

Alcohol Phenol Ether

Preparation of Alcohols

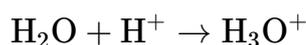
From Alkenes

1. Acid Catalysed Hydration:

- Alkenes react with water in the presence of an acid catalyst to form alcohols.
- For unsymmetrical alkenes, the addition follows Markovnikov's rule.

Mechanism:

- Step 1:** Protonation of alkene to form carbocation.



- Step 2:** Nucleophilic attack of water on the carbocation.
- Step 3:** Deprotonation to form an alcohol.

2. Hydroboration-Oxidation:

- Diborane (BH_3)₂ reacts with alkenes to give trialkyl boranes, which are then oxidized to alcohols by hydrogen peroxide in the presence of aqueous sodium hydroxide.
- The addition of borane to the double bond attaches the boron atom to the carbon with more hydrogen atoms, leading to anti-Markovnikov addition.

From Carbonyl Compounds

1. Reduction of Aldehydes and Ketones:

- Aldehydes and ketones are reduced to their corresponding alcohols by catalytic hydrogenation using catalysts like platinum, palladium, or nickel.
- Alternatively, reduction can be done using sodium borohydride (NaBH_4) or lithium aluminium hydride (LiAlH_4).
- Aldehydes yield primary alcohols, and ketones yield secondary alcohols.

2. Reduction of Carboxylic Acids and Esters:

- Carboxylic acids are reduced to primary alcohols using lithium aluminium hydride (LiAlH_4).
- Esters can be reduced similarly, or they can first be converted to alcohols through catalytic hydrogenation.

From Grignard Reagents

- Grignard reagents react with aldehydes and ketones to produce alcohols.
- The first step involves the nucleophilic addition of the Grignard reagent to the carbonyl group, forming an adduct. This adduct is then hydrolyzed to yield the alcohol.
- Methanal produces primary alcohols, other aldehydes produce secondary alcohols, and ketones produce tertiary alcohols.

Summary of Methods:

- **Alkenes to Alcohols:** Acid catalysed hydration, hydroboration-oxidation.
- **Aldehydes and Ketones to Alcohols:** Catalytic hydrogenation, NaBH_4 , LiAlH_4 .
- **Carboxylic Acids and Esters to Alcohols:** Reduction with LiAlH_4 .
- **Grignard Reagents with Carbonyl Compounds:** Nucleophilic addition followed by hydrolysis.

These methods cover the various ways to prepare alcohols from different starting materials, emphasizing both the reagents and conditions required for each reaction.