



Organic Chemistry Revision Sheets

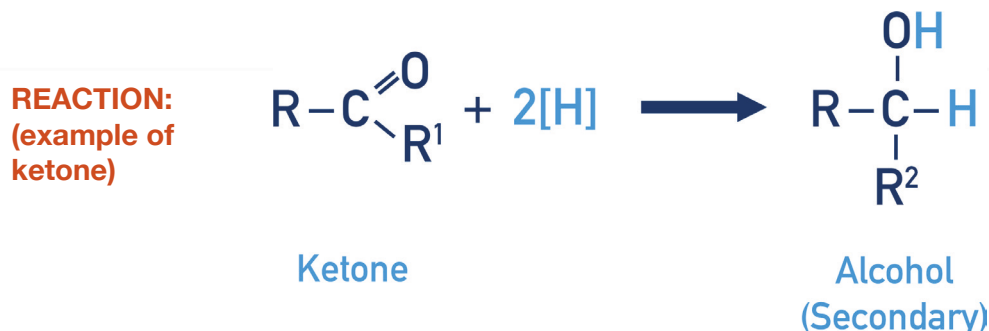
Carbonyl Compounds | Nucleophilic Addition (NaBH_4)

Reaction

REACTANTS: Carbonyl (aldehyde or ketone) and NaBH_4 or LiAlH_4

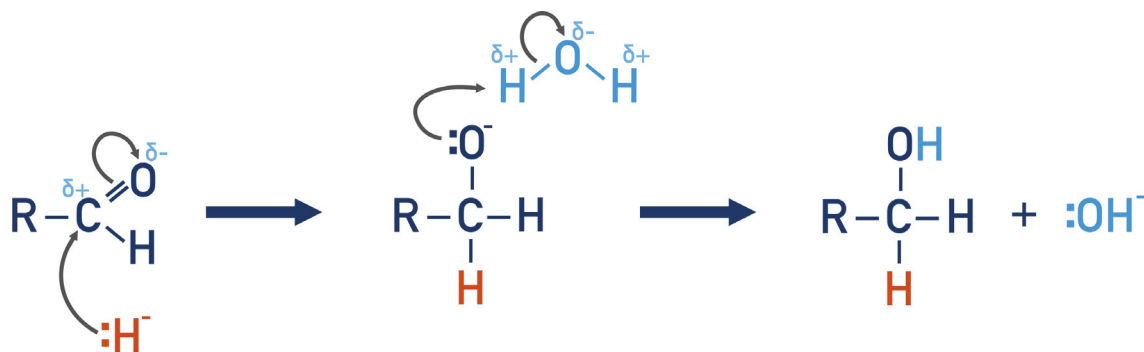
PRODUCT: Alcohol

REACTION TYPE: Nucleophilic Addition, *reduction*



Mechanism

Hydride ion ($:\text{H}^-$) 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 ($:\text{H}^-$) ions that are needed for the reduction of carbonyls.