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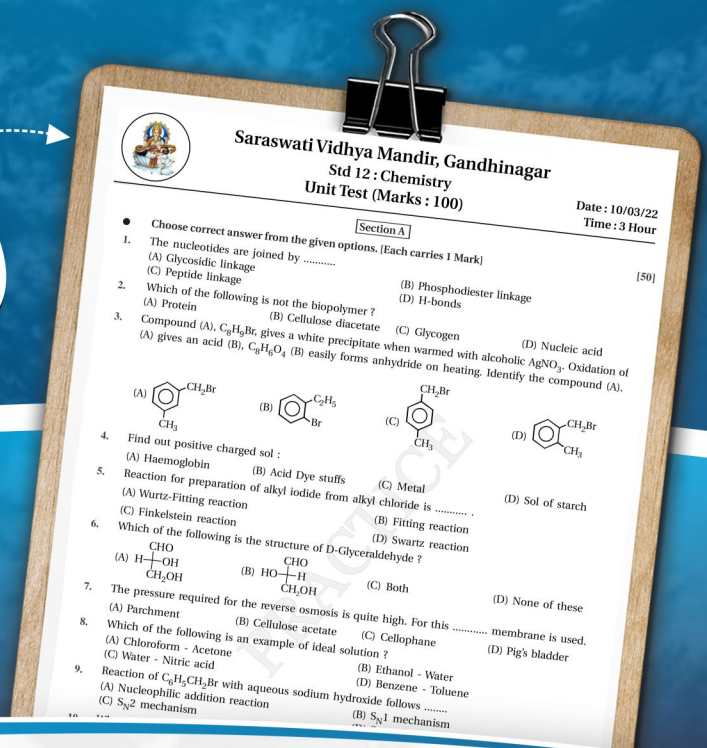

Saraswati Vidhya Mandir, Gandhinagar
Std 12 : Chemistry
Unit Test (Marks : 100)
Date : 10/03/22
Time : 3 Hour

Section A

• Choose correct answer from the given options. [Each carries 1 Mark] [50]

1. The nucleotides are joined by .....
(A) Glycosidic linkage (B) Phosphodiester linkage
(C) Peptide linkage (D) H-bonds

2. Which of the following is not the biopolymer ?
(A) Protein (B) Cellulose diacetate (C) Glycogen (D) Nucleic acid

3. Compound (A), C_8H_9Br, gives a white precipitate when warmed with alcoholic $AgNO_3$. Oxidation of (A) gives an acid (B), $C_8H_6O_4$ (B) easily forms anhydride on heating. Identify the compound (A).
(A) (B) (C) (D)

4. Find out positive charged sol :
(A) Haemoglobin (B) Acid Dye stuffs (C) Metal (D) Sol of starch

5. Reaction for preparation of alkyl iodide from alkyl chloride is ..... .
(A) Wurtz-Fitting reaction (B) Fitting reaction
(C) Finkelstein reaction (D) Swartz reaction

6. Which of the following is the structure of D-Glyceraldehyde ?
(A) (B) (C) Both (D) None of these

7. The pressure required for the reverse osmosis is quite high. For this ..... membrane is used.
(A) Parchment (B) Cellulose acetate (C) Cellophane (D) Pig's bladder

8. Which of the following is an example of ideal solution ?
(A) Chloroform - Acetone (B) Ethanol - Water
(C) Water - Nitric acid (D) Benzene - Toluene

9. Reaction of $C_6H_5CH_2Br$ with aqueous sodium hydroxide follows .....
(A) Nucleophilic addition reaction (B) S_N1 mechanism
(C) S_N2 mechanism

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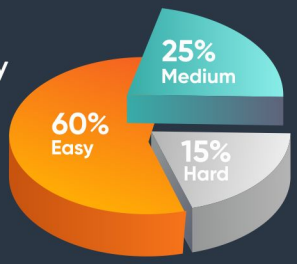

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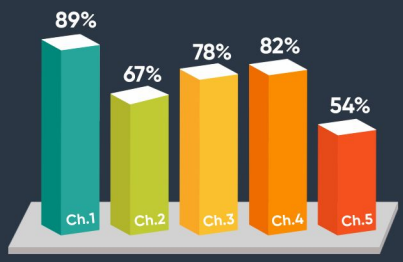

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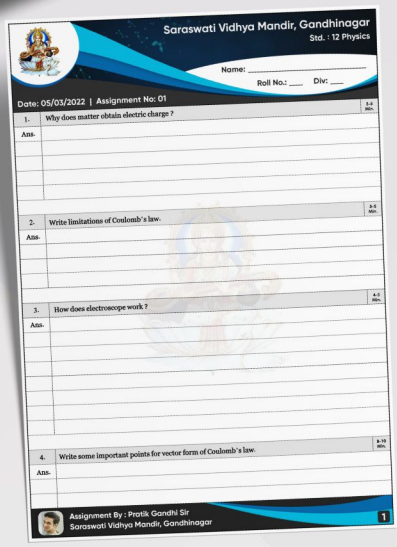

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11 Alcohols, Phenols and Ethers

KUMAR

Questions asked in PART - B in board exam from this chapter

Section - A

❖ **Answer the following questions in short : (2 marks of each)** **[16]**

1) Write following conversion in two steps : Phenol to salicylic acid. [May-2021]

2) Explain : Lucas test. [May-2021]

Section - B

❖ **Answer the following questions : (3 marks of each)** **[18]**

1) Give chemical reaction of following compounds with hydrogen iodide. [March-2020]

(a) 1-propoxy propane (b) Methoxy benzene (c) Benzyl ethyl ether

2) Write the reactions of Williamson synthesis of 2-ethoxy-3-methyl pentane starting from ethanol and 3-methyl pentan-2-ol. [March-2020]

3) Write the reaction mechanism of dehydration of ethanol in presence of acid to form ethene. [August-2020]

4) Explain Williamson synthesis to prepare ether and state the limitation of the process. State all reactions. [August-2020]

5) Write the names of reagents and equations for the preparation of following ethers by Williamson's synthesis : (i) 1-propoxy propane (ii) Ethoxy benzene (iii) 2-methoxy-2-methyl propane [May-2021]

6) Write the reactions of formaldehyde, acetaldehyde and acetone with methyl magnesium bromide. [March-2022]

Section - C

❖ **Answer the following questions in detail : (4 marks of each)** **[16]**

1) Explain industrial method to form phenol by less expensive and having high quality. Also explain bromination of phenol. [March-2018]

2) Write chemical reaction to form Salicylic acid from phenol. Discuss uses of methyl salicylate by writing structural formula. [July-2018]

3) Give only chemical formula to form following substances from phenol. [March-2019]

(a) Phenyl acetate (b) Benzene (c) *p*-bromophenol (d) 1,4-benzoquenone

4) Give chemical reaction for following conversion :

(a) Butan-2-ol from acetaldehyde (b) Phenol from aniline [July-2019]

5) Write the reactions to prepared phenol from Aniline and Cumine. [March-2022]

Section-1 Questions S1

1) What are alcohols, phenols and ethers ? State the various applications of these compounds in day-to-day life ? #

➠ The alcohols and phenols are formed by the replacement of hydrogen atom in an aliphatic and aromatic hydrocarbon respectively. The ethers are formed by the replacement of the hydrogen atom in hydrocarbon by alkoxy or aryloxy groups. The ethers may also visualize as the replacement of hydrogen of –OH group of alcohol or phenol by alkyl or aryl group.

➠ The alcohols contain one or more than one –OH groups bonded directly to carbon atom(s) of an aliphatic system (CH_3OH) whereas phenol contains –OH group(s) bonded directly to the sp^2 carbon of an aromatic system (C_6H_5OH).

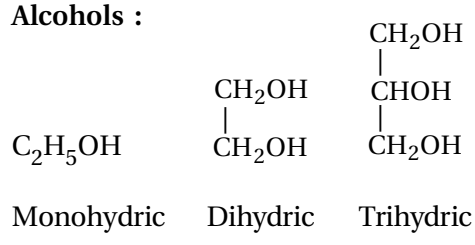
➠ **Applications :** Ethanol is used for polishing of a wooden furniture. It is called ordinary spirit. The sugar we eat, the cotton used in fabrics, the paper used for writing, are all made of compounds containing –OH groups.

11.1 Classification :

2) Give classification of alcohols and phenols based on number of –OH groups.

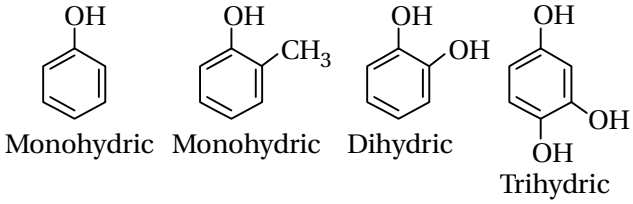
➠ Alcohols and phenols may be classified as mono-, di- tri- or polyhydric compounds depending on whether they contain one, two, three or many hydroxyl groups respectively in their structures.

➠ **Alcohols :**



Monohydric Dihydric Trihydric

➠ **Phenols :**



Monohydric Monohydric Dihydric Trihydric

3) Give classification of monohydric alcohols based on –OH group bonded to sp^3 and sp^2 carbon.

➠ **(a) The monohydric alcohols having sp^3 C – OH bond is classified as follows :**

➠ **(i) Primary (1°), Secondary (2°), Tertiary (3°) alcohols :** In these three types of alcohols, the –OH group is bonded to primary, secondary and tertiary carbon respectively.

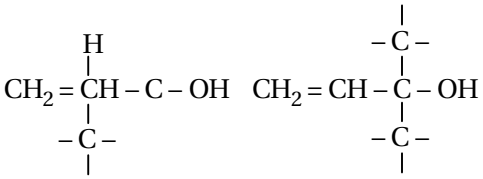
$-CH_2-OH$ $\quad >CH-OH$ $\quad >C-OH$

Primary (1°) Secondary (2°) Tertiary (3°)

➠ **(ii) Allylic alcohols :** The alcohols in which the –OH group is bonded to sp^3 carbon present adjacent to $>C=C<$ are called allylic alcohols. These are further classified as primary allylic, secondary allylic and tertiary allylic alcohols.

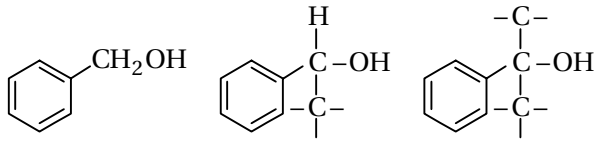
$CH_2 = CH - CH_2 - OH$

Primary



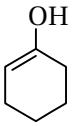
Secondary Tertiary

➠ **(iii) Benzylic alcohols :** In these alcohols, the –OH group is bonded to sp^3 carbon next to an aromatic ring. These are further classified as primary benzylic, secondary benzylic and tertiary benzylic alcohols.



Primary Secondary Tertiary

➠ **(b) Alcohols in which –OH is bonded to sp^2 carbon :** The alcohols in which the –OH group is bonded to sp^2 carbon directly are called vinylic alcohols.

$CH_2 = CH - OH$ 

4) Give classification of ethers. #

➠ The general representation of ether is R – O – R'. Ethers are classified as symmetrical (simple) or unsymmetrical depending on the groups bonded to the oxygen of ether.

➠ If the groups bonded to ethers are same (R = R'), the ethers are known as symmetrical and if the groups bonded are different (R ≠ R'), the ethers known as unsymmetrical.

$C_2H_5OC_2H_5$	$C_2H_5OCH_3$	$C_2H_5OC_6H_5$
Ethoxyethane	Methoxyethane	Ethoxybenzene
(symmetrical)	(unsymmetrical)	

11.2 Nomenclature :

5) Explain IUPAC naming of alcohols, phenols and ethers.

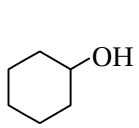
➠

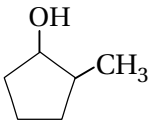
Compounds	Alcohols	Phenols	Ethers
Suffix	-ol (monohydric) -diol (dihydric) -triol (trihydric)	-phenol (derivative of phenol)	-oxy alkane (ethereal oxygen is taken with small chain)

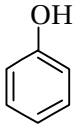
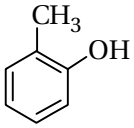
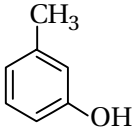
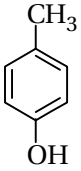
➠ **Alcohols :** 2° Prefix - 1° Prefix - Root word - 1° suffix - 2° suffix (-ol/-diol/-triol)

➠ **Ethers :** Alkoxy (small chain) alkane (parent chain)

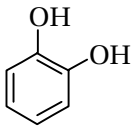
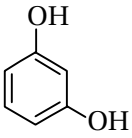
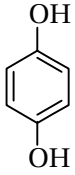
Compound	Common name	IUPAC name
$CH_3 - OH$	Methyl alcohol	Methanol
$CH_3 - CH_2 - CH_2 - OH$	n-Propyl alcohol	Propan-1-ol
$CH_3 - \underset{\displaystyle OH}{\underset{\vert}{CH}} - CH_3$	Isopropyl alcohol	Propan-2-ol
$CH_3 - CH_2 - CH_2 - CH_2 - OH$	n-Butyl alcohol	Butan-1-ol
$CH_3 - \underset{\displaystyle OH}{\underset{\vert}{CH}} - CH_2 - CH_3$	sec-Butyl alcohol	Butan-2-ol
$CH_3 - \underset{\displaystyle CH_3}{\underset{\vert}{CH}} - CH_2 - OH$	Isobutyl alcohol	2-Methylpropan-1-ol
$CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\vert}{\underset{\vert}{C}}}} - OH$	tert-Butyl alcohol	2-Methylpropan-2-ol
$HO - H_2C - CH_2 - OH$	Ethylene glycol	Ethane-1,2-diol
$\underset{\displaystyle OH}{\underset{\vert}{CH_2}} - \underset{\displaystyle OH}{\underset{\vert}{CH}} - \underset{\displaystyle OH}{\underset{\vert}{CH_2}}$	Glycerol	Propane -1, 2, 3-triol


Cyclohexanol

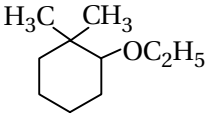

2-Methylcyclopentanol

Common name	Phenol	o-Cresol	m-Cresol	p-Cresol
IUPAC name	Phenol	2-Methylphenol	3-Methylphenol	4-Methylphenol

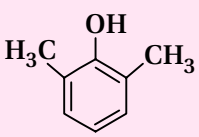
Common name	Catechol	Resorcinol	Hydroquinone or quinol
IUPAC name	Benzene-1,2-diol	Benzene-1,3-diol	Benzene-1,4-diol

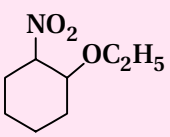
Compound	Common name	IUPAC name
CH_3OCH_3	Dimethyl ether	Methoxymethane
$C_2H_5OC_2H_5$	Diethyl ether	Ethoxyethane
$CH_3OCH_2CH_2CH_3$	Methyl n-propyl ether	1-Methoxypropane
$C_6H_5OCH_3$	Methyl phenyl ether (Anisole)	Methoxybenzene (Anisole)
$C_6H_5OCH_2CH_3$	Ethyl phenyl ether (Phenetole)	Ethoxybenzene
$C_6H_5O(CH_2)_6 - CH_3$	Heptyl phenyl ether	1-Phenoxyheptane
$CH_3O-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_3$	Methyl isopropyl ether	2-Methoxypropane
$C_6H_5-O-CH_2-CH_2-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_3$	Phenyl isopentyl ether	3-Methylbutoxybenzene
$CH_3-O-CH_2-CH_2-OCH_3$	—	1,2-Dimethoxyethane
	—	2-Ethoxy-1,1-dimethyl-cyclohexane

Example-11.1 : Give IUPAC names of the following compounds : # S7

(i) $CH_3-\underset{\displaystyle Cl}{\underset{\vert}{CH}}-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-CH_2OH$

(ii) $CH_3-\underset{\displaystyle CH_3}{\underset{\vert}{CH}}-O-CH_2CH_3$

(iii) 

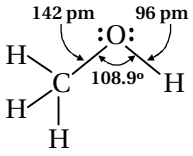
(iv) 

➠ (i) 4-Chloro-2,3-dimethylpentan-1-ol
(ii) 2-Ethoxypropane
(iii) 2,6-Dimethylphenol
(iv) 1-Ethoxy-2-nitrocyclohexane

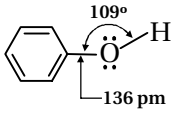
11.3 Structures of Functional Groups :

6) Explain the structures of alcohols and phenols. #

- In alcohols, the –OH group is bonded to the sp^3 hybridized carbon. The oxygen of the –OH group is also sp^3 hybridized with two lone pair of electrons. Thus, the carbon-oxygen bond in alcohol is formed by the straight overlapping of sp^3 orbitals of carbon and oxygen.
- In alcohols, the bond angle is slightly less than the regular tetrahedral angle (109° 28') because of lone-lone pair repulsions on oxygen atom. The bond angle in methanol is 108.9°.
- In phenols, the C – O bond length in phenol is smaller than methanol because (i) Partial double bond character on account of conjugation of unshared electron pair of oxygen with the aromatic ring and (ii) The sp^2 hybridized state of carbon to which the oxygen of –OH group is bonded. The bond angle in phenol is 109°. The C – O bond length in methanol is 142 pm and in phenol it is 136 pm.



Methanol

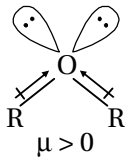


Phenol

- The dipole moment of phenol (1.54 D) is smaller than methanol (1.71 D) because the C – O bond in phenol is less polar due to electron withdrawing effect of benzene ring while in methanol, the C – O bond is more polar due to electron donating effect of methyl group.

7) Write a note on structure of ethers.

- In ethers the, oxygen is bonded to either alkyl or aryl groups. In ethers, four electron pairs i.e., the two bond pairs and two lone pairs of electrons on oxygen atom are arranged approximately in a tetrahedral arrangement.
- In ethers, the bond angle is 111.7°, which is greater than the normal tetrahedral angle (109°28') because of steric repulsions of two bulky alkyl groups bonded to the oxygen atom. The C – O bond length is 141 pm which is nearly same as in alcohols.
- The ethers are polar molecule with the net dipole moment. This is because of its bent structure; the bond moments do not cancel each other. As a result, the boiling points of ethers are higher than alkanes of comparable molecular mass.



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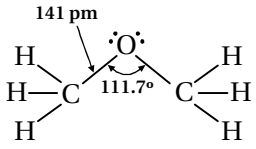
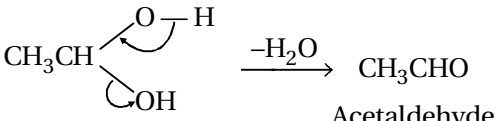


Methoxymethane

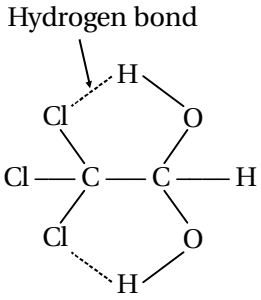
❖ More Information ❖

- The alcohols with two –OH groups on the same carbon are unstable. These compounds lose a water molecule to form either aldehyde or ketones.



Ethylidene glycol — Acetaldehyde

- Chloral hydrate $[CCl_3CH(OH)_2]$, however, is a stable compound because of intramolecular H-bonding.



- **Carbinol system of naming :** The alcohols may be regarded as the derivatives of methyl alcohol commonly known as carbinol. The name of the substituents bonded to the carbon having –OH groups are named in an alphabetical order before the suffix carbinol and entire name of the compound is written in one word.

  CH_3OH (Carbinol),

  $CH_3 – CH_2 – OH$ (Methylcarbinol),

  $(CH_3)_2CH – OH$ (Dimethyl carbinol),

  $CH_3CH(CH_3)CH_2OH$ (Isopropylcarbinol),

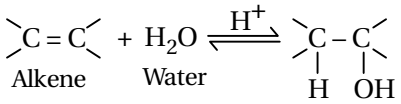
  $(C_6H_5)_3C – OH$ (Triphenyl carbinol) etc.

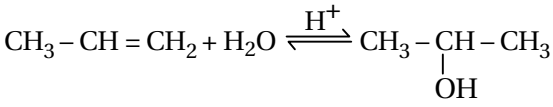
11.4 Alcohols and Phenols :

8) Give the preparation of alcohols from alkenes. #

➠ **The alcohols are prepared from alkenes by two ways :**

➠ **(i) Acid catalysed hydration :** In presence of acid, the hydration of alkenes gives alcohols as per Markovnikov's rule. The acid act as a catalyst in the reaction.

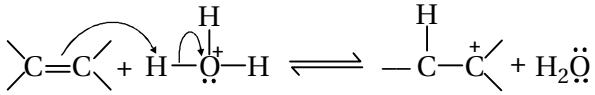




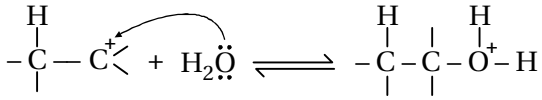
➠ **Mechanism of the reaction :**

Step-1 : Protonation of alkene to form carbocation by electrophilic attack of H_3O^+.

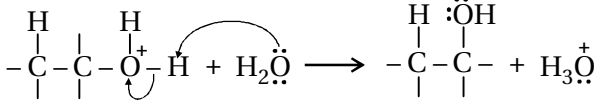
$H_2O + H^+ \rightarrow H_3O^+$



Step-2 : Nucleophilic attack of water on carbocation.

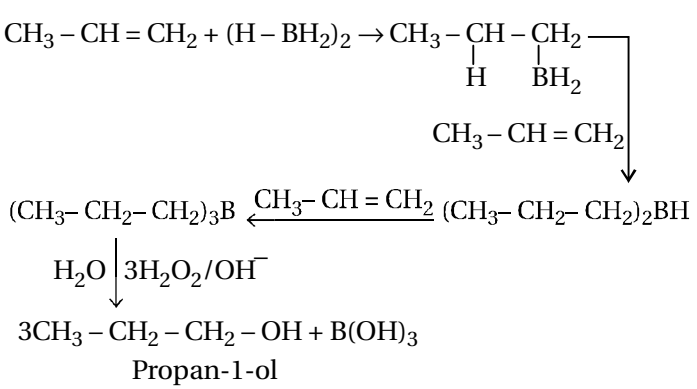


Step-3 : Deprotonation to form an alcohol.



➠ The electrophilic attack by H_3O^+ is a slow step in the reaction and thus it is a rate determining step. As the electrophile is added in a slow step of the reaction, it is known as electrophilic addition reaction.

➠ **(ii) Hydroboration-oxidation of alkenes :** Diborane $(BH_3)_2$ reacts with alkenes to give trialkyl boranes as addition product. The trialkyl borane is oxidized to trialkyl borate by hydrogen peroxide in presence of aqueous alkaline solution.

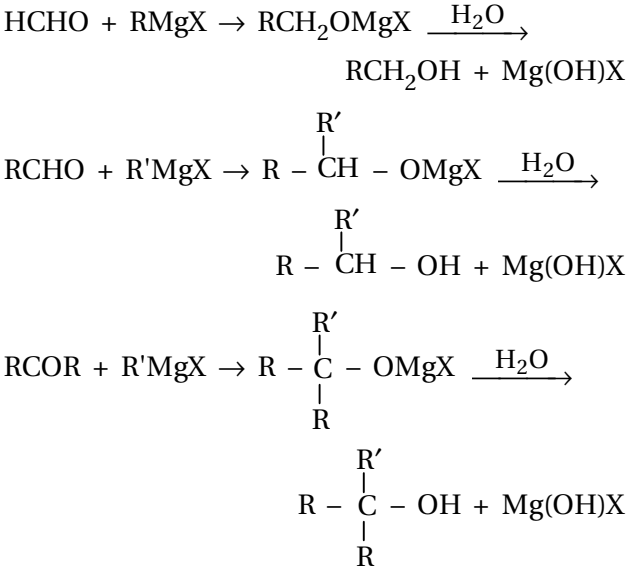


➠ The addition of boranes to double bond takes place in such a manner that the boron atom gets attached sp^2 carbon carrying greater number of hydrogen atoms. The alcohol so formed looks as if it has been formed by the addition of water to the alkene in a way opposite to the Markovnikov's rule. In this method the alcohol is obtained in excellent yield.

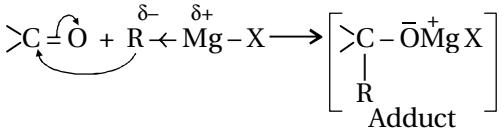
9) Give preparation of alcohols from aldehydes and ketones.

➠ **The alcohols can be prepared from aldehyde and ketones by :**

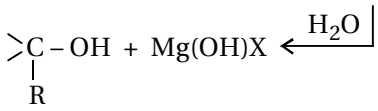
➠ **(i) Reaction with the Grignard reagent (R – MgX) :** By this method, all three types of alcohols i.e., primary, secondary and tertiary alcohols can be prepared. Methanal always produces primary alcohol, aldehyde except methanal produces secondary alcohols whereas ketone always produces tertiary alcohols.



➠ **Mechanism of the reaction :** The first step of the reaction is the nucleophilic addition reaction of Grignard reagent to the carbonyl group to form a tetrahedral intermediate. The hydrolysis of intermediate produces alcohols.

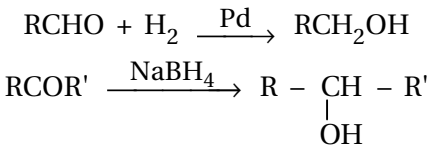


... (i)



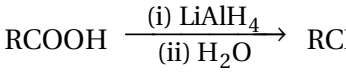
... (ii)

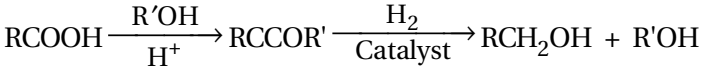
➠ **(ii) Reduction of aldehydes and ketones :** In a presence of reducing agents such as $LiAlH_4/H_2O$ [LAH] or $NaBH_4/H_2O$ or by addition of H_2 in presence of finely divide metals such as Pt or Pd or Ni (Catalytic hydrogenation), the aldehyde and ketone reduces to alcohols. The reduced product of aldehyde is primary alcohol and that of ketone is a secondary alcohol.



10) Give the preparation of alcohols from carboxylic acids and esters. #

➠ The alcohols are prepared from carboxylic acids and esters by reduction. The reducing agent is $LiAlH_4$ / H_2O. The $LiAlH_4$ reduces carboxylic acids in excellent yield. Commercially the carboxylic acids are converted to ester followed by their reduction using hydrogen in the presence of catalyst.





Example-11.2 : Give the structures and IUPAC names of the products expected from the following reactions : S7

(a) Catalytic reduction of butanal.

(b) Hydration of propene in the presence of dilute sulphuric acid.

(c) Reaction of propanone with methyl-magnesium bromide followed by hydrolysis.

➠ (a) $CH_3 - CH_2 - CH_2 - CH_2 - OH$
Butan-1-ol

(b) $CH_3 - \underset{\underset{OH}{|}}{CH} - CH_3$
Propan-2-ol

(c) $CH_3 - \underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}} - OH$
2-Methylpropan-2-ol

❖ More Information ❖

1. The alcohol can be prepared directly also by reduction of ester, aldehyde and ketone in presence of Na/C_2H_5OH. The reaction is known as Bouveault-Blanc reduction. The role of sodium is to provide electron for the reduction.

$$R - CO - OR' \xrightarrow[\text{ethanol}]{\text{Na in}} R - CH_2OH + R' - OH$$

2. The $NaBH_4$ does not reduce ester and carboxylic acids. The $LiAlH_4$ or $NaBH_4$ does not reduce $>C=C<$ unless, the unsaturation is present between $>C=O$ group and C_6H_5 group.

$$C_6H_5 - CH = CH - CH_2 - CH = O \xrightarrow[H_2O]{LiAlH_4\ /} C_6H_5 - CH = CH - CH_2 - CH_2OH$$

$$C_6H_5 - CH = CH - CH = O \xrightarrow[H_2O]{LiAlH_4\ /} C_6H_5 - CH_2 - CH_2 - CH_2OH$$

3. The hydroboration-oxidation reaction is the syn-addition of diborane to the double bond of alkene.

4. Meerwein-Pondorff-Verley reduction : In presence of isopropyl alcohol, the ketones are reduced to secondary alcohol by aluminium isopropoxide. The reverse of this reaction is known Oppenauer oxidation. The acetone formed in this reaction is distilled out from the reaction mixture.

$$R_2CO + (CH_3)_2CH - OH \xrightarrow{[AlOCH(CH_3)_2]_3} R_2CH - OH + (CH_3)_2CO$$

5. Alcohols are also prepared from primary amines. When aliphatic primary amine is treated with nitrous acid, primary alcohol is obtained.

$$R - NH_2 + HONO \rightarrow R - OH + N_2 + H_2O$$

6. Due to pyrophoric nature, instability and toxicity, the lithium aluminium hydride has been replaced by sodium bis-(2-methoxyethoxy) aluminium hydride (SMEAH) that shows similar reactivity.

7. Alcohols are also prepared from alkenes by oxymercuration-demercuration. The reaction takes place by Markovnikov's rule. The reaction is anti-addition and takes place without the formation of the carbocation.

$$R - CH = CH_2 + Hg(OCOCH_3)_2 + H_2O \xrightarrow{THF}$$

$$RCH(OH)CH_2 - HgOCOCH_3 \xrightarrow{NaBH_4}$$

$$RCH(OH)CH_3 + Hg^{2+} + CH_3COO^-$$

8. The reaction of R-Li (Alkyl lithium) with carbonyl compounds such as aldehyde, ketones, esters, epoxide etc. gives alcohols. Also, the Grignard reagent with epoxides gives alcohols. The R^- attacks on the less crowded carbon of the epoxides (S_N2 type reaction).

11) Give commercial preparation of methanol and state its properties and uses. #

➠ Methanol, CH_3OH is also known as "wood spirit" was produced by destructive distillation of wood. Today, most of the methanol is produced by the catalytic hydrogenation of carbon monoxide at high pressure and temperature in presence of $ZnO\text{-}Cr_2O_3$ catalyst.

$$CO + 2H_2 \xrightarrow[200\text{-}300 \text{ atm}\\ 573\text{-}673 \text{ K}]{ZnO - Cr_2O_3} CH_3OH$$

➠ **Properties and Uses of methanol :** Methanol is colourless liquid and boils at 337 K. It is highly toxic in nature. Ingestion of small amount of methanol can cause blindness and large quantities even death.

➠ Methanol is used as solvent in paints, varnishes and chiefly for making formaldehyde.

12) Give commercial preparation of ethanol. State its properties and uses.

➠ Ethanol is commercially prepared by the fermentation reaction. The oldest method is from sugars. The sugar in molasses, sugarcane or fruits such as grapes is converted to glucose and fructose (both have formula $C_6H_{12}O_6$), in the presence of enzyme invertase. Glucose and fructose undergo fermentation in the presence of another enzyme, zymase which is found in yeast.

$$C_{12}H_{22}O_{11} + H_2O \xrightarrow{Invertase} \underset{Glucose}{C_6H_{12}O_6} + \underset{Fructose}{C_6H_{12}O_6}$$

$$C_6H_{12}O_6 \xrightarrow{Zymase} 2C_2H_5OH + 2CO_2$$

➠ In wine making, grapes are the source of sugars and yeast. As grapes ripen, the quantity of sugar increases the yeast grows on the outer skin. When grapes are crushed, sugar and the enzyme come in contact and fermentation starts. Fermentation takes place in anaerobic conditions (absence of air). Carbon dioxide is released during the fermentation.

➠ The action of zymase is inhibited once the percentage of alcohol formed exceeds 14 percent. If air gets into fermentation mixture, the oxygen of the air oxidizes ethanol to ethanoic acid which in turn destroys the taste of alcohol drinks.

➠ The commercial alcohol is made unfit for drinking by addition of copper sulphate (to give it colour) and pyridine (a foul-smelling liquid). It is known as alcohol denaturation. Nowadays, ethanol in large quantities is prepared by hydration of ethene.

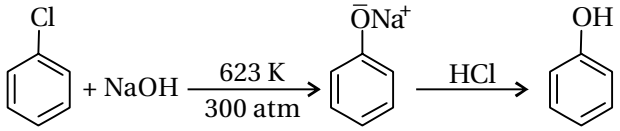
➠ **Properties and uses of ethanol :** Ethanol is a colourless liquid with boiling point 351 K.

➠ It is used as a solvent in paint industry and in the preparation of a few carbon compounds.

13) Give preparation of phenol from chloro-benzene OR

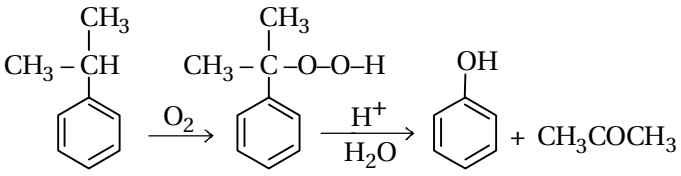
Write a note on Dow's process.

➠ In this method, the chlorobenzene is fused with 6-8 % aqueous NaOH solution at 623 K and 320 atmospheric pressure. The product obtain is sodium phenoxide acidification of which produces phenol.



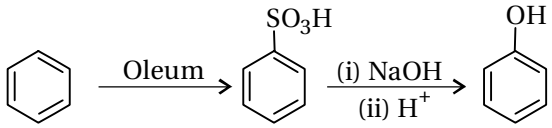
14) Explain cumene process. #

➠ Phenol is manufactured from the hydrocarbon, cumene. Cumene (isopropylbenzene) is oxidized in the presence of air to cumene hydroperoxide. It is converted to phenol and acetone by treating with dilute acid. Acetone, a by-product of this reaction is also obtained in large quantities by this method. By this method, the phenol of high purity is obtained.

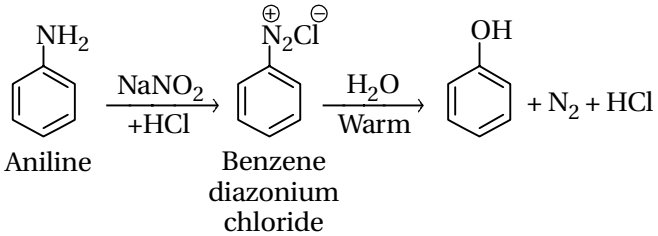


15) Give preparation of phenol from benzene-sulphonic acid and benzene diazonium chloride.

➠ **(i) From benzenesulphonic acid :** Benzene is sulphonated with oleum and benzene sulphonic acid so formed is converted to sodium phenoxide on heating with molten sodium hydroxide. Acidification of the sodium salt gives phenol.



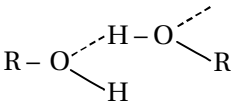
➠ **(ii) From benzene diazonium salt :** A diazonium salt is formed by treating an aromatic primary amine with nitrous acid ($NaNO_2$ + HCl) at 273-278 K. Diazonium salts are hydrolysed to phenols by warming with water or by treating with dilute acids.

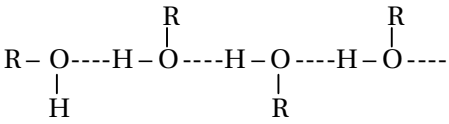


16) Write a note physical properties of alcohols.

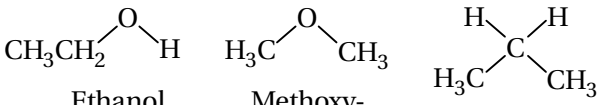
➠ The alcohols consist of two parts, an alkyl group and a hydroxyl group. The properties of alcohol are chiefly due to –OH group.

➠ **(i) Boiling points :** The boiling point of alcohol increases with the increase in the number of carbon atoms. This is because of increase in the van dar Waal's forces. The boiling points, however, decreases with the increase in the branching of chain because with the increase in branching, the contact surface area decreases which results in decrease of van dar Waal's forces.





➠ The boiling point of alcohol is higher than ethers, alkyl halides and alkanes of comparable molecular mass because of intermolecular H-bonding. Alcohols form intermolecular H-bond because of presence of polar –OH group.

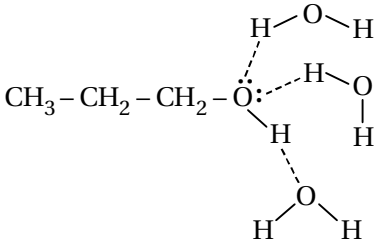


Ethanol Molecular mass/b.p. 46/351 K

Methoxy-methane Molecular mass/b.p. 46/248 K

Propane Molecular mass/b.p. 44/231 K

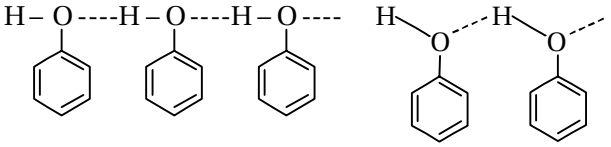
➠ **(ii) Water solubility :** The alcohols are soluble in water because of presence of –OH group in alcohol, that forms intermolecular H-bonds with water. The solubility, however decreases with the increase in the size of carbon chain (alkyl group). The alcohols of lower molecular mass are soluble in water in all proportions.



17) Write a note on physical properties of phenols. #

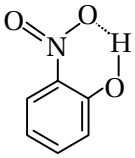
➠ The phenol consists of two parts, an aryl group and a hydroxyl group. The properties of phenol are chiefly due to –OH group.

➠**(i) Boiling points :** The boiling point of phenol is higher than haloarenes, alkyl benzenes and benzene of comparable molecular mass because it forms intermolecular H-bonding due to presence of polar –OH group.

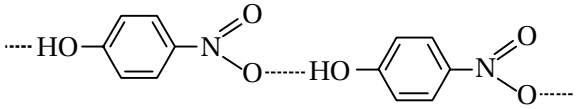


➠**(ii) Water solubility :** The phenols are water soluble because of formation of intermolecular H-bonding. The boiling point decreases with the increase in the size of aryl group.

➠ The o-nitrophenol and p-nitrophenol differs largely in properties. The o-nitrophenol shows intramolecular H-bonding whereas the p-nitrophenol shows intermolecular H-bonding. Thus, o-nitrophenol shows lower boiling point and lower water solubility than p-nitrophenol.



o-Nitrophenol
(Intramolecular H-bonding)



p-Nitrophenol
(Intermolecular
H-bonding)

Example-11.3 : Arrange the following sets of compounds in order of their increasing boiling points : S7

(a) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol.

(b) Pentan-1-ol, n-butane, pentanal, ethoxyethane.

➠ (a) Methanol, ethanol, propan-1-ol, butan-2-ol, butan-1-ol, pentan-1-ol.

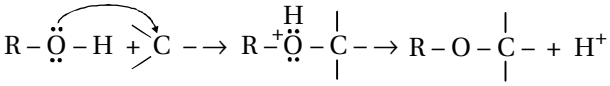
(b) n-Butane, ethoxyethane, pentanal and pentan-1-ol.

UID : P2-C11-S1-Q17

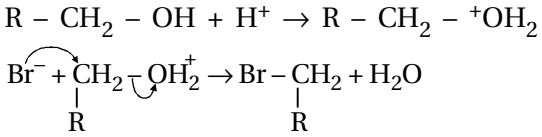
18) Write a note on chemical properties of alcohols.

➠ In alcohols, the C – O bond and O – H bonds are polar bonds. These bonds in the presence of polar reagents will undergo cleavage. Also, the oxygen of –OH group of alcohol act as electron donor as it possesses non-bonding electron pairs. The alcohols act as both electrophiles and nucleophiles. When the O – H bond is broken, it acts as nucleophiles and act as an electrophile when C – O bond is broken.

Alcohols as nucleophiles



Protonated alcohols as electrophiles



➠ **Thus, alcohols show three types of reactions :**

➠**(i) Reaction involving breaking of O – H bonds :** These reactions include the breaking of O – H bond whereas the C – O bond remains undisturbed. The reaction of alcohols with active metals, with carboxylic acid (esterification) and their derivatives etc. involves cleavage of O – H bond.

➠**(ii) Reactions involving breaking of C – OH bond :** These reactions include the cleavage of C – OH bond. When the bond is broken, the shared pair of electrons is taken away by the oxygen giving rise to the formation of carbocation intermediate. The order of reactivity of the alcohols is 3° > 2° > 1°, because the tertiary carbocation is most stable. The reactions of alcohols with hydrogen halides, phosphorus halides, thionyl chloride etc. involves breaking of C – OH bond.

➠**(iii) Reactions involving both alkyl group and –OH group :** These types of reactions are dehydration of alcohols, oxidation of alcohols etc.

19) Write a note on acidic nature of alcohols.

➠ The hydrogen of –OH group of alcohol is acidic in nature.

➠**(i) Reactions with metals :** The alcohols with an electropositive element such as Na, K, Ca, Zn, Mg etc. produce dihydrogen gas and metal alkoxide.

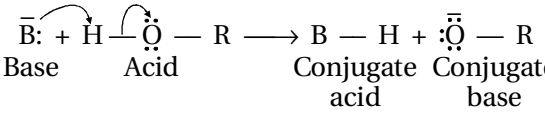
$$2R - O - H + 2Na \longrightarrow 2R - O - Na + H_2$$

Sodium alkoxide

$$6CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-OH + 2Al \longrightarrow 2\left(CH_3-\underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}}-O\right)Al + 3H_2$$

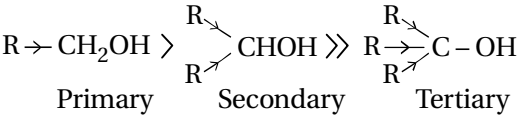
tert-Butyl alcohol Aluminium tert-butoxide

➠ **(ii) Reaction with the strong base :** The alcohols react with the strong base by donating its proton. Thus, alcohols act as a Bronsted acids.



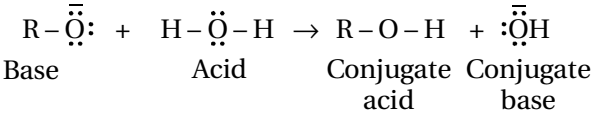
Base Acid Conjugate acid Conjugate base

➠ The acidic nature of alcohol is because of polar O – H bond. An electron-releasing group ($-CH_3$, $-C_2H_5$) increases electron density on oxygen tending to decrease the polarity of O – H bond. This decreases the acid strength. For this reason, the acidic strength of alcohols decreases from primary to tertiary.



Primary Secondary Tertiary

➠ The alcohol however, is less acidic than water. This can be illustrated by the reaction of water with an alkoxide. The reaction shows that water is better proton donor than alcohol and thus act as a stronger acid. Also, the alkoxide is better proton acceptor than hydroxide ion, which suggest than alkoxide are strong bases.



Base Acid Conjugate acid Conjugate base

➠ The alcohols are Bronsted base. This is because of presence of electron pairs on oxygen atom that makes the alcohol a proton acceptors.

20) Write a note on esterification reaction of alcohols. #

➠ The alcohols react with carboxylic acid and its derivatives such as acid halides and acid anhydrides to form esters. The reaction of alcohol with the carboxylic acid and acid anhydride is carried out in presence of a small amount concentrated sulphuric acid. The reaction is reversible and therefore, water is removed as soon as the ester is formed.

➠ The reaction

$$ROH + R' - COOH \underset{}{\overset{H^+}{\rightleftharpoons}} ROCOR' + H_2O$$

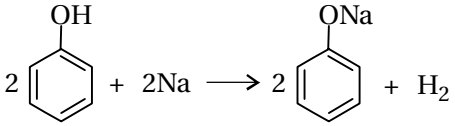
$$R - OH + (R'CO)_2O \overset{H^+}{\rightleftharpoons} ROCOR' + R'COOH$$

of acid halides is carried out the presence of base such as pyridine so as to neutralize HCl which is formed during the reaction. It shifts the equilibrium to the right-hand side. The introduction of CH_3CO group to alcohols is known as acetylation.

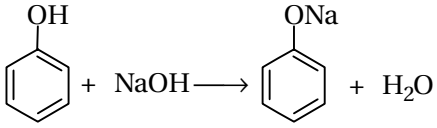
$$ROH + R'COCl \xrightarrow{\text{Pyridine}} ROCOR' + HCl$$

21) Write a note of acidic nature of phenol and compare its acidic strength with the alcohols.

➠ The acidic nature of phenol is due to the presence of polar –OH group and resonance stabilization of the phenoxide ion. Phenol produces hydrogen gas when reacted with electropositive elements such as sodium, potassium, magnesium etc. It also reacts with sodium hydroxide to form sodium phenoxide.

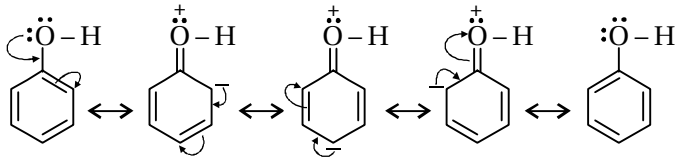


Phenol Sodium Phenoxide

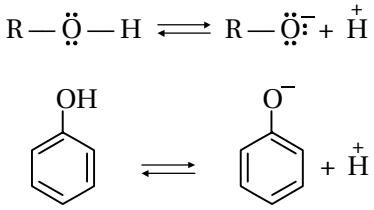


Sodium Phenoxide

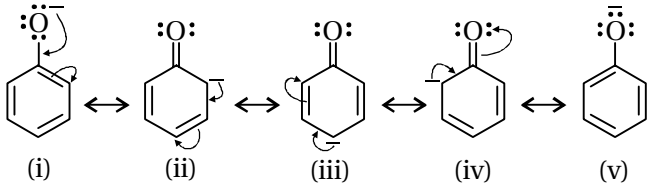
➠ The hydroxyl group of phenol is bonded directly to the sp^2 carbon of the benzene ring that acts as an electron withdrawing group. Due to this, the charge distribution in phenol molecule as depicted in its resonance structures, causes the oxygen of –OH to be positive.



