Ordinary Thinking

Objective Questions

General introduction of alcohol, Phenol & Ethers

1. Butane-2-ol is [CPMT 1977, 89]

(a) Primary alcohol (b) Secondary alcohol

(c) Tertiary alcohol (d) Aldehyde

2. Picric acid is [CPMT 1971, 80, 81; DPMT 1983; MP PMT 1990; BHU 1996]

(a) Trinitroaniline (b) Trinitrotoluene

(c) A volatile liquid (d) 2, 4, 6 trinitrophenol

3. 3- pentanol is a [RPET 2002]

(a) Primary alcohol (b) Secondary alcohol

(c) Tertiary alcohol (d) None of these

4. Glycerol is a [DPMT 1984, 2000; MP PET 2001; J & K 2005]

(a) Primary alcohol (b) Monohydric alcohol

(c) Secondary alcohol (d) Trihydric alcohol

5. Cresols are

(a) Hydroxy toluenes (b) Dihydric phenols

(c) Trihydric phenols (d) Trihydric alcohols

6. Carbon percentage is maximum in [BHU 1998]

(a) Pyrene (b) Gammexane

(c) Ethylene glycol (d) PVC

7. Ortho-dihydroxy benzene is

(a) Carvacrol (b) Resorcinol

(c) Catechol (d) Orcinol

8. Glycerine has [MP PMT/PET 1988; MP PMT 1989, 91; AIIMS 1997]

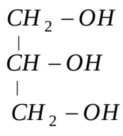
(a) One primary and two secondary $-OH$ groups

(b) One secondary and two primary $-OH$ groups

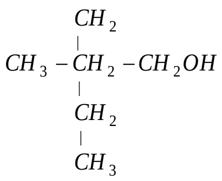
(c) Three primary $-OH$ groups

(d) Three secondary $-OH$ groups

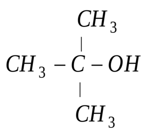
9. Which of the following is tertiary alcohol [DPMT 2000]

(a) 

$$\begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array}$$

(b) 

$$\begin{array}{c}\qquad CH_2\\ \qquad |\\ CH_3-CH_2-CH_2OH\\ \qquad |\\ \qquad CH_2\\ \qquad |\\ \qquad CH_3\end{array}$$

(c) 

$$\begin{array}{c}CH_3\\ |\\ CH_3-C-OH\\ |\\ CH_3\end{array}$$

(d) CH_3-CH_2-OH

10. Which is primary alcohol [CPMT 1980]

(a) Butane-2-ol (b) Butane-1-ol

(c) Propane-2-ol (d) Isopropyl alcohol

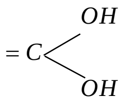
11. Carbinol is [RPMT 2000]

(a) C_2H_5OH (b) CH_3OH

(c) $(CH_3)_2CHOH$ (d) $CH_3CH_2CH(OH)CH_3$

12. General formula of primary alcohol is [CPMT 1975]

(a) $>CHOH$ (b) $>C-OH$

(c) $-CH_2OH$ (d) 

$$=C\begin{array}{l}\diagup OH\\ \diagdown OH\end{array}$$

13. Which of following is phenolic [J & K 2005]

(a) Phthalic acid (b) Phosphoric acid

(c) Picric acid (d) Phenylacetic acid

14. 1, 2, 3-trihydroxybenzene is also known as

(a) Pyrogallol (b) Phloroglucinol

(c) Resorcinol (d) Quinol

15. Butanal is an example of [MP PET 1991]

(a) Primary alcohol (b) Secondary alcohol

(c) Aliphatic aldehyde (d) Aliphatic ketone

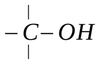
16. Cyclohexanol is a

(a) Primary alcohol (b) Secondary alcohol

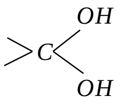
(c) Tertiary alcohol (d) Phenol

17. The characteristic grouping of secondary alcohols is [DPMT 1984]

(a) $-CH_2OH$ (b) $>CHOH$

(c) 

$$\begin{array}{c}|\\ -C-OH\\ |\end{array}$$

(d) 

$$>C\begin{array}{l}\diagup OH\\ \diagdown OH\end{array}$$

18. Which of the following are isomers [AFMC 2005; BCECE 2005]

(a) Methyl alcohol and dimethyl ether

(b) Ethyl alcohol and dimethyl ether

(c) Acetone and acetaldehyde

(d) Propionic acid and propanone

19. The compound $HOCH_2-CH_2OH$ is

(a) Ethane glycol (b) Ethylene glycol

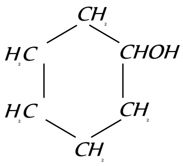
(c) Ethylidene alcohol (d) Dimethyl alcohol

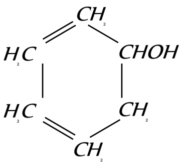
20. Methylated spirit is

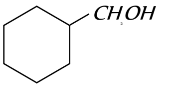
(a) Methanol (b) Methanol + ethanol

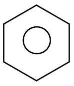
(c) Methanoic acid (d) Methanamide

21. The structural formula of cyclohexanol is [Bihar CEE 1995]

(a) 

(b) 

(c) 

(d) 

22. Molecular formula of amyl alcohol is

(a) $C_7H_{14}O$ (b) $C_6H_{13}O$

(c) $C_5H_{12}O$ (d) $C_5H_{10}O$

23. Carbolic acid is [MP PET/PMT 1998; RPET 1999; KCET (Engg./Med.) 1999; BHU 2000; MP PET 2003]

(a) Phenol (b) Phenyl benzoate

(c) Phenyl acetate (d) Salol

24. Absolute alcohol is [RPMT 1997]

(a) 100% pure ethanol

(b) 95% alcohol + 5% H_2O

(c) Ethanol + water + phenol

(d) 95% ethanol + 5% methanol

25. Which of the following is dihydric alcohol [DCE 2004]
(a) Glycerol (b) Ethylene glycol
(c) Catechol (d) Resorcinol

26. Wood spirit is known as [AFMC 2004]
(a) Methanol (b) Ethanol
(c) Acetone (d) Benzene

27. Oxygen atom in ether is [MP PMT/PET 1988]
(a) Very active (b) Replaceable
(c) Comparatively inert (d) Active

28. Which of the following is a simple ether [AFMC 1997]
(a) CH_3OCH_3 (b) $C_2H_5OCH_3$
(c) $C_6H_5OCH_3$ (d) $C_6H_5OC_2H_5$

29. An example of a compound with the functional group '$-O-$' is[CPMT 1983]
(a) Acetic acid (b) Methyl alcohol
(c) Diethyl ether (d) Acetone

30. Which of the following do not contain an acyl group
(a) Acid chloride (b) Amide
(c) Ester (d) Ether

31. Name of $(CH_3)_2HC-O-CH_2-CH_2-CH_3$ is [MP PMT 1992]
(a) Isopropyl propyl ether (b) Dipropyl ether
(c) Di-isopropyl ether (d) Isopropyl propyl ketone

32. Acetals are [BVP 2003]
(a) Ketones (b) Diethers
(c) Aldehyde (d) Hydroxy aldehydes

33. In ethers, the $C-O-C$ bond angle is
(a) 180^o (b) 90^o
(c) 110^o (d) 160^o

34. According to Lewis concept of acids and bases, ether is [CPMT 1994]
(a) Acidic (b) Basic
(c) Neutral (d) Amphoteric

35. The compound which is not isomeric with diethyl ether is [IIT 1981; CPMT 1989; Bihar MEE 1995; MP PET 2001]
(a) *n*-propylmethyl ether (b) Butan-1-*ol*
(c) 2-methylpropan-2-*ol* (d) Butanone

36. Structure of diethyl ether is confirmed by [DPMT 1985]
(a) Kolbe's synthesis (b) Frankland's synthesis
(c) Wurtz's synthesis (d) Williamson's synthesis

37. Fermentation is an [CPMT 1977; RPMT 1999]
(a) Endothermic reaction (b) Exothermic reaction
(c) Reversible reaction (d) None of these

38. Nitroglycerine is
(a) An ester (b) An alcohol
(c) A nitro compound (d) An acid

39. Which of the following are known as mercaptans [Pb. PMT 2002]
(a) Thio-alcohols (b) Thio-ethers
(c) Thio-acids (d) Thio-aldehydes

Preparation of alcohol, Phenol and Ethers

1. Ethanol is prepared industrially by [MP PMT 1989]
(a) Hydration of ethylene (b) Fermentation of sugars
(c) Both the above (d) None of these

2. Ethyl alcohol is industrially prepared from ethylene by [CPMT 1985]
(a) Permanganate oxidation
(b) Catalytic reduction
(c) Absorbing in H_2SO_4 followed by hydrolysis
(d) Fermentation

3. Propene, $CH_3-CH=CH_2$ can be converted to 1-propanol by oxidation. Which set of reagents among the following is ideal to effect the conversion [CBSE PMT 1991]
(a) Alkaline $KMnO_4$
(b) B_2H_6 and alkaline H_2O_2
(c) O_3 / Zn dust
(d) $OsO_4 / CH_4, Cl_2$

4. Which one of the following will produce a primary alcohol by reacting with CH_3MgI [MP PET 1991]
(a) Acetone (b) Methyl cyanide
(c) Ethylene oxide (d) Ethyl acetate

5. The fermentation of starch to give alcohol occurs mainly with the help of [CPMT 1971; MH CET 1999; RPMT 2000]
(a) O_2 (b) Air
(c) CO_2 (d) Enzymes

6. Coconut oil upon alkaline hydrolysis gives [MP PET 1991; AFMC 2000; KCET 2001; BCECE 2005]
(a) Glycol (b) Alcohol
(c) Glycerol (d) Ethylene oxide

7. Which enzyme converts glucose and fructose both into ethanol [MP PMT 1989, 90, 96; CPMT 1983, 84, 86, 94; KCET 1989; MNR 1978; MP PET 1994, 99]
(a) Diastase (b) Invertase
(c) Zymase (d) Maltase

8. Chlorination of toluene in the presence of light and heat followed by treatment with aqueous *NaOH* gives [IIT-JEE 1990]
(a) *o*-cresol (b) *p*-cresol
(c) 2, 4-dihydroxy toluene (d) Benzyl alcohol

9. In the commercial manufacture of ethyl alcohol from starchy substances by fermentation method, which enzymes stepwise complete the fermentation reaction [BIT 1992]
(a) Diastase, maltase and zymase
(b) Maltase, zymase and invertase
(c) Diastase, zymase and lactase
(d) Diastase, invertase and zymase

10. Primary alcohols can be obtained from the reaction of the *RMgX* with [Pb. PMT 2001]
(a) CO_2 (b) $HCHO$
(c) CH_3CHO (d) H_2O

11. On heating aqueous solution of benzene diazonium chloride, which is formed [CPMT 1988; BHU 1980]
(a) Benzene (b) Chlorobenzene
(c) Phenol (d) Aniline

12. $LiAlH_4$ converts acetic acid into [CPMT 1977; MP PMT 1990, 92]
(a) Acetaldehyde (b) Methane
(c) Ethyl alcohol (d) Methyl alcohol

13. Formaldehyde gives an additive product with methyl magnesium iodide which on aqueous hydrolysis gives [MP PMT/PET 1988]
(a) Isopropyl alcohol (b) Ethyl alcohol
(c) Methyl alcohol (d) Propyl alcohol

14. Benzyl alcohol is obtained from benzaldehyde by [CPMT 1983; MNR 1993]
(a) Fittig's reaction (b) Cannizaro's reaction
(c) Kolbe's reaction (d) Wurtz's reaction

15. Benzene diazonium chloride on boiling with dilute sulphuric acid gives [MP PMT 1983]
(a) Toluene (b) Benzoic acid
(c) Benzene (d) Phenol

16. The reaction given below is known as

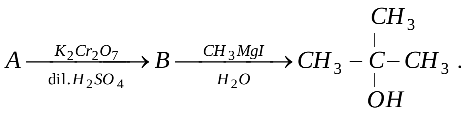
$$C_2H_5ONa + IC_2H_5 \longrightarrow C_2H_5OC_2H_5 + NaI$$

[CPMT 1990; KCET 1990; MH CET 2003; Pb. CET 2002]
(a) Kolbe's synthesis (b) Wurtz's synthesis
(c) Williamson's synthesis (d) Grignard's synthesis

17. Salicylaldehyde can be prepared from [CPMT 1983]
(a) Phenol and chloroform
(b) Phenol, chloroform and sodium hydroxide
(c) Phenol, carbon tetrachloride and *NaOH*
(d) None of these

18. If formaldehyde and potassium hydroxide are heated, then we get [CPMT 1989, 90; KCET 2000]
(a) Acetylene (b) Methane
(c) Methyl alcohol (d) Ethyl formate

19. An organic compound dissolved in dry benzene evolved hydrogen on treatment with sodium. It is [NCERT 1981; SCRA 1990]
(a) A ketone (b) An aldehyde
(c) A tertiary amine (d) An alcohol

20. 

$$A \xrightarrow[\text{dil.}H_2SO_4]{K_2Cr_2O_7} B \xrightarrow[H_2O]{CH_3MgI} CH_3-\overset{\overset{\large CH_3}{|}}{\underset{\underset{\large OH}{|}}{C}}-CH_3$$

. The reactant *A* is [MH CET 2002, 03; AFMC 2004; MP PMT/PET 1988; EAMCET 1989; CPMT 1988; MP PET 2000]
(a) $CH_3CHOHCH_3$ (b) CH_3COCH_3
(c) C_2H_5OH (d) CH_3COOH

21. The reaction, water gas $(CO+H_2)+H_2$ $673K, 300$ atmosphere in presence of the catalyst Cr_2O_3 / ZnO is used for the manufacture of[MP PMT 1989]
(a) *HCHO* (b) *HCOOH*
(c) CH_3OH (d) CH_3COOH

22. $CH_2=CH_2 + B_2H_6 \xrightarrow[H_2SO_4]{NaOH}$ Product.
Product in above reaction is [RPMT 2003]
(a) CH_3CH_2CHO (b) CH_3CH_2OH
(c) CH_3CHO (d) None of these

23. Phenolphthalein is obtained by heating phthalic anhydride with conc. H_2SO_4 and [BHU 1996]
(a) Benzyl alcohol (b) Benzene
(c) Phenol (d) Benzoic acid

24. Maltose on hydrolysis gives [BHU 1996; CPMT 2001]
(a) Mannose + glucose (b) Galactose + glucose
(c) Glucose (d) Mannose + fructose

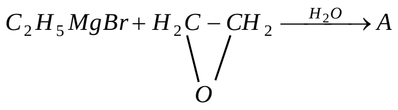
25. Absolute alcohol can be obtained from rectified spirit [KCET 1985]
(a) By removing the water in it using concentrated sulphuric acid
(b) By removing the water using phosphorus pentoxide
(c) By distilling with the appropriate amount of benzene
(d) By distilling over plenty of quick lime

26. Grignard reagent reacts with compounds containing which of the following groups [MNR 1987]
(a) $>C=O$ (b) $-C\equiv N$
(c) $>C=S$ (d) All of these

27. Oil $+ NaOH_{(aq)} \xrightarrow{\Delta}$ Glycerol + Soap
Above reaction is called [UPSEAT 2001]
(a) Saponification (b) Esterification
(c) Hydrogenation (d) None of these

28. Acetone on treatment with CH_3-Mg-I and on further hydrolysis gives [UPSEAT 2000]
(a) Isopropyl alcohol (b) Primary alcohol
(c) Acetic acid (d) 2-methyl 2-propanol

