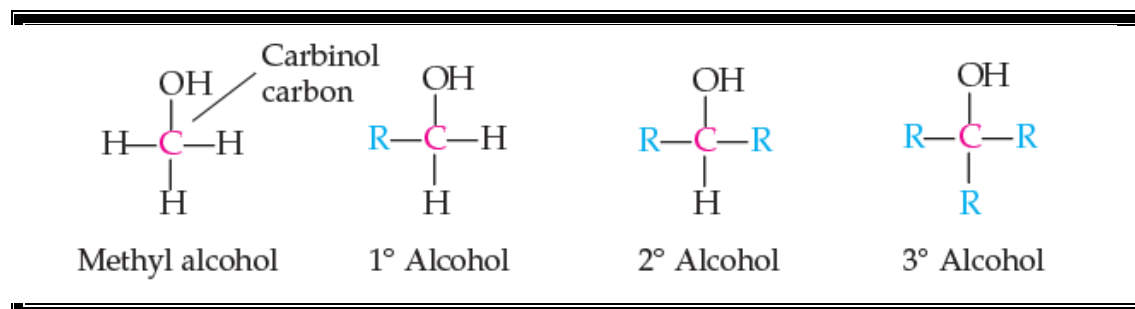


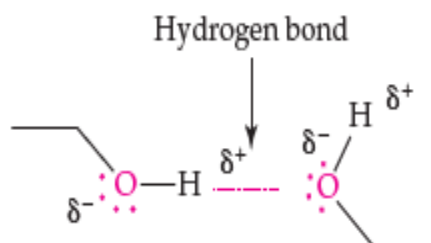
Lecture 3: Alcohols

An alcohol is an organic compound that contains a hydroxyl group (—OH) attached to an alkyl group (R—O—H). Alcohols are classified as **primary (1°)**, **secondary (2°)**, or **tertiary (3°)**, depending on the number of alkyl groups attached to the **carbinol carbon**, the carbon bearing the hydroxyl (—OH) group. If no alkyl groups are attached, the alcohol is methyl alcohol.

- ▶ A primary alcohol **has one alkyl group attached to the carbinol carbon.**
- ▶ A secondary alcohol **has two alkyl groups attached to the carbinol carbon.**
- ▶ A tertiary alcohol **has three alkyl groups attached to the carbinol carbon.**



- They are very polar because the hydroxyl group is polar
- Alcohols form intermolecular hydrogen bonds and as a result have higher boiling points than hydrocarbons of comparable molar mass.



Nomenclature of alcohols

- In the IUPAC system, alcohols are named by determining the parent compound and replacing the -e ending with -ol.
- Common names are derived from the alkyl group corresponding to the parent compound.

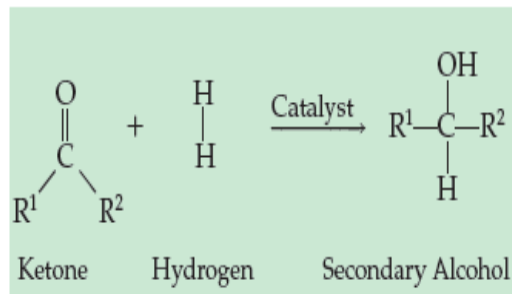
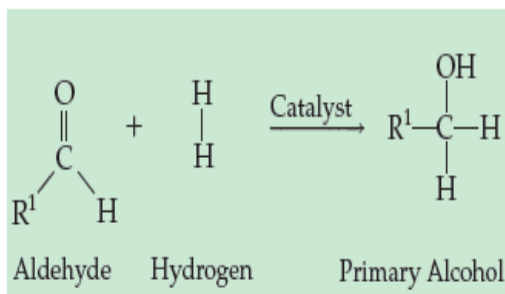
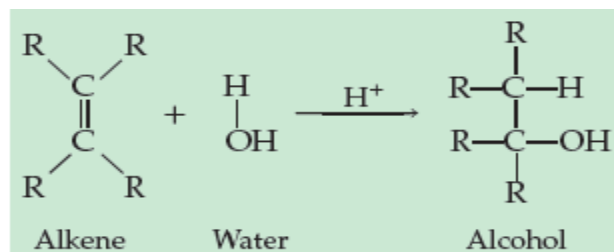
Study the following examples:



NOMENCLATURE OF ALCOHOLS		
Formula	Common Name	IUPAC Name
$\text{CH}_3\text{—OH}$	Methyl alcohol	methanol
$\text{CH}_3\text{—CH}_2\text{—OH}$	Ethyl alcohol	ethanol
$\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—OH}$	n-propyl alcohol	propan-1-ol
$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3\text{—CH—CH}_3 \end{array}$	Isopropyl alcohol	propan-2-ol
$\text{CH}_3\text{—CH}_2\text{—CH}_2\text{—CH}_2\text{—OH}$	n-butyl alcohol	butan-1-ol
$\begin{array}{c} \text{OH} \\ \\ \text{CH}_3\text{—CH}_2\text{—CH—CH}_3 \end{array}$	sec-butyl alcohol	butan-2-ol
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{—C—OH} \\ \\ \text{CH}_3 \end{array}$	tert-butyl alcohol	2-methylpropan-2-ol
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{—CH—CH}_2\text{—OH} \end{array}$	Isobutyl alcohol	2-methylpropan-1-ol
$\begin{array}{c} \text{CH}_3 \\ \\ \text{CH}_3\text{—C—CH}_2\text{—OH} \\ \\ \text{CH}_3 \end{array}$	Neopentyl alcohol	2,2-dimethylpropan-1-ol

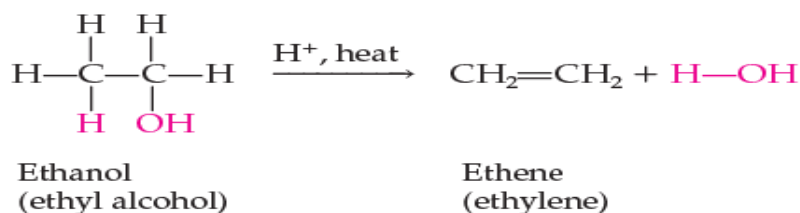
Preparation of alcohol

Alcohols can be prepared by the hydration of alkenes **OR** the reduction of aldehydes and ketones.



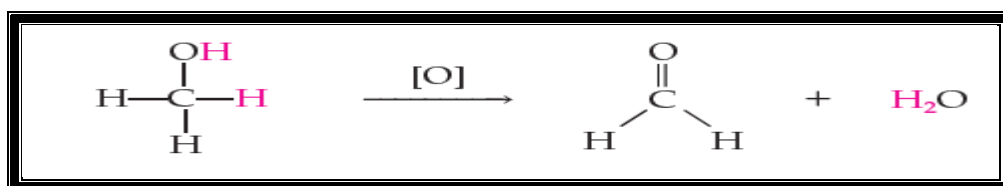
Reaction of alcohol

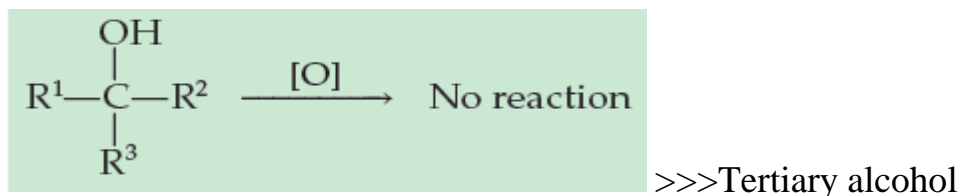
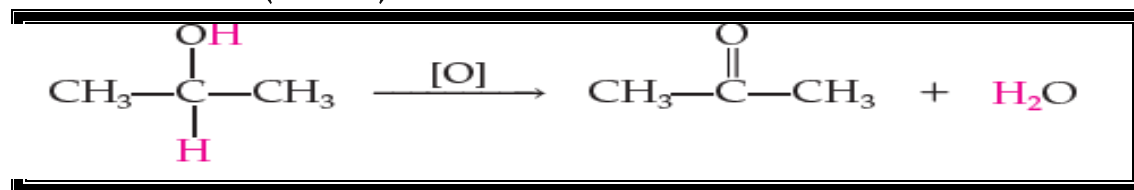
1. Alcohols can undergo dehydration to produce alkenes



