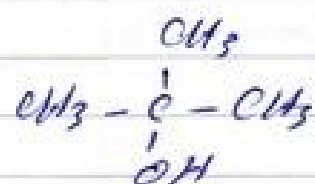


# **CHAPTER ONE ...**

## **ALCOHOLS**

# 1. Structure of alcohols:

Alcohols are compounds of the general formula  $ROH$ , where  $R$  is any alkyl or substituted alkyl group. The group may be primary, secondary or tertiary; it may be open chain or cyclic; it may contain a halogen atom, additional hydroxyls, or one of the many groups that are still unfamiliar to us: a double bond, or an aromatic ring. For example:



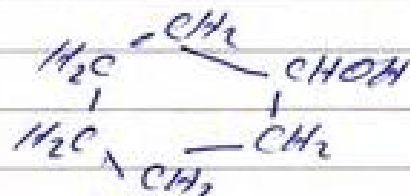
Tert-butyl alcohol

or 2-Methyl-2-propanol

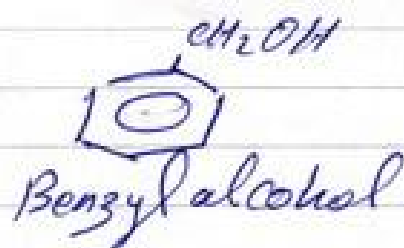


Allyl alcohol

or 2-propen-1-ol



cyclohexanol



Benzyl alcohol

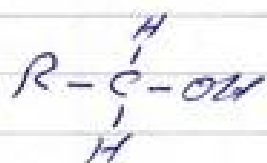


2-Chloroethanol

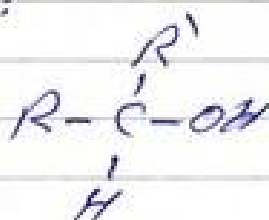


1,2,3-propanetriol  
or Glycerol

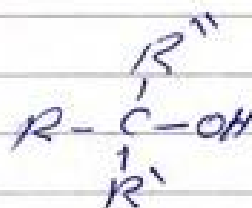
An alcohol is classified as primary, secondary and tertiary, according to the kind of carbon that bears the  $-OH$  group:



1°



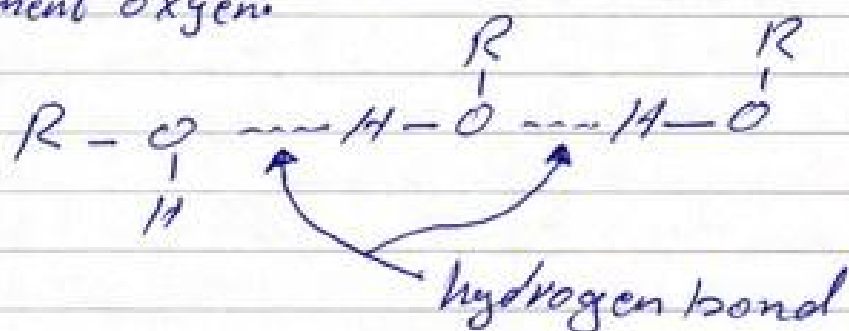
2°



3°

## 2. Physical properties of alcohols

The hydroxyl group is quite polar and most important, contains hydrogen bonded to the highly electronegative element oxygen.



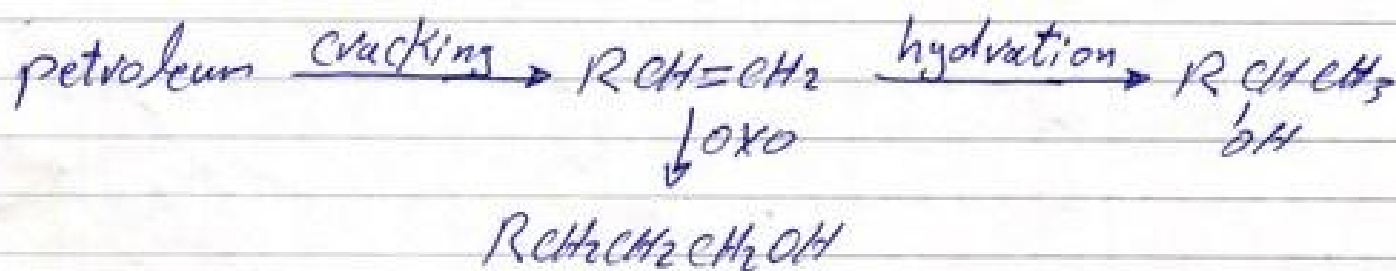
The boiling point of alcohols are almost highest from n-alkane, ethers, alkyl halide, aldehyde and water because present the hydrogen bond.

## 3. Industrial source of alcohols

There are three principal ways to get the simple alcohols that are the back-bone of aliphatic organic synthesis, ways that can utilize all our sources of organic raw material - petroleum, natural gas, coal and the biomass.

