Organic Chemistry Revision Sheets
Carbonyl Compounds | Nucleophilic Addition ($NaBH_4$)

Reaction

REACTANTS: Carbonyl (aldehyde or ketone) and $NaBH_4$ or $LiAlH_4$
PRODUCT: Alcohol
REACTION TYPE: Nucleophilic Addition, *reduction*

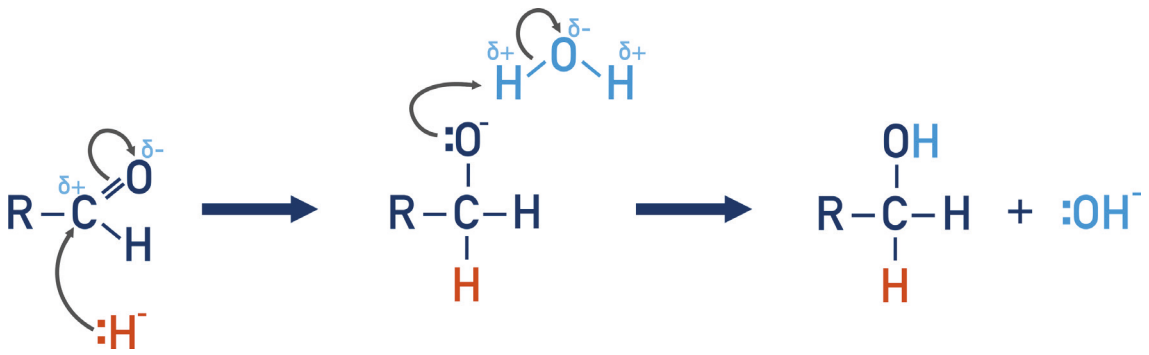
REACTION: (example of ketone)

Ketone

Alcohol (Secondary)

Mechanism

Hydride ion ($:H^-$) comes from reducing agent ($NaBH_4$ or $LiAlH_4$*) and **acts as a nucleophile due to its lone pair of electrons attacking the carbon (with partial positive charge) in the carbonyl group**. A carbon-hydrogen bond forms. The carbon-oxygen double bond breaks to a single bond, giving the oxygen a negative charge. The negative oxygen is protonated by water, forming a hydroxyl group and a hydroxide ion. Alcohol is formed, H is added to the carbonyl.***Addition reaction.***



Notes:

- Aldehydes form **primary alcohols** when reduced.
- Ketones form **secondary alcohols** when reduced.
- *$NaBH_4$ and $LiAlH_4$ are reducing agents, they are able to provide hydride ($:H^-$) ions that are needed for the reduction of carbonyls.