



PRACTICE MCQS

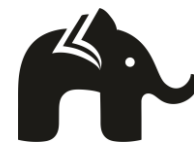
CLASS 12 CHEMISTRY (TERM - I)

**ALCOHOL, PHENOL
AND ETHER**

BY

learn-o-hub
learning simplified



**Question 1:**

Williamson's synthesis of preparing dimethyl ether is an:

- (a) S_N1 reaction
- (b) Elimination reaction
- (c) S_N2 reaction
- (d) Nucleophilic addition reaction

Answer: (c) S_N2 reaction

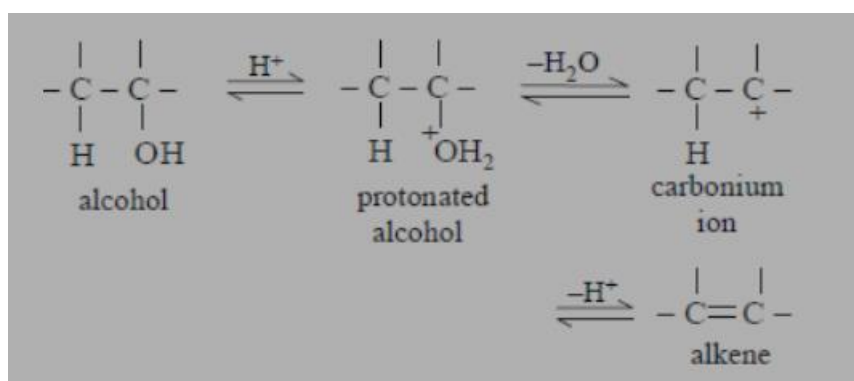
Alkoxide ion reacts with primary alkyl halide in a single step to form ether.

Question 2:

During dehydration of alcohols to alkenes by heating with concentrated H_2SO_4 , the initiation step is:

- (a) protonation of alcohol molecule
- (b) formation of carbocation
- (c) elimination of water
- (d) formation of an ester

Answer: (a) protonation of alcohol molecule



Dehydration of alcohol to alkene in presence of concentrated H_2SO_4 involves the $-OH$ group in the alcohol that donates two electrons to H^+ from the acid



reagent, forming an alkyloxonium ion. The deprotonated acid (the nucleophile) then attacks the hydrogen adjacent to the carbocation and form a double bond.

Thus, the initiation step is protonation of alcohol.

Question 3:

Which of the following reactions is used to prepare salicylaldehyde?

- (a) Kolbe's reaction
- (b) Etard reaction
- (c) Reimer- Tiemann reaction
- (d) Stephen's reduction.

Answer: (c) Reimer- Tiemann reaction

Kolbe's reaction is used to prepare salicylic acid, Etard reaction for benzaldehyde, Reimer- Tiemann reaction for salicylaldehyde and Stephen's reduction for aldehyde.

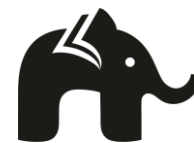
Question 4:

The boiling points of alcohols are higher than those of hydrocarbons of comparable masses due to:

- (a) Hydrogen bonding
- (b) Ion – dipole interaction
- (c) Dipole- dipole interaction
- (d) Van der Waal's forces.

Answer: (a) Hydrogen bonding

Alcohols form intermolecular hydrogen bonds.

**Question 5:**

Major product obtained on reaction of 3-Phenyl propene with HBr in presence of organic peroxide

- (a) 3- Phenyl 1- bromopropane
- (b) 1 –Phenyl -3- bromopropane
- (c) 1-Phenyl -2-bromopropane
- (d) 3-Phenyl -2- bromopropane

Answer: (b) 1 –Phenyl -3- bromopropane

$(C_6H_5)CH_2CH=CH_2 + HBr$ (organic peroxide) $\rightarrow (C_6H_5)CH_2CH_2CH_2Br$ anti-Markovnikov addition)

Question 6:

Lower molecular mass alcohols are:

- (a) miscible in limited amount of water
- (b) miscible in excess of water
- (c) miscible in water in all proportions
- (d) immiscible in water

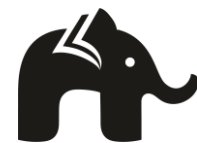
Answer: (c) miscible in water in all proportions

Lower molecular mass alcohols are able to form hydrogen bonds with water.