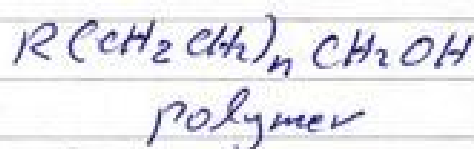
These methods are:

- a - by hydration of alkenes
- b - by the oxo process from alkenes
- c - by fermentation of carbohydrates



petroleum cracking  $\rightarrow R-CH=CH_2$

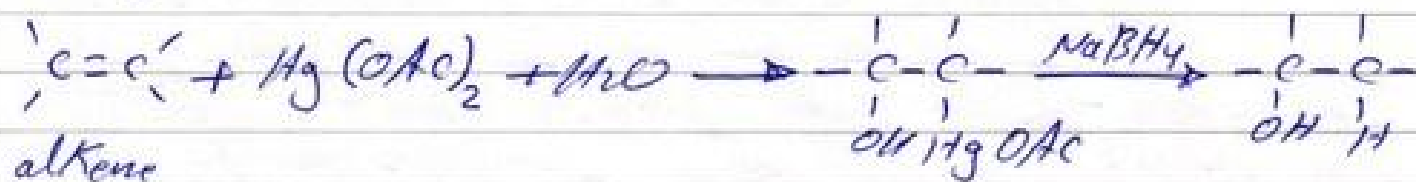
$\downarrow$  polymerisation



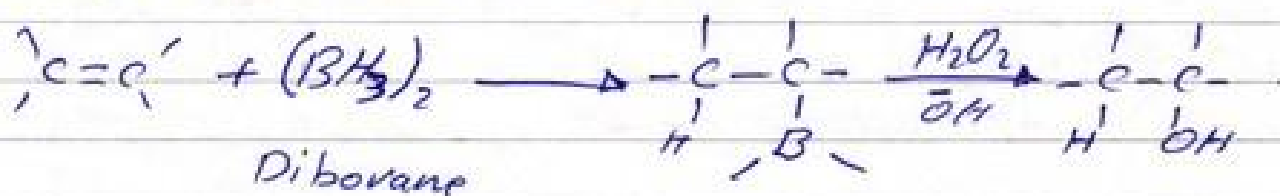
Sugars  $\xrightarrow{\text{Yeast fermentation}}$   $CH_3CH_2OH$   
ethyl alcohol

#### 4. Preparation of alcohols :

1- Oxymercuration - demercuration :



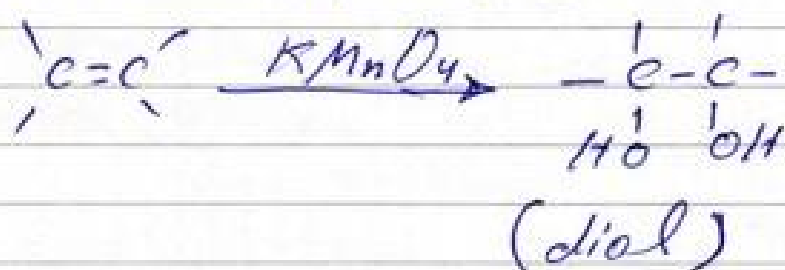
2- Hydroboration - Oxidation :



3- Hydrolysis of alkyl halide :

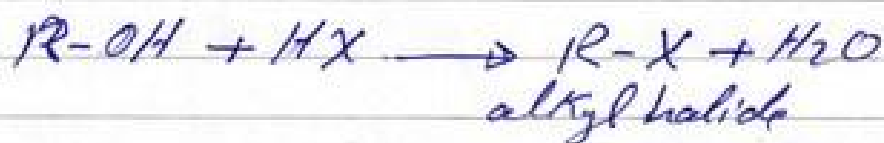


#### 4. Oxidation of alkenes:

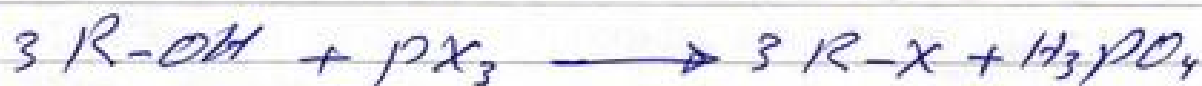


#### 5. Reactions of alcohols:

##### 1- Reaction with hydrogen halide:

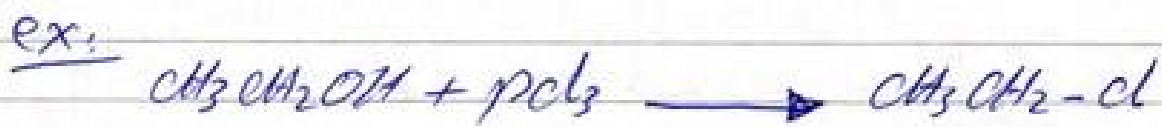


##### 2- Reaction with phosphorus trihalides:

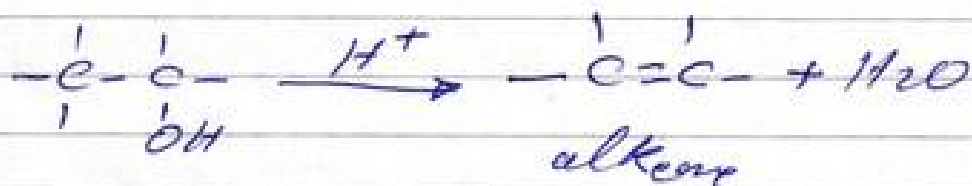


where:  $\text{PX}_3$  :  $\text{PBr}_3$  or  $\text{PCl}_3$ ,  $\text{PI}_3$

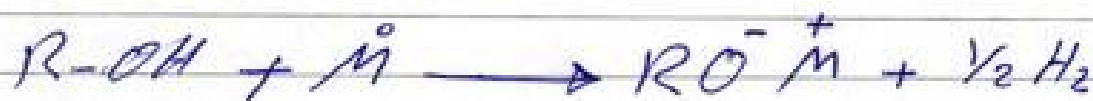
ex:



##### 3- Dehydration:

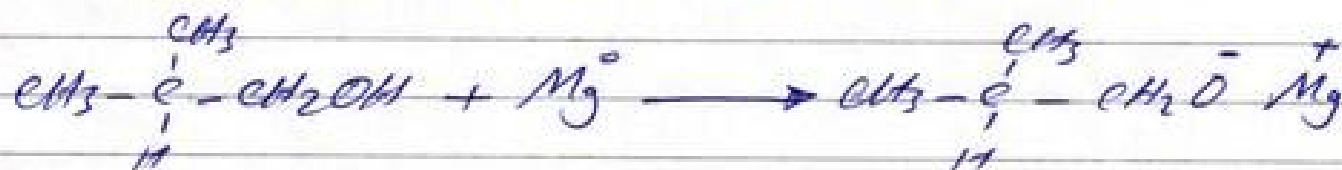


#### 4 - Reaction with active metals :

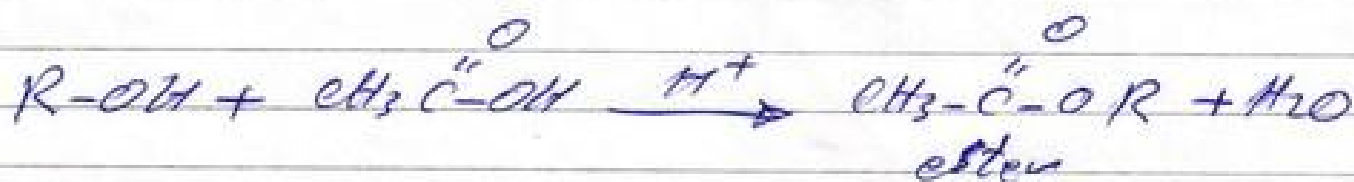
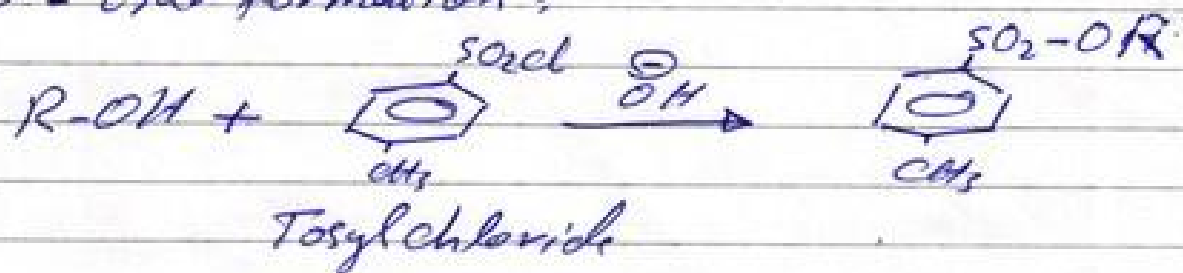


where M is Na, K, Mg, Al, ... etc.

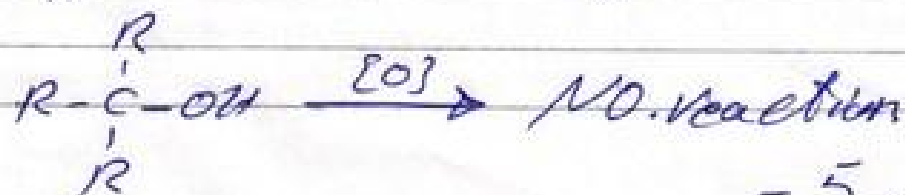
ex:



#### 5 - Ester formation :



#### 6 - Oxidation :



## Problems :

Q / Show all steps in a possible laboratory synthesis of each of the following from n-butyl alcohol :

1. n-butyl bromide
2. sodium n-butoxide
3. n-butyraldehyde

Q / Starting from alcohols of four carbons atom or fewer and making use of any necessary solvent or reagents to synthesis for each compounds :

1. 2-chloro propane
2. ethyl tosylate
3. potassium tert.-butoxide