Saitechinfo NEET-JEE Academy

Here is a summary of important reactions related to the preparation and chemical properties of alcohols, phenols, and ethers.

Alcohols

Preparation Methods:

1. **Hydration of Alkenes:**

$$\text{Alkene} + H_2O \xrightarrow{\text{acid catalyst}} \text{Alcohol}$$

   Example: Ethene to ethanol using sulfuric acid as a catalyst.
2. **Reduction of Aldehydes and Ketones:**

$$\text{Aldehyde} \xrightarrow[\text{LiAlH}_4/\text{NaBH}_4]{} \text{Primary Alcohol} \quad \text{Ketone} \rightarrow \text{Secondary Alcohol}$$

   Example: Ethanal to ethanol, propanone to isopropanol.
3. **Hydrolysis of Alkyl Halides:**

$$\text{Alkyl Halide} + \text{Aqueous KOH} \rightarrow \text{Alcohol}$$

4. **Fermentation:**

$$\text{C}_6\text{H}_{12}\text{O}_6 \xrightarrow{\text{enzymes}} 2\text{C}_2\text{H}_5\text{OH} + 2\text{CO}_2$$

   Fermentation of glucose to ethanol.

Chemical Properties:

1. **Dehydration to form Alkenes:**

$$\text{Alcohol} \xrightarrow[\text{conc. H}_2\text{SO}_4]{443K} \text{Alkene} + H_2O$$

2. **Oxidation:**
   - **Primary alcohol** oxidizes to an **aldehyde** and then to a **carboxylic acid**:

$$\text{Primary Alcohol} \xrightarrow{\text{KMnO}_4/\text{K}_2\text{Cr}_2\text{O}_7} \text{Aldehyde} \rightarrow \text{Carboxylic Acid}$$

   - **Secondary alcohols** oxidize to **ketones**:

$$\text{Secondary Alcohol} \xrightarrow{\text{Oxidizing Agent}} \text{Ketone}$$

3. **Reaction with Sodium:**

$$\text{Alcohol} + \text{Na} \rightarrow \text{Alkoxide Salt} + H_2$$

4. **Esterification:**

$$\text{Alcohol} + \text{Carboxylic Acid} \xrightarrow{\text{acid}} \text{Ester} + H_2O$$

Phenols

Preparation Methods:

1. **From Chlorobenzene (Dow's Process):**

$$\text{Chlorobenzene} + \text{NaOH} \xrightarrow{623K, 300atm} \text{Sodium Phenoxide} \xrightarrow{\text{HCl}} \text{Phenol}$$

2. **From Cumene (Cumene Hydroperoxide Process):**

$$\text{Cumene} \xrightarrow{\text{O}_2} \text{Cumene Hydroperoxide} \xrightarrow{\text{H}_2\text{O}} \text{Phenol} + \text{Acetone}$$

Chemical Properties:

1. **Electrophilic Substitution Reactions:**
   - **Nitration:**

$$\text{Phenol} + \text{HNO}_3 \rightarrow \text{Ortho and Para Nitrophenol}$$

   - **Halogenation:**

$$\text{Phenol} + \text{Br}_2 \rightarrow \text{2,4,6-Tribromophenol}$$

2. **Reaction with Sodium Hydroxide:**

$$\text{Phenol} + \text{NaOH} \rightarrow \text{Sodium Phenoxide} + H_2O$$

3. **Riemer-Tiemann Reaction:**

$$\text{Phenol} + \text{CHCl}_3 + \text{NaOH} \rightarrow \text{Salicylaldehyde}$$

4. **Kolbe's Reaction:**

$$\text{Phenol} + \text{CO}_2 + \text{NaOH} \rightarrow \text{Salicylic Acid}$$

Ethers

Preparation Methods:

1. **Williamson Ether Synthesis:**

$$\text{Alkyl Halide} + \text{Sodium Alkoxide} \rightarrow \text{Ether} + \text{NaX}$$

   Example: Synthesis of diethyl ether from sodium ethoxide and ethyl bromide.
2. **Dehydration of Alcohols:**

$$2\text{Alcohol} \xrightarrow{\text{conc. } \text{H}_2\text{SO}_4, 413K} \text{Ether} + H_2O$$

Chemical Properties:

1. **Cleavage by Acids:**

$$\text{Ether} + \text{HX} \xrightarrow{\text{heat}} \text{Alcohol} + \text{Alkyl Halide}$$

2. **Inert Nature:** Ethers are generally inert and do not react with bases, oxidizing agents, or reducing agents under normal conditions. However, they can undergo cleavage reactions with strong acids like HI or HBr.

These reactions cover the key preparation methods and important chemical properties for alcohols, phenols, and ethers, which are essential for understanding their behavior in organic chemistry.