2. Oxidation Reactions

Alcohols may be oxidized with a variety of oxidizing agents to **aldehydes**, **ketones** and **carboxylic acids**. The most commonly used oxidizing agents are solutions of basic potassium permanganate ($\text{KMnO}_4/\text{OH}_2$) and chromic acid (H_2CrO_4). The symbol [O] over the reaction arrow is used to designate any general oxidizing agent.





Importance of alcohols

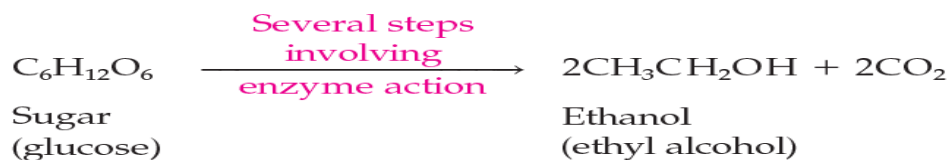
1. Methanol

- A. Methanol (methyl alcohol), CH_3OH , is a colorless and odorless liquid that is used as a solvent and as the starting material for the synthesis of methanal (formaldehyde).
- B. Methanol is toxic and can cause blindness and perhaps death if ingested.

2. Ethanol

- A. Ethanol spirits consist of a mixture of ethanol with a small quantity of methanol, Because methanol is poisonous, industrial Ethanol spirits are unfit to drink.
- B. Ethanol (ethyl alcohol), $\text{CH}_3\text{CH}_2\text{OH}$, is a colorless and odorless liquid and is the alcohol in alcoholic beverages. It is also widely used as a solvent and as a raw material for the preparation of other organic chemicals.

Fermentation is usually done by using yeast to act on carbohydrates to produce ethanol and carbon dioxide.



3. Propanol

- A. Propanol was commonly called *rubbing alcohol* because patients with high fevers were often given alcohol baths to reduce body temperature. Rapid evaporation of the alcohol results in skin cooling. This practice is no longer commonly used.

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B. It is also used as an antiseptic, an industrial solvent, and a raw material in the synthesis of organic chemicals. It is colorless, has a very slight odor, and is toxic when ingested.

4. 1,2-Ethanediol (ethylene glycol): is used as automobile antifreeze..
5. 1,2,3-Propanetriol (glycerol): is a viscous, sweet-tasting, nontoxic liquid. It is very soluble in water and is used in cosmetics, pharmaceuticals, and lubricants. Glycerol is obtained as a byproduct of the hydrolysis of fats.

Medical Perspective:

A. Fetal Alcohol Syndrome: The use of alcoholic beverages by a pregnant woman can cause *fetal alcohol syndrome (FAS)*. When the alcohol consumed by the mother crosses the placenta and enters the bloodstream of the fetus. Within about 15 minutes (min), the concentration of alcohol in the blood of the fetus is as high as that of the mother! However, the mother has enzymes to detoxify the alcohol in her blood; the fetus does not.

1. abnormalities including mental retardation,
2. poor growth before and after birth
3. facial malformations
4. alcohol can cause cell division to stop or be radically altered.
5. alcohol toxicity damages a number of aspects of fetal nervous system development. Among these are cell division, differentiation, and migration of axons.

B. Alcohol interferes with the liver function, so the liver unable to break down fats creating fatty acids. **Cirrhosis** is a condition in which liver tissue is destroyed and then replaced with scarred tissue. Scarred that it is unable to function, no blood flow in scared area. Most peoples die due to Cirrhosis are heavy drinkers.

Alcohol's Effects on the Body:

