

# Alcohol Phenol Ether

## Physical Properties of Alcohols

### 1. Boiling Points

- Alcohols have higher boiling points compared to hydrocarbons, ethers, and haloalkanes of similar molecular masses due to the presence of intermolecular hydrogen bonding.
- The boiling points increase with the number of carbon atoms (van der Waals forces increase) and decrease with branching (decrease in surface area and van der Waals forces).

### 2. Solubility

- Alcohols are soluble in water due to their ability to form hydrogen bonds with water molecules.
- Solubility decreases with the increase in size of the alkyl group (hydrophobic effect). Lower molecular mass alcohols are miscible with water in all proportions.

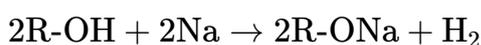
### 3. Density and Viscosity

- Alcohols are generally less dense than water.
- The viscosity of alcohols increases with the increase in molecular weight and the number of hydroxyl groups.

## Chemical Properties of Alcohols

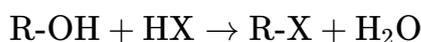
### 1. Acidity of Alcohols

- Alcohols are weakly acidic and can donate a proton (Brønsted acids). The acidic character decreases with the increase in alkyl chain length.
- Alcohols react with active metals like sodium, potassium, and aluminum to form alkoxides and hydrogen gas.



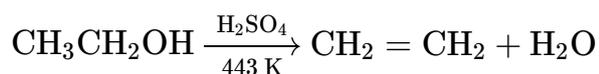
### 2. Reaction with Hydrogen Halides

- Alcohols react with hydrogen halides (HX) to form alkyl halides. This reaction is commonly used to distinguish between primary, secondary, and tertiary alcohols (Lucas test).



### 3. Dehydration

- Alcohols undergo dehydration to form alkenes when heated with concentrated sulfuric acid or phosphoric acid.



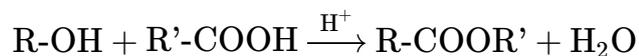
### 4. Oxidation

- Primary alcohols are oxidized to aldehydes and further to carboxylic acids.
- Secondary alcohols are oxidized to ketones.
- Tertiary alcohols are resistant to oxidation but can be oxidized under strong conditions to form carboxylic acids.



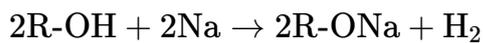
### 5. Esterification

- Alcohols react with carboxylic acids in the presence of an acid catalyst to form esters.



### 6. Reaction with Sodium

- Alcohols react with sodium to form alkoxides and hydrogen gas, demonstrating their weakly acidic nature.



## Summary of Reactions Involving Cleavage of Bonds

- O-H Bond Cleavage:** Reactivity as acids, forming alkoxides.
- C-O Bond Cleavage:** Conversion to alkyl halides, dehydration to alkenes.

These points cover the essential physical and chemical properties of alcohols, emphasizing their behavior in various reactions and interactions.