➠ **Comparison of acidic strength with alcohols :** The reaction of phenol with sodium hydroxide indicates that phenols are stronger acids than alcohols and water. The ionization of alcohol and phenol takes place as follows:



- Due to the higher electronegativity of sp^2 carbon of phenol, the electron density on the oxygen atom decreases. This increase the polarity of O – H bond and results in an increase in ionization of phenols than that of alcohols.
- In alkoxide ion, the negative charge on the oxygen atom is localized whereas in phenoxide ion, it is delocalized due to resonance. The delocalization of negative charge makes the phenoxide ion more stable and favours the ionization of phenol. Although there is also a charge delocalization in phenol, its resonance structures have charge separation due to which the phenol molecule is less stable than phenoxide ion.



- Phenol, however, being a weaker acid, will not decompose sodium carbonate and sodium hydrogen carbonate. This indicates that phenols are weaker acid than carboxylic acids.

22) Write a note on acidic strength of substituted phenols. #

- In substituted phenols, the presence of electron withdrawing groups such as nitro group, enhances the acidic strength of phenol. The effect is more pronounced when groups are present at ortho and para positions. It is due to effective delocalization of negative charge in phenoxide ion when the substituents are present at ortho and para positions.
- The presence of electron releasing groups, for example, the alkyl groups, do not favour the formation of phenoxide ion. This results in the decrease in the acidic strength. For example, cresol is less acidic than phenol.

pK_a Values of some Phenols and Ethanol

Compound	Formula	pK_a
o-Nitrophenol	o-$O_2N-C_6H_4-OH$	7.2
m-Nitrophenol	m–O_2N–C_6H_4-OH	8.3
p-Nitrophenol	p-$O_2N-C_6H_4-OH$	7.1
Phenol	C_6H_5-OH	10.0
o-Cresol	o-$CH_3-C_6H_4-OH$	10.2
m-Cresol	m-$CH_3C_6H_4-OH$	10.1
p-Cresol	p-$CH_3-C_6H_4-OH$	10.2
Ethanol	C_2H_5OH	15.9

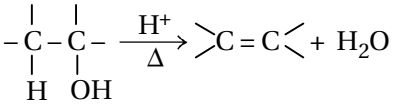
Lower pK_a value, indicates greater acidic strength.

Example-11.4 : Arrange the following compounds in increasing order of their acid strength : Propan-1-ol, 2,4,6-trinitrophenol, 3-nitrophenol, 3,5-dinitrophenol, phenol, 4-methylphenol : S7

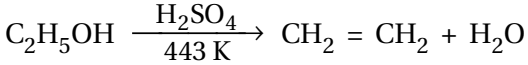
- Propan-1-ol, 4-methylphenol, phenol, 3-nitrophenol, 3,5-dinitrophenol, 2,4,6-trinitrophenol.

23) Explain dehydration of alcohols.

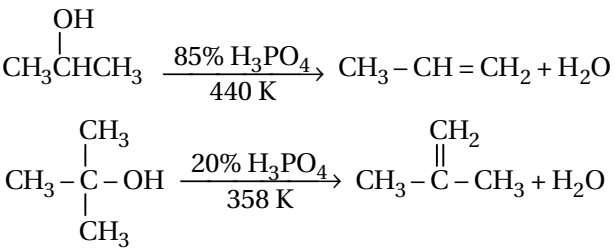
- In the presence of strong dehydrating agents such as conc. H_2SO_4 or H_3PO_4, the alcohols dehydrate to form alkenes. The reaction is also carried out in presence of catalyst such as alumina or anhydrous zinc chloride. The alkene is formed as per Saitzev's rule.
- The reaction proceeds by formation of carbocation intermediate. Thus, the relative ease of dehydration of alcohols is 3° > 2° > 1°



- Ethanol dehydrates to form ethene by heating with conc. H_2SO_4 at 443 K temperature.



- Secondary and tertiary alcohols are dehydrated under milder conditions. For example,



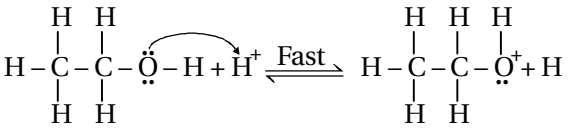
24) Give the mechanism of dehydration of alcohols. # OR

Write the reaction mechanism of dehydration of ethanol in presence of acid to form ethene.

[August-2020]

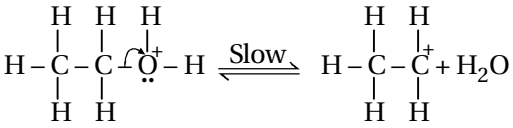
➠ The mechanism takes place in three steps as follows :

Step-1 : Formation of protonated alchohol.

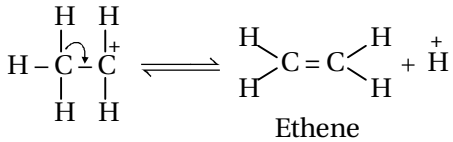


Ethanol — Protonated alcohol (Ethyl oxonium ion)

Step-2 : Formation of carbocation : It is the slowest step and hence, the rate determining step of the reaction.



Step-3 : Formation of ethene by elimination of a proton.



Ethene

➠ The acid used in step-1 is released in step-3. To drive the equilibrium to the right. The ethene is removed as it is formed.

25) Write the reactions of alcohols with hydrogen halides. OR Explain Lucas test. [May-2021]

➠ With hydrogen halides, the alcohols react to form alkyl halides. The difference in the reactivities of three classes of alcohols with HCl distinguishes from one another.

➠ The alcohol reacts with Lucas reagent (conc. HCl and $ZnCl_2$) while their halides are immiscible and produce turbidity in solution. In case of tertiary alcohols, the turbidity is produced immediately as they form halides easily. Primary alcohols do not produce turbidity at room temperature.

➠ The reaction of tertiary alcohols take place by S_N1 mechanism whereas primary and secondary alcohols reacts by S_N2 mechanism.

$$(CH_3)_3C - OH \xrightarrow{ZnCl_2/HCl} (CH_3)_3\ C - Cl + H_2O$$

26) Give the reactions of alcohols with phosphorus halides.

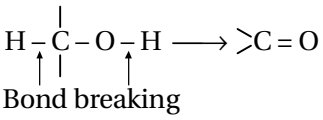
➠ Alcohols react with phosphorus halides such as PCl_5, PCl_3, PI_3 etc. to form corresponding alkyl halides. Phosphorus tribromides and phosphorus tri-iodides are prepared in situ during the reaction by action of phosphorus on bromine and iodine.

$$3R - OH + PX_3 (X = Br, I) \rightarrow 3R - X + H_3PO_3$$

$$R - OH + PCl_5 \rightarrow R - Cl + POCl_3 + HCl$$

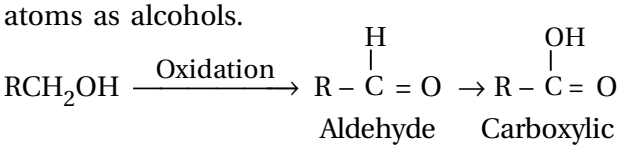
27) Write a note on oxidation of alcohols.

➠ Oxidation of alcohols involves the formation of $>C = O$ with the cleavage of C – O and C – H bonds. Such a cleavage and formation of bonds occur in oxidation reactions. This is also known as dehydrogenation reaction because it involves the loss of dihydrogen from alcohol molecule.



Bond breaking

➠ **(i) Oxidation of primary alcohols :** In presence of oxidizing agents such as acidic potassium dichromate solution, or acidified potassium permanganate, anhydrous chromium trioxide etc., the primary alcohol gets oxidized to aldehyde and then to carboxylic acids. The aldehyde and carboxylic acid formed during the reaction contains the same number of carbon atoms as alcohols.



Aldehyde — Carboxylic acid

➠ CrO_3 is used in anhydrous medium for isolation of aldehydes.

$$RCH_2OH \xrightarrow{CrO_3} RCHO$$

➠ A better reagent for the oxidation of primary alcohols to aldehydes in good yield is pyridinium chlorochromate (PCC), a complex of chromium trioxide with pyridine and HCl.

$$CH_3 - CH = CH - CH_2OH \xrightarrow{PCC} CH_3 - CH = CH - CHO$$

➠ When the vapours of primary alcohol are passed through Cu at 573 K, the alcohol dehydrogenates to form aldehyde.

$$RCH_2OH \xrightarrow[573\ K]{Cu} RCHO$$

➠**(ii) Oxidation of Secondary alcohols :** Secondary alcohols are easily oxidized to ketones with same number of carbon atoms by oxidizing agents such chromic anhydride or acidified dichromate solution. However, under vigorous conditions, the ketones are further oxidized to carboxylic acids. The carboxylic acid formed has the smaller number of carbon atoms then the parent alcohols.

$$R-\underset{\underset{OH}{|}}{CH}-R' \xrightarrow{CrO_3} R-\underset{\underset{O}{||}}{C}-R'$$

Sec-alcohol Ketone

$$(CH_3)_2CH-OH \xrightarrow{[O]} (CH_3)_2CO$$

$$\xrightarrow{\text{vigorous conditions}} HCOOH + CH_3COOH$$

➠ When the vapours of secondary alcohols are passed through Cu at 573 K, the alcohol dehydrogenates to form ketones.

$$R-\underset{\underset{OH}{|}}{CH}-R' \xrightarrow[573\ K]{Cu} R-\underset{\underset{O}{||}}{C}-R'$$

➠**(iii) Oxidation of tertiary alcohols :** Tertiary alcohols do not undergo oxidation due to absence of hydrogen on alpha carbon. However, under strong reaction conditions, such as presence of strong oxidizing agents ($KMnO_4$ or conc. HNO_3) and elevated temperatures, the C – C bonds and C – O bond breaks to form ketones with a lesser number of carbon atoms which further oxidizes to form mixture of carboxylic acids.

$$(CH_3)_3C-OH \xrightarrow{[O]} (CH_3)_2CO \xrightarrow{[O]}$$

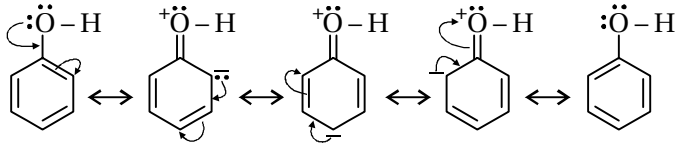
$$CH_3COOH + HCOOH \xrightarrow{[O]} H_2O + CO_2$$

➠ When the vapours of tertiary alcohols are passed through Cu at 573 K temperature, it dehydrates to form alkenes.

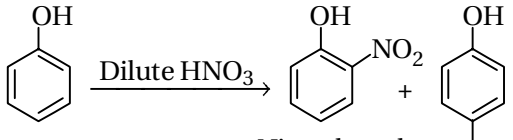
$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-OH \xrightarrow[573\ K]{Cu} CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2$$

28) Write a note on nitration reactions of phenols. #

➠ In phenol, the reactions that take place on the aromatic ring are electrophilic substitution reactions. The –OH group attached to the benzene ring activates it towards electrophilic substitution. Also, it directs the incoming group to ortho and para positions in the ring as these positions become electron rich due to the resonance effect caused by –OH group.

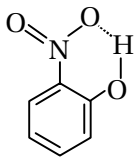


➠**(i) Nitration of phenols :** With dilute nitric acid at low temperature (298 K), phenol yields a mixture of ortho and para nitrophenols.

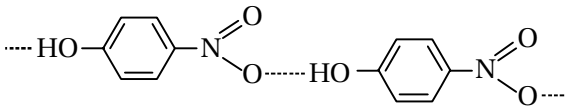


o-Nitrophenol p-Nitrophenol

➠ The ortho and para isomers can be separated by steam distillation. The o-nitrophenol is steam volatile due to intermolecular hydrogen bonding while p-nitrophenol is less volatile due to intermolecular H-bonding which causes association of the molecules.

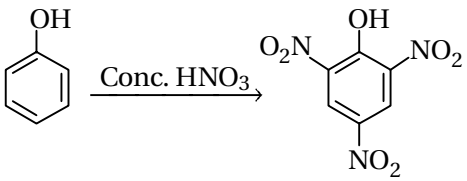


o-Nitrophenol
(Intramolecular H-bonding)



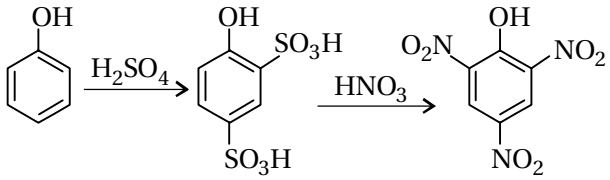
p-Nitrophenol
(Intermolecular H-bonding)

➠ With concentrated nitric acid, phenol is converted to 2,4,6-tinitrophenol (Picric acid).



2, 4, 6-trintrophenol
(Picric acid)

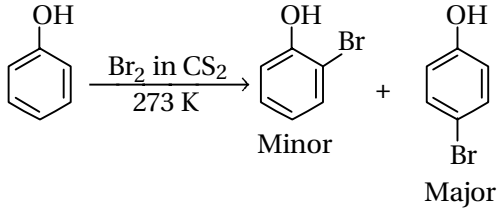
➠ Now-a-days the picric acid is prepared by treating phenol first with concentrated sulphuric acid which converts it to phenol-2,4-disulphonic acid and then with concentrated nitric acid to get 2,4,6-trinitrophenol.



29) Write a note on bromination of phenols. #

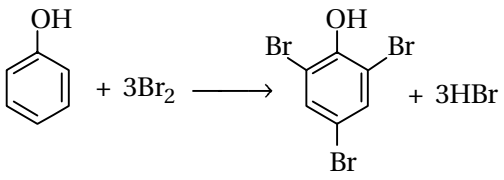
➠ On treating the phenol with bromine, different reaction products are formed under different experimental conditions.

➠ **(a)** When the reaction is carried out in solvents of low polarity such as chloroform or carbon-disulphide, ($CHCl_3$ or CS_2) and at low temperature, mono-bromophenols are obtained.



➠ **(b)** The usual halogenation of benzene takes place in the presence of Lewis acid such as $FeBr_3$ which polarizes the Br_2 molecule. In case of phenol, the polarization of bromine takes place even in the absence of Lewis acid. It is due to highly activating effect of –OH group attached to benzene ring.

➠ When phenol is treated with bromine water, 2,4,6-tribromophenol is formed as white precipitates.



2, 4, 6-tribromophenol

Example-11.5 : Write the structures of the major products expected from the following reactions :

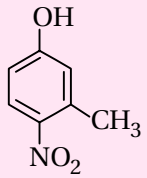
(a) Mononitration of 3-methylphenol

(b) Dinitration of 3-methylphenol

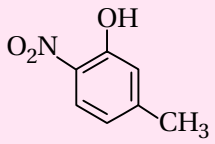
(c) Mononitration of phenyl methanoate. S7

➠ The combined influence of –OH and $–CH_3$ groups determine the position of the incoming group.

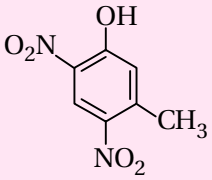
(a)



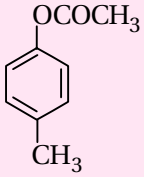
and



(b)

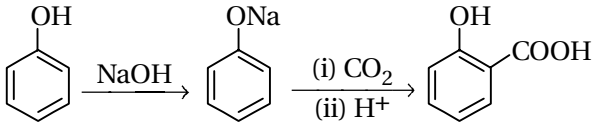


(c)



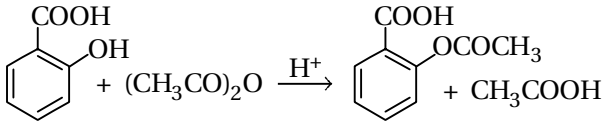
30) Write a note on Kolbe's reaction. OR Write chemical reaction to form Salicylic acid from phenol. Discuss uses of methyl salicylate by writing structural formula. [July-2018]

➠ Phenoxide ion generated by treating phenol with sodium hydroxide is even more reactive than phenol towards electrophilic aromatic substitution. Hence, it undergoes electrophilic substitution with carbon dioxide, a weak electrophile. The ortho-hydroxy benzoic acid is formed as the main reaction product.



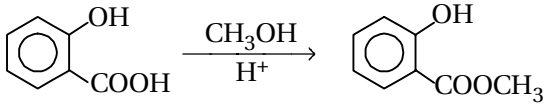
2-Hydroxybenzonic acid
(Salicylic acid)

➠ The ortho hydroxybenzoic acid when reacted with acetic anhydride, the aspirin (2-ethanoyloxy benzene carboxylic acid) is obtained. Aspirin is an analgesic drug. The reaction is known as acetylation of phenolic group.



Salicylic acid — Acetylsalicylic acid (Aspirin)

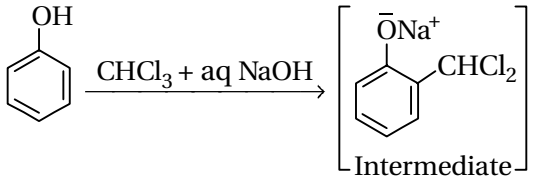
➠ The esterification of salicylic acid with methanol gives analgesic drug methyl salicylate.

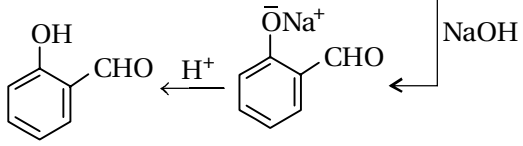


Salicylic acid — Methyl Salicylic

31) Write a note on Reimer-Tiemann reaction. #

➠ On treating a phenol with chloroform in the presence of sodium hydroxide, a –CHO group is introduced at ortho position of the ring. This reaction is known as Reimer-Tiemann reaction. The intermediate benzal chloride is hydrolysed in the presence of alkali to form salicylaldehyde.

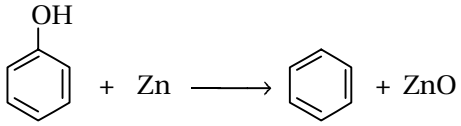




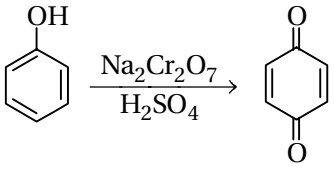
Salicylaldehyde

32) Give the oxidation and the reduction reactions of phenols.

➠ Phenol is converted to benzene on heating with zinc dust. This is the reduction reaction of phenol.



➠ The oxidation of phenol with chromic acid produces a conjugated diketone known as benzoquinone. In the presence of air, phenols are slowly oxidized to dark coloured mixture containing quinones.



Benzoquinone

❖ More Information ❖

1) Victor Meyer's Test :

➠ The test is specifically used to distinguish primary, secondary and tertiary alcohols.

$$R-CH_2-OH \xrightarrow{P+I_2} R-CH_2-I \xrightarrow{AgNO_2} RCH_2NO_2 \xrightarrow{HNO_2} R-C(NO_2)=N-OH \xrightarrow{NaOH} \text{Blood red colour}$$

$$R_2CH-OH \xrightarrow{P+I_2} R_2-CH-I \xrightarrow{AgNO_2} R_2-CHNO_2 \xrightarrow{HNO_2} R_2C(NO_2)-NO \xrightarrow{NaOH} \text{Blue colour}$$

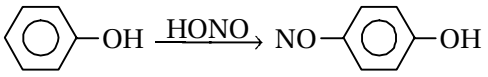
➠ Tertiary alcohols give no colour.

2) Neutral $FeCl_3$ test :

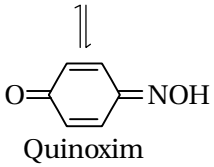
➠ With Neutral $FeCl_3$, phenol gives violet colour due to formation of complex $[Fe(OC_6H_5)_6]^{3-}$. The cathechol gives green, resorcinol gives violet, o-cresol gives blue and pyrogallol gives red colour with neutral ferric chloride.

3) Libermann's Nitroso Reaction :

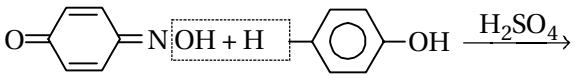
➠ The reaction is used for the detection of phenols. When phenol is warmed with a mixture of sodium nitrite and conc. H_2SO_4 a characteristic blue or green colour is obtained. When the reaction mixture is diluted with water, the colour becomes red but again turns deep blue on adding excess of sodium hydroxide.

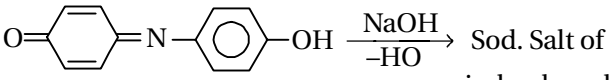


p-Nitrosophenol



Quinoxim



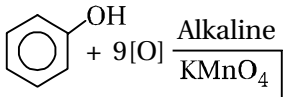


Indo phenol (Red)

indo phenol (blue)

4) Oxidation of alkaline $KMnO_4$:

➠ In presence of alkaline $KMnO_4$, the aromatic ring of phenol gets ruptured resulting in the formation of tartaric acid and carbon dioxide.



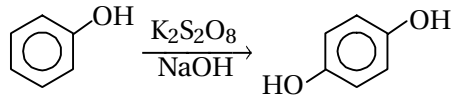
Phenol

$$HOOC-CH(OH)-CH(OH)-COOH + 2CO_2$$

Tartaric acid

5) Elbs persulphate oxidation of phenol :

➠ When phenol is oxidized by alklaine potassium persulphate, it forms p-dihydroxybenzene.



Phenol

p-dihroxybenzene

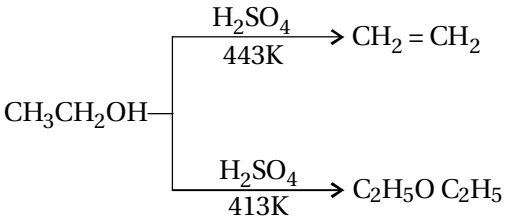
11.6 Ethers :

33) Give preparation of ethers from alcohols. #

OR

Explain the intermolecular dehydration of alcohols. State the limitations of this method.

➠ In the presence of protic acids such as H_2SO_4 or H_3PO_4, the alcohol dehydrates to form either alkene or ether depending upon the reaction conditions. For example, ethanol is dehydrated to ethene in the presence of sulphuric acid at 443 K and at 413 K, ethoxyethane is obtained.



➠ The formation of ether is a nucleophilic bimolecular substitution reaction (S_N2) involving the attack of alcohol molecule on a protonated alcohol. The reaction takes place as follows :

(i) $CH_3 - CH_2 - \ddot{O} - H + H^+ \rightarrow CH_3 - CH_2 - \overset{H}{\overset{|}{\overset{+}{\ddot{O}}}} - H$

(ii) $CH_3CH_2 - \ddot{O}: + CH_3 - CH_2 - \overset{+}{O}\langle \overset{H}{H} \longrightarrow$

$CH_3CH_2 - \overset{+}{\underset{H}{O}} - CH_2CH_3 + H_2O$

(iii) $CH_3CH_2 - \overset{+}{O}(H) - CH_2CH_3 \longrightarrow$

$CH_3CH_2 - O - CH_2CH_3 + H^+$

Order of dehydration of alcohols to form ethers : 1° > 2° > 3°

➠ **Limitations of the method :**

➠ **(i)** The method is suitable for the preparation of ethers having primary alkyl groups only. The alkyl group should be unhindered, and the temperature of the reaction must be low otherwise the alkene will be formed in major proportion. If the alcohol is secondary or tertiary, the elimination favours over substitution and as a result, alkene will be obtained as a major product.

➠ **(ii)** The method is not suitable for the preparation of unsymmetrical ethers (mixed ethers). This is because of combination of two different alcohols that would result in the formation of mixture of three ethers which are not easy to separate. For example, the ethyl methyl ether cannot be prepared by this method.

34) Write a note on Williamson's ether synthesis.

OR

Write a laboratory preparation of symmetrical and unsymmetrical ethers. **OR**

Explain Williamson synthesis to prepare ether and state the limitation of the process. State all reactions. **[August-2020]**

➠ In this method, an alkyl halide is allowed to react with sodium alkoxide.

$$R - X + R' - \ddot{O}\,\overset{+}{Na} \longrightarrow R - \ddot{O} - R' + NaX$$

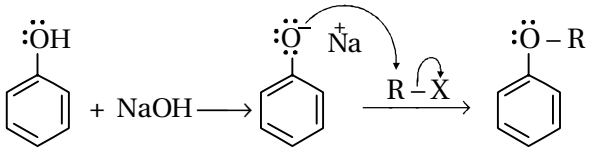
➠ Ethers containing substituted alkyl groups (secondary or tertiary) may also prepared by this method. The reaction involves the S_N2 attack of an alkoxide ion on a primary alkyl halide. With the primary alkyl halide better results are obtained. In case of secondary and tertiary alkyl halides, elimination competes over substitution. If the tertiary alkyl halide is used, an alkene is the only reaction product and no ether is formed. This can be observed from the following reactions :

$$CH_3 - \underset{CH_3}{\overset{CH_3}{C}} - \ddot{O}\,Na + CH_3 - Br \rightarrow CH_3 - \ddot{O} - \underset{CH_3}{\overset{CH_3}{C}} - CH_3 + NaBr$$

$$CH_3 - \underset{CH_3}{\overset{CH_3}{C}} - Br + Na\ddot{O} - CH_3 \rightarrow CH_3 - \underset{CH_3}{C} = CH_2 + NaBr + CH_3OH$$

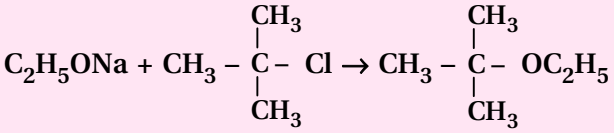
2-Methylpropene

➠ In order to prepare tertiary ether, the primary alkyl halide is taken as substrate and nucleophile is chosen as tertiary in order to prevent the formation of alkene molecule. The alkene is formed because of strong basic nature of alkoxide group that favours the formation of alkene from tertiary alkyl halides. Phenols are also converted to ethers by this method.



➠ **For limitations of the process see topic of answer No.-33**

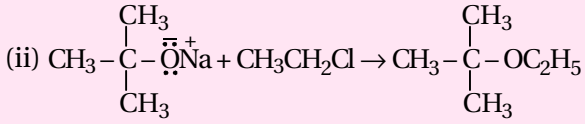
Example-11.6 : The following is not an appropriate reaction for the preparation of t-butylethyl ether.



(i) What would be the major product of this reaction ?

(ii) Write a suitable reaction for the preparation of t-butylethyl ether. **S7**

➠(i) The major product of the given reaction is 2-methylprop-1-ene. It is because sodium ethoxide is a strong nucleophile as well as a strong base. Thus elimination reaction predominates over substitution.

(ii) 

35) Write a note on physical properties of ethers.

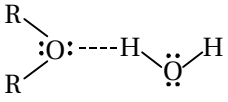
➠**(i) Boiling points :** The C – O bonds in ethers are polar and thus, ethers have a net dipole moment. The weak polarity of ethers, do not appreciably affect their boiling points which are comparable to those of alkanes of comparable molecular masses but are much lower than the boiling points of alkanes of comparable molecular masses and are much lower than the boiling points of alcohols as shown in the following cases :

Formula :

	$CH_3(CH_2)_3CH_3$	$C_2H_5-O-C_2H_5$	$CH_3(CH_2)_3-OH$
	n-Pentane	Ethoxyethane	Butan-1-ol
b.p./K	309.1	307.6	390

➠ The large difference in the boiling points of alcohols and ethers is due to the presence of hydrogen bonding in alcohols.

➠**(ii) Water solubility :** The miscibility of ethers with water resembles those of alcohols of the same molecular masses. Both ethoxyethane and butan-1-ol are soluble in water to almost same extent, i.e., 7.5 and 9 g per 100 mL water, respectively, whereas pentane is insoluble in water because of its non-polar nature. The solubility of ethers in water is due to fact that oxygen of ethers forms H-bonding with water.



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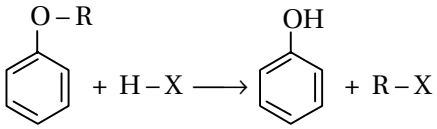
36) Write a note on reaction of ethers with hydrogen halides.

➠ Ethers behaves nearly as an inert material. However, in acidic medium, the ethers show chemical reactivity. The cleavage of C – O bond in ethers takes place under drastic conditions with excess of hydrogen halides. The reaction of dialkyl ethers gives two alkyl halide molecules.

$$R-O-R + HX \longrightarrow RX + R-OH$$

$$R-OH + HX \longrightarrow R-X + H_2O$$

➠ Alkyl aryl ethers are cleaved at the alkyl-oxygen bond due to more stable aryl- oxygen bond. This reaction yields phenol and alkyl halide.



➠ The ethers with two different alkyl groups are also cleaved in a same manner.

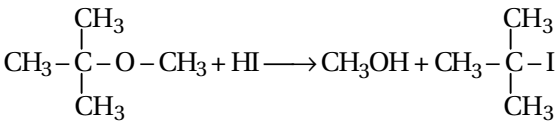
$$R-O-R' + HX \longrightarrow R-X + R'-OH$$

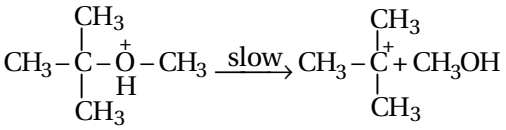
➠ The reactivity of ethers can be summarized as:

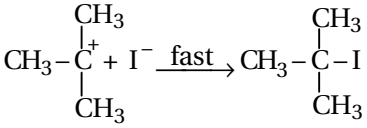
	Nature of Alkyl Group	Reaction Path
1.	Tertiary	S_N1
2.	Primary or secondary	S_N2

➠ Whereas the reactivity of hydrogen halides is HI > HBr > HCl > HF. The cleavage of ethers takes place by HBr or HI at a high temperature.

➠ If one of the groups is a tertiary alkyl group, the reaction proceeds by S_N1 path because of formation of stable tertiary carbocation intermediate.







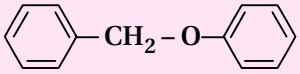
➠ In case of anisole, methylphenyl oxonium ion formed by protonation of ether. The bond between O – CH_3 is weaker than the bond between O – C_6H_5 because the carbon of phenyl group is sp^2 hybridized and there is a partial

double bond character. Therefore, the attack of I^- ion breaks the $O-CH_3$ bond to form CH_3I. Phenols do not react further to give halides because the sp^2 hybridized carbon of phenol cannot undergo nucleophilic substitution reaction needed for the conversion of halide.

Example-11.7 : Give the major products that are formed by heating each of the following ethers with HI.

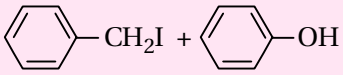
(i) $CH_3-CH_2-\underset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2-O-CH_2-CH_3$

(ii) $CH_3-CH_2-CH_2-O-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-CH_2-CH_3$

(iii)  **S7**

➠ (i) $CH_3-CH_2-\underset{\displaystyle CH_3}{\overset{|}{CH}}-CH_2OH + CH_3CH_2I$

(ii) $CH_3CH_2CH_2OH + CH_3CH_2-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-I$

(iii) 

37) Write the mechanism of reaction of ethers with hydrogen halides. #

➠ The reaction of ether with HI starts with the protonation of ether molecule.

Step-1 :

$$CH_3-\ddot{O}(-CH_2-CH_3)+H-I \rightleftharpoons CH_3-\overset{\displaystyle H}{\overset{|}{\overset{+}{\ddot{O}}}}-CH_2CH_3 + I^-$$

➠ The reaction takes place with HBr or HI because these reagents are sufficiently acidic.

Step-2 :

➠ Iodide is a good nucleophile. It attacks the least substituted carbon of the oxonium ion formed in step-1 and displaces an alcohol molecule by S_N2 mechanism. Thus in the cleavage of mixed ethers with two different alkyl groups, the alcohol and alkyl iodide formed, depend on the nature of alkyl groups. When primary or secondary alkyl groups are present, it is lower alkyl group that forms alkyl iodide (S_N2 reaction).

$$I^- + CH_3-\overset{\displaystyle H}{\overset{|}{\overset{+}{\ddot{O}}}}-CH_2CH_3 + \rightarrow \left[I\text{ --- }CH_3\text{ --- }\overset{\displaystyle H}{\overset{|}{\overset{+}{\ddot{O}}}}\text{--- }CH_2CH_3\right]^-$$

$$\longrightarrow CH_3-I + CH_3CH_2-OH$$

➠ When HI is in excess and the reaction is carried out at high temperature, ethanol reacts with another molecule of HI and is converted to ethyl iodide.

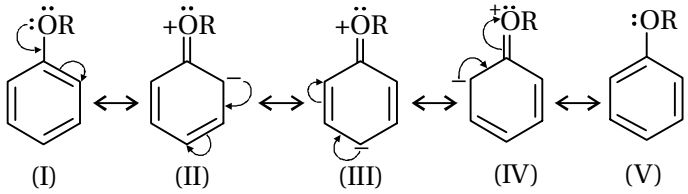
Step-3 :

$$CH_3CH_2-\ddot{O}(-H)+H-I \rightleftharpoons CH_3CH_2-\overset{\displaystyle H}{\overset{|}{\overset{+}{\ddot{O}}}}-H + I^-$$

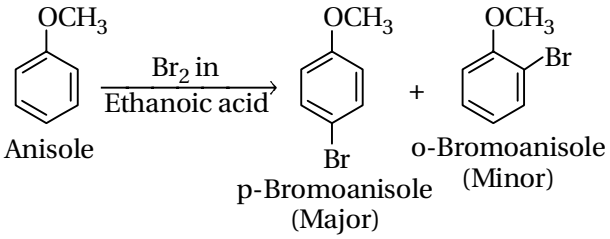
$$I^- + CH_3-CH_2-\overset{+}{O}H_2 \longrightarrow CH_3CH_2I + H_2O$$

38) Write a note on electrophilic substitution reactions of anisole.

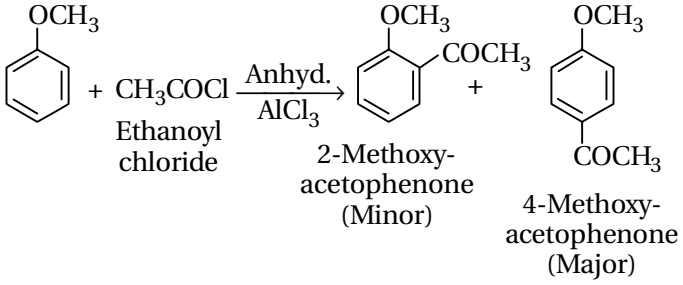
➠ The alkoxy group (–OR) of ether is ortho and para director and activates the aromatic ring towards electrophilic substitution reaction in the same way as phenol.

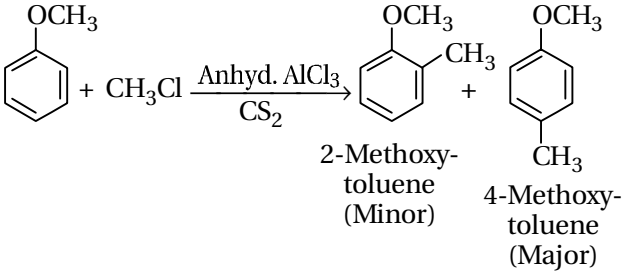


➠ **(i) Halogenation :** Anisole undergoes bromination with bromine in ethanoic acid even in the absence of iron (III) bromide catalyst. It is due to the activation of benzene ring by methoxy group. Para isomer is obtained in 90% yield.

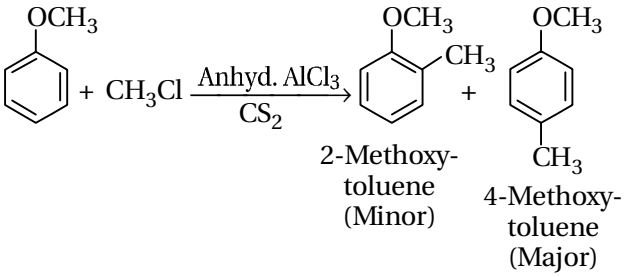


➠ **(ii) Friedel-Crafts reaction :** Anisole undergoes Friedel Crafts acylation and alkylation at ortho and para positions by reaction with acyl halides and alkyl halides respectively in the presence of anhydrous aluminium chloride (a Lewis acid) as catalyst.





➠**(iii) Nitration :** Anisole reacts with a mixture of concentrated sulphuric acid and nitric acid to yield a mixture of ortho and para nitroanisole.



❖ More Information ❖

1) The higher ethers are produced by the action of Grignard reagent on α-halo ethers.

$R-O-CH_2Cl + R'-MgCl \rightarrow R-O-CH_2-R' + MgCl_2$

2) The ethers are also obtained by the action of diazomethane on alcohols in presence of fluoroboric acid (HBF_4) as catalyst.

$$R-OH + CH_2N_2 \xrightarrow{HBF_4} R-O-CH_3 + N_2$$

3) The alkyl iodide when heated with dry silver oxide (Ag_2O) gives ethers.

$$2R-X + Ag_2O \rightarrow R-O-R + 2AgX$$

4) Formation of ether peroxide: Aliphatic ethers undergoes auto-oxidation on prolong exposure to air forming ether peroxide. Ether peroxides are highly unstable.

$$C_2H_5-O-C_2H_5 + O_2 \rightarrow (C_2H_5)_2\ O^+-O^-$$

➠ The presence of ether peroxide can be detected by the development of red colour when shaken with a mixture of ferrous ammonium sulphate and potassium thiocyanate. The Fe^{2+} ion is oxidized to Fe^{3+} that produced red colour complex with thiocyanate ion.

➠ **Ring opening Reactions of epoxide :**

Medium of Reaction	Type of Reaction	Action of Nucleophile	Stereochemistry
Acidic	S_N1	On more crowded carbon	Always causes inversion of configuration
Alkaline	S_N2	On less crowded carbon	

39) Explain industrial method to form phenol by less expensive and having high quality. Also explain bromination of phenol. # [March-2018]

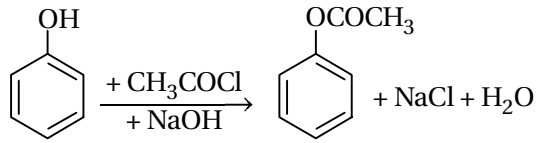
➠ **See for answer Section-1, Q.-29**

40) Give only chemical formula to form following substances from phenol. [March-2019]

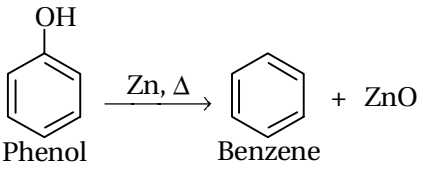
(a) Phenyl acetate (b) Benzene

(c) *p*-bromophenol (d) 1,4-benzoquenone

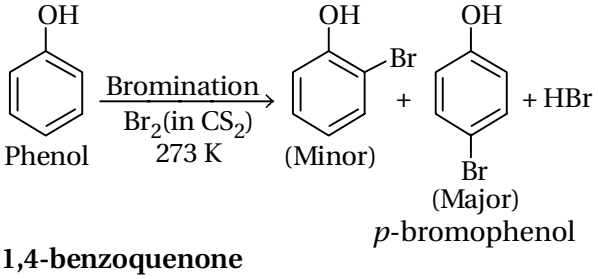
➠**(a) Phenyl acetate :**



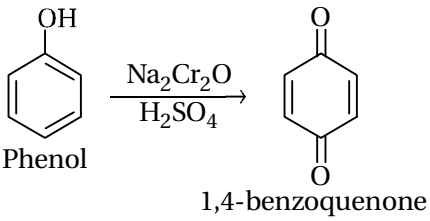
➠**(b) Benzene :**



➠**(c) *p*-bromophenol**



➠**(d) 1,4-benzoquenone**

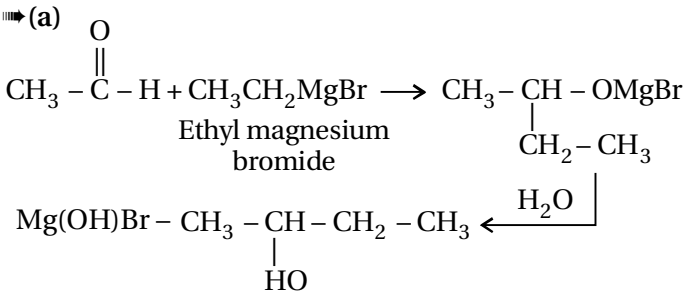


41) Give chemical reaction for following conversion :

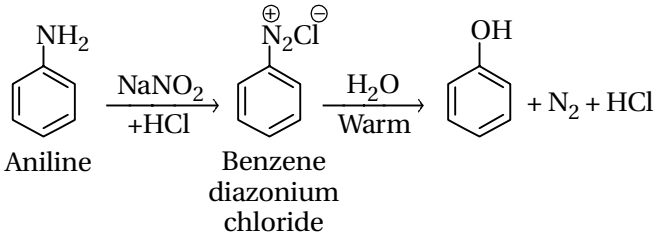
(a) Butan-2-ol from acetaldehyde

(b) Phenol from aniline # [July-2019]

➠ (a)



➠ (b)



42) Write the names of reagents and equations for the preparation of following ethers by Williamson's synthesis : (i) 1-propoxypropane (ii) Ethoxy benzene (iii) 2-methoxy-2-methyl propane [May-2021]

➠ See for answer Section-3, Q.-24

43) Write following conversion in two steps : Phenol to salicylic acid. [May-2021]

➠ See for answer Section-1, Q.-30

44) Write the reactions of formaldehyde, acetaldehyde and acetone with methyl magnesium bromide. [March-2022]

➠ See for answer Section-1, Q.-9 point (i), (ii)

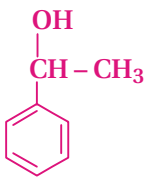
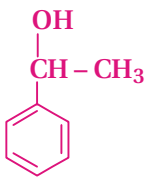
45) Write the reactions to prepared phenol from Aniline and Cumine. [March-2022]

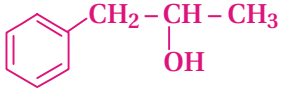
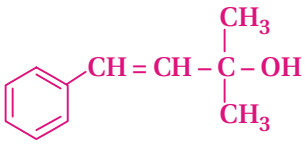
➠ See for answer Section-1, Q.-14 and Q.-15 point (ii)

Section-2 Intext Questions and Answers S2

1) Classify the following as primary, secondary and tertiary alcohols :

(i) $CH_3-C(CH_3)_2-CH_2OH$ (ii) $H_2C = CH - CH_2OH$ (iii) $CH_3 - CH_2 - CH_2 - OH$

(iv)  (iv) 

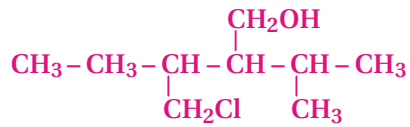
(v)  (vi) 

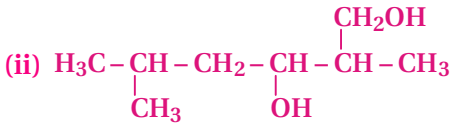
➠ Primary alcohols : (i), (ii) and (iii)
Secondary alcohols : (iv) and (v)
Tertiary alcohol : (vi)

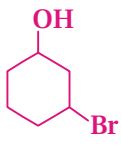
2) Identify the allylic alcohols in the above examples.

➠ (ii) and (vi) are allylic alcohols

3) Name the following compounds according to IUPAC system.

(i) 

(ii) 

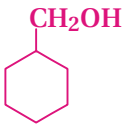
(iii) 

(iv) $H_2C = CH - \underset{OH}{CH} - CH_2 - CH_2 - CH_3$

(v) $CH_3 - \underset{CH_3}{C} = \underset{Br}{C} - CH_2OH$

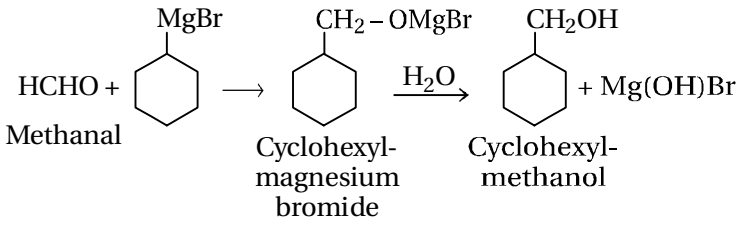
➠ (i) 4-Chloro-3-ethyl-2-(1-methylethyl)butan-1-ol (ii) 2,5-Dimethylhexan-1,3-diol
(iii) 3-Bromocyclohexan-1-ol (v) Hex-1-en-3-ol (iv) 2-Bromo-3-methylbut-2-en-1-ol

4) Show how are the following alcohols prepared by the reaction of a suitable Grignard reagent on methanol. #

(i) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2OH$ **(ii)** 

➠ The alcohols are primary alcohols in both (i) and (ii). Thus, the starting material is methanal.

