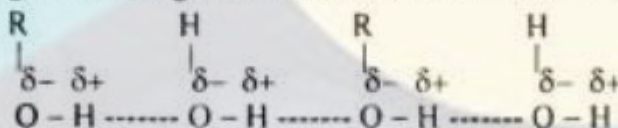


Short Questions and answers.

Q1: Write down the physical properties of alcohol?

Answer

Alcohol upto butanols are generally colourless liquids characteristics sweet smell and burning taste. They are readily soluble in H_2O . The solubility of alcohol is due to hydrogen bonding which is significant in lower alcohols but decreases in high alcohols.



Bonding which is present in alcohols but absent in alkanes.

Q2: Write down the structure of alcohol?

Answer

The alcohol functional group consists of an O atom bonded to a C atom and an H atom via σ bonds.

But the C-O and O-H bonds are polar due to the high electronegativity of the O atom.

Q3: Write down the acidity of alcohols?

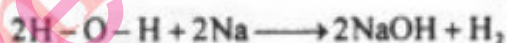
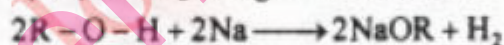
Answer

Due to the electronegativity of the O-atoms alcohols are slightly acidic.

The atom released by the deprotonation of an alcohol is the alkoxide.

Alkoxides are important bases in organic chemistry.

Alcohol reacts with Na (or) like H_2O to give the alkoxide.



Q4: Write down the reaction of RLi or RMgX aldehydes and ketones.

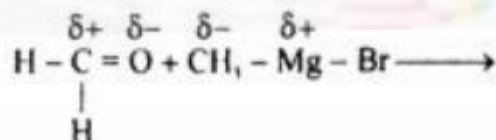
Answer

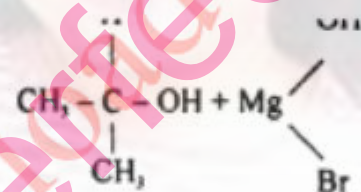
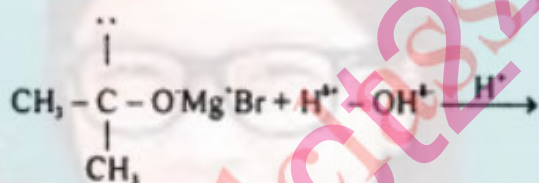
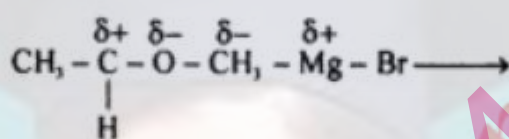
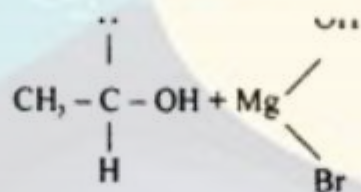
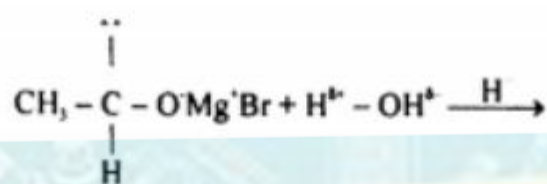
Primary, secondary and tertiary alcohols can be prepared by the use of Grignard reagents. The Grignard reagent acts to a carbonyl molecule and the resulting compound from alcohol on hydrolysis.

a) Primary Alcohol: From aldehyde gives primary alcohol with Grignard's reagent.

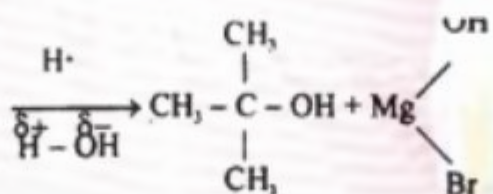
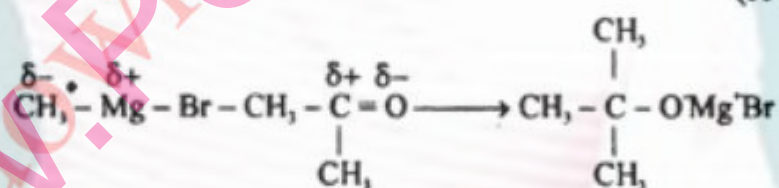
b) Secondary Alcohol: All other aldehydes give secondary alcohols.

c) Tertiary Alcohols: Ketones from tertiary alcohols with Grignard's reagent under similar conditions.





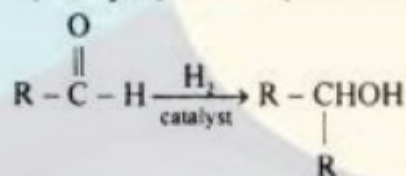
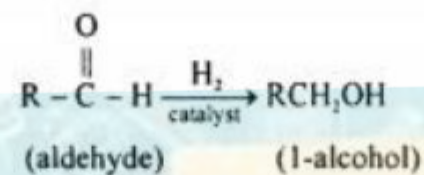
(so propyl alcohol)



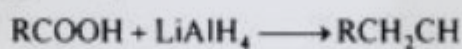
Q5: Write down the reduction of aldehydes and ketones?

Answer

Reduction of aldehydes, ketones and carboxylic acid (esters in the presence of Ni, Pd or Pt) gives alcohol.



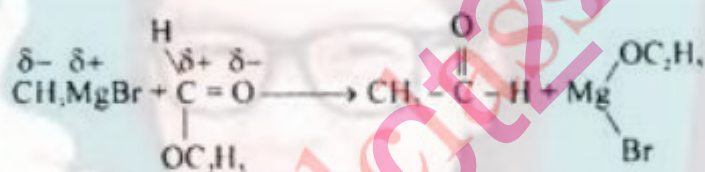
LiAlH_4 besides reducing aldehydes, ketones and ester, also reduces carboxylic acid.



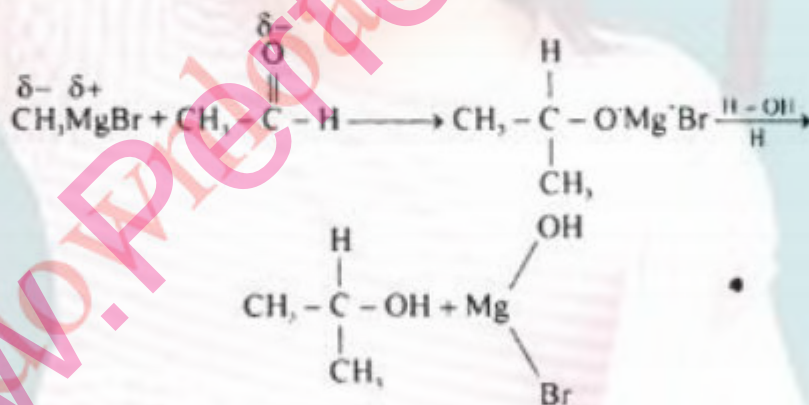
Q6: Write down the reaction of RLi or RMgX with esters?

Ester react with Grignard reagent to form alcohols? Justify it?

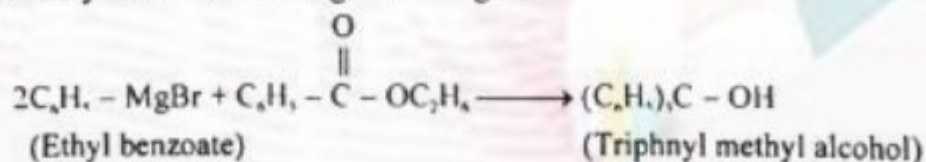
Answer



The aldehyde so formed reacts with another molecule of Grignard's reagent to give alcohol.



Ester give tertiary alcohols with Grignard's reagents.

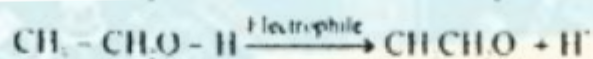
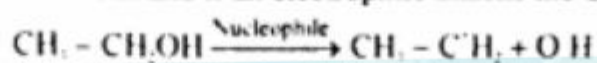


Q7: Write down the order of reactivity of alcohol with respect to O-H bonds cleavage?

Answer

Alcohol reacts with other reagents due to the breaking of C - O and O - H bonds. Breaking of bonds depends upon the nature of the attacking reagent moleculeophile

attacks the C-O bonds break and if an electrophile attacks the O-H bonds bonds breaks.



The order of reactivity of alcohol with respect to cleavage of C-O bond is

Tertiary alcohol Secondary alcohol primary alcohol

The order of reactivity of alcohol with respect to O-H bonds cleavage.

CH_3OH Tertiary alcohol Secondary alcohol Primary alcohol.

Q8: What is Lucas test?

Answer

The difference of chemical reactivity of alcohol with halogen acid is used for their identification.

For this purpose alcohol is treated with a solution of Zncl₂ in concentrated HCl.

1) Tertiary alcohol immediately forms an insoluble layer of a ter-alkyl chloride.

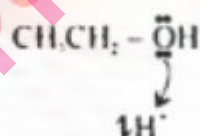
2) Secondary alcohol forms an insoluble Sec alkyl chloride in 5-10 minuts.

3) Primary alcohol form an insoluble prim-alkyl chloride on heating.

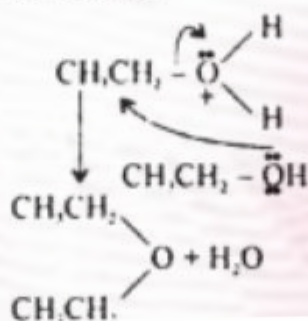
Q9: Write down the mechanisms for alcohol condensation to give an ether?

Answer

Step 1: An acid/base reaction protonation of the alcoholic oxygen to make a better leaving group. This step is very fast and recensible. This lone pairs on the oxygen make it a lewis base.



Step 2: The O of the second alcohol molecule functions as the nucleophile and attacks to displace the good leaving group a nutral water molecule by cleaning the C-O bond. This create an oxoniumion intermediate.



Step 3: Another acid/base reaction. The proton is unmount by a situable base to give the ether produced.

Q10: Write down the preparation of eaters?

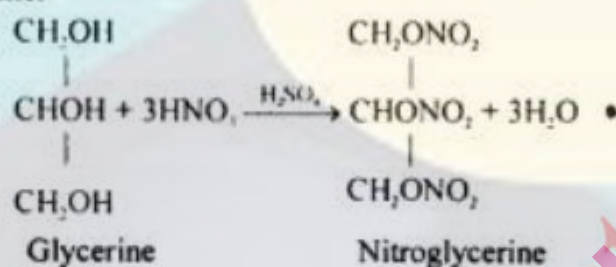
Answer

Alcohol react with organic as well as inorganic acid to form their sespective esters.

This alkyl halides and also esters of halogen acids.



Glycerine reacts with a mixture of concentrated HNO_3 and H_2SO_4 to give an ester called Nitroglycerine.



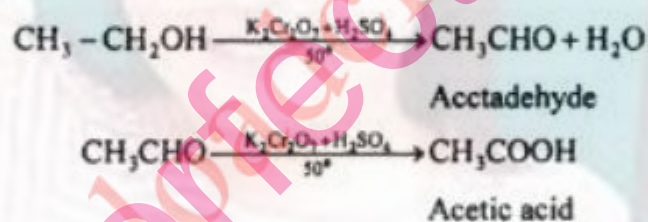
Q11: Write the oxidation of primary, alcohols and secondary alcohols?

Answer

Alcohols are easily oxidized by alkaline KMnO_4 or $\text{K}_2\text{Cr}_2\text{O}_7 + \text{H}_2\text{SO}_4$ solution to give different products.

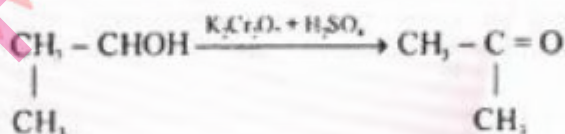
i) **Primary alcohols:**

Primary alcohol is first oxidized to an aldehyde, which is further oxidized to a carboxylic acid.



ii) **Secondary alcohol:**

A secondary alcohol is oxidized under similar condition to give a ketone which is not further oxidized.

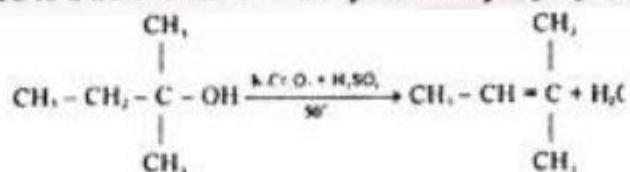


Q12: Write down the oxidation of tertiary alcohol and cleavage of 1, 2 diols?

Answer

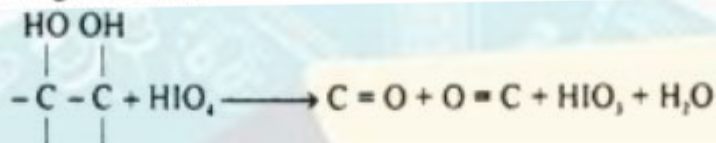
Tertiary alcohol:

Tertiary alcohol is not oxidized by alkaline KMnO_4 when heated with a mixture of $\text{K}_2\text{Cr}_2\text{O}_7$ and H_2SO_4 . It is first dehydrated to an alkene in the presence of acid. Then alkene is oxidized to a ketone and a carboxylic acid by $\text{K}_2\text{Cr}_2\text{O}_7$ and H_2SO_4 .



Cleavage of 1, 2 Diols.

Oxidation cleavage of Diols.



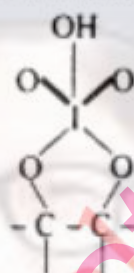
1,2 or vicinal diols are cleaved by periodate and HIO_4 in two carbonyl compounds.

The reaction is selective for 1,2 diols.

The reaction occurs with the formation of a cyclic periodate ester.

This can be used as a functional group test for 1,2 diols.

The products are determined by the substituents on the diol.



Q13: Draw and explain the structure of phenols?

Answer

The alcohol functional group consists of an O atom bonded to an sp_2 hybridized aromatic C atom and a H atom via σ bonds.

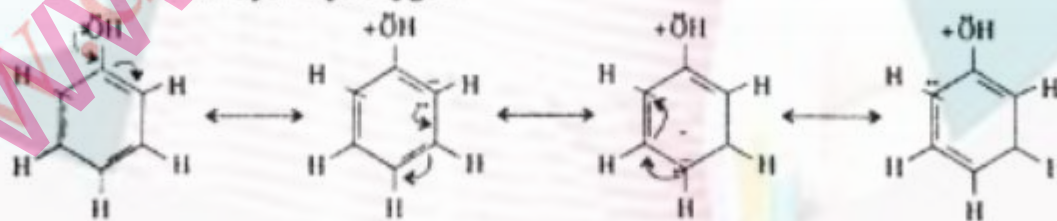
Both the C-O and O-H bonds are polar due to the high electronegativity of the O atom. Conjugation exists between an unshared electron pair on the oxygen and the aromatic ring.

This results in a compound similar to simple alcohol.

→ a shorter carbon oxygen bond distance.

→ a more basic hydroxyl oxygen

→ a more acidic hydroxyl oxygen.

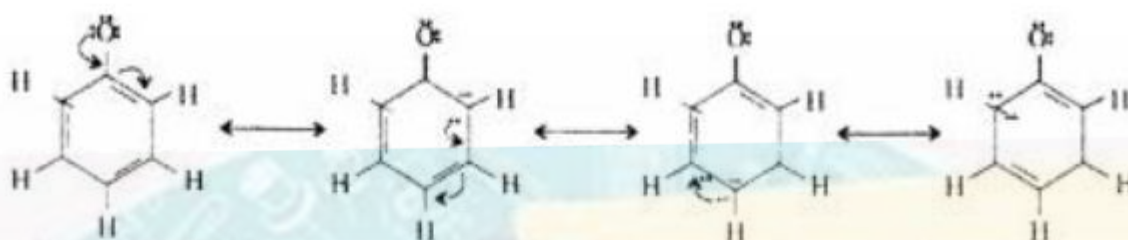


Q14: Write down the acidity of phenols?

Answer

Phenols are more acidic ($\text{pK}_a \gg 10$) than alcohols ($\text{pK}_a \gg 16-20$) but less acidic than carboxylic acids ($\text{pK}_a \gg 5$).

The negative charge of the phenolate ion is stabilized by resonance due to electron delocalization onto the ring as shown.



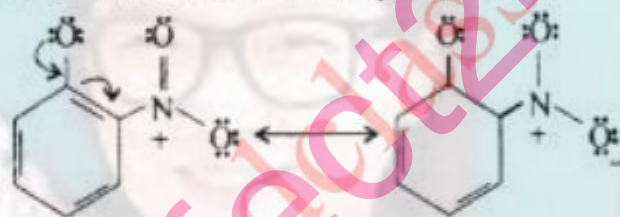
The acidity difference means that it is possible to separate from alcohols and / or carboxylic acids.

Nucleophilic substitution reactions of phenols are generally carried out under basic conditions as the phenolate ion is a better nucleophile.

Q15: Substituents affect the acidity of phenols? Justify?

Answer

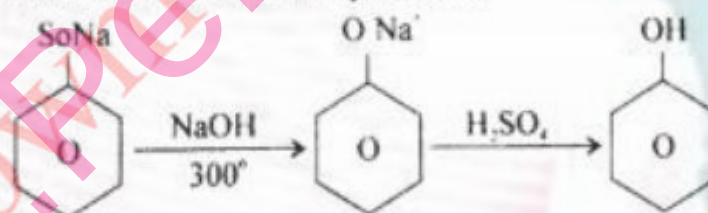
Substituents particularly those located ortho or para to the OH group can dramatically influence the acidity of the phenol due to resonance and / or inductive effect. Electron withdrawing groups enhance the acidity while electron donating substituents decrease the acidity. The resonance stabilization of O-nitrophenol is



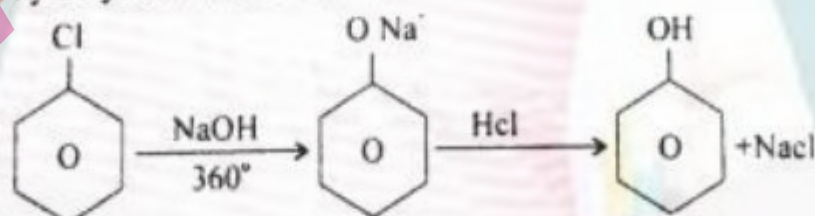
Q16: Write down the reaction for the preparation of phenol?

Answer

→ Reaction of Benzene sulfonic acid with hydroxides.

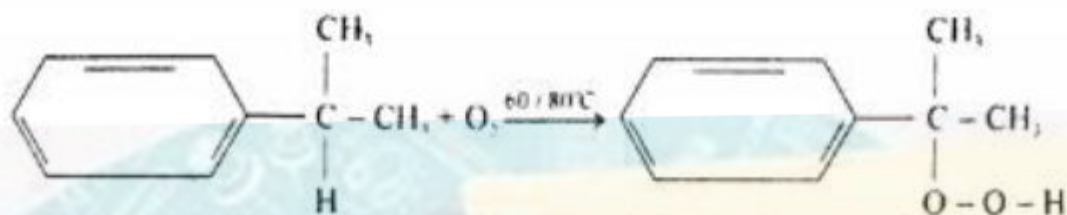


→ Reaction of hydrolysis of chlorobenzene.

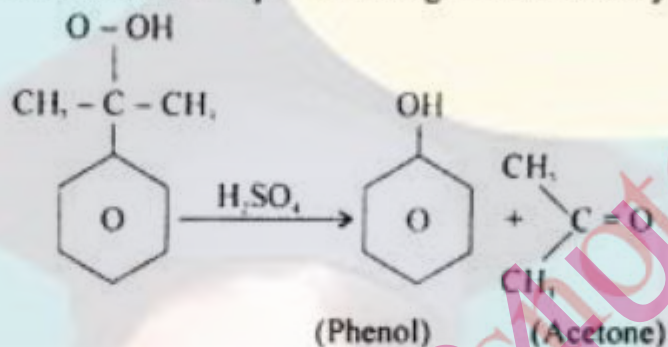


Acidic oxidation of cumene.

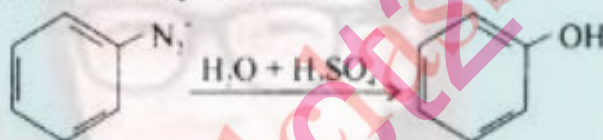
It is a recently developed commercial method for the preparation of phenol, cumene is oxidized by atmospheric oxygen in the presence of a metal catalyst to form cumene hydroperoxide.



The hydroperoxide is converted into phenol through and acid catalyzed rearrangement.



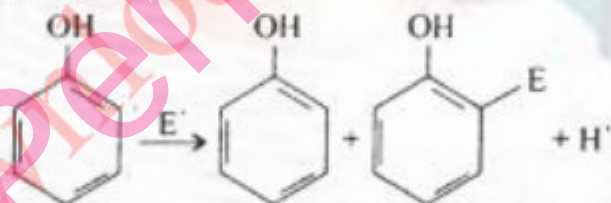
Preparation of phenols from acyl Diazonium salts.



Q17: Write down the reactions of phenols?

Answer

Electrophilic aromatic substitution:



Phenols are potentially very reactive towards electrophilic substitution.

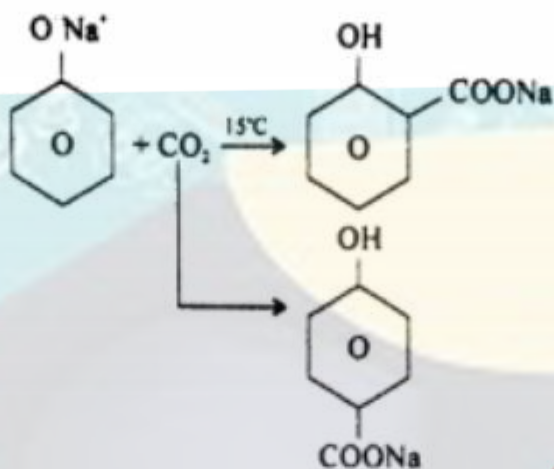
This is because the hydroxyl group OH is activating other, para, directing substituent.

Substitution typically occurs para to the hydroxyl group unless the para position is blocked, then ortho substitution occurs the strong activation often means that milder reaction condition than those used for benzene itself can be used. Phenols are so activated that polysubstitution can be a problem.

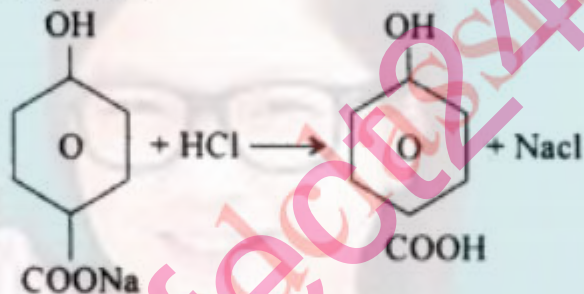
Q18: Write down the reaction of phenol with sodium metal?

Answer

Kolbe Schmitt reaction (carboxylation of phenol)

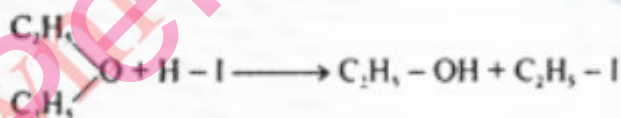


Carbon of CO_2 acts as electrophilic centre in this reaction acidification of the salt gives corresponding hydroxyl acid.

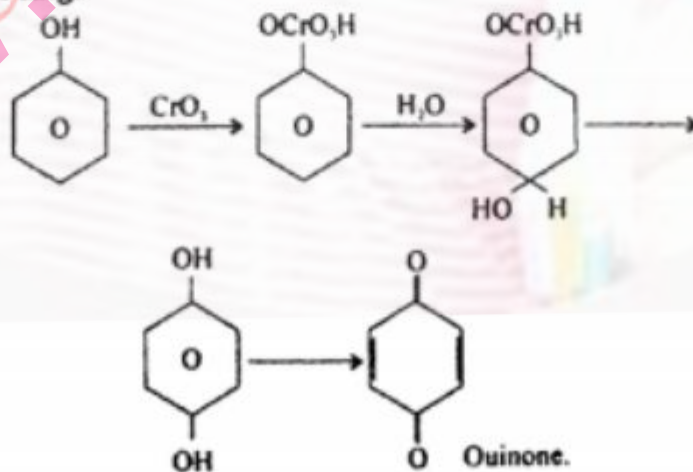


Oxidation of Phenols:

Phenols are very reactive towards diethyl ethers reacts with HI to form $\text{C}_2\text{H}_5\text{-OH}$ and $\text{C}_2\text{H}_5\text{I}$.



Oxidizing agents. The oxidation takes place through several steps eventually destroying the ring.



Q19: Differentiate between the alcohols and phenols.

Answer

The compound in which hydroxyl group is attached to an alkyl group. Alcohols are hydroxyl derivatives of alkanes. The compounds in which one hydrogen of H_2O is replaced by an alkyl group. The general formula of alcohol is $R-OH$. Alcohols may be monohydric and polyhydric depending on the number $-OH$ groups attached. However alcohol generally colorless liquids. Alcohol have a characteristic sweet smell and burning taste. They are readily soluble in H_2O but solubility decreases in higher alcohols. Alcohols react with C-O bond breaks or in which O-H bond breaks.

Phenols:

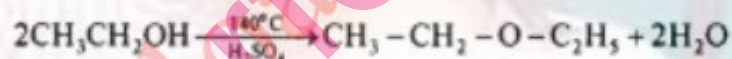
The compounds in which hydroxyl group is attached to an acyl group. Phenols are decivate or benzene. The compounds in which one hydrogen of H_2O is replaced by an acyl on group. The general formula of phenol is it is also known as calbolic acid.

Phenols are not monohydric or polyhydric. They are colourless, crystalline, deliquescent solids. They have characteristics phenolic order its metting points is $41^\circ C$. Phenol are make acidic ($Pka \gg 10$) than alcohols ($Pka \gg 16-20$). It is aparingly soluble in H_2O forming pink solution at room temperature but completely soluble above $68.5^\circ C$. Phenols ion have resonance structure but alcohols do not have such type structure.

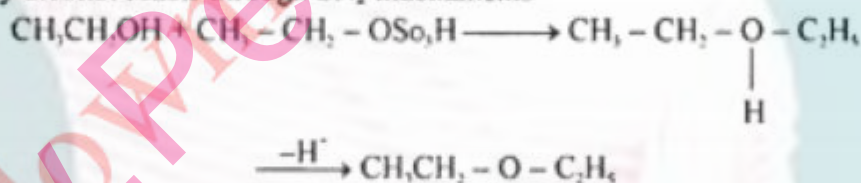
Q20: Write down the preparation of ethers?

Answer

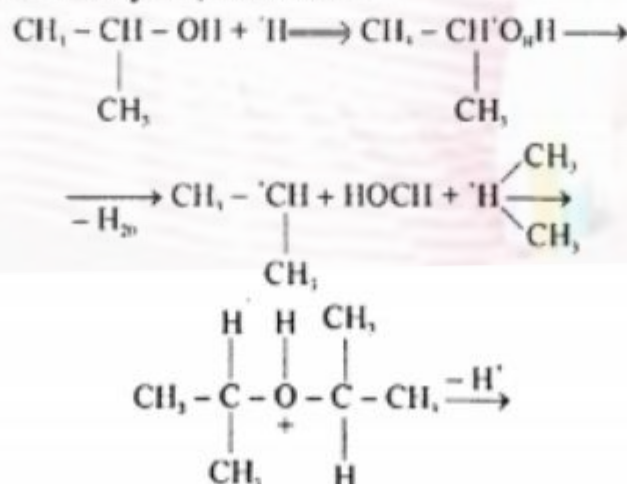
By heating excess of alcohol with concentrated H_2SO_4 at $140^\circ C$ dehydration to ethers occurs to ethers occurs.

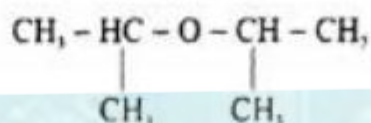


Primary alcohol reacts through SN_2 machanisms



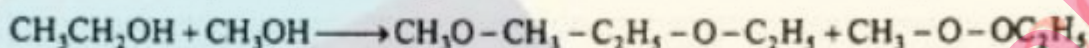
Secondary alcohol react by SN_1 machanism.





Di-isopropyl ether.

Two different primary alcohol give three ethers when treated with H_2SO_4



Ter-butyl and ethyl alcohol give on ether.

Q21: Write down the physical properties of ethers?

Answer

Ethers are colourless, low boiling, highly flammable compounds.

Their chemical reactivity and their ability to dissolve fats, oil, gum, and many other organic compound make them very good solvent.

Ether are soluble in concentrated sulphuric acid, a characteristics of oxygen containing compounds. This property is used as a test to distinguish between ether and saturated hydrocarbons.

Q22: How ethers show resistance to oxidation?

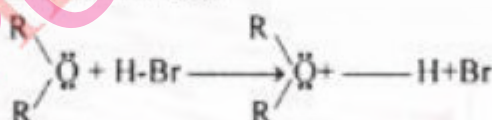
Answer

Ethers are resistance to attack by the usual chemical oxidizing agents. Moreover reagent like NH_3 , Na, alkali and acids have no action on ethers.

Q23: How ethers react with H-Br?

Answer

The oxygen atom of an ether molecule possesses unshared electron pair which accepts portion of H-Br to form oxonium ions.



No further reaction takes place.

Q24: How ether react H-I?

Answer

The oxygen atom of an ether molecules possesses unshared electron pair which accept a proton of H-I to form oxonium ion which react with I to form R-OH and RI.