29. In the following reaction '*A*' is



$$C_2H_5MgBr + \underset{\diagdown\ \diagup \atop O}{H_2C-CH_2} \xrightarrow{H_2O} A$$

[MP PET 1994; CBSE PMT 1998]
(a) $C_2H_5CH_2CHO$ (b) $C_2H_5CH_2CH_2OH$
(c) $C_2H_5CH_2OH$ (d) C_2H_5CHO

30. Sodium benzene sulphonate reacts with *NaOH* and then on acidic hydrolysis, it gives [Roorkee 1995; KCET 1998]
(a) Phenol (b) Benzoic acid
(c) Benzene (d) Disodium benzaldehyde

31. Phenol is obtained by heating aqueous solution of [MP PMT 1995]
(a) Aniline
(b) Benzene diazonium chloride
(c) Benzoic acid
(d) None of these

32. C_2H_5MgI reacts with *HCHO* to form last product [MP PMT 1991]
(a) CH_3CHO (b) C_3H_7OH
(c) CH_3COCH_3 (d) CH_3COOCH_3

33. Which one is not synthesized by Grignard reagent [MP PET 1991]
(a) Primary alcohol (b) Secondary alcohol
(c) A ketone (d) An ester

34. Reaction of aqueous sodium hydroxide on (i) ethyl bromide and (ii) chlorobenzene gives
(a) (i) Ethene and (ii) *o*-chlorophenol
(b) (i) Ethyl alcohol and (ii) *o*-chlorophenol
(c) (i) Ethyl alcohol and (ii) phenol
(d) (i) Ethyl alcohol an d(ii) no reaction

35. *RMgBr* on reaction with an excess of oxygen followed by hydrolysis gives [Roorkee Qualifying 1998]
(a) *RH* (b) *ROOR*
(c) *ROOH* (d) *ROH*

36. The reaction between an ester and excess of Grignard reagent shall finally result in a [UPSEAT 2000]
(a) Primary alcohol (b) Secondary alcohol
(c) Tertiary alcohol (d) Ketone

37. The compound that will react most readily with *NaOH* to form methanol is [IIT-JEE (Screening) 2001]
(a) $(CH_3)_4N^+I^-$ (b) CH_3OCH_3
(c) $(CH_3)_3S^+I^-$ (d) $(CH_3)_3Cl$

38. When 2-ethylanthraquinol dissolved in a mixture of benzene and cyclohexanol is oxidised, the product is [JIPMER 1999]
(a) Ethanol (b) Hydrogen peroxide
(c) Anthracene (d) None of these

39. Which gas is eliminated in fermentation [RPMT 1997]
(a) O_2 (b) CO_2
(c) N_2 (d) H_2

40. Action of nitrous acid with ethylamine produces [BHU 2000]
(a) Ethane (b) Ammonia
(c) Ethyl alcohol (d) Nitroethane

41. The product of reduction of benzaldehyde is
(a) Benzoic acid (b) Benzyl alcohol
(c) Benzene (d) Catechol

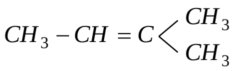
42. Commercially methanol is prepared by [IIT 1984; MP PMT 1990; KCET 1992]
(a) Reduction of *CO* in presence of $ZnO.Cr_2O_3$

(b) Methane reacts with water vapours at $900^{\circ}C$ in presence of *Ni* catalyst

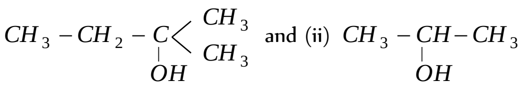
(c) Reduction of *HCHO* by $LiAlH_4$

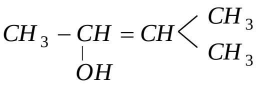
(d) Reduction of *HCHO* by aqueous *NaOH*

43. Action of water in the presence of sulphuric acid with the following alkenes

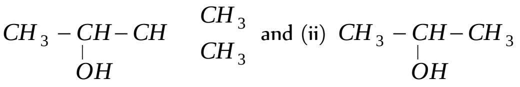
(i)  $CH_3-CH=C\left<\begin{matrix}CH_3\\CH_3\end{matrix}\right.$ and

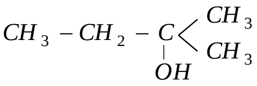
(ii) $CH_3-CH=CH_2$ gives

(a)  $CH_3-CH_2-\underset{\underset{OH}{|}}{C}\left<\begin{matrix}CH_3\\CH_3\end{matrix}\right.$ and (ii) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

(b) (i)  $CH_3-\underset{\underset{OH}{|}}{CH}=CH\left<\begin{matrix}CH_3\\CH_3\end{matrix}\right.$ and

(ii) $CH_3-CH_2-CH_2OH$

(c) (i)  $CH_3-\underset{\underset{OH}{|}}{CH}-CH\begin{matrix}CH_3\\CH_3\end{matrix}$ and (ii) $CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

(d) (i)  $CH_3-CH_2-\underset{\underset{OH}{|}}{C}\left<\begin{matrix}CH_3\\CH_3\end{matrix}\right.$ and

(ii) $CH_3-CH_2-CH_2OH$

44. From Williamson's synthesis preparation of which of following is possible

(a) Only symmetrical ethers (b) Only symmetrical ethers

(c) Both types (d) None of these

45. In the reaction $Ar-OH+Rx\xrightarrow{\text{alkali}}A$, A is **[MP PET 1994]**

(a) An aldehyde (b) An aryl chloride

(c) An ether (d) A ketone

46. Williamson's synthesis is used to prepare **[DPMT 1976, 81, 82, 83, 84; CPMT 1976, 82]**

(a) Acetone (b) Diethyl ether

(c) P.V.C. (d) Bakelite

47. When an alkyl halide is allowed to react with a sodium alkoxide the product most likely is **[MP PMT 1996; EAMCET 1998]**

(a) An aldehyde (b) A ketone

(c) An ether (d) A carboxylic acid

48. In Williamson's synthesis, ethoxyethane is prepared by **[MP PMT 1995; BHU 2005]**

(a) Passing ethanol over heated alumina

(b) Sodium ethoxide with ethyl bromide

(c) Ethyl alcohol with sulphuric acid

(d) Ethyl iodide and dry silver oxide

49. Formation of diethyl ether from ethanol is based on a **[BVP 2003]**

(a) Dehydration reaction

(b) Dehydrogenation reaction

(c) Hydrogenation reaction

(d) Heterolytic fission reaction

50. The compound formed when ethyl bromide is heated with dry silver oxide is **[MP PET/PMT 1988]**

(a) Dimethyl ether (b) Diethyl ether

(c) Methyl alcohol (d) Ethyl alcohol

51. The reagent used for the preparation of higher ether from halogenated ethers is **[Tamil Nadu CET 2001]**

(a) conc. H_2SO_4 (b) Sodium alkoxide

(c) Dry silver oxide (d) Grignard reagent

52. Acetyl bromide reacts with excess of CH_3MgI followed by treatment with a saturated solution of NH_4Cl gives **[AIEEE 2004]**

(a) 2-methyl-2-propanol (b) Acetamide

(c) Acetone (d) Acetyl iodide

53. What is obtained when chlorine is passed in boiling toluene and product is hydrolysed **[DCE 2004]**

(a) *o*-Cresol (b) *p*-Cresol

(c) 2, 4-Dihydroxytoluene (d) Benzyl alcohol

54. Which of the following is formed when benzaldehyde reacts with sodium hydroxide **[Pb. CET 2002]**

(a) Benzyl alcohol (b) Benzoic acid

(c) Glucose (d) Acetic acid

55. When ethanal reacts with CH_3MgBr and C_2H_5OH /dry *HCl* the product formed are **[DCE 2003]**

(a) Ethyl alcohol and 2-propanol

(b) Ethane and hemi-acetal

(c) 2-propanol and acetal

(d) Propane and methyl acetate

56. Which of the following is industrially prepared by passing ethylene into hypochlorous acid **[BHU 2004]**

(a) Ethylene glycol (b) Ethylene oxide

(c) Ethylene dinitrate (d) Ethane

57. In which case methyl-*t*-butyl ether is formed **[Orissa JEE 2004]**

(a) $(C_2H_5)_3CONa+CH_3Cl$

(b) $(CH_3)_3CONa+CH_3Cl$

(c) $(CH_3)_3CONa+C_2H_5Cl$

(d) $(CH_3)_3CONa+CH_3Cl$

58. Which of the following combinations can be used to synthesize ethanol **[KCET 2004]**

(a) CH_3MgI and CH_3COCH_3

(b) CH_3MgI and C_2H_5OH

(c) CH_3MgI and $CH_3COOC_2H_5$

(d) CH_3MgI and $HCOOC_2H_5$

59. $C_6H_5-CH=CHCHO\xrightarrow{X}C_6H_5CH=CHCH_2OH$. In the above sequence *X* can be **[DCE 2004]**

(a) H_2/Ni (b) $NaBH_4$

(c) $K_2Cr_2O_7/H^+$ (d) Both (a) and (b)

60. Alkenes convert into alcohols by **[MP PET 1991]**

(a) Hydrolysis by dil. H_2SO_4

(b) Hydration of alkene by alkaline $KMnO_4$

(c) Hydrolysis by water vapours and conc. H_2SO_4

(d) Hydration of alkene by aqueous *KOH*

61. Acetic acid and CH_3OH are obtained on large scale by destructive distillation of

(a) Wood (b) Coal

(c) Turpentine (d) Crude oil

62. Which is formed when benzalamine react with nitrous acid **[KCET (Med.) 2001]**

(a) C_6H_5OH (b) C_6H_5ON

(c) $C_2H_5N_2OH$ (d) $C_6H_5CH_2OH$

63. Acid catalyzed hydration of alkenes except ethene leads to the formation of **[AIEEE 2005]**

(a) Primary alcohol
(b) Secondary or tertiary alcohol
(c) Mixture of primary and secondary alcohols
(d) Mixture of secondary and tertiary alcohols

64. Methylphenyl ether can be obtained by reacting **[J & K 2005]**

(a) Phenolate ions and methyl iodide
(b) Methoxide ions and bromobenzene
(c) Methanol and phenol
(d) Bromo benzene and methyl bromide

Properties of alcohol, Phenol and Ethers

1. Which compound is formed when CH_3OH reacts with CH_3-Mg-X **[CPMT 1977, 89]**

(a) Acetone (b) Alcohol
(c) Methane (d) Ethane

2. A compound *X* of formula C_3H_8O yields a compound C_3H_6O, on oxidation. To which of the following classes of compounds could *X* being **[Pb. PMT 2000]**

(a) Secondary alcohol (b) Alkene
(c) Aldehyde (d) Tertiary alcohol

3. The boiling point of alcohol are .... than corresponding thiols**[Pb. PMT 2000]**

(a) More (b) Same
(c) Either of these (d) Less

4. Methyl alcohol can be distinguished from ethyl alcohol using **[KCET 1984; BHU 2000]**

(a) Fehling solution
(b) Schiff's reagent
(c) Sodium hydroxide and iodine
(d) Phthalein fusion test

5. A compound *X* with molecular formula C_3H_8O can be oxidised to a compound *Y* with the molecular formula $C_3H_6O_2$ *X* is most likely to be **[MP PMT 1991]**

(a) Primary alcohol (b) Secondary alcohol
(c) Aldehyde (d) Ketone

6. An alcohol on oxidation is found to give CH_3COOH and CH_3CH_2COOH. The structure of the alcohol is **[BIT 1990]**

(a) $CH_3CH_2CH_2OH$
(b) $(CH_3)_2C(OH)CH_2CH_3$
(c) $CH_3CH_2CHOHCH_3$
(d) $CH_3CH(OH)CH_2CH_2CH_3$

7. An organic liquid *A* containing C, H and *O* has a pleasant odour with a boiling point of 78^oC On boiling *A* with conc. H_2SO_4 a colourless gas is produced which decolourises bromine water and alkaline $KMnO_4$. One mole of this gas also takes one mole of H_2. The organic liquid *A* is **[KCET 1993]**

(a) C_2H_5Cl (b) C_2H_5CHO
(c) C_2H_6 (d) C_2H_5OH

8. An aromatic amine (*A*) was treated with alcoholic potash and another compound (*Y*) when foul smelling gas was formed with formula C_6H_5NC. *Y* was formed by reacting a compound (*Z*) with Cl_2 in the presence of slaked lime. The compound (*Z*) is**[CBSE PMT 1990**

(a) $C_6H_5NH_2$ (b) C_2H_5OH
(c) CH_3OCH_3 (d) $CHCl_3$

9. Rectified spirit obtained by fermentation contains 4.5% of water. So in order to remove it, rectified spirit is mixed with suitable quantity of benzene and heated. Benzene helps because **[KCET 1987]**

(a) It is dehydrating agent and so removes water
(b) It forms the lower layer which retains all the water so that alcohol can be distilled off
(c) It forms an azeotropic mixture having high boiling point and thus allows the alcohol to distill over
(d) It forms low boiling azeotropic mixtures which distill over, leaving behind pure alcohol which can then be distilled

10. $C_6H_5OH + ClCOCH_3 \xrightarrow{\text{aq. } NaOH} C_6H_5OCOCH_3$ is an example of **[BHU 1984]**

(a) Dow's reaction
(b) Reimer-Tiemann reaction
(c) Schotten-Baumann reaction
(d) Kolbe's reaction

11. Ortho-nitrophenol is steam volatile whereas para-nitrophenol is not. This is due to **[CBSE PMT 1989]**

(a) Intramolecular hydrogen bonding present in ortho-nitrophenol
(b) Intermolecular hydrogen bonding
(c) Intramolecular hydrogen bonding present in para-nitrophenol
(d) None of these

12. Reaction of phenol with dil. HNO_3 gives **[KCET 1993; RPMT 1997]**

(a) *p* and *m*-nitrophenols (b) *o*- and *p*-nitrophenols
(c) Picric acid (d) *o*- and *m*-nitrophenols

13. Phenol is less acidic than **[IIT-JEE 1986; UPSEAT 2003; Orissa JEE 2004]**

(a) Acetic acid (b) *p*-nitrophenol
(c) Both (a) and (b) (d) None of these

14. The strongest acid among the following aromatic compounds is**[NCERT 1978]**

(a) *ortho*-nitrophenol (b) *para*-chlorophenol
(c) *para*-nitrophenol (d) *meta*-nitrophenol

15. Diazo-coupling is useful to prepare some **[CBSE PMT 1994]**

(a) Pesticides (b) Proteins
(c) Dyes (d) Vitamins

16. Glycerol reacts with $P_4 + I_2$ to form **[CBSE PMT 1991]**

(a) Aldehyde (b) Allyl iodide
(c) Allyl alcohol (d) Acetylene

17. When glycerine is added to a litre of water which of the following behaviour is observed **[NCERT 1977; BHU 1979]**

(a) Water evaporates more easily
(b) The temperature of water is increased
(c) The freezing point of water is lowered
(d) The viscosity of water is lowered

18. Final product formed on reduction of glycerol by hydroiodic acid is**[CPMT 1987**

(a) Propane (b) Propanoic acid
(c) Propene (d) Propyne

19. Glycerol was distilled with oxalic acid crystals and the products were led into Fehling solution and warmed. Cuprous oxide was precipitated. It is due to **[KCET 1987]**

