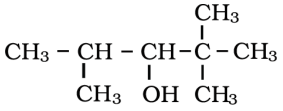
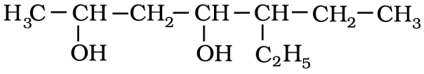
GRADE: XII **SUBJECT: CHEMISTRY**

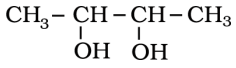
TOPIC: ALCOHOLS, PHENOLS, AND ETHERS

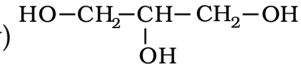
Section-A Short Answer Type Questions [2 & 3 marks]

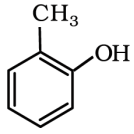
1. Write IUPAC names of the following compounds:

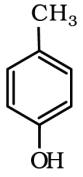
i) 

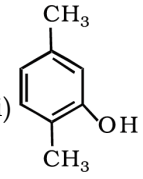
ii) 

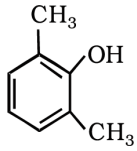
iii) 

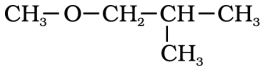
iv) 

v) 

vi) 

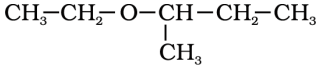
vii) 

viii) 

ix) 

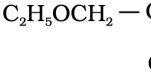
x) $C_6H_5–O–C_2H_5$

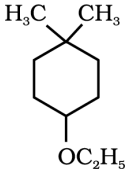
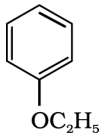
xi) $C_6H_5–O–C_7H_{15}$(n–)

xii) 

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.
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 above question (i) as primary, secondary and tertiary alcohols.
4. Explain why propanol has higher boiling point than that of the hydrocarbon, butane?
5. Alcohols are comparatively more soluble in water than hydrocarbons of comparable molecular masses. Explain this fact.
6. What is meant by hydroboration-oxidation reaction? Illustrate it with an example.
7. Give the structures and IUPAC names of monohydric phenols of molecular formula, C_7H_8O.
8. While separating a mixture of ortho and para nitrophenols by steam distillation, name the isomer which will be steam volatile. Give reason.
9. Give the equations of reactions for the preparation of phenol from cumene.
10. Write chemical reaction for the preparation of phenol from chlorobenzene.
11. Write the mechanism of hydration of ethene to yield ethanol.
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 synthesise:
    i) 1-phenylethanol from a suitable alkene.
    ii) cyclohexylmethanol using an alkyl halide by an S_N2 reaction.
    iii) pentan-1-ol using a suitable alkyl halide?
14. Give two reactions that show the acidic nature of phenol. Compare acidity of phenol with that of ethanol.
15. Explain why is ortho nitrophenol more acidic than ortho methoxyphenol ?

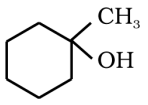
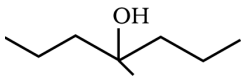
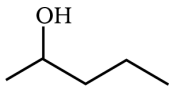
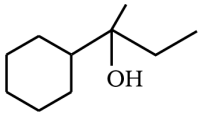
16. Explain how does the –OH group attached to a carbon of benzene ring activate it towards electrophilic substitution?
17. Give equations of the following reactions:
    i) Oxidation of propan-1-ol with alkaline $KMnO_4$ solution.
    ii) Bromine in CS_2 with phenol.
    iii) Dilute HNO_3 with phenol.
    iv) Treating phenol wih chloroform in presence of aqueous NaOH.
18. Explain the following with an example.
    i) Kolbe's reaction. ii) Reimer-Tiemann reaction.
19. Write the mechanism of acid dehydration of ethanol to yield ethene.
20. How are the following conversions carried out?
    i) Propene → Propan-2-ol.
    ii) Benzyl chloride → Benzyl alcohol.
    iii) Ethyl magnesium chloride → Propan-1-ol.
    iv) Methyl magnesium bromide → 2-Methylpropan-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.
22. Give reason for the higher boiling point of ethanol in comparison to methoxymethane.
23. Give IUPAC names of the following ethers:

    i) 
    ii) $CH_3OCH_2CH_2Cl$ iii) $O_2N–C_6H_4–OCH_3(p)$ iv) $CH_3CH_2CH_2OCH_3$

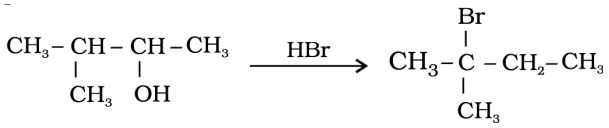
    v) 
    vi) 

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
25. Illustrate with examples the limitations of Williamson synthesis for the preparation of certain types of ethers.
26. How is 1-propoxypropane synthesised from propan-1-ol? Write mechanism of this reaction.
27. Preparation of ethers by acid dehydration of secondary or tertiary alcohols is not a suitable method. Give reason.
28. Write the equation of the reaction of hydrogen iodide with:
    i) 1-propoxypropane ii) methoxybenzene and iii) benzyl ethyl ether.
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.
30. Write the mechanism of the reaction of HI with methoxymethane.
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.

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

i) 
ii) 
iii) 
iv) 

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



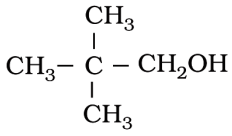
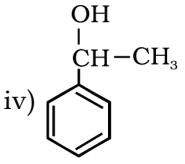
Give a mechanism for this reaction.

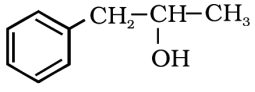
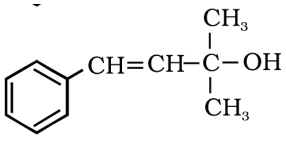
Section-B Long Answer Type Questions [5 marks]

34. Explain the following with an example.
i) Williamson ether synthesis. ii) Unsymmetrical ether.

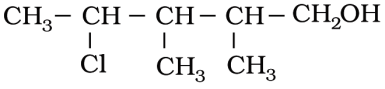
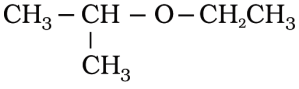
Section-C - Numericals

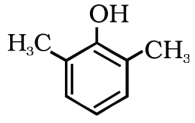
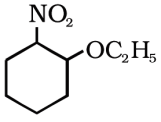
1. Classify the following as primary, secondary and tertiary alcohols:

i) 
ii) $H_2C = CH - CH_2OH$ iii) $CH_3 - CH_2 - CH_2 - OH$
iv) 

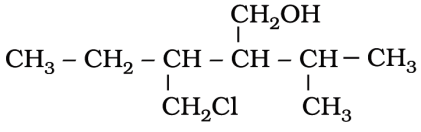
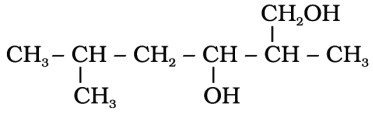
v) 
vi) 

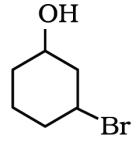
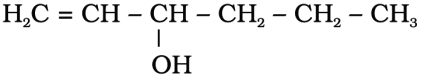
2. Identify allylic alcohols in the above examples.
3. Give IUPAC names of the following compounds:

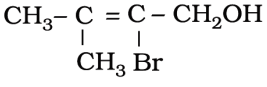
i) 
ii) 

iii) 
iv) 

4. Name the following compounds according to IUPAC system.

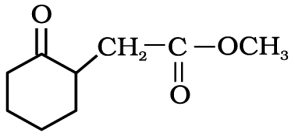
i) 
ii) 

iii) 
iv) 

v) 

5. Give the structures and IUPAC names of the products expected from the following reactions:
   a) Catalytic reduction of butanal. b) Hydration of propene in the presence of dilute sulphuric acid.
   c) Reaction of propanone with methylmagnesium bromide followed by hydrolysis.
6. Write structures of the products of the following reactions:

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

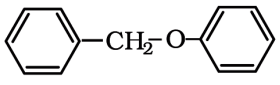
ii) 

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

7. Arrange the following sets of compounds in order of their increasing boiling points:
   a) Pentan-1-ol, butan-1-ol, butan-2-ol, ethanol, propan-1-ol, methanol.
   b) Pentan-1-ol, n-butane, pentanal, ethoxyethane.
8. 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.
9. 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.
10. Give structures of the products you would expect when each of the following alcohol reacts with
    a) HCl –$ZnCl_2$ b) HBr and c) $SOCl_2$.
    i) Butan-1-ol ii) 2-Methylbutan-2-ol
11. Predict the major product of acid catalysed dehydration of
    i) 1-methylcyclohexanol and ii) butan-1-ol
12. Ortho and para nitrophenols are more acidic than phenol. Draw the resonance structures of the corresponding phenoxide ions.
13. Write the equations involved in the following reactions:
    i) Reimer - Tiemann reaction ii) Kolbe's reaction
14. The following is not an appropriate reaction for the preparation of t-butyl ethyl ether.

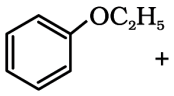
$$C_2H_5ONa + CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-Cl \longrightarrow CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}-OC_2H_5$$

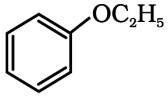
    i) What would be the major product of this reaction ?
    ii) Write a suitable reaction for the preparation of t-butylethyl ether.
15. Explain the following with an example.
    i) Williamson ether synthesis. ii) Unsymmetrical ether.
16. Give the major products that are formed by heating each of the following ethers with HI.

i) $CH_3–CH_2–\underset{\displaystyle CH_3}{\underset{|}{CH}}–CH_2–O–CH_2–CH_3$ ii) $CH_3–CH_2–CH_2–O–\underset{\displaystyle CH_3}{\overset{\displaystyle CH_3}{\overset{|}{\underset{|}{C}}}}–CH_2CH_3$ iii) 

17. Predict the products of the following reactions:

i) $CH_3 - CH_2 - CH_2 - O - CH_3 + HBr \rightarrow$

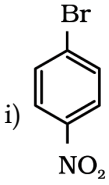
ii)  + HBr $\longrightarrow$

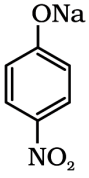
iii)  $\xrightarrow[\text{Conc. } HNO_3]{\text{Conc. } H_2SO_4}$

iv) $(CH_3)_3 C - OC_2H_5 \xrightarrow{HI}$

18. Write the reactions of Williamson synthesis of 2-ethoxy-3-methylpentane starting from ethanol and 3-methylpentan-2-ol.

19. Which of the following is an appropriate set of reactants for the preparation of 1-methoxy-4-nitrobenzene and why?

i)  + CH_3ONa

ii)  + CH_3Br