(i) $HCHO + CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - MgBr \longrightarrow CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - \underset{\displaystyle OMgBr}{\overset{\displaystyle |}{CH_2}} \xrightarrow[H_2O]{H^+} Mg(OH)Br + CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2 - OH$

(ii) 

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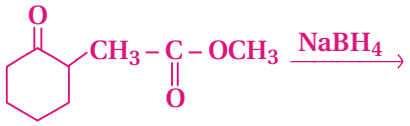
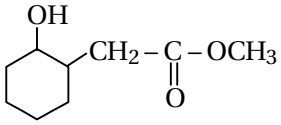
5) Write the structures of the products of the following reactions.

(i) $CH_3 - CH = CH_2 \xrightarrow{H_2O/H^+}$

(ii) 

(iii) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CHO \xrightarrow{NaBH_4}$

➠ (i) $CH_3 - \underset{\displaystyle OH}{\overset{\displaystyle |}{CH}} - CH_3$ Propan-2-ol

(ii) 

Methyl (2-hydroxy cyclohexyl) ethanoate

(iii) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2OH$
2-Methylbutan-1-ol

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6) Give the structures of the products you would expect when each of the following alcohol reacts with (a) HCl – $ZnCl_2$ (b) HBr (c) $SOCl_2$

(i) Butan-1-ol (ii) 2-Methylbutan-2-ol

➠ **(i) Reactions of Butan-1-ol**

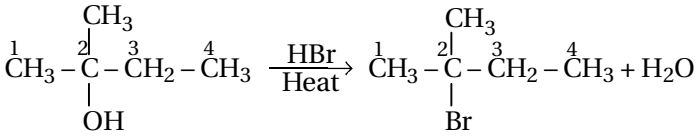
(a) $\overset{4}{C}H_3 - \overset{3}{C}H_2 - \overset{2}{C}H_2 - \overset{1}{C}H_2 - OH \xrightarrow[\text{Heat}]{HCl - ZnCl_2} \overset{4}{C}H_3 - \overset{3}{C}H_2 - \overset{2}{C}H_2 - \overset{1}{C}H_2 - Cl + H_2O$
Butan-1-ol(1°) (Lucas reagent) 1-Chlorobutane

(b) $CH_3 - CH_2 - CH_2 - CH_2 - OH \xrightarrow[\text{Heat}]{HBr} \overset{4}{C}H_3 - \overset{3}{C}H_2 - \overset{2}{C}H_2 - \overset{1}{C}H_2 - Br + H_2O$
Butan-1-ol 1-bromobutane

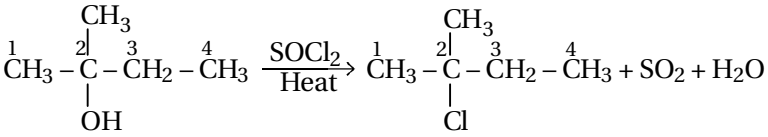
(c) $CH_3 - CH_2 - CH_2 - CH_2 - OH \xrightarrow[\text{Heat}]{SOCl_2} \overset{4}{C}H_3 - \overset{3}{C}H_2 - \overset{2}{C}H_2 - \overset{1}{C}H_2 - Cl + SO_2 + HCl$
1-chlorobutane

➠ **(ii) Reactions of 2-Methylbutan-2-ol**

(a) $\overset{1}{C}H_3 - \overset{2}{\underset{\displaystyle OH}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}} - \overset{3}{C}H_2 - \overset{4}{C}H_3 \xrightarrow[\text{Lucas reagent}]{HCl - ZnCl_2} \overset{1}{C}H_3 - \overset{2}{\underset{\displaystyle Cl}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}}} - \overset{3}{C}H_2 - \overset{4}{C}H_3 + H_2O$
2-methylbutan-2-ol(3°) 2-chloro-2-methylbutane

(b) 

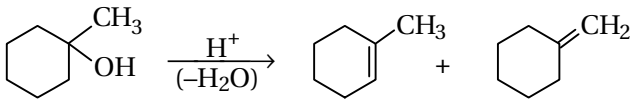
2-methylbutan-2-ol 2-bromo-2-methylbutane

(c) 

2-chloro-2-methylbutane

7) Predict the major product of acid-catalysed dehydration of :

(i) 1-Methylcyclohexanol (ii) Butan-1-ol #

➠ **(i)** 

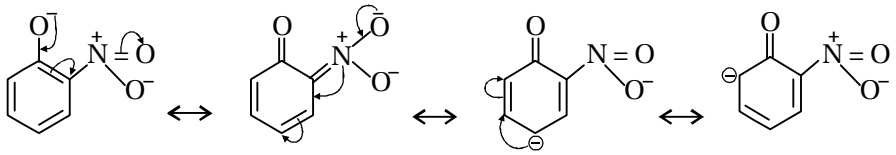
1-Methyl cyclohexene (major) Methylene-cyclohexane (minor)

➠ **(ii)** $CH_3CH_2CH_2CH_2OH \longrightarrow \underset{\text{But-2-ene (major)}}{CH_3CH = CH - CH_3} + \underset{\text{But-1-ene (minor)}}{CH_3CH_2CH = CH_2}$

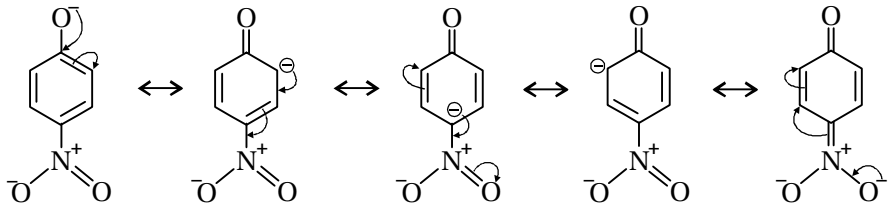
8) Ortho and para nitrophenols are more acidic than phenol. Draw the resonating structures of the corresponding phenoxide ions.

➠ The electron pair of the O – H bond is pulled towards the oxygen atom because of –M effect of $-NO_2$ that decreases the electron density on the oxygen atom. This facilitates the release of proton and stabilizes the phenoxide ion.

➠ Resonating forms of o-nitrophenoxide ion :



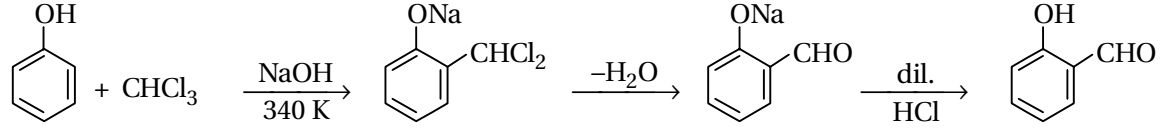
➠ Resonating forms of p-nitro phenoxide ion :



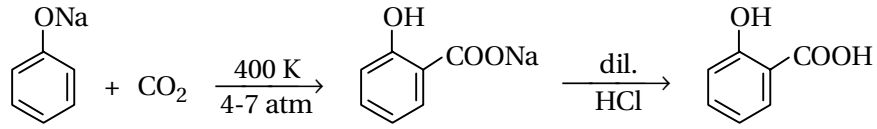
9) Write the equations involved in the following reactions:

(i) Reimer-Tiemann reaction (ii) Kolbe's reaction

➠ **(i) Reimer-Tiemann Reaction :**



➠ **(ii) Kolbe's reaction :**



(Salicylic acid)

10) Write the reactions of Williamson's synthesis of 2-ethoxy-3-methylpentane starting from ethanol and 3-methylpentan-2-ol. # [March-2020]

➠ $CH_3CH_2OH + HBr \xrightarrow{\Delta} CH_3CH_2Br + H_2O$

$CH_3CH_2\underset{CH_3}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-OH + Na \longrightarrow CH_3CH_2-\underset{CH_3}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-O^-Na^+ + H_2$

$CH_3CH_2\underset{CH_3}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-O^-Na^+ + CH_3CH_2Br \xrightarrow{S_N2} CH_3CH_2-\underset{CH_3}{\underset{|}{CH}}-\underset{CH_3}{\underset{|}{CH}}-OCH_2CH_2 + NaBr$

2-Ethoxy-3-methylpentane

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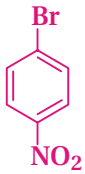
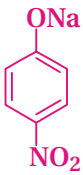
11) Which of the following is an appropriate set of reactants for the preparation of 1-Methoxy-4-nitrobezene and why ?

(i) 

+ CH_3ONa (ii) 

+ CH_3Br

➠ The set (ii) more appropriate. This is because in set (i) CH_3ONa although a strong nucleophile, the bromobenzene has less reactivity because the bromine is bonded to sp^2 carbon of the ring which results in partial double bond character of C – Br bond. In case of set (ii), the nucleophile p-NO_2 – C_6H_4 – ONa is bulky which will attack readily on methyl bromide by S_N2 path and thus the desired product is obtained readily.

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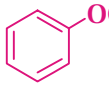
12) Predict the products of the following reactions :

(i) $CH_3 - CH_2 - CH_2 - O - CH_3 + HBr \longrightarrow$ **(ii)** 

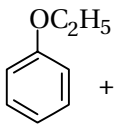
+ HBr $\longrightarrow$

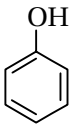
(iii) 

+ HBr $\xrightarrow[\text{Conc. } HNO_3]{\text{Conc. } H_2SO_4}$ **(iv)** $(CH_3)_3C - OC_2H_5 \xrightarrow{HI}$

➠ (i) $CH_3CH_2CH_2OCH_3 + HBr \xrightarrow{373\ K} CH_3CH_2CH_2OH + CH_3Br$

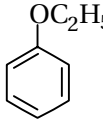
Propan-1-ol Bromomethane

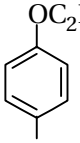
(ii) 

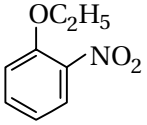
+ HBr $\xrightarrow{373\ K}$ 

+ CH_3CH_2Br

Phenol Bromoethane

(iii) 

$\xrightarrow[\text{Conc. } HNO_2]{\text{Conc. } H_2SO_4}$ 

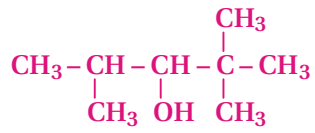
+ 

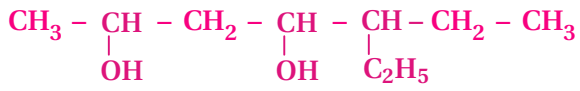
(Major) (Minor)

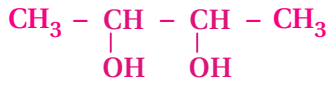
(iv) $(CH_3)_3C - OC_2H_5 + HI \longrightarrow CH_2 - \underset{CH_3}{\overset{CH_3}{\underset{|}{\overset{|}{C}}}} - I + CH_3CH_2OH$

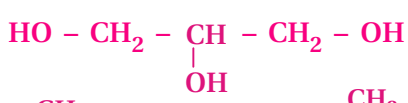
Section-3 Textual Exercise S3

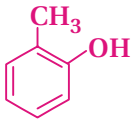
1) Write the IUPAC name of the following compounds : #

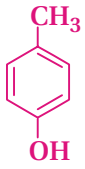
(i) 

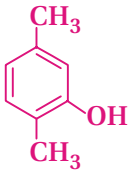
(ii) 

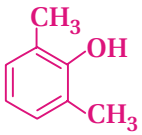
(iii) 

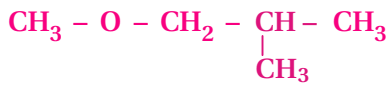
(iv) 

(v) 

(vi) 

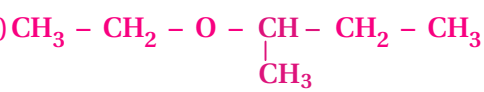
(vii) 

(viii) 

(ix) 

(x) $C_6H_5 - O - C_2H_5$

(xi) $C_6H_5 - O - C_7H_{15}(n^-)$

(xii) 

➠ (i) 2,2,4-Trimethylpentan-3-ol

(ii) 5-Ethylheptan-2-,4-diol

(iii) Butane-2,4-diol

(iv) Propan-1,2,3-triol

(v) 2-Methylphenol

(vi) 4-Methylphenol

(vii) 2,5-Dimethylphenol

(viii) 2,6-Dimethylphenol

(ix) 1-Methoxy-2-methylpropane

(x) Ethoxy benzene

(xi) 1-Phenoxyheptane

(xii) 2-Ethoxybutane

2) Write structures of the compounds whose IUPAC names are as follows :

(i) 2-Methylbutan-2-ol

(ii) 1-Phenylpropan-2-ol

(iii) 3,5-Dimethylhexane-1,3,5-triol

(iv) 2,3-Diethylphenol

(v) 1-Ethoxypropane

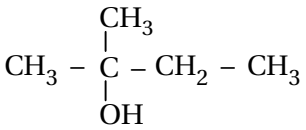
(vi) 2-Ethoxy-3-methylpentane

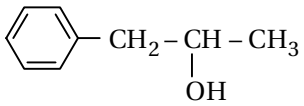
(vii) Cyclohexylmethanol

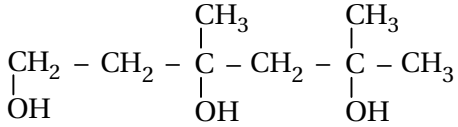
(viii) 3-Cyclohexylpentan-3-ol

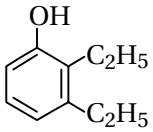
(ix) Cyclopent-3-en-1-ol

(x) 4-Chloro-3-ethylbutan-1-ol.

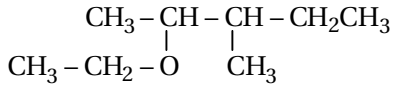
➠ (i) 

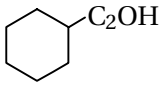
(ii) 

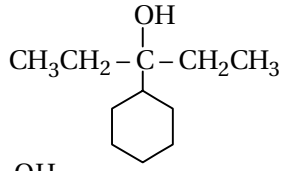
(iii) 

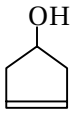
(iv) 

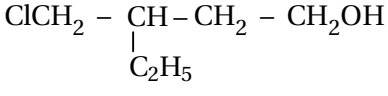
(v) $CH_3CH_2 - O - CH_2CH_2CH_3$

(vi) 

(vii) 

(viii) 

(ix) 

(x) 

3) (i) Draw the structures of all isomeric alcohols of molecular formula $C_5H_{12}O$ and give their IUPAC names.

(ii) Classify the isomers of alcohols in question (3)(i) as primary, secondary and tertiary alcohols. #

➠ (i) $CH_3CH_2CH_2CH_2CH_2OH$
Pentan-1-ol
(1°)

(ii) $CH_3CH_2CH_2-\underset{\displaystyle OH}{\underset{|}{C}}HCH_3$
Pentan-2-ol
(2°)

(iii) $CH_3CH_2\underset{\displaystyle OH}{\underset{|}{C}}H-CH_2CH_3$
Pentan-3-ol
(2°)

(iv) $CH_3CH_2\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2OH$
2-Methylbutan-1-ol
(1°)

(v) $CH_3\underset{\displaystyle CH_3}{\underset{|}{C}}HCH_2CH_2OH$
3-Methylbutan-1-ol
(1°)

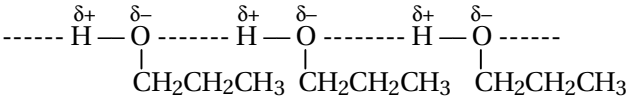
(vi) $CH_3-\underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2CH_3$
2-Methylbutan-2-ol
(3°)

(vii) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}}-CH_2OH$
2,2-Dimethylpropan-1-ol
(1°)

(viii) $CH_3-\underset{\displaystyle CH_3}{\overset{|}{C}}H-\underset{\displaystyle OH}{\overset{|}{C}}H-CH_3$
3-Methylbutan-2-ol
(2°)

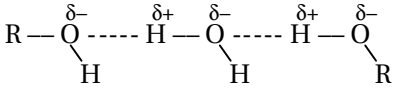
4) Explain why propanol has higher boiling point than that of the hydrocarbon, butane ?

➠ This is because of presence of polar –OH group in propanol, that form intermolecular H-bonding.



5) Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.

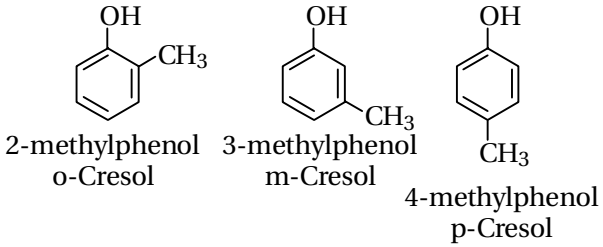
➠ The water solubility of alcohol is because of intermolecular H-bonding due to presence of polar –OH group, whereas in the hydrocarbons being non-polar, do not form intermolecular H-bonding and so they are insoluble in water.



6) What is meant by hydroboration-oxidation reaction ? Illustrate it with an example.

➠ **See for answer Section-1, Q.- 8**

7) Give the structures and IUPAC names of monohydric phenols of molecular formula C_7H_8O.

➠ 
2-methylphenol
o-Cresol

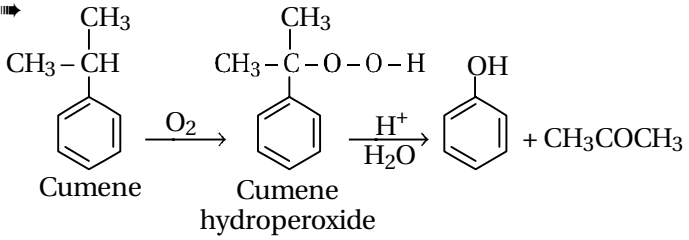
3-methylphenol
m-Cresol

4-methylphenol
p-Cresol

8) While separating a mixture of ortho and para nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.

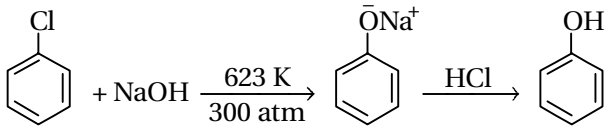
➠ The o-nitrophenol shows lower boiling point than para nitrophenol because of intramolecular H-bonding in the former case. Thus, o-nitrophenol will be steam volatile. The molecules of p-nitrophenols are strongly associated by intermolecular H-bonding, as a result of which it shows higher boiling point.

9) Give the equations of reactions for the preparation of phenol from cumene.

➠ 
Cumene

Cumene hydroperoxide

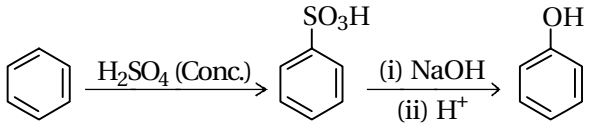
10) Write chemical reaction for the preparation of phenol from chlorobenzene. #

➠ 

11) Write the mechanism of hydration of ethene to yield ethanol.

➠ **See for answer Section-1, Q.-8**

12) You are given benzene, conc. H_2SO_4 and NaOH. Write the equations for the preparation of phenol using these reagents.

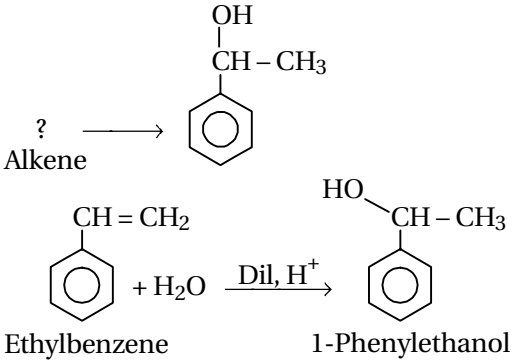
➠ 

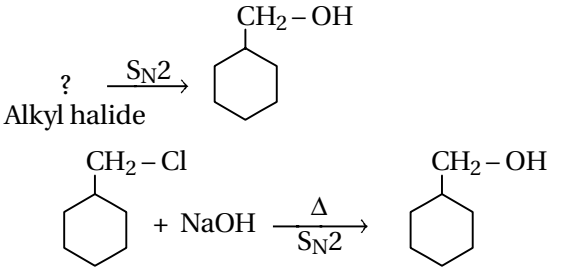
13) Show how will you synthesize :

(i) 1-Phenylethanol from a suitable alkene.

(ii) Cyclohexylmethanol using alkyl halide by an S_N2 reaction.

(iii) Pentan-1-ol using suitable alkyl halide ?

➠(i) 

(ii) 

(iii) $? \longrightarrow CH_3 - (CH_2)_3 - CH_2OH$

Alkyl haide

$CH_3 - (CH_2)_3 - CH_2 - Cl + NaOH \xrightarrow[\Delta]{S_N2,\ \text{hydrolysis}}$

1-Chloropentane

$CH_3 - (CH_2)_3 - CH_2 - OH$

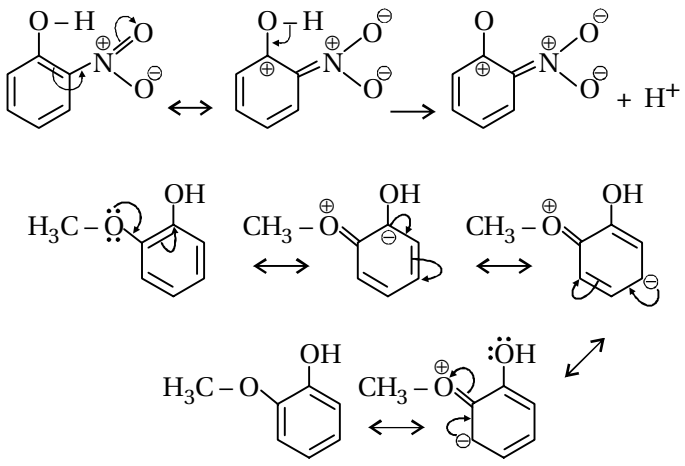
Pentan-1-ol

14) Give two reactions that show the acidic nature of phenol. Compare acidity of phenol with that of ethanol.

➠ **See for answer Section-1, Q.-21**

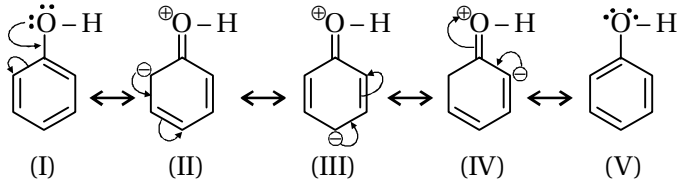
15) Explain why is ortho nitrophenol more acidic than ortho methoxyphenol ?

➠ The acidic property of phenol arises from the loss of hydrogen of –OH group of phenol as H^+. This loss of is favoured if the polarity of the O – H bond increases and hydrogen becomes more electropositive. The presence of electron withdrawing groups such as $-NO_2$ increases the polarity of O – H bond and thus the acidic strength of the phenol is raised. On the contrary, the $-OCH_3$ is an electron releasing group and it decreases the polarity of O – H bond and thus makes the release of H^+ difficult. This can be understood by the resonating structures :



16) Explain how does the –OH group attached to a carbon of benzene ring activate it towards electrophilic substitution ?

➠ The –OH group is electron releasing groups. It increases the electron density at ortho and para positions through resonance. The electrophiles being electron deficient in nature attacks the ring at electron high density regions, i.e., ortho- and para- positions. Thus, –OH group of benzene activates the ring towards electrophilic substitution reaction.



➠ From the structures II, III and IV, it is clear that ortho and para positions are most active sites for the electrophilic attack.

17) Give equations of the following reactions :

(i) Oxidation of propan-1-ol with alkaline $KMnO_4$ solution.

(ii) Bromine in CS_2 with phenol.

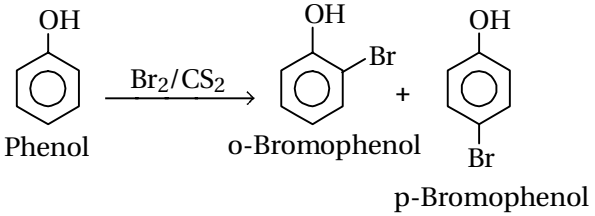
(iii) Dilute HNO_3 with phenol.

(iv) Treating phenol wih chloroform in presence of aqueous NaOH. #

➠(i) $CH_3-CH_2-CH_2OH \xrightarrow[KMnO_4]{Alk.} CH_3CH_2COOH + H_2O$

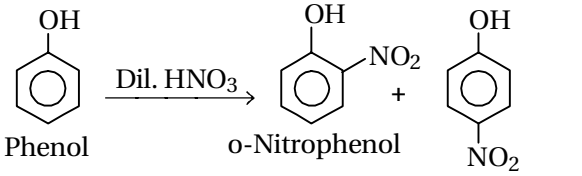
Propan-1-ol — Propanoic acid

(ii)



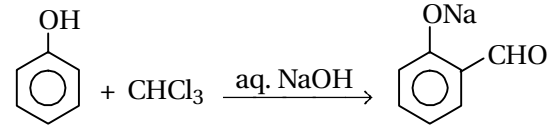
Phenol — o-Bromophenol — p-Bromophenol

(iii)



Phenol — o-Nitrophenol — p-Nitrophenol

(iv)



Phenol

18) Explain the following with an example.

(i) Kolbe's reaction.

(ii) Reimer-Tiemann reaction.

(iii) Williamson ether synthesis.

(iv) Unsymmetrical ether.

➠ **(i) See for answer Section-1, Q.-30**

(ii) See for answer Section-1, Q.-31

(iii) See for answer Section-1, Q.-34

(iv) Unsymmetrical ethers are organic compounds in which the ethereal oxygen is bonded to two different alkyl or aryl groups. For example, $CH_3-O-C_2H_5$.

19) Write the mechanism of acid dehydration of ethanol to yield ethene.

➠ **See for answer Section-1, Q.-24**

20) How are the following conversions carried out ?

(i) Propane → Propan-2-ol.

(ii) Benzyl chloride → Benzyl alcohol.

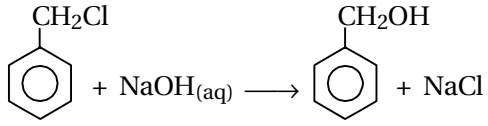
(iii) Ethyl magnesium chloride → Propan-1-ol.

(iv) Methyl magnesium bromide → 2-Methyl-propan-2-ol.

➠(i) $H_3C-CH=CH_2 \xrightarrow[\Delta]{H_2O/H^+} CH_3-\underset{OH}{\underset{|}{CH}}-CH_3$

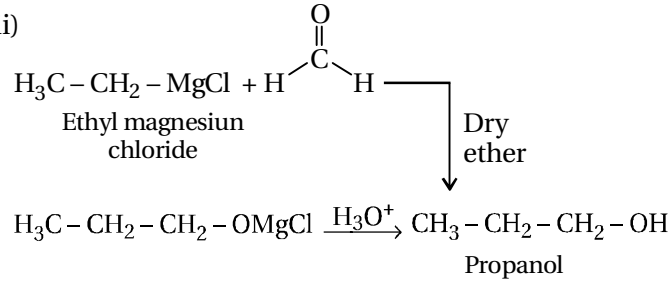
Propene — Propan-2-ol

(ii)



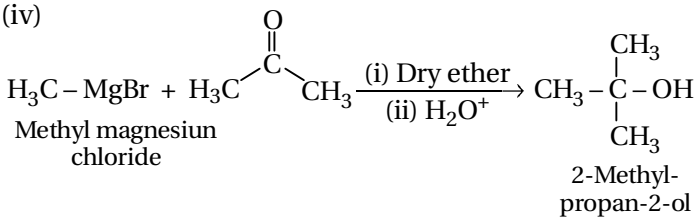
Benzyl chloride — Benzyl alcohol

(iii)



Propanol

(iv)



Methyl magnesiun chloride — 2-Methyl-propan-2-ol

21) Name the reagents used in the following reactions :

(i) Oxidation of a primary alcohol to carboxylic acid.

(ii) Oxidation of a primary alcohol to aldehyde.

(iii) Bromination of phenol to 2,4,6-tribromophenol.

(iv) Benzyl alcohol to benzoic acid.

(v) Dehydration of propan-2-ol to propene.

(vi) Butan-2-one to butan-2-ol.

➠ (i) Alkaline $KMnO_4$

(ii) Pyridinium Chlorochromate in CH_2Cl_2

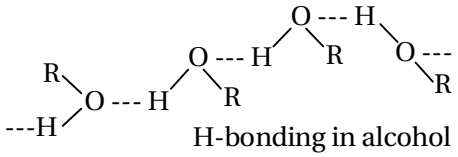
(iii) Br_2/H_2O

(iv) Conc. H_2SO_4

(v) $LiAlH_4/H_2O$ or $NaBH_4/H_2O$ or H_2/Pd

22) Give reason for the higher boiling point of ethanol in comparison to methoxymethane. #

➠ The higher boiling point of ethanol may be attributed to the presence of intermolecular hydrogen bonding.Due to such extensive bonding more energy needs to be supplied to ethanol to break these bonds and move it into the vapour phase. The hydrogen bonding is absent in methane and so the boiling point is low.



H-bonding in alcohol

23) Give IUPAC names of the following ethers :

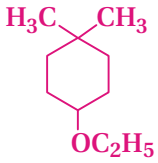
(i) $C_2H_5OCH_2 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_3$

(ii) $CH_3OCH_2CH_2Cl$

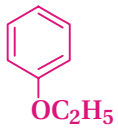
(iii) $O_2N - C_6H_4 - OCH_3(p)$

(iv) $CH_3CH_2CH_2OCH_3$

(v)



(vi)



➠ (i) 1-Ethoxy-2-methylpropane

(ii) 2-Chloro-1-methoxyethane

(iii) 4-Nitroanisole

(iv) 1-Methoxypropane

(v) 1-Ethoxy-4,4-dimethylcyclohexane

(vi) Ethoxy benzene

24) Write the names of reagents and equations for the preparation of the following ethers by Williamson's synthesis :

(i) 1-Propoxypropane

(ii) Ethoxybenzene

(iii) 2-Methoxy-2-methylpropane

(iv) 1-Methoxyethane

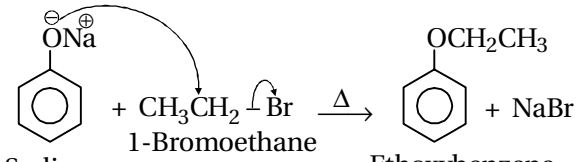
➠ (i) $CH_3CH_2CH_2\overset{\ominus}{O}\overset{\oplus}{Na} + CH_3CH_2CH_2 - Br \xrightarrow{\text{Heat}}$

Sodium propoxide 1-Bromopropane

$CH_3CH_2CH_2 - O - CH_2CH_2CH_3 + NaBr$

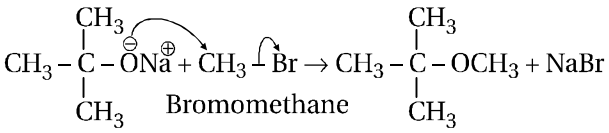
1-Propoxypropane

(ii)



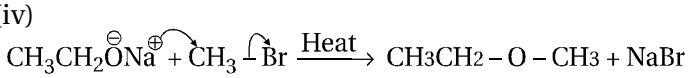
Sodium-phenoxide 1-Bromoethane Ethoxybenzene

(iii)



Bromomethane 2-Methyl-2methoxypropane

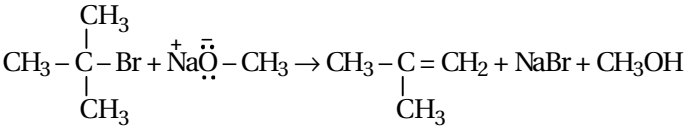
(iv)



Sodium ethoxide Bromoethane 1-Methoxyethane

25) Illustrate with examples the limitations of Williamson synthesis for the preparation of certain types of ethers.

➠ The Williamson synthesis is not a suitable method for the preparation of unsymmetrical ethers where compound contains secondary or tertiary alkyl groups. For example, the reaction between tert-butyl bromide and sodium methoxide yield alkenes. This is because of sodium methoxide is strong base apart from a nucleophile and as a result, the elimination dominates over substitution reaction.



26) How is 1-propoxypropane synthesised from propan-1-ol ? Write mechanism of this reaction.

➠ (i) $3CH_3CH_2CH_2OH + PBr_3 \rightarrow 3CH_3CH_2Br + H_3PO_3$

Propan-1-ol 1-Bromoprapane

(ii) $2CH_3CH_2CH_2OH + 2Na \rightarrow 2CH_3CH_2CH_2O^-Na^+ + H_2$

Propan-1-ol Sodiumpropoxide

$CH_3CH_2CH_2\overset{\delta+}{O}Na + CH_3CH_2\overset{\delta+}{C}H_2 - \overset{\delta-}{Br} \xrightarrow[\text{Heat}]{\text{Dry ether}}$

$CH_3CH_2CH_2 - O - CH_2CH_2CH_3 + NaBr$

1-propoxypropane

27) Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method. Give reason. #

➠ **See for answer Section-1, Q.- 33**

28) Write the equation of the reaction of hydrogen iodide with : [March-2020]

(i) 1-propoxypropane

(ii) methoxybenzene and

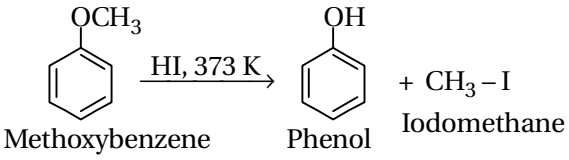
(iii) benzyl ethyl ether.

➠(i) $CH_3CH_2CH_2OCH_2CH_2CH_3 \xrightarrow[373\ K]{HI}$

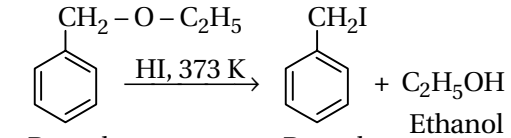
1-propoxypropane

$CH_3CH_2CH_2 - OH + CH_3CH_2CH_2I$

Propan-1-ol Iodopropane

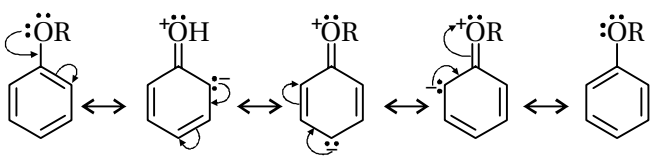
(ii) 

Methoxybenzene Phenol Iodomethane

(iii) 

Benzyl ethyl ether Benzyl Iodide Ethanol

29) Explain the fact that in aryl alkyl ethers (i) the alkoxy group activates the benzene ring towards electrophilic substitution and (ii) it directs the incoming substituents to ortho and para positions in benzene ring.

➠ 

➠ From the above structures, it is confirmed that the presence of –OR (alkoxy) group increase the electron density on the benzene ring at ortho and para positions which is observed in structures (II), (III) and (IV), Thus, alkoxy group is ortho- and para- director. As a result, the electrophiles (electron deficient species) easily gets attached to ortho- and para-positions because of high electron density.

30) Write the mechanism of the reaction of HI with methoxymethane.

➠(a) $CH_3 - \ddot{O} - CH_3 - H - I \xrightarrow[Fast]{Protonation} CH_3 - \overset{H}{\underset{|}{\overset{|}{\overset{+}{O}}}} - CH_3 - I^-$

Oxonium ion

(b) $I^- + CH_3 - \overset{H}{\underset{|}{\overset{|}{\overset{+}{O}}}} - CH_3 \xrightarrow[Slow]{S_N2} CH_3 - I + CH_3OH$

➠ If however, excess of HI is used, methyl alcohol formed in step (b) is also converted into methyl iodide by following mechanism :

(c) $CH_3 - \ddot{O} - H + H - I \xrightarrow[Fast]{Prodonation} CH_3 - \overset{H}{\underset{|}{\overset{|}{\overset{+}{O}}}} - H + I^-$

(d) $I^- + CH_3 - \overset{H}{\underset{|}{\overset{|}{\overset{+}{O}}}} - H \xrightarrow[Slow]{S_N2} CH_3I + H_2O$

31) Write equations of the following reactions :

(i) Friedel-Crafts reaction - alkylation of anisole.

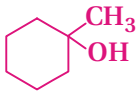
(ii) Nitration of anisole.

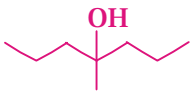
(iii) Bromination of anisole in ethanoic acid medium.

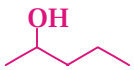
(iv) Friedel-Craft's acetylation of anisole.

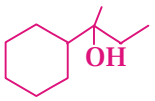
➠ **See for answer Section-1, Q.- 38**

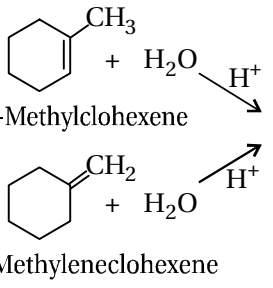
32) Show how would you synthesise the following alcohols from appropriate alkenes ?

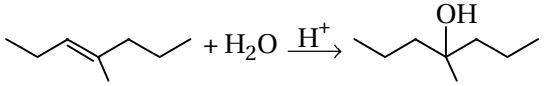
(i) 

(ii) 

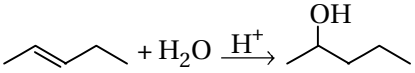
(iii) 

(iv) 

➠(i) 

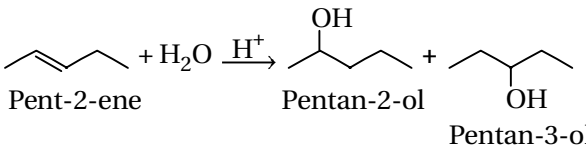
(ii) 

4-Methylhept-3-ene 4-Methylhept-4-ol

(iii) 

Pent-2-ene Pentan-2-ol

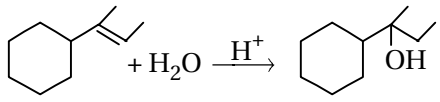
Acid-catalyzed hydration of pent-2-ene also produces pentan-2-ol but along with pentan-3-ol.



Pent-2-ene — Pentan-2-ol — Pentan-3-ol

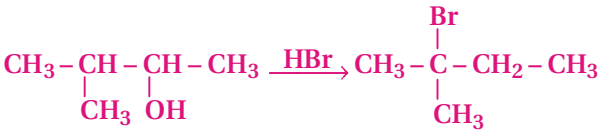
Thus, the first reaction is preferred over the second one to get pentan-2-ol.

(iv)



2-Cyclohexylbut-2-ene — 2-Cyclohexylbut-2-ol

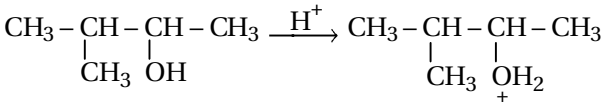
33) When 3-methylbutan-2-ol is treated with HBr, the following reaction takes place :



Give a mechanism for this reaction. #

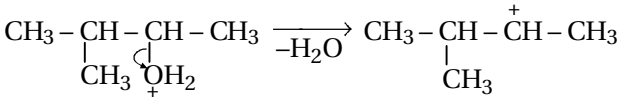
(Hint : The secondary carbocation formed in step II rearranges to a more stable tertiary carbocation by a hydride ion shift from 3rd carbon atom).

➠ Step-1 : Protonation



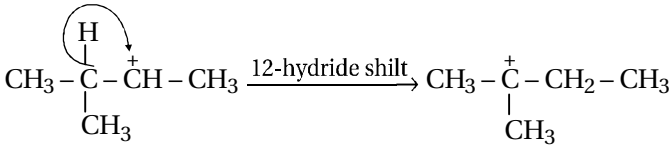
3-Methylbutan-2-ol

➠ Step-2 : Formation of 2° carbocation by the elimination of a water molecule



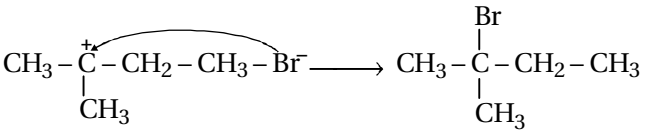
2° Carbocation

➠ Step-3 : Re-arrangement by the hydride-ion shift



(less stable) — 3° Carbocation (more stable)

➠ Nucleophilic attack



2-Bromo-2-methylbutane

Section-4 NCERT Exemplar Solution S4

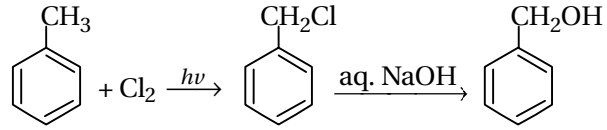
Multiple Choice Questions (MCQs)

1) Mono-chlorination of toluene in a sunlight followed by hydrolysis with aq. NaOH yields .....

(A) o-Cresol (B) m-Cresol
(C) 2,4-Dihydroxytoluene
(D) Benzyl alcohol

Ans. **(D)** Benzyl alcohol

➠



Toluene — Benzyl chloride — Benzyl alcohol

2) How many alcohols with a molecular formula $C_4H_{10}O$ are chiral in nature?

(A) 1 (B) 2 (C) 3 (D) 4

Ans. **(A)** 1

3) What is the correct order of reactivity of alcohols in the following reaction ?

$R-OH + HCl \xrightarrow{ZnCl_2} R-Cl + H_2O$

(A) 1° > 2° > 3° (B) 1° < 2° > 3°
(C) 3° > 2° > 1° (D) 3° > 1° > 2°

Ans. **(C)** 3° > 2° > 1°

➠ The reaction proceeds through formation of carbo-cation intermediate. As tertiary carbocation is most stable, the tertiary alcohol is most readily reacted.

4) CH_3CH_2OH can be converted into CH_3CHO by .....

(A) Catalytic hydrogenation
(B) Treatment with $LiAlH_4$
(C) Treatment with pyridinium chlorochromate
(D) Treatment with $KMnO_4$

Ans. **(C)** Treatment with pyridinium chlorochromate.

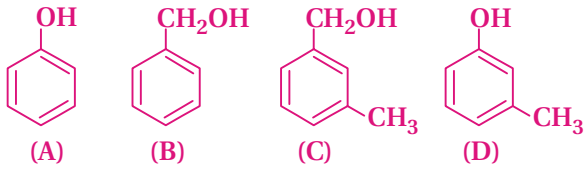
5) The process of converting alkyl halide into alcohols involves ..... #

(A) Addition reaction
(B) Substitution reaction
(C) Dehydrohalogenation reaction
(D) Rearrangement reaction

Ans. (B) Substitution reaction.

➠ $R-X \xrightarrow{NaOH} R-OH + NaX$

6) Which of the following compounds is aromatic alcohol ?



(A) (A), (B), (C) and (D)
(B) (A) and (D)
(C) (B) and (C)
(D) (A)

Ans. **(C)** (B) and (C)

➠ The compounds (B) and (C) are aromatic alcohols because the –OH group is bonded to the sp^3 carbon.

7) Give the IUPAC name of the compound given below :

$$CH_3 - \underset{\underset{Cl}{|}}{CH} - CH_2 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$$

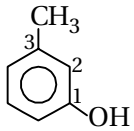
(A) 2-Chloro-5-hydroxyhexane
(B) 2-Hydroxy-5-chlorohexane
(C) 5-Chlorohexan-2-ol
(D) 2-Chlorohexan-5-ol

Ans. **(C)** 5-Chlorohexan-2-ol

8) IUPAC name of m-cresol is .....

(A) 3-methylphenol (B) 3-chlorophenol
(C) 3-methoxyphenol (D) Benzene-1,2-diol

Ans. **(C)** 3-methoxyphenol

➠ 

9) IUPAC name of the compound :

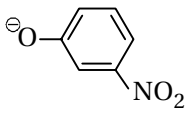
$$CH_3 - \underset{\underset{CH_3}{|}}{CH} - OCH_3$$

(A) 1-methoxy-1-methylethane
(B) 2-methoxy-2-methylethane
(C) 2-methoxypropane
(D) Isopropylmethyl ether

Ans. **(C)** 2-methoxypropane

➠ $H_3\overset{3}{C} - \overset{2}{CH} - OCH_3$ (1: CH_3)

10) Which of the following species can act as the strongest base ?

(A) $^{\ominus}OH$ (B) $^{\ominus}OR$
(C) $^{\ominus}OC_6H_5$ (D) 

Ans. **(B)** $^{\ominus}OR$

➠ –OR act as strongest base since the alkyl group increases the electron density on the oxygen atom.

11) Which of the following compounds will react with sodium hydroxide solution in water ?

(A) C_6H_5OH (B) $C_6H_5CH_2OH$
(C) $(CH_3)_3COH$ (D) C_2H_5OH

Ans. **(A)** C_6H_5OH

➠ Phenol in aqueous solution reacts with sodium to form sodium phenoxide. The phenoxide ion formed is resonance stabilized. However, the alcohols are weak acids.

$C_6H_5OH + Na \rightarrow C_6H_5ONa + H_2O$

12) Phenol is less acidic than .....

(A) Ethanol (B) o-nitrophenol
(C) o-methylphenol (D) o-methoxyphenol

Ans. **(B)** o-nitrophenol

➠ The presence of electron withdrawing groups stabilizes the phenoxide ion and as a result, the acidic strength of the phenol increases. However, the presence of electron releasing group destabilizes the phenoxide ion and so acidic strength of phenol decreases.