Question 7:

Phenol does not undergo nucleophilic substitution reaction easily due to:

- (a) acidic nature of phenol
- (b) partial double bond character of C-OH bond
- (c) partial double bond character of C-C bond



(d) instability of phenoxide ion

Answer: (b) partial double bond character of C-OH bond

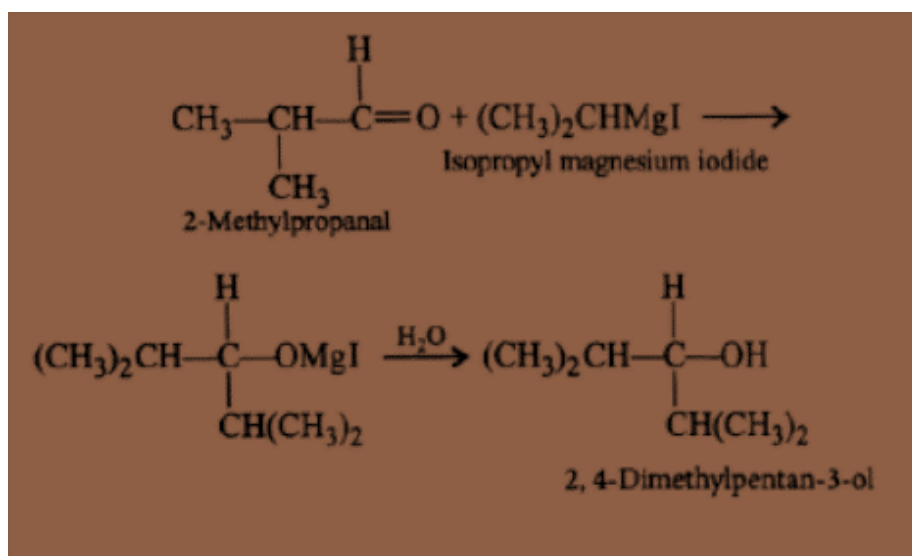
The C—O bond in phenols has some double-bond character due to resonance and hence cannot be easily cleaved by the nucleophile. In contrast, the C—O bond in alcohol is a pure single bond and hence can be easily cleaved by nucleophile.

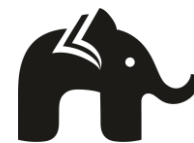
Question 8:

What would be the reactant and reagent used to obtain 2,4-dimethyl pentan-3-ol?

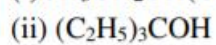
- (a) Propanal and propyl magnesium bromide
- (b) 3-methylbutanal and 2-methyl magnesium
- (c) 2-dimethylpropanone and methyl magnesium iodide
- (d) 2- methylpropanal and isopropyl magnesium iodide

Answer: (d) 2- methylpropanal and isopropyl magnesium iodide

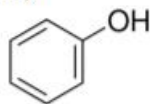


**Question 9:**

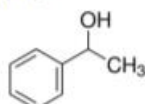
Identify the secondary alcohols from the following set:



(iii)



(iv)

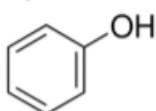


- (a) (i) and (iv)
 (b) (i) and (iii)
 (c) (i) and (ii)
 (d) (i), (iii) and (iv)

Answer: (a) (i) and (iv)

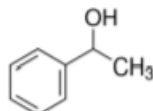
(i) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_3$ (secondary) (ii) $(\text{C}_2\text{H}_5)_3\text{COH}$ (tertiary)

(iii)



Phenol not an alcohol

(iv)

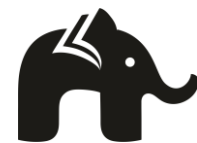


secondary

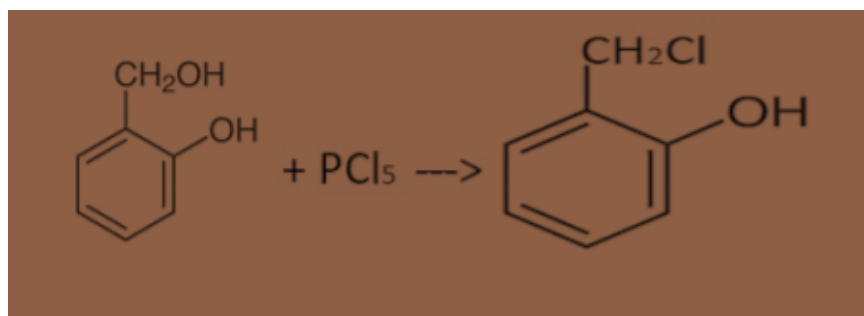
Question 10:

o-hydroxy benzyl alcohol when reacted with PCl_3 gives the product as (IUPAC name)

- (a) o- hydroxy benzyl chloride
 (b) 2- chloromethylphenol
 (c) o-chloromethyl chlorobenzene
 (d) 4-hydroxymethylphenol



Answer: (b) 2- chloromethylphenol



Question 11:

Which are not cleaved by HIO_4 ?