(a) CO (b) $HCHO$
(c) CH_3CHO (d) $HCOOH$

20. Kolbe-Schmidt reaction is used for **[CBSE PMT 1991]**

(a) Salicylic acid (b) Salicylaldehyde
(c) Phenol (d) Hydrocarbon

21. Which of the following explains the viscous nature of glycerol**[JIPMER 1997]**

(a) Covalent bonds (b) Hydrogen bonds
(c) Vander Wall's forces (d) Ionic forces

22. On heating glycerol with conc. H_2SO_4, a compound is obtained which has a bad odour. The compound is [CPMT 1974; CBSE PMT 1994]

(a) Glycerol sulphate (b) Acrolein
(c) Formic acid (d) Allyl alcohol

23. Isopropyl alcohol on oxidation forms [CPMT 1971, 81, 94; RPMT 2002]

(a) Acetone (b) Ether
(c) Ethylene (d) Acetaldehyde

24. Benzenediazonium chloride on reaction with phenol in weakly basic medium gives [IIT-JEE 1998]

(a) Diphenyl ether (b) *p*-hydroxyazobenzene
(c) Chlorobenzene (d) Benzene

25. The alcohol that produces turbidity immediately with $ZnCl_2$ + conc. *HCl* at room temperature [EAMCET 1997; MP PMT 1989, 99; IIT JEE 1981, 86; CBSE PMT 1989; CPMT 1989; MP PET 1997; JIPMER 1999]

(a) 1-hydroxybutane
(b) 2-hydroxybutane
(c) 2-hydroxy-2-methylpropane
(d) 1-hydroxy-2-methylpropane

26. The reagent which easily reacts with ethanol and propanol is [MP PET 1989]

(a) Fehling solution (b) Grignard reagent
(c) Schiff's reagent (d) Tollen's reagent

27. Propene is the product obtained by dehydrogenation of [KCET (Engg.) 2001]

(a) 2-propanol (b) 1-propanol
(c) Propanal (d) *n*-propyl alcohol

28. Which of the following statements is correct [BHU 1997]

(a) Phenol is less acidic than ethyl alcohol
(b) Phenol is more acidic than ethyl alcohol
(c) Phenol is more acidic than carboxylic acid
(d) Phenol is more acidic than carbonic acid

29. Boiling point of alcohol is comparatively higher than that corresponding alkane due to [MH CET 2002]

(a) Intermolecular hydrogen bonding
(b) Intramolecular hydrogen bonding
(c) Volatile nature
(d) None of these

30. When Phenol is heated with phthalic anhydride in concentrated sulphuric acid and the hot reaction mixture is poured into a dilute solution of sodium hydroxide, the product formed is [MP PET 1997, 2003; RPMT 1999; KCET (Med.) 2000; CPMT 1981; CBSE PMT 1988]

(a) Alizarin (b) Methyl orange
(c) Fluorescein (d) Phenolphthalein

31. $CH_3-CH=CH-CH(OH)-CH_3 \xrightarrow[\text{reagent}]{\text{Jon's}} X$,

Product *X* is [RPET 2000]

(a) $CH_3CH_2CH_2CH(OH)CH_3$
(b) $CH_3CH=CHCOCH_3$
(c) Both (a) and (b) are correct
(d) $CH_3CH_2CH_2COCH_3$

32. Reaction : $CH_3OH+O_2 \xrightarrow[Ag]{600^0C}$ product

The product is [RPET 2000]

(a) $CH_2=C=O$ (b) $H_2C=O$
(c) C_2H_4 (d) C_2H_2

33. Ethylene glycol, on oxidation with per-iodic acid, gives [NCERT 1983; CPMT 1983]

(a) Oxalic acid (b) Glycol
(c) Formaldehyde (d) Glycollic acid

34. An unknown compound '*D*', first oxidised to aldehyde and then acitic acid by a dilute solution of $K_2Cr_2O_7$ and H_2SO_4. The unknown compound '*D*' is [BHU 2000]

(a) CH_3CHO (b) CH_2CH_3OH
(c) CH_3CH_2OH (d) $CH_3CH_2CH_3$

35. The reaction of ethylene glycol with PI_3 gives [MP PMT 2000]

(a) ICH_2CH_2I (b) $CH_2=CH_2$
(c) $CH_2=CHI$ (d) $ICH=CHI$

36. The compound '*A*' when treated with ceric ammonium nitrate solution gives yellow *ppt*. The compound '*A*' is [MP PET 2002]

(a) Alcohol (b) Aldehyde
(c) Acid (d) Alkane

37. Which of the following product is formed, when ether is exposed to air [AIIMS 2000; RPMT 2002]

(a) Oxide (b) Alkanes
(c) Alkenes (d) Peroxide of diethyl ether

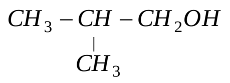
38. During dehydration of alcohols to alkenes by heating with conc. H_2SO_4 the initiation step is [AIEEE 2003]

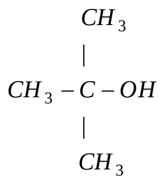
(a) Protonation of alcohol molecule
(b) Formation of carbocation
(c) Elimination of water
(d) Formation of an ester

39. Phenol is less acidic than [MNR 1995]

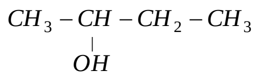
(a) Ethanol (b) Methanol
(c) *o*-nitrophenol (d) *p*-methylphenol

40. The compound which gives the most stable carbonium on dehydration is [MNR 1995]

(a) 
$CH_3-CH(CH_3)-CH_2OH$

(b) 
$CH_3-C(CH_3)_2-OH$

(c) $CH_3-CH_2-CH_2-CH_2OH$

(d) 
$CH_3-CH(OH)-CH_2-CH_3$

41. At higher temperature, iodoform reaction is given by [AIIMS 2003]

(a) $CH_3CO_2CH_3$ (b) $CH_3CO_2C_2H_5$
(c) $C_6H_5CO_2CH_3$ (d) $CH_3CO_2C_6H_5$

42. Cresol has [CPMT 2003]

(a) Alcoholic – OH (b) Phenolic – OH
(c) – $COOH$ (d) – CHO

43. In $CH_3CH_2OH \xrightarrow[350^oC]{X} CH_2=CH_2+H_2O$;

'*X*' is

(a) *NaCl* (b) $CaCl_2$
(c) P_2O_5 (d) Al_2O_3

44. Sodium phenoxide reacts with CO_2 at $400K$ and 4-7 *atm* pressure to give [MP PET 1996]

(a) Sodium salicylate (b) Salicylaldehyde

(c) Catechol (d) Benzoic acid

45. The reaction of C_2H_5OH with H_2SO_4 does not give [MP PET 1996]

(a) Ethylene (b) Diethyl ether

(c) Acetylene (d) Ethyl hydrogen sulphate

46. The order of stability of carbonium ions is [MP PET 1996]

(a) Methyl > ethyl > iso-propyl > tert-butyl

(b) Tert-butyl > iso-propyl > ethyl > methyl

(c) Iso-propyl > tert-butyl > ethyl > methyl

(d) Tert-butyl > ethyl > iso-propyl > methyl

47. Which statement is not correct about alcohol [AFMC 1997]

(a) Alcohol is lighter than water

(b) Alcohol evaporates quickly

(c) Alcohol of less no. of carbon atoms is less soluble in water than alcohol of high no. of carbon atoms

(d) All of these

48. An organic compound *A* reacts with sodium metal and forms *B*. On heating with conc. H_2SO_4, *A* gives diethyl ether. *A* and *B* are[AFMC 1998]

(a) C_2H_5OH and C_2H_5ONa

(b) C_3H_7OH and CH_3ONa

(c) CH_3OH and CH_3ONa

(d) C_4H_9OH and C_4H_9ONa

49. In the Liebermann's nitroso reaction, sequential changes in the colour of phenol occurs as [AFMC 1998; BHU 1999]

(a) Brown or red → green → red → deep blue

(b) Red → deep blue → green

(c) Red → green → white

(d) White → red → green

50. Which one of the following reactions does not yield an alkyl halide[EAMCET 1998]

(a) Diethyl ether $+Cl_2$

(b) Diethyl ether $+HI$

(c) Diethyl ether and PCl_5

(d) Diethyl ether $\xrightarrow{\text{Reduction}} X \xrightarrow{SO_2Cl_2}$

51. Compound *A* reacts with PCl_5 to give *B* which on treatment with *KCN* followed by hydrolysis gave propionic acid. What is *A* and *B* respectively [EAMCET 1998]

(a) C_3H_8 and C_3H_7Cl

(b) C_2H_6 and C_2H_5Cl

(c) C_2H_5Cl and C_2H_5Cl

(d) C_2H_5OH and C_2H_5Cl

52. The increasing order of acidity among phenol, *p*-methylphenol, *m*-nitrophenol and *p*-nitrophenol is [CBSE PMT 1995; RPMT 2002]

(a) *m*-nitrophenol, *p*-nitrophenol, phenol, *p*-methylphenol

(b) *p*-methylphenol, *m*-nitrophenol, phenol, *p*-nitrophenol

(c) *p*-methylphenol, phenol, *m*-nitrophenol, *p*-nitrophenol

(d) Phenol, *p*-methylphenol, *p*-nitrophenol, *m*-nitrophenol

53. Which of the following is not characteristic of alcohols [AFMC 1992]

(a) Lower alcohols are stronger and have bitter taste

(b) Higher alcohols are stronger and have bitter taste

(c) The boiling points of alcohols increase with increasing molecular mass

(d) The lower alcohols are soluble in water

54. In reaction of alcohols with alkali metal, acid etc. which of the following alcohol will react fastest [BHU 1984]

(a) Secondary (b) Tertiary

(c) Primary (d) All equal

55. Order of reactivity of alcohols towards sodium metal is [Pb. CET 1985]

(a) *Pri* > *Sec* > *Ter* (b) *Pri* > *Sec* < *Ter*

(c) *Pri* < *Sec* > *Ter* (d) *Pri* < *Sec* < *Ter*

56. 23 *g* of *Na* will react with methyl alcohol to give [NCERT 1972]

(a) One mole of oxygen (b) One mole of H_2

(c) $\frac{1}{2}$ mole of H_2 (d) None of these

57. Which reagent is useful in converting 1-butanol to 1-bromobutane[EAMCET 198

(a) $CHBr_3$ (b) Br_2

(c) CH_3Br (d) PBr_3

58. The $-OH$ group of methyl alcohol cannot be replaced by chlorine by the action of [KCET 1989]

(a) Chlorine

(b) Hydrogen chloride

(c) Phosphorus trichloride

(d) Phosphorus pentachloride

59. Which of the following gives ketone on oxidation [EAMCET 1987; BIT 1992]

(a) $(CH_3)_3COH$ (b) $CH_3CH_2CH_2OH$

(c) $(CH_3)_2CHCH_2OH$ (d) $CH_3CHOHCH_3$

60. Phenol is treated with bromine water and shaken well. The white precipitate formed during the process is [KCET (Med.) 2001; BIT 1992; AIIMS 1996; KCET 2001]

(a) *m*-bromophenol

(b) 2, 4-dibromophenol

(c) 2, 4, 6-tribromophenol

(d) A mixture of *o*- and *p*-bromophenols

61. Which compound has the highest boiling point [MP PET 2003]

(a) Acetone (b) Diethyl ether

(c) Methanol (d) Ethanol

62. When vapour of ethanol are passed over platinised asbestos in excess of air, the compound formed is [CPMT 1983]

(a) CH_3CHO (b) CH_3COCH_3

(c) C_2H_2 (d) CH_3COOH

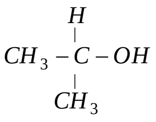
63. Dehydration of ethanol gives [CPMT 1985; BHU 1989]

(a) Acetic acid (b) Ethane

(c) Ethylene (d) Acetylene

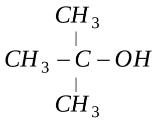
64. Which of the following compound will give positive iodoform test [MP PMT 1986,

(a) CH_3OH (b)



$CH_3-\overset{H}{\underset{CH_3}{C}}-OH$

(c)



$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-OH$

(d) $CH_3CH_2CH_2OH$

65. Absolute ethanol cannot be obtained by simple fraction of a solution of ethanol and water because [KCET 1984; MP PMT 1987]

(a) Their B.P.'s are very nearer

(b) Ethanol remains dissolved in water

(c) They form a constant boiling mixture

(d) Ethanol molecules are solvated

66. The alcohol which easily reacts with conc. HCl is **[MP PMT 1985]**

(a) $CH_3-CHOH-CH_2-CH_3$

(b) $(CH_3)_3-C-OH$

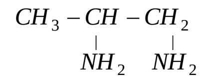
(c) $CH_3-CH_2-CH_2-CH_2-OH$

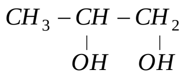
(d) $(CH_3)_3-CH-CH_2OH$

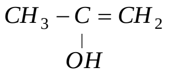
67. In the following series of chemical reactions, identify Z

$$C_3H_7OH \xrightarrow[160-180^{o}C]{Conc.H_2SO_4} X \xrightarrow{Br_2} Y \xrightarrow[Alc.KOH]{\text{Excess of}} Z$$

[Manipal MEE 1995]

(a) 
$CH_3-\underset{NH_2}{\underset{|}{CH}}-\underset{NH_2}{\underset{|}{CH_2}}$

(b) 
$CH_3-\underset{OH}{\underset{|}{CH}}-\underset{OH}{\underset{|}{CH_2}}$

(c) 
$CH_3-\underset{OH}{\underset{|}{C}}=CH_2$

(d) $CH_3C\equiv CH$

68. Alcohols of low molecular weight are **[CPMT 1976, 89; Pb. PMT 2000]**

(a) Soluble in water

(b) Soluble in all solvents

(c) Insoluble in all solvents

(d) Soluble in water on heating

69. Which of the following compounds is oxidised to prepare methyl ethyl ketone **[DCE 2001]**

(a) 2 - propanol (b) 1 - butanol

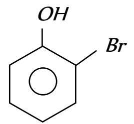
(c) 2 - butanol (d) Tert-butyl alcohol

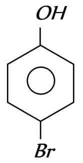
70. Which of the following is acidic **[CBSE PMT 2001; MH CET 2001]**

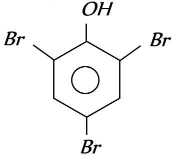
(a) CH_3OH (b) C_6H_5OH

(c) $(CH_3)_2CHOH$ (d) CH_3CH_2OH

71. With excess bromine, phenol reacts of form **[BHU 2001]**

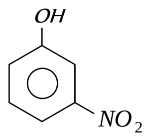
(a) 

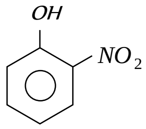
(b) 

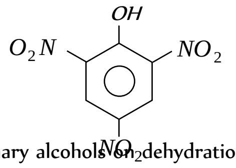
(c) 

(d) Mixture of (a) and (b)

72. Which is obtained on treating phenol, with dilute HNO_3 **[BVP 2003]**

(a) 

(b) 

(c) 

(d) None of these

73. Primary alcohols on dehydration give **[NCERT 1986]**

(a) Alkenes (b) Alkanes

(c) Both (a) and (b) (d) None of these

74. Primary and secondary alcohols on action of reduced copper give **[CPMT 1982; MP PMT 1985; EAMCET 1987, 93; MP PET 1995]**

