Addition of a hydride anion ($\text{H}^-$) to an aldehyde or ketone gives an alkoxide anion, which on protonation yields the corresponding alcohol. Aldehydes produce 1°-alcohols and ketones produce 2°-alcohols.

In metal hydrides reductions the resulting alkoxide salts are insoluble and need to be hydrolyzed (with care) before the alcohol product can be isolated. In the sodium borohydride reduction the methanol solvent system achieves this hydrolysis automatically. In the lithium aluminum hydride reduction water is usually added in a second step. The lithium, sodium, boron and aluminum end up as soluble inorganic salts at the end of either reaction. Note! LiAlH$_4$ and NaBH$_4$ are both capable of reducing aldehydes and ketones to the corresponding alcohol.

**Mechanism**

This mechanism is for a LiAlH$_4$ reduction. The mechanism for a NaBH$_4$ reduction is the same except methanol is the proton source used in the second step.

1) Nucleophilic attack by the hydride anion
2) The alkoxide is protonated

Addition of an organometallic reagent to an aldehyde or ketone gives an alkoxide anion, which on protonation yields the corresponding alcohol. Aldehydes produce 2º-alcohols and ketones produce 3º-alcohols.

Addition to formaldehyde gives 1º alcohols

Addition to aldehydes gives 2º alcohols
Addition to ketones gives $^3\text{O}$ alcohols

**Mechanism**

1) Nucleophilic attack

2) Protonation

**Contributors**

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