I: glycerol

II: glycol

III: 1, 3-propenediol

IV: methoxy-2-propanol

(a) I, II, III, IV

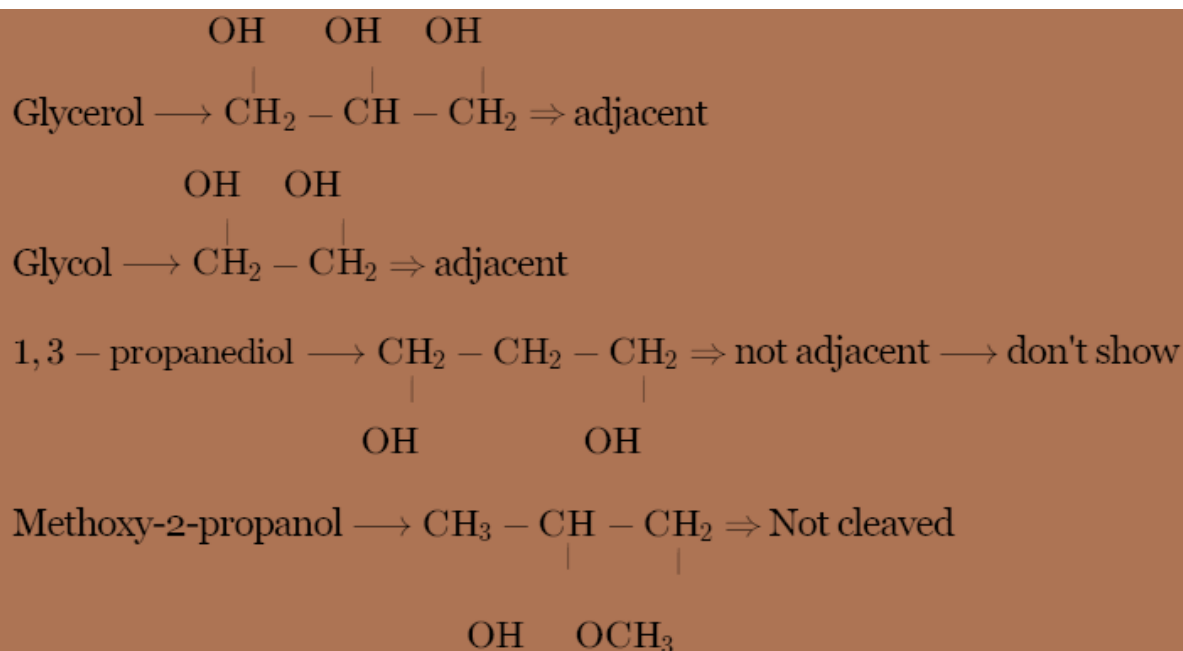
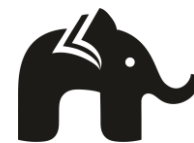
(b) I, II

(c) II, III

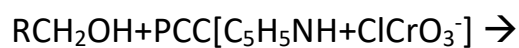
(d) III, IV

Answer: (d) III, IV

HIO_4 will not oxidise, diol from 1, 3 atom & not used for cleavage of ether.

**Question 12:**

For the following reaction, select the statement that best describes the change.



- (a) The alcohol is oxidized to an acid, and the Cr(VI) is reduced
- (b) The alcohol is oxidized to an aldehyde, and the Cr(VI) is reduced
- (c) The alcohol is reduced to an aldehyde, and the Cr(III) is oxidized
- (d) The alcohol is oxidized to a ketone, and the Cr(VI) is reduced

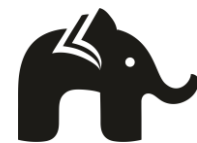
Answer: (b) The alcohol is oxidized to an aldehyde, and the Cr (VI) is reduced

$\text{Cr}^{6+} \rightarrow \text{Cr}^{3+}$ (PCC oxidises 1° alcohols to aldehyde).

Question 13:

The common reagent used for dehydration of alcohol is _____.

Answer: Conc. H_2SO_4 and Al_2O_3 .



The common reagent used for dehydration of alcohol is Conc. H_2SO_4 and Al_2O_3

Dehydration of alcohols can be done by:

a) Using aluminium oxide as catalyst.

This is a simple way of making gaseous alkenes like ethene. If ethanol vapour is passed over heated aluminium oxide powder, the ethanol is essentially cracked to give ethene and water vapour.

b) Using sulphuric acid at a temperature of $170^\circ C$.

Concentrated sulphuric acid produces messy results. Not only is it an acid, but it is also a strong oxidising agent. It oxidises some of the alcohol to carbon dioxide and at the same time is reduced itself to sulphur dioxide.

Both of these gases have to be removed from the alkene. It also reacts with alcohol to produce a mass of carbon. There are other side reactions as well.

Question 14:

An organic compound of molecular formula $C_4H_{10}O$ does not react with sodium. With excess of HI, it gives only one type of alkyl halide. The compound is:

- (a) Ethoxy ethane
- (b) 2- Methoxy propane
- (c) 1-Methoxy propane
- (d) 1-Butanol

Answer: (a) Ethoxy ethane

Since the organic compound does not react with sodium, it cannot be an alcohol (butanol). Given, the molecular formula is $C_4H_{10}O$.

