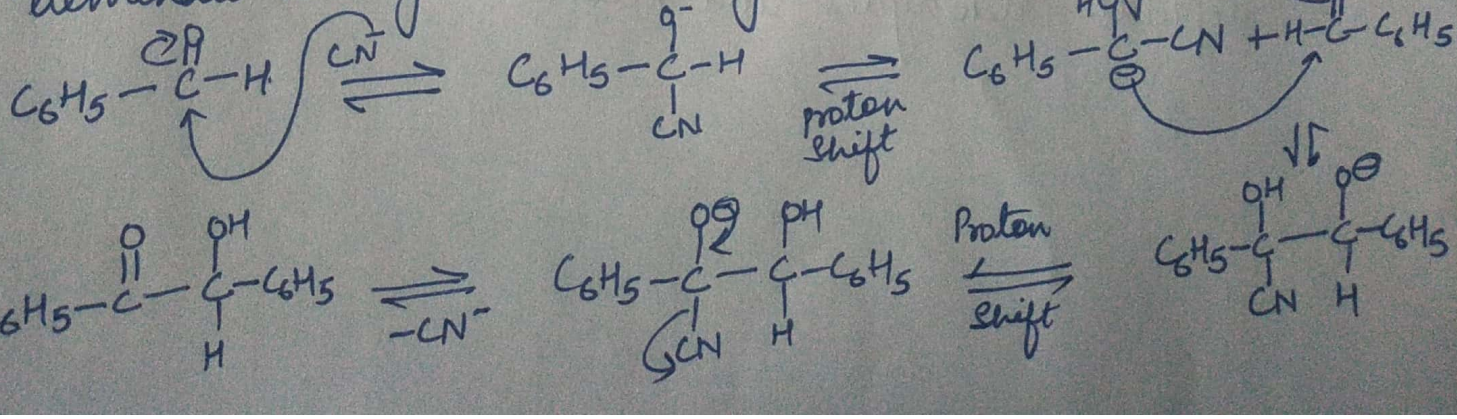
Benzoin Condensation :-

Aromatic aldehydes on treatment with cyanide ions (Sodium or potassium cyanide) undergo self condensation to form α-hydroxy ketone (Benzoin). This is known as Benzoin Condensation.

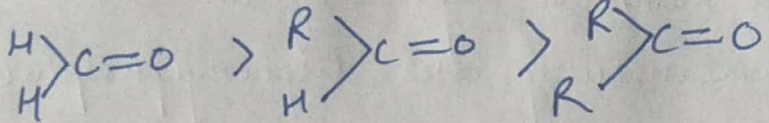


The first step is addition of cyanide ~~ion~~ into the aldehyde to generate alkoxide. This undergoes a 1,2 hydrogen shift to generate an anion which can add into another aldehyde molecule. The alkoxide generated then undergoes another proton shift to generate another alkoxide which can eliminate the cyanide to regenerate the catalyst.

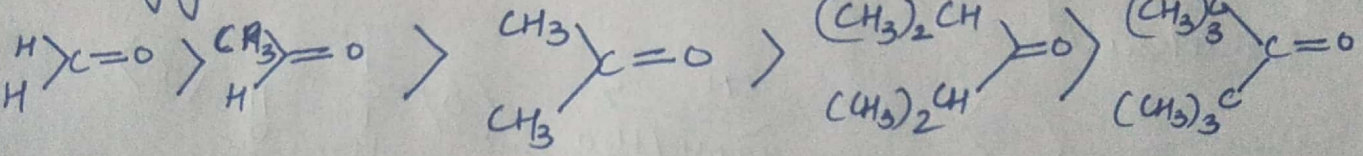


Reactivity of aldehyde and ketone towards Nucleophilic Addition Reaction:-

① The ease with which a nucleophile attacks the carbonyl carbon depends upon the magnitude of the positive charge on the carbonyl carbon. Since an alkyl group has electron donating effect (+I effect) therefore greater the number alkyl groups attached to carbonyl carbon greater is the electron-density on the carbonyl carbon and hence lower its its reactivity towards nucleophilic addition reactions. Thus



② As the number and the size of these alkyl groups increase the attack of the nucleophile on the carbonyl group become more and more difficult due to steric hinderance. In other words as crowding increases, the reactivity decreases accordingly.



* In general aromatic aldehyde and ketones are less reactive than the corresponding aliphatic analogues. This is due to the reason that (+R effect) of the benzene ring increases the electron density on the carbonyl carbon thereby repelling the nucleophiles. As a result, aromatic aldehydes and ketones are less reactive than the corresponding aliphatic aldehydes and ketones.