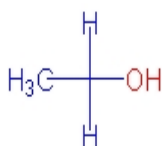


Alcohols**Purpose of experimental**

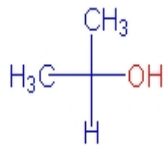
1. To characterization of alcohols
2. To learn some of characteristic chemical reactions of alcohols

Theory part of experimental

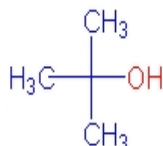
Alcohols and Phenols contain the functional group, OH. In a phenol, the OH group is connected to a carbon on a benzene ring where as in alcohols, the OH group is connected to a sp^3 hybridized carbon atom. Alcohols are classified as 1^0 , 2^0 and 3^0 , depending on the number of carbon atoms connected to the carbon bearing the OH group. Representative examples of a phenol, and three types of alcohols are shown below.



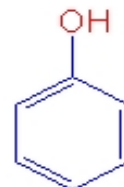
A primary alcohol



A secondary alcohol



A tertiary alcohol



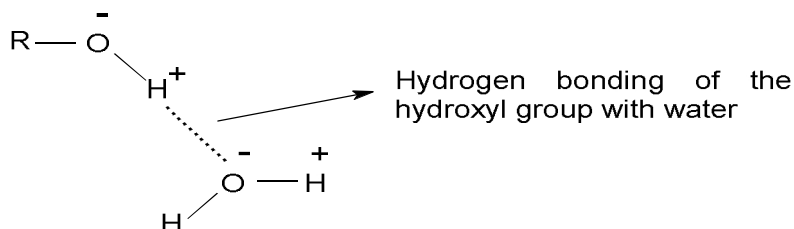
Phenol

Phenols are more acidic than alcohols. Alcohols as well as phenols find a variety of industrial, pharmaceutical, and even household applications. Derivatives of alcohols and phenols are found in medicines, alcohols are used as common industrial solvents etc.

Physical Properties

- Since the hydroxyl group is present in alcohols and phenols, these compounds are polar because of the hydroxyl group.
- The polar side and hydrogen bonding allows them to dissolve in water.

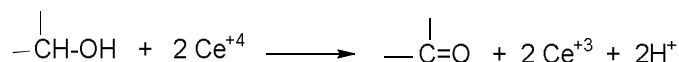
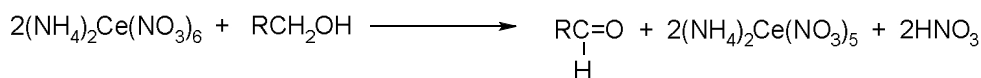
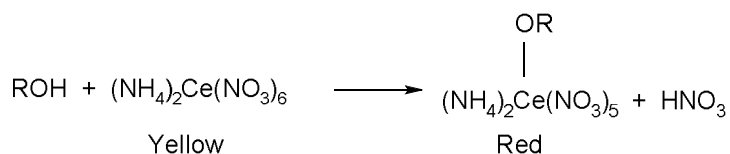
- The non-polar side allows them to dissolve in certain organic solvents, such as dichloromethane and diethyl ether.
- Alcohols are not acidic Phenols are acidic



Chemical Properties

1. General test for alcohols by addition of Ceric ammonium nitrate $(\text{NH}_4)_2\text{Ce}(\text{NO}_3)_6$

Ceric ammonium nitrate (yellow solution) is an oxidizing agent that reacts with alcohols to give a red complex and with phenols to give a brown to greenish brown precipitate.

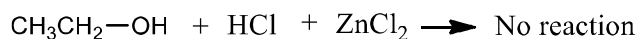


2. Lucas test: This test is used to distinguish between water-soluble primary, secondary, and tertiary alcohols. Lucas reagent is a mixture of zinc chloride, ZnCl_2 , in concentrated HCl . Upon addition of this reagent, a tertiary alcohol reacts rapidly and immediately gives an insoluble white layer. A secondary alcohol reacts slowly and, after heating slightly, gives the white layer within 15-20 min. A primary

Experimental No. (11)

Alcohols

alcohol does not react. Any formation of a heterogeneous phase or appearance of an emulsion is a positive test. The reaction depends on the formation of a stable carbonium ion. The more stable the carbonium ion formed, the faster the reaction is.

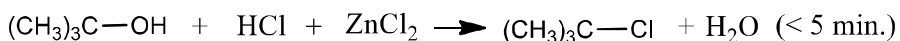


Primary alcohol



Secondary alcohol

Insoluble

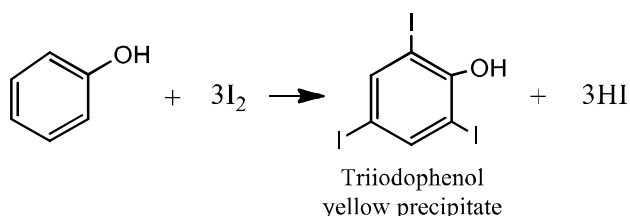
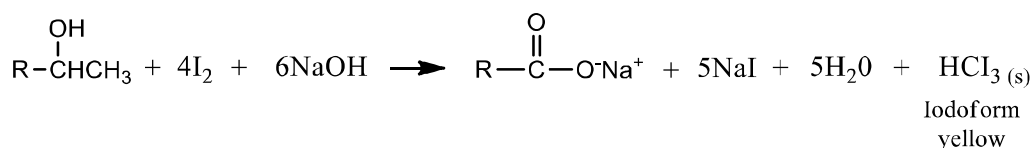


Tertiary alcohol

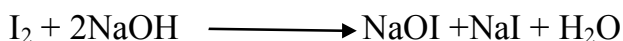
Insoluble

3- Iodoform test

This test is used to distinguish alcohols with the partial structure R—CH(OH)CH_3 from other alcohols. Phenols also react.



The mechanism of this reaction involves many steps, the first of which is the formation of the oxidizing agent sodium hypoiodate (NaOI).

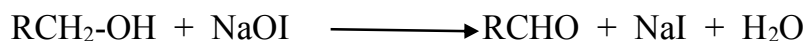


The next steps are: Oxidation of the alcohol to the corresponding

Experimental No. (11)

Alcohols

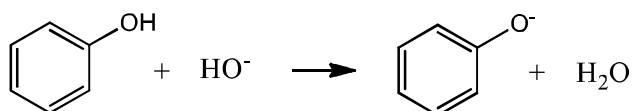
aldehyde or ketone by sodium hypoiodate .



Both ethanol and sec-butanol give positive iodoform test and they can be differentiated only by testing their solubility in water; sec-butanol is less soluble in water than ethanol.

4-Acidity

Phenols are acidic and dissolve in a basic solution. Alcohols are not acidic and will not dissolve in a basic solution.



Chemical and Apparatus

Different alcohols, ceric ammonium nitrate solution, H₂O, 10% NaOH, iodine (I₂) solution, test tube

Procedure of Experimental

1- General test

In test tube mix (1 ml) of the alcohol with one drop of ceric ammonium nitrate solution(reagent). A red complex indicates a positive test.

2- Lucas test

Mix (3 ml) of the alcohol with (1 ml) of Lucas reagent & observe the results: **Tertiary alcohols** give two phases that separate within 2-3 minutes. **Secondary alcohols** give two phases that separate after 15-

Experimental No. (11)**Alcohols**

20 minutes (giving a cloudy solution). In **primary alcohols** one layer appears

3- Iodoform test :

- In test tube mix (3 drops) of alcohol and (1 mL) of H₂O.
- Add about (1 ml) of 10% NaOH solution.
- Add iodine (I₂) solution drop wise with shaking until either a yellow iodoform precipitate is formed(test is positive and is completed) or the dark colour of the iodine solution is present. Allow the solution to stand for (3 minutes) during which period check for the appearance of the yellow precipitate at the bottom of the test tube. If there is no precipitate , warm the solution in water bath (60°C) for (3 minutes) with shaking from time to time and check for the yellow precipitate. Finally if no precipitate is formed after the 10 minutes-standing period, dilute the solution with an equal volume of distilled water to obtain the iodoform precipitate.

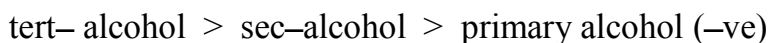
Results:

Record the results in the following table

No.	Name of alcohol	General test	Lucas test	Iodoform test
1-				
2-				
3-				

Questions for discussion

- 1- Explain , why the rate of the reaction among different alcohols with lucas reagent is shown below:



- 2- Write the mechanism of iodoform test reaction