With HI, it gives only one type of alkyl iodide. So, it must be a symmetrical ether.



Here, among all ethers, ethoxy ethane is symmetrical.

The reaction is as follows:



Assertion Reason Based Questions

In the following questions from 15 to 18 a statement of assertion followed by a statement of reason is given. Choose the correct answer out of the following choices.

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

Question 15:

Assertion (A): Phenols do not react with metal carbonates and metal hydrogen carbonates.

Reason (R): Metal carbonates and metal hydrogen carbonates are basic in nature.

Answer: (b) Both A and R are true but R is not the correct explanation of A.

Phenols are weaker acids ($K_a = 1.3 \times 10^{-10}$) than carboxylic acids ($K_a = 10^{-5}$) and carbonic acids ($K_a = 10^{-7}$). Therefore, phenols do not react with carbonates and bicarbonates.



Question 16:

Assertion (A): Phenols are more acidic than aliphatic alcohols.

Reason (R): Phenoxides are stabilized by resonance.

Answer: (a) Both A and R are true and R is the correct explanation of A

When a molecule of phenol loses a proton, it forms phenoxide ion which is stabilized by resonance as the negative charge is delocalized over aromatic nucleus. No such resonance is present when an alcohol loses a proton to form alkoxide ion. Hence, phenols are more acidic than alcohols.

Question 17:

Assertion (A): Lucas reagent can be used to distinguish between methanol and ethanol.

Reason (R): An equimolar mixture of anhydrous $ZnCl_2$ and conc. HCl is called Lucas reagent.

Answer: (c) A is true but R is false.

Both methanol and ethanol are 1° alcohol and hence cannot be distinguished by Lucas reagent.

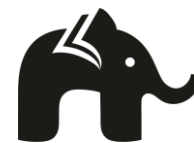
Question 18:

Assertion (A): p-Nitrophenol is less acidic than m-nitrophenol.

Reason (R): Phenol is weaker acid than carbonic acid.

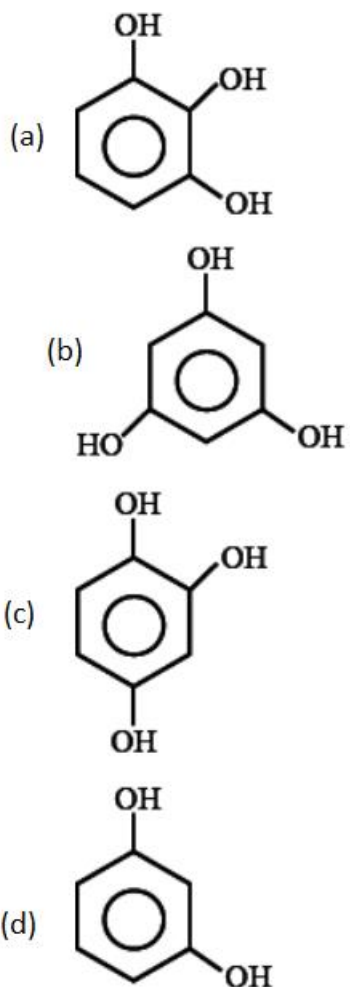
Answer: (d) A is false but R is true.

p-Nitrophenol is more acidic than m-nitrophenol due to +I effect and -m character of NO_2 group. At m-position only -I effect is considered.

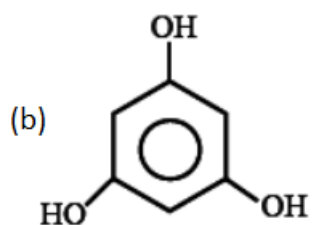


Question 19:

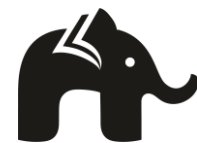
Which of the following compound can react with hydroxylamine?



