CHAPTER

25 Alcohols, Phenols and Ethers

Key Notes and Formulae

Ethers

Ethers are organic compounds in which two alkyl groups are attached to an oxygen atom and have general formula R - O - R or R - O - R'.

Williamson Synthesis

$C_2H_5ONa + C_2H_5I \xrightarrow{Heat} C_2H_5OC_2H_5 + NaI$

Alcohols

Compounds containing one or more hydroxyl group (-OH) directly attached to carbon atoms are called alcohols. Both carbon and oxygen atoms of the alcoholic group are in sp^3 hybridised state.

Monohydric Alcohols

Monohydric alcohols can be represented by general formula $C_nH_{2n+1}OH$ or R - OH. They are primary (1^0), secondary (2^0) and teritary (3^0) alcohols.

Victor Meyer Test

Victor Meyer test is based on the different behaviour of primary, secondary and teritary nitroalkanes towards nitrous acid.

(a) Primary alcohols produce a blood red colour.

(b) Secondary alcohols produce blue colour.

(c) Teritary alcohols produce no colour.

Oxidation of Alcohols

Primary alcohol $\rightarrow$ aldehydes $\rightarrow$ carboxylic acids
(same number of carbon atoms as the parent alcohol)

Secondary alcohol $\rightarrow$ Ketones $\rightarrow$ Acids
(same number of carbon atom) (less number of carbon atoms)

Teritary alcohol $\rightarrow$ Ketones $\rightarrow$ Acids
(Less number of carbon atoms as theparent alcohol)

Solubility of Alcohols

Solubility of alcohols in water is due to hydrogen bonding between alcohol and water molecules.

Methylated Spirit

Ordinary rectified spirit is called industrial alcohol.

Ethylene Glycol ($CH_2OH - CH_2OH$)

It is used for lowering the freezing temperature of water in automobile radiators under the name of prestone.

Nitroglycol

Nitroglycol is an explosive substance.

Esterification

$CH_3COOH + C_2H_5OH \xrightarrow{\text{conc } H_2SO_4} CH_3COOC_2H_5 + H_2O$

(Ethanoic acid) (Ethanol)

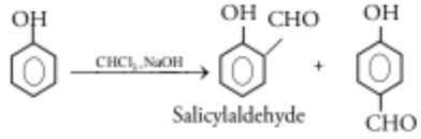
Phenol

Phenol is acidic in nature. Presence of +1 effect group (CH_3, NH_2, OCH_3) decreases acidity. Presence of -1 effect group (NO_2, X, COOH, CN) increases acidity.

Epoxides

They are cyclic ethers. They contain oxyrane ring and so they are also known as Epoxy etane.

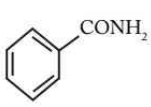
Reimer-Tieman reaction

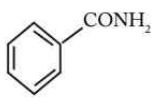


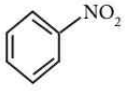
Previous Years' Questions

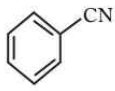
NEET

1. A given nitrogen-containing aromatic compound A reacts with Sn/HCI, followed by HNO_2 to give an unstable compound B. B on treatment with phenol, forms a beautiful coloured compound C with the molecular formula $C_{12}H_{10}N_2O$. The structure of compound A is : **[July 2016]**

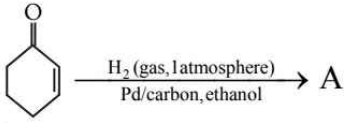
(a) 

(b) 

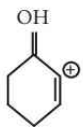
(c) 

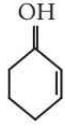
(d) 

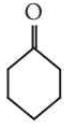
2. The correct structure of the product A formed in the reaction: **[July 2016]**

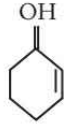


is :

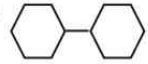
(a) 

(b) 

(c) 

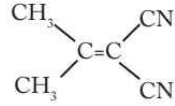
(d) 

3. In which of the following molecules, all atoms are coplanar? **[July 2016]**

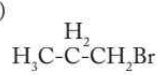
(a) 

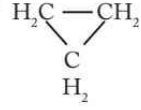
(b) 

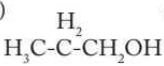
(c) 

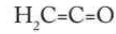
(d) 

4. Which of the following compounds shall not produce propene by reaction with HBr followed by elimination or direct only elimination reaction? **[July 2016]**

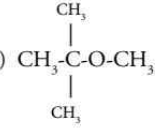
(a) 

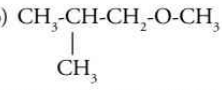
(b) 

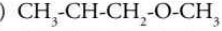
(c) 

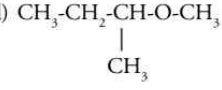
(d) 

5. Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI? **[2013]**

(a) 

(b) 

(c) 

(d) 

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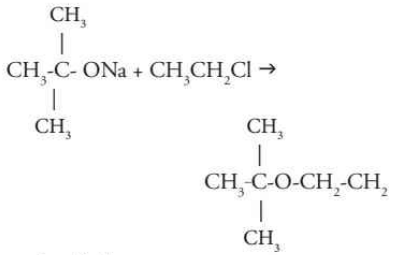
6. The reaction, **[2015]**



is called

(a) Etard reaction

(b) Gattermann-Koch reaction

(c) Wiliamson synthesis

(d) Williamson continuous etherification process.

7. Among the following sets of reactants which one produces anisole ? **[2014]**

(a) CH_3CHO; RMgX

(b) C_6H_5OH; NaOH; CH_3I

(c) C_6H_5OH; neutral $FeCl_3$

(d) C_6H_5-CH_3; CH_3COCl; $AlCl_3$

8. Which of the following will not be soluble in sodium hydrogen carbonate ? **[2014]**

(a) 2, 4, 6-trinitrophenol

(b) Benzoic acid

(c) O-nitrophenol

(d) Benzenesulphonic acid

9. In the following sequence of reactions **[2012]**

CH_3-Br $\xrightarrow{KCN}$ A $\xrightarrow{H^3O^+}$ B $\xrightarrow[Ether]{}$ C

the end product (C) is

(a) acetone (b) Methane

(c) acetaldehyde (d) ethyl alcohol

10. Which of the following compounds can be used as antifreeze in automobile radiators? **[2012]**

(a) Methyl alcohol (b) Glycol

(c) Nitrophenol (d) Ethyl alcohol

11. Among the following four compounds

(A) Phenol (B) Methyl phenol

(C) meta-nitrophenol (D) Para nitrophenol

The acidity order is **[2010]**

(a) D>C>A>B (b) C>D>A>B

(c) A>D>C>B (d) B>A>C>D

12. When glycerol is treated with excess of HI, it produces **[2010]**

(a) 2-iodopropane (b) allyl iodide

(c) propene (d) glycerol triiodide

13. Consider the following reaction; **[2009]**

Phenol $\xrightarrow{Zn\ dust}$ X $\xrightarrow[anhyd.\ AlCl_3]{CH_3Cl}$ Y $\xrightarrow[Alkaline\ KMnO_4]{}$ Z

the product Z is

(a) benzaldehyde

(b) benzoic acid

(c) benzene

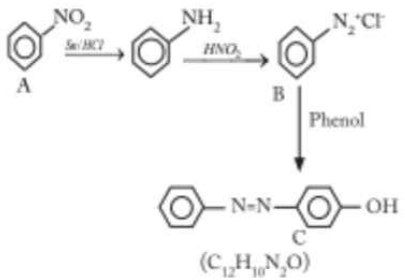
(d) toluene

Answer key

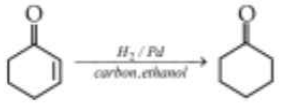
1. (c)	2. (c)	3. (b)	4. (d)	5. (a)
6. (c)	7. (b)	8. (c)	9. (d)	10. (b)
11. (a)	12. (a)	13. (b)		

Detailed Solutions

1. **(c).**



2. **(c).**



During hydrogenation of α, β unsaturated carbonyl compound by pd catalyst selective reduction is observed of double bond.

3. **(b).**

All carbon atoms are sp^2 hybridised and its geometry is trigonal planar.

4. **(d)**

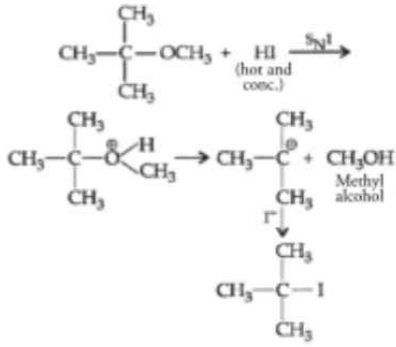
i. $CH_3\text{-}CH_2\text{=}CH_2\text{-}Br \xrightarrow{\text{elimination}} CH_3\text{-}CH\text{=}CH_2$

ii. 

iii. $CH_3\text{-}CH_2\text{-}CH_2\text{-}OH \xrightarrow{HBr} CH_3\text{-}CH_2\text{-}CH_2\text{-}Br \xrightarrow{\text{elimination}} CH_3\text{-}CH\text{=}CH_2$

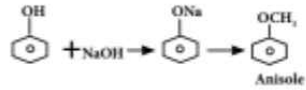
iv. $CH_2\text{=}C\text{=}O \xrightarrow{HBr}$ No reaction

5. **(a).**

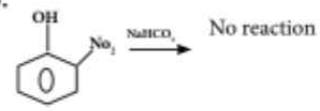


6. **(c).** Williamson synthesis.

7. **(b).** Wiliamson's synthesis



8. **(c).**



9. **(d).** $CH_3Br \xrightarrow{KCN} CH_3CN \xrightarrow{H_3O^+} CH_3COOH$

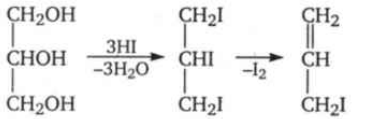
$\xrightarrow{LiAlH_4} CH_3CH_2OH$

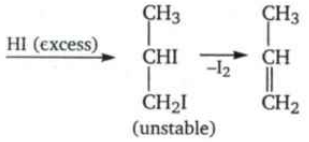
10. **(b).** Glycol

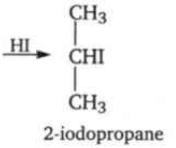
11. **(a).** An electron withdrawing group (-I showing group like $-NO_2$,-CN) stabilises the phenoxide ion, thus when present, increases the acidity of phenol. But electron releasing groups (+I showing group like - CH_3,-C_2H_5) when present, decrease the acidity of phenol by destabilising phenoxide ion. Hence the correct order of acidity of given compound is

p-Nitrophenol>m-Nitrophenol>Phenol>
(D) (C) (A)
Methyl phenol
(B)

12. (a).







13. (b).