

## Alcohols, Phenols and Ethers

### SUBJECTIVE PROBLEMS:

#### Q1.

An organic liquid (A), containing C, H and O with boiling point: 78°C, and possessing a rather pleasant odour, on heating with concentrated sulphuric acid gives a gaseous product (B) – with the empirical formula, CH<sub>2</sub>. 'B' decolorizes bromine water as well as alkaline KMnO<sub>4</sub> solution and takes up one mole of H<sub>2</sub> (per mole of 'B') in the presence of finely divided nickel at high temperature. Identify the substances 'A' and 'B'.  
(IIT JEE 1997 – 4 Marks)

#### Q2.

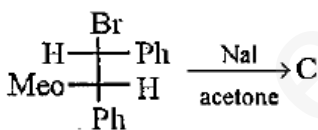
A compound (X) containing C, H and O is unreactive towards sodium. It does not add bromine. It also does not react with Schiff's reagent. On refluxing with an excess of hydriodic acid, (X) yields only one organic product (Y). On hydrolysis, (Y) yields a new compound (Z) which can be converted into (Y) by reaction with red phosphorus and iodine. The compound (Z) on oxidation with potassium permanganate gives a carboxylic acid. The equivalent weight of this acid is 60. What are the compounds (X), (Y) and (Z)? Write chemical equations leading to the conversion of (X) to (Y).  
(IIT JEE 1981 – 3 Marks)

#### Q3.

Write the structural formula of the main organic product formed when :

(i) ethanol  $\xrightarrow[\text{NaOH}]{\text{I}_2}$  (IIT JEE 1985 – 1 Marks)

(ii) Predict the structure of the product in the following reaction. (IIT JEE 1996 – 1 Marks)



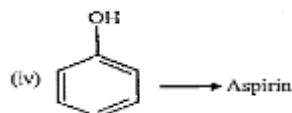
#### Q4.

Outline the reaction sequence for the conversion of

(i) 1-Propanol from 2-Propanol (in three steps) (IIT JEE 1982 – 1 Marks)

(ii) Ethyl alcohol to vinyl acetate. (in not more than 6 steps) (IIT JEE 1986 – 3 Marks)

(iii) Phenol to acetophenone (IIT JEE 1989 – 1 ½ Marks)



**Q5.**

State with balanced equations what happens when:

(i) Acetic anhydride reacts with phenol in presence of a base. **(IIT JEE 1982 – 1 Marks)**

(ii) Ethylene glycol is obtained by the reaction of ethylene with potassium permanganate.

**(IIT JEE 1991 – 1 Marks)**

**Q6.**

Give reasons for the following:

A. Sodium metal can be used for drying diethyl ether but not ethanol.

B. phenol is an acid but it does not react with sodium bicarbonate.

C. Acid catalyzed dehydration of *t*-butanol is faster than that of *n*-butanol.

**Q7.**

An alcohol A, when heated with conc.  $\text{H}_2\text{SO}_4$  gives an alkene B. When B is bubble through bromine water and the product obtained is dehydrohalogenated with excess of sod amide, a new compound C is obtained. The compound C gives D when treated with warm dilute  $\text{H}_2\text{SO}_4$  in presence of  $\text{HgSO}_4$ . D can also be obtained either by oxidizing A with  $\text{KMnO}_4$  or from acetic acid through its calcium salt. Identify A, B, C and D.

**(IIT JEE 1983 – 4 Marks)**

**Q8.**

A compound of molecular formula  $\text{C}_7\text{H}_8\text{O}$  is insoluble in water and dilute sodium bicarbonate but dissolves in dilute aqueous sodium hydroxide. On treatment with bromine water, it readily gives a precipitate of  $\text{C}_7\text{H}_5\text{OBr}_3$ . Write down the structure of the compound.

**(IIT JEE 1985 – 2 Marks)**

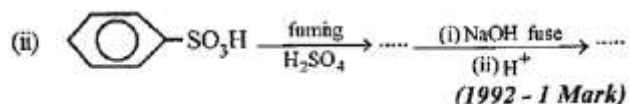
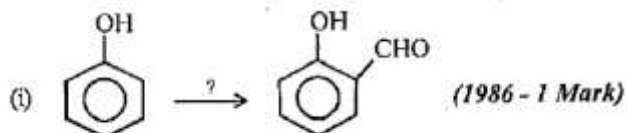
**Q9.**

Give a chemical test/suggest a reagent to distinguish between methanol and ethanol.

**(IIT JEE 1985 – 2 Marks)**

**Q10.**

Complete the following with appropriate structures :



**Q11.**

Compound 'X' (molecular formula,  $C_5H_8O$ ) does not react appreciably with Lucas reagent at room temperature but gives a precipitate with ammonical silver nitrate. With excess of  $MeMgBr$ , 0.42 g of 'X' gives 224 ml of  $CH_4$  at STP. Treatment of 'X' with  $H_2$  in presence of Pt. catalyst followed by boiling with excess HI, gives n-pentane. Suggest structure for 'X' and write the equation involved.

(IIT JEE 1992 – 5 Marks)

**Q12.**

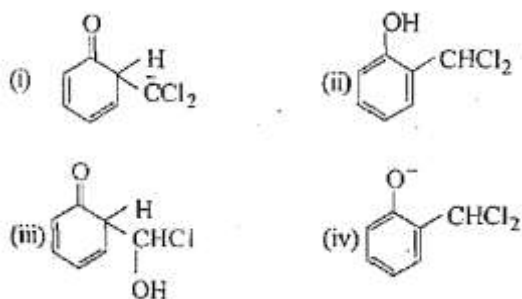
When *t*-butanol and *n*-butanol are separately treated with a few drops of dilute  $KMnO_4$  in one case only the purple colour disappears and a brown precipitate is formed. Which of the two alcohols gives the above reaction and what is the brown precipitate?

(IIT JEE 1994 – 2 Marks)

**Q13.**

When phenol is reacted with  $CHCl_3$  and NaOH followed by acidification, salicylaldehyde is obtained. Which of the following species are involved in the above mentioned reaction as intermediates?

(IIT JEE 1995 – 2 Marks)



**Q14.**

3, 3-Dimethylbutan-2-ol loses a molecule of water in the presence of concentrated sulphuric acid to give tetramethylethylene as a major product. Suggest a suitable mechanism. **(IIT JEE 1996 – 2 Marks)**

**Q15.**

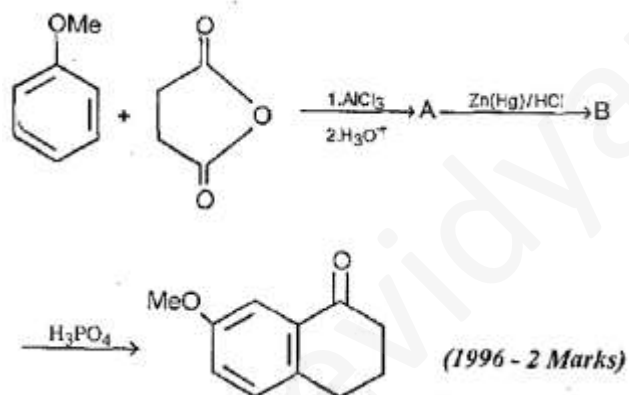
A compound D ( $C_8H_{10}O$ ) upon treatment with alkaline solution of iodine gives a yellow precipitate. The filtrate on acidification gives a white solid E ( $C_7H_6O_2$ ). Write the structures of D and E and explain the formation of E. **(IIT JEE 1996 – 2 Marks)**

**Q16.**

An optically active alcohol A ( $C_6H_{10}O$ ) absorbs two moles of hydrogen per mole of A upon catalytic hydrogenation and gives a product B. The compound B is resistant to oxidation by  $CrO_3$  and does not show any optical activity. Deduce the structures of A and B. **(IIT JEE 1996 – 2 Marks)**

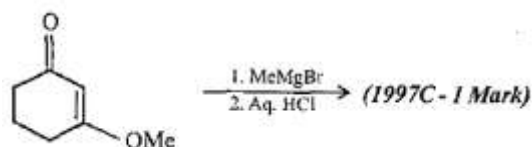
**Q17.**

Predict the structures of the intermediates/products in the following reaction sequence:



**Q18.**

Predict the major product in the following reactions

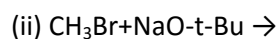
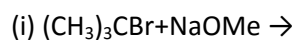


**Q19.**

2, 2-Dimethyloxirane can be cleaved by acid ( $H^+$ ). Write mechanism **(IIT JEE 1997 – 2 Marks)**

**Q20.**

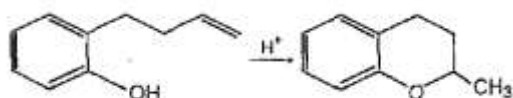
Which of the following is the correct method for synthesizing methyl-t-butyl ether and why?



(IIT JEE 1997 – 2 Marks)

**Q21.**

Write the intermediate steps for each of the following reaction.

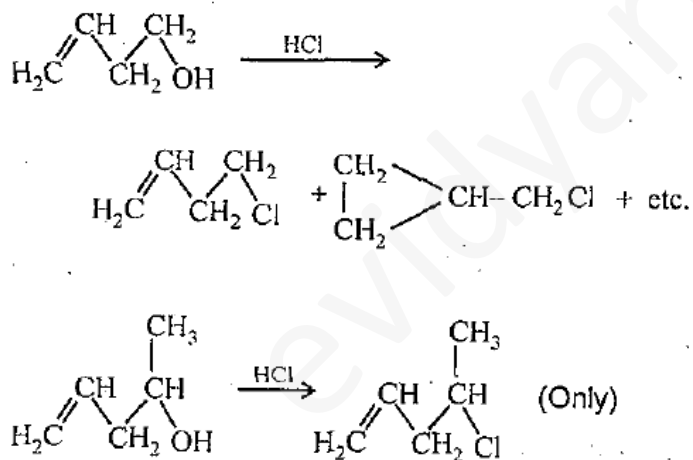


(IIT JEE 1998 – 1 Marks)

**Q22.**

Explain briefly the formation of the products giving the structures of the intermediates.

(IIT JEE 1999 – 3 Marks)



**Q23.**

A biologically active compound, bombykol ( $\text{C}_{16}\text{H}_{30}\text{O}$ ) is obtained from a natural source. The structure of the compound is determined by the following reactions.

(IIT JEE 2002 – 5 Marks)

(A). on hydrogenation, bombykol gives a compound A,  $\text{C}_{16}\text{H}_{34}\text{O}$ , which reacts with acetic anhydride to give as ester,

(B). Bombykol also reacts with acetic anhydride to give another ester, which on oxidative ozonolysis ( $\text{O}_3/\text{H}_2\text{O}_2$ ) gives a mixture of botanic acid, oxalic acid and 10-acetoxydecanoic acid.

Determine the number of double bonds in bombykol. Write the structures of compound A and bombykol. How many geometrical isomers are possible for bombykol?

**Q24.**

An organic compound (P) of molecular formula  $C_5H_{10}O$  is treated with dil.  $H_2SO_4$  to give two compounds (Q) and (R) both of which respond iodoform test. The rate of reaction of (P) with dil.  $H_2SO_4$  is  $10^{10}$  faster than the reaction of ethylene with dil.  $H_2SO_4$ . Identify the organic compounds, (P), (Q) and (R) and explain the extra reactivity of (P).

**(IIT JEE 2004 – 4 Marks)**

**Q25.**

Identify (X) and (Y) in the following reaction sequence.

**(IIT JEE 2005 – 2 Marks)**