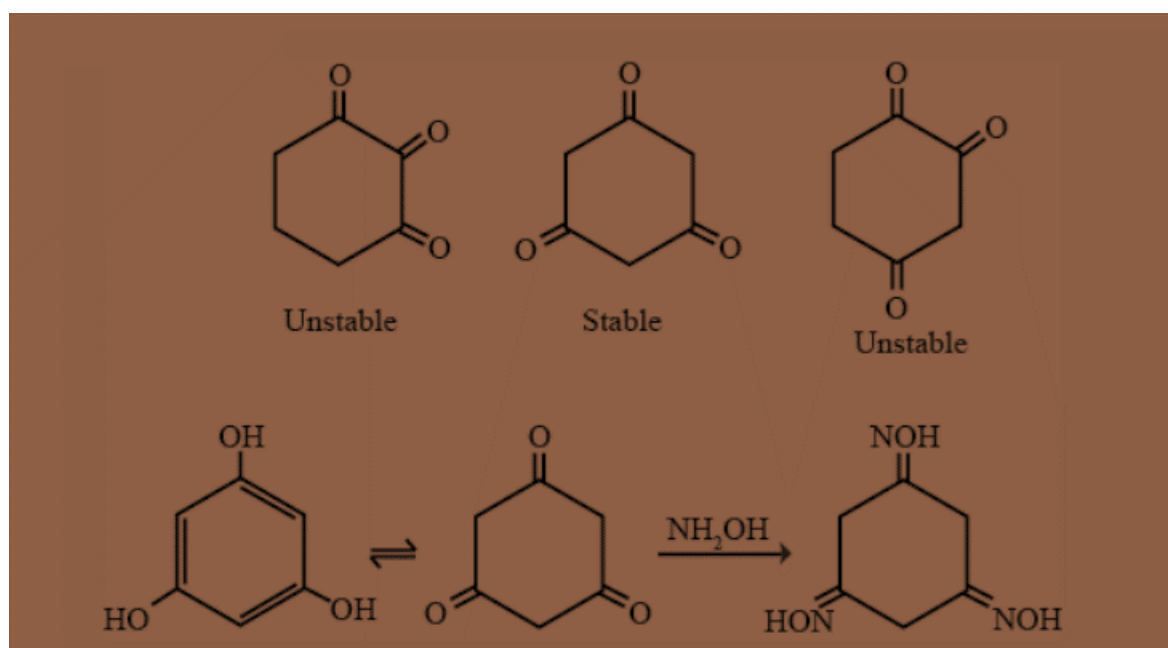
Answer:



Phenols show keto-enol tautomerism and the stability of the keto form depends upon the number of keto group (more the number of keto groups ,



higher will be stability of the keto tautomer). Thus trihydric phenols should exist in keto form in considerable amount but only when the two keto groups are not on adjacent carbon atoms which decreases - stability due to positive charge on adjacent carbon atoms .



Question 20:

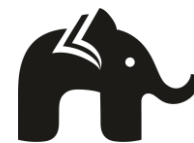
In Williamson's synthesis, ethoxyethane is prepared by:

- (a) passing ethanol over heated alumina
- (b) heating ethanol with dry Ag_2O
- (c) heating sodium ethoxide with ethyl bromide
- (d) treating ethyl alcohol with excess of H_2SO_4 at 430-440K

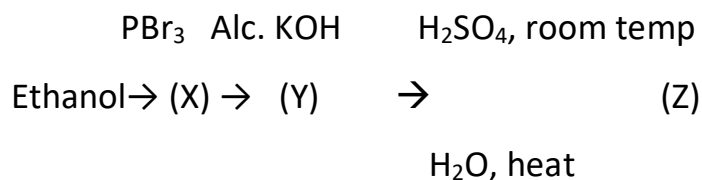
Answer: (c) heating sodium ethoxide with ethyl bromide

Williamson's synthesis is an organic reaction forming an ether from organohalide and alkoxide.



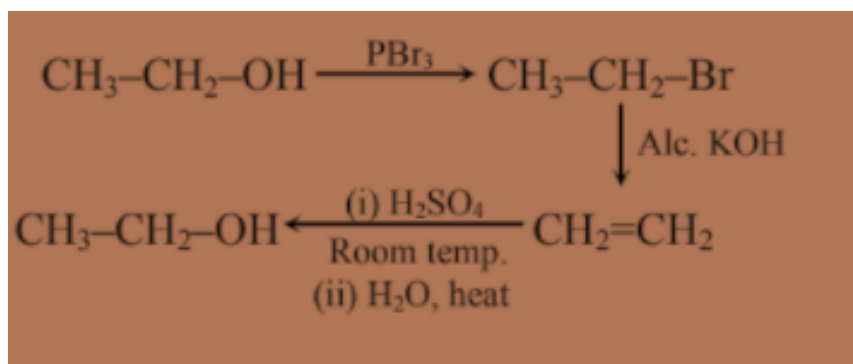
**Question 21:**

Identify (Z) in the following reaction series:



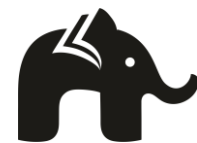
- (a) $\text{H}_2\text{C}=\text{CH}_2$
- (b) $\text{CH}_3\text{CH}_2\text{OH}$
- (c) $\text{CH}_3\text{CH}_2\text{OSO}_3\text{H}$
- (d) $\text{C}_2\text{H}_5\text{OC}_2\text{H}_5$

Answer: (b) $\text{CH}_3\text{CH}_2\text{OH}$

**Question 22:**

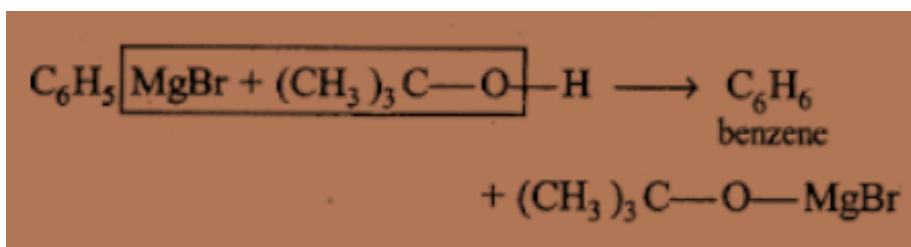
When phenyl magnesium bromide reacts with tertiary butanol, which of the following is formed?

- (a) benzene
- (b) phenol
- (c) t-butyl benzene
- (d) t-butyl phenyl ether



Answer: (a) benzene

Phenyl magnesium bromide reacts with t-butanol benzene is obtained. Grignard reagent reacts with compounds containing active hydrogen to form hydrocarbons corresponding to alkyl(or aryl) part of the reagent.



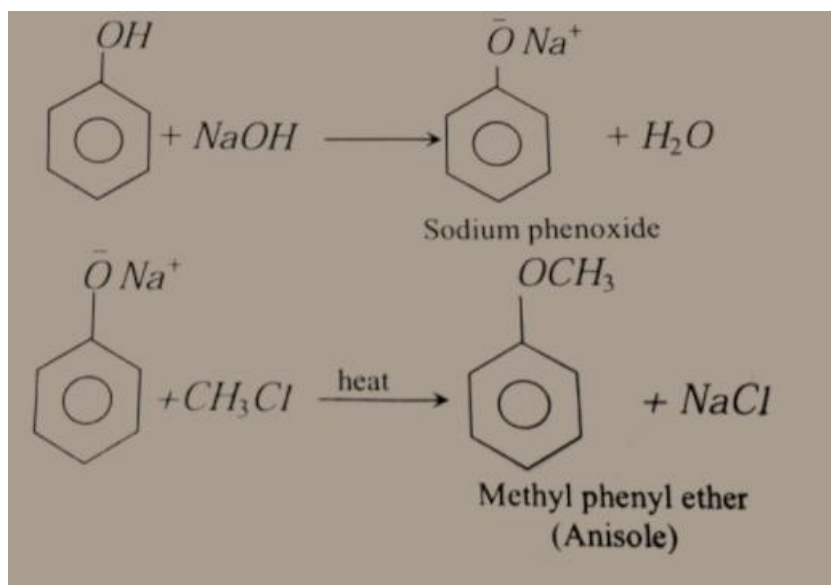
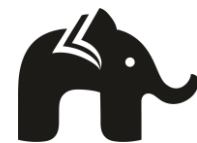
Question 23:

Anisole is the product obtained from phenol by the reaction known as:

- (a) Coupling
- (b) Etherification
- (c) Oxidation
- (d) Esterification

Answer: (b) Etherification

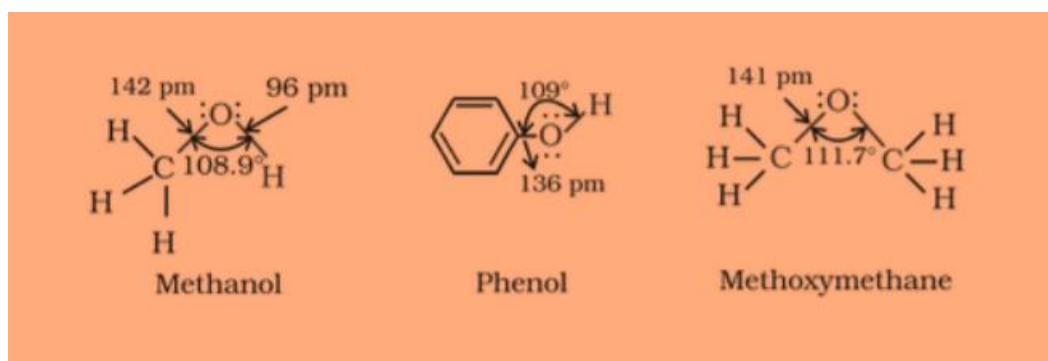
Phenol reacts with alkyl halides in alkali solution to form phenyl ethers (Williamson's synthesis). The phenoxide ion is a nucleophile and will replace halogen of alkyl halide.



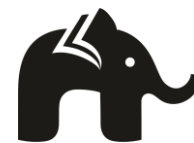
Case-Study Based Questions

Question 24:

In alcohols, the oxygen of the $-\text{OH}$ group is attached to carbon by a sigma (σ) bond formed by the overlap of a sp^3 hybridised orbital of carbon with a sp^3 hybridised orbital of oxygen. Figure given below depicts structural aspects of methanol, phenol and methoxymethane.



1. The bond angle C-O-H in alcohols is slightly less than the tetrahedral angle ($109^\circ 28'$). It is due to –



- (a) The attraction between C-O and O-H bond pairs.
- (b) The repulsion between the unshared electron pairs of oxygen.
- (c) The repulsion between neighbouring C-H bonds.
- (d) The high electronegativity of oxygen.

2. In phenols, the -OH group is attached to _____ hybridised carbon of an aromatic ring.

- (a) sp^3
- (b) sp
- (c) dsp^2
- (d) sp^2

3. The C – O bond length in phenol is slightly less than that in methanol. This is due to –

- (a) Partial double bond character on account of the conjugation of unshared electron pair of oxygen with the aromatic ring.
- (b) Presence of heavier group – phenol.
- (c) Positioning of lone pair over oxygen in 3 – D space.
- (d) sp^3 hybridised state of carbon to which oxygen is attached.

4. The bond angle in ethers is slightly greater than the tetrahedral angle due to

- (a) Presence of four electron pair around the oxygen.
- (b) The repulsive interaction between the two bulky (-R) groups.
- (c) Absence of O – H bond.
- (d) The attractive interaction between the two bulky (-R) groups.

5. In methoxymethane, the oxygen atom is _____ hybridised.



- (a) sp^3
- (b) sp
- (c) dsp^2
- (d) sp

Answer:

1. (b) The repulsion between the unshared electron pairs of oxygen.

The bond angle in C–O...–H in alcohols is slightly less than tetrahedral is slightly less than tetrahedral angle ($109^\circ 28'$). It is due to the repulsion between the unshared electron pairs of oxygen. In alcohols, two lone pair of electrons are present. Therefore, there is comparatively more repulsion and less bond angle.

The C–O–C bond angle in ethers is slightly greater than the tetrahedral angle due to the repulsive interaction between the two bulky (-R) groups.



2. (d) sp^2

In phenol carbon atom attached to -OH group is bonded with 3 σ bond and 1 π bond. Hence, the hybridisation will be sp^2 .

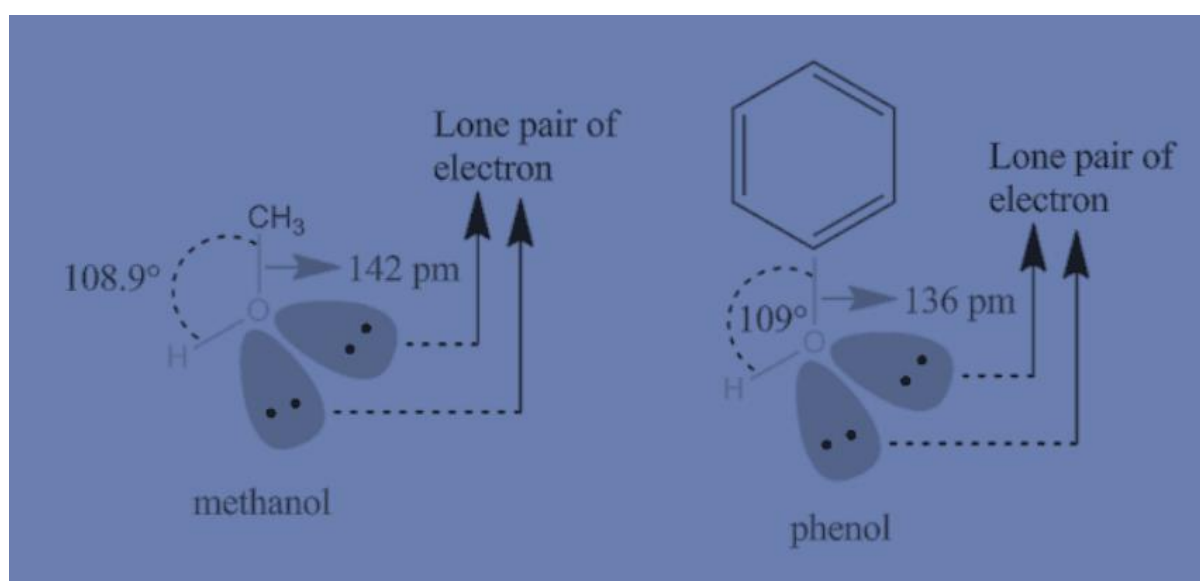
3. (a) Partial double bond character on account of the conjugation of unshared electron pair of oxygen with the aromatic ring.



(i) In phenol, conjugation of unshared electron pair over oxygen with aromatic ring results in partial double bond character in carbon-oxygen bond.

(ii) In phenol, oxygen is attached to a sp^2 hybridised carbon atom while in methanol, it is attached to a sp^3 hybridized carbon atom. The bond formed between oxygen and sp^2 hybridised carbon is more stable than that formed between oxygen and sp^3 hybridised carbon.

Therefore, phenolic C — O bond (136 pm) is slightly less than methanolic C — O (142 pm) bond.

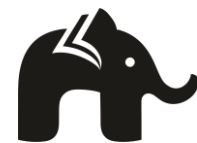


4. (b) The repulsive interaction between the two bulky (–R) groups.

In the ether, the bond angle is greater than the tetrahedral angle due to repulsion of bulky alkyl groups in ethers bond angles is slightly greater than tetrahedral bond angle.

5. (a) sp^3

Ether is a compound having alkyl groups which is connected with an oxygen atom. Each carbon and one oxygen is sp^3 hybridized. Dimethyl ether has a bent



structure. It is also known as methoxy methane since two methyl groups are attached.

Question 25:

By a proper choice of reagents, both symmetrical and unsymmetrical ethers can be prepared by Williamson synthesis which involves the reaction between an alkyl halide and an alkoxide ion. The reverse process involves the cleavage of ethers to give back the original alkyl halide and the alcohol can be carried out by heating the ether with HI at 373 K.

1. The mechanism of Williamson synthesis involves –

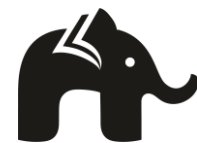
- (a) Nucleophilic substitution bimolecular
- (b) Nucleophilic substitution unimolecular
- (c) Electrophilic substitution bimolecular
- (d) Electrophilic substitution unimolecular

2. Benzyl ethyl ether reacts with HI to form –

- (a) p-iodotoluene and ethyl alcohol.
- (b) Benzyl alcohol and ethyl iodide.
- (c) Benzyl iodide and ethyl alcohol.
- (d) Iodobenzene and ethyl alcohol.

3. Allyl phenyl ether can be prepared by heating –

- (a) $C_6H_5Br + CH_2=CH-CH_2ONa$
- (b) $CH_2=CHCH_2Br + C_6H_5ONa$
- (c) $C_6H_5CH=CHBr + CH_3ONa$
- (d) $CH_2=CHBr + C_6H_5CH_2ONa$



4. Which of the following ethers are not cleaved by HI?

- (a) Dicyclohexyl ether
- (b) Ethyl phenyl ether
- (c) Di – tert – butyl ether
- (d) Diphenyl ether

Answer:

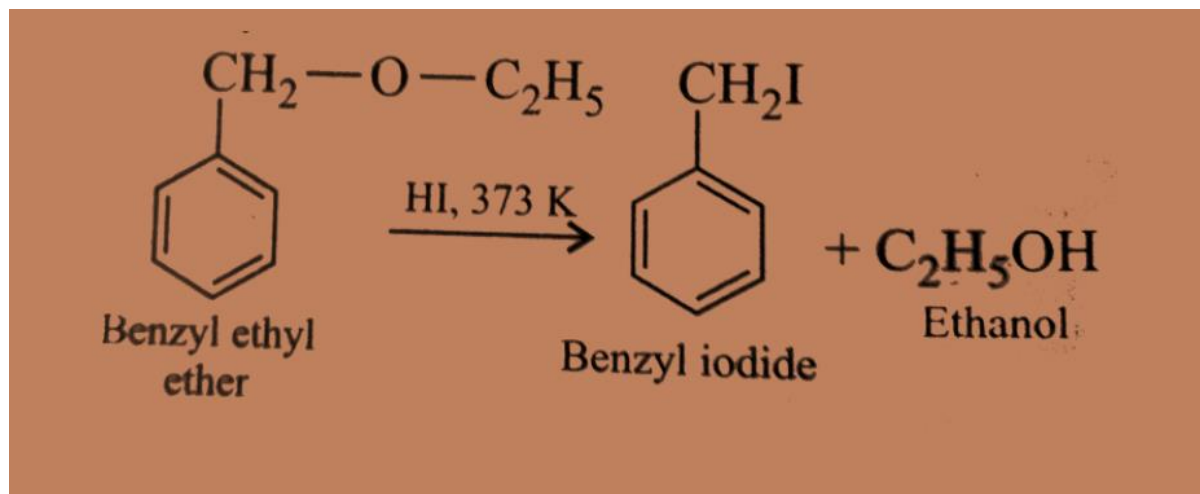
1. (a) Nucleophilic substitution bimolecular

When sodium or potassium alkoxide is heated with an alkyl halide to give ether, this reaction is known as Williamson's synthesis.



This is an example of nucleophilic substitution and follow $\text{S}_{\text{N}}2$ mechanism.

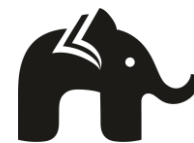
2. (c) Benzyl iodide and ethyl alcohol.



3. (b) $\text{C}_6\text{H}_5\text{OCH}_2\text{CH}=\text{CH}_2$ is allyl phenyl ether

Allyl phenyl ether can be prepared by heating





4. (d) Diphenyl ether

In diphenyl ether, oxygen atom is bonded to phenyl ring and both bonds are strong. They cannot be cleaved by HI.