(a) Aldehydes and ketones respectively

(b) Ketones and aldehydes respectively

(c) Only aldehydes

(d) Only ketones

75. Methyl alcohol on oxidation with acidified $K_2Cr_2O_7$ gives **[MNR 1987]**

(a) CH_3COCH_3 (b) CH_3CHO

(c) $HCOOH$ (d) CH_3COOH

76. Ethyl alcohol on oxidation with $K_2Cr_2O_7$ gives **[MNR 1987; Bihar CEE 1995; UPSEAT 2000]**

(a) Acetic acid (b) Acetaldehyde

(c) Formaldehyde (d) Formic acid

77. Lucas test is used for **[CBSE PMT 1990; AIIMS 2002; AFMC 2005]**

(a) Alcohols (b) Amines

(c) Diethyl ether (d) Glacial acetic acid

78. When phenol reacts with ammonia in presence of $ZnCl_2$ at 300°C, it gives **[AFMC 2001]**

(a) Primary amine (b) Secondary amine

(c) Tertiary amine (d) Both (b) and (c)

79. Azo-dyes are prepared from **[CPMT 2001]**

(a) Aniline (b) Benzaldehye

(c) Benzoic acid (d) Phenol

80. A compound that easily undergoes bromination is **[KCET (Engg.) 2002]**

(a) Phenol (b) Toluene

(c) Benzene (d) Benzoic acid

81. Which of the following has lowest boiling point **[MH CET 1999]**

(a) *p*-nitrophenol (b) *m*-nitrophenol

(c) *o*-nitrophenol (d) phenol

82. In esterification, the reactivity of alcohols is **[DPMT 2000]**

(a) 1° > 2° > 3° (b) 3° > 2° > 1°

(c) Same in all cases (d) None of these

83. The role of conc. H_2SO_4 in the esterification process is **[RPMT 1999]**

(a) Catalyst

(b) Dehydrating agent

(c) Hydrolysing agent

(d) Dehydrating agent and catalyst

84. Methanol and ethanol are distinguished by the **[MP PET 1999]**

(a) Action of HCl (b) Iodoform test

(c) Solubility in water (d) Sodium

85. For phenol, which of the following statements is correct **[MP PMT 1995]**

(a) It is insoluble in water

(b) It has lower melting point compared to aromatic hydrocarbons of comparable molecular weight

(c) It has higher boiling point than toluene

(d) It does not show acidic property

86. The reaction of Lucas reagent is fast with **[MP PMT 2000]**

(a) $(CH_3)_3COH$ (b) $(CH_3)_2CHOH$

(c) $CH_3(CH_2)_2OH$ (d) CH_3CH_2OH

87. Which of the following reagents convert the propene to 1-propanol **[CBSE PMT**

(a) H_2O, H_2SO_4

(b) Aqueous KOH

(c) $MgSO_4$, $NaBH_4 / H_2O$

(d) B_2H_6, H_2O_2, OH^-

88. Compound '*A*' reacts with PCl_5 to give '*B*' which on treatment with KCN followed by hydrolysis gave propanoic acid as the product. What is '*A*' **[CBSE PMT 2002]**

(a) Ethane (b) Propane

(c) Ethyl chloride (d) Ethyl alcohol

89. Which reagent can convert acetic acid into ethanol **[BVP 2003]**

(a) Na + alcohol (b) $LiAlH_4$ + ether

(c) $H_2 + Pt$ (d) $Sn + HCl$

90. Which of the following would undergo dehydration most readily **[UPSEAT 2000]**

(a) 1-phenyl-1butanol (b) 2-phenyl-2-butanol

(c) 1-phenyl-2-butanol (d) 2-phenyl-1-butanol

91. Phenol and benzoic acid is distinguished by **[BHU 2003]**

(a) $NaOH$ (b) $NaHCO_3$

(c) Na_2CO_3 (d) H_2SO_4

92. Electrophilic substitution reaction in phenol take place at **[RPMT 2002]**

(a) *p*- position (b) *m*- position

(c) *o*- position (d) *o*- and *p*- position

93. Liebermann's test is answered by **[KCET 1998]**

(a) Aniline (b) Methylamine

(c) Ethyl benzoate (d) Phenol

94. In the sequence of the following reactions **[MP PMT 2002]**

$$CH_3CH_2OH \xrightarrow[\text{Chromic Acid}]{[O]} X \xrightarrow[\text{Chromic Acid}]{[O]} CH_3COOH$$

X is

(a) CH_3COCH_3 (b) CH_3CHO

(c) CH_3OCH_3 (d) CH_3CH_2COOH

95. The boiling point of glycerol is more than propanol because of**[CPMT 1997, 2002]**

(a) Hydrogen bonding (b) Hybridisation

(c) Resonance (d) All the above

96. Which of the following produces violet colour with $FeCl_3$ solution

(a) Enols (b) Ethanol

(c) Ethanal (d) Alkyl halides

97. When heated with NH_3 under pressure alone or in presence of zinc chloride phenols are converted into **[RPMT 1997]**

(a) Aminophenols (b) Aniline

(c) Nitrobenzene (d) Phenyl hydroxylamine

98. Because of resonance the oxygen atom of $-OH$ group of phenol

(a) Acquires positive charge (b) Acquires negative charge

(c) Remains uneffected (d) Liberates

99. When glycerol is heated with $KHSO_4$ it gives **[CPMT 1974, 85; MP PMT 1988, 90, 91, 92, 94; MP PET 1988, 92]**

(a) $CH_2 = CH - CH_3$ (b) $CH_2 = CH - CH_2OH$

(c) $CH_2 = CH - CHO$ (d) $CH_2 = C = CH_2$

100. An organic compound *X* on treatment with acidified $K_2Cr_2O_7$ gives a compound *Y* which reacts with I_2 and sodium carbonate to form tri-iodomethane. The compound *X* is **[KCET 1996]**

(a) CH_3OH (b) $CH_3 - CO - CH_3$

(c) CH_3CHO (d) $CH_3CH(OH)CH_3$

101. The reaction of conc. HNO_3 and phenol forms **[MP PMT/PET 1988; BHU 1988; MP PMT 1999; Pb. PMT 2000]**

(a) Benzoic acid (b) Salicylic acid

(c) *o*-and *p*-nitrophenol (d) Picric acid

102. Phenol is **[MP PMT 1990; UPSEAT 1999]**

(a) A weaker base than NH_3

(b) Stronger than carbonic acid

(c) Weaker than carbonic acid

(d) A neutral compound

103. Phenol at $25^o C$ is

(a) A white crystalline solid (b) A transparent liquid

(c) A gas (d) Yellow solution

104. At low temperature phenol reacts with Br_2 in CS_2 to form **[MP PET 1991; CPMT 1981; MP PMT 1990; IIT 1982; RPMT 2000]**

(a) *m*-bromophenol (b) *o*-and *p*-bromophenol

(c) *p*-bromophenol (d) 2, 4, 6-tribromophenol

105. Oxidation of ethanol by chromic acid forms **[MP PET 1992]**

(a) Ethanol (b) Methanol

(c) 2-propanone (d) Ethanoic acid

106. Which of the following not gives effervescence with $NaHCO_3$ **[MP PET 1992]**

(a) Phenol (b) Benzoic acid

(c) 2, 4-dinitrophenol (d) 2, 4, 6-trinitrophenol

107. Conc. H_2SO_4 reacts with C_2H_5OH at $170^o C$ to form **[MP PMT 1991; MP PET 1991; IIT-JEE 1981; EAMCET 1979; KCET 2001]**

(a) CH_3COCH_3 (b) CH_3COOH

(c) CH_3CHO (d) C_2H_4

108. Which compound has hydrogen bonding **[MP PMT 1992; MP PET 1991]**

(a) Toluene (b) Phenol

(c) Chlorobenzene (d) Nitrobenzene

109. Which statement is true **[MP PMT 1991]**

(a) C_6H_5OH is more acidic than C_2H_5OH

(b) C_6H_5OH is less acidic than C_2H_5OH

(c) C_6H_5OH react with $NaHCO_3$

(d) C_6H_5OH gives oxime with NH_2OH and HCl

110. Read the following statements carefully :

(A) A secondary alcohol on oxidation gives a ketone

(B) Ethanol reacts with conc. H_2SO_4 at $180^o C$ to yield ethylene

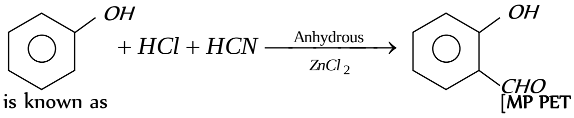
(C) Methanol reacts with iodine and sodium hydroxide to give a yellow precipitate of iodoform

(D) Hydrogen gas is liberated when sodium is added to alcohol. Select the correct statements from the above set:

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

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

111. The following reaction :



is known as [MP PET 1997]

(a) Perkin reaction

(b) Gattermann reaction

(c) Kolbe reaction

(d) Gattermann-Koch reaction

112. Carbylamine test is done by heating alcoholic *KOH* with [IIT-JEE 1984; BIT 1992; CBSE PMT 1992]

(a) Chloroform and silver powder

(b) Trihalogen methane and primary amine

(c) Alkyl halide and primary amine

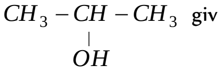
(d) Alkyl cyanide and primary amine

113. Isopropyl alcohol heated at $300^o C$ with copper catalyst to form[AFMC 1990; MP PMT 1986, 89, 92; JIPMER 2000]

(a) Acetone (b) Dimethyl ether

(c) Acetaldehyde (d) Ethane

114. Dehydrogenation of



$CH_3 - \underset{|}{\underset{OH}{CH}} - CH_3$ gives [MP PMT 2002]

(a) Acetone (b) Acetaldehyde

(c) Acetic acid (d) Acetylene

115. In the sequence of the following reactions

$$CH_3OH \xrightarrow{HI} CH_3I \xrightarrow{KCN}$$

$$CH_3CN \xrightarrow{\text{reduction}} X \xrightarrow{HNO_3} Y$$

X and *Y* are respectively [MP PMT 2002]

(a) $CH_3CH_2NH_2$ and CH_3CH_2OH

(b) $CH_3CH_2NH_2$ and CH_3COOH

(c) CH_3CH_2OH and CH_3CHO

(d) CH_3OCH_3 and CH_3CHO

116. Alcohols (i) $CH_3CH_2CH_2OH$, (ii) $CH_3 - CHOH - CH_3$ and (iii) $CH_3 - C(CH_3)(OH) - CH_3$ were treated with Lucas reagent (Conc. $HCl + ZnCl_2$). What results do you expect at room temperature

(a) (ii) and (iii) react immediately and (i) in about 5 minutes

(b) (iii) reacts immediately, (ii) reacts in about 5 minutes and (i) not at all

(c) (i) reacts immediately, (ii) reacts in about 5 minutes and (iii) not at all

(d) (i) reacts in about 5 minutes, (ii) reacts in about 15 minutes and (iii) not at all

117. Ethylene may be obtained by dehydration of which of the following with concentrated H_2SO_4 at 160 – 170°C [DPMT 2000; MP PET 2001]

(a) C_2H_5OH (b) CH_3OH

(c) $CH_3CH_2CH_2OH$ (d) $(CH_3)_2 CHCH_2OH$

118. The final product of the oxidation of ethyl alcohol is [KCET (Med.) 1999]

(a) Ethane (b) Acetone

(c) Acetaldehyde (d) Acetic acid

119. The compound obtained by heating salicylic acid with phenol in the presence of phosphorus oxychloride is [KCET (Med.) 1999]

(a) Salol (b) Aspirin

(c) Oil of wintergreen (d) *o*-chlorobenzoyl chloride

120. When phenol is allowed to react with Br_2 in (i) CS_2 solution and (ii) in aqueous solution, the resulting compounds are

(a) (i) 2, 4, 6-tribromophenol and
(ii) *o*-and *p*-bromophenol

(b) (i) *m*-bromophenol and
(ii) 2, 3, 4-tribromophenol

(c) (i) *o*-and *p*-bromophenol and
(ii) 2, 4, 6-tribromophenol

(d) (i) *o*- and *m*-bromophenol and
(ii) 2, 3, 4-tribromophenol

121. Which of the following is not true in case of reaction with heated copper at $300^o C$ [CPMT 1999]

(a) Phenol → Benzyl alcohol

(b) Primary alcohol → Aldehyde

(c) Secondary alcohol → Ketone

(d) Tertiary alcohol → Olefin

122. Which of the following is the most suitable method for removing the traces of water from ethanol [CPMT 1999]

(a) Heating with *Na* metal

(b) Passing dry *HCl* through it

(c) Distilling it

(d) Reacting with *Mg*

123. With oxalic acid, glycerol at $260^o C$ gives [BHU 1996]

(a) Allyl alcohol (b) Glyceryl mono-oxalate

(c) Formic acid (d) Glyceraldehyde

124. Absolute alcohol cannot be prepared by fractional distillation of rectified spirit since

(a) It forms azeotropic mixture

(b) It is used as power alcohol

(c) It is used in wines

(d) None of the above

125. The reagent used for the dehydration of an alcohol is [MP PET/PMT 1998]

(a) Phosphorus pentachloride

(b) Calcium chloride

(c) Aluminium oxide

(d) Sodium chloride

126. Which one of the following compounds gives a positive iodoform test [MP PMT 1997]

(a) Pentanal (b) 1-phenyl ethanol

(c) 2-phenyl ethanol (d) 3-pentanol

127. What amount of bromine will be required to convert 2 *g* of phenol into 2, 4, 6-tribromophenol [MP PET/PMT 1998]

(a) 4.00 (b) 6.00

(c) 10.22 (d) 20.44

128. Ethyl alcohol exhibits acidic character on reacting with [MP PMT 1995]

(a) Acetic acid

(b) Sodium metal

(c) Hydrogen iodide

(d) Acidic potassium dichromate

129. The mixture of ethanol and water cannot be separated by distillation because [KCET 1984]

(a) They form a constant boiling mixture

(b) Alcohol molecules are solvated

(c) Their boiling points are very near
(d) Alcohol remains dissolved in water

130. The reaction between an alcohol and an acid with the elimination of water molecule is called **[MH CET 1999]**
(a) Esterification (b) Saponification
(c) Etherification (d) Elimination

131. The compound with the highest boiling point is **[MNR 1985]**
(a) CH_4 (b) CH_3OH
(c) CH_3Cl (d) CH_3Br

132. The boiling point of ethyl alcohol should be less than that of **[Pb. CET 1985]**
(a) Propane (b) Formic acid
(c) Dimethyl ether (d) None of these

133. Which of the following is not characteristic of alcohols **[AIIMS 1980]**
(a) They are lighter than water
(b) Their boiling points rise fairly uniformly with increasing molecular weight
(c) Lower members are insoluble in water and organic solvents but solubility regularly increases with molecular weight
(d) Lower members have pleasant smell and burning taste, while higher members are odourless and tasteless

134. At room temperature the alcohol that do not reacts with Lucas reagent is
(a) Primary alcohol (b) Secondary alcohol
(c) Tertiary alcohol (d) All these three

135. By means of calcium chloride which of following can be dried
(a) Methanol (b) Ethanol
(c) Both (a) and (b) (d) None of these

136. Lucas test is used to distinguish between **[MP PET 1994]**
(a) $1^o, 2^o$ and 3^o alcohols (b) 1^o, 2^o and 3^o amines
(c) Aldehydes and ketones (d) Alkenes and alkynes

137. Among the following, the compound that undergoes nitration readily is **[NCERT 1984]**
(a) Benzoic acid (b) Toluene
(c) Phenol (d) Nitrobenzene

138. $\text{Phenol} \xrightarrow[\text{Distillation}]{Zn} A \xrightarrow[\text{Conc. } HNO_3]{\text{Conc. } H_2SO_4} B \xrightarrow[NaOH]{Zn} C$

In the above reaction A, B and C are the following compounds
(a) $C_6H_6, C_6H_5NO_2$ and aniline
(b) C_6H_6, dinitrobenzene and metanitroaniline
(c) Toluene, metanitrobenzene and metatoluedine
(d) $C_6H_6, C_6H_5NO_2$ and hydrazobenzene

