ALCOHOLS:

Alcohols are those organic compounds which are characterized by the presence of one, two or more ***hydroxyl groups (−OH)*** that are attached to the carbon atom in an alkyl group or hydrocarbon chain.
These alcohols are considered to be as the derivatives of water where one among the hydrogen atoms is replaced by alkyl group, which is typically represented by the letter R in an organic structure. Alcohol also comes in different structures and forms.

Alcohols are known to be one among most of the commonly occurring organic compounds. These are utilized in the form of sweeteners, preparation of perfumes, and sometimes in the process of synthesizing other compounds, wherein some others are abundantly manufactured in organic chemicals coming in various industries.

Main Types of Alcohols:

Alcohols are differentiated based upon the presence of the hydroxyl group attached. The location of this hydroxyl group as well will change the physical and chemical properties of any alcohol.

There are three types of alcohol. Alcohols are classified as ***primary, secondary or tertiary alcohols.***

Primary Alcohols

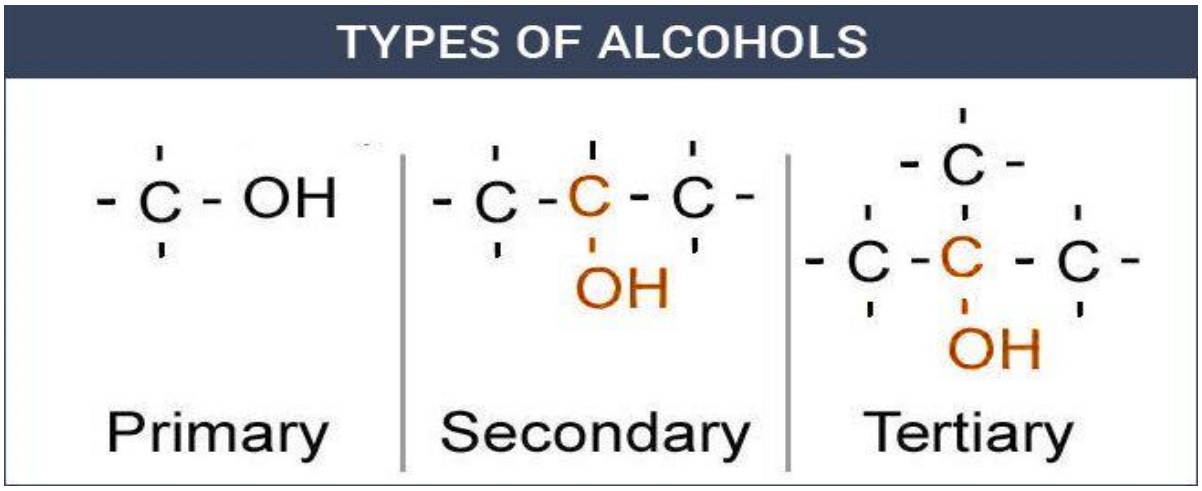
Primary alcohols are those alcohols where the carbon atom of the hydroxyl group (OH) is attached to only one single alkyl group. Some examples of these primary alcohols include Methanol (propanol), ethanol, etc. The complexity of this alkyl chain is unrelated to the classification of any alcohol considered as primary. The existence of only one linkage among – OH group and an alkyl group and the thing that qualifies any alcohol as a primary

2. Secondary Alcohols

Secondary alcohols are those where the carbon atom of the hydroxyl group is attached to two alkyl groups on either side. The two alkyl groups present may be either structurally identical or even different.

3. Tertiary Alcohols

Tertiary alcohols are those which feature a hydroxyl group attached to the carbon atom which is connected to 3- alkyl groups. The physical properties of these alcohols mainly depend on their structure. The presence of this -OH group allows the alcohols in the formation of hydrogen bonds with their neighboring atoms. The bonds formed are weak, and this bond makes the boiling points of alcohols higher than its alkanes.



QUALITATIVE TESTS FOR ALCOHOLS

To detect the alcoholic functional group in the organic compounds

1. Sodium metal test
2. Esterification test
3. Phosphorus pentachloride test
4. Cerric ammonium nitrate test
5. Acetyl chloride test

1. Sodium Metal Test:

Procedure:

1. Take the organic compound to be tested in a dry test tube.

2. Add 1gm of anhydrous calcium sulfate and shake well to remove excess water.
3. Decant the solution to another clean test tube.
4. Add a small piece of sodium metal.
5. If brisk effervescence appears due to the evolution of hydrogen gas indicate the presence of alcoholic group.

Principle: It is based on the appearance of *brisk effervescence* due to the liberation of hydrogen gas when alcohol reacts with active metals like sodium.

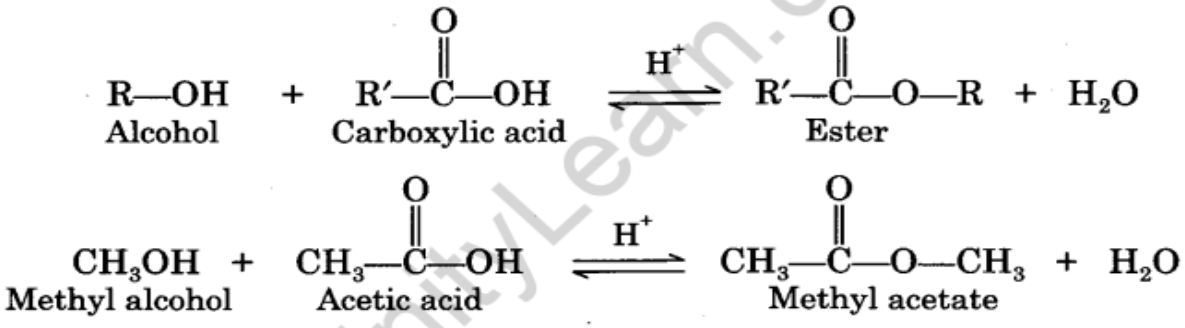
The alcohol to be tested should be dry because water also reacts with sodium. Sodium should be handled carefully; unreacted sodium should be destroyed by adding excess alcohol. This test is favorable if phenyl or carboxyl groups are absent.

Note: *Evolution of hydrogen gas cause a brisk effervescence indicates an alcoholic group.*

2. **Esterification Test:**

Procedure:

1. Take 1ml of the organic liquid to be tested in a clean dry test tube.
2. Add 1ml of glacial acetic acid and 2-3 drops of conc. sulfuric acid.
3. Heat the mixture in a water bath for 10 minutes.
4. The hot mixture is poured into a beaker containing cold water.
5. Smell the water in the beaker.
6. A fruity smell confirms the presence of alcoholic group.



Principle: Carboxylic acid reacts with alcohols forming a fruit smelling ester. The reaction between an alcohol and a carboxylic acid is called *esterification*. This reaction is a slow reaction catalysed by concentrated sulphuric acid.

Note: A sweet smell indicates the presence of alcoholic group.

3. Phosphorous Pentachloride Test:

Procedure: Alcohol reacts with PCl5 results in the mixture becomes warm with evolution of HCl Gas, the given compound contains an –OH group. The chemical equation is given below.

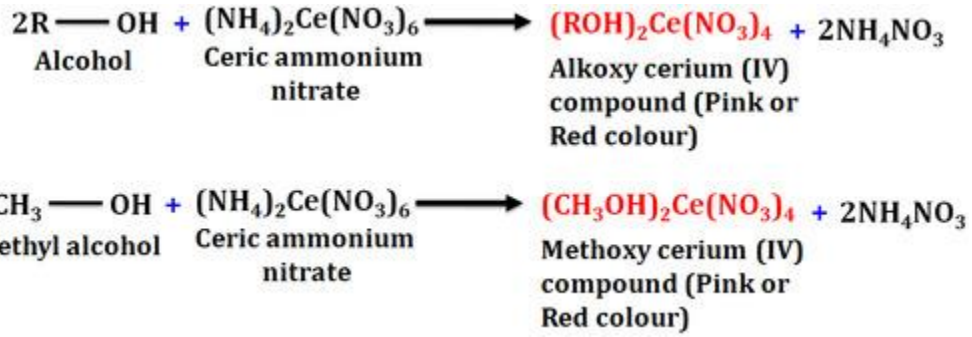
$$R\text{-}OH + PCl_5 \rightarrow R\text{-}Cl + POCl_3 + HCl$$

Note: Evolution of HCl gas indicates an alcoholic group

4. Cerric Ammonium Nitrate Test:

Procedure:

1. Take 1ml of given compound in a dry test tube.
2. Add a few drops of cerric ammonium nitrate reagent and shake the solution well.
3. Observe the solution.
4. If red precipitate appears then the presence of alcoholic group is conformed.



Principle: Alcohol or reaction with cerric ammonium nitrate forms a pink or red colour precipitates due to the formation of a complex compound and ammonium nitrate.

Note: The appearance of wine red color precipitate shows the presence of alcoholic group

5. **<u>Acetyl Chloride Test:</u>**

Procedure:

1. Take 2ml of given organic compound in a clean test tube
2. Add 1gm of anhydrous calcium sulfate and shake well.
3. Filter the solution. To the filtrate add 3 to 4 drops of acetyl chloride and shake well.
4. Take a glass rod dipped in ammonium hydroxide solution.
5. Bring the glass rod near the mouth of the test tube.
6. If white fumes occur then the presence of alcoholic group is conformed.

Principle: Alcohol reacts with acetyl chloride results in the formation of ester and hydrogen chloride. The resulting hydrogen chloride on contact with ammonium hydroxide forms white fumes of ammonium chloride and water.

Note: The formation of white fumes indicates the presence of alcohol.