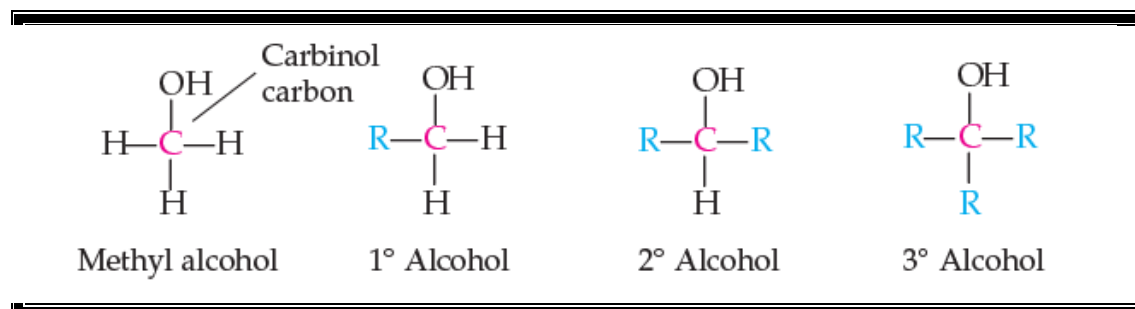


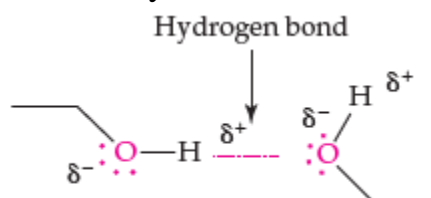
Lecture 3: Alcohols and Nitro compounds

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.



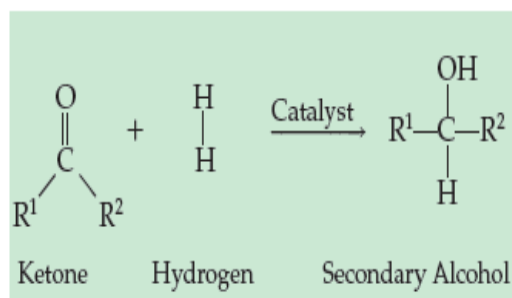
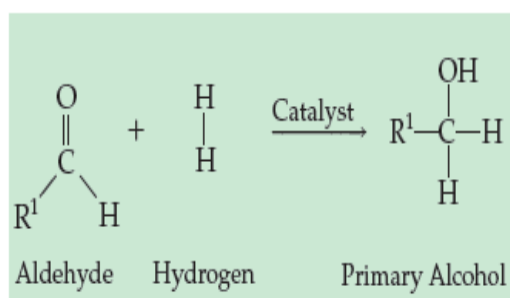
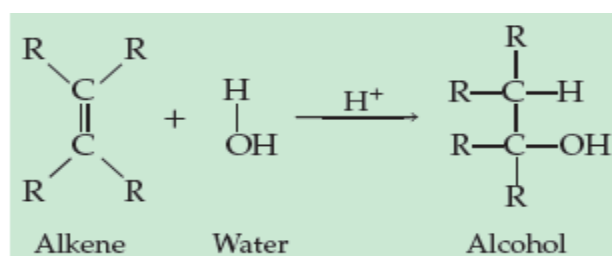
3.1 Nomenclature

- In the IUPAC system, alcohols are named by determining the parent compound and replacing the -e ending with -ol.

- The parent chain is numbered to give the hydroxyl group the lowest possible number.
- Common names are derived from the alkyl group corresponding to the parent compound.

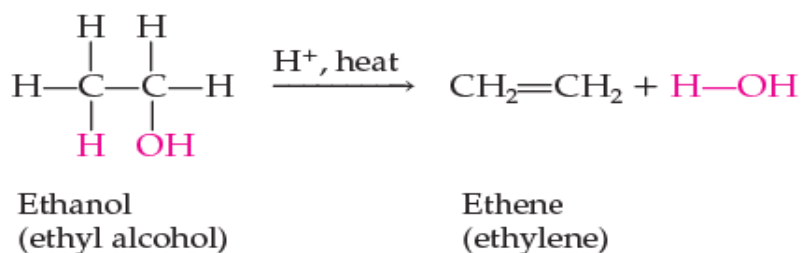
3.2 Preparation of alcohol

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



3.3 Reaction of alcohol

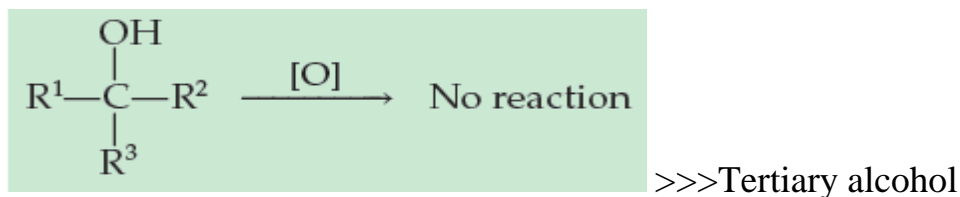
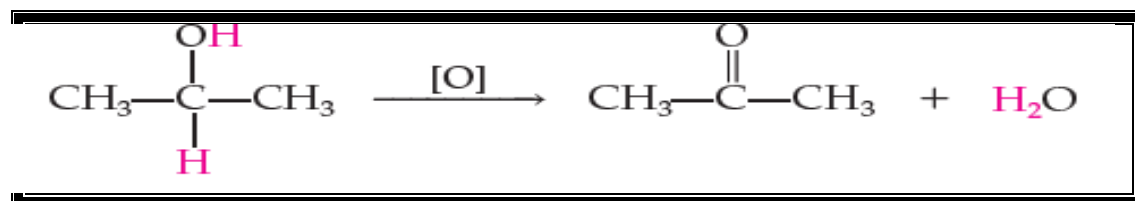
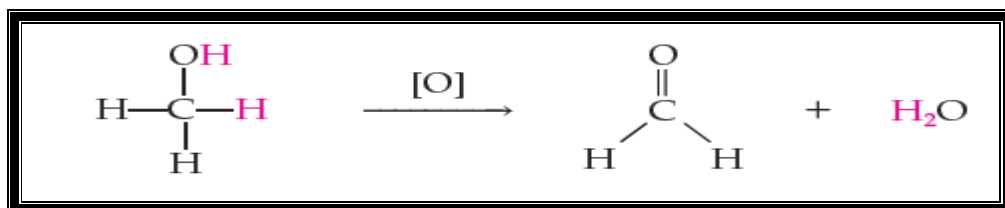
1. Alcohols can undergo dehydration to produce alkenes



Dehydration is an example of an elimination reaction; that is, one in which a molecule loses atoms or ions from its structure.

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.

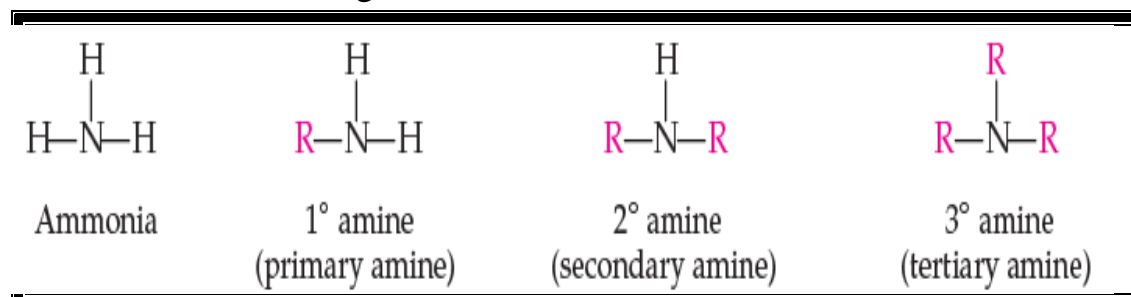


3.4 Medical important of alcohols

- Methanol is a toxic alcohol that is used as a solvent.
- Ethanol is the alcohol consumed in beer, wine, and distilled liquors. It is produced by the alcohol fermentation of sugars
- Isopropanol is used as an antiseptic.
- Ethylene glycol (1,2-ethanediol) is used as antifreeze.
- Glycerol (1,2,3-propanetriol) is used in cosmetics and pharmaceuticals.

3.5 Amines

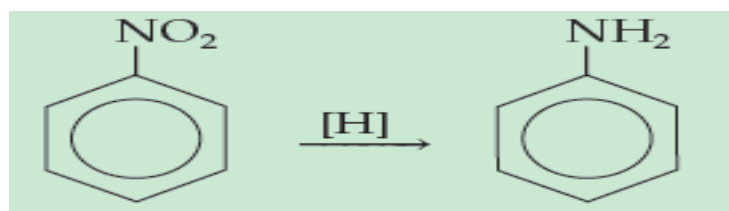
- Amines are organic derivatives of ammonia and, like ammonia, they are basic. In fact, amines are the most important type of organic base found in nature.
- Primary amines are liquids at room temperature containing three to four carbon atoms, whereas higher amines are solids.
- Amines are classified according to the number of alkyl or aryl groups attached to the nitrogen.



- The nitrogen atom is more electronegative than the hydrogen atoms in amines. As a result, the N-H bond is polar. In addition, the nitrogen atom contains an unshared pair of electrons. As a result, hydrogen bonding between amine molecules or between amine molecules and water can occur.

3.6 Preparation of Amines

In the laboratory, amines are prepared by the reduction of amides and nitro compounds.



- On the other hand: The breakdown of amino acids releases amines, famously in the case of decaying fish which smell of trimethylamine. Many neurotransmitters are amines, including epinephrine, norepinephrine, dopamine, serotonin, and histamine.

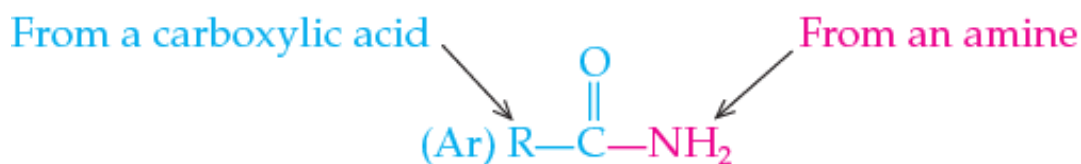
- Urea is the chief nitrogenous end product of the metabolic breakdown of proteins in all mammals and some fishes. In the breakdown of proteins amino groups are removed from the amino acids that partly comprise proteins. These amino groups are converted to ammonia, which is toxic to the body and thus must be converted to urea by the liver. The urea then passes to the kidney and is eventually excreted in the urine.

3.7 Medically Important Amines

- Although amines play many different roles in our day-to-day lives, one important use is in medicine. A host of drugs derived from amines is responsible for improving the quality of life, whereas others, such as cocaine and heroin, are highly addictive.
- Amphetamines, such as benzedrine and methedrine, stimulate the central nervous system. They elevate blood pressure and pulse rate and are often used to decrease fatigue. Medically, they have been used to treat depression and epilepsy.
- Ephedrine, its stereoisomer pseudoephedrine, and phenylephrine are used as decongestants in cough syrups and nasal sprays. These compounds are very closely related to dopamine, which is a key compound in the function of the central nervous system.
- The sulfa drugs, the first chemicals used to fight bacterial infections, are synthesized from amines

3.8 Amide

- **Amides** are the products formed in a reaction between a carboxylic acid derivative and ammonia or an amine.



- Most amides are solids at room temperature. They have very high boiling points, and the simpler ones are quite soluble in water. Both of these properties are a result of strong intermolecular hydrogen bonding between the N-H bond of one amide and the C=O group of a second amide.

Mustansiriyah University

College of Medicine

Chemistry and Biochemistry Department

Medical Chemistry (Organic) / Lecturer. Dr. Tamara Sami Naji

3.9 Medically Important Amides

- Barbiturates, often called “downers,” are derived from amides and are used as sedatives. They are also used as anticonvulsants for epileptics and for people suffering from a variety of brain disorders that manifest themselves in neurosis, anxiety, and tension.
- Phenacetin and acetaminophen are also amides. Acetaminophen is an aromatic amide that is commonly used in place of aspirin, to relieve pain and reduce fever.

Note:

1. The main difference between amine and amide is the presence of a carbonyl group in their structure; amines have no carbonyl groups attached to the nitrogen atom whereas amides have a carbonyl group attached to a nitrogen atom.
2. Amines are derivatives of ammonia with at least one alkyl or aryl group, while amides are derivatives of a carboxylic acid with a carbonyl group attached to a nitrogen atom