139. $CH_3-O-C_3H_7$ and $C_2H_5-O-C_2H_5$ exhibit which type of isomerism **[MP PMT 1989]**
(a) Metamerism (b) Position
(c) Chain (d) Functional

140. Phenol reacts with CCl_4 in presence of aqueous alkali and forms a product which on hydrolysis gives **[MP PMT 1990]**
(a) Salicylaldehyde (b) Salicylic acid
(c) Benzaldehyde (d) Benzoic acid

141. In fermentation by zymase, alcohol and CO_2 are obtained from the following sugar **[MP PMT/PET 1988]**
(a) Glucose (b) Invert sugar
(c) Fructose (d) All of these

142. The order of melting point of *ortho*, *para*, *meta*-nitrophenol is**[Orissa JEE 2003]**
(a) $o > m > p$ (b) $p > m > o$
(c) $m > p > o$ (d) $p > o > m$

143. The alcohol which does not give a stable compound on dehydration is **[MP PET 1997]**
(a) Ethyl alcohol (b) Methyl alcohol
(c) *n*-propyl alcohol (d) *n*-butyl alcohol

144. When ethyl alcohol (C_2H_5OH) is mixed with ammonia and passed over heated alumina, the compound formed is **[DPMT 1981; CBSE PMT 1989]**
(a) $C_2H_5NH_2$ (b) C_2H_4
(c) $C_2H_5OC_2H_5$ (d) CH_3OCH_3

145. A mixture of methanol vapours and air is passed over heated copper. The products are **[KCET 1988]**
(a) Carbon monoxide and hydrogen
(b) Formaldehyde and water vapour
(c) Formic acid and water vapour
(d) Carbon monoxide and water vapour

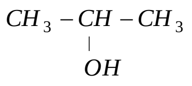
146. In the esterification reaction of alcohols **[Bihar CEE 1995]**
(a) OH^- is replaced by CH_3COO group
(b) OH^- is replaced by chlorine
(c) H^- is replaced by sodium metal
(d) OH^- is replaced by C_2H_5OH

147. A compound *A* on oxidation gave acetaldehyde, then again on oxidation gave acid. After first oxidation it was reacted with ammoniacal $AgNO_3$ then silver mirror was produced. *A* is likely to be **[DPMT 1996]**
(a) Primary alcohol (b) Tertiary alcohol
(c) Acetaldehyde (d) Acetone

148. $\text{Phenol} \xrightarrow[H^+]{CHCl_3/NaOH} \text{Salicyldehyde}$

The above reaction is known as **[Pb. PMT 2002]**
(a) Riemer Tiemann reaction
(b) Bucherer reaction
(c) Gattermann synthesis
(d) Perkin reaction

149. Alcohol which gives red colour with Victor Meyer test is **[MP PMT/PET 1988]** **[RPMT 2003]**
(a) C_2H_5OH (b)



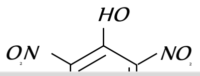
$CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_3$

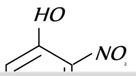
(c) $C(CH_3)_3OH$ (d) None of these

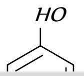
150. Conc. H_2SO_4 heated with excess of C_2H_5OH at 140^oC to form **[MP PMT 1990; RPMT 2000; AFMC 2002]**
(a) $CH_3CH_2-O-CH_3$
(b) $CH_3CH_2-O-CH_2CH_3$
(c) $CH_3-O-CH_2-CH_2-CH_3$
(d) $CH_2=CH_2$

151. Rate of substitution reaction in phenol is **[MP PMT 1989]**
(a) Slower than the rate of benzene
(b) Faster than the rate of benzene
(c) Equal to the rate of benzene
(d) None of these

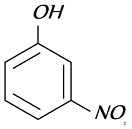
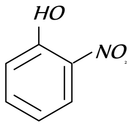
152. Phenol reacts with dilute HNO_3 at normal temperature to form[**MP PMT 198**







(a) (b)

(c)  (d) 

153. One mole of phenol reacts with bromine to form tribromophenol. How much bromine is used [MP PMT 1989]

(a) 1. 5 mol (b) 3 mol

(c) 4.5 mol (d) 6 mol

154. In presence of $NaOH$, phenol react with $CHCl_3$ to form *o*-hydroxy benzaldehyde. This reaction is called [BIT 1992; MP PMT 1990, 2002; AIIMS 1992; MP PET 1994; JIPMER 1999]

(a) Riemer-Tiemann's reaction

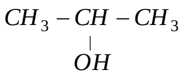
(b) Sandmeyer's reaction

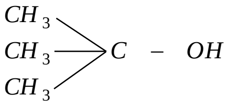
(c) Hoffmann's degradation reaction

(d) Gattermann's aldehyde synthesis

155. Which of the following vapours passed over heated copper to form acetone [BIT 1992]

(a) $H_3C-CH_2-CH_2OH$

(b) 
$CH_3-\underset{|}{\overset{}{CH}}-CH_3$ with OH

(c) 
$(CH_3)_3C-OH$

(d) $CH_2=CH-CH_2OH$

156. Methyl alcohol (methanol), ethyl alcohol (ethanol) and acetone (propanone) were treated with iodine and sodium hydroxide solutions. Which substances will give iodoform test

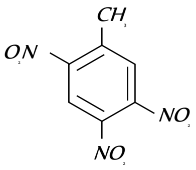
(a) Only ethyl alcohol

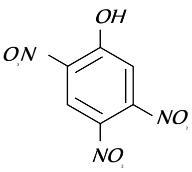
(b) Only methyl alcohol and ethyl alcohol

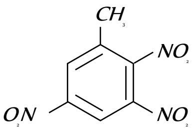
(c) Only ethyl alcohol and acetone

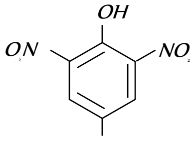
(d) Only acetone

157. TNT has the structure [UPSEAT 2000]

(a) 

(b) 

(c) 

(d) 

158. The vapour pressure of aqueous solution of methanal is [UPSEAT 2000]

(a) Equal to water (b) Equal to methanal

(c) More than water (d) Less than water

159. Glycerol reacts with conc. HNO_3 and conc. H_2SO_4 to form[CPMT 1983; MP PMT/PET 1988]

(a) Glycerol mononitrate (b) Glycerol dinitrate

(c) Glycerol trinitrate (d) Acrolein

160. Glycerol heated with oxalic acid at 110^oC to form [CPMT 1986, 90, 91, 97; JIPMER 1997]

(a) Formic acid (b) Oxalic acid

(c) Allyl alcohol (d) Glycerol trioxalate

161. Dimethyl ether and ethyl alcohol are [CPMT 1986; Manipal MEE 1995]

(a) Branched isomer (b) Position isomer

(c) Functional isomer (d) Tautomer

162. The process of manufacture of absolute alcohol from rectified spirit is [CPMT 1986, 87; Kurukshetra CEE 2002]

(a) Fractional distillation (b) Steam distillation

(c) Azeotropic distillation (d) Vacuum distillation

163. When ethyl alcohol reacts with acetic acid, the products formed are[CPMT 1989

(a) Sodium ethoxide + hydrogen

(b) Ethyl acetate + water

(c) Ethyl acetate + soap

(d) Ethyl alcohol + water

164. Picric acid is (at 25^oC)

(a) A white solid (b) A colourless liquid

(c) A gas (d) A bright yellow solid

165. Phenol on distillation with zinc dust gives [MP PET 1991; CPMT 1997; MP PMT 1999, 2001; Pb. PMT 2000]

(a) C_6H_6 (b) C_6H_{12}

(c) $C_6H_5OC_6H_5$ (d) $C_6H_5-C_6H_5$

166. Methanol and ethanol are miscible in water due to [MP PET/PMT 1988; CPMT 1989; CBSE PMT 1991]

(a) Covalent character

(b) Hydrogen bonding character

(c) Oxygen bonding character

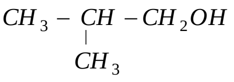
(d) None of these

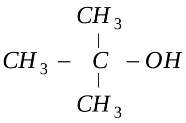
167. By distilling glycol with fuming sulphuric acid, which of following is obtained

(a) Glycerol (b) Pinacol

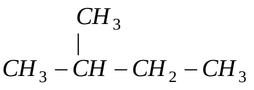
(c) Dioxan (d) Ethylene oxide

168. The compound which gives the most stable carbonium ion on dehydration is [DCE 2000]

(a) 
$CH_3-\underset{CH_3}{\underset{|}{CH}}-CH_2OH$

(b) 
$CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-OH$

(c) $CH_3-CH_2-CH_2-CH_2OH$

(d) 
$CH_3-\overset{CH_3}{\overset{|}{CH}}-CH_2-CH_3$

169. In CH_3CH_2OH which bond dissociates heterolytically [IIT-JEE 1988; CPMT 1996]

(a) $C-C$ (b) $C-O$

(c) $C-H$ (d) $O-H$

170. Which compound is soluble in water [IIT-JEE 1980; CPMT 1993; RPET 1999]

(a) CS_2 (b) C_2H_5OH

(c) CCl_4 (d) $CHCl_3$

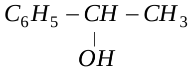
171. Which of the following is most soluble in water [MP PMT 1995]

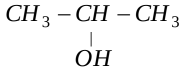
(a) Normal butyl alcohol (b) Isobutyl alcohol

(c) Tertiary butyl alcohol (d) Secondary butyl alcohol

172. Which of the following gives negative iodoform test

(a) CH_3CH_2OH (b) $CH_3CH_2CH_2OH$

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

(d) 
$CH_3-\underset{OH}{\underset{|}{CH}}-CH_3$

173. If ethanol dissolves in water, then which of the following would be done **[MP PET 1989]**

(a) Absorption of heat and contraction in volume

(b) Emission of heat and contraction in volume

(c) Absorption of heat and increase in volume

(d) Emission of heat and increase in volume

174. A migration of hydrogen with a pair of electrons is called

(a) Alkyl shift (b) Hydride shift

(c) Hydrogen ion formation (d) Dehydrogenation

175. When rectified spirit and benzene are distilled together, the first fraction obtained is

(a) A ternary azeotrope (b) Absolute alcohol

(c) A binary azeotrope (d) Denatured spirit

176. Alcohols react with Grignard reagent to form **[DPMT 1986]**

(a) Alkanes (b) Alkenes

(c) Alkynes (d) All of these

177. Action of diazomethane on phenol liberates

(a) O_2 (b) H_2

(c) N_2 (d) CO_2

178. The ring deuteration of phenol

(a) Lowers the acidity

(b) Increases the acidity

(c) Imparts no effect

(d) Causes amphoteric nature

179. In esterification of an acid, the other reagent is **[CPMT 1988]**

(a) Aldehyde (b) Alcohol

(c) Amine (d) Water

180. Maximum solubility of alcohol in water is due to **[MP PMT/ PET 1988; MP PMT 1989]**

(a) Covalent bond (b) Ionic bond

(c) *H*-bond with H_2O (d) None of the above

181. Alcohols can be distinguished from alkenes by

(a) Dissolving in cold concentrated H_2SO_4

(b) Decolourizing with bromine in CCl_4

(c) Oxidizing with neutral permanganate solution

(d) None of the above

182. At 25^oC Ethylene glycol is a

(a) Solid compound (b) Liquid

(c) Gas (d) Brown solid

183. When primary alcohol is oxidised with chlorine, it produces **[AFMC 1999]**

(a) $HCHO$ (b) CH_3CHO

(c) CCl_3CHO (d) C_3H_7CHO

184. Alcohols combine with acetylene in the presence of mercury compounds as catalyst to form

(a) Acetals (b) Xanthates

(c) Vinyl ethers (d) None of the above

185. The compound which will give negative iodoform test is **[CPMT 1993, 99]**

(a) CH_3CHO (b) CH_3CH_2OH

(c) Isopropyl alcohol (d) Benzyl alcohol

186. Which of the following is most acidic **[CPMT 1999]**

(a) Phenol (b) Benzyl alcohol

(c) *m*-chlorophenol (d) Cyclohexanol

187. Number of metamers represented by molecular formula $C_4H_{10}O$ is **[Tamil Nadu CET 2001]**

(a) 4 (b) 3

(c) 2 (d) 1

188. When ether is exposed in air for sometime an explosive substance produced is **[RPMT 2002]**

(a) Peroxide (b) TNT

(c) Oxide (d) Superoxide

189. Ether which is liquid at room temperature is **[BVP 2002]**

(a) $C_2H_5OCH_3$ (b) CH_3OCH_3

(c) $C_2H_5OC_2H_5$ (d) None of these

190. In the following reaction

$C_2H_5OC_2H_5+4[H]\xrightarrow{\text{Red P+HI}}2X+H_2O,$ X is **[MP PMT 2002]**

(a) Ethane (b) Ethylene

(c) Butane (d) Propane

191. Diethyl ether absorbs oxygen to form **[DPMT 1984]**

(a) Red coloured sweet smelling compound

(b) Acetic acid

(c) Ether suboxide

(d) Ether peroxide

192. Diethyl ether can be decomposed by heating with **[CPMT 1980, 81, 89]**

(a) *HI* (b) *NaOH*

(c) Water (d) $KMnO_4$

193. On boiling with concentrated hydrobromic acid, phenyl ethyl ether will yield **[AIIMS 1992]**

(a) Phenol and ethyl bromide

(b) Phenol and ethane

(c) Bromobenzene and ethanol

(d) Bromobenzene and ethane

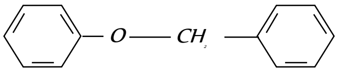
194. Ether is formed when ethyl alcohol is heated with conc. H_2SO_4. The conditions are **[KCET 1984]**

(a) Excess of H_2SO_4 and 170^oC

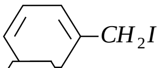
(b) Excess of C_2H_5OH and 140^oC

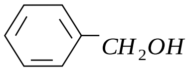
(c) Excess of C_2H_5OH and 180^oC

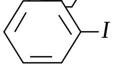
(d) Excess of conc. H_2SO_4 and 100^oC

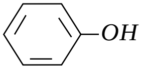
195. The ether 

when treated with *HI* produces **[IIT-JEE 1999]**

(a) 

(b) 

(c) 

(d) 

196. Addition of alcohols to aldehydes in presence of anhydrous acids yield **[CET Pune 1998]**

(a) Carboxylic acids (b) Ethers

(c) Cyclic ethers (d) Acetals

197. In which of the following reaction, phenol or sodium phenoxide is not formed **[CPMT 1996]**

(a) $C_6H_5N_2Cl + alco. KOH \rightarrow$

(b) $C_6H_5OCl + NaOH \rightarrow$

(c) $C_6H_5N_2Cl + aq. NaOH \rightarrow$

(d) $C_6H_5NNCl \xrightarrow[\Delta]{H_2O}$

198. Dimethyl ether when heated with excess *HI* gives **[CPMT 1996]**

(a) CH_3I and CH_3OH

(b) CH_3I and H_2O

(c) $C_2H_6 + CH_3I$ and CH_3OH

(d) CH_3I and *HCHO*

199. The ether that undergoes electrophilic substitution reactions is**[JIPMER 2001]**

(a) $CH_3OC_2H_5$ (b) $C_6H_5OCH_3$

(c) CH_3OCH_3 (d) $C_2H_5OC_2H_5$

200. Acetyl chloride does not react with **[MNR 1995]**

(a) Diethyl ether (b) Aniline

(c) Phenol (d) Ethanol

201. The products formed in the following reaction

$C_6H_5 - O - CH_3 + HI \xrightarrow{\text{heat}}$ are **[IIT 1995]**

(a) $C_6H_5 - I$ and $CH_3 - OH$

(b) $C_6H_5 - OH$ and $CH_3 - I$

(c) $C_6H_5 - CH_3$ and *HOI*

(d) C_6H_6 and CH_3OI

202. Etherates are

(a) Ethers

(b) Solution in ether

(c) Complexes of ethers with Lewis acid

(d) Complexes of ethers with Lewis base

203. An ether is more volatile than an alcohol having the same molecular formula. This is due to **[AIEEE 2003]**

(a) Dipolar character of ethers

(b) Alcohols having resonance structures

(c) Inter-molecular hydrogen bonding in ethers

(d) Inter-molecular hydrogen bonding in alcohols

204. When ether is reacted with O_2, it undergoes explosion due to**[CPMT 1996]**

(a) Peroxide (b) Acid

(c) Ketone (d) TNT

205. The compound which does not react with sodium is **[CBSE PMT 1994]**

(a) C_2H_5OH (b) $CH_3 - O - CH_3$

(c) CH_3COOH (d) $CH_3 - CHOH - CH_3$

206. Methyl-terbutyl ether on heating with *HI* of one molar concentration gives **[MP PET 1997]**

(a) $CH_3I + (CH_3)_3COH$ (b) $CH_3OH + (CH_3)_3Cl$

(c) $CH_3I + (CH_3)_3Cl$ (d) None of the above

207. A substance $C_4H_{10}O$ yields on oxidation a compound C_4H_8O which gives an oxime and a positive iodoform test. The original substance on treatment with conc. H_2SO_4 gives C_4H_8. The structure of the compound is **[SCRA 2000]**

(a) $CH_3CH_2CH_2CH_2OH$

(b) $CH_3CH(OH)CH_2CH_3$

(c) $(CH_3)_3COH$

(d) $CH_3CH_2 - O - CH_2CH_3$

208. Ethylene glycol reacts with excess of PCl_5 to give **[Kerala PMT 2004]**

(a) 1, 1-dichloroethane

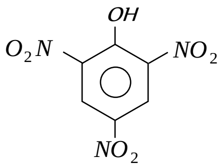
(b) 1, 2-dicholoroethane

(c) 1, 1, 1-trichloroethane

(d) 1, 1, 2, 2-tetrachloroethane

(e) 2, 2-dichloroethane

209. Which of the following will not react with *NaOH* **[CPMT 2004]**

(a) 

(b) C_2H_5OH

(c) CH_3CONH_2 (d) $CH(CN)_3$

210. The boiling point of methanol is greater than that of methyl thiol because **[Kerala PMT 2004]**

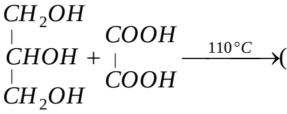
(a) There is intramolecular hydrogen bonding in methanol and intermolecular hydrogen bonding in methyl thiol

(b) There is intermolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol

(c) There is no hydrogen bonding in methanol and intermolecular hydrogen bonding in methyl thiol

(d) There is intramolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol

(e) There is no hydrogen bonding in methanol and intramolecular hydrogen bonding in methyl thiol

211. In the reaction 

$$\begin{array}{l} CH_2OH \\ | \\ CHOH \\ | \\ CH_2OH \end{array} + \begin{array}{l} COOH \\ | \\ COOH \end{array} \xrightarrow{110°C} (A)$$

product (*A*) will be **[Pb . CET 2001]**

(a) Glycerol monoformate

(b) Allyl alcohol

(c) Formaldehyde

(d) Acetic acid

212. Which of the following will not form a yellow precipitate on heating with an alkaline solution of iodine **[CBSE PMT 2004]**

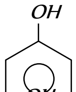
(a) CH_3OH

(b) CH_3CH_2OH

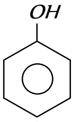
(c) $CH_3CH(OH)CH_3$

(d) $CH_3CH_2CH(OH)CH_3$

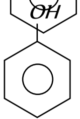
213. In Friedal-Crafts acylation, besides $AlCl_3$, the other reactants are**[DPMT 2004]**

(a) 

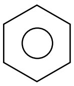
$+CH_3Cl$

(b) 

$+CH_3COCl$

(c) 

$+HN_3$

(d) 
$+CH_3Cl$

214. Which of the following reagents will produce salicyldehyde on reaction with phenol **[DPMT 2004]**

(a) $CHCl_3 / NaOH$ (b) $CCl_4 / NaOH$

(c) $CH_2Cl_2 / NaOH$ (d) $CH_3Cl / NaOH$

215. At 530 *K*, glycerol reacts with oxalic acid to produce **[Pb. CET 2002]**

(a) Allyl alcohol (b) Formic acid
(c) Glyceraldehyde (d) Glycerol monooxalate

216. With anhydrous zinc chloride, ethylene glycol gives **[MP PMT 2004]**

(a) Formaldehyde (b) Acetylene
(c) Acetaldehyde (d) Acetone

217. Which of the following compound give yellow precipitate with I_2 and *NaOH* **[Pb. CET 2003]**

(a) CH_3OH (b) $CH_3CH_2CH_2OH$
(c) $C_2H_5OC_2H_5$ (d) CH_3CH_2OH

218. Amongst the following, *HBr* reacts fastest with **[IIT-JEE 1986; JIPMER 2000; DCE 2003]**

(a) Propane-1-ol (b) Propane-2-ol
(c) 2-methyl propane-1-ol (d) 2-methyl propane-2-ol

219. Which of the following react with benzoic acid to form ethyl benzoate **[Pb. CET 2001]**

(a) Ethyl alcohol (b) Cinnamic acid
(c) Sodium ethoxide (d) Ethyl chloride

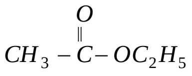
220. When phenyl magnesium bromide reacts with *t*-butanol, the product would be

(a) Benzene (b) Phenol
(c) *t*-butyl benzene (d) *t*-butyl ether

221. Which of the following is used as catalyst for preparing Grignard reagent **[Pb. CET 2002]**

(a) Iron powder (b) Dry ether
(c) Activated charcoal (d) MnO_2

222. Ethyl alcohol is heated with conc. H_2SO_4. The product formed is **[DCE 2004]**

(a) 
$CH_3-\overset{\overset{O}{\|}}{C}-OC_2H_5$
(b) C_2H_6
(c) C_2H_4 (d) C_2H_2

223. Dehydration of 2-butanol yield **[Pb. CET 2004]**

(a) 1-butene (b) 2-butene
(c) 2-butyne (d) Both (a) and (b)

224. Fats, on alkaline hydrolysis, gives **[MH CET 2003]**

(a) Oils (b) Soaps
(c) Detergents (d) Glycol + acid

225. When vapours of an alcohol are passed over hot reduced copper, alcohol is converted into alkene quickly, the alcohol is **[CPMT 1985]**

(a) Primary (b) Secondary
(c) Tertiary (d) None of these

226. The adduct of the compound '*A*' obtained by the reaction with excess of isopropyl magnesium iodide, upon hydrolysis gives a tertiary alcohol. The compound '*A*' is **[MP PET 1985]**

(a) An ester (b) A secondary alcohol
(c) A primary alcohol (d) An aldehyde

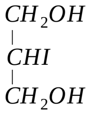
227. If there be a compound of the formula $CH_3C(OH)_3$ which one of the following compounds would be obtained from it without reaction with any reagent **[CPMT 1983]**

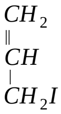
(a) CH_3OH (b) C_2H_5OH
(c) CH_3COOH (d) $HCHO$

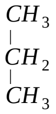
228. Which of the following can work as a dehydrating agent for alcohols **[BHU 1980]**

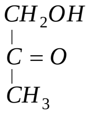
(a) H_2SO_4 (b) Al_2O_3
(c) H_3PO_4 (d) All of these

229. What is formed when glycerol reacts with *HI* **[DCE 2002]**

(a) 
$CH_2OH-CHI-CH_2OH$

(b) 
$CH_2=CH-CH_2I$

(c) 
$CH_3-CH_2-CH_3$

(d) 
$CH_2OH-C(=O)-CH_3$

230. The dehydration of 2-methyl butanol with conc. H_2SO_4 gives **[UPSEAT 2004]**

(a) 2-methyl butene as major product
(b) Pentene
(c) 2-methyl but-2-ene as major product
(d) 2-methyl pent-2-ene

231. Which alcohol reacts with fatty acids to form fats **[MP PMT/PET 1988; MP PET 1991]**

(a) Ethanol (b) Glycerol
(c) Methanol (d) Isopropanol

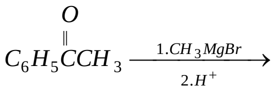
232. Which will dehydrate easily **[Roorkee 1995]**

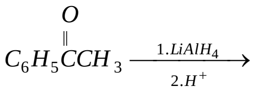
(a) 3-methyl-2-butanol (b) Ethyl alcohol
(c) 2-methyl propane-2-ol (d) 2-methyl butanol-2

233. $A \xleftarrow[\Delta]{Cu} CH_3CH_2OH \xrightarrow[\Delta]{Al_2O_3} B$. *A* and *B* respectively are **[RPMT/PET 2000]**

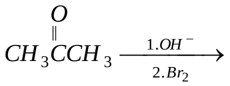
(a) Alkene, alkanal (b) Alkyne, alkanal
(c) Alkanal, alkene (d) Alkene, alkyne

234. Which one of the following reactions would produce secondary alcohol **[MP PET 1994]**

(a) 
$C_6H_5\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow[2.H^+]{1.CH_3MgBr}$

(b) 
$C_6H_5\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow[2.H^+]{1.LiAlH_4}$

(c) $CH_3CHO \xrightarrow[2.H^+]{1.LiAlH_4}$

(d) 
$CH_3\overset{\overset{O}{\|}}{C}CH_3 \xrightarrow[2.Br_2]{1.OH^-}$

235. On reaction with hot conc. H_2SO_4, which one of the following compounds loses a molecule of water **[CPMT 1989]**

(a) CH_3COCH_3 (b) CH_3COOH
(c) CH_3OCH_3 (d) CH_3CH_2OH

236. The best method to prepare cyclohexene from cyclohexanol is by using **[IIT 2005]**

(a) Conc. $HCl + ZnCl_2$ (b) Conc. H_3PO_4
(c) HBr (d) Conc. HCl

237. Which of the following compound is most acidic **[BCECE 2005]**

(a) CH_4 (b) C_2H_6
(c) $CH \equiv CH$ (d) C_2H_5OH

238. C_2H_5OH can be differentiated from CH_3OH by

[MP PMT 1994]

(a) Reaction with HCl (b) Reaction with NH_3

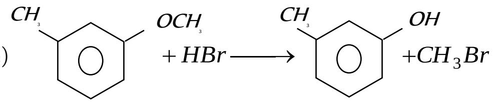
(c) By iodoform test (d) By solubility in water

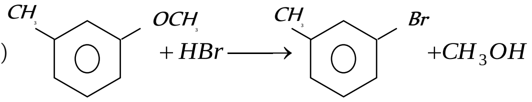
239. A compound does not react with 2.4 di-nitrophenyl hydrazine and Na, compound is [UPSEAT 2003]

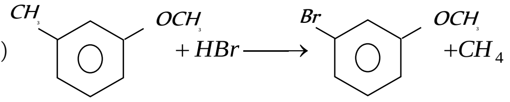
(a) Acetone (b) Acetaldehyde

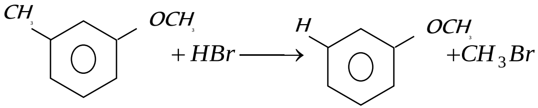
(c) CH_3OH (d) $CH_2 = CHOCH_3$

240. Which of the following reaction is correctly represented [Orissa JEE 2005]

(a)


(b)


(c)


(d)


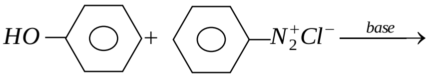
241. Tertiary butyl alcohol gives tertiary butyl chloride on treatment with [Orissa JEE 2005]

(a) Conc. HCl /anhydrous $ZnCl_2$

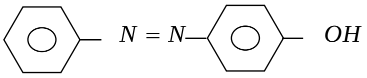
(b) KCN

(c) $NaOCl$

(d) Cl_2

242.


[DPMT 2005]

(a)


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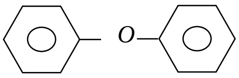

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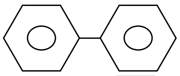

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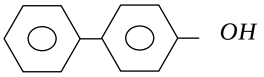


243. In which of the following reactions carbon carbon bond formation takes place [DPMT 2005]

(a) Cannizzaro (b) Reimer-Tiemann

(c) HVZ reaction (d) Schmidt reaction

244. Reaction of phenol with chloroform/sodium hydroxide to give o-hydroxy benzaldehyde involves the formation of [J & K 2005]

(a) Dichloro carbene (b) Trichloro carbene

(c) Chlorine atoms (d) Chlorine molecules

245. Which is not correct [J & K 2005]

(a) Phenol is more acidic than acetic acid

(b) Ethanol is less acidic than phenol

(c) Ethanol has lower boiling point than ethane

(d) Ethyne is a non-linear molecule

Uses of alcohol, Phenol and Ethers

1. Glycerol is used in the manufacture of [SCRA 1991]

(a) Dynamite (b) Varnish

(c) Paints (d) Soft drinks

2. Glycerol as a triester present in [MP PMT 1990]

(a) Petroleum (b) Kerosene

(c) Vegetable oil and fat (d) Naphtha

3. In presence of air, fermentation of ethyl alcohol by azotobactor bacteria forms [MP PMT 1989]

(a) $CH_2 = CH_2$ (b) C_2H_6

(c) CH_3CHO (d) CH_3COOH

4. Aspirin is also known as [CPMT 1989, 94; MP PET 1995]

(a) Methyl salicylic acid (b) Acetyl salicylic acid

(c) Acetyl salicylate (d) Methyl salicylate

5. Substances used in bringing down the temperature in high fevers are called [DPMT 1983]

(a) Pyretics (b) Antipyretics

(c) Antibiotics (d) Antiseptics

6. When glycol is heated with dicarboxylic acid, the products are

(a) Polyesters (b) Polyethers

(c) Polyethylene (d) No reaction at all

7. Cresol is [BHU 1996]

(a) A mixture of three cresols with little phenol

(b) Used as dye for wood

(c) A soapy solution of cresols

(d) Having an aldehyde group

8. Phenol is used in the manufacture of [AIIMS 1996]

(a) Bakelite (b) Polystyrene

(c) Nylon (d) PVC

9. In cold countries ethylene glycol is added to water in the radiators to [CPMT 1971; NCERT 1971; MP PMT 1993]

(a) Bring down the specific heat of water

(b) Lower the viscosity

(c) Reduce the viscosity

(d) Make water a better lubricant

10. Power alcohol is [KCET 1990]

(a) An alcohol of 95% purity

(b) A mixture of petrol hydrocarbons and ethanol

(c) Rectified spirit

(d) A mixture of methanol and ethanol

11. 4-chloro-3, 5-dimethyl phenol is called [KCET 2003]