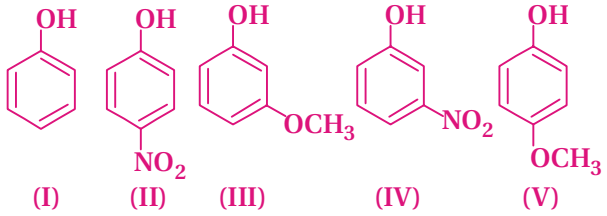
13) Which of the following is most acidic ?

(A) Benzyl alcohol (B) Cyclohexanol
(C) Phenol (D) m-chlorophenol

Ans. **(D)** m-chlorophenol

➠ The –I effect of chlorine makes m-chlorophenol most acidic among those listed above.

14) Mark the correct order of decreasing acidic strength of the following compounds : #



(I) (II) (III) (IV) (V)

(A) V > IV > II > I > III

(B) II > IV > I > III > V

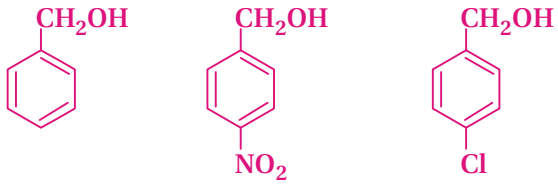
(C) IV > V > III > II > I

(D) V > IV > III > II > I

Ans. **(B)** II > IV > I > III > V

➠ The presence of electron withdrawing groups such as $-NO_2$ increases the acidic strength and the –M effect is pronounced maximum at o- and p-positions. However, at m-position only -I effect is observed. Similarly, the presence of electron releasing groups at o- and p-positions decreases the stability of phenoxide group and its +M effect is observed maximum at o- and p-positions.

15) Mark the correct increasing order of reactivity of the following compounds with HBr/HCl :



(I) (II) (III)

(A) I < II < III (B) II < I < III

(C) II < III < I (D) III < II < I

Ans. **(C)** II < III < I

➠ The reaction takes place by the formation of carbocation intermediate. Stable the intermediate, faster is the reaction. The presence of -M or -I group decreases the stability of the carbocation.

16) Arrange the following compounds in increasing order of boiling point :

Propan-1-ol, Butan-1-ol, Butan-2-ol, Pentan-1-ol

(A) Propan-1-ol, Butan-2-ol, Butan-1-ol, Pentan-1-ol

(B) Propan-1-ol, Butan-1-ol, Butan-2-ol, Pentan-1-ol

(C) Pentan-1-ol, Butan-2-ol, Butan-1-ol, Propan-1-ol

(D) Pentan-1-ol, Butan-1-ol, Butan-2-ol, Propan-1-ol

Ans. **(D)** Pentan-1-ol, Butan-1-ol, Butan-2-ol, Propan-1-ol

UID : P2-C11-S4-Q14

➠ The boiling point increases with the increase in the molecular mass of the compound and decreases with the branching.

Multiple Choice Questions MCQs (More than one options)

17) Which of the following are used to convert R – CHO to R – CH_2OH ?

(A) H_2/Pd (B) $LiAlH_4$

(C) $NaBH_4$

(D) Reaction with R-MgX followed by hydrolysis.

Ans. **(A), (B) and (C)**

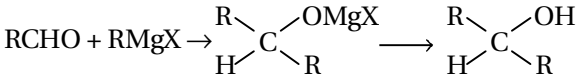
➠ $RCHO + \xrightarrow{H_2/Pd} RCH_2OH$

It can also be prepared by using $NaBH_4$ and LiAlH4 as a reducing agent.

$RCHO + \xrightarrow{NaBH_4} RCH_2OH$

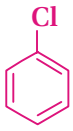
$RCHO + \xrightarrow{LiAlH_4} RCH_2OH$

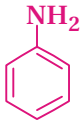
Reaction of RMgX with any aldehyde other than methanal gives secondary alcohols not the primary alcohols.



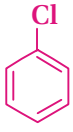
(where, R = $-C_2H_5$, C_3H_7, etc.)

18) Which of the following reactions will yield phenol ?

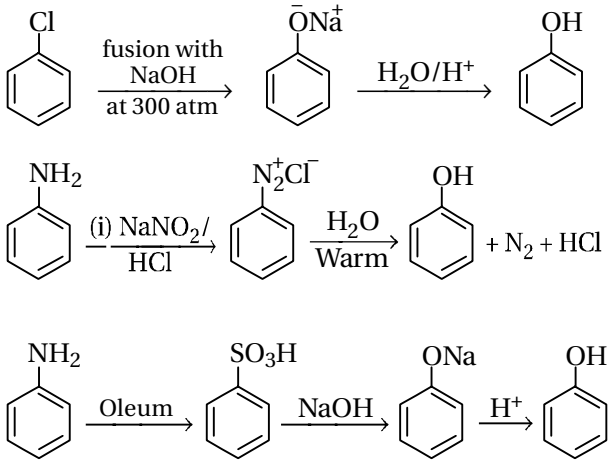
(A)  $\xrightarrow[(ii)\ H_2O/H^+]{(i)\ \text{fusion with NaOH at 300 atm}}$

(B)  $\xrightarrow[(ii)\ H_2O\ (\text{Warming})]{(i)\ NaNO_2/HCl}$

(C)  $\xrightarrow[(iii)\ H^+]{\substack{(i)\ \text{Oleum} \\ (ii)\ NaOH,\ H_2O\ (\text{Heating})}}$

(D)  $\xrightarrow[(ii)\ HCl]{(i)\ NaOHN_{(aq)}\ 298\ k/1\ atm}$

Ans. **(A), (B) and (C)**

➠ 

19) Which of the following reagents can be used to oxidize primary alcohols to aldehydes ? #

(A) CrO_3 in anhydrous medium

(B) $KMnO_4$ in acidic medium

(C) Pyridinium chlorochromate

(D) Heat in presence of Cu at 573 K

Ans. (A), (C) and (D)

20) Phenol can be distinguished from ethanol by the reaction with .....

(A) Br2/ water

(B) Na

(C) Neutral $FeCl_3$

(D) All of the above

Ans. (A) and (C)

➠ Phenol with neutral $FeCl_3$ gives a violet complex whereas ethanol forms yellow hexagonal crystals of iodoform when heated with alkaline solution of iodine. Phenol also forms a tribromo derivate which is not given by alcohol.

21) Which of the following are benzylic alcohols ?

(A) $C_6H_5 - CH_2 - CH_2OH$

(B) $C_6H_5 - CH_2OH$

(C) $C_6H_5 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - OH$

(D) $C_6H_5 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - OH$

Ans. (B) and (C)

➠ In benzylic alcohols, the –OH group is bonded to sp^3 carbon that is directly bonded to benzene ring.

Short Answer Type Questions

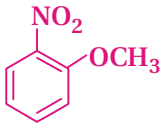
22) What is the structure and IUPAC name of glycerol ?

➠ $\begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array}$

IUPAC name: Propane-1,2,3-triol

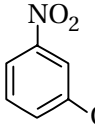
23) What is the IUPAC name of the following compounds ?

(a) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - \underset{\displaystyle OH}{\underset{|}{CH}} - \underset{\displaystyle C_2H_5}{\underset{|}{CH}} - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$

(b) 

➠ (a) $\overset{6}{CH_3} - \underset{\displaystyle CH_3}{\overset{5}{\underset{|}{CH}}} - \underset{\displaystyle OH}{\overset{4}{\underset{|}{CH}}} - \underset{\displaystyle C_2H_5}{\overset{3}{\underset{|}{CH}}} - \underset{\displaystyle OH}{\overset{2}{\underset{|}{CH}}}\overset{1}{CH_3}$

3-Ethyl-5-methylhexane-2,4-diol

(b) 

1-methoxy-3-nitrocyclohexane

24) Write the IUPAC name of the compound given below :

$$CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{C}} = \underset{\displaystyle CH_2OH}{\underset{|}{C}} - OH$$

➠ $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\underset{|}{C}} = \underset{\displaystyle CH_2OH}{\underset{|}{C}} - OH$

3-Methylpent-2-ene-1, 2-diol

25) Name the factors responsible for the solubility of alcohols in water.

➠ The presence of polar –OH group in alcohols make the alcohol water soluble because of the formation of intermolecular H-bonding.

$$R - O - H \text{ --- } \underset{\displaystyle H}{\underset{|}{O}} - H \text{ --- } \underset{\displaystyle R}{\underset{|}{O}} - H$$

26 What is denatured alcohol ?

➠ The process of mixing of pyridine or copper sulphate to the alcohol is known as alcohol denaturation and the alcohol with pyridine or copper sulphate is known as denatured alcohol. The denatured alcohol is unfit for drinking.

27) Suggest the reagent for the following conversion : #

➠ The pyridinium chlorochromate will convert the secondary alcohols to ketones without oxidizing the double bond.

28) Out of 2-chloroethanol and ethanol, which is more acidic and why ?

➠ 2-chloroethanol is more acidic than ethanol. This is because of the presence of chlorine atom that exerts the strong -I effect that facilitates the release the proton making the ethoxide ion more stable.

29) Suggest a reagent for conversion of ethanol to ethanal.

➠ Pyridinium chlorochromate.

30) Suggest the reagent for conversion of ethanol to ethanoic acid.

➠ Acidified $KMnO_4$ or acidified $K_2Cr_2O_7$ oxidizes the ethanol to ethanoic acid.

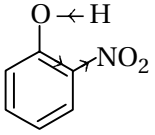
$$CH_3CH_2OH \xrightarrow{[O]} CH_3CHO \xrightarrow{[O]} CH_3COOH$$

31) Out of o-nitrophenol and p-nitrophenol, which is more volatile ?

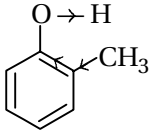
➠ Ortho-nitrophenol is more volatile because of intramolecular H-bonding (Chelation) whereas, the intermolecular H-bonding is present in p-nitrophenol. Thus, the p-nitrophenol is associated with the other molecules through H-bonding and so it shows higher boiling point.

32) Out of o-nitrophenol and o-cresol which is more acidic ?

➠ The presence of –I or –M group stabilizes the phenoxide ion and thus increases the acidic strength of the phenol whereas the +I or +M group destabilizes the phenoxide ion and as a result the acidic strength decreases. The $-NO_2$ is strong –M and –I group, whereas the $-CH_3$ (methyl group) is +I group, thus, $-NO_2$ increases the acidic strength of the phenol. So, o-nitrophenol is more acidic.



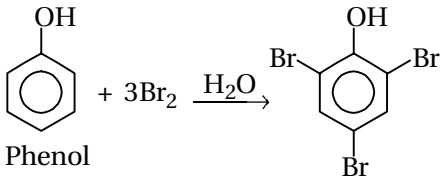
o-Nitrophenol
(–*I* efect of NO_2 group)



o-Cresol
(+*I* efect of CH_3 group)

33) When phenol is treated with bromine water, white precipitate is obtained. Give the structure and the same of the compound formed.

➠ The white precipitate of 2,4,6-Tribromophenol is obtained.



Phenol

(2,4,6-Tribromophenol)

34) Arrange the following compounds in increasing order of acidity and give a suitable explanation. Phenol, o-nitrophenol, o-cresol.

➠ Increasing order of acidic character :

o-cresol < Phenol < o-nitrophenol

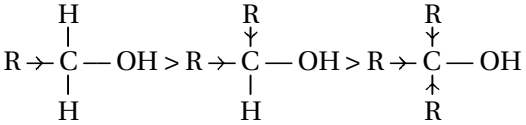
➠ The presence of +M group or + I group ($-CH_3$) decreases the acidic strength whereas presence of –I or –M group ($-NO_2$) increases the acidic strength. Thus, o-nitrophenol is most acidic.

35) Alcohols react with active metals, e.g., Na, K etc. to give corresponding alkoxides. Write down the decreasing order of reactivity of sodium metal primary, secondary and tertiary.

➠ The order of reactivity of alcohols with sodium metal is of order :

Primary alcohol > Secondary alcohol > Tertiary alcohol

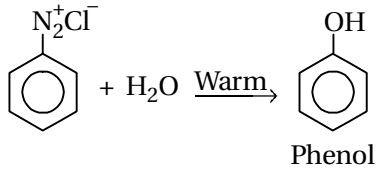
➠ The +I effect of the alkyl groups increases the electron density on the oxygen atom as a result of which the electropositive hydrogen of –OH group is more tightly held by the molecule which makes the release of H+ difficult. The effect if more pronounced if the alkyl groups are more in the molecule. Thus, tertiary alcohol is least acidic.



pri-alcohol sec-alcohol teri-alcohol

36) What happens when benzene diazonium chloride is heated with water ?

➠ When phenol is reacted with benzene diazonium chloride, phenol is obtained.



37) Arrange the following compounds in decreasing order of acidity : #

H_2O, R – OH, HC ≡ CH

➠ The order of acidity is : $H_2O > HC \equiv CH > R - OH$

The acidic strength increases with the increase in the electronegativity of atom and stability of the anion. The alcohol is a weak acid because the alkyl group destabilizes the alkoxide ion (conjugate base of the alcohol). In case of ethyne, the hydrogen is bonded to less electronegative atom, i.e., carbon whereas in water, the hydrogen is bonded to more electronegative element oxygen. So, the water is maximum acidic.

38) Name the enzymes and write the reactions involved in the preparation of ethanol from sucrose by fermentation.

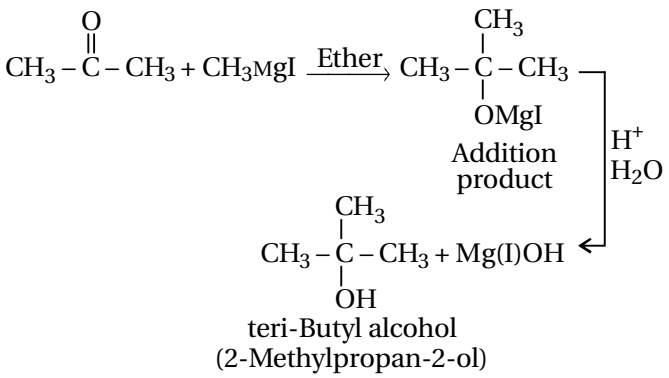
➠ The enzymes invertase and zymase are used to prepare ethanol from sucrose by fermentation.

$$C_{12}H_{22}O_{11} \xrightarrow{\text{Invertase}} \underset{\text{Glucose}}{C_6H_{12}O_6} + \underset{\text{Fructose}}{C_6H_{12}O_6}$$

$$\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethanol}}{2C_2H_6OH} + 2CO_2$$

39) How can propan-2-one be converted to tertiary butyl alcohol ?

➠ The propan-2-one can be converted to tertiary butyl alcohol by reaction with Grignard reagent CH_3MgX (X = Cl, Br, I).



40) Write the structures of the isomers of alcohols with molecular formula $C_4H_{10}O$. Which of these will exhibit optical activity ?

➠ The structures of the isomers of alcohols with molecular formula $C_4H_{10}O$ are :

(a) $CH_3CH_2CH_2CH_2OH$
Butan-1-ol(1°)

(b) $CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - CH_2OH$
2-Methylpropan-1-ol (1°)

(c) $CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_2CH_3$
Butan-2-ol(2°)

(d) $CH_3 - \underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}} - CH_3$
2-methylpropan-2-ol(3°)

Butan-2-ol is optically active.

41) Explain why the –OH group in phenols more strongly held as compared to –OH group in alcohols?

➠ In phenol, the oxygen of the –OH group is bonded to sp^2 carbon of the benzene ring. Due to resonance, the C – O bond acquires the partial double bond character and hence the bond between the ring and –OH group becomes shorter and stronger than C – OH bond in alcohol.

42) Explain why the nucleophilic substitution reactions are not very common in phenol ?

➠ In phenols, the oxygen atom of –OH group delocalise the lone pair of electrons over the benzene ring and as a result, the electron density on the benzene ring increases which makes difficult for the nucleophiles to attack due to repulsions.

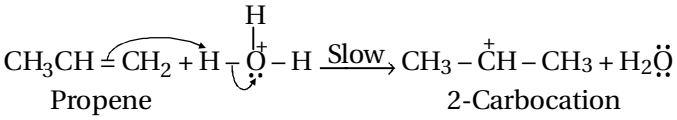
43) Preparation of alcohols from alkenes involves the electrophilic attack on alkene carbon. Explain its mechanism.

➠ **Step-1 :** Electrophilic attack by hydronium ion (H_2O^+) on alkene gives an intermediate. carbocation.

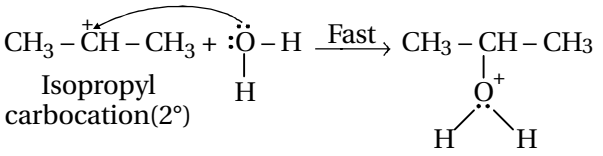
$(H_2SO_4 \rightarrow H^+ + {}^-OSO_2OH)$

$$H - \ddot{\underset{\cdot\cdot}{O}} - H + H^+ \rightarrow H - \overset{\displaystyle H}{\overset{|}{\overset{+}{\ddot{\underset{\cdot\cdot}{O}}}}} - H(H_3O^+)$$

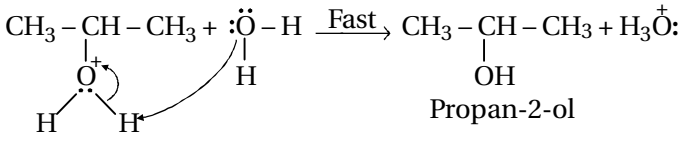
Hydrominum ion



➠ Step-2 : Nucleophilic attack by water on carbocation to yield protonated alcohol.

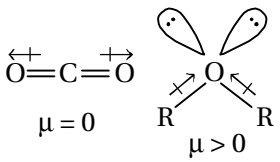


➠ Step-3 : Deprotonation (loss of proton) to form an alcohol.



44) Explain why is O = C = O non-polar while R – O – R is polar ? #

➠ This can be explained by molecular geometry. The CO_2 molecule is linear whereas the R_2O molecule is bent or angular in shape. Thus, in case of ethers, the bond moments do not cancel each other and so the molecule possess the net dipole moment. In case of CO_2 molecule, the bond moments are oriented exactly in opposite direction cancelling each other.

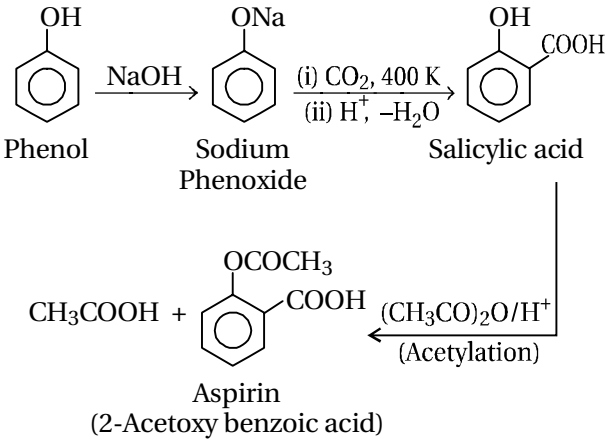


45) Why is the reactivity of all three classes of alcohols with concentrated HCl and $ZnCl_2$ (Lucas' reagent) different ?

➠ The reaction of alcohols with Lucas' reagent takes place by the formation of the carbocation intermediate which is also the rate determining step in the reaction. The tertiary carbocation is most stable because of hyperconjugation and the primary carbocation is least stable. Thus, the cleavage of C – OH bond is most easy in case of tertiary alcohols because that will result in the formation of stable intermediate tertiary carbocation. Thus, the order of reactivity is tertiary alcohol > secondary alcohol > primary alcohol.

46) Write the steps to carry out the conversion of phenol to aspirin.

➠



47) Nitration is an example of aromatic electrophilic substitution reaction and its rate depends upon the group already present in the benzene ring. Out of benzene and phenol, which one is more easily nitrated ?

➠ Phenol is more easily nitrated because of the presence of –OH group, the electron density on the ring increases due to +M effect. Thus, the nitronium ion will attack more readily on phenol.

48) In Kolbe's reaction, instead of phenol, the phenoxide is treated with the carbon dioxide. Why ?

➠ The phenoxide is more reactive than phenol because of greater ability of $-O^-$ to donate electron to the benzene ring and thus the bonding of CO_2 (weak nucleophile) easier.

49) Dipole moment of phenol is smaller than that of methanol. Why ?

➠ In phenol, the C – O bond is less polar because of –I effect of benzene ring whereas in case of methanol, C – O bond is more polar because of +I effect of methyl group. So, the dipole moment of phenol is less than methanol.

50) Ethers can be prepared by Williamson synthesis in which an alkyl halide is reacted with sodium alkoxide. Di-tertiary ether can't be prepared by this method. Explain.

➠ The Williamson's reaction take place in presence of strong nucleophile alkoxide ion and alkyl halide. The alkoxide ion is also a strong base apart from strong nucleophile. If the substrate is tertiary alkyl halide, the alkoxide ion will bring out the elimination reaction of tertiary alkyl halide that results in the formation of alkene as a major product.

51) Why is the C – O – H bond angle in alcohol is slightly less than the tetrahedral angle whereas the C – O – C bond angle in ether is slightly greater ? #

➠ The oxygen atom in both alcohol and ether is sp3 hybridized. The lone pair-lone pair repulsions in alcohols is greater than bond pair-bond pair repulsions and so the bond angle is 108.9° which is slightly less than regular tetrahedral angle (109°28'). In ether, there is a steric repulsion between two bulky alkyl or aryl groups and so the bond angle is 111.7° which greater than 109°28'.

52) Explain why are low molecular mass alcohols soluble in water?

➠ In alcohols of low molecular mass, the size of the non-polar alkyl group is small which exerts less steric hindrance as a result of which the intermolecular H-bonds with water are easily formed by alcohols. Hence, the alcohols of low molecular mass are readily soluble in water.

53) Explain why p-nitrophenol is more acidic than phenol ?

➠ An electron withdrawing group like $-NO_2$ stabilises the phenoxide ion by dispersal of negative charge. Thus, it increases the acidic strength of the phenol. The –M effect of $-NO_2$ group is more pronounced at ortho and para positions which results in higher acidic strength of p-nitro phenol.

54) Explain why the ethers and alcohols of comparable molecular mass have different boiling points ?

➠ Alcohols form intermolecular H-bond due to presence of polar –OH group whereas ether molecule does not form H-bond. Thus, the boiling points of ethers are lower than alcohols.

55) The carbon-oxygen bond is phenol is slightly stronger than that in methanol. Why?

➠ The C-O bond in phenol has the partial double bond character due to resonance whereas there is no resonance in methanol molecule. So, the C-O bond in phenol stronger than C-O bond in methanol.

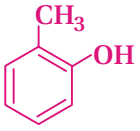
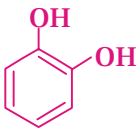
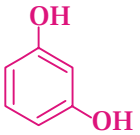
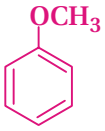
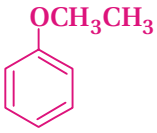
56) Arrange water, ethanol and phenol in increasing order of acidity and give reason for your answer.

➠ The acidic strength of a substance depends on the stability of the conjugate base. Stable is the conjugate base, stronger is the acid. The phenoxide ion is most stable among those listed because of resonance whereas in case of ethanol, there is no resonance and the +I effect of the ethyl group increase the electron density on the oxygen atom and destabilize the system. So, alcohol is weakest acid and phenol is the strongest acid. The order of acidic strength is: phenol > water > ethanol.

Matching The Columns

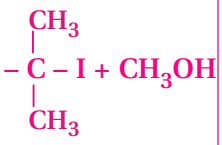
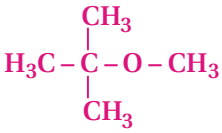
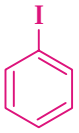
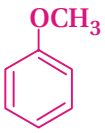
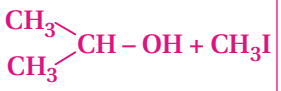
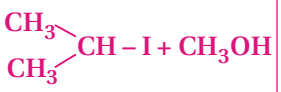
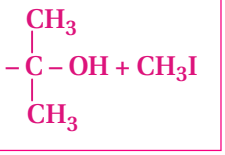
❖ **Match the items of column-I and column-II in the following questions :**

57) Match the structures of the compounds given in column-I with the name of the compounds given in column-II

Column-I	Column-II
(i) 	(a) Hydroquinone
(ii) 	(b) Phenetole
(iii) 	(c) Catechol
(iv) 	(d) o-Cresol
(v) 	(e) Quinone
(vi) 	(f) Resorciol
	(g) Anisole

➠ **(i → d), (ii → c), (iii → f), (iv → a), (v → g), (vi → b)**

58) Match the starting materials given in Column-I with the products formed by these (Column-II) in the reaction with HI. #

Column-I	Column-II
(i) $CH_3 - O - CH_3$	(a)  $+ CH_3I$
(ii) 	(b) 
(iii) 	(c)  $+ CH_3OH$
(iv) 	(d) $CH_3 - OH + CH_3 - I$
	(e) 
	(f) 
	(g) 

➠ (i → d), (ii → e), (iii → b), (iv → a)

59) Match the items of Column-I with the items of Column-II

Column-I	Column-II
(i) Antifreezer used in car engine	(a) Neutral ferric chloride
(ii) Solvent used in perfumes	(b) Glycerol
(iii) Starting material for picric acid	(c) Methanol
(iv) Wood spirit	(d) Phenol
(v) Reagent used for detection of phenolic group	(e) Ethyleneglycol
(vi) By product of soap industry used in cosmetics	(f) Ethanol

➠ (i → e), (ii → f), (iii → d), (iv → c), (v → a), (vi → b)

UID : P2-C11-S4-Q58

60) Match the items of column-I with the items of column-II

Column-I	Column-II
(i) Methanol	(a) Conversion of phenol to o-hydroxysalicylic acid
(ii) Kolbe's reaction	(b) Ethyl alcohol
(iii) Williamson's synthesis	(c) Conversion of phenol to salicylaldehyde
(iv) Conversion of 2° alcohol to ketone	(d) Wood spirit
(v) Reimer-Tiemann reaction	(e) Heated copper at 573K
(vi) Fermentation	(f) Reaction of alkyl halide with sodium alkoxide

➠ (i → d), (ii → a), (iii → f), (iv → e), (v → c), (vi → b)

Assertion and Reason Type Questions

❖ **In the following questions a statement of Assertion (A) followed by a statement of Reason (R) is given. Choose the correct answer out of the following choices.**

(A) Assertion and reason both are correct statements and reason explains the assertion.

(B) Both assertion and reason are wrong statements.

(C) Assertion is correct statement and reason is wrong statement.

(D) Assertion is wrong statement and reason is correct statement.

(E) Assertion and reason both are correct statement, but reason does not explain assertion.

61) Assertion (A) : Addition reaction of water to but-1-ene in acidic medium yields butan-1-ol.

Reason : Addition of water in acidic medium proceeds through the formation of primary carbocation.

Ans. **(B) Both assertion and reason are wrong statements.**

➠ The but-1-ene with water forms butan-2-ol by Markonikov's rule and the reaction proceeds through the formation of secondary carbocation.

62) Assertion (A) : p-nitrophenol is more acidic than phenol

Reason (R) : Nitro group helps in the stabilisation of the phenoxide ion by dispersal of negative charge due to resonance. #

Ans. **(A) Assertion and reason both are correct statements and reason explains the assertion.**

63) Assertion (A) : IUPAC name of the compound is 2-ethoxy-2-methylethane

$CH_3 - \underset{\displaystyle CH_3}{\underset{|}{CH}} - O - CH_2 - CH_2 - CH_3$

Reason (R) : In IUPAC nomenclature, ether is regarded as hydrocarbon derivative in which a hydrogen atom is replaced by –OR or –OAr group. [R = alkyl group, Ar = aryl group]

Ans. **(D) Assertion is wrong statement and reason is correct statement.**

➠ The IUPAC name of the compound is 2-propoxypropane

64) Assertion (A) : Bond angle in ethers is slightly less than the tetrahedral angle.

Reason (R) : There is a repulsion between the two bulky (–R) groups.

Ans. **(D) Assertion is wrong statement and reason is correct statement.**

➠ Because of repulsion between two bulky groups in ether, the bond angle is greater than tetrahedral angle.

65) Assertion (A) : Boiling points of alcohols and ethers are high.

Reason (R) : They can form intermolecular H-bonding.

Ans. **(B) Both assertion and reason are wrong statements.**

➠ Ethers have low boiling points because they do not form intermolecular H-bonding.

66) Assertion (A) : Like bromination of benzene bromination of phenol is also carried out in presence of Lewis acid.

Reason (R) : Lewis acid polarises bromine molecule.

Ans. **(D) Assertion is wrong statement and reason is correct statement.**

➠ Bromination of phenol can be carried out in absence of Lewis acid.

67) Assertion (A) : o-nitrophenol is less soluble in water than m-nitrophenol.

Reason (R) : m-nitrophenol and p-nitrophenols exist as associated molecules.

Ans. **(E) Assertion and reason both are correct statement, but reason does not explain assertion.**

➠ o-nitrophenol has a less solubility due to intramolecular H-bonding. The m-nitrophenol and p-nitrophenol exist as associated molecules due to intermolecular H-bonding.

68) Assertion(A) : Ethanol is a weaker acid than phenol

Reason (R) : Sodium ethoxide many be prepared by reaction of ethanol with aqueous KOH

Ans. **(C) Assertion is correct statement and reason is wrong statement.**

➠ Phenol is stronger acid than ethanol because the phenoxide ion is resonance stabilized. The sodium ethoxide is prepared by reaction of sodium metal with ethanol.

69) Assertion (A) : Phenol forms 2,4,6-tribromophenol on treatment with Br_2 in carbon disulphide at 273 K.

Reason (R) : Bromine polarizes carbon disulphide

Ans. **(B) Both assertion and reason are wrong statements.**

➠ Phenol forms 2,4,6-tribromophenol on treatment with Br_2/H_2O. In phenols, the polarization of bromine takes place even in absence of Lewis acids.

70) Assertion (A) : Phenol give o- and p-nitrophenol on nitration with conc. HNO_3 and H_2SO_4 mixture.

Reason (R) : –OH group in phenol is o- and p-directing.

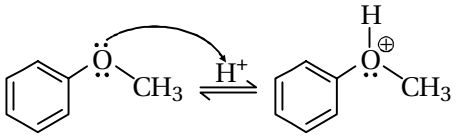
Ans. **(D) Assertion is wrong statement and reason is correct statement.**

➠ Phenol with conc. HNO_3 forms 2,4,6-tri-nitrophenol.

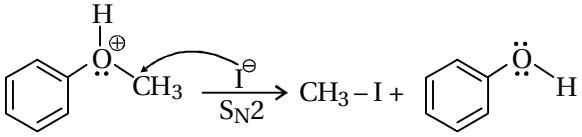
Long Answer Type Questions

71) Write mechanism of the reaction of HI with methoxy benzene. #

➠ Step : 1 Protonation of –OH group of Phenol



Step : 2 Attack of Nucleophile (I^-)



72) (A) Name the starting material used in the industrial preparations of phenol.

(B) Write the complete reaction for the bromination of phenol in aqueous and non-aqueous medium

(C) Explain why Lewis acid is not required in bromination of phenol ?

➠ (A) See for answer Section-1, Q.-14

(B) See for answer Section-1, Q.-29

(C) See for answer Section-1, Q.-29

73) How can phenol be converted to aspirin ?

➠ See for answer Section-1, Q.-30

74) Explain the process in which a biocatalyst is used in industrial preparation of a compound known to you.

➠ See for answer Section-1, Q.-12

Section-5 Darpan's Exam Oriented MCQs S5

Darpan's Exam Oriented MCQs

1) The general molecular formula of monohydric alcohols and ..... is same.

(A) Aldehyde (B) Ketones
(C) Ethers (D) Ester

Ans. **(C)** Ethers.

➠ Both ethers and mono-hydric alcohols have formula $C_nH_{2n+2}O$

2) Which of the following isomerism is not shown by alcohols ?

(A) Chain (B) Position
(C) Functional (D) Metamerism

Ans. **(D)** Metamerism

➠ The hydroxyl group is not a polyvalent functional group. Metamerism is shown only by the polyvalent functional groups such as ester, secondary amines, ketones etc.

3) Ordinary spirit is .....

(A) Methanol (B) Ethanol
(C) Phenol (D) Butan-1-ol

Ans. **(B)** Ethanol

4) Wood spirit is_____

(A) Methanol (B) Isopropyl alcohol
(C) Butan-1-ol (D) Phenol

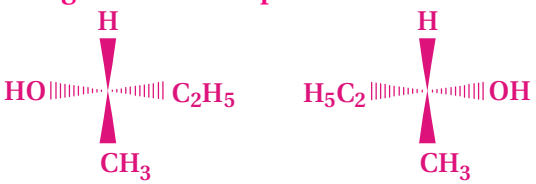
Ans. **(A)** Methanol

5) The IUPAC name of $(CH_3)_3C-CH_2OH$ is .....

(A) 2,2-Dimethylpropan-1-ol
(B) Tertiary butyl carbinol
(C) Neopentyl alcohol
(D) 1,1-Dimethylethylcarbinol

Ans. **(A)** 2,2-Dimethylpropan-1-ol

6) The given two compounds are :



(A) Constitutional isomers (B) Enantiomers
(C) Diastereomers (D) Identical

Ans. **(B)** Enantiomers

7) Identify the correct order of boiling points :

(A) Propane < Methoxymethane < Fluoroethane < Ethanol

(B) Propane < Fluoroethane < Methoxymethane < Ethanol

(C) Methoxymethane < Propane < Fluoroethane < Ethanol

(D) Fluoroethane < Methoxymethanel < Ethanol < Propane

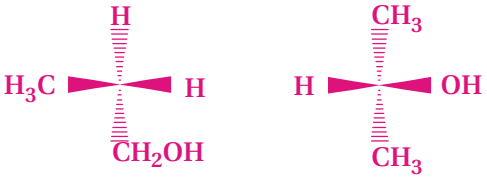
Ans. **(B)** Propane < Fluoroethane < Methoxymethane < Ethanol

8) **Which compound is used to treat cold and cough ? #**

(A) Phenyl benzoate (B) Phenyl salicylate
(C) Methyl salicylate (D) Ethyl salicylate

Ans. **(C)** Methyl salicylate

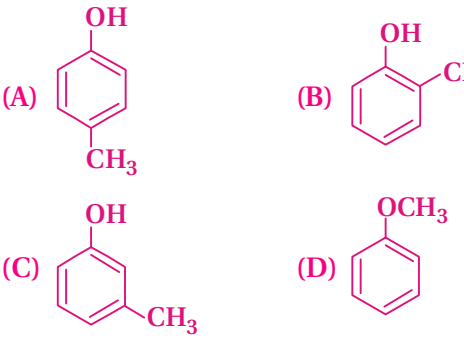
9) **The given two compounds are .....**



(A) Enantiomers (B) Identical
(C) Constitutional isomers
(D) Meso-compounds

Ans. **(C)** Constitutional isomers

10) **An organic compound (A) C_7H_8O is insoluble in aqueous $NaHCO_3$, but soluble in NaOH. (A) on treatment with bromine water rapidly forms compound (B), $C_7H_5OBr_3$. The compound (A) is .....**



Ans. **(C)**

➠ Since the compound is soluble in NaOH and forms a tri-bromo product, it must be m-cresol. Ethers are not soluble in NaOH.

11) **What is the IUPAC name of $H_2C = CH - CH_2OH$?**

(A) Prop-2-en-1-ol (B) Prop-1-en-3-ol
(C) 1-Hydoxypropene (D) Allyl alcohol

Ans. **(A)** Prop-2-en-1-ol

12) **The correct order of dehydration of alcohols to form ethers is .....**

(A) 1° > 2° > 3° (B) 1° < 2° < 3°
(C) 2° > 3° > 1° (D) 3° < 1° < 2°

Ans. **(A)** 1° > 2° > 3°

13) **Which of the following is not an oxidizing agent ?**

(A) Lithium aluminium hydride
(B) Pyridinium chlorochromate
(C) CrO_3/H_2SO_4 (D) Alkaline $KMnO_4$

Ans. **(A)** Lithium aluminium hydride

14) **Which of the following will not form yellow precipitates with alkaline iodine solution ?**

(A) Ethanol (B) Isopropyl alcohol
(C) Isobutyl alcohol (D) Acetone

Ans. **(C)** Isobutyl alcohol

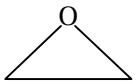
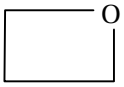
15) **Identify the product of the reaction :**

$$C_6H_5 - COOH \xrightarrow[(ii)\,H_2O]{(i)\,LiAlH_4} X$$

(A) Phenyl methanol (B) Ethyl benzene
(C) 1-Phenyl ethanol (D) Ethyl benzoate

Ans. **(A)** Phenyl methanol

16) **The butanol can be obtained by the reaction of methyl magnesium iodide with .....**

(A)  (B) 
(C) Methanal (D) Propanal

Ans. **(B)**

17) **The catalyst used in the industrial production of methanol is .....**

(A) $ZnO - Cr_2O_3$ (B) Pt – Rh
(C) Fe + Mo (D) MnO_2

Ans. **(A)** $ZnO - Cr_2O_3$

18) **The pure ethanol is obtained by .....**

(A) Membrane technology
(B) Fermentation
(C) Acid catalyst hydration of alkenes
(D) Hydroboration oxidation reaction

Ans. **(A)** Membrane technology

19) **Which of the following is not soluble in sodium hydrogen carbonate ?**

(A) Formic acid (B) Picric acid
(C) Carbolic acid (D) Benzoic acid

Ans. **(C)** Carbolic acid

20) **Alcohols are .....**

(A) Bronsted Base (B) Lewis Base
(C) Bronsted acid (D) All of these

Ans. **(D)** All of these

21) The phenol with a high purity is obtained from .... #

(A) Cumene
(B) Benzene sulphonic acid
(C) Chlorobenzene (D) Diazonium salt

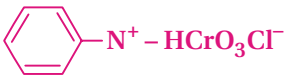
Ans. **(A)** Cumene

22) The enzyme that carries out the conversion of sucrose to glucose and fructose is .....

(A) Zymase (B) Transferase
(C) Invertase (D) Zymase

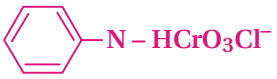
Ans. **(C)** Invertase

23) The correct structural formula of pyridinium chlorochromate is .....

(A) 

(B) 

(C) 

(D) 

Ans. **(A)**

24) 0.037 g of an alcohol was added to methyl magnesium iodide and the gas evolved at STP, occupies the volume 11.2 cm^3. On dehydration, the alcohol gives an alkene. The alkene upon ozonolysis produces acetone as one of its products. The alcohol gives the carboxylic acid upon oxidation with same number of carbon atom. The alcohol is .....

(A) n-butyl alcohol (B) Isopropyl alcohol
(C) Isobutyl alcohol (D) Sec. Butyl alcohol

Ans. **(C)** Isobutyl alcohol

➠ The molecular mass of

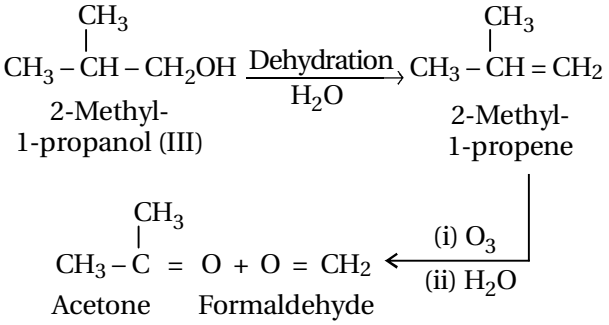
$$R - OH = \frac{22400 \times 0.037}{11.2} = 74 \text{ g.}$$

$\therefore \quad C_nH_{2n+2}O = 74 \Rightarrow 12n + (2n + 2) + 16 = 74$

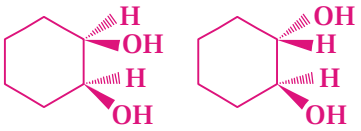
$\Rightarrow n = 4$

➠ The possible alcohols are n-butyl alcohol, isobutyl alcohol, sec. Butyl alcohol and tertiary butyl alcohol. As the alcohol gives the carboxylic acid with same number of carbon atoms upon oxidation, the option (d) is ruled out. Also, option (b) is ruled out as the alcohol is of 4-carbon atoms.

➠ The one of the products of ozonolysis of Alkene is acetone. Thus, alkene has = $C(CH_3)_2$ group. Thus, alkene must be isobutylene, i.e., $(CH_3)_2C = CH_2$. So, the given alcohol is isobutyl alcohol.



25) Which of the following is used to distinguish the given pair of compounds ?



(A) Acetone
(B) Alkaline $KMnO_4$
(C) Alkaline I_2 solution
(D) Victor Meyer's reagent.

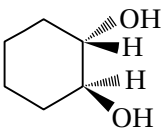
Ans. **(A)** Acetone

➠ In cis-diol, the two –OH groups are on the same side that forms cyclic ketal with acetone whereas the trans-isomer will not form ketal because the –OH groups are present on the opposite side.

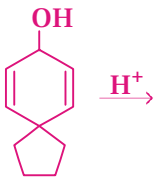
26) Which of the following statements is true for the given reaction ?

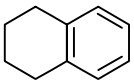
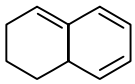
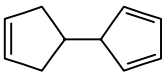
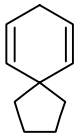
(A) Anti-addition of –H (from BH_3) and –OH (from solution) occurs.
(B) Syn-addition of –H (from BH_3) and –OH (from H_2O_2) occurs.
(C) The product formed is optically active.
(D) Addition follows Markovnikov's rule.

Ans. **(C)** The product formed is optically active



27) The major product in the following reaction is : #



(A) 
(B) 
(C) 
(D) 

Ans. **(A)**

28) The dehydration of alcohols to form ethers in presence of concentrated acid follows:

(A) Unimolecular nucleophilic substitution reaction.
(B) Biomolecular nucleophilic substitution reaction
(C) Unimolecular elimination reaction
(D) Bimolecular elimination reaction

Ans. **(B)** Bimolecular nucleophilic substitution reaction

29) The order of esterification of alcohols is .....

(A) Tertiary > Primary > Secondary
(B) Tertiary > Secondary > Primary
(C) Primary > Secondary > Tertiary
(D) Secondary > Primary > Tertiary

Ans. **(C)** Primary > Secondary > Tertiary

30) The isopropyl alcohol and n-propyl alcohol can be distinguished chemically by .....

(A) Alkaline solution of iodine
(B) Reduction
(C) Ozonolysis
(D) Phosphorus pentachloride

Ans. **(A)** Alkaline solution of iodine

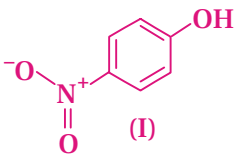
Isopropyl alcohol forms a yellow precipitate of iodoform with alkaline solution of iodine

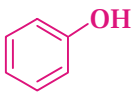
31) The alcohol that responds to Lucas reagent fastest is .....

(A) 2-Methyl propan-2-ol
(B) 2-Methyl propan-1-ol
(C) Butan-2-ol
(D) Propan-1-ol

Ans. **(A)** 2-Methyl propan-2-ol

32) The reactivity of the following compounds with acetyl chloride is .....



(I)


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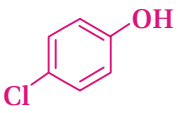


(III)

(A) III > II > I (B) II > III > I
(C) I > III > II (D) II > I > III

Ans. **(C)** I > III > II

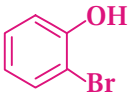
➠ The reaction with acetyl chloride involves the breaking of O – H bond of phenol. The presence of electron attracting groups polarizes the O – H bonds more effectively that favours the removal of hydrogen of –OH group.

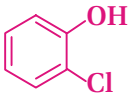
33) A yellow product formed when an organic compound C_3H_8O is warmed with aqueous solution of sodium carbonate and iodine solution. The product is .....

(A) Sodium iodide (B) Acetone
(C) Iodoform (D) Sodium iodate

Ans. **(C)** Iodoform

34) The correct order of acidic strength of following compounds is .....



(I)


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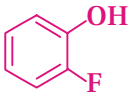
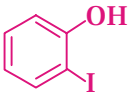


(III)


(IV)

(A) III > II > I > IV (B) II > I > IV > III
(C) III > II > IV > I (D) IV > I > II > III

Ans. **(B)** II > I > IV > III

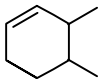
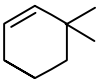
➠ 2-Fluorophenol is least acidic due to intramolecular H-bonding.

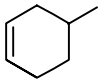
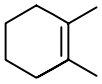
35) The electrophile in Reimer-Tiemann reaction is .....

(A) Dichlorocarbocation
(B) Dichlorocarbene
(C) Trichlorocarbocation
(D) Formyl cation

Ans. **(B)** Dichlorocarbene

36) On heating 2,2-Dimethylcyclohexanol with concentrated sulphuric acid, the major alkene formed is .....

(A)  (B) 

(C)  (D) 

Ans. **(D)**

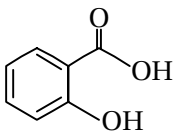
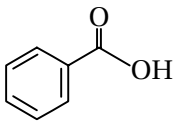
37) Phenol and ethanol are distinguished chemically by ..... #

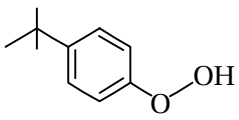
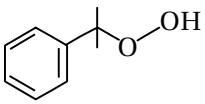
(A) Neutral $FeCl_3$ (B) Fehling's reagent

(C) Ammonical Cu_2Cl_2 (D) Tollen's reagent

Ans. **(A)** Neutral $FeCl_3$

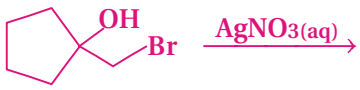
38) Phenol is distilled with a zinc dust followed by Friedel-Craft's alkylation with propyl chloride in the presence of $AlCl_3$ to give a compound (B). (B) is oxidized in the presence of air to form a compound (C). The structural formula of (C) is .....

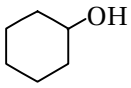
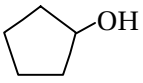
(A)  (B) 

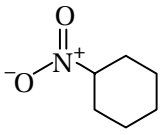
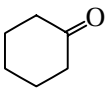
(C)  (D) 

Ans. **(D)**

39) The major product in the following reaction is .....



(A)  (B) 

(C)  (D) 

Ans. **(D)**

40) The rate of dehydration of alcohols to form alkenes depends on .....

(A) Both the concentration of dehydrating agent and alcohol

(B) Only on the concentration of alcohol

(C) The concentration of protonated alcohol

(D) Only on the concentration of dehydrating agent.

Ans. **(C)** The concentration of protonated alcohol.

➠ The formation of carbocation from the protonated alcohol is the slow step of the reaction and thus it is the rate determining step.

41) Propan-1-ol is prepared from Propene by .....

(A) H_2O/H_2SO_4

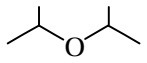
(B) B_2H_6-THF and H_2O_2/OH^-

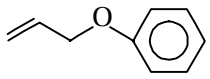
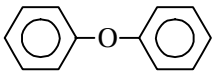
(C) Pyridinium chlorochromate in methylene dichloride

(D) $Hg(OCOCH_3)_2/H_2O$ and $NaBH_4$

Ans. **(B)** B_2H_6-THF and H_2O_2/OH^-

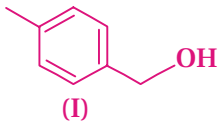
42) Which of the following ethers will not form peroxide ?

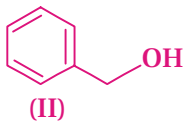
(A)  (B) 

(C)  (D) 

Ans. **(D)**

43) The correct reacting order of following alcohols with (H_2SO_4 + NaBr) is .....


(I)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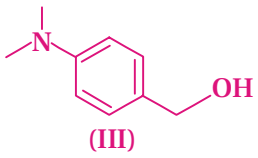
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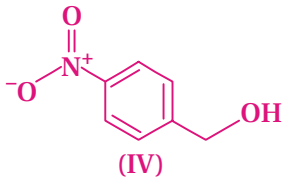

(IV)

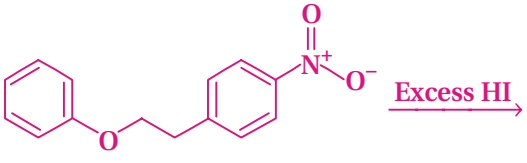
(A) III > I > II > IV (B) I > III > II > IV

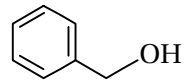
(C) IV > III > I > II (D) II > IV > III > I

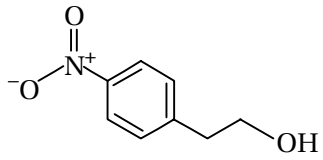
Ans. **(A)** III > I > II > IV

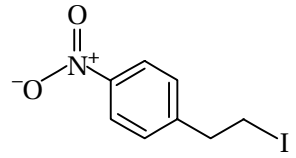
The substitution reaction favours by the formation of carbocation. The presence of electron withdrawing groups decrease the stability of carbocation whereas the presence of electron releasing groups increases the stability of carbocation.

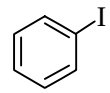
44) Identify the major product of the reaction :



(A) 

(B) 

(C) 

(D) 

Ans. **(C)**

45) **The action of enzyme is inhibited during the fermentation once the concentration of alcohol exceeds ..... #**

(A) 14 percent (B) 15 percent
(C) 20 percent (D) 10 percent

Ans. **(A)** 14 percent

46) **Which of the following is not an example of electrophilic substitution ?**

(A) Kolbe's reaction (B) Oxidation of phenol
(C) Reimer-Tiemann reaction
(D) Bromination of phenol

Ans. **(B)** Oxidation of phenol

47) **Which of the following is the strongest acid ?**

(A) Cyclohexan-1-ol (B) Phenol
(C) p-nitrophenol (D) p-methyl phenol

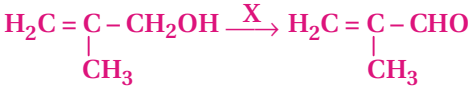
Ans. **(C)** p-nitrophenol

48) **Phenetole is .....**

(A) Diphenyl ether (B) Ethoxy benzene
(C) Methoxy benzene (D) Diethyl ether

Ans. **(B)** Ethoxy benzene

49) **Identify the (X) in the following reaction :**



(A) CrO_3/H_2SO_4 (B) PCC/CH_2Cl_2
(C) $Na_2Cr_2O_7/H_2SO_4$ (D) $KMnO_4/H_2SO_4$

Ans. **(B)** PCC/CH_2Cl_2

50) **Propan-1-ol and Ethanol is distinguished chemically by .....**

(A) Lucas test (B) Victor Meyer's test
(C) Iodoform test (D) Libermann's test

Ans. **(C)** Iodoform test

➠ Ethanol forms iodoform with alkaline iodine solution.

51) **The reagent used in hydroboration oxidation of alkene is .....**

(A) Diborane
(B) Borax
(C) Sodium borohydride
(D) Boric acid

Ans. **(A)** Diborane

52) **The major product of the reaction of alcohols with carboxylic acid in presence of acid catalyst is .....**

(A) Ester (B) Ether
(C) Anhydride (D) Aldehyde

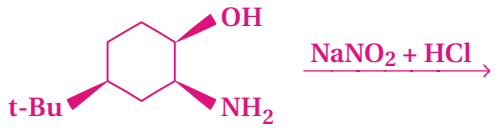
Ans. **(A)** Ester

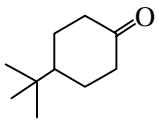
53) **2-Phenylbutan-2-ol is best prepared by which of the following combinations?**

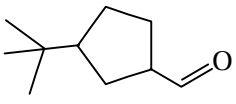
(A) $C_6H_5COCH_3 + C_2H_5MgBr$
(B) $C_2H_5COCH_3 + C_6H_5MgBr$
(C) $C_6H_5COC_2H_5 + CH_3MgBr$
(D) All of these

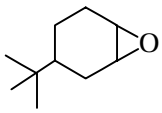
Ans. **(D)** All of these

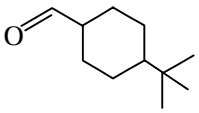
54) **The major product in the following reaction is .....**



(A) 

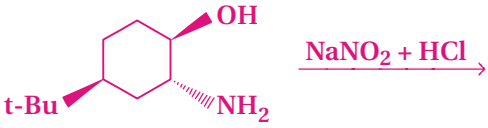
(B) 

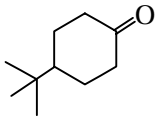
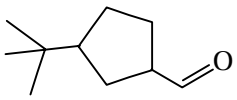
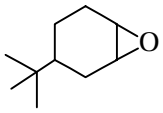
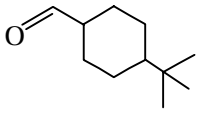
(C) 

(D) 

Ans. **(B)**

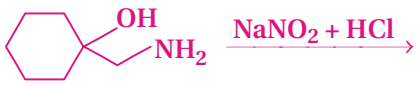
55) Identify the major product in the reaction : #

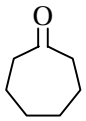
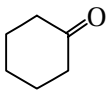
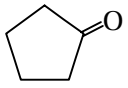


(A) 
(B) 
(C) 
(D) 

Ans. **(C)**

56) The major product of the reaction is .....



(A) 
(B) 
(C) 
(D) 

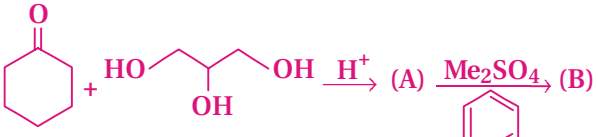
Ans. **(A)**

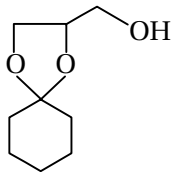
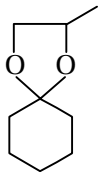
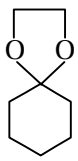
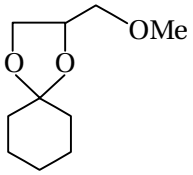
57) Which of the following alcohols give ketone on oxidation ?

(A) Propan-2-ol (B) Propan-1-ol
(C) 2-Methyl propan-1-ol
(D) Butan-1-ol

Ans. **(A)** Propan-2-ol

58) The product (B) in the reaction is .....

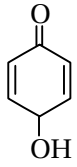
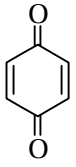
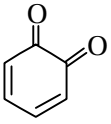
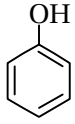


(A) 
(B) 
(C) 
(D) 

Ans. **(D)** (Me = CH_3– group)

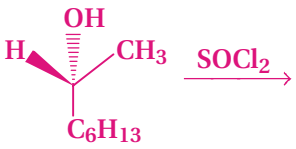
➠ $(CH_3)_2SO_4$ is a methylating agent.

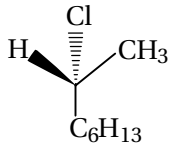
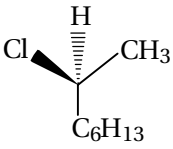
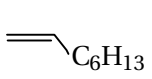
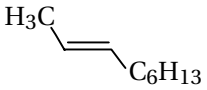
59) The major product in the following reaction is .....

(A) 
(B) 
(C) 
(D) 

Ans. **(D)**

60) The major product of the following reaction is .....

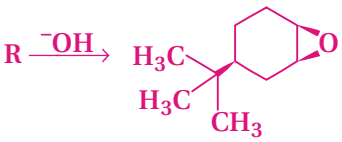


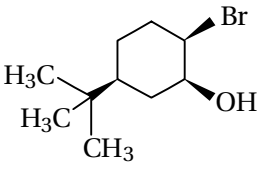
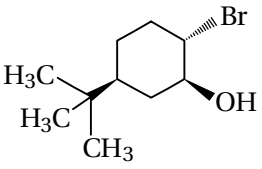
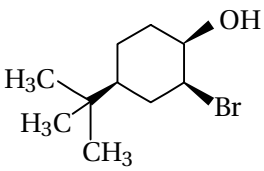
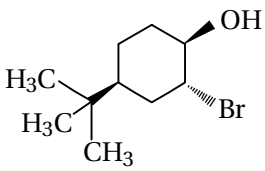
(A) 
(B) 
(C) 
(D) 

Ans. **(A)**

➠ The reaction of $SOCl_2$ with alcohol in absence of pyridine takes place by retention of configuration. It is the example of S_Ni (substitution nucleophilic internal reaction).

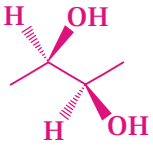
61) Identify the reactant in the reaction :



(A) 
(B) 
(C) 
(D) 

Ans. **(D)**

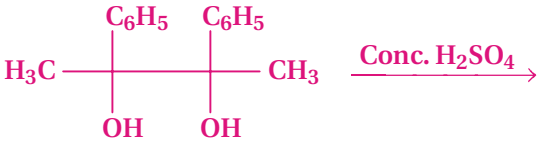
62) The correct configuration of the following compound is ..... #

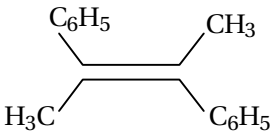
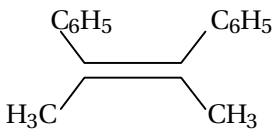
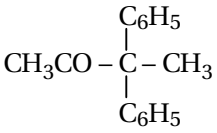
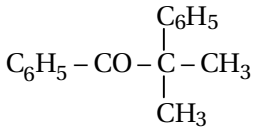


(A) 2R, 3S (B) 2S, 3R
(C) 2S, 3S (D) 2R, 3R

Ans. (D) 2R, 3R

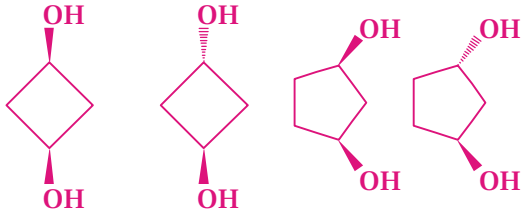
63) The major product of the following reaction is .....



(A) 
(B) 
(C) 
(D) 

Ans. (C)

64) Which of the following is optically active ?



(I) (II) (III) (IV)

(A) (I) (B) (II)
(C) (III) (D) (IV)

Ans. (D) (IV)

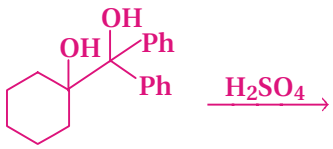
65) R-(–)-2-Bromooctane on treatment with aqueous KOH mainly gives 2-octanol. Which of the following is true ?

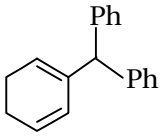
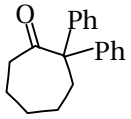
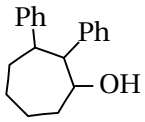
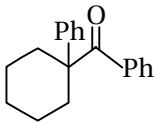
(A) Optically active with R-configuration
(B) Optically active with S-configuration
(C) A racemic mixture
(D) A meso compound

Ans. (B) Optically active with S-configuration

➠ The reaction follows S_N2 path and thus the inversion of configuration takes place.

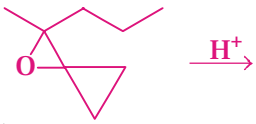
66) The major product of the following reaction is .....

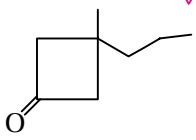
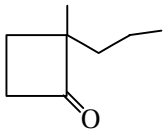
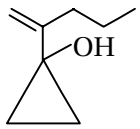
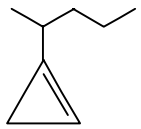


(A) 
(B) 
(C) 
(D) 

Ans. (B)

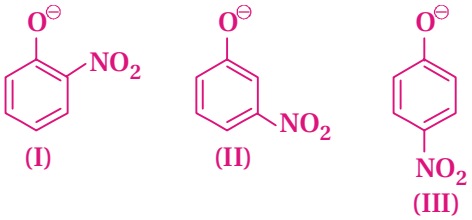
67) The major product in the following reaction is .....



(A) 
(B) 
(C) 
(D) 

Ans. (B)

68) The correct order of basicity of the following anions is .....

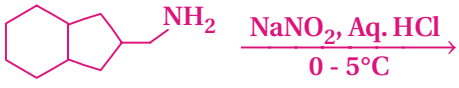


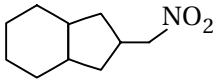
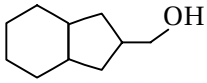
(I) (II) (III)

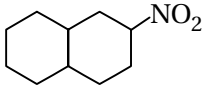
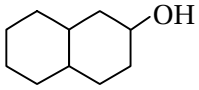
(A) II > III > I (B) I > II > III
(C) II > I > III (D) III > II > I

Ans. (C) II > I > III

69) The major product in the following reaction is .....

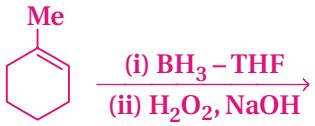


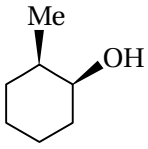
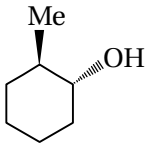
(A)  (B) 

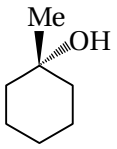
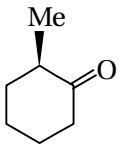
(C)  (D) 

Ans. **(D)**

70) **The major product of the reaction is ..... #**



(A)  (B) 

(C)  (D) 

Ans. **(B)**

71) **Identify the correct order of the acidic strength :**

(A) Methanol > Phenol > H_2O

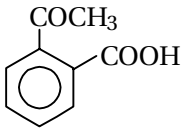
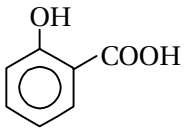
(B) H_2O > Methanol > Phenol

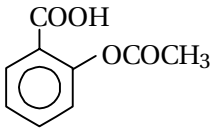
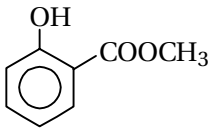
(C) Phenol > H_2O > Methanol

(D) H_2O > Phenol > Methanol

Ans. **(C)** Phenol > H_2O > Methanol

72) **Which of the following is an analgesic drug ?**

(A)  (B) 

(C)  (D) 

Ans. **(C)**

73) **The preparation of salicylaldehyde from phenol is known as .....**

(A) Dow's reaction

(B) Reimer- Tiemann reaction

(C) Kolbe's reaction

(D) Cumene process

Ans. **(B)** Reimer-Tiemann reaction

UID : P2-C11-S5-Q70

74) **Which of the following compound having maximum solubility and highest boiling point ?**

(A) Ethanol

(B) Ethane-1,2-diol

(C) Propane-1,2,3-triol

(D) Butan-1-ol

Ans. **(C)** Propan-1,2,3-triol

75) **The bromination of anisole is carried out in the presence of .....**

(A) CH_3COCH_3 (B) CH_3COOH

(C) CH_3CH_2OH (D) CH_3CN

Ans. **(B)** CH_3COOH

76) **In which of the following, intermolecular H-bond is not present ?**

(A) Alcohol-Alcohol (B) Phenol-Phenol

(C) Ether-Ether (D) Ether-Water

Ans. **(C)** Ether-Ether

77) **The cleavage of carbon-oxygen bond in ether takes place in .....**

(A) Alkaline medium (B) Acidic medium

(C) Neutral medium (D) Alcohol medium

Ans. **(B)** Acidic medium

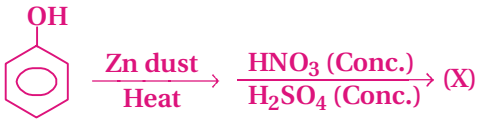
78) **The boiling point of ethanol is .....**

(A) 334 K (B) 351 K

(C) 360 K (D) 313 K

Ans. **(B)** 351 K

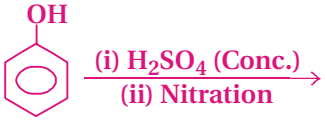
79) **In the following reaction, the (X) is .....**



(A) Benzene (B) Nitrobenzene

(C) m-dinitrobenzene (D) 1,3,5-trinitrobenzene

Ans. **(B)** Nitrobenzene

80) **The major product**  **in the following reaction is :**

(A) Picric acid

(B) 2,4-Dinitrophenol

(C) m-nitrobenzene sulphonic acid

(D) 3,5-Dinitrobenzenesulphonic acid

Ans. **(A)** Picric acid

81) **Which reagent is used to reduce aldehyde and ketone to alcohol ? #**

(A) Sodium borohydride

(B) Lithium Aluminium hydride

(C) H_2/Pd

(D) All of these

Ans. **(D)** All of these

82) **The by-product in Dow's process is .....**

(A) Ketone (B) Aldehyde

(C) Ether (D) Carboxylic acid

Ans. **(C)** Ether

83) **Which of the following gives primary alcohol with a Grignard reagent ?**

(A) HCHO (B) $C_6H_5CHO_3$

(C) CH_3CH_2CHO (D) C_6H_5CHO

Ans. **(A)** HCHO

84) **The product obtained by oxidation of phenol is .....**

(A) 1,4-Benzoquinone (B) Resorcinol

(C) Catechol (D) Hydroquinone

Ans. **(A)** 1,4-Benzoquinone

85) **The oxidation of phenol in presence of alkaline per-sulphate solution is .....**

(A) 1,4-Benzoquinone (B) Hydroquinone

(C) Catechol (D) Resorcinol

Ans. **(B)** Hydroquinone

86) **The acid catalysed hydration of alkenes proceeds by formation of .....**

(A) Carbene intermediate

(B) Carbocation intermediate

(C) Carbanion intermediate

(D) Free radical intermediate

Ans. **(B)** Carbocation intermediate

87) **A compound (X) with a molecular formula $C_4H_{10}O$ on oxidation gives (Y) which gives positive iodoform test. (Y) with CH_3MgI followed by hydrolysis gives (Z). The (Z) is .....**

(A) $CH_3 - (CH_2)_4 - OH$

(B) $CH_3CH(CH_3)CH_2CH_2OH$

(C) $(CH_3CH_2)_2CH - OH$

(D) $(CH_3)_2C(OH)C_3H_5$

Ans. **(D)** $(CH_3)_2C(OH)C_3H_5$

88) **The two compounds (X) and (Y) have the same molecular formula C_4H_8O. These two compounds were subjected to certain chemical tests and following results were obtained :**

Tests	X	Y
Na metal	Bubbles	—
Br_2 water	Decolourizes	—
Chromic acid	Orange to green	—
Lucas' test	—	—

(A) $H_2C = CH - CH(OH) - CH_3$ and $CH_3CH_2CH_2CHO$

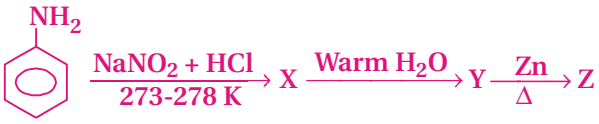
(B) $CH_3CH = CH - CH_2OH$ and $CH_3CH_2CH_2CHO$

(C) $H_2C = CH - CH(OH) - CH_3$ and $CH_3CH_2COCH_3$

(D) $CH_3CH_2COCH_3$ and $H_2C = CH - CH(OH) - CH_3$

Ans. **(B)** $CH_3CH = CH - CH_2OH$ and $CH_3CH_2CH_2CHO$

89) **Identify (X), (Y) and (Z) in the reaction :**



	X	Y	Z
(A)	Chlorobenzene	Phenol	Benzene
(B)	Nitrobenzene	Phenol	Zinc Phenoxide
(C)	Benzene Diazonium Chloride	Sodium Phenoxide	Phenol
(D)	Benzene diazonium Chloride	Phenol	Benzene

Ans. **(D)** Benzene diazonium chloride, Phenol and Benzene respectively.

90) **An optically active alcohol with a minimum number of carbon atoms when oxidized by acidic dichromate solution gives (Y). (Y) when reacted with CH_3MgI followed by hydrolysis gives the (Z). No change in colour takes place when acidic dichromate solution was added to (Z). However, (Z) gives immediate turbidity with HCl (conc.) in presence of $ZnCl_2$(anhydrous). The (X), (Y) and (Z) in the reaction are respectively :**

	X	Y	Z
(A)	Propan-2-ol	Propanone	2-methyl propan-2-ol
(B)	Butan-2-ol	Butan-2-one	2-methyl butan-2-ol
(C)	Pentan-2-ol	Pentan-2-one	2-methyl pentan-2-ol
(D)	2-methyl butan-1-ol	2-methyl butan-1-al	2,3-dimethyl butan-2-ol

Ans. **(B)** Butan-2-ol, Butan-2-one, 2-Methylbutan-2-ol

91) **Common name of Propane 2 – ol is ..... . #**

(A) Propanol (B) Butanol

(C) Isopropyl alcohol (D) None of these

Ans. **(C)** Isopropyl alcohol

92) **The boiling point of alcohol is higher than that of isomeric alkane and alkyl halide, because....**

(A) They are in liquid state

(B) Intermolecular attractions are more

(C) They have H-bond

(D) Not given

Ans. **(C)** They have H-bond

93) **The boiling point of alcohol, gradually decrease as moving from 1^o (Primary) to 3^o (Tertiary) alcohol because –**

(A) Intermolecular distance decreases

(B) Formation of H-bond

(C) Intermolecular distance increases

(D) All of these

Ans. **(C)** Intermolecular distance decreases

94) **Which of the following alcohol is more acidic than water ?**

(A) Methanol (B) Ethanol

(C) Propanol (D) All of these

Ans. **(A)** Methanol

95) **Which group will increase the electron density of Alcohol ?**

(A) $-CH_3$ (B) $-C_2H_5$

(C) $-CH_2CH_2CH_3$ (D) All of these

Ans. **(D)** All of these

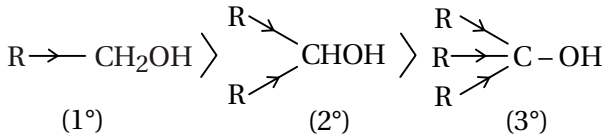
➠ In alochol, the alkyl group like, $-CH_3$, $-C_2H_5$ are electron rich group and hence it increase electron density of –OH-bond.

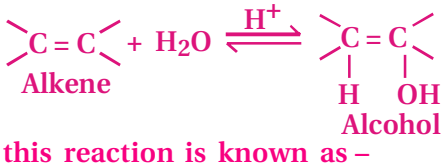
96) **Which is the correct order of acidity of alcohol ?**

(A) $1^o > 2^o > 3^o$ (B) $3^o > 2^o > 1^o$

(C) $1^o < 2^o < 3^o$ (D) $2^o > 1^o > 3^o$

Ans. **(A)** $1^o > 2^o > 3^o$

➠ 

97) 

this reaction is known as –

(A) Acid catalysed hydration

(B) Acid catalysed hydrolysis of alkenes

(C) (A) and (B) both

(D) hydration of alkene

Ans. **(A)** Acid catalysed hydration

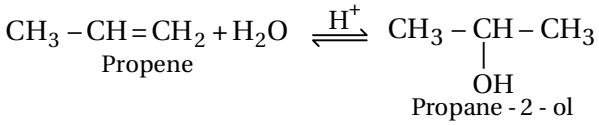
98) **$CH_3CH = CH_2 + H_2O \xrightleftharpoons{H^+}$ X ; indentify X.**

(A) Propane (B) Propane 2-ol

(C) Propanol (D) None of these

Ans. **(B)** Propane 2-ol

➠ Unsymmetric alkene undergo addition reaction according to Markonikov's rule.



99) **Indirect addition of water molecule to alkene, during the preparation of alcohol in laboratory is takes place in presence of which reagent ?**

(A) BH_3 (B) $(BH_3)_2$

(C) H_2O_2 (D) All of these

Ans. **(B)** $(BH_3)_2$

100) **The addition product is obtained by reaction between alkene and diborane. This reaction is called....**

(A) Acid catalysed hydration

(B) Reduction of alkene

(C) Oxidation of alkene

(D) Hydroboration reaction

Ans. **(D)** Hydroboration reaction

101) **$3(CH_3(CH = CH_2) \xrightarrow[\text{Hydroboration}]{(BH_3)_2}$ X,**

identify X.

(A) $(CH_3CH_2CH_2)_3 \cdot B$ (B) $(CH_3CH_2CH_2)_2B$

(C) $CH_3CH_2CH_2B$ (D) $CH_3–CH(OH)CH_3 \cdot B$

Ans. **(A)** $(CH_3CH_2CH_2)_3B$

➠ $3(CH_3CH = CH_2) \xrightarrow[\text{Hydroboration}]{(BH_3)_2} (CH_3CH_2CH_2)\ B$

102) Which oxidizing reagent used to oxidise trialkyl borane in presence of aq. sodium hydroxide ? #

(A) $LiAlH_4$ (B) $(BH_3)_2$

(C) H_2O_2 (D) All of these

Ans. **(C)** H_2O_2

103) $CH_3CH_2CH_2CH_2CH = CH_2 \xrightarrow[[H_2O]]{H_3O^+}$ **Alcohol; indentify alcohol.**

(A) Hexan-2-ol (B) Hexan-1-ol

(C) Hexan-3-ol (D) Hexan-4-ol

Ans. **(A)** Hexan-2-ol

➠ $CH_3CH_2CH_2CH_2CH = CH_2 \xrightarrow[[H_2O]]{H_3O^+}$

$CH_3CH_2CH_2CH_2\underset{\underset{OH}{|}}{CH}\ CH_3$

Haxane 2 - ol

104) Which reagent reduce aldehyde and ketone to Alcohol ?

(A) Sodium borohydride ($NaBH_4$)

(B) Lithium Aluminium hydride

(C) (A) and (B) both

(D) Hydrogen peroxide

Ans. **(C)** (A) and (B) both

105) Which type of alcohol is obtained on reduction of aldehyde ?

(A) 1^o (B) 2^o

(C) 3^o (D) All of these

Ans. **(A)** 1^o

106) Which type of alcohol is obtained on reduction of ketone ? [Oct.-2012]

(A) 1^o (B) 2^o

(C) 3^o (D) All of these

Ans. **(B)** 2^o

➠ Reduction of aldehyde result in to 1^o alcohol and reduction of ketone results in to 2^o alcohol.

107) $4CH_3CH_2CH_2CHO \xrightarrow[H_2O]{NaBH_4}$ **X, what is X ?**

(A) $4CH_3\,CH_2\,\underset{\underset{OH}{|}}{CH_2}\,CH$

(B) $4CH_3CH_2CH_2CH_2OH$

(C) $4CH_3\,CH_2CH_2\,\underset{\underset{O}{||}}{C}\,CH_3$

(D) $4CH_3 - CH_2 - CH_2 - CH_3$

Ans. **(B)** $4CH_3CH_2CH_2CH_2OH$

108) $4CH_3\,CH_2\,\underset{\underset{O}{||}}{C}\,CH_3 \xrightarrow[H_2O]{NaBH_4}$ **X, what is X ?**

(A) $4CH_3\,CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$

(B) $4CH_3CH_2CH_2OH$ (C) $4CH_3 - \underset{\underset{OH}{|}}{CH} - CH_3$

(D) $4CH_3CH_2CH_2OH$

Ans. **(A)** $4CH_3\,CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$

➠ $4CH_3CH_2 - \underset{\underset{O}{||}}{C} - CH_3 \xrightarrow[H_2O]{NaBH_4}$

$4CH_3 - CH_2 - \underset{\underset{OH}{|}}{CH} - CH_3$

(Butan-2-ol)

109) Which reagent is used to reduce acid or ester ?

(A) $NaBH_4$ (B) BH_3

(C) $LiAlH_4$ (D) All of these

Ans. **(C)** $LiAlH_4$

➠ $LiAlH_4$ is strong reducing agent.

110) $CH_3COOH \xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4}$ **X, what is X ?**

(A) CH_3CH_2OH (B) $CH_3\,\underset{\underset{OH}{|}}{CH} - CH_3$

(C) CH_3CHO (D) $CH_3 - \underset{\underset{O}{||}}{C} - CH_3$

Ans. **(A)** CH_3CH_2OH

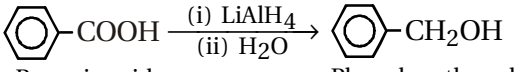
➠ $\underset{\text{acitic acid}}{CH_3COOH} \xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4} \underset{\text{ethanol}}{CH_3CH_2OH}$

111)  **X, what is X ?**

(A) Phenyl methanol (B) Ethyl Benzene

(C) 1 phenyl 1 ethanol (D) Ethyl Benzoate

Ans. **(A)** Phenyl methanol

➠ 

Benzoic acid Phenyl methanol

112) $CH_3COOCH_2CH_3 \xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4} X$, identify X. #

(A) $CH_3CH_2CH_2OH$ (B) $2CH_3CH_2OH$

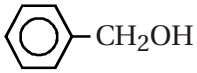
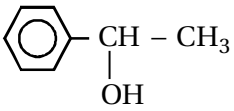
(C) $CH_3 - CHO$ (D) $CH_3–CH(OH)CH_3$

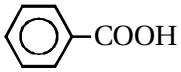
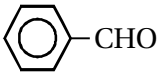
Ans. **(B)** $2CH_3CH_2OH$

➠ $\underset{\text{Ethyl ethanoate}}{CH_3COOCH_2CH_3} \xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4} \underset{\text{Ethanol}}{2CH_3CH_2OH}$

113)  $\xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4} X$

$+ CH_3CH_2OH$, identify X.

(A)  (B) 

(C)  (D) 

Ans. **(A)**

➠ 
Ethyl benzoate

$\xrightarrow[(ii)\ H_2O]{(i)\ LiAlH_4}$  $+ CH_3CH_2OH$

Phenyl methanol Ethanol

114) Addition of Grignard reagent to carbonyl compounds results into which alcohol ?

(A) 1^o (B) 2^o

(C) 3^o (D) All of these

Ans. **(D)** All of these

➠ $>C=O + R\,Mg\,X \longrightarrow \left[R - \underset{|}{\overset{|}{C}} - OMg\,X\right]$

$\xrightarrow{H_2O} R - \underset{|}{\overset{|}{C}} - OH + Mg(OH)X$

115) Which of the following convert into 1^o alcohol on reaction with Grignard reagent ?

(A) Ethanal (B) Methanal

(C) Benzaldehyde (D) None of these

Ans. **(B)** Methanal

116) Which compounds gives tertiary alcohol on treatment with Grignard reagent ?

(A) Ketones (B) Ethens

(C) Phenols (D) All of these

Ans. **(A)** Ketones

117) Industrial production of ethanol is done by which method ?

(A) Grignard reagent

(B) Fermentation method

(C) Oxidation

(D) None of these

Ans. **(B)** Fermentation method

118) Sugar on fermentation with which enzyme convert into Glucose and Fructose ?

(A) Invertase (B) Zymase

(C) Cellulase (D) None of these

Ans. **(A)** Invertase

119) Which enzyme is present in yeast ? [Oct.-2012]

(A) Invertase (B) Zymase

(C) Cellulase (D) All of these

Ans. **(B)** Zymase

120) Pick up the azeotropic mixture from the following.

(A) 90% ethanol + 10% water

(B) 5% ethanol + 95% water

(C) 95% ethanol + 5% water

(D) 85% ethanol + 5% water

Ans. **(C)** 95% ethanol + 5% water

121) Which method is used to get pure ethanol ?

(A) Membarane Technology

(B) Esterification

(C) Fermentation method

(D) None of these

Ans. **(A)** Membarane Technology

122) Which is the use of ethanol ?

(A) In colour industry as a solvent

(B) In preparation of organic compounds

(C) (A) & (B) both

(D) Remove colour impurities

Ans. **(C)** (A) & (B) both

123) Which metal not react with Alcohol ?

(A) Na (B) Mg (C) K (D) Ni

Ans. **(D)** Ni

124) $2CH_3OH + 2Na \rightarrow X + H_{2(g)}$

What is X ?

(A) Sodium methoxide (B) Sodium ethoxide

(C) Sodium ethanoate (D) sodium methanoate

Ans. **(A)** Sodium methoxide

➠ $\underset{\text{Methanol}}{2CH_2OH} + 2Na \rightarrow \underset{\text{Sodium methoxide}}{2CH_3ONa} + H_{2(g)}$

125) $2CH_3CH_2OH + Mg \rightarrow X + H_{2(g)}$ What is X ? #

(A) Magnesium methoxide

(B) Magnesium ethoxide

(C) Magnesium methanol

(D) Magnesium ethanol

Ans. **(B)** Magnesium ethoxide

➠ $\underset{\text{Ethanol}}{2CH_3CH_2OH} + Mg \rightarrow \underset{\text{Magnesium ethoxide}}{(CH_3CH_2O)_2 Mg} + H_{2(g)}$

126) Reaction of Alcohol with carboxylic acid in presence of acid catalyst is known as ..... reaction.

(A) Fermentation (B) Esterification

(C) Oxidation (D) Hydration

Ans. **(B)** Esterification

➠ $\underset{\text{Alcohol}}{R-OH} + \underset{\text{Acid}}{R'-COOH} \overset{H^+}{\rightleftharpoons} \underset{\text{Ester}}{R'-COOR} + H_2O$

127) $CH_3OH + C_6H_5COOH \overset{H^+}{\rightleftharpoons} X + H_2O$;

What is X ?

(A) Phenyl methanol (B) Benzophenone

(C) Methyl benzoate (D) Phenyl benzoate

Ans. **(C)** Methyl benzoate

➠

$\underset{\text{Methanol}}{CH_3OH} + \underset{\text{Benzoic acid}}{C_6H_5COOH} \overset{H^+}{\rightleftharpoons} \underset{\text{Methyl benzoate}}{C_6H_5COOCH_3} + H_2O$

128) $CH_3CH_2OH + CH_3COOH \overset{H^+}{\rightleftharpoons} X + H_2O$ What is X ?

(A) Ethyl ethanoate (B) Methyl ethanoate

(C) Ethyl propanoate (D) Ethyl methanoate

Ans. **(A)** Ethyl ethanoate

➠

$CH_3CH_2OH + CH_3COOH \overset{H^+}{\rightleftharpoons} CH_3COOCH_2CH_3 + H_2O$

129) Which oxidising agent is used for the oxidation of alcohol ?

(A) H_2CrO_4 (B) $KMnO_4$

(C) PCC (D) All of these

Ans. **(D)** All of these

130) Which of the following compound is most acidic ?

(A) Phenol (B) Ethanol

(C) P-nitrophenol (D) Picric acid

Ans. **(D)** Picric acid

➠ In picric acid there are three electrons on $-NO_2$ group and hence it is more acidic.

131) Which product is obtained when primary alcohol is oxidised with $KMnO_4$ or H_2CrO_4 ?

(A) Aldehyde (B) Ketone

(C) Acid (D) Ester

Ans. **(C)** Acid

132) $R-CH_2OH \xrightarrow[-H_2O]{[O]\ Na_2Cr_2O_7/H_2SO_4} X$; What is X ?

(A) R – COOH (B) R – CHO

(C) R – CO – R (D) R – O – H

Ans. **(A)** R – COOH

➠ $\underset{1^o-\text{Alcohol}}{R-CH_2OH} \xrightarrow[-H_2O]{[O]\ Na_2Cr_2O_7/H_2SO_4} \underset{\text{Aldehyde}}{R-CHO}$

133) $CH_3CH_2CH_2CH_2OH \xrightarrow{[O]\ Na_2Cr_2O_7/H_2SO_4} X$;

What is X ?

(A) $CH_3\ CH_2\ COOH$ (B) CH_3COOH

(C) $CH_3CH_2CH_2COOH$ (D) $CH_3CH_2CH_2CHO$

Ans. **(C)** $CH_3CH_2CH_2COOH$

➠ $\underset{\text{Butan-1-ol}}{CH_3CH_2CH_2CH_2OH} \xrightarrow[Na_2Cr_2O_7/H_2SO_4]{[O]} \underset{\text{Butanoic acid}}{CH_3CH_2CH_2COOH}$

134) Which reagent stops the alcohol at aldehyde stage ?

(A) PCC (B) H_2CrO_4

(C) $KMnO_4$ (D) All of these

Ans. **(A)** PCC

135) $R-CH_2OH \xrightarrow[CH_2Cl_2]{PCC\ [O]} X$, what is X ?

(A) R–COOH (B) R–CHO

(C) R–CO–H (D) R–O–H

Ans. **(B)** R–CHO

➠ $\underset{1^o\text{ - Alcohol}}{R-CH_2OH} \xrightarrow[CH_2Cl_2]{PCC[O]} \underset{\text{Aldehyde}}{R-CHO}$

136) $CH_3CH_2CH_2CH_2OH \xrightarrow[CH_2Cl_2]{PCC[O]} X$. What is X ? #

(A) $CH_3CH_2CH_2CHO$

(B) $CH_3CH_2CH_2COOH$

(C) $CH_3-\underset{\displaystyle CH_3}{\underset{|}{CH}}-COOH$

(D) $CH_3-\underset{\displaystyle O}{\underset{\|}{C}}-CH_2-CH_3$

Ans. **(A)** $CH_3CH_2CH_2CHO$

➠ $\underset{\text{Butan-1-ol}}{CH_3CH_2CH_2CH_2OH} \xrightarrow[CH_2Cl_2]{PCC[O]} \underset{\text{Butanal}}{CH_3CH_2CH_2CHO}$

137) Which of the following compound obtain on oxidation of 2^o alcohol with H_2CrO_4 or $KMnO_4$?

(A) Aldehyde (B) Ketone

(C) Ester (D) None of these

Ans. **(B)** Ketone

➠ $R-\underset{\displaystyle OH}{\underset{|}{CH}}-R' \xrightarrow[Na_2Cr_2O_7/H_2SO_4]{[O]} R-\underset{\displaystyle O}{\underset{\|}{C}}-R'$

Alcohol Ketone

138) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3 \xrightarrow[Na_2Cr_2O_7/H_2SO_4]{[O]} X$; what is X ?

(A) Propanone (B) Propanal

(C) Propanoic acid (D) None of these

Ans. **(A)** Propanone

➠ $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3 \xrightarrow[Na_2Cr_2O_7/H_2SO_4]{[O]} CH_3-\underset{\displaystyle O}{\underset{\|}{C}}-CH_3$

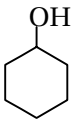
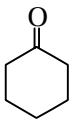
Propan - 2 - ol Propanone

139)  $\xrightarrow[Na_2Or_2O_7/H_2SO_4]{[O]} X$, What is X ?

(A) Cyclohaxane (B) Cyclohaxanone

(C) Cyclohaxene (D) None of these

Ans. **(B)** Cyclohaxanone

➠  $\xrightarrow[Na_2Or_2O_7/H_2SO_4]{[O]}$ 

Cyclo Hexanol Cyclo Hexanone

140) 3° alcohol can not be oxidised even with strong oxidising agent because –

(A) 'C' with –OH group does not having H atom

(B) 'C' with –OH group having H atom

(C) It is a tertiary 'C' atom

(D) Quartarnory H is not attached to 'C'

Ans. **(A)** 'C' with –OH group does not having H atom

➠ $R-\underset{\displaystyle R''}{\underset{|}{\overset{\displaystyle R'}{\overset{|}{C}}}}-OH \xrightarrow[Na_2Cr_2O_7/H_2SO_4]{[O]}$ No oxidation

141) Which test used to detect the types of Alcohol ?

(A) Tollen's test (B) Dow process

(C) Lucas test (D) Cumene process

Ans. **(C)** Lucas test

142) Which of the following is a strong oxidising agent ?

(A) $KMnO_4/H_2SO_4$ (B) $Na_2Cr_2O_7/H_2SO_4$

(C) $KMnO_4/KOH$ (D) All of these

Ans. **(D)** All of these

143) What is observed when tertiary alcohol is subjected to Lucas test ?

(A) Oily droplets on the upper surface

(B) Mixture remain unreacted

(C) Mixture becomes milky white within 5 minutes

(D) None of these

Ans. **(A)** Oily droplets on the upper surface

144) Which catalyst used in Lucas test ?

(A) Anhydrous $ZnCl_2$ (B) Hydrous $ZnCl_2$

(C) Anhydrous $ZnSO_4$ (D) Hydrous $ZnSO_4$

Ans. **(A)** Anhydrous $ZnCl_2$

145) Which alcohol respond slowly in Lucas Test?

(A) Primary (B) Secondary

(C) Tertiary (D) Aryl alcohol

Ans. **(B)** Secondary

146) $R-OH + HCl \xrightarrow[\Delta]{Anhy.\ ZnCl_2} X + H_2O$

What is X ?

(A) R – Cl (B) R – CO – R

(C) R – COOH (D) R – O – R

Ans. **(A)** R–Cl

➠ $R-OH + HCl \xrightarrow[\Delta]{Anhy.\ ZnCl_2} R-Cl + H_2O$

147) What happened when $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$ undergo Lucas Test ? #

(A) Mixture remain unreacted

(B) Mixture becomes milky white within 5 minutes

(C) Oily droplets observed on the surface

(D) Mixture becomes brown coloured

Ans. **(B)** Mixture becomes milky white within 5 minutes

148) What is the product, when 1° and 2° alcohol is react with phosphorus Tribromide (PBr_3) ?

(A) Bromo alcohol (B) Bromo alkane

(C) Bromo butane (D) Bromo ketone

Ans. **(B)** Bromo alkane

➠ $\underset{\text{Alcohol}}{3(R-OH)} + \underset{\text{Phosphorus tribromide}}{PBr_3} \rightarrow \underset{\text{Bromo alkane}}{3(R-Br)} + \underset{\text{Phosphorus acid}}{H_3PO_3}$

149) $3CH_3CH_2\underset{\underset{CH_3}{|}}{CH}CH_2OH \xrightarrow[-H_3PO_3]{PBr_3} 3X + H_3PO_3$

What is X ?

(A) 1 – bromo – 2 – methyl butane

(B) 3 – methyl – 4 – bromo butane

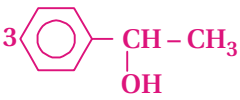
(C) 1 – bromo – 3 – methyl butane

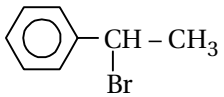
(D) 3 – bromo – 1 – methyl butane

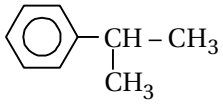
Ans. **(A)** 1 – bromo – 2 – methyl butane

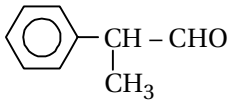
➠ $3CH_3CH_2\underset{\underset{CH_3}{|}}{CH}CH_2OH \xrightarrow[-H_3PO_3]{PBr_3}$

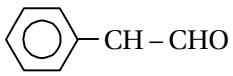
$3CH_3\,CH_2\,\underset{\underset{CH_3}{|}}{CH}\,CH_2\,Br$

150)  **3X; What is X ?**

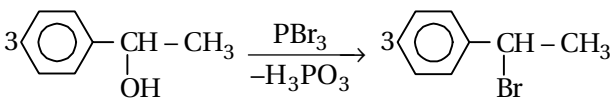
(A) 

(B) 

(C) 

(D) 

Ans. **(A)**

➠ 

151) Formation of alkene by removal of water molecule from alcohol is called ..... of alcohol.

(A) Hydration (B) Dehydration

(C) Oxidation (D) Reduction

Ans. **(B)** Dehydration

152) Which of the following is used for dehydration alcohol ?

(A) 85% Phosphoric acid

(B) 75% Phosphoric acid

(C) 85% Sulphuric acid

(D) None of these

Ans. **(A)** 85% Phosphoric acid

153) The correct order of ease with which the alcohol dehydrates to form an alkene is .....

(A) $3^o > 2^o > 1^o$ (B) $2^o > 3^o > 1^o$

(C) $1^o > 2^o > 3^o$ (D) $3^o < 2^o < 1^o$

Ans. **(A)** $3^o > 2^o > 1^o$

154) Which compound will react rapidaly with anhydrous $ZnCl_2$ and Conc. HCl ?

(A) Propan 1-ol (B) Ethanol

(C) 2-methyl Propan 2-ol (D) None of these

Ans. **(C)** 2-methyl Propan 2-ol

155) Which reagent mixture is used in Lucas test ?

(A) Anhydrous $AlCl_3$

(B) Anhydrous $ZnCl_2$ + Conc. HCl

(C) Anhydrous $ZnCl_2$ + Conc. HNO_3

(D) Anhydrous $ZnCl_2 + H_2SO_4$

Ans. **(B)** Anhydrous $ZnCl_2$ + Conc. HCl

156) Which of the following will reduce alcohol ?

(A) Red P (B) Black P

(C) White P (D) None of these

Ans. **(A)** Red P

157) $CH_3CH_2OH + 2HI \xrightarrow[\Delta]{\text{Red P}} X + I_2 + H_2O$

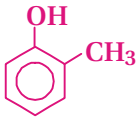
What is X ?

(A) Methane (B) Ethane

(C) Ethene (D) Butane

Ans. **(B)** Ethane

➠ $CH_3CH_2OH + 2HI \xrightarrow[\Delta]{\text{Red P}} CH_3-CH_3 + I_2 + H_2O$

158) State the IUPAC name of  . #

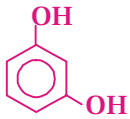
(A) o – cresol (B) 2 – methyl phenol
(C) 3 – methyl phenol (D) m – cresol

Ans. **(B)** 2 – methyl phenol

159) State the IUPAC name of  .

(A) Benzene phenol (B) p – cresol
(C) 4 – methyl phenol (D) o – cresol

Ans. **(C)** 4 – methyl phenol

160) What is the common name of  ?

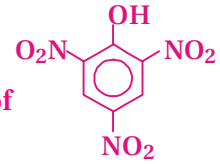
(A) Resorcinol (B) m - cresol
(C) catachol (D) None of these

Ans. **(A)** Resorcinol

161) What is the IUPAC name of  ?

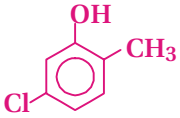
(A) Benzene 1, 4 di-ol (B) Dihydroxy Benzene
(C) p-hydroxybenzene phenol
(D) All of these

Ans. **(A)** Benzene 1, 4 di-ol

162) What is the IUPAC name of  ?

(A) Picric acid
(B) 2, 4, 6 Triamino phenol
(C) 2, 4, 6 Trinitro phenol
(D) 2, 4, 6 Trinitro benzene

Ans. **(C)** 2, 4, 6 Trinitro phenol

163) What is the IUPAC name of  ?

(A) 5 – chloro – 2 – methyl phenol
(B) 3 – methylchloro phenol
(C) 4 – chlorohydroxy Toluene
(D) 3 – chloro 1 hydroxy Toluene

Ans. **(A)** 5 – chloro – 2 – methyl phenol

164) In phenol, the hybrid state of C and O are respectively .....

(A) sp^3, sp^2 (B) sp^2, sp^3
(C) sp, sp^2 (D) sp^2, sp

Ans. **(B)** sp^2, sp^3

165) What is the C – O – H bond angle in phenol ?

(A) 108.5° (B) 109° (C) 108° (D) 111.7°

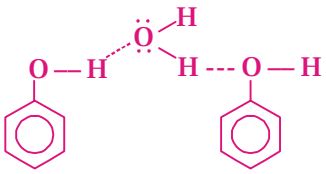
Ans. **(B)** 109°

166) Boiling point and solubility of phenol is more than that of other arenes and haloarene with same molecular weight; because –

(A) Phenol can form intermolecular H - bond
(B) Phenol can form weak Vander valls bond
(C) Phenol is very reactive
(D) All of these are correct

Ans. **(A)** Phenol can form intermolecular H - bond

167) Following structure represents which thing ?



(A) Intermolecular H-bond between phenols
(B) Intermolecular H-bond between phenol and water
(C) Intermolecular H-bond between phenol and alcohol
(D) All of the above.

Ans. **(B)** Intermolecular H-bond between phenol and water

168) Which of the following will neutralise the phenol ?

(A) Na_2CO_3 (B) NaOH
(C) $NaHCO_3$ (D) $NaNH_2$

Ans. **(B)** NaOH

169) Phenol is .....

(A) Acidic (B) Basic
(C) Neutral (D) Amphoteric

Ans. **(A)** Acidic

170) Aquous solution of phenol is more acidic than which of the following ?

(A) Acetic acid (B) Alcohol
(C) (A) & (B) both (D) None of these

Ans. **(B)** Alcohol

171) Which is the use of phenol ? #

(A) Production of dyes

(B) Production of drugs

(C) Production of polymers

(D) All of these

Ans. **(D)** All of these

172) Which is the bi-product in Dow process ?

(A) Phenoxy benzene (B) Methoxy benzene

(C) Ethoxy benzene (D) Chlorobenzene

Ans. **(A)** Phenoxy benzene

173) Which reagent mixture is used in Dow process ?

(A) Chlorobenzene + 6 – 8% NaOH

(B) Chlorobenzene + 6 – 8% HCl

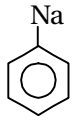
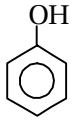
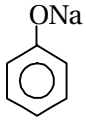
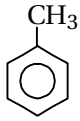
(C) Chlorobenzene + 6 – 8% NH_4OH

(D) Chlorobenzene + 6 – 8% Na_2CO_3

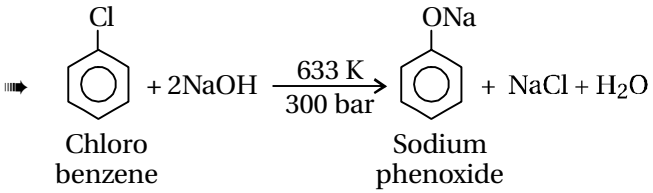
Ans. **(A)** Chlorobenzene + 6 – 8% NaOH

174)  + 2NaOH $\xrightarrow[300\ bar]{633\ K}$ X + NaCl + H_2O ;

what is X ?

(A)  (B)  (C)  (D) 

Ans. **(C)**



Chloro benzene — Sodium phenoxide

175) Which catalyst is used in cumene process ?

(A) H_3PO_4 (B) H_3PO_3 (C) H_3PO_2 (D) H_2CrO_4

Ans. **(A)** H_3PO_4

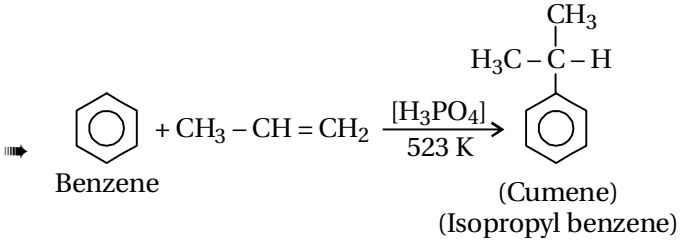
176)  + $CH_3-CH=CH_2$ $\xrightarrow[523\ K]{[H_3PO_4]}$ Z ;

What is Z ?

(A) Cumene (B) Phenol

(C) Ethyl Benzene (D) None of these

Ans. **(A)** Cumene



Benzene — (Cumene) (Isopropyl benzene)

177) Which is the product, when benzene reacts with fuming H_2SO_4 ?

(A) Phenol

(B) Benzene sulphonic acid

(C) Benzene sulphonate

(D) Acetone

Ans. **(B)** Benzene sulphonic acid

178) The reaction between Aniline and Nitrous acid at very low temp (0 °C) gives which product ?

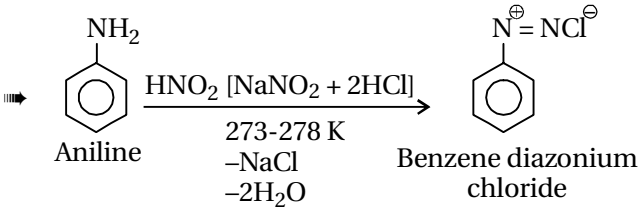
(A) Acetanilide

(B) Benzene diazonium chloride

(C) Sodium phenoxide

(D) Diphenyl ether

Ans. **(B)** Benzene diazonium chloride



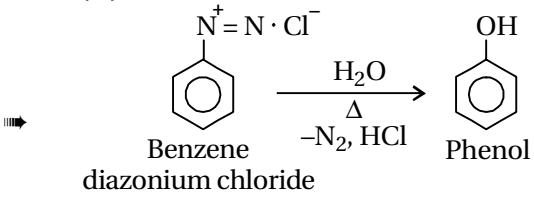
Aniline — Benzene diazonium chloride

179) Which product is formed by reaction between water and benzene diazo cloride salt ?

(A) Diphenyl ether (B) Sodium phenoxide

(C) No reaction (D) Phenol

Ans. **(D)** Phenol



Benzene diazonium chloride — Phenol

180) Which compound not reacts with phenol ?

(A) Na_2CO_3 (B) $NaHCO_3$

(C) (A) and (B) both (D) NaOH

Ans. **(C)** (A) and (B) both

181) Phenol gives which product of reaction with acid anhydried or acid chloride in alkali medium ?

(A) Phenyl ester (B) Phenyl ether

(C) Phenyl acid (D) Phenyl amine

Ans. **(A)** Phenyl ester

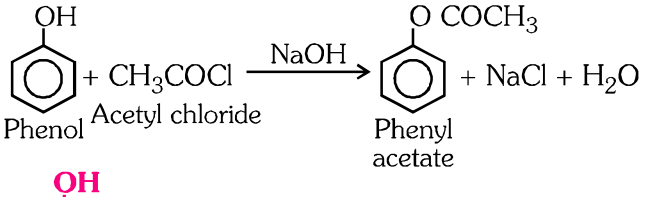
182)  + CHO_3COCl $\xrightarrow{NaOH}$ X + NaCl + H_2O

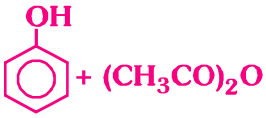
Phenol — Acetyl Chloride

What is X ?

(A) Sodium phenoxide (B) Phenyl benzoate
(C) Phenyl acetate (D) Aniline

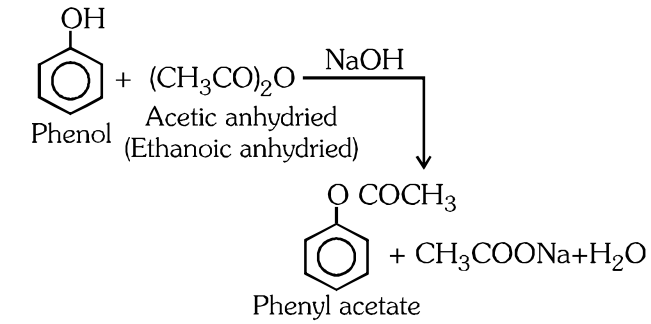
Ans. **(C)** Phenyl acetate



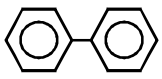
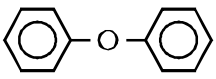
183)  **X. What is X ? #**

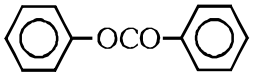
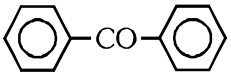
(A) Phenyl acetate (B) Phenyl benzoate
(C) Phenoxy benzene (D) Toluene

Ans. **(A)** Phenyl acetate

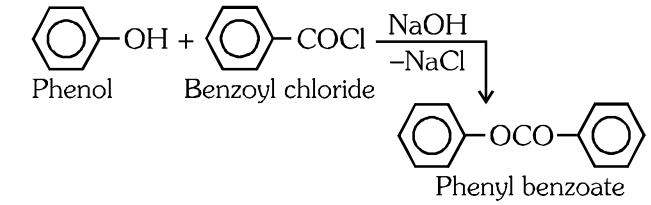


184)  **What is X ?**

(A)  (B) 

(C)  (D) 

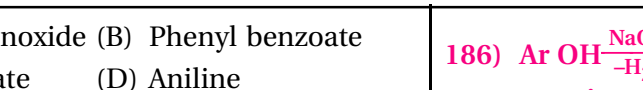
Ans. **(C)**



185) Reaction between solution of phenol in aq.sodium hydroxide and halo alkane will give ether, what is the name of this process of ether preparation ?

(A) Williamson's synthesis
(B) Dow process
(C) Cumene process
(D) None of these

Ans. **(A)** Williamson's synthesis

186)  **This reaction represent which of the following ?**

(A) Lucas test (B) Cumene test
(C) Dow process (D) None of these

Ans. **(D)** None of these

187)  **What is X ?**

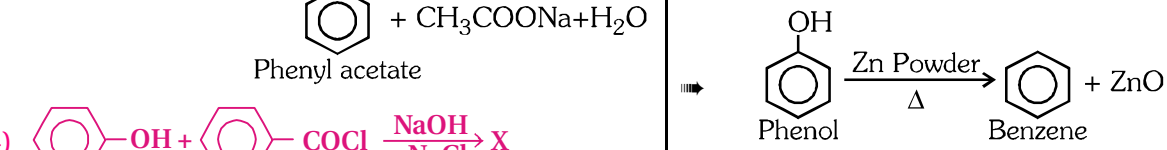
(A) Methoxy benzene (B) Phenoxy benzene
(C) Ethoxy benzene (D) Toluene benzene

Ans. **(A)** Methoxy benzene

188) Phenol on heating with zinc powder give which of the following product ?

(A) Toluene (B) Benzene
(C) Nitrobenzene (D) Anisole

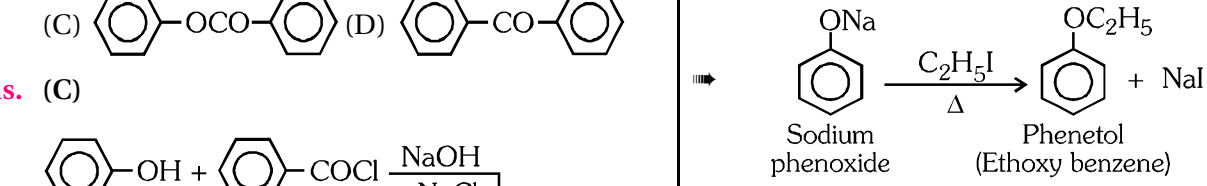
Ans. **(B)** Benzene



189) Which is the product when sodium phenoxide is heated with ethyl Iodied ? [GUJCET-2006]

(A) Ethoxy benzene (B) Methoxy benzene
(C) Iodo benzene (D) None of these

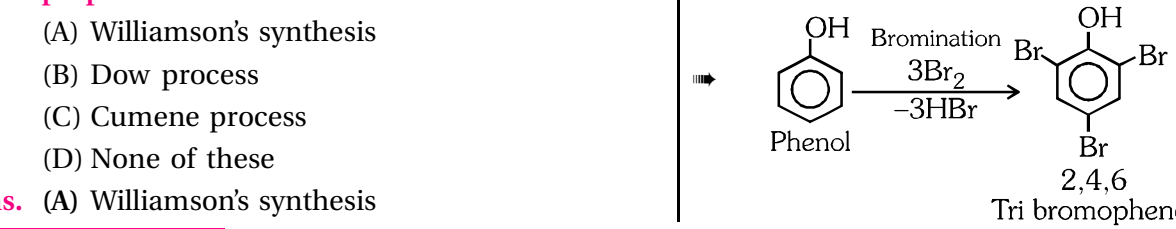
Ans. **(A)** Ethoxy benzene



190) Which product is obtained on addition of Br_2 water to phenol at room temperature ?

(A) Bromobenzene
(B) 2, 4, 6 Tribromo phenol
(C) 2, 4, 6 Tribromo benzene
(D) 4 – bromophenol

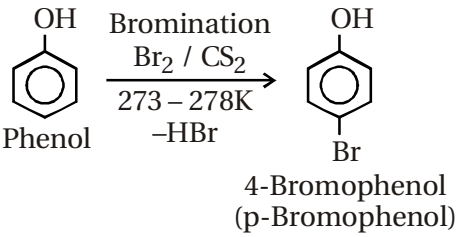
Ans. **(B)** 2, 4, 6 Tribromo phenol



191) Which is the product when phenol is reacts with Br_2, in presence of carbon disulphide at 273 – 278 K temperature ? #

(A) 4 – bromophenol (B) 2 – bromophenol
(C) 3 bromophenol (D) None of these

Ans. **(A)** 4 – bromophenol



192) When phenol reacts with acid chloride/acid anhydried in presence of anhydrous $AlCl_3$, gives phenolic ketone. This process is known as ..... .

(A) Lucas test (B) Fries rearrangement
(C) Williamson's process
(D) Tollen's test

Ans. **(B)** Fries rearrangement

193) Preparation of salysilic acid from phenol is known as ..... process.

(A) Dow (B) Cumene
(C) Kolbe-Schmitt (D) Reimer-Tiemann

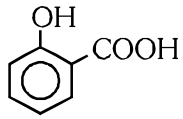
Ans. **(C)** Kolbe-Schmitt

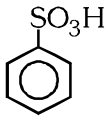
194) Which of the following drug is prepared from salysilic acid ?

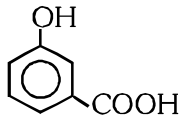
(A) Aspirin (B) Methyl salisylate
(C) (A) and (B) both (D) Paracetamol

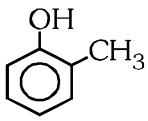
Ans. **(C)** (A) and (B) both

195) Which is the correct structural formula of 2 hydroxy benzoic acid (salysilic acid) ?

(A) 

(B) 

(C) 

(D) 

Ans. **(A)**

196) The addition of aldehyde group to aromic molecules of phenol when it react with sodium hydroxide and chloroform is known as ..... reaction.

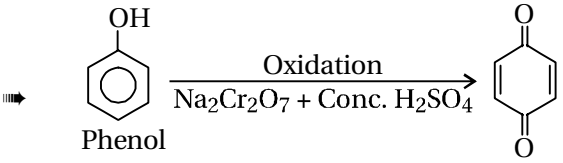
(A) Kolbe-Schmitt (B) Reimer-Tiemann
(C) Williamson's (D) Fries rearrangment

Ans. **(B)** Reimer-Tiemann

197) Which is the product when phenol is oxidised with chromic acid ($Na_2Cr_2O_7$ + Conc. H_2SO_4) ?

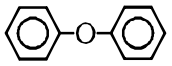
(A) 1, 4 benzoquinon (B) Resorcinol
(C) Benzoyl chloride (D) Hydro qunine

Ans. **(A)** 1, 4 benzoquinon



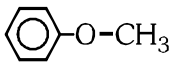
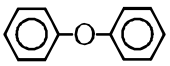
Cyclo hexa-2
5-diene-1,4 di-on
1,4-benzoquinon

198) Which one of the following is a symmetrical ether ?

(A) $CH_3 - O - CH_3$ (B) $C_2H_5O - C_2H_5$
(C)  (D) All of these

Ans. **(D)** All of these

199) Which of the following is an unsymmetrical ether ?

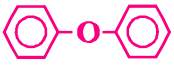
(A) $CH_3 - O - CH_3$
(B) $CH_3CH_2 - O - CH_2CH_3$
(C)  (D) 

Ans. **(C)**

200) What is the IUPAC name of  ?

(A) Methoxy benzene (B) Methyl benzene
(C) Phenoxy methyl (D) Benzene methy ether

Ans. **(A)** Methoxy benzene

201) What is the IUPAC name of  ?

(A) Diphenyl ether (B) Phenoxy benzene
(C) Dibenzene ether (D) Diphenyl ketone

Ans. **(B)** Phenoxy benzene

202) What is the IUPAC name of $CH_2 = CH - O - CH = CH_2$?

(A) Ethenoxy ethene (B) Divinyl ether
(C) 2 – Ethoxy propane (D) Diethyl ether

Ans. **(A)** Ethenoxy ethene

203) What is the IUPAC name of CH_3CH_2–O–  ?

(A) Methoxy benzene (B) Phenetol
(C) Ethyl phenyl ether (D) Ethoxy benzene

Ans. **(D)** Ethoxy benzene

204) What type of hybridisation of 'C' and 'O' in ether ? #

(A) sp (B) sp^2 (C) sp^3 (D) dsp^2

Ans. **(C)** sp^3

205) State the value of C – O – C bond angle in ether.

(A) 108° (B) 109° (C) 111.7° (D) 111°

Ans. **(C)** 111.7°

206) The Boiling point of ether is very low compared to that of same molecular weight of alcohol, because –

(A) Ether having intermolecular Vanderwall's bond.

(B) Ether is a weak polar solvent.

(C) Ether can not form intermolecular hydrogen bond.

(D) All of these

Ans. **(C)** Ether can not form intermolecular hydrogen bond.

207) The solubility of ether in water is similar to that of –

(A) Alcohol having same molecular weight

(B) Phenol having same molecular weight

(C) Ester having same molecular weight

(D) Ketone having same molecular weight

Ans. **(A)** Alcohol having same molecular weight

208) $CH_3CH_2OH \xrightarrow[443K]{\text{Excess conc. } H_2SO_4} X$,

What is X ?

(A) Ethene (B) Ethane

(C) Dimithyl ether (D) Butene

Ans. **(A)** Ethene

➠ $CH_3CH_2OH \xrightarrow[443K]{\text{Excess con. } H_2SO_4} H_2C = CH_2$

209) $2CH_3CH_2OH \xrightarrow[413°K]{\text{Conc. } H_2SO_4} X$, **what is X ?**

(A) Ethene (B) Ethoxy ethane

(C) Dimethyl ether (D) Butane

Ans. **(B)** Ethoxy ethane

➠ $2CH_3CH_2OH \xrightarrow[413°K]{\text{Conc. } H_2SO_4} C_2H_5OC_2H_5$

(Ethoxy ethane)
(Diethyl ether)

210) Ethoxy ethane is obtained by the reaction between 2 mole of ethanol with conc. H_2SO_4 at 413 K temp. This reaction is known as .....

(A) Williamson's synthesis

(B) Continuous etherification

(C) Grignand reaction

(D) None of these

Ans. **(B)** Continuous etherification

211) Who discovered the nucleophilic substitution reaction for synthesis of unsymmetrical ethens ?

(A) Williamson's (B) Grignard

(C) Hofmann (D) Nernst

Ans. **(A)** Williamson's

212) $CH_3CH_2–O–CH_2–CH_3 + H_2O \xrightarrow[\Delta]{\text{dil. } H_2SO_4} X$,

What is X ?

(A) Ethanol (B) Propanol

(C) Butanol (D) Ethyl acetate

Ans. **(A)** Ethanol

➠

$$\underset{\text{Ethoxy ethane}}{CH_3CH_2 - O - CH_2CH_3} + H_2O \xrightarrow[\text{Pressure}]{\text{Hydrolysis, dil. } H_2SO_4,\ \Delta} \underset{\text{Ethanol}}{2CH_3CH_2OH}$$

213) $C_2H_5 – O – C_2H_5 + 2HBr \xrightarrow[-H_2O]{\Delta} X$;

What is X ?

(A) Bromo butane (B) Bromo ethane

(C) Bromo ethene (D) Ethanol

Ans. **(B)** Bromo ethane

➠ $C_2H_5 – O – C_2H_5 + 2HBr \xrightarrow[-H_2O]{\Delta} 2C_2H_5Br$

214) What is the general formula of Quinol ?

(A) $C_6H_6O_2$ (B) $C_6H_8O_2$

(C) $C_6H_5O_2$ (D) $C_7H_8O_2$

Ans. **(A)** $C_6H_6O_2$

215) Which by product obtained in Dow process ?

(A) Phenol

(B) Phenoxybenzene

(C) Chlorobenzene

(D) Phenyl chloride

Ans. **(B)** Phenoxybenzene

216) Which is the product when phenol reacts with Br_2 in presence of CS_2 at 278 K temp. ? #

(A) Bromophenol [Oct.-2015]

(B) 2, 4, 6 Tribromophenol

(C) 1, 4 – dibromophenol

(D) p – bromophenol

Ans. (D) p – bromophenol

217) Simple and mix ethers can be prepared by which process ?

(A) Wurtz reaction

(B) Etherification reaction

(C) Grignard reaction

(D) Williamson's reaction

Ans. (D) Williamson's reaction

218) Which product is obtained when Anisole undergo Friedel Craft alkylation reaction ?

(A) o – methexy toluene

(B) p – methoxy toluene

(C) m – methoxy toluene

(D) (A) and (B) both

Ans. (D) (A) and (B) both

219) Acidity of phenol is because of ..... .

(A) Resonance structure of phenoxide ion

(B) Resonance structure of phenol

(C) Oxygen is more electro negative than hydrogen

(D) Not given

Ans. (A) Resonance structure of phenoxide ion

220) How much ethanol is present in Azeotropic mixture ? [Guj. March-2006]

(A) 5% (B) 95% (C) 15% (D) 100%

Ans. (B) 95%

221) What is the IUPAC name of $HC \equiv C - CH_2 - O - CH_3$?

(A) 3-methoxy prop-1-yne

(B) methyl propanyl ether

(C) ethenoxy ethyne

(D) propyl methyl ether

Ans. (A) 3-methoxy prop-1-yne

UID : P2-C11-S5-Q216

222) Anisole is of which type ether ?

(A) Symmetrical (B) Asymmetrical

(C) Mix (D) (B) and (C) both

Ans. (D) (B) and (C) both

223) What is the product when vapour of ethyl alcohol is passed over Al_2O_3 at 623K temperature ?

(A) Ethane 1, 2 diol (B) Ethene

(C) Ethanoic acid (D) Ethyl methyl ether

Ans. (B) Ethene

224) Reaction of anisole with conc. HNO_3 and conc. H_2SO_4 will give...

(A) phenol

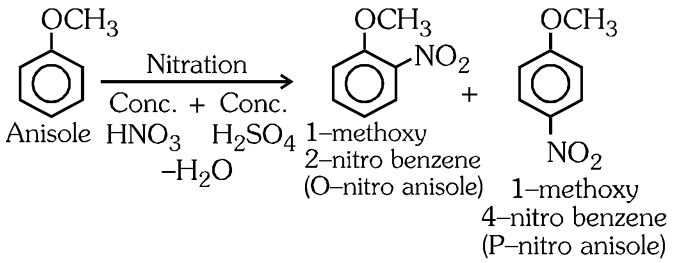
(B) ortho nitro anisole

(C) nitro benzene

(D) o, p-nitro anisole

Ans. (D) o, p-nitro anisole

➠



225) Chemically salol is known as–

(A) Acetyl salicylic acid

(B) Sodium salicylate

(C) Methyl salicylate

(D) Phenyl salicylate

Ans. (D) Phenyl salicylate

226) By the reaction between 3 mole ethanol and 1 mole PBr_3, the product obtained are 3 mole bromo ethane and 1 mole X; What is X ?

(A) H_3PO_4 (B) H_3PO_2

(C) H_3PO_3 (D) HPO_3

Ans. (C) H_3PO_3

➠ $3CH_3 \cdot CH_2 \cdot OH \xrightarrow{PBr_3} 3CH_3CH_2 \cdot Br + H_3PO_3$

Ethanol Bromo ethane

Section-6 MCQs aksed in Various Exams S6

MCQs asked in Competitive Exam

1) Which product obtained when diethyl ether is heated with Conc. HI ? # (IIT - 1983)

(A) Ethanol (B) Methyl iodied
(C) Iodine (D) Ethyl iodide

Ans. **(D)** Ethyl iodide

2) The following reaction is known as –

$C_6H_5OH \xrightarrow[\text{Pyridine}]{CH_3COCl} C_6H_5OCOCH_3$ **? (BHU-1984)**

(A) Remer-Tiemann reaction
(B) Kolbe-Schmitt reaction
(C) Acetylation (D) Benzoylation

Ans. **(C)** Acetylation

3) Glycerol is... (PMT - 1984)

(A) Primary alcohol (B) Secondary alcohol
(C) Monohydric acid (D) Trihydric alcohol

Ans. **(D)** Trihydric alcohol

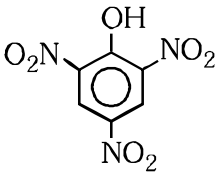
➠ Glycerol (1, 2, 3 Propane tri-ol)

$CH_2(OH)-CH(OH)-CH_2(OH)$

4) Picric acid is... (Kerala PMT - 2001)

(A) Trinitro toluene (B) Trinitro aniline
(C) Trinitro phenol (D) None of these

Ans. **(C)** Trinitro phenol

➠ 

Trinitro phenol (Picric acid)

5) Lucas reagent is a... (PMT - 1988)

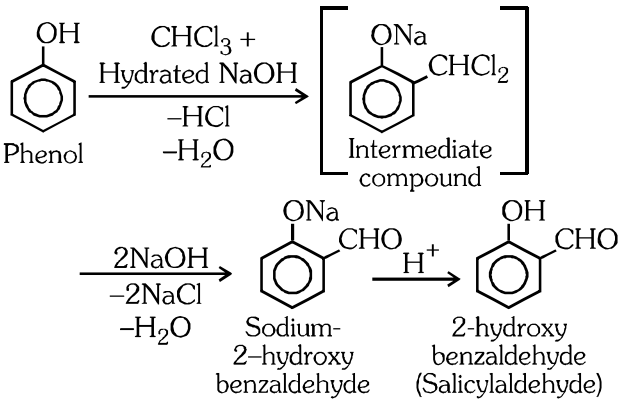
(A) Concentrated HCl + Anhydrous $ZnCl_2$
(B) Concentrated HNO_3 + Anhydrous $ZnCl_2$
(C) Concentrated HCl + Hydrated $ZnCl_2$
(D) Concentrated HNO_3 + Hydrated $ZnCl_2$

Ans. **(A)** Concentrated HCl + Anhydrous $ZnCl_2$

6) The reaction by which the salicylaldehyde is prepared when phenol is heated with $CHCl_3$ and alcoholic KOH is known as ..... . (CBSC PMT - 1988, 1989, MPPMT - 2001)

(A) Friedel Craft reaction
(B) Reimer-Tiemann reaction
(C) Grignard reaction
(D) None of these

Ans. **(B)** Reimer-Tiemann reaction

➠ 

7) Which of the following compound has strong intermolecular Hydrogen bond ? (AIIMS-1991)

(A) Methyl hydroxy benzene
(B) Phenol (C) Benzaldehyde
(D) p-hydroxy benzaldehyde

Ans. **(B)** Phenol

8) Phenol is.... (MLNR - 1992)

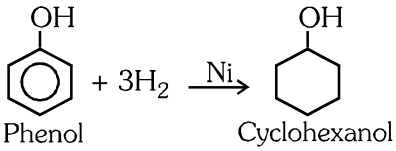
(A) strong base than ammonia
(B) weak acid than carbonic acid
(C) strong acid than carbonic acid
(D) neutral compound

Ans. **(B)** weak acid than carbonic acid

9) Phenol on reduction with H_2 in presence of Ni catalyst will give.... (PMT - 1992)

(A) benzene (B) toluene
(C) cyclohexanol (D) cyclohaxane

Ans. **(C)** cyclohexanol

➠ 

10) Which alcohol is obtained from water gas ? (PMT - 1997)

(A) Butanol (B) Methanol
(C) Ethanol (D) None of these

Ans. **(B)** Methanol

11) On long exposure to air ethanol becomes sour in taste, because of – # (CET - 1998)

(A) Bacteria

(B) Formation of formic acid

(C) Formation of acetic acid due to oxidation

(D) None of these

Ans. **(C)** Formation of acetic acid due to oxidation

12) Which alcohol does not give stable compound on dehydration ? (MPT - 1998)

(A) Methyl alcohol (B) Ethyl alcohol

(C) Propyl alcohol (D) n-Butyl alcohol

Ans. **(A)** Methyl alcohol

13) Which of the following compound react most readily with Lucas test ? (PMT - 1989, MPPET - 1998, Tamilnadu CET - 2001)

(A) Butane – 1 – ol

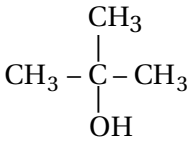
(B) 2 – Methyl propane – 1 – ol

(C) 2 – Butane – 2 – ol

(D) 2 – Methyl propane – 2 – ol

Ans. **(D)** 2 – Methyl propane – 2 – ol

➠ Lucas test responds speedy with 3° alcohol, slow with 2° alcohol and no reaction with 1° alcohol.

e.g. 

14) Which of the following compound possess strongest hydrogen bond ? (CPMT - 1999)

(A) Ethyl ammine (B) Ethyl alcohol

(C) Diethyl ether (D) Ammonia

Ans. **(B)** Ethyl alcohol

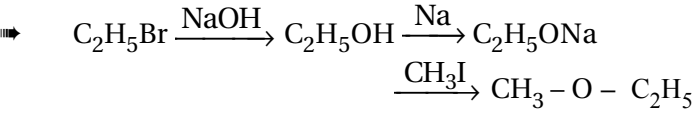
➠ CH_3CH_2OH–Ethyl alcohol–OH In ethanol, the formation of H-bond is possible.

15) What is C in the following reaction ? (UP CET - 1999)

(A) Ethyl iodide (B) Ethane

(C) Propane (D) Methyl ethyl ether

Ans. **(D)** Methyl ethyl ether

➠ 

16) The acidic organic compound, which does not have carboxylic function group is .... (KCET - 2001)

(A) Ascorbic acid (B) Vinegar

(C) Oxalic acid (D) Picric acid

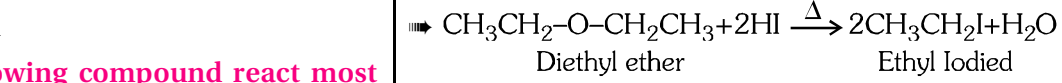
Ans. **(D)** Picric acid

17) By which reagent the diethyl ether is dissociate at high temperature ? (CPMT - 1980, 1989)

(A) Water (B) HI

(C) $KMnO_4$ (D) HCl

Ans. **(B)** HI

➠ 

18) Diethyl ether will not reacts with which of the following one ? (CPMT - 1990)

(A) H_2SO_4 (B) HCl

(C) HI (D) CH_3COOH

Ans. **(D)** CH_3COOH

19) Which of the following have strong inter molecular H-bond ? (AIIMS - 1991)

(A) Methyl hydroxy benzaldehyde

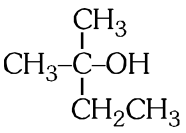
(B) Phenol

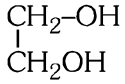
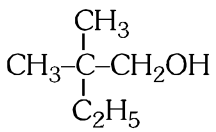
(C) Benzaldehyde

(D) P-hydroxy benzaldehyde

Ans. **(B)** Phenol

20) Which of the following is a 3° alcohol ? (MP PMT - 1991)

(A) CH_3CH_2OH (B) 

(C)  (D) 

Ans. **(B)**

21) Which of the following is not obtained when ethanol is reacts with H_2SO_4 ? (MP PET - 1996)

(A) Ethene (B) Diethyl ether

(C) Acetylene (D) None of these

Ans. **(C)** Acetylene

22) Which statement is not correct with referance to alcohol ? # (Punjab P.M.T - 1997)

(A) Ethanol is heavier than the water

(B) Ethyl alcohol is a volatile liquied

(C) Lower molecular weight alcohols are water soluble.

(D) Alcohol produces H_2 gas with Na. metal.

Ans. **(A)** Ethanol is heavier than the water

23) The higher B.P of Glycerol than that of Propanol is because of – (C.P.M.T - 1997)

(A) hybridization (B) resonance

(C) H-bond (D) All of these

Ans. **(C)** H-bond

➠ $\underset{\text{Ethanol}}{CH_3CH_2OH}$ $\quad$ $\underset{\text{Propane 1,2, 3 tri-ol}}{CH_2(OH)-CH(OH)-CH_2(OH)}$

Having more –OH group.

24) At room temperature which of the following will respond Lucas test ? (MP P.E.T. - 1998, TN CET - 2001)

(A) Butanol (B) Propanol

(C) 2-methyl propane-2-ol

(D) None of these

Ans. **(C)** 2-methyl propane-2-ol

25) Which of the following having a highest boiling point ? (C.P.M.T. - 1997)

(A) Ethane (B) Butane

(C) Pentane (D) Butane-2-ol

Ans. **(D)** Butane-2-ol

➠ In alcohol, there is a formation of H-bond, while in alkane H-bond is not possible.

26) Which of the following is used to cure cold and cough ? (M.P. P.M.T - 1998)

(A) Methyl salicylate (B) Ethyl salicylate

(C) Phenyl salicylate (D) Phenyl benzoate

Ans. **(A)** Methyl salicylate

27) Sweet fruity smell is obtained by the reaction of ethanol with ..... (BHU - 2000)

(A) PCl_3 (B) $CH_3–O–CH_3$

(C) CH_3COOH (D) $SOCl_2$

Ans. **(C)** CH_3COOH

➠ $C_2H_5OH + CH_3COOH \rightarrow CH_3COOC_2H_5 + H_2O$

Esther is a compound having fruity smell.

28) Which gas is obtained on reaction of phenol with Na-metal ? (BHU - 2000)

(A) Methane (B) CO

(C) Hydrogen (D) CO_2

Ans. **(C)** Hydrogen

➠ $\underset{\text{Phenol}}{C_6H_5OH} + Na \rightarrow C_6H_5 - O - Na + \frac{1}{2}H_{2(g)}$

29) The compound with molecular formula $C_4H_{10}O$ does not reacts with sodium metal but with excess HI it gives one alkyl halide compound. Which is the compound ? (I.I.T Screening - 2001)

(A) Methoxy methane (B) Methoxy propane

(C) Ethoxy ethane (D) 2–Butanol

Ans. **(C)** Ethoxy ethane

➠ $C_2H_5 - OC_2H_5 + 2HI \rightarrow 2C_2H_5I + H_2O$

$\underset{\text{(Ethoxy ethane)}}{\text{Diethyl ether}}$

30) On exposure to air, ether forms an explosive compound ..... (Raj. P.M.T - 2002)

(A) Peroxide (B) T.N.T.

(C) Superoxide (D) Trioxide

Ans. **(A)** Peroxide

31) Which of the following ether is in liquid state at room temperature ? (PUNA - 2002)

(A) $CH_3–O–CH_3$ (B) $C_2H_5–O–C_2H_5$

(C) $CH_3–O–C_2H_5$ (D) None of these

Ans. **(A)** $CH_3–O–CH_3$

➠ At room temp. diethyl ether is in gaseous state and hence during contineous etherification it is contineously passed through condensor and obtained into liquid state.

32) Propane-1-ol and Propane-2-ol are distinguish by which method ? (C.B.S.E.PMT - 2002)

(A) Ozonolysis (B) Reduction

(C) Dehydration (D) Oxidation

Ans. **(D)** Oxidation

33) Which chemicals are useful to prepare Aspirin drugs ? (Raj. PMT - 2010)

(A) Salicylic acid (B) Phenol

(C) Acetyl chloride (D) (A) and (B) both

Ans. **(A)** Salicylic acid

34) **Which of the following will give ethanol and carbon dioxide by the reaction with Zymase enzyme ? # (K. CET - 2002)**

(A) Glucose (B) Invert sugar

(C) Fructose (D) All of these

Ans. **(D)** All of these

35) **In the following reaction equation, what is A and C ? (A.I.P.M.T - 2011)**

(i) $CH_3-\underset{\underset{OH}{|}}{CH}-\underset{\underset{CH_3}{|}}{CH}-CH_3 \xrightarrow{H^+/heat} \underset{\text{Main product}}{A} + \underset{\text{By product}}{B}$

(ii) $A \xrightarrow{HBr,\ dark} \underset{\text{Main Product}}{C} + \underset{\text{by Product}}{D}$

(A) $CH_2=\underset{\underset{CH_3}{|}}{C}-CH_2-CH_3$ and $CH_2(Br)-CH(CH_3)-CH_2-CH_3$

(B) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$ and $CH_3-\underset{\underset{Br}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-CH_3$

(C) $CH_3-\underset{\underset{CH_3}{|}}{C}=CH-CH_3$ and $CH_3-CH(CH_3)-\underset{\underset{Br}{|}}{CH}-CH_3$

(D) $CH_2=\underset{\underset{CH_3}{|}}{C}-CH_2-CH_3$ and $CH_3-\underset{\underset{Br}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_2-CH_3$

Ans. **(B)**

36) **Which reagent is used to distinguish phenol and benzoic acid ? (AIEEE - 2011)**

(A) Neutral $FeCl_3$ (B) Aq. NaOH

(C) Tollen's reagent (D) Schiff's reagent

Ans. **(A)** Neutral $FeCl_3$

37) **Pick up the correct order of acidity of the following.**

(I) Phenol (II) P – Cresol

(III) m – Nitrophenol (IV) P – Nitrophenol

(AIEEE - 2011)

(A) IV > III > I > II (B) II > IV > I > III

(C) I > II > IV > III (D) III > II > I > IV

Ans. **(A)** IV > III > I > II

38) **Which major product is obtained on heating phenol with KBr and $KBrO_3$? (AIEEE - 2011)**

(A) 2 – bromophenol

(B) 3 – bromophenol

(C) 4 – bromophenol

(D) 2, 4, 6 Tribromophenol

Ans. **(D)** 2, 4, 6 Tribromophenol

39) **By reaction with which reagent phenol will convert into salicyldehyde ? (Orissa J.E.E. - 2011)**

(A) $CHCl_3$ + NaOH (B) SiO_2 + NaOH

(C) $CHBr_3$ + $KBrO_3$ (D) KClO + $HClO_4$

Ans. **(A)** $CHCl_3$ + NaOH

40) **Which of the following compound will easliy undergo dehydration ? (Kerala P.M.T. - 2011)**

(A) 2 – methyl propane – 2 – ol

(B) Ethyl alcohol

(C) 3 – methyl – 2 – butanol

(D) 2 – pentenol

Ans. **(A)** 2 – methyl propane – 2 – ol

41) **By which reaction phenol can be converted in to O-hydroxy benzaldehyde ? (Kerala P.M.T. - 2011)**

(A) Kolbe-Schmitt (B) Reimer-Tiemann

(C) Wurtz (D) Cannizaro

Ans. **(B)** Reimer-Tiemann

42) **The compound X having –OH functional group, quickly reacts with Conc. HCl and anhydrous $ZnCl_2$. What is X ? (Kerala P.M.T. - 2011)**

(A) 3 – methyl – 2 – butanol

(B) 3 – nethyl – 1 – butanol

(C) 1 – butanol

(D) 2 – methyl – 2 – butanol

Ans. **(D)** 2 – methyl – 2 – butanol

43) **Pick the correct group of the following having decending order of its acidity. (W.B. J.E.E. - 2011)**

(A) m – nitrophenol > p – nitrophenol > o – nitrophenol

(B) o – nitrophenol > m – nitrophenol > p – nitrophenol

(C) p – nitrophenol > m – nitrophenol > o – nitrophenol

(D) p – nitrophenol > o – nitrophenol > m – nitrophenol

Ans. **(D)** p – nitrophenol > o – nitrophenol > m – nitrophenol

44) **Which of the following compound gives milky white solution with Lucas reagent ? #** (Karnataka C.E.T. - 2011)

(A) Butane – 1 – ol

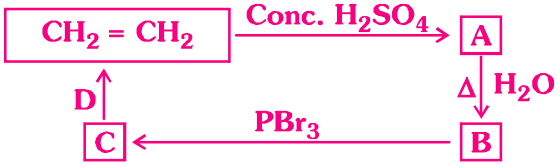
(B) Butane – 2 – ol

(C) 2 – methyl propane – 2 – ol

(D) 3-Methylbutan-2-ol

Ans. **(B)** Butane – 2 – ol

45) **Identify B and D in the following.**



(Karnataka CET - 2011)

(A) Methanol and Bromoethane

(B) Ethanol and Alcoholic KOH

(C) Ethanol and K_2CO_3

(D) Ethyl hydrogen sulphate and KOH

Ans. **(B)** Ethanol and Alcoholic KOH

46) **Phenol on heating with alcoholic KOH and Chloroform represent which reaction ?** (J.K.C.E.T CET - 2011)

(A) Reimer-Tiemann (B) Koble-Schmitt

(C) Gatermann (D) Cannizaro

Ans. **(A)** Reimer-Tiemann

47) **Cumene** $\xrightarrow[(ii)\ H_2O,\ H^+]{(i)\ O_2}$ **(X) and (Y),**

What is X and Y ? (A.M.U - 2011)

(A) Toluene, Propene

(B) Toluene, Propyl chloride

(C) Phenol, Acetone

(D) Phenol, Acetaldehyde

Ans. **(C)** Phenol, Acetone

48) **Which of the Grignard reagent will use to prepare 3-methyl 2-butanol ?** (A.M.U - 2011)

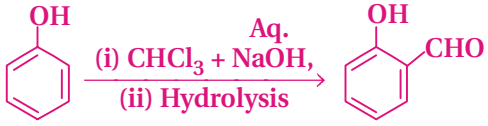
(A) 2 – butanon + Methyl magnesium bromide

(B) Acetone + Ethyl magnesium bromide

(C) Acetaldehyde + Propyl magnesium bromide

(D) Ethyl propionate + Methyl magnesium bromide

Ans. **(C)** Acetaldehyde + Propyl magnesium bromide

49) 

By which mechanism the above reaction will proceed ? (A.M.U - 2011)

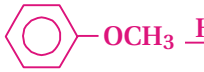
(A) Electrophilic addition

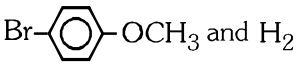
(B) Electrophilic displacement

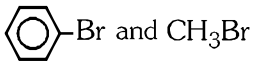
(C) Activated nucleophilic displacement

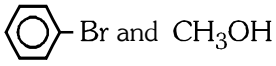
(D) Benzoyl intermediate

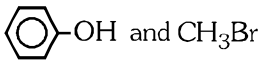
Ans. **(B)** Electrophilic displacement

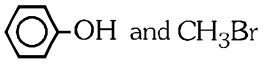
50) **Process :**  **X . What is X ?**

(A)  (I.I.T - 2010)

(B) 

(C) 

(D) 

Ans. **(D)** 

51) **Phenol** $\xrightarrow{X}$ **Tribromo derivaties.**

What is X ? (Karnataka C.E.T - 2010)

(A) Bromine + Benzene

(B) Bromine + Water (Bromine water)

(C) Potassium bromide

(D) Bromine + CCl_4

Ans. **(B)** Bromine + Water (Bromine water)

52) **Phenol on heating with bromine and chloroform will give...** (J.K. C.E.T - 2010)

(A) m–bromophenol

(B) Ortho and Parabromo phenol

(C) P–bromophenol

(D) 2,4,6 Tribromophenol

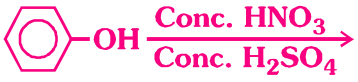
Ans. **(B)** Ortho and Parabromo phenol

53) **Which of the following is an isomer of ethanol ?** (Orissa JEE - 2010)

(A) Acetaldehyde (B) Nitrophenol

(C) Picric acid (D) Dimethyl ether

Ans. **(D)** Dimethyl ether

54)  X, what is X ? #

(Orissa JEE - 2010)

(A) Picric acid (B) Nitrophenol

(C) Dinitro phenol (D) None of these

Ans. **(A)** Picric acid

55) Phenol $\xrightarrow{\text{Zn Powder}}$ X $\xrightarrow[\text{Anhy. } AlCl_3]{CH_3Cl}$ Y $\xrightarrow[KMnO_4]{\text{Alkaline}}$ Z

What is Z ? (C.B.S.E PMT - 2009)

(A) Benzaldehyde (B) Benzene

(C) Toluene (D) Benzoic acid

Ans. **(D)** Benzoic acid

56) Ethanol $\xrightarrow{PBr_3}$ X $\xrightarrow[KOH]{\text{Alcoholic}}$ Y $\xrightarrow[(I)\ H_2O,\ \Delta]{(i)\ H_2SO_4}$ Z

What is Z ? (C.B.S.E PMT - 2009)

(A) $CH_3CH_2OCH_2CH_3$ (B) $CH_3CH_2–O–SO_3H$

(C) CH_3CH_2OH (D) $CH_2=CH_2$

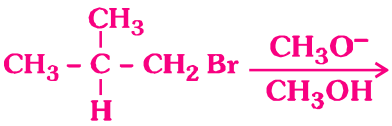
Ans. **(C)** CH_3CH_2OH

57) Methoxy methane and ethanol are of which type isomers ? (Karnataka CET - 2008)

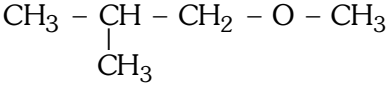
(A) Functional group (B) Optical

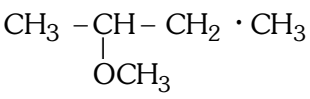
(C) Position (D) Chain

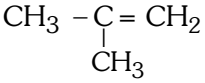
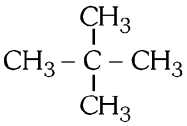
Ans. **(A)** Functional group

58)  X, What is X ?

(AIIM - 2005)

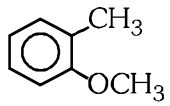
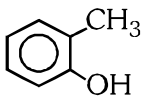
(A) 

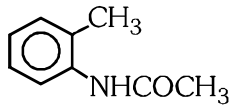
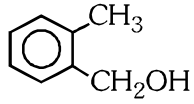
(B) 

(C)  (D) 

Ans. **(C)**

59) Which of the following electrophile is the most reactive species ? (A.I.P.M.T - 2011)

(A)  (B) 

(C)  (D) 

Ans. **(A)**

60) Which is the common general formula of alkanol compounds ? (C.B.S.E. - 2006)

(A) $C_nH_{2n}O$ (B) $C_nH_{2n+1}O$

(C) $C_nH_{2n+2}O$ (D) $C_nH_{2n}O_2$

Ans. **(C)** $C_nH_{2n+2}O$

61) What is the correct acidity order of the following compounds ? (C.B.S.E Med. - 2011)

(I)  (II)  (III) 

(A) I > II > III (B) III > I > II

(C) II > III > I (D) I > III > II

Ans. **(B)** III > I > II

62) By reaction of propene with which of the following, propane 1–ol can be obtained ?

(C.B.S.E Med. - 2002)

(A) H_3BO_3 (B) $B_2H_6/NaOH,\ H_2O_2$

(C) H_2SO_4/H_2O (D) $CH_3–\underset{\underset{O}{\|}}{C}–O–O–H$

Ans. **(B)** $B_2H_6/NaOH,\ H_2O_2$

➠ $\underset{\text{Propene}}{CH_3-CH=CH_2} \xrightarrow[NaOH]{B_2H_6} (CH_3CH_2CH_2)_3B \xrightarrow[H_2O_2]{OH^-} \underset{\text{Propane-1-ol}}{3CH_3CH_2CH_2OH}$

63) By which reagent n.propyl alcohol and iso propyl alcohol can be separated ?

(C.B.S.E Med. - 2002)

(A) PCl_5 (B) Reduction

(C) Oxidation with potassium diformate

(D) Reaction with O_3(ozonolysis)

Ans. **(C)** Oxidation with potassium diformate

64) Both alcohol and ether having same molecular formula ether is more volatile than alcohol, why ? (AIEEE - 2003)

(A) Presence of intermolecular H-bond in alcohol

(B) Ether is polar

(C) Resonating structure of alcohol

(D) Presence of intermolecular H-bond in ether.

Ans. **(A)** Presence of intermolecular H-bond in alcohol

65)  $+ C_2H_5I \xrightarrow{NaOH}$ # (IIT Screening-2003)

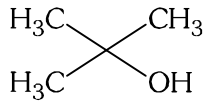
(A) $C_6H_5OC_2H_5$ (B) $C_2H_5OC_2H_5$

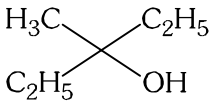
(C) $C_6H_5OC_6H_5$ (D) C_6H_5I

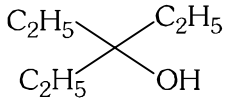
Ans. **(A)** $C_6H_5OC_2H_5$

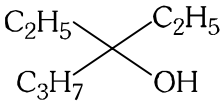
66) Ethyl acetate $\xrightarrow{\text{excess } CH_3MgBr}$ P.

What is P ? (IIT - 2003)

(A) 

(B) 

(C) 

(D) 

Ans. **(A)**

67) Which of the following can be easily undergo dehydration ? (AIEEE - 2004)

(A) $CH_3CH_2 - \underset{\underset{OH}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2CH_3$

(B) $CH_3CH_2CH_2\underset{\underset{OH}{|}}{CH} - CH_3$

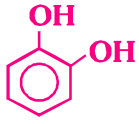
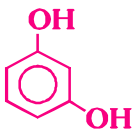
(C) $CH_3CH_2CH_2CH_2OH$

(D) $CH_3CH_2 - \underset{\underset{CH_3}{|}}{CH}CH_2CH_2OH$

Ans. **(A)**

➠ $CH_3CH_2 - \underset{\underset{OH}{|}}{C} - (CH_3)CH_2CH_3$ is giving rise most stable carbocation and hence it is easily dehydrated.

68) Arrange the following compounds in their decreasing order of boiling point.

(I)  (II)  (III)  (IV) 

(A) (IV) > (III) > (II) > (I)

(B) (III) > (IV) > (II) > (I)

(C) (I) > (II) > (III) > (IV)

(D) (III) > (II) > (I) > (IV)

Ans. **(A)** (IV) > (III) > (II) > (I)

69) What is D in the following reaction ?

$CH_3CH_2OH \xrightarrow{P, I_2} A \xrightarrow[ether]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$

(AIEEE - 2007)

(A) n - Butyl alcohol (B) n - Propyl alcohol

(C) Propanol (D) Butanol

Ans. **(B)** n - Propyl alcohol

➠

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow{P, I_2} \underset{(A)}{CH_3CH_2I} \xrightarrow[ether]{Mg} \underset{(B)}{CH_3CH_2MgI} \xrightarrow{HCHO}$$

$$CH_3CH_2CH_2OMgI \xrightarrow{H_2O} Mg(OH)I + \underset{\text{n-Propyl alcohol}}{CH_3CH_2CH_2OH}$$

70) Complete the reaction.

$$CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - O - CH_2 - CH_3 + HI \xrightarrow{\Delta}$$

(C.B.S.E. Med. - 2007)

(A) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2OH + CH_3CH_3$

(B) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_3 + CH_3CH_2OH$

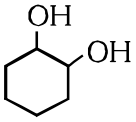
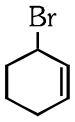
(C) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2OH + CH_3CH_2I$

(D) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - I + CH_3CH_2OH$

Ans. **(C)**

71)  $\xrightarrow[\text{(ii) Alcoholic KOH}]{\text{(i) } PBr_3}$

What is the product ? (Orissa JEE - 2008)

(A)  (B)  (C)  (D) 

Ans. **(A)**

72) Which is the suitable reagent for the following reaction ? (Kerala PMT - 2009)

$R - CH_2CH_2OH \rightarrow R-CH_2CH_2COOH$

(A) PBr_3, KCN, H_3O^+ (B) PBr_3, KCN, H_2 / Pt

(C) KCN, H_3O^+ (D) PBr_3, H_3O^+

Ans. **(A)** PBr_3, KCN, H_3O^+

73) What is Z in the following reaction ? #

$$\text{Ethanol} \xrightarrow{PBr_3} X \xrightarrow{\text{Alcoholic KOH}} Y \xrightarrow[\Delta]{\substack{(i)\ H_2SO_4 \\ (ii)\ H_2O}} Z$$

(CBSE PMT - 2009)

(A) $CH_3CH_2OCH_2CH_3$ (B) $CH_3CH_2O - SO_3H$

(C) CH_3CH_2OH (D) $CH_2 = CH_2$

Ans. **(C)** CH_3CH_2OH

➠

$$\underset{\text{Ethanol}}{CH_3CH_2OH} \xrightarrow{PBr_3} \underset{\text{Ethyl Bromide}}{CH_3CH_2Br} \xrightarrow[-KBr\ -H_2O]{\text{Alcoholic KOH}}$$

$$\underset{\text{Ethene}}{CH_2 = CH_2} \xrightarrow[H_2O]{H_2SO_4} \underset{\text{Ethanol}}{CH_3CH_2OH}$$

74) What is the product when $OH \cdot CH_2 \cdot CH_2 \cdot OH$ is heated with periodic acid ? (CBSE PMT - 2009)

(A) 2 HCOOH (B) $\begin{matrix}CHO\\|\\CHO\end{matrix}$

(C) 2 $\begin{matrix}H\\\diagdown\\C=O\\\diagup\\H\end{matrix}$ (D) 2 CO_2

Ans. **(C)**

➠ $\underset{\substack{|\\CH_2OH}}{\overset{CH_2OH}{|}}$ (Ethanol 1,2 di–ol) $\xrightarrow{HIO_4}$ 2 HCHO (Formoldehyde (methanal))

$\underset{\substack{|\\CH_2-OH}}{\overset{CH_2-OH}{|}} \xrightarrow{(O)} \underset{\substack{|\\CHO}}{\overset{CHO}{|}}$ (Glyoxal) $\xrightarrow{(O)} \underset{\substack{|\\COOH}}{\overset{COOH}{|}}$ (Oxalic acid)

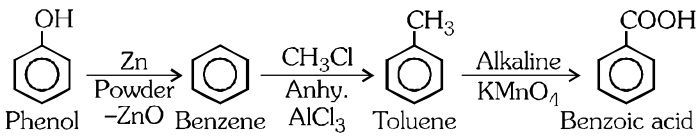
75) Phenol $\xrightarrow[\text{Powder}]{Zn} X \xrightarrow[\text{Anhy. } AlCl_3]{CH_3Cl} Y \xrightarrow[KMnO_4]{\text{Alkaline}} Z$ What is Z ? (CBSE PMT - 2009)

(A) Benzaldehyde (B) Benzoic acid

(C) Benzene (D) Toluene

Ans. **(B)** Benzoic acid

➠



76) How many stereo isomer of 3-chloro butane 2-ol ? (AMV Engg. - 2010)

(A) 2 (B) 6 (C) 8 (D) 4

Ans. **(D)** 4

➠ $CH_3 - \overset{*}{C}H(Cl) - \overset{*}{C}H(OH) - CH_3$ 3 – chloro Butane 2 – ol

No. of stereo isomer of compound = 2^n

where, n = no. of chiral 'C' in the compound here, n = 2

$\therefore$ Total isomer = $2^n = 2^2 = 4$

77) Ortho-nitrophenol is less soluble in water than p and m-nitrophenols because [AIEEE - 2012]

(A) o-nitrophenol shows intramolecular H-bonding.

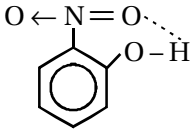
(B) o-nitrophenol shows intermolecular H-bonding.

(C) melting point of o-nitrophenol is lower than those of m- and p-isomers.

(D) o-nitrophenol is more volatile in steam than those of m- and p-isomers.

Ans. **(A)** o-nitrophenol shows intramolecular H-bonding.

➠ o-Nitrophenol is stable due to intramolecular hydrogen bonding.



It is difficult to break the H-bonding when dissolved in water thus less soluble.

78) The major organic product in the reaction, $CH_3–O–CH(CH_3)_2 + HI \longrightarrow$ Product is [CBSE-PMT - 2006]

(A) $ICH_2OCH(CH_3)_2$ (B) $\begin{matrix}CH_3OC(CH_3)_2\\|\\I\end{matrix}$

(C) $CH_3I + (CH_3)_2CHOH$

(D) $CH_3OH + (CH_3)_2CHI$

Ans. **(C)** $CH_3I + (CH_3)_2CHOH$

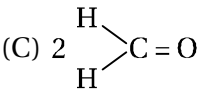
➠ In case of unsymmetrical ethers, the site of cleavage depends on the nature of alkyl group e.g.,

$$CH_3O - CH(CH_3)_2 + HI \xrightarrow{373K} \underset{\text{Methyl iodide}}{CH_3I} + \underset{\text{Isopropyl alcohol}}{(CH_3)_2CHOH}$$

➠ The alkyl halide is always formed from the smaller alkyl group.

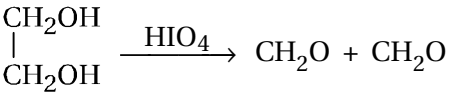
79) $H_2COH \cdot CH_2OH$ on heating with periodic acid gives : # [CBSE-PMT - 2009]

(A) 2HCOOH (B) 

(C)  (D) $2CO_2$

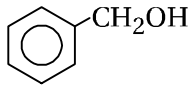
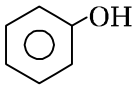
Ans. **(C)**

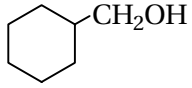
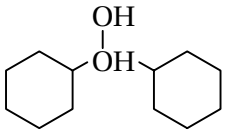
➠ 1, 2 – Diols, when treated with an aqueous solution of periodic acid give aldehyde or ketones



Note that a 1° alcohol gives CH_2O. Since in glycol both the OH groups, are primary hence give 2 molecules of CH_2O as by product.

80) Which one of the following compounds has the most acidic nature ? [CBSE-PMT - 2010]

(A)  (B) 

(C)  (D) 

Ans. **(B)**

➠ Phenol is most acidic because its conjugate base is stabilised due to resonance, while the rest three compounds are alcohol, hence, their corresponding conjugate bases do not exhibit resonance.

81) Among the following four compounds :

(i) phenol (ii) methylphenol

(iii) meta-nitrophenol

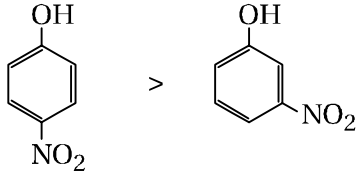
(iv) para-nitrophenol

the acidity order is : [CBSE-PMT - 2010]

(A) ii > i > iii > iv (B) iv > iii > i > ii

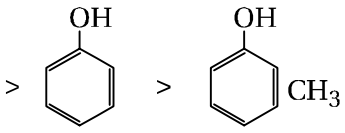
(C) iii > iv > i > ii (D) i > iv > iii > ii

Ans. **(B)** iv > iii > i > ii



➠ (iv) (iii)

(–I and – M effects, both increase acidity) (only – I effect)



(i) (ii) (+I effect of CH_3 group decreases acidity)

82) Lucas test is used for the determination of [AIIMS - 2002]

(A) alcohols (B) alkyl halides

(C) phenols (D) aldehydes

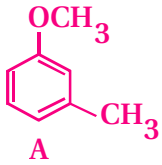
Ans. **(A)** alcohols

➠ Lucas test – Alcohol reacts with concentrated hydrochloric acid in presence of anhydrous $ZnCl_2$ to form alkyl halides. The three type of alcohols undergo this reaction at different rates. Order of rate of reaction is : tertiary > secondary > primary.

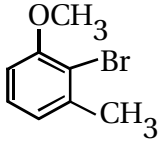
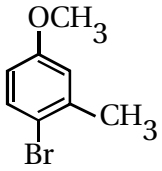
$R - OH + HCl \xrightarrow{anhy \cdot ZnCl_2} R - Cl + H_2O$

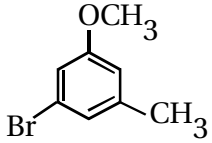
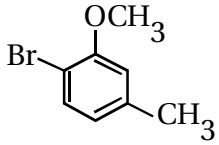
Alkyl chloride

83) The major product obtained on the monobromination (with $Br_2/FeBr_3$) of the following compound A is [AIIMS - 2006]



A

(A)  (B) 

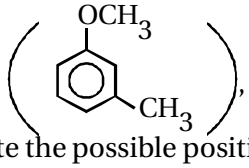
(C)  (D) 

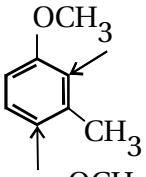
Ans. **(B)**

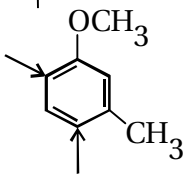
➠ The position taken up by a third group entering the ring depends on the nature of the two groups already present.

➠ When both groups show o- and p-directing nature, the directive power of each group is generally in the following order :

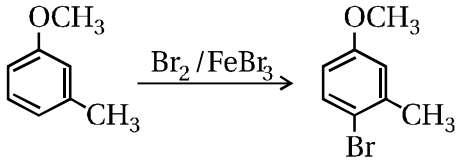
$O^- > NH_2 > NR_2 > OH > OMe, NHAc > Me > X$

➠ In case of compound A  , the arrows are used to indicate the possible positions that may be taken up by an incoming group.


(with respect to $-OCH_3$, group)


(With respect to both $-CH_3$ group and $-OCH_3$, group)

➠ Due to presence of bulky group, steric effect works, and the favourable product will be this.

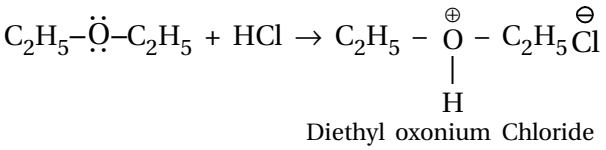


84) A : Ethers behave as bases in the presence of mineral acids.
R : It is due to the presence of lone pair of electrons on the oxygen. #
[AIIMS - 2002, 2008]

(A) a (B) b (C) c (D) d

Ans. (A) a

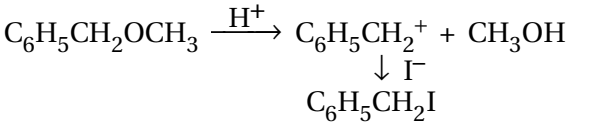
➠ Due to the presence of lone pair of electrons on oxygen atom, ethers behave as base and form stable oxonium salts with mineral acids.


Diethyl oxonium Chloride

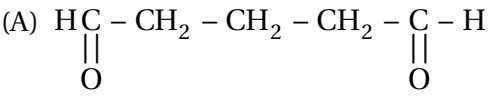
85) A : The major products formed by heating $C_6H_5CH_2OCH_3$ with HI are $C_6H_5CH_2I$ and CH_3OH.
R : Benzyl cation is more stable than methyl cation.
[AIIMS - 2003]

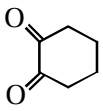
(A) a (B) b (C) c (D) d

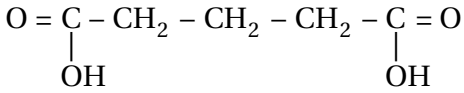
Ans. (A) a

➠ 
This can be explained on the basis of SN^1 mechanism, the carbonium ion produced being benzylium ion, since this type is more stable than alkylium ion.

86) Oxidation product 1, 2-cyclopentanediol with HIO_4 gives
[AIIMS - 2008]

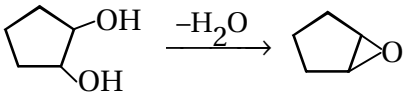
(A) 

(B) 

(C) 

(D) none of these

Ans. (A)

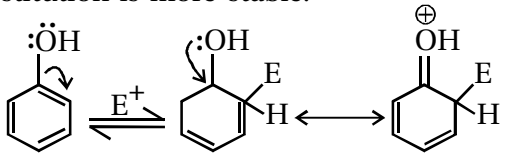
➠ 

87) A : Phenol is more reactive than benzene towards electrophilic substitution reaction.
R : In the case of phenol, the intermediate carbocation is more resonance stabilised.
[AIIMS - 2008]

(A) a (B) b (C) c (D) d

Ans. (C) c

➠ –OH group shows +M effect and is an activating group, moreover the arenium ion of phenolic substitution is more stable.



88) A : Ethers can be dried by using sodium wire.
R : Ethers do not react with sodium.
[AIIMS - 2009]

(A) a (B) b (C) c (D) d

Ans. (A) a

89) Find the product for
$CH_3CH_2 - O - CH_2-CH_2 - O - CH_2 - C_6H_5 + HI$ (excess)
[AIIMS - 2011]

(A) $HO-CH_2CH_2OH$, $C_6H_5CH_2-I$, CH_3CH_2-I
(B) $C_6H_5CH_2 - OH$, CH_3CH_2-I, $I-CH_2CH_2-OH$
(C) $I-CH_2-CH_2-I$, $C_6H_5CH_2-I$, CH_3CH_2-OH
(D) $HO-CH_2CH_2-OH$, $C_6H_5CH_2-I$, CH_3CH_2-OH

Ans. (A) $HO-CH_2CH_2OH$, $C_6H_5CH_2-I$, CH_3CH_2-I

➠ Presence of excess of HI favours SN^1 mechanism.

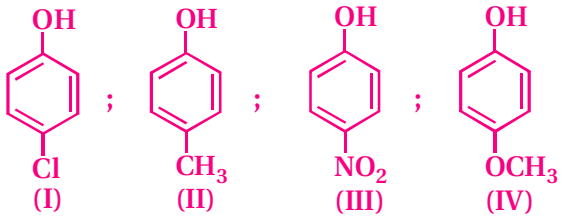
➠ So, formation of products is controlled by the stability of the carbocation resulting in the cleavage of C – O bond in protonated ether.

Thus, the product for given equation are

$C_6H_5CH_2I$, CH_3CH_2I, $HOCH_2 - CH_2OH$

MCQs asked in JEE/NEET/AIEEE

90) Arrange the following compounds in order of decreasing acidity : # [JEE-2013]

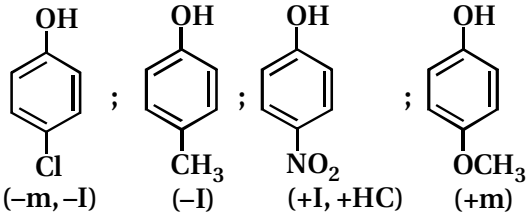


(A) II > IV > I > III (B) I > II > III > IV

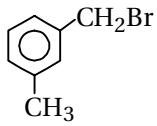
(C) III > I > II > IV (D) IV > III > I > II

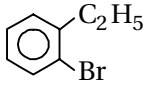
Ans. (C) III > I > II > IV

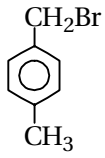
➠

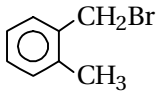


91) Compound (A), C_8H_9Br, gives a white precipitate when warmed with alcoholic $AgNO_3$. Oxidation of (A) gives an acid (B), $C_8H_6O_4$ (B) easily forms anhydride on heating. Identify the compound (A). [JEE-2013]

(A) 

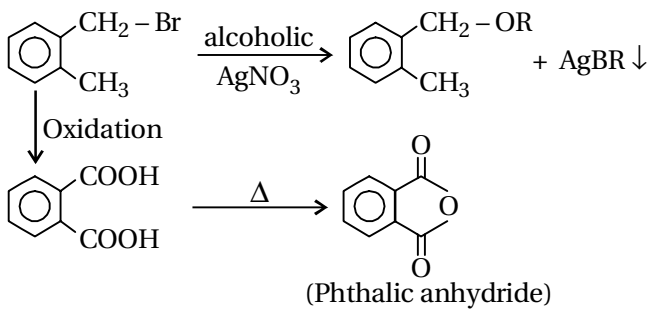
(B) 

(C) 

(D) 

Ans. (D)

➠



(Phthalic anhydride)

92) Among the following ethers, which one will produce methyl alcohol on treatment with hot concentrated HI ? [NEET-2013]

(A) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - CH_2 - O - CH_3$

(B) $CH_3 - CH_2 - CH_2 - CH_2 - O - CH_3$

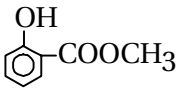
(C) $CH_3 - CH_2 - \underset{\displaystyle CH_3}{\overset{\displaystyle |}{CH}} - O - CH_3$

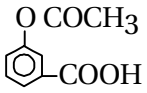
(D) $CH_3 - \underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{\displaystyle |}{\underset{\displaystyle |}{C}}}} - O - CH_3$

Ans. (D)

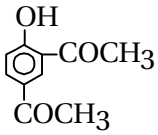
93) Sodium phenoxide when heated with CO_2 under pressure at 125°C yields a product which on acetylation produces C. [JEE-2014]

The major product C would be :

(A) 

(B) 

(C) 

(D) 

Ans. (C)

94) The most suitable reagent for the conversion of R – CH_2 – OH → R – CHO is : [JEE-2014]

(A) CrO_3 (B) PCC(Pyridinium Chlorochromate)

(C) $KMnO_4$ (D) $K_2Cr_2O_7$

Ans. (B) PCC (Pyridinium Chlorochromate)

95) Among the following sets of reaction which one produces anisole ? [NEET-2014]

(A) CH_3CHO, RMgX

(B) C_6H_5OH, NaOH, CH_3I

(C) C_6H_5OH, neutral $FeCl_3$

(D) $C_6H_5CH_3$, CH_3COCl, $AlCl_3$

Ans. (B) C_6H_5OH, NaOH, CH_3I

➠(A) $CH_3 - \underset{\displaystyle O}{\overset{\displaystyle ||}{CH}} = O + RMgX \rightarrow \underset{\text{Alcohol}}{CH_3 - \overset{\displaystyle R}{\overset{\displaystyle |}{CH}} - OH}$

(B) $C_6H_5-OH + NaOH \rightarrow C_6H_5-ONa \xrightarrow[SN^2]{CH_3I} \underset{\text{(Anisole)}}{C_6H_5-OCH_3}$

(C) C_6H_5OH + natural $FeCl_3 \rightarrow$ Violet colour complex

(D) $C_6H_5CH_3 + CH_3COCl + AlCl_3 \rightarrow$ Para-methyl acetophenone

96) Which of the following will not be soluble in sodium hydrogen carbonate ? # [NEET-2014]

(A) 2, 4, 6 – trinitrophenol

(B) Benzoic acid (C) o – Nitrophenol

(D) Benzenesulphonic acid

Ans. **(C)** o – Nitrophenol

➠ Acids stronger than H_2CO_3 give CO_2 gas with sodium hydrogen carbonate and also soluble in it.

97) Identify Z in the sequence of reactions :

$$CH_3CH_2CH=CH_2 \xrightarrow[H_2O_2]{HBr} Y \xrightarrow{C_2H_5ONa} Z$$

[NEET-2014]

(A) $CH_3-(CH_2)_3-O-CH_2CH_3$

(B) $(CH_3)_2CH_2-O-CH_2CH_3$

(C) $CH_3(CH_2)_4-O-CH_3$

(D) $CH_3CH_2-CH(CH_3)-O-CH_2CH_3$

Ans. **(A)** $CH_3-(CH_2)_3-O-CH_2CH_3$

➠ $$CH_3CH_2CH=CH_2 \xrightarrow[H_2O_2]{HBr} CH_3CH_2\underset{H}{\overset{Br}{C}}H-CH_2 \xrightarrow{C_2H_5ONa} CH_3-(CH_2)_3-OCH_2CH_3$$

➠ HBr in presence of peroxide gives anti Markovnikov addition product. 1°alkyl halide on reaction with C_2H_5ONa gives SN^2 reaction.

98) The reaction

$$CH_3-\underset{CH_3}{\overset{CH_3}{C}}-ONa + CH_3CH_2Cl \xrightarrow[-NaCl]{} CH_3-\underset{CH_3}{\overset{CH_3}{C}}-O-CH_2-CH_3$$

is called : [NEET-1 – 2015]

(A) Williamson Synthesis

(B) Williamson continuous etherification process

(C) Etard reaction

(D) Gatterman – Koch reaction

Ans. **(A)** Williamson Synthesis

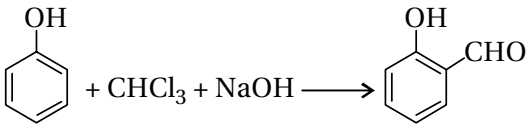
➠ Given reaction is an important laboratory method for the preparation of symmetrical and unsymmetrical ethers. In this method, an alkyl halide is allowed to react with sodium alkoxide.

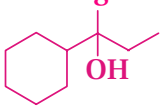
99) Reaction of phenol with chloroform in presence of dilute sodium hydroxide finally introduces which one of the following functional group ? [NEET-2 – 2015]

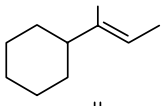
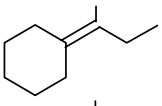
(A) $-CHCl_2$ (B) –CHO (C) $-CH_2Cl$ (D) –COOH

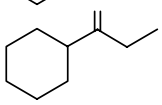
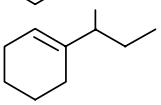
Ans. **(B)** –CHO

➠ Reimer - Tieman reaction

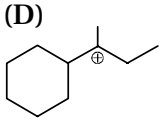


100) Which of the following is not the product of dehydration of  ? [NEET-2 – 2015]

(A)  (B) 

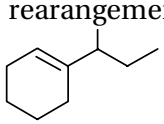
(C)  (D) 

Ans. **(D)**

➠ 

Intermediate carbocation (more stable).

No rearangement in C^+ takes place.

So  product is not possible.

101) Which of the following reaction(s) can be used for the preparation of alkyl halides ?

[NEET-2 – 2015]

(I) $CH_3CH_2OH + HCl \xrightarrow{anh.ZnCl_2}$

(II) $CH_3CH_2OH + HCl \longrightarrow$

(III) $(CH_3)_3COH + HCl \longrightarrow$

(IV) $(CH_3)_2CHOH + HCl \xrightarrow{anh.ZnCl_2}$

(A) (IV) only (B) (III) and (IV) only

(C) (I), (III) and (IV) only

(D) (I) and (II) only

Ans. **(C)** (I), (III) and (IV) only

➠ (I) and (IV) can be used due to presence of anhydrous $ZnCl_2$ (III) gives alkyl halide due to formation of more stable carbocation.

102) 2-Chloro-2-methylpentane on reaction with sodium methoxide in methanal yields :

(a) $C_2H_5CH_2\underset{CH_3}{\overset{CH_3}{C}}-OCH_3$ **(b)** $C_2H_5CH_2\underset{CH_3}{C}=CH_2$

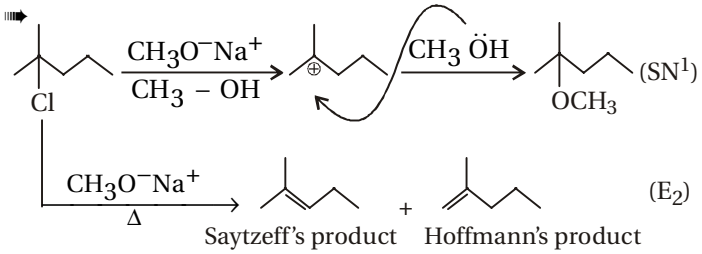
(c) $C_2H_5CH=\underset{CH_3}{C}-CH_3$

[JEE-2016]

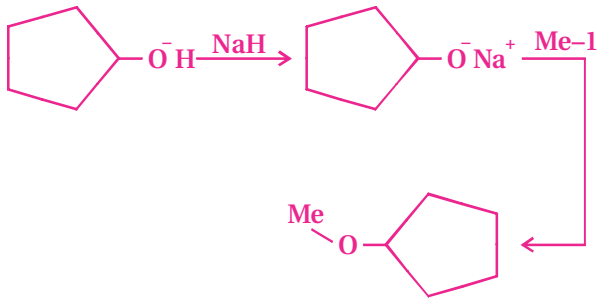
(A) (a) and (b) (B) All of these

(C) (a) and (c) (D) (c) only

Ans. **(B)**



103)



Can be classified as : # [NEET-1 – 2016]

(A) Alcohol formation reaction

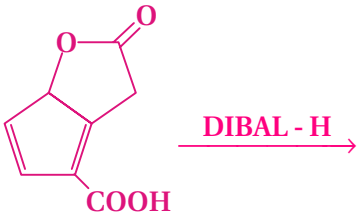
(B) Dehydration reaction

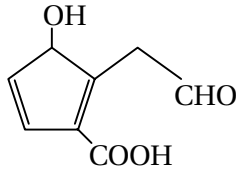
(C) Williamson alcohol synthesis reaction

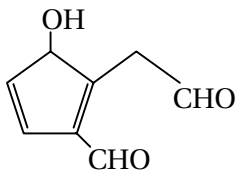
(D) Williamson ether synthesis reaction

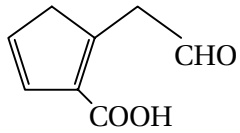
Ans. **(D)** Williamson ether synthesis reaction

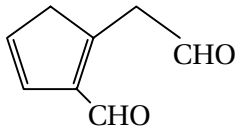
104) The major product obtained in the following reaction is ..... [JEE-2017]



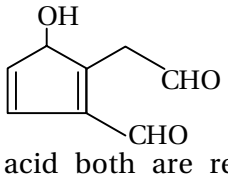
(A) 

(B) 

(C) 

(D) 

Ans. **(B)**



DIBAL-H ester and carboxylic acid both are reduced to aldehyde at lower temperature.

105) The oxidation of phenol with chromic acid gives.... [NEET-2017]

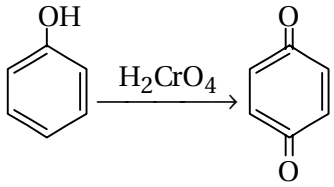
(A) a simple diketone.

(B) a conjugated diketone.

(C) ortho benzoquinone.

(D) an aldehyde.

Ans. **(B)** a conjugated diketone.



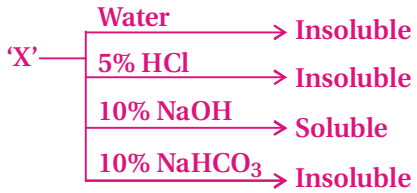
106) Of the following alcohols, the one that would react fastest with conc. HCl and anhydrous $ZnCl_2$ is ..... [NEET-2017]

(A) Butan–1–ol (B) Butan–2–ol

(C) 2-methylpropan-2-ol (D) 2–methylpropanol

Ans. **(C)** 2-methylpropan-2-ol

107) An organic compound (X) showing the following solubility profile :



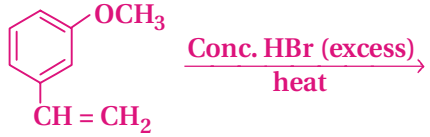
The compound (X) is ..... [JEE APRIL- 2019]

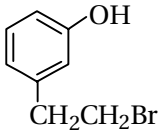
(A) m-cresol (B) Oleic acid

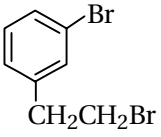
(C) o-Toludiene (D) Benzamide

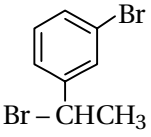
Ans. **(A)** m-cresol

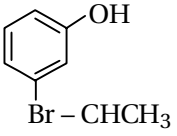
108) The major product in the following reaction is ..... [JEE APRIL-2019]



(A) 

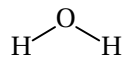
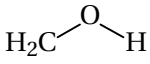
(B) 

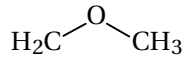
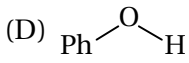
(C) 

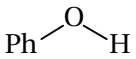
(D) 

Ans. **(D)**

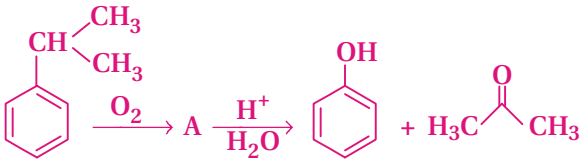
109) The compound that is most difficult to protonate is ..... # [NEET-2019]

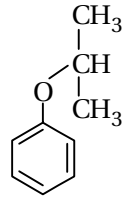
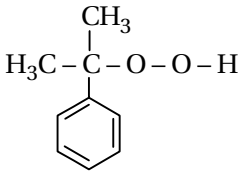
(A)  (B) 

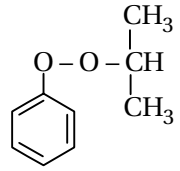
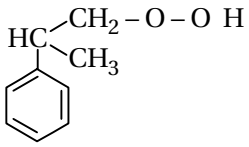
(C)  (D) 

Ans. **(D)** 

110) The structure (A) in the following reaction is ..... [NEET-2019]

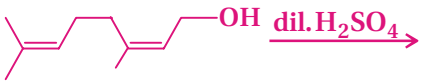


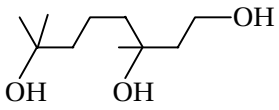
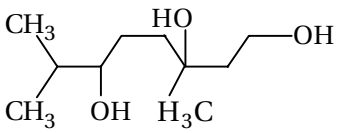
(A)  (B) 

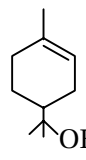
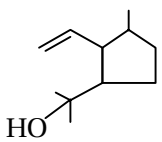
(C)  (D) 

Ans. **(B)**

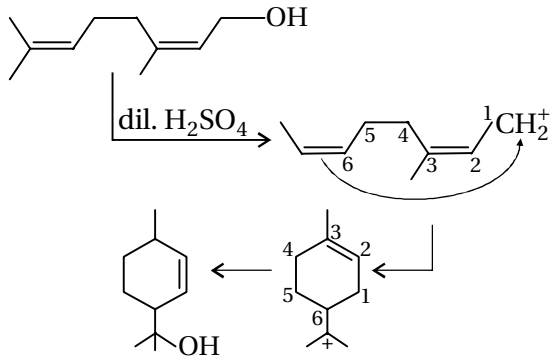
111) Major product in the following reaction is :

 [JEE - 2020]

(A)  (B) 

(C)  (D) 

Ans. **(C)**

➠ 

112) Arrange the following compounds in increasing order of C – OH bond length : [JEE - 2020]

methanol, phenol, p-ethoxyphenol

(A) phenol < methanol < p-ethoxyphenol

(B) methanol < p-ethoxyphenol < phenol

(C) phenol < p-ethoxyphenol < methanol

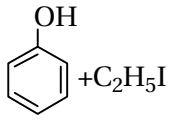
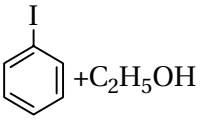
(D) methanol < phenol < p-ethoxyphenol

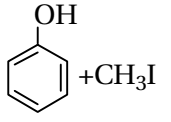
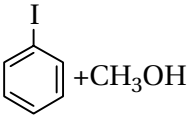
Ans. **(C)** phenol < p-ethoxyphenol < methanol

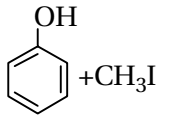
➠ In methanol, there is no resonance. In phenol, there is resonance. In p-Ethoxyphenol, there is resonance involved but the involvement of lone pair of oxygen in OH group is poor as compared with phenol due to the presence of lone pair oxygen in OCH_3 group which are also involved in resonance.

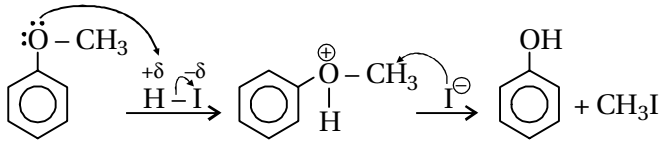
➠ So, partial double bond character develops in C – OH bond of phenol and p-ethoxyphenol but in case of p-ethoxyphenol, resonance is poor as compared to phenol. So, bond length follows the order : methanol > p-ethoxyphenol > phenol

113) Anisole on cleavage with HI gives : [NEET-2020]

(A)  (B) 

(C)  (D) 

Ans. **(C)** 

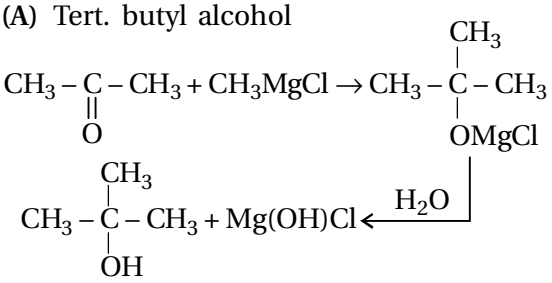
➠ 

114) Reaction between acetone and methyl-magnesium chloride followed by hydrolysis will give : # [NEET-2020]

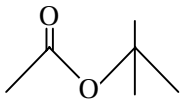
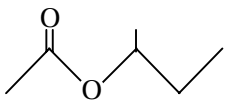
(A) Tert. butyl alcohol (B) Isobutyl alcohol

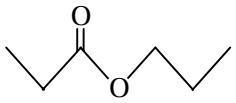
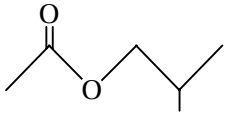
(C) Isopropyl alcohol (D) Sec. butyl alcohol

Ans. **(A)** Tert. butyl alcohol

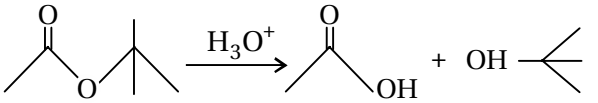


115) An organic compound (A) (molecular formula $C_6H_{12}O_2$) was hydrolysed with dil. H_2SO_4 to give a carboxylic acid (B) and an alcohol (C). 'C' gives white turbidity immediately when treated with anhydrous $ZnCl_2$ and conc. HCl. The organic compound (A) is : [JEE (September)-2020]

(A)  (B) 

(C)  (D) 

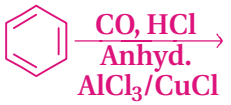
Ans. **(A)**



3° Alcohol

3° Alcohol given Lucas test immediately.

116) Match List-I with List-II [NEET-2021]

List-I	List-II
(a) 	(i) Hell-Volhard-Zelinsky reaction
(b) $R-\overset{\overset{O}{\|}}{C}-CH_3 + NaOX \rightarrow$	(ii) Gattermann-Koch reaction
(c) $R-CH_2-OH + R'COOH \xrightarrow[H_2SO_4]{Conc.}$	(iii) Haloform reaction
(d) $R-CH_2COOH \xrightarrow[(ii)\ H_2O]{(i)\ X_2/\ Red\ P}$	(iv) Esterification

Choose the correct answer from the options given below.

(A) (a - i), (b - iv), (c - iii), (d - ii)

(B) (a - ii), (b - iii), (c - iv), (d - i)

(C) (a - iv), (b - i), (c - ii), (d - iii)

(D) (a - iii), (b - ii), (c - i), (d - iv)

Ans. **(B)** (a - ii), (b - iii), (c - iv), (d - i)

MCQs asked in GUJCET Exam

117) By which process phenyl acetate can be converted in to hydroxy acetophenone ? [GUJCET - 2006]

(A) Fries rearrangment

(B) Reimer-Tiemann process

(C) Kolbe-Schmitt reaction

(D) Acetylation

Ans. **(A)** Fries rearrangment

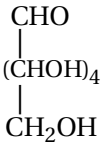
118) Which of the following compound having mixture obtained on fermentation ? [GUJCET - 2006]

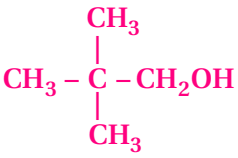
(A) 1-propanol (B) Ethanol

(C) Glucose (D) Glycerol

Ans. **(C)** Glucose

Glucose having 5 –OH group compound with more –OH group are more soluble.



119) 

How this compound respond the Lucas test ? [GUJCET - 2007]

(A) No reaction

(B) Coloured layer formed

(C) Oily droplets appear

(D) Mixture becomes milky white

Ans. **(A)** No reaction

120) Which two statement of the following are true for phenol ?

(1) Phenol is more acidic than alcohol.

(2) Malamine plastic can be prepared from phenol.

(3) It gives violet colour with neutral $FeCl_3$.

(4) It gives phenetol on heating with CH_3COCl. [GUJCET - 2008]

(A) Statement (3) Statement (4)
(B) Statement (1) Statement (4)
(C) Statement (2) Statement (3)
(D) Statement (1) Statement (3)

Ans. **(D)** Statement (1) Statement (3)

121) The organic compound A on reaction with $Na_2Cr_2O_7$ / H_2SO_4 gives B. This B on reduction in presence of Ni gives ethyl alcohol. What is A ? #
[GUJCET - 2008]

(A) Ethanoic acid (B) Ethene
(C) Ethanal (D) Ethanol

Ans. **(D)** Ethanol

➥ $CH_3CH_2OH \xrightarrow[-H_2O]{\text{Oxidations } Na_2Cr_2O_7/H_2SO_4} CH_3CHO \xrightarrow[\text{Redaction}]{Ni/H_2} CH_3CH_2OH$ (Ethanol)

122) Which of the following compound is more acidic ?
[GUJCET-2013]

(A) $CH_3 \cdot OH$ (B) $CH_3 \cdot \underset{\displaystyle OH}{\underset{|}{CH}} \cdot CH_3$
(C) $CH_3 \cdot CH_2 \cdot CH_2 \cdot OH$ (D) $CH_3 \cdot \underset{\displaystyle OH}{\underset{|}{\overset{\displaystyle CH_3}{\overset{|}{C}}}} - CH_3$

Ans. **(A)** $CH_3 \cdot OH$

123) Following options contain the pairs of the name of reaction and the name of final product, which pair is incorrect ?
[GUJCET-2013]

(A) Kolbe-Smitt reaction → 2-Hydroxy benzoic acid
(B) Cumene Process → Phenol and acetone
(C) Reimer-Tiemann reaction → 2-Hydroxy benzaldehyde
(D) Fries rearrangement → Methoxy benzoic acid

Ans. **(D)** Fries rearrangement → Methoxy benzoic acid

124) Which one of the following compounds do not give primary alcohol on reduction ?
[GUJCET-2014]

(A) Propanoic acid (B) Propanal
(C) Methyl propanoate (D) Propan-2-one

Ans. **(D)** Propan-2-one

125) In which of the following reactions of alcohol there is no cleavage of C – O bond ?
[GUJCET-2014]

(A) Oxidation reaction of alcohol
(B) Dehydration reaction of alcohol
(C) Reduction reaction of alcohol
(D) Reaction of alcohol with phosphorous tribromide

Ans. **(A)** Oxidation reaction of alcohol

126) Which reagent is used for bromination of methyl phenyl ether ? [GUJCET-2015]

(A) Br_2/Red P (B) Br_2/CH_3COOH
(C) $Br_2/FeBr_3$ (D) HBr/Δ

Ans. **(B)** Br_2/CH_3COOH

127) Which of the following statement is not correct ? [GUJCET-2015]

(A) Phenol is used to prepare analgesic drugs.
(B) Phenol is neutralised by sodium carbonate.
(C) Solubility of phenol in water is more than that of chlorobenzene.
(D) Boiling point of o-nitrophenol is lower than that of p-nitrophenol.

Ans. **(B)** Phenol is neutralised by sodium carbonate.

128) Which of the following is an analgesic drug ?
[GUJCET-2016]

(A) Aspirin (B) Ranitidine
(C) Erythromycin (D) Luminal

Ans. **(A)** Aspirin

129) Which reagents from the following give aldehyde by reacting with primary alcohol ?
[GUJCET-2016]

(A) PCC + CH_2Cl_2 (B) $KMnO_4 + H_2SO_4$
(C) $KMnO_4$ + KOH (D) $Na_2Cr_2O_7 + H_2SO_4$

Ans. **(A)** PCC + CH_2Cl_2

130) Which of the following reagent reacts with but-1-ene to give optically inactive product ?
[GUJCET-2016]

(A) Br_2/CCl_4 (B) HBr
(C) H_2O/H^+ (D) $(BH_3)_2/H_2O_2(OH^-)$

Ans. **(D)** $(BH_3)_2/H_2O_2(OH^-)$

131) How many σ and π bonds are present respectively in the final product obtained by the Reimer-Tiemann reaction of phenol ?
[GUJCET-2016]

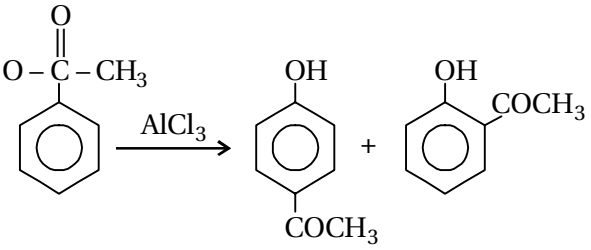
(A) 15 and 3 (B) 14 and 4
(C) 15 and 4 (D) 14 and 3

Ans. **(C)** 15 and 4

132) Which products are otained when phenyl ethanoate reacts in presence of Anh.$AlCl_3$? # [GUJCET-2017]

(A) o – Hydroxy acetophenone and
p – Hydroxy acetophenone
(B) o – Methoxy acetophenone and
p – Methoxy acetophenone
(C) o – Methyl acetophenone and
p – Methyl acetophenone
(D) o – Ethoxy acetophenone and
p – Ethoxy acetophenone

Ans. **(A)** o – Hydroxy acetophenone and
p – Hydroxy acetophenone



133) How many gm. of ethanol is required in the reaction with Na metal in order to give 560 ml. dihydrogen gas at STP ? [GUJCET-2017]
[mole. mass of ethanol = 46 gm mol^{-1}]

(A) 1.15 (B) 2.3 (C) 4.6 (D) 11.5

Ans. **(B)** 2.3

➠ $C_2H_5OH + Na \longrightarrow C_2H_5ONa + \frac{1}{2}H_2$

46 gram 11200 mili

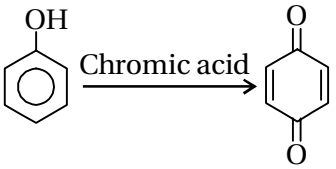
(?) 560

$\frac{560 \times 46}{11200}$ = 2.3 gram Na is Needed

134) The IUPAC name of the product obtained by the oxidation of phenol with the help of chromic acid is ..... . [GUJCET-2017]

(A) Cyclo hexa – 2,4 – diene – 1,4 – dione
(B) Cyclo hexa – 2,5 – diene – 1,4 – dione
(C) Cyclo hexa – 2,5 – diene – 1,4 – diol
(D) Cyclo hexa – 2,4 – diene – 1,4 – diol

Ans. **(B)** Cyclo hexa – 2,5 – diene – 1,4 – dione

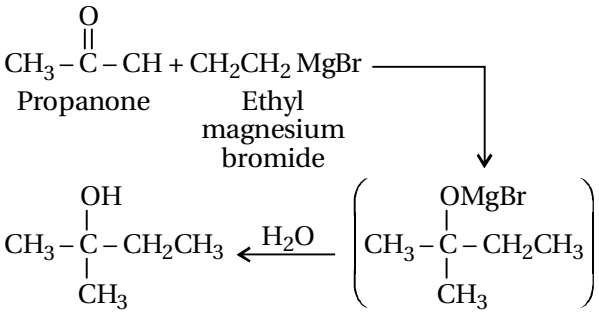


Cyclo hexa-2
5, diene, 1, 4-dion

135) Which is the final product obtained by the reaction of a Grignard reagent ethyl Magnesium bromide with propanone ? [GUJCET-2018]

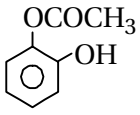
(A) Pentane-1-ol
(B) 2-Methylbutane-2-ol
(C) Pentane-2-ol
(D) 3-Methylbutane-2-ol

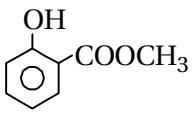
Ans. **(B)** 2-Methylbutane-2-ol

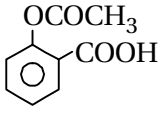


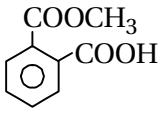
2-methylbutan-2-ol

136) Which is the correct structural formula of Aspirin ? [GUJCET - 2018]

(A) 

(B) 

(C) 

(D) 

Ans. **(C)**

137) Which of the following alcohol has the highest boiling point ? [GUJCET - 2019]

(A) Butan-2-ol (B) 2-Methylpropan-2-ol
(C) Propan-2-ol (D) Butan-1-ol

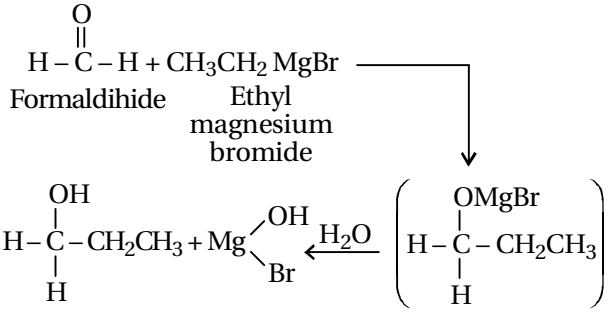
Ans. **(B)** 2-Methylpropan-2-ol

➠ Creakr the molecules mass, higher the boiling point, further greather the branching, lesser the boiling point.

138) Which is the major product obtained by hydrolysis of compound formed by reaction between formaldehyde and ethyl magnesium bromide ? [GUJCET - 2019]

(A) Ethan-1-ol (B) Propan-2-ol
(C) Propan-1-ol (D) 2-Methyl-propan-2-ol

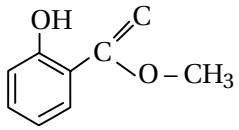
Ans. **(C)** Propan-1-ol

➠ 

139) Give the IUPAC name for methyl salicylate. # [GUJCET - 2019]

(A) Methoxy benzoic acid
(B) 2-Hydroxy benzoic acid
(C) Methyl-2-hydroxy benzoate
(D) Methyl-3-hydroxy benzoate

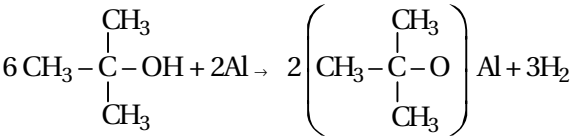
Ans. **(C)** Methyl-2-hydroxy benzoate

➠ 
Methyl-2-hydroxybenzoate

140) 1 mole of metal 'M' reacts completely with alcohol to give 1.5 moles of H_2. Then what will be the valency of metal 'M' ? [GUJCET-2020]

(A) 4 (B) 3 (C) 2 (D) 1

Ans. **(B)** 3

➠ 

From the reaction, it is clear that 3 moles of $H_{2(g)}$ is produced by 2 moles of $Al_{(s)}$. Hence, 1 mole of Al will liberate 1.5 moles of $H_{2(g)}$.

141) Which of the following has highest boiling point ? [GUJCET-2020]

(A) n-Butane (B) Ethoxy ethane
(C) Pentanal (D) Pentan-1-ol

Ans. **(D)** Pentan-1-ol

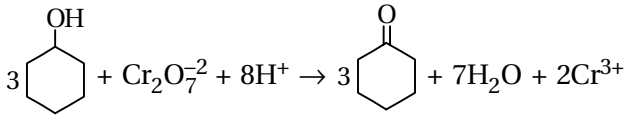
➠ Alcohol has the highest boiling point among ethers, alkanes and aldehydes because of intermolecular H-bonding.

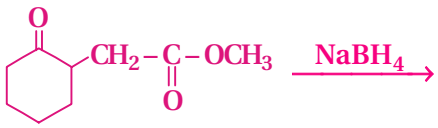
142) Which reagent is required to convert cyclohexanol to cyclohexanone ? [GUJCET-2020]

(A) PCC (B) O_3/H_2O-Zn dust
(C) Anhydrous CrO_3 (D) DIBAL-H

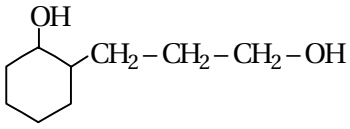
Ans. **(A)** PCC

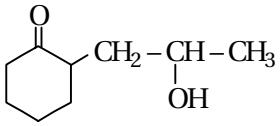
➠ PCC is a suitable reagent to convert cyclohexanol to cyclohexanone.

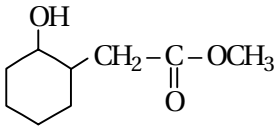

Cyclohexanol Cyclohexanone

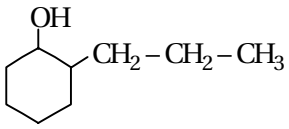
143)  **"X".**

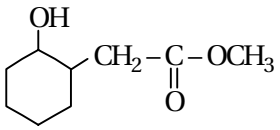
What is "X" in reaction ? [GUJCET-2020]

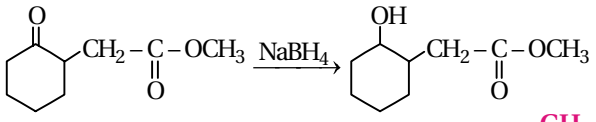
(A) 

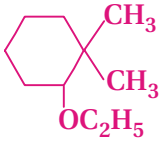
(B) 

(C) 

(D) 

Ans. **(C)** 

➠ 

144) From following IUPAC name of  **compound is ?** [GUJCET - 2021]

(A) 2-ethoxy-1, 1-dimethyl cyclohexane
(B) 1-ethoxy-2, 2-dimethyl cyclohexane
(C) 5-ethoxy-6, 6-dimethyl cyclohexane
(D) 1-ethoxy-6, 6-dimethyl cyclohexane

Ans. **(A)** 2-ethoxy-2, 2-dimethyl cyclohexane

145) Which Grignard reagent gives 2-methylpropane-1-ol with reaction with methanal ? # [GUJCET-2021]

(A) $CH_3 - CH_2 - CH_2 - Mg - X$

(B) $CH_3 - CH = CH - Mg - X$

(C) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - Mg - X$

(D) $CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - Mg - X$

Ans. **(C)**

➠ $CH_3 - \underset{\underset{CH_3}{|}}{CH} - Mg - X + HCHO \longrightarrow CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - O - MgX \xrightarrow{H_2O} CH_3 - \underset{\underset{CH_3}{|}}{CH} - CH_2 - OH + Mg(OH)X$

2-methylpropane-1-ol

146) Which compound having maximum value of pK_a from following ? [GUJCET - 2021]

(A) $o - O_2N - C_6H_4 - OH$

(B) $m - O_2N - C_6H_4 - OH$

(C) $p - O_2N - C_6H_4 - OH$

(D) C_6H_5OH

Ans. **(D)** C_6H_5OH

➠ In substitutive halogen compounds, the nitro groups like electron withdrawing group increases acidity of phenol by decreasing pK_a value of nitro substitute phenol. Hence, pK_a value of phenol is highest.

147) Which of the following reactions will not give Benzene ? [GUJCET - 2022]

(A) $C_6H_5OH + Zn \xrightarrow{\Delta}$

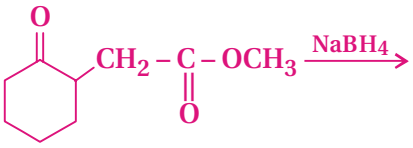
(B) $C_6H_5N_2^+Cl^- + H_3PO_2 + H_2O \rightarrow$

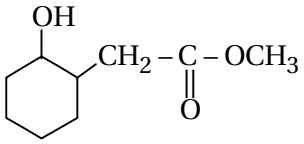
(C) $C_6H_5COONa + \text{Sodalime} \xrightarrow{\Delta}$

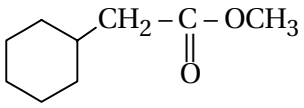
(D) $C_6H_5OH + H_2CrO_4 \xrightarrow{[O]}$

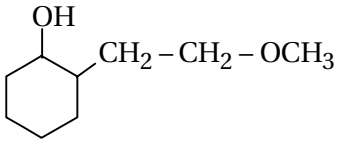
Ans. **(D)** $C_6H_5OH + H_2CrO_4 \xrightarrow{[O]}$

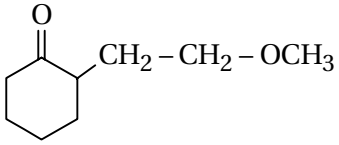
148) Which product is obtained from following reaction ? [GUJCET - 2022]

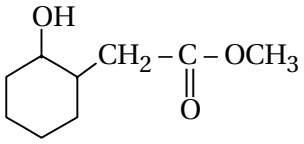


(A) 

(B) 

(C) 

(D) 

Ans. **(A)** 

149) Which reaction is used to prepare salicylic acid from phenol ? [GUJCET - 2022]

(A) Etard's reaction

(B) Kolbe's reaction

(C) Stephen reaction

(D) Reimer-Tiemann reaction

Ans. **(B)** Kolbe's reaction

MCQs asked in Board Exam

150) Minimum carbon containing 2° alcohol undergoes dehydration and gives A. Benzene diazonium chloride when heated with water gives B which on reduction by zinc metal gives A and C also react with other. Name the process between A and C. [October-2012]

(A) Reimer – Tiemann Reaction

(B) Kolbe–Schmitt Reaction

(C) Cumene Process

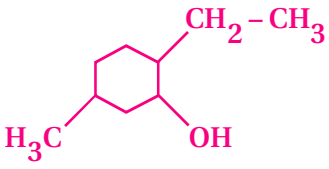
(D) Fries Rearrangement

Ans. **(C)** Cumene Process

151) **Choose the correct order of boiling point for ethanol, ethylene glycol and glycerol. #** [October-2012]

(A) Ethanol > ethylene glycol > glycerol
(B) Ethanol > glycerol > ethylene glycol
(C) Glycerol > ethylene glycol > ethanol
(D) Glycerol > ethanol > ethylene glycol

Ans. **(C)** Glycerol > ethylene glycol > ethanol

152) **IUPAC name of the**  **is .....** [October-2012]

(A) 2-Ethyl-5-methyl cyclohexanol
(B) 5-Methyl-2-ethyl cyclohexanol
(C) 2-Methyl-5-ethyl cyclohexanol
(D) 5-Ethyl-2-methyl cyclohexanol

Ans. **(A)** 2-Ethyl-5-methyl cyclohexanol

153) **What is the IUPAC name of the product obtained from oxidation of phenol ?** [October-2012]

(A) 1, 4 - Benzoquinone
(B) 1, 2 - Benzo Catechol
(C) Cyclohexa - 2, 5 - diene - 1, 4 - dione
(D) None of these

Ans. **(A)** 1, 4 - Benzoquinone

154) **How many alcohols and ethers are possible with general formula $C_4H_{10}O$?** [October-2012]

(A) 7 (B) 4 (C) 5 (D) 8

Ans. **(A)** 7

155) **Which of the following alcohol will respond to Lucas test slowest ?** [October-2012]

(A) Secondary butyl alcohol
(B) 3° - butanol
(C) Neo pentyl alcohol
(D) None of the above

Ans. **(C)** Neo pentyl alcohol

156) **What is obtained as end product when phenol dissolved in aqueous solution of sodium hydroxide is heated with carbon dioxide gas at 398K temperature and 4-7 bar pressure ?** [October-2012]

(A) Cumene hydro peroxide
(B) Sodium phenoxide
(C) Salicyladehyde
(D) Sodium salicylate

Ans. **(D)** Sodium salicylate

157) **Which of the following is used as a solvent in oxidation of Alcohol by Pyridinium chloro chromate ?** [October-2013]

(A) Chloro methane (B) Trichloro ethane
(C) Trichloro methane (D) Dichloro methane

Ans. **(D)** Dichloro methane

158) **Which of the following is a product of hydrolysis of diethyl ether ?** [October-2013]

(A) Ethene (B) Ethane
(C) Ethanol (D) Ethyne

Ans. **(C)** Ethanol

159) **Which of the following product is obtained on performing Riemer Tiemann reaction on phenol ?** [October-2013]

(A) Salicylic acid (B) Phenyl acetate
(C) Salicylaldehyde (D) 1, 4 Benzoquinone

Ans. **(C)** Salicylaldehyde

160) **Give the correct order of acidic strength of the following alcohols.** [October-2013]

(A) 2-methyl propan-2-o1 > propan-1-o1> propan-2-o1
(B) Propan-1-o1 > propan-2-o1 > 2-methyl propan-2-o1
(C) 2-methyl propan-2-o1 > propan-2-o1> propan-1-o1
(D) Propan-1-o1 > 2-methyl propan-2-o1 > propan-2-o1 >

Ans. **(B)** Propan-1-o1 > propan-2-o1 > 2-methyl propan-2-o1

161) **Which of the following compound cannot be oxidized by chromic acid and when Lucas test is performed on it, oily drops appear in on the upper layer of mixture ?** [October-2013]

(A) Butane-1-o1
(B) Propane-2-o1 (C) Propane-1-o1
(D) 2-methyl propane-2-o1

Ans. **(D)** 2-methyl propane-2-o1

162) Sodium phenoxide on reaction with methyl iodide produces compound X, which on Friedel-Craft's acylation produces compounds Y and Z. Mention compounds X, Y and Z. # [October-2013]

(A) X = Methoxy Benzene, Y = o-methoxy toluene, Z = p-methoxy toluene

(B) X = Methoxy Benzene, Y = o-chloro anisole, Z = p-chloro anisole

(C) X = Anisole, Y = 1(2-methoxy phenyl) ethan - 1 - one, Z = 1(4-methoxy phenyl) ethan - 1 - one

(D) X = Anisole, Y = o - nitro Anisole, Z = p-nitro anisole

Ans. **(C)** X = Anisole, Y = 1(2-methoxy phenyl) ethan - 1 - one, Z = 1(4-methoxy phenyl) ethan - 1 - one

163) Match Column-I with Column-II : [October-2013]

Column-I	Column-II
(P) $CH_3CHO + CH_3CH_2MgBr \rightarrow$ Intermediate Product $\rightarrow$	(i) 2-methyl hexan-2-ol
(Q) $C_6H_5OH + CH_3COCl \xrightarrow{NaOH}$	(ii) Ethyl Bromide
(R) $CH_3CH_2 - O - CH_2CH_3 + 2HBr \xrightarrow{\Delta}$	(iii) Phenyl acetate
(S) $CH_3CH_2CH_2CH_2MgBr + CH_3COCH_3 \rightarrow$ Intermediate Product $\rightarrow$	(iv) Butan-2-ol

(A) P $\rightarrow$ (iv), Q $\rightarrow$ (iii), R $\rightarrow$ (ii), S $\rightarrow$ (i)

(B) P $\rightarrow$ (i), Q $\rightarrow$ (iii), R $\rightarrow$ (iv), S $\rightarrow$ (ii)

(C) P $\rightarrow$ (ii), Q $\rightarrow$ (iv), R $\rightarrow$ (i), S $\rightarrow$ (iii)

(D) P $\rightarrow$ (iv), Q $\rightarrow$ (iii), R $\rightarrow$ (i), S $\rightarrow$ (ii)

Ans. **(A)** P $\rightarrow$ (iv), Q $\rightarrow$ (iii), R $\rightarrow$ (ii), S $\rightarrow$ (i)

164) In "lucas test" which of the following alcohol cannot give any change ? [October-2014]

(A) Butylalcohol (B) 2-butanol

(C) 2-methylpropan-2-ol (D) 2-propanol

Ans. **(A)** Butylalcohol

165) Dehydration of 3° alcohol undergoes in presence of : [October-2014]

(A) 20 % H_3PO_4 (B) 85 % H_3PO_4

(C) 50 % H_3PO_4 (D) con. H_2SO_4

Ans. **(A)** 20 % H_3PO_4

166) In the following reaction

$$X \xrightarrow[\Delta]{Zn\ dust} Y \xrightarrow[Propene]{(Alkylation)} Z$$

What is X and Z ? [October-2014]

(A) X = Benzene Z = Cumene

(B) X = Phenol Z = Benzene

(C) X = Phenol Z = Cumene

(D) X = Benzene Z = Phenol

Ans. **(C)** X = Phenol Z = Cumene

167) Give bond angle in C – O – C and hybridization of oxygen atom in simple ether. [October-2014]

(A) 180°, sp (B) 117°, sp^2

(C) 111.7°, sp^3 (D) 109°, sp^3

Ans. **(C)** 111.7°, sp^3

168) Salicyldehyde can be prepared by ..... .

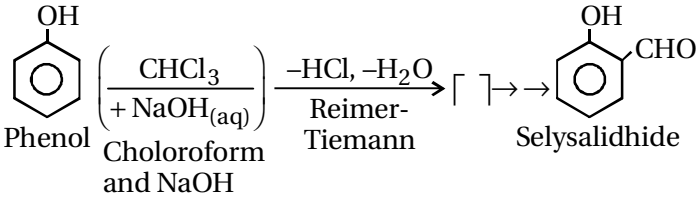
(A) Fitting reaction [October-2014, 2016]

(B) Reimer - Tiemann reaction

(C) Fries rearrangement reaction

(D) Kolbe - Schmitt reaction

Ans. **(B)** Reimer - Tiemann reaction



169) Which of the following statement is true ? [October-2014]

(A) 3° carbocation is formed by the loss of a water molecule from the oxonium ion. This step is fast.

(B) 3° carbocation reacts with Cl^- rapidly and forms chloro alkane.

(C) 1° and 2° alcohol reacts with pBr_3 to form alkene.

(D) Tertiary alcohol is converted in to an ion through protonation by H^+ of acid is slow step.

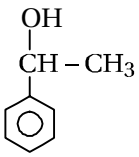
Ans. **(B)** 3° carbocation reacts with Cl^- rapidly and forms chloro alkane.

UID : P2-C11-S6-Q162

170) How many number of carbon atoms are present in 1-phenyl ethanol ? # [October-2015]

(A) 6 (B) 7 (C) 8 (D) 9

Ans. **(C)** 8

➠ 

1–phenyl ethan-1-ol

171) Which of the following is correct order of boiling point of alcohol ? [October-2015]

(i) Propan - 1 - ol (ii) Butan - 1 - ol

(iii) Butan - 2 - ol (iv) 2-Methyl propan - 2-ol

(A) (i) < (iii) < (ii) < (iv)

(B) (i) < (ii) < (iv) < (iii)

(C) (i) < (iv) < (iii) < (ii)

(D) (i) < (ii) < (iii) < (iv)

Ans. **(C)** (i) < (iv) < (iii) < (ii)

172) Which is the correct priority order for absolute configuration ? [October-2015]

(A) –COOH, $-CONH_2$, –CHO, $-COCH_3$

(B) $-COCH_3$, $-CONH_2$, –COOH, –CHO

(C) –COOH, $-COCH_3$, $-CONH_2$, –CHO

(D) –COOH, $-CONH_2$, $-COCH_3$, –CHO

Ans. **(D)** –COOH, $-CONH_2$, $-COCH_3$, –CHO

173) In section - I conversion are given and in section-II name of reaction are given match section-I and section-II. [October-2015]

Section - I	Section - II
(1) Ethyl acetate from ethanol	(a) Wurtz-Fitting reaction
(2) Ethoxy ethane from ethanol	(b) Esterification
(3) Salicyl aldehyde from phenol	(c) Reimer - Tiemann reaction
(4) Ethyl benzene from chlorobenzene	(d) Etherification reaction
	(e) Alkylation reaction

(A) (1) → (e), (2) → (b), (3) → (a), (4) → (d)

(B) (1) → (b), (2) → (d), (3) → (c), (4) → (a)

(C) (1) → (c), (2) → (e), (3) → (d), (4) → (b)

(D) (1) → (d), (2) → (a), (3) → (e), (4) → (c)

Ans. **(B)** (1) → (b), (2) → (d), (3) → (c), (4) → (a)

174) Which of the following alcohol is secondary (2°) alcohol ? [October-2016]

(A) Isobutyl alcohol

(B) Ethylene glycol

(C) Neo pentanol

(D) Iso propyl alcohol

Ans. **(D)** Iso propyl alcohol

	Name	Structure	Type
(A)	Iso butyl alcohol	$CH_3-\underset{\underset{CH_3}{\vert}}{CH}-\underset{\underset{1°}{\uparrow}}{CH_2OH}$	1° – alcohol
(B)	Ethylene glycol	$\underset{\underset{1°}{\uparrow}}{CH_2OH}\quad\underset{\underset{1°}{\uparrow}}{CH_2OH}$	1° – alcohol
(C)	Neo-Pentanol	$H_3C-\overset{\overset{CH_3}{\vert}}{\underset{\underset{CH_3}{\vert}}{C}}-\underset{\underset{1°}{\uparrow}}{CH_2OH}$	1° – alcohol
(D)	Iso-Propyl alcohol	$CH_3-\underset{\underset{2°}{\uparrow}}{\overset{\overset{OH}{\vert}}{CH}}-CH_3$	2° – alcohol

175) Which of the following alcohol is most reactive with HCl in presence of anhydrous Zinc chloride at room temperature ? [October-2016]

(A) $CH_3-CH_2-CH_2-OH$

(B) $(CH_3)_3-C-OH$

(C) $(CH_3)_3-C-CH_2OH$

(D) $(CH_3)_2\ CH-OH$

Ans. **(B)** $(CH_3)_3\ C-OH$

➠ The reaction with HCl in presence of anhydrous $ZnCl_2$, SN^1, substitution. This reaction is fastest in 3°-alcohols.

$$(CH_3)_3C-OH + HCl \xrightarrow[ZnCl_2]{\text{Anhydrous}} (CH_3)_3C-Cl + H_2O$$

3°-alcohol 3°-butyl chloride

➠ 3° – alcohols > 2° – alcohols > 1° – alcohols

← Rate of SN^1 reactions ←

Formula of alcohol	Type of alcohol
(A) $CH_3 - CH_2 - \underset{\uparrow}{CH_2} - OH$ (1°)	1° – alcohol
(B) $(CH_3)_3 - \underset{\uparrow}{C} - OH$ (3°)	3° – alcohol
(C) $(CH_3)_3 - C - \underset{\uparrow}{CH_2}\ OH$ (1°)	1° – alcohol
(D) $(CH_3)_2 - \underset{\uparrow}{CH} - OH$ (2°)	2° – alcohol

176) Which of the following pair gets converted into alcohol by reduction ? # [October-2016]

(A) Acetic acid and acetaldehyde

(B) Ethyl benzoate and benzoic acid

(C) Chloro ethane

(D) (A) and (B) both

Ans. (D) (A) and (B) both

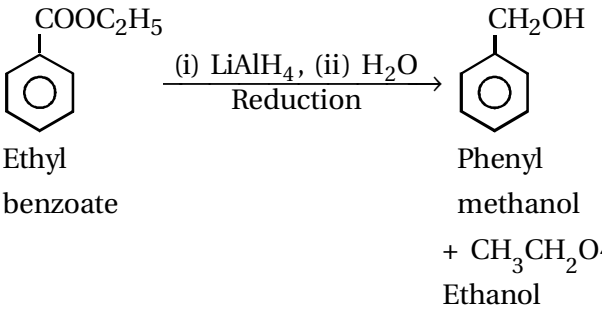
➠

(A) $CH_3COOH \xrightarrow[LiAlH_4, H_2O]{\text{Reduction}} CH_3CH_2OH$

Acetic acid

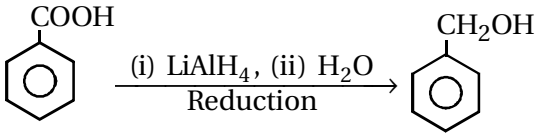
$CH_3CHO \xrightarrow[NaBH_4]{\text{Reduction}} CH_3CH_2OH$

Acetaldehyde Ethanol

(B) 

Ethyl benzoate

Phenyl methanol + CH_3CH_2O4 Ethanol



Benzoic acid Benzyl alcohol

(C) Chloroethane is not converted to alcohol by reduction.

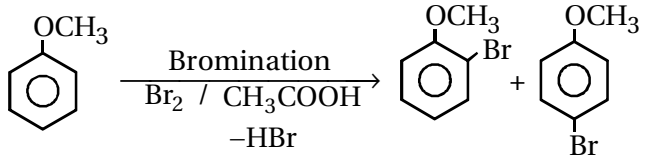
177) Which reagent is used in bromination of methoxy benzene ? [October-2016]

(A) Br_2 water (B) Br_2 / Acetic acid

(C) Br_2 / Fe Br_3 (D) Br_2 / CH_3CHO

Ans. (B) Br_2 / Acetic acid

➠



methoxy benzene

O-Bromo anisole

P-Bromo anisole

178) P $\xrightarrow{\text{Reduction}}$ Q $\xrightarrow{\text{Dehydration}}$ R $\xrightarrow{\text{Hydro-chlorination}}$ S

What is P, Q, R, S ? [October-2016]

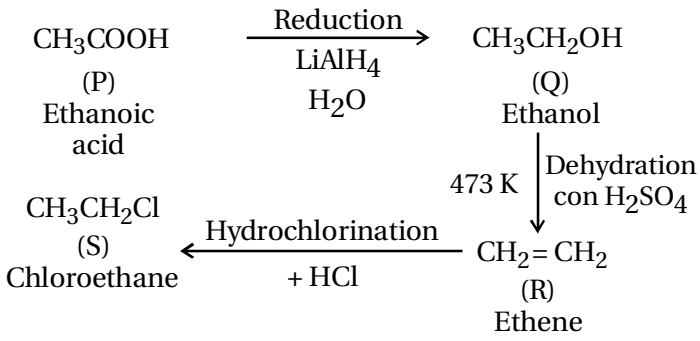
(A) P = CH_3COOH Q = CH_3CH_2OH
R = CH_3CHO S = CH_3CH_2Cl

(B) P = CH_3CHO Q = CH_3CH_2OH
R = $CH_2=CH_2$ S = CH_3CH_2OH

(C) P = CH_3COOH Q = CH_3CH_2OH
R = $CH_2=CH_2$ S = CH_3CH_2C1

(D) P = CH_3CH_2C1 Q = CH_3CH_2OH
R = $CH_2=CH_2$ S = CH_3CH_2C1

Ans. (C) (P) = CH_3COOH (Q) = CH_3CH_2OH,
(R) = $CH_2 = CH_2$ (S) = CH_3CH_2Cl



179) Which of the following reaction will give isopropanol ? Choose the right answer.

(I) Acetone $\xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgI}$ [October-2016]

(II) CH_3CHO $\xrightarrow[(ii)\ H_2O]{(i)\ CH_3Mg1}$

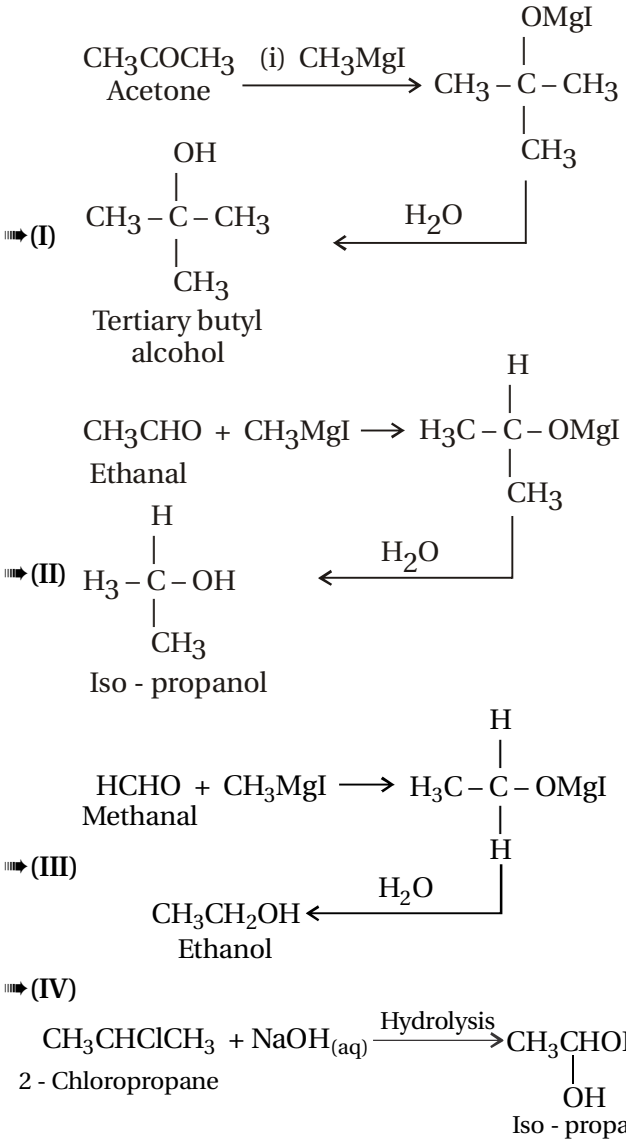
(III) HCHO $\xrightarrow[(ii)\ H_2O]{(i)\ CH_3MgI}$

(IV) 2 - Chloropropane $\xrightarrow[Aq.\ NaOH]{Hydrolysis}$

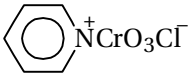
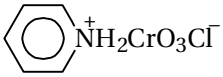
(A) (I) & (II) (B) (II) & (IV)

(C) (II) & (III) (D) (I), (II) & (IV)

Ans. **(B)** (II) & (IV)

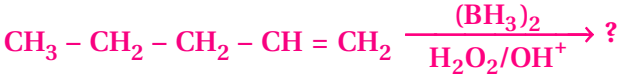


180) Identify Pyridinium chlorochromate from the following : # [March-2018]

(A) 
(B) 
(C) 
(D) 

Ans. **(A)**

181) Name the product obtained by the following reaction ? [March-2018]



(A) Pentan-3-ol (B) Pentan-2-ol
(C) Pentan-1-ol (D) 2-methyl butan-2-ol

Ans. **(C)** Pentan-1-ol

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182) Give the IUPAC name of the product obtained when phenol is oxidized by chromic acid (Na_2Cr_2O7 + Conc. H_2SO_4) [March-2018]

(A) Cyclohexa-2,5-diene-1,4-dione
(B) Cyclohexa-1,4-dione
(C) Cyclohexanone
(D) Cyclohexa-1,4-diene-2,5-dione

Ans. **(A)** Cyclohexa-2,5-diene-1,4-dione

183) Which of the following substance does not produce tri-iodomethane with the mixture of alkali and I_2 ? [March-2019]

(A) Propan-1-ol (B) Ethanol
(C) Dimethyl ketone (D) Ethanal

Ans. **(A)** Propan-1-ol

184) Substance A $\xrightarrow{Cu/573\,K}$ isobutylene, which is the structural formula of the substance A in thisreaction? [March-2019]

(A) $CH_3CH_2CH_2CH_2 - OH$
(B) $CH_3CH(CH_3)CH_2OH$
(C) $CH_3CH(OH)CH_2CH_3$
(D) $(CH_3)_3C - OH$

Ans. **(D)** $(CH_3)_3C - OH$

185) How much litres of dihydrogen gas will be produced at STP in the reaction of ethanol with 12 gram of Mg ? (Mg = 24 gram/mol) [March-2019]

(A) 11.2 litre (B) 2.24 litre
(C) 22.4 litre (D) 5.6 litre

Ans. **(A)** 11.2 litre

186) By which of the following reactions, ether compound will be obtained easily ?

(A) $(CH_3)_3CONa + CH_3Cl \rightarrow$ [March-2019]
(B) $(CH_3)_3CONa + (CH_3)_3C - Cl \rightarrow$
(C) $(CH_3)_3CONa + (CH_3)_2CHCl \rightarrow$
(D) $(CH_3)_2CHONa + (CH_3)_2CHCl \rightarrow$

Ans. **(A)** $(CH_3)_3CONa + CH_3Cl \rightarrow$

187) The reagent (X) in the given reaction is phenol $\xrightarrow[273\,k]{\text{"X"}}$ Parabromophenol. [March-2020]

(A) Br_2/CH_3COOH (B) $Br_2/FeBr_3$
(C) Bromine water (D) Br_2/CS_2

Ans. **(D)** Br_2/CS_2

188) Possible isomers of monohydric phenol having molecular formula C_7H_8O are ..... # [March-2020]

(A) 3 (B) 4 (C) 1 (D) 2

Ans. **(A)** 3

189) Which of the following compound has highest boiling point ? [March-2020]

(A) Butan-2-ol (B) Butan-1-ol

(C) Pentan-1-ol (D) Propan-1-ol

Ans. **(C)** Pentan-1-ol

190) Which product is obtained when one mole of ether (R–O–R) is reacted with one mole of HX ? [August-2020]

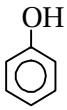
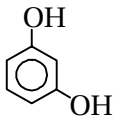
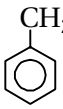
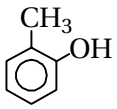
(A) Only R – X (B) Only R – OH

(C) R – X + R – OH (D) 2R – X + H_2O

Ans. **(C)** R – X + R – OH

➠ $R-O-R + HX \xrightarrow{\Delta} R-OH + R-X$

191) Which of the following compound does not contain phenolic "–OH" group in it ? [August-2020]

(A)  (B)  (C)  (D) 

Ans. **(C)**

192) Which one would be useful to distinguish between phenol and ethanol ? [August-2020]

(A) Sodium metal

(B) Anhydrous $ZnCl_2$ + Conc. HCl

(C) Neutral $FeCl_3$ (D) All of them

Ans. **(C)** Neutral $FeCl_3$

➠ Neutral $FeCl_3$ forms a violet colour complex with the phenol. However, it shows no reaction with ethanol. Hence, $FeCl_3$ can be used to distinguish phenol and ethanol in laboratory.

193) From which of the following organic compounds phenol can not be prepared ? [May-2021]

(A) Isopropyl benzene

(B) Benzene sulphonic acid

(C) Chloro benzene (D) Toluene

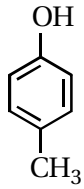
Ans. **(D)** Toluene

194) Which of the following has highest value of pK_a ? [May-2021]

(A) m-nitro phenol (B) p-nitrophenol

(C) phenol (D) p-cresol

Ans. **(D)** p-cresol



➠ Due to (+I) effect of CH_3 group at p-position, the pK_a of p-cresol is maximum.

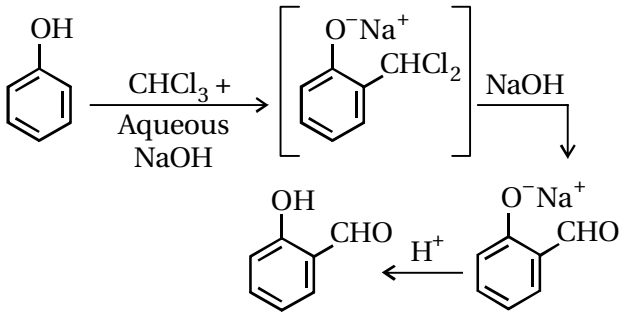
195) What is the product of Riemer-Temann reaction ? [May-2021]

(A) Salicylic acid (B) Benzoquinone

(C) Salicylaldehyde (D) Picric acid

Ans. **(C)** Salicylaldehyde

➠ Riemer-Temann reaction :



196) How many chiral carbons are in pentan-2, 3, 4-triol ? [March - 2022]

(A) 3 (B) 4 (C) 1 (D) 2

Ans. **(D)** 2

197) Reduction of which compound gives 2° alcohol ? [March - 2022]

(A) Acetaldehyde (B) Acetic acid

(C) Acetone (D) Ethyl acetate

Ans. **(C)** Acetone

➠ Reduction of ketone compound gives 2° alcohol.

198) Which product is obtained by oxidation of phenol with chromic acid ? [March - 2022]

(A) Benzene (B) Benzoic acid

(C) Benzoquinone (D) Acetophenone

Ans. **(C)** Benzoquinone

199) Under identical condition, which of the following has highest boiling point ? [March - 2022]

(A) Propan-1-ol (B) Butan-1-ol

(C) 2-Methylpropan-2-ol

(D) Butan-2-ol

Ans. **(B)** Butan-1-ol

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