
EXERCISE

Q1: Select the right answer from the choices given with each question.

- 1) Which compound shows hydrogen bonding?
a) C_2H_6
b) $\text{C}_2\text{H}_5\text{Cl}$
c) $\text{CH}_3 - \text{O} - \text{CH}_3$
d) $\text{C}_2\text{H}_5\text{OH}$
- 2) Which compound is called a universal solvent?
a) H_2O
b) CH_3OH
c) $\text{C}_2\text{H}_5\text{OH}$
d) $\text{CH}_3 - \text{O} - \text{CH}_3$
- 3) According to Lewis concept ethers behave as:
a) Acid
b) Base
c) Acid as well as base
d) None of them
- 4) Ethanol can be converted into ethanoic acid by:
a) Hydrogenation
b) Hydration
c) Oxidation
d) Fermentation

- =====
- 5) Ethanol is denatured by adding:
- Methanol
 - Carbolic acid
 - Acetone
 - Propanol
- 6) When phenol reacts with CH_3COCl the product formed is?
- Ether
 - Alcohol
 - Aldehyde
 - Ester
- 7) Williamsone synthesis of ethers is superior to alcohols because it makes:
- Symmetrical ethers
 - Asymmetircal ethers
 - Ether at room temperature
 - Both symmetrical and asymmetrical ethers
- 8) A methy phenol is also called:
- A Cresol
 - Benzyl alcohol
 - Alcohol
 - Formaldehyde
- 9) Which one of the following compounds does not contain carboxylic group?
- Acetic acid
 - Formic acid
 - Benzoic acid
 - Picric acid
- 10) Hydrogen boding is maximum in:
- Diethyl ether
 - Methanol
 - Ethyl alcohol
 - Triethyl amine
- 11) Which of the following compound has no attraction at all with water?
- C_6H_6
 - $\text{C}_2\text{H}_5\text{OH}$
 - $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH}$
 - $\text{CH}_3 - \text{O} - \text{CH}_3$
- 12) Phenols are more acidic than alcohols which statement is correct?
- Phenol turns blue litmus paper red
 - Alcohol liberates CO_2 with carbonate solution
 - Phenoxide ion is stabilized due to resonance
 - Alxoxide ion is stabilized due to resonance
- 13) Carbolic acid is treated with dilute nitric and at 25°C , the product is:
- O - nitrophenol
 - P -nitrophenol
 - m- nitrophenol
 - Both a and b
- 14) Oxonium ion is formed when:
- Ethanol reacts with Na metal
 - Phenol reacts NaOH solution
 - Ether is treated with HI
 - Ethanol is treated with aq NaOH and iodine
- 15) 2,4,6 - Trinitrophenol is commercially called as:
- TNT
 - Picric acid
 - Carbolic acid
 - Fumeric acid
- =====

Answers

1)	d)	2)	a)	3)	b)	4)	d)	5)	a)
6)	d)	7)	c)	8)	a)	9)	d)	10)	d)
11)	a)	12)	c)	13)	d)	14)	c)	15)	b)

Q2. Give short answers of the following questions.

Q1. What are alcohols? How are they classified?

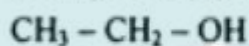
Answer

Aliphatic organic compounds having -OH groups are called as alcohols.

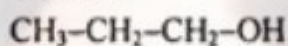
There are two types.

- 1) Monhydric alcohols
- 2) Polyhydric alcohols

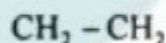
Examples of Monohydric alcohols:



(methyl alcohol)

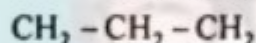


(ethyl alcohol)



Glycol

(A Dihydric alcohol)



Glycerol

(A trihydric alcohol)

Q2. How are monhydric alcohols classified?

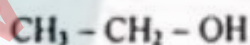
Answer

Classification of Monohydric alcohols

Monohydric alcohols are of three types.

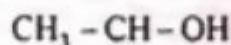
- 1) Primary alcohols
- 2) Secondary Alcohols
- 3) Tertiary Alcohols

Examples



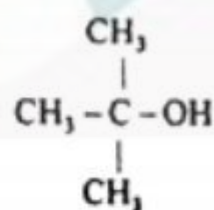
Methyl alcohol

(Prim alcohol)



isopropyl alcohol

(Sec alcohol)



tert-butyl alcohol

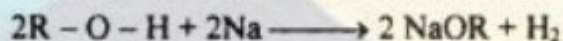
(tertiary alcohol)

Q3. Compare the acidity of primary secondary and tertiary alcohols.

Answer

Acidity of Alcohols

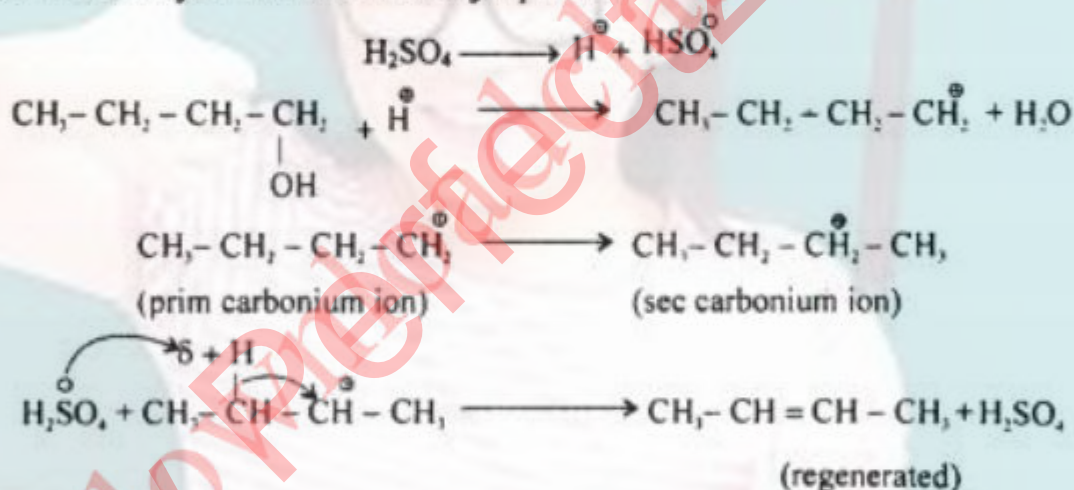
- 1) Due to high electronegativity of the O – atoms, alcohols are slightly acidic.
- 2) The anion derived by the deprotonation of an alcohol is the alkoxide.
- 3) Alkoxides are important bases in a organic chemistry.
- 4) Alcohols react with Na (or K) like water to give the alkoxide.



Q4. 2 – butane is the major product when n-butyl alcohol is heated with conc. H_2SO_4 . Explain.

Answer

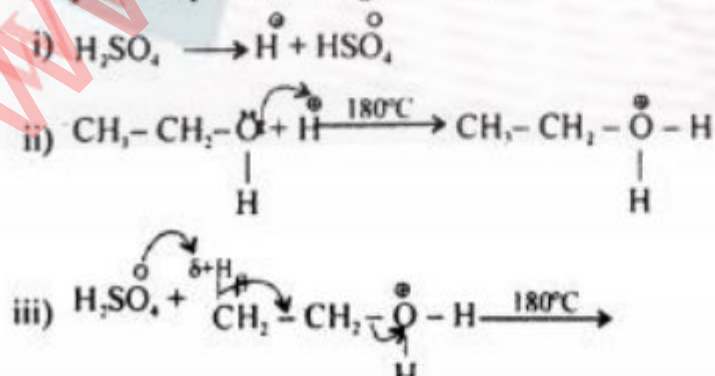
n – butyl alcohol on reaction with H ion of H_2SO_4 produce primary carbonium ion. This primary carbonium ion is converted into secondary carbonium ion by shifting β – hydrogen atom, as secondary carbonium ion is more stable than the primary carbonium ion that is why 2 – butane is the major product.

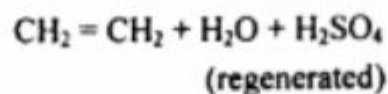


Q5. Give the mechanism of dehydration of alcohols.

Answer

Alcohols on heating at $180^\circ C$ in presence of H_2SO_4 produce alkenes the reaction takes place as per following mechanism:

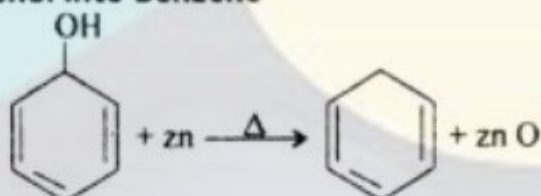




Q6. How will you obtain benzene from alcohol?

Answer

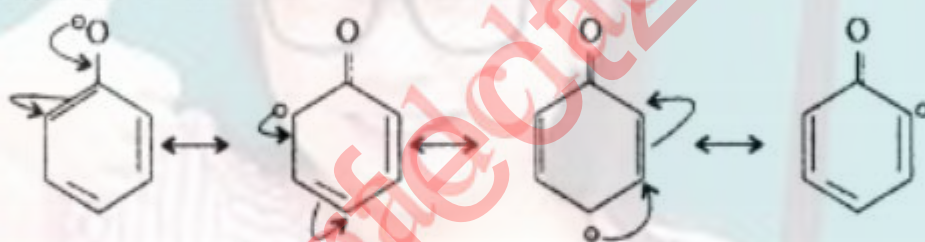
Conversion of phenol into Benzene



Q7. Alcohols phenols both have OH group but phenols are more acidic than alcohols.

Answer

Phenol after release of H^+ - ion produce phenoxide ($\text{C}_6\text{H}_5\text{O}^-$) as conjugated base which is very stable due to resonance.



Whereas alcohols don't give very stable conjugated base.

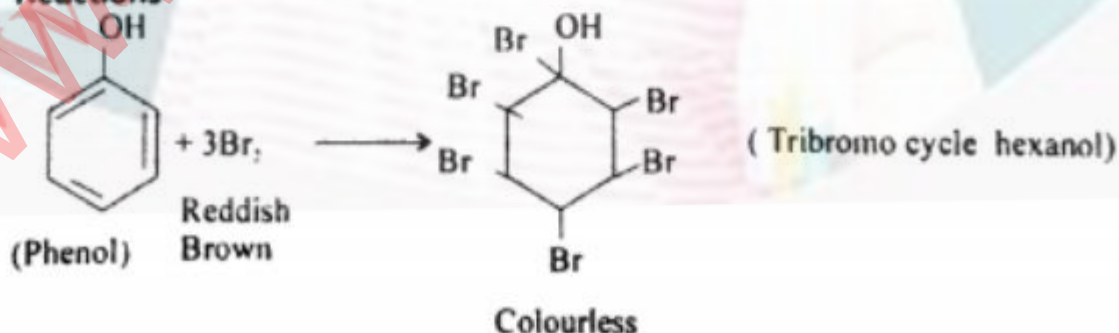
Q8. How will you differentiate between an alcohol and phenol?

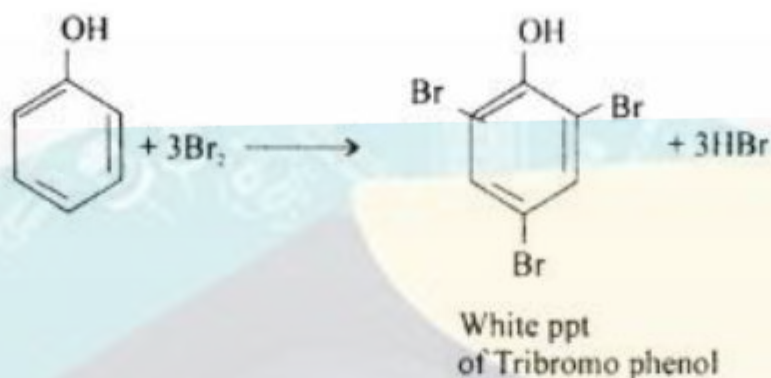
Answer

A test to distinguish alcohols and phenol

Acid bromine water gradually to concentrated solution of phenol in a test tube. Bromine water first decolorizes and then on adding excess of it, a white or yellowish white ppt. Of polybromo derivative is produced which indicates the presence of phenolic group.

Reactions



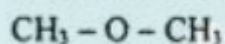


Q9. Write the nomenclature of ether by IUPAC system.

Answer

IUPAC system of Nomenclature of Ethers

IUPAC system of naming simple ethers are named by naming the two groups linked to oxygen atom followed by the word ether e.g.

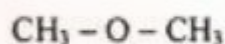


(Dimethyl ether)

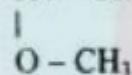
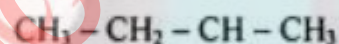


(Dimethyl ether)

Mixed ether are named as alkyl derivatives of hydrocarbons e.g.



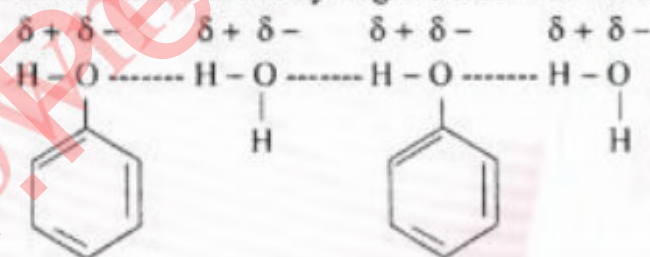
Methoxy ethane butane



Q10. Why is phenol more soluble in water than toluene?

Answer

Phenol is a polar molecule and forms hydrogen bonds with water molecules as follows:



Whereas toluene is non-polar  and is insoluble in water.

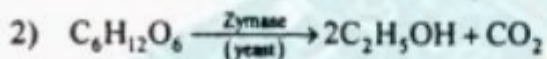
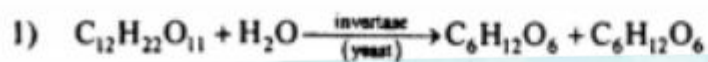
Q3: Give detailed answers for the following questions.

Q1. How will you prepare alcohols on industrial scale?

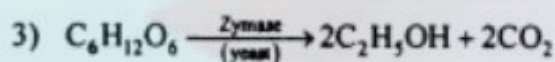
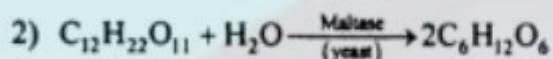
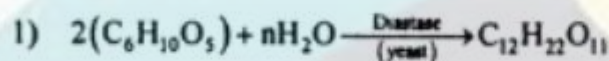
Answer

Industrially ethanol is prepared by fermentation of molasses, starch grains or fruit juices like sugarcane juice (called molasses by fermentation in presence of enzymes present in yeast).

From Molasses



From Starch



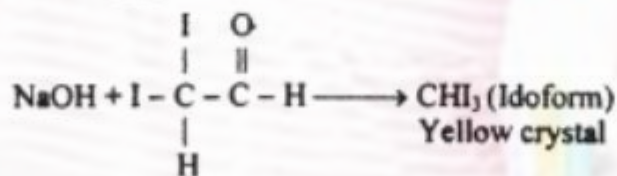
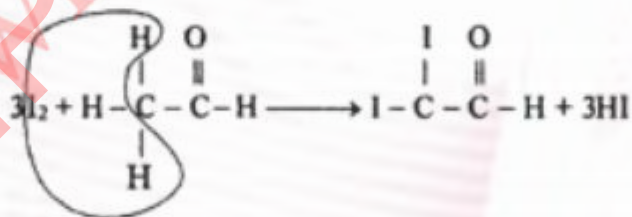
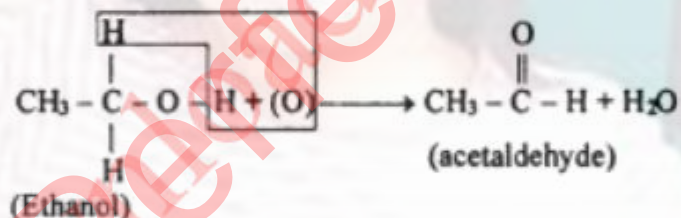
Q2. Distinction between ethanol and methanol and ethanol from phenol.

Answer

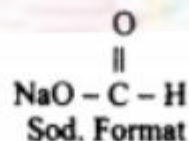
a) Distinction between ethanol and methanol

Ethanol on heating with I_2 and NaOH give yellow precipitates of Iodoform whereas methanol does not give this test.

Reactions



+



b) Distinction between ethanol and phenol

Ethanol gives iodoform test positive but phenol does not.

Iodoform Test

Ethanol + Solid Iodine + NaOH $\longrightarrow$ Yellow crystals of Iodoform
(reactions given in part a)

But phenol does not give yellow crystal.

Q3. How will you distinguish between primary, secondary and tertiary alcohols? Explain with reactions.

Answer

Please see Answer of Q7. of chapter notes.

Q4. Give IUPAC names and structures of the following compounds.

i) Sec. butyl alcohol

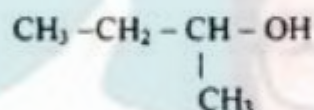
ii) Lactic acid

iii) Ter. butyl alcohol

iv) Tartaric acid

Answer

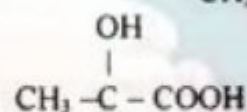
i)



Sec. butyle alcohol

2 - methyl - 2 butanol

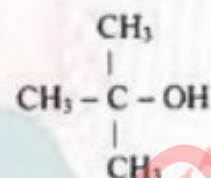
ii)



Lactic acid

2 - hydroxyl propanoic acid

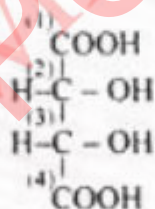
iii)



Ter butyl alcohol

2 - methyl - 2 - propanol

iv)



Tartaric acid

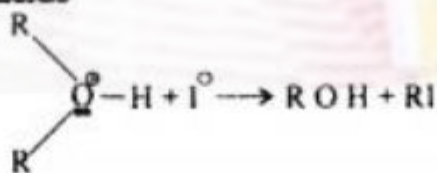
2,3 - dihydroxy

butandioic acid

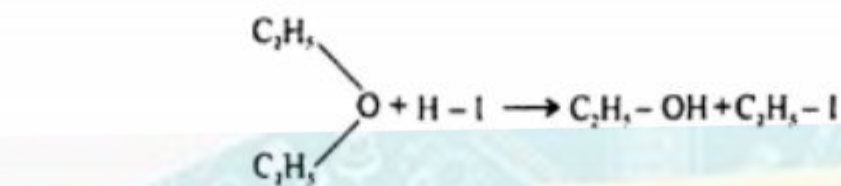
Q5. Give the reactivity of Ethers.

Answer

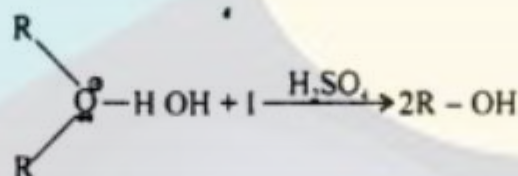
Reaction with Haloacids



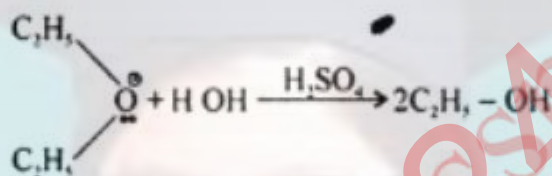
Like;



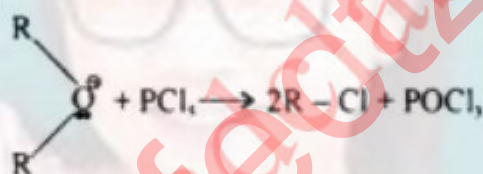
Reaction with water



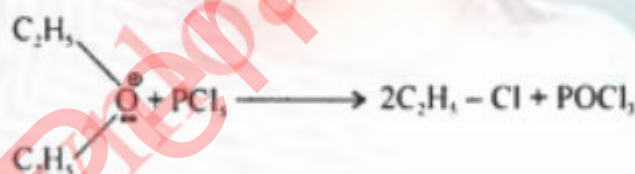
Like;



Reaction with PCl_5



Like;



Q6. Give at least two methods for the preparation of phenol.

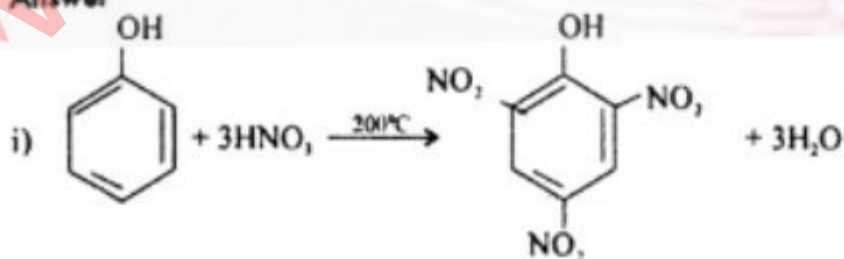
Answer

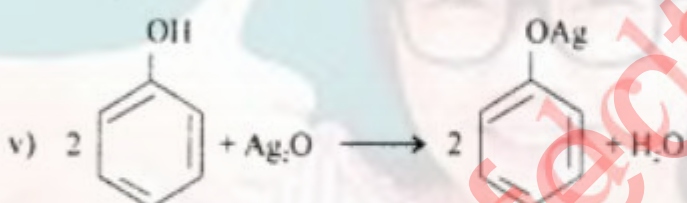
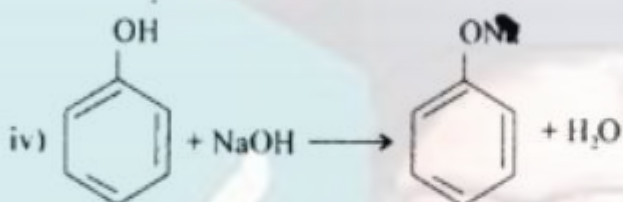
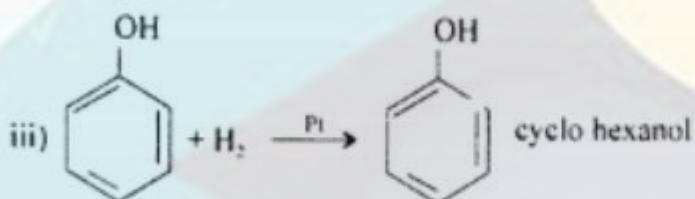
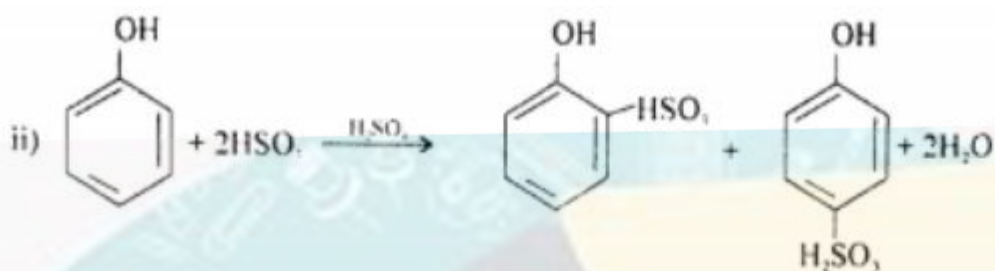
Please Answers of Q15 and Q16.

Q7. How does phenol reacts with

- | | |
|-----------------------------|-----------------------------|
| i) HNO_3 | ii) H_2SO_4 |
| iii) H_2/Pt | iv) NaOH |
| v) Ag_2O | |

Answer



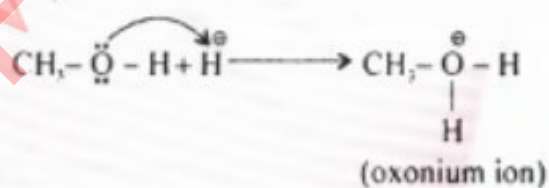


Q8. What is oxonium ion? Describe the chemical reactivity of ether.

Answer

An oxygen having positive charge is called as oxonium ion.

e.g.



Reactivity of Ethers

Please see Answer of reactivity of ether Q5 of exercise.

Q9. Explain following terms using ethyl alcohol as an example;

Answer

i) **Oxidation**

ii) **Dehydration**

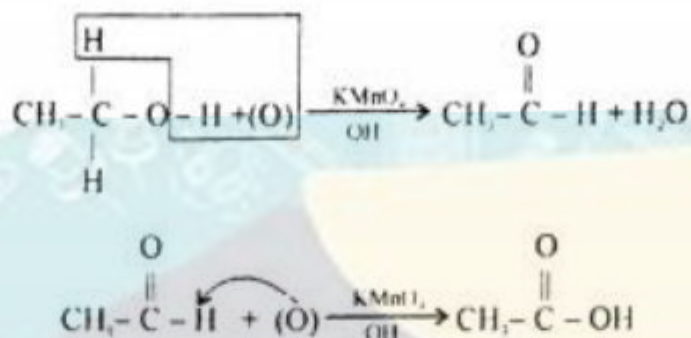
iii) **Esterification**

iv) **Ether formation**

Answer

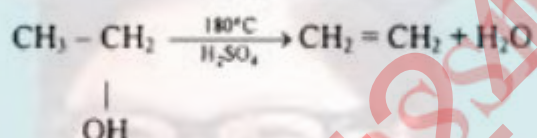
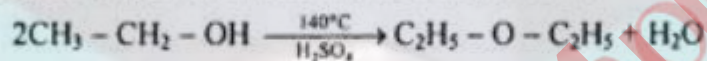
i) **Oxidation**

Oxidation of ethyl alcohol procedure octadecyle which on oxidation is converted into acetic acid.



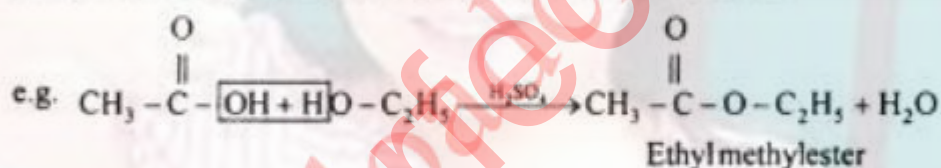
ii) Dehydration

Removal of hydrogen from a substance is called dehydration. Dehydration of ethyl alcohol at different temperature produce different products.



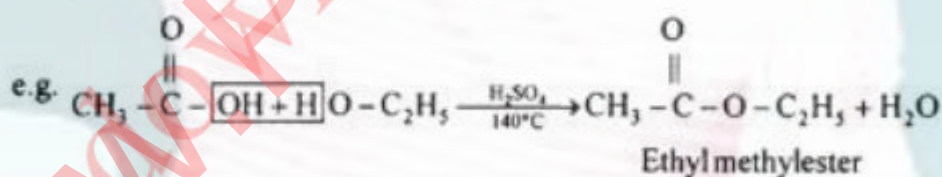
iii) Esterification

Formation of an ester from an alcohol is called esterification.



iv) Ether Formation

Ethyl alcohol on heating with H_2SO_4 at 140°C .



Q10. How does ethyl alcohols react with the following reagents?

Answer

i) Conc. H_2SO_4

ii) Na

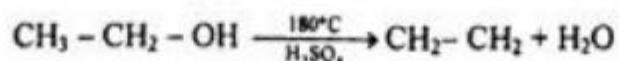
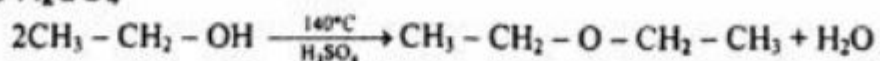
iii) PCl_5

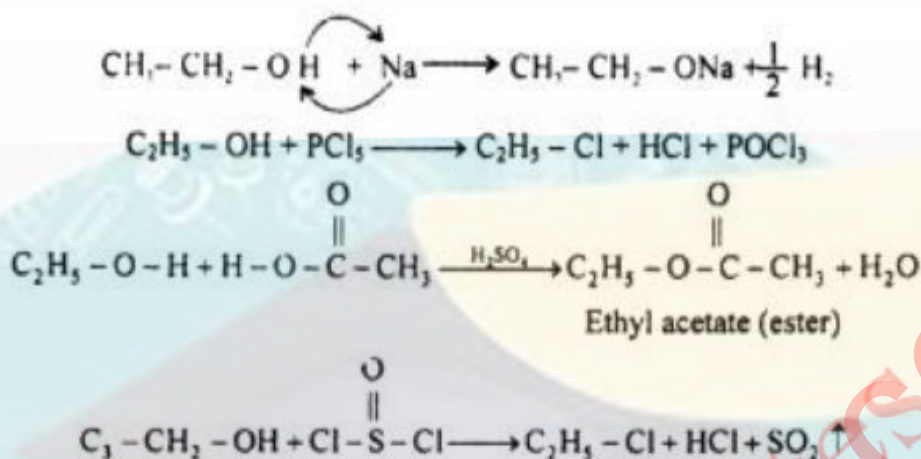
iv) CH_3COOH

v) SOCl_2

Answer

i) Conc. H_2SO_4





Q11. How will you distinguish between

- an alcohol and a phenol
- an alcohol and an ether
- Methanol and ethanol
- A tertiary alcohol and a primary alcohol
- 1 – propanol and 2 – propanol

Answer

An alcohol and a phenol

Please see Answer of Q2,8 of exercise.

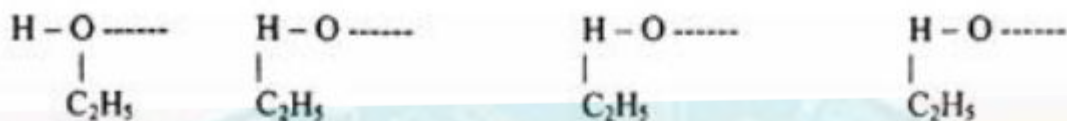
- Distinction between alcohol on reaction with Na – metal generate H_2 gas which burn luminous flame.
But ethers don't react with Na-metal.
- Distinction between ethanol and methanols
Please see Answer of Q3. 2 of exercise.
- A tertiary alcohol and a primary alcohol.
Please see Answer of Q7. of chapter notes.
- 1 – propanol and 2 – propanol
Please see Answer of Q7. of chapter notes.

Q12. Give reason for the followings:

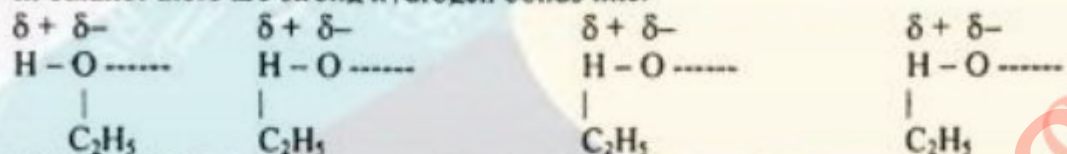
- Ethyl alcohol is a liquid while ethyl chloride is a gas.
- Ethanol has higher boiling point than diethyl ether.
- Absolute alcohol cannot be prepared by fermentation process.
- Ethanol gives different products with Conc. H_2SO_4 under different conditions.
- Water has higher boiling point than ethanol.

Answer

- Ethyl alcohol is liquid due to strong hydrogen bonds which are not present in ethyl chloride i.e.
 $\delta + \delta^- \quad \delta + \delta^- \quad \delta + \delta^- \quad \delta + \delta^-$



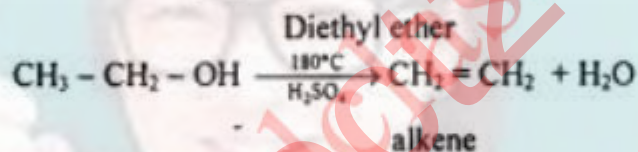
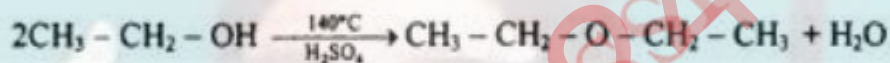
ii) In ethanol there are strong hydrogen bonds like.



Whereas diethyl ether is a neutral molecule having zero dipole moment

iii) During fermentation there are obtained mixture of compounds whereas absolute alcohol is 100% pure alcohol. The fractional separation of alcohols by distillation of alcohols is not easy due to strong hydrogen bonds among alcohols.

iv) Ethanol on heating with concentrated H_2SO_4 at 140°C produce an ether. Whereas ethanol on heating with H_2SO_4 at 180°C produce on alkene.



v) I one water molecule may forms two hydrogen bonds whereas one ethanol molecule may form one hydrogen bond that is why boiling point of water is 100°C and that of ethanol is 78.5°C .