(a) Chloramphenicol (b) Paracetamol

(c) Barbital (d) Dettol

12. Alcoholic fermentation is brought about by the action of [CPMT 1977, 79, 88; DPMT 1983]

(a) CO_2 (b) O_2

(c) Invertase (d) Yeast

13. Rectified spirit is a mixture of [DPMT 1982; MP PMT 1976, 77, 96; CPMT 1976, 77, 90; KCET 1990]

(a) 95% ethyl alcohol + 5% water

(b) 94% ethyl alcohol + 4.53% water

(c) 94.4% ethyl alcohol + 5.43 % water

(d) 95.57% ethyl alcohol + 4.43% water

14. Methyl alcohol is toxic. The reason assigned is [RPET 2000]

(a) It stops respiratory track

(b) It reacts with nitrogen and forms CN^- in the lungs

(c) It increases CO_2 content in the blood

(d) It is a reduction product of formaldehyde

15. Glycerol is used [Kurukshetra CET 2002]

(a) As a sweetening agent

(b) In the manufacture of good quality soap

(c) In the manufacture of nitro glycerine

(d) In all of these

16. Glycerol is not used in which of following cases

(a) Explosive making (b) Shaving soap making

(c) As an antifreeze for water (d) As an antiseptic agent

17. Liquor poisoning is due to [CPMT 1971]
(a) Presence of bad compound in liquor
(b) Presence of methyl alcohol
(c) Presence of ethyl alcohol
(d) Presence of carbonic acid

18. In order to make alcohol undrinkable pyridine and methanol are added to it. The resulting alcohol is called
(a) Power alcohol (b) Proof spirit
(c) Denatured spirit (d) Poison alcohol

19. Denatured spirit is mainly used as a [MNR 1995; MP PET 2002]
(a) Good fuel
(b) Drug
(c) Solvent in preparing varnishes
(d) Material in the preparation of oil

20. Main constituent of dynamite is [MP PET 1992; BHU 1979]
(a) Nitrobenzene (b) Nitroglycerine
(c) Picric acid (d) TNT

21. Wine (alcoholic beverages) contains [CPMT 1972, 77; BHU 1996; AFMC 2001]
(a) CH_3OH (b) Glycerol
(c) C_2H_5OH (d) 2-propanol

22. Tonics in general contain [MNR 1995]
(a) Ether (b) Methanol
(c) Ethanol (d) Rectified spirit

23. Widespread deaths due to liquor poisoning occurs due to [DPMT 2001]
(a) Presence of carbonic acid in liquor
(b) Presence of ethyl alcohol in liquor
(c) Presence of methyl alcohol in liquor
(d) Presence of lead compounds in liquor

24. Diethyl ether finds use in medicine as [KCET 1989]
(a) A pain killer (b) A hypnotic
(c) An antiseptic (d) An anaesthetic

25. Washing soap can be prepared by saponification with alkali of the oil [CPMT 1986]
(a) Rose oil (b) Paraffin oil
(c) Groundnut oil (d) Kerosene

26. Ether can be used [CPMT 1982]
(a) As a general anaesthetic (b) As a refrigerant
(c) In perfumery (d) All of these

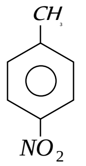
27. The Bouveault-Blanc reduction involves [MP PET 1991]
(a) C_2H_5OH / Na (b) $LiAlH_4$
(c) $C_2H_5MgX^-$ (d) Zn / HCl

28. Which is used as an antifreeze [AFMC 1992]
(a) Glycol (b) Ethyl alcohol
(c) Water (d) Methanol

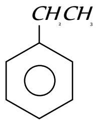
Critical Thinking

Objective Questions

1. Which will undergo a Friedel-Craft's alkylation reaction [Pb. PMT 1998]



1



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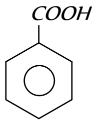

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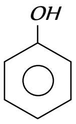
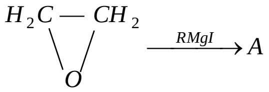


4

(a) 1, 2 and 4 (b) 1 and 3
(c) 2 and 4 (d) 1 and 2

2. The product 'A' in the following reaction is [MP PMT 2003]



(a) $RCHOHR$ (b) $RCHOH \cdot CH_3$
(c) $R-CH_2-CH_2-OH$ (d)

R_2CHCH_2OH

3. Glycerol boils at $290^o C$ with slight decomposition. Impure glycerine can be purified by [CPMT 1983, 94]
(a) Steam distillation (b) Simple distillation
(c) Vacuum distillation (d) Extraction with a solvent

4. Phenol $\xrightarrow{NaNO_2 / H_2SO_4} B \xrightarrow{H_2O} C \xrightarrow{NaOH} D$
Name of the above reaction is [KCET 2003]
(a) Liebermann's reaction
(b) Phthalein fusion test
(c) Reimer-Tiemann reaction
(d) Schottenf-Baumann reaction

5. The correct order of boiling point for primary (1^o), secondary (2^o) and tertiary (3^o) alcohols is [CPMT 1999; RPMT 2002]
(a) $1^o > 2^o > 3^o$ (b) $3^o > 2^o > 1^o$
(c) $2^o > 1^o > 3^o$ (d) $2^o > 3^o > 1^o$

6. What will be the products of reaction if methoxybenzene reacts with *HI*
(a) Methyl alcohol (methanol) + iodobenzene
(b) Methyl iodide (iodomethane) + benzene
(c) Methyle iodide + phenol
(d) Methyl iodide + iodobenzene

7. Ethylene reacts with Baeyer's reagent to give [CPMT 1988]
(a) Ethane (b) Ethyl alcohol
(c) Ethylene glycol (d) None of these

8. Which of the following statements is correct regarding case of dehydration in alcohols [CPMT 1980, 85; MP PMT 2001; BHU 2002]
(a) Primary > Secondary (b) Secondary > Tertiary
(c) Tertiary > Primary (d) None of these

9. Oxiran is
(a) Ethylene oxide (b) Diethyl ether
(c) Ethyl glycolate (d) Glycolic ester

10. Propan-1-ol can be prepared from propene by alcohol [AIIMS 2003]
(a) H_2O / H_2SO_4
(b) $Hg(OAc)_2 / H_2O$ followed by $NaBH_4$
(c) B_2H_6 followed by H_2O_2
(d) CH_3CO_2H / H_2SO_4

11. Distinction between primary, secondary and tertiary alcohol is done by [MP PMT/PET 1988; RPMT 2000]
(a) Oxidation method
(b) Lucas test
(c) Victor Meyer method
(d) All of these

12. Oxidation of which of the following by air in presence of vanadium pentoxide gives phenol
(a) Toluene (b) Benzene
(c) Benzaldehyde (d) Phenyl acetic acid

13. The most suitable method of the separation of a 1 : 1 mixture of *ortho* and *para* nitrophenols is [CBSE PMT 1994, 99; CPMT 1997]
(a) Distillation (b) Sublimation
(c) Crystallization (d) Chromatography

14. Which of the following does not form phenol or phenoxide [AFMC 2000]

(a) C_6H_5Cl (b) C_6H_5COOH

(c) $C_6H_5N_2Cl$ (d) $C_6H_5SO_3Na$

15. Which of the following will be obtained by keeping ether in contact with air for a long time **[RPMT 2003]**

(a) $C_2H_5-O-CH(CH_3)-O-OH$

(b) $C_2H_5-OCH_2-OH$

(c) $C_2H_5-O-C_2H_5OH$

(d) $CH_3-O\,CH(CH_3)-O-OH$

16. When a mixture of ethanol and methanol is heated in the presence of concentrated H_2SO_4 the resulting organic product or products is/are **[Manipal MEE 1995]**

(a) $CH_3OC_2H_5$

(b) CH_3OCH_3 and $C_2H_5OC_2H_5$

(c) $CH_3OC_2H_5$ and CH_3OCH_3

(d) $CH_3OC_2H_5$, CH_3OCH_3 and $C_2H_5OC_2H_5$

17. In the following groups

$-OAc$	$-OMe$	$-OSO_2Me$	$-OSO_2CF_3$
I	II	III	IV

The order of leaving group ability is **[IIT 1997]**

(a) I > II > III > IV

(b) IV > III > I > II

(c) III > II > I > IV

(d) II > III > IV > I

18. Epoxides are

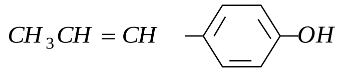
(a) Cyclic ethers

(b) Not ethers

(c) Aryl-alkyl ethers

(d) Ethers with another functional group

19. The reaction of



with *HBr* gives **[IIT-JEE 1998]**

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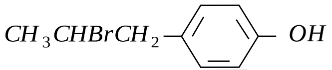

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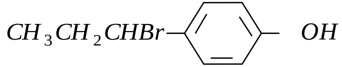

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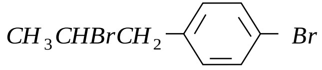

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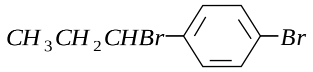


20. Which of the following compounds on boiling with $KMnO_4$ (alk.) and subsequent acidification will not give benzoic acid **[KCET 2001]**

(a) Benzyl alcohol (b) Acetophenone

(c) Anisole (d) Toluene

21. The best reagent to convert pent-3-en-2-ol into pent-3-in-2-one is **[AIEEE 2005]**

(a) Acidic permanganate

(b) Acidic dichromate

(c) Chromic anhydride in glacial acetic acid

(d) Pyridinium chloro-chromate

22. When alcohol reacts with concentrated H_2SO_4 intermediate compound formed is **[AFMC 2005]**

(a) Carbonium ion (b) Alkoxy ion

(c) Alkyl hydrogen sulphate (d) None of these

AR Assertion & Reason

For AIIMS Aspirants

Read the assertion and reason carefully to mark the correct option out of the options given below:

(a) If both assertion and reason are true and the reason is the correct explanation of the assertion.

(b) If both assertion and reason are true but reason is not the correct explanation of the assertion.

(c) If assertion is true but reason is false.

(d) If the assertion and reason both are false.

(e) If assertion is false but reason is true.

1. Assertion : A triester of glycerol and palmitic acid on boiling with aqueous *NaOH* gives a solid cake having soapy touch
Reason : Free glycerol is liberated which is a greasy solid **[AIIMS 1996]**

2. Assertion : Phenol is a weak acid than etnanol
Reason : Groups with + M effect and – I effect decrease acidity at *p*-position **[AIIMS 2002]**

3. Assertion : Phenol is more reactive than benzene towards electrophilic substitution reaction
Reason : In the case of phenol, the intermediate carbocation is more resonance stabilized **[IIT-JEE (Screening) 2000]**

4. Assertion : Phenol undergo Kolbe reaction, ethanol does not.
Reason : Phenoxide ion is more basic than ethoxide ion. **[AIIMS 1994]**

5. Assertion : Lucas reagent is a mixture of anhydrous $ZnCl_2$ and concentrate *HCl*
Reason : Primary alcohol produce ppt. with Lucas reagents. **[AIIMS 1995]**

6. Assertion : Resorcinol turns $FeCl_3$ solution purple.
Reason : Resorcinol have phenolic group. **[AIIMS 2000]**

7. Assertion : Glycerol is purified by distillation under reduced pressure.
Reason : Glycerol is a trihydric alcohol.

8. Assertion : Alcohol and phenol can be distinguished by sodium hydroxide.
Reason : Phenol is acidic while alcohol is neutral.

9. Assertion : Alcohols are dehydrated to hydrocarbons in the presence of acidic zeolites.
Reason : Zeolites are porous catalysts.

10. Assertion : The major products formed by heating $C_6H_5CH_2OCH_3$ with *HI* are $C_6H_5CH_2I$ and CH_3OH.
Reason : Benzyl cation is more stable than methyl cation. **[AIIMS 2004]**

11. Assertion : The *pka* of acetic acid is lower than that of phenol.
Reason : Phenoxide ion is more resonance stabilized. **[AIIMS 2004]**

12. Assertion : Alcoholic fermentation involves conversion of sugar into ethyl alcohol by yeast.
Reason : Fermentation involves the slow decomposition of complex organic

13. Assertion : The water solubility of the alcohols follow the order *t*-butyl > *s*-butyl alcohol > *n*-butyl alcohol.
Reason : Alcohols form *H*-bonding with water to show soluble nature.

14. Assertion : Absolute ethanol can be obtained by simple fractional distillation of a mixture of alcohol and water.
Reason : The absolute alcohol boils at 78.3°*C*.

15. Assertion : Acid catalysed dehydration of *t*-butanol is slower than *n*-butanol.
Reason : Dehydration involves formation of the protonated alcohol, ROH_2^+.

16. Assertion : Tertiary alcohols give turbidity immediately with Lucas reagent.
Reason : A mixture of conc.*HI* + anhydrous $ZnCl_2$ is called Lucas reagent.

17. Assertion : 4-nitrophenol is more acidic than 2, 4, 6-trinitrophenol.
Reason : Phenol is a weaker acid than carbonic acid.

18. Assertion : Phenols cannot be converted into esters by direct reaction with carboxylic acids.
Reason : Electron withdrawing groups increase the acidity of phenols.

19. Assertion : *tert*-butyl alcohol undergoes acid catalysed dehydration readily than propanol.
Reason : 3° alcohols do not give Victor-Meyer's test.

20. Assertion : The ease of dehydration of alcohols follows the order. Primary > Secondary > Tertiary.
Reason : Dehydration proceeds through the formation of oxonium ions.

21. Assertion : Phenol reacts with acyl halides in presence of pyridine to form phenyl acetate.
Reason : Benzoylation of phenol is carried out in the presence of NH_4OH .

22. Assertion : Alcohols are easily protonated than phenols.
Reason : Alcohols undergo intermolecular hydrogen bonding due to the presence of highly electronegative oxygen.

23. Assertion : Phenol is less acidic than *p*-nitrophenol.
Reason : Phenolate ion is more stable then *p*-nitrophenolate ion.

24. Assertion : Treatment of phenol with nitrous acid yields *p*-benzoquinone monoxime.
Reason : *p*-nitrosophenol and *p*-benzoquinone monoxime are tautomers.

25. Assertion : Reimer-Tiemann reaction of phenol with CCl_4 in *NaOH* at 340 *K* gives salicylic acis as the major product.
Reason : The reaction occurs through intermediate formation of dichlorocarbene.

26. Assertion : Primary and secondary alcohols can be distinguished by Victor-Meyer's test.
Reason : Primary alcohols form nitrolic acid which dissolve in *NaOH* to form blood red colouration but secindary alcohols form pseusonitrotes which give blue colouration with *NaOH.*

27. Assertion : HIO_4 cleaves 1, 2-glycols but not 1, 3- or higher glycols.
Reason : Only 1, 2- glycols form cyclic esters which subsequently undergo cleavage to form carbonyl compounds.

28. Assertion : Dehydration of glycerol with $KHSO_4$ gives acrolein.
Reason : Acrolein is an α, β-unsaturated aldehyde.

29. Assertion : Both symmetrical and unsymmetrical ethers can be prepared by Williamson's synthesis.
Reason : Williamson's synthesis is an example of nucleophilic substitution reaction.

30. Assertion : Etherates are coordination complexes of ethers with Lewis acids.
Reason : Ethers are easily cleaved by mineral acids such as *HCl* and H_2SO_4 at 373 *K*.

31. Assertion : $(CH_3)_3-Br$ and CH_3CH_2ONa react to form $(CH_3)_3C-O-CH_2CH_3$.
Reason : Good yields of ethers are obtained when tert-alkyl halides are treated with alkoxides.

32. Assertion : A rate of hydrolysis of methyl chloride to methanol is higher in DMF than in water.
Reason : Hydrolysis of methyl chloride follows second order kinetics. [AIIMS 2005]

33. Assertion : *t*-Butyl methyl ether is not prepared by the reaction of *t*-butyl bromide with sodium methoxide.
Reason : Sodium methoxide is a strong nucleophile.
[AIIMS 2005]

Answers

General introduction of alcohol, Phenol & Ethers

1	b	2	d	3	c	4	d	5	a
6	c	7	c	8	b	9	c	10	b
11	b	12	c	13	c	14	a	15	c
16	b	17	b	18	b	19	b	20	b
21	a	22	c	23	a	24	a	25	b
26	a	27	c	28	a	29	c	30	d
31	a	32	b	33	c	34	b	35	d
36	d	37	b	38	a	39	a		

Preparation of alcohol, Phenol and Ethers

1	c	2	c	3	b	4	c	5	d
6	c	7	c	8	d	9	a	10	b
11	c	12	c	13	b	14	b	15	d
16	c	17	b	18	c	19	d	20	b
21	c	22	b	23	c	24	c	25	c
26	d	27	a	28	d	29	b	30	a
31	b	32	b	33	d	34	c	35	d
36	c	37	a	38	a	39	b	40	c
41	b	42	a	43	a	44	c	45	c
46	b	47	c	48	b	49	a	50	b
51	d	52	a	53	d	54	a	55	c
56	a	57	b	58	c	59	b	60	bc
61	a	62	d	63	b	64	a		

Properties of alcohol, Phenol and Ethers

1	c	2	a	3	a	4	c	5	a
6	d	7	d	8	b	9	d	10	c
11	a	12	b	13	c	14	c	15	c
16	b	17	c	18	c	19	d	20	a
21	b	22	b	23	a	24	b	25	c
26	b	27	a	28	b	29	a	30	d
31	b	32	b	33	c	34	c	35	b
36	a	37	d	38	a	39	c	40	b
41	d	42	b	43	d	44	a	45	c
46	b	47	c	48	a	49	a	50	a
51	d	52	c	53	b	54	c	55	a

56	c	57	d	58	a	59	d	60	c
61	d	62	a	63	c	64	b	65	c
66	b	67	d	68	b	69	c	70	b
71	c	72	c	73	a	74	a	75	c
76	a	77	a	78	a	79	d	80	a
81	c	82	a	83	d	84	b	85	c
86	a	87	b	88	d	89	b	90	c
91	b	92	d	93	d	94	b	95	a
96	a	97	b	98	a	99	c	100	d
101	d	102	c	103	a	104	b	105	d
106	a	107	d	108	b	109	a	110	c
111	b	112	b	113	a	114	a	115	a
116	b	117	a	118	d	119	a	120	c
121	a	122	d	123	a	124	a	125	c
126	b	127	c	128	b	129	a	130	a
131	b	132	b	133	c	134	a	135	d
136	a	137	b	138	d	139	a	140	b
141	a	142	b	143	b	144	a	145	b
146	a	147	a	148	a	149	a	150	b
151	b	152	b	153	b	154	a	155	b
156	c	157	d	158	c	159	c	160	a
161	c	162	c	163	b	164	d	165	a
166	b	167	c	168	b	169	d	170	b
171	c	172	b	173	b	174	b	175	a
176	a	177	c	178	a	179	b	180	c
181	b	182	b	183	c	184	a	185	d
186	c	187	b	188	a	189	c	190	a
191	d	192	a	193	a	194	b	195	ad
196	d	197	b	198	b	199	b	200	a
201	b	202	c	203	d	204	a	205	b
206	a	207	b	208	b	209	b	210	b
211	a	212	a	213	b	214	a	215	a
216	c	217	d	218	d	219	a	220	a
221	b	222	a	223	d	224	b	225	c
226	a	227	c	228	d	229	b	230	a
231	b	232	d	233	c	234	b	235	d
236	b	237	d	238	c	239	d	240	a
241	a	242	a	243	b	244	a	245	a

Uses of alcohol, Phenol and Ethers

1	a	2	c	3	d	4	b	5	b
6	a	7	a	8	a	9	a	10	b
11	d	12	d	13	d	14	b	15	d
16	d	17	b	18	c	19	c	20	b
21	c	22	c	23	c	24	d	25	c
26	d	27	a	28	a				

Critical Thinking Questions

1	c	2	c	3	c	4	a	5	a
6	c	7	c	8	c	9	a	10	c
11	d	12	b	13	a	14	b	15	a
16	d	17	b	18	a	19	b	20	c
21	c	22	a						

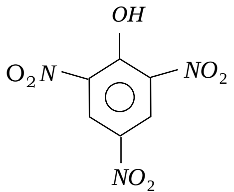
Assertion & Reason

1	c	2	d	3	a	4	c	5	c
6	a	7	b	8	a	9	b	10	a
11	c	12	a	13	b	14	e	15	e
16	c	17	e	18	b	19	b	20	e
21	c	22	b	23	c	24	b	25	c
26	a	27	a	28	b	29	b	30	c
31	d	32	c	33	b				

AS Answers and Solutions

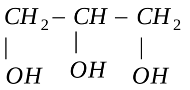
General introduction of alcohol, Phenol & Ethers

2. (d)



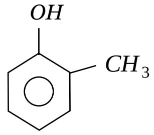
2, 4, 6-trinitrophenol or picric acid

4. (d)



$\underset{OH}{CH_2}-\underset{OH}{CH}-\underset{OH}{CH_2}$ Glycerol is trihydric alcohols.

5. (a)



Hydroxy

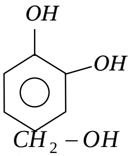
6. (c) % of $C = \frac{\text{Mass of } C}{\text{Mass of substance}} \times 100$

$$CCl_4 = \frac{12}{154} \times 100 = 7.79\%$$

$$C_6H_6Cl_6 = \frac{72}{291} \times 100 = 24.74\%$$

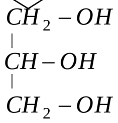
$$CH_2OH - CH_2OH = \frac{24}{62} \times 100 = 38.70\%.$$

7. (c)



o-dihydroxy benzene or catechol.

8. (b)



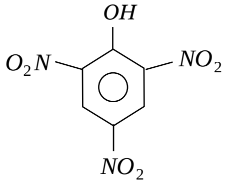
$$\begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array}$$

one secondary and two primary alcoholic groups.

11. (b) Carbinol is CH_3OH (Methanol).

12. (c) $-OH$ group is attached to primary carbon.

13. (c)

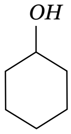


(Picric acid) or 2, 4, 6-trinitrophenol

Picric acid is phenolic while others are non phenolic.

15. (c) Butanal $CH_3-CH_2-CH_2-CHO$, an aliphatic aldehyde.

16. (b)

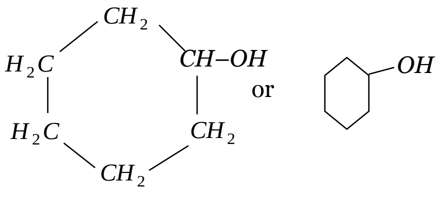


Cyclohexanol is a secondary alcohol because $-OH$ group is linked to 2^o carbon.

18. (b) C_2H_5OH and CH_3-O-CH_3 are isomers.

20. (b) 5-10 % methyl and remaining ethanol is called methylated spirit. It is also known as denatured alcohol because it is unfit for drinking.

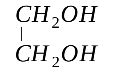
21. (a)



cyclohexanol

23. (a) 5% aqueous solution of phenol at room temperature is called as carbolic acid.

25. (b) Glycols are dihydric alcohols (having two hydroxyl groups). Ethylene glycol is the first member of this series.



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

(Ethyleneglycol)

26. (a) Methanol is also referred as wood alcohol or wood spirit or wood naphtha as the earliest method for its preparation was by destructive distillation of wood.

34. (b) Ether is basic because lone pairs of electrons are present on oxygen atom, $R-\overset{\bullet\bullet}{\underset{\bullet\bullet}{O}}-R$.

39. (a) Thio alcohol is known as mercaptans.

Preparation of alcohol, Phenol and Ethers

1. (c) Hydration of alkenes

$$CH_2=CH_2+\overset{+}{H}\overset{-}{HSO_4} \rightarrow CH_3-CH_2-HSO_4$$

$$CH_3-CH_2HSO_4 \xrightarrow[Boil]{H_2O} CH_3-CH_2-OH+H_2SO_4$$

Fermentation of sugars:

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

$$\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} 2C_2H_5OH+2CO_2$$

2. (c) $CH_2=CH_2 \xrightarrow{H_2SO_4} CH_3-CH_2-HSO_4 \xrightarrow{\text{Hydrolysis}}$

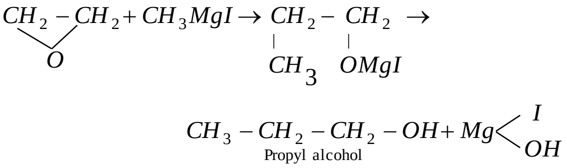
$$CH_3CH_2-OH+H_2SO_4$$

3. (b) Hydroboration oxidation (Industrial preparation of alcohol)

$$3CH_3CH=CH_2+\frac{1}{2}B_2H_6 \xrightarrow[\text{ether}]{\text{Dry}} (CH_3CH_2CH_3)_3B$$

$$(CH_3CH_2CH_3)_3B \xrightarrow{H_2O_2} 3CH_3CH_2CH_2-OH$$

4. (c)



$$CH_2-CH_2\,(O)+CH_3MgI \rightarrow \underset{CH_3}{CH_2}-\underset{OMgI}{CH_2} \rightarrow$$

$$\underset{\text{Propyl alcohol}}{CH_3-CH_2-CH_2-OH}+Mg\begin{cases} I \\ OH \end{cases}$$

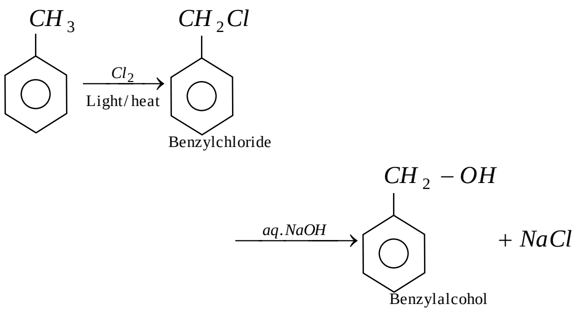
5. (d) Starch $\xrightarrow{\text{Enzymes}}$ Alcohol

6. (c) Coconut oil + Alkali → Soap + Glycerol

It is a saponification reaction.

7. (c) $\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethylalcohol}}{2C_2H_5OH+2CO_2}$

8. (d)



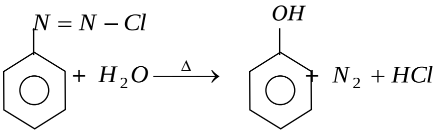
9. (a) $2(C_6H_{10}O_5)_n + nH_2O \xrightarrow[\text{(from germinated barley)}]{\text{Diastase}} n(C_{12}H_{22}O_{11})$ (Starch, Maltose)

$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{(from yeast)}]{\text{Maltase}} 2C_6H_{12}O_6$ (Glucose)

$C_6H_{12}O_6 \xrightarrow[\text{(from yeast)}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$

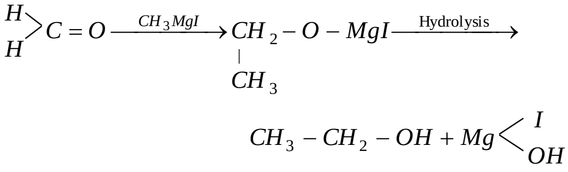
10. (b)

11. (c)



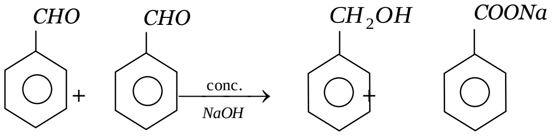
12. (c) $CH_3COOH + 4H \xrightarrow{LiAlH_4} CH_3CH_2OH + H_2O$

13. (b)

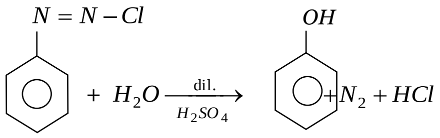


$$\begin{matrix} H \\ H \end{matrix}\!\!>C=O \xrightarrow{CH_3MgI} \underset{\underset{CH_3}{|}}{CH_2}-O-MgI \xrightarrow{\text{Hydrolysis}} CH_3-CH_2-OH + Mg<^{I}_{OH}$$

14. (b)

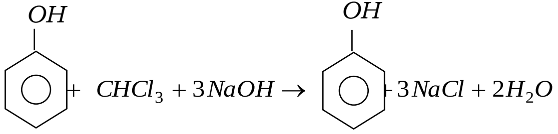


15. (d)



16. (c) $C_2H_5ONa + IC_2H_5 \rightarrow C_2H_5OC_2H_5 + NaI$

17. (b)



18. (c) $HCHO + HCHO \xrightarrow{\text{Conc. KOH}} \underset{\text{Methyl alcohol}}{CH_3OH} + \underset{\text{Potassium formate}}{HCOOK}$

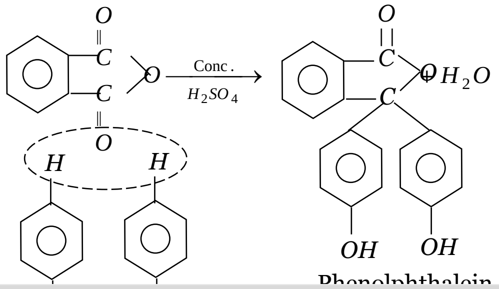
It is cannizzaro's reaction.

19. (d) Alcohol + $\underset{\text{(dry)}}{\text{Benzene}}$ → Soluble

(Alcohol) $R-OH + Na \rightarrow R-ONa + H_2$

21. (c) $\underbrace{CO + H_2}_{\text{water gas}} + H_2 \xrightarrow[672\ K,\ 200\ atm]{Cr_2O_2\ /\ ZnO} CH_3OH$

23. (c)



24. (c) $\underset{\text{Maltose}}{C_{12}H_{22}O_{11}} + H_2O \xrightarrow[\text{(from yeast)}]{\text{Maltase}} \underset{\text{Glucose}}{2C_6H_{12}O_6}$.

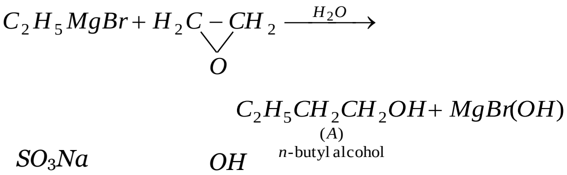
26. (d) Grignard reagent reacts with compounds containing multiple bonds like

$>C=O,\quad >C=S,\quad >C\equiv N$.

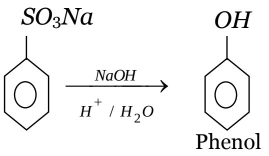
28. (d) Acetone reacts with Grignard's reagent to give tertiary alcohol.

$(CH_3)_2C=O + CH_3MgBr \xrightarrow{H_2O} \underset{\text{ter-butyl alcohol}}{(CH_3)_3C-OH}$

29. (b)

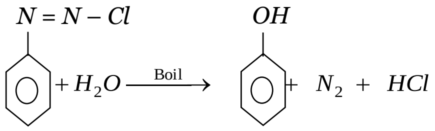


30. (a)



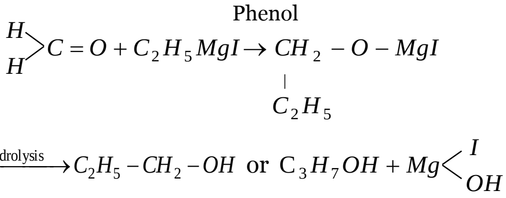
Phenol

31. