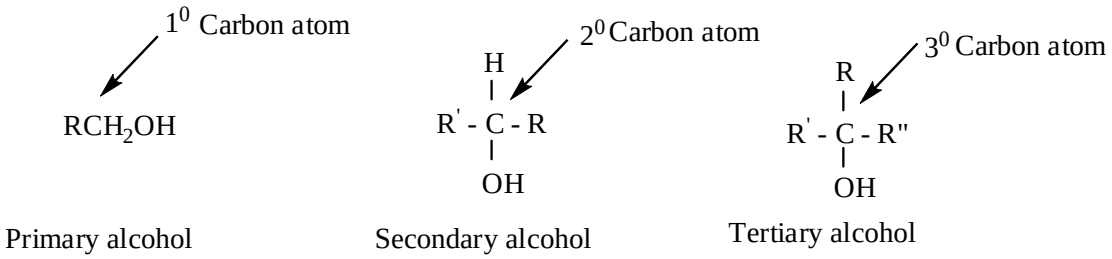
Alcohols , Phenols and Ethers

Alcohols : are compounds that contain as (-OH) group, called a hydroxyl or hydroxy group, bonded to alkyl group, for example : CH_3CH_2OH.

Alcohols, are classified according to their structure. Thus, a primary alcohol is a compound in which the hydroxy group is bonded to a primary carbon.

In a secondary alcohol the hydroxy group is bonded to a secondary carbon. In a tertiary alcohol the hydroxy group is bonded to a tertiary carbon.

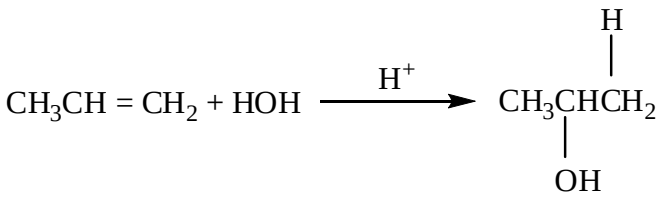


Primary alcohol Secondary alcohol Tertiary alcohol

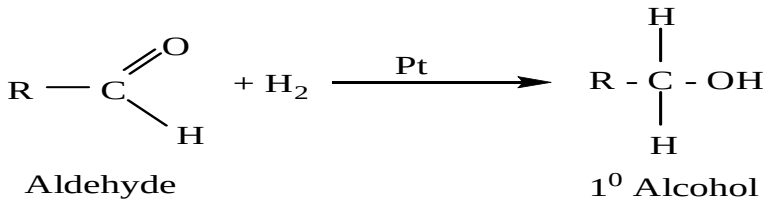
Preparing alcohols :

1- By hydration of alkenes:

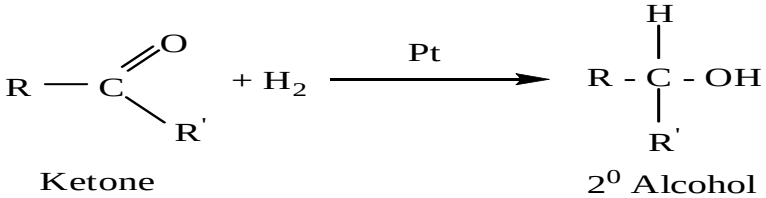
Add water to the double bond according to the **Markonikoff rule.**



2- By Reduction of carbonyl compounds :



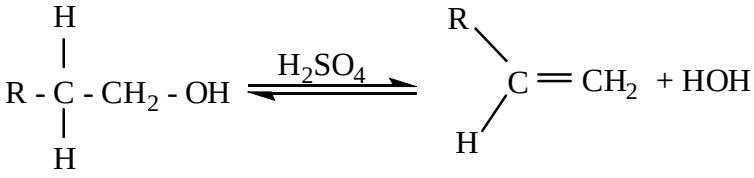
Aldehyde 1^0 Alcohol



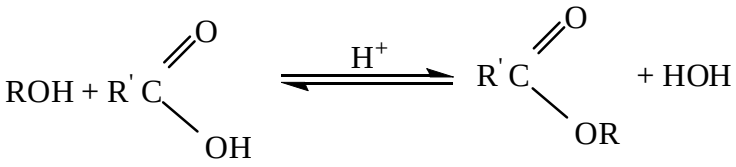
Ketone 2^0 Alcohol

Reactions of Alcohols

1- Dehydration :

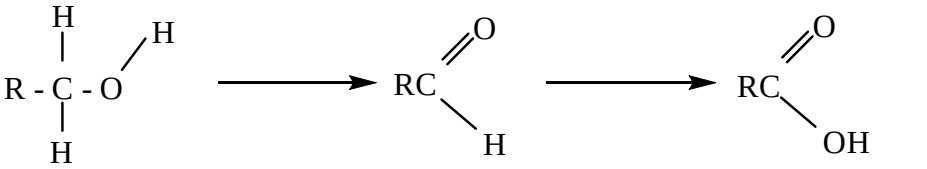


2- Ester formation

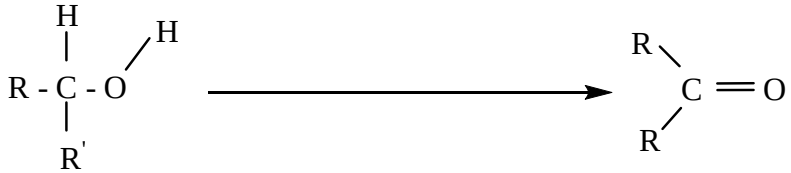


Alcohol Carboxylic acid Ester

3- Oxidation

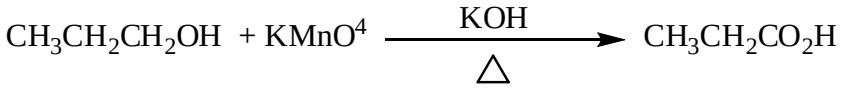


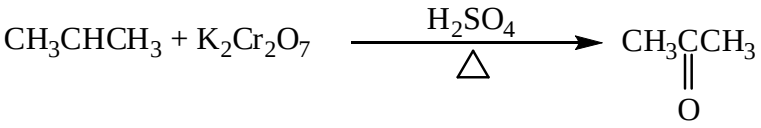
Primary alcohol Aldehyde Carboxylic acid



Secondary alcohol Ketone

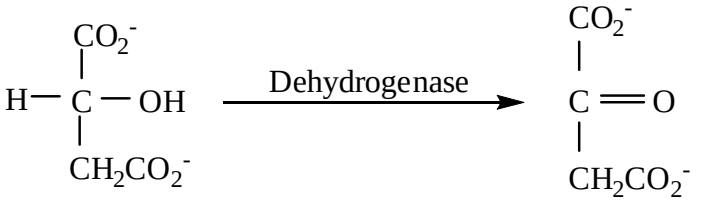
The usual reagent used for the oxidation of alcohols are acidic potassium dichromate or a hot alkaline solution of potassium permanganate.





Oxidation of Alcohols in living Systems

The oxidation of alcohols is an important reaction in living systems. Enzymes called dehydrogenase catalyze these reactions. One example is the oxidation of malate to oxaloacetate, which occurs in the citric acid cycle.

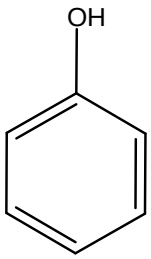


Malate Oxaloacetate

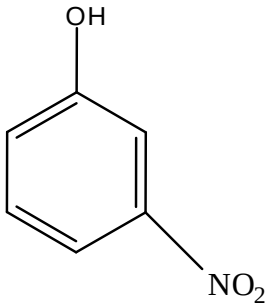
Phenols

Phenols are compounds that contain a hydroxyl group to a benzene ring.

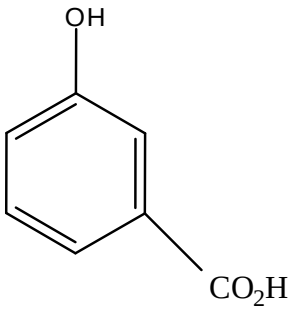
Examples :



Phenol

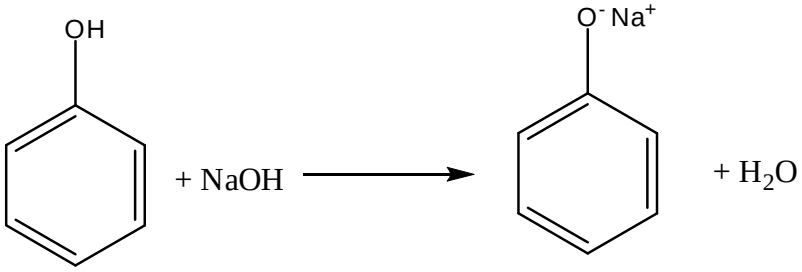


2- Nitrophenol



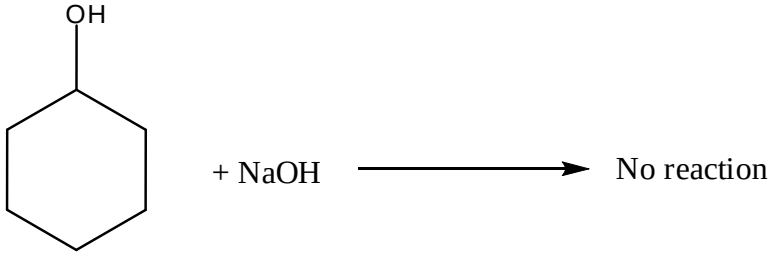
Salicylic acid

Phenol react with bases such as hydroxide ion, whereas cyclohexanol does not :



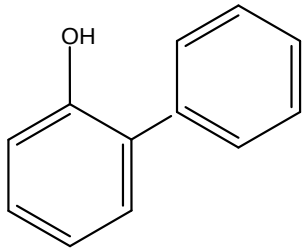
Phenol

Sodium phenoxide

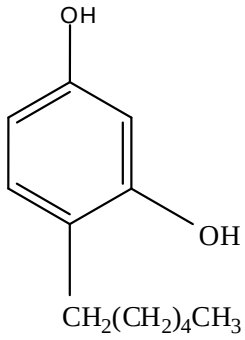


Cyclohexanol

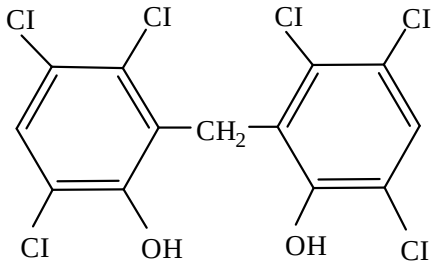
All phenolic compounds appear to have germicidal properties and it used in mouthwashes, germicidal soaps, some toothpastes, and deodorants, for example :



O – Phenylphenol

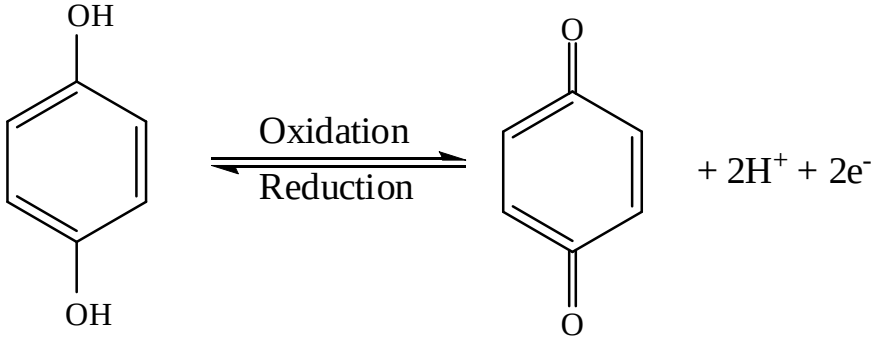


p - Hexylresocinol



Hexachlorophene

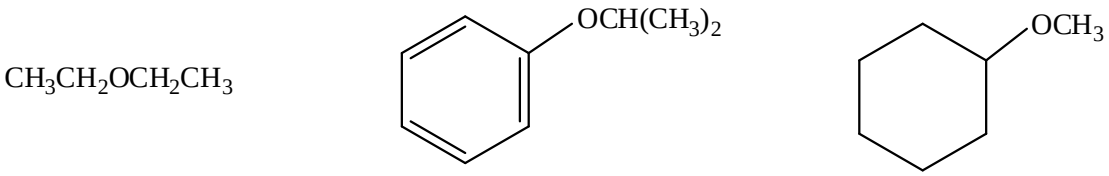
Aromatic 1,2- and 1,4- dihydroxy compounds are phenols that undergo an important **oxidation - reduction** reaction for example, **hydroquinone** is easily oxidized to **quinone.** This reaction is reversible, because quinone is easily reduced to hydroquinone, this reaction in the respiratory system.



Hydroxyquinone Quinione

Ethers

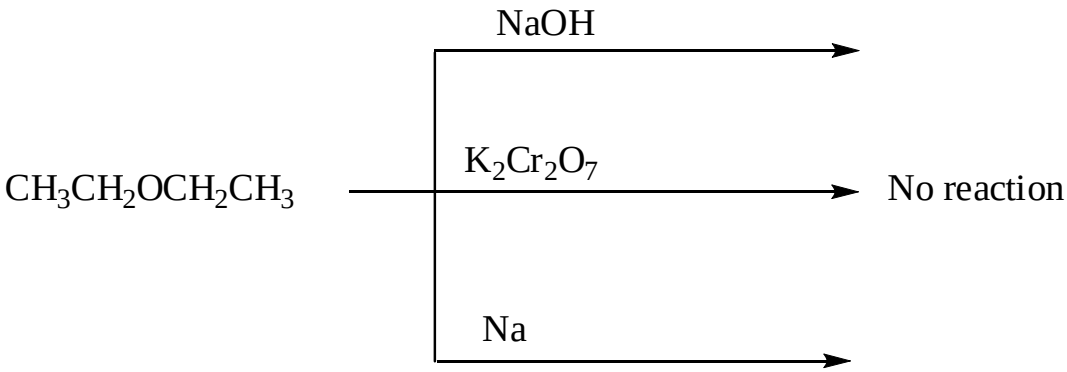
Ether are compounds that contain an **oxygen atom** bonded to **two alkyl groups, two aryl groups,** or one aryl group. For examples :



Diethyl ether | Isopropyl phenyl ether | Cyclohexyl methyl ether

Ethers are quite unreactive :

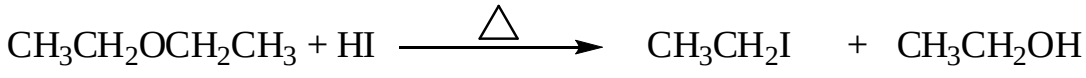
For example, they do not react with bases, most oxidizing reagent, or metals such as sodium or magnesium.



Ethers react with acids :

the products of the reaction with hydroiodic acid (HI) are an alkyl iodide and an alcohol.

A similar reaction occurs with hydrobromic acid (HBr).



Diethyl ether | Hydroiodic acid | Ethyl iodide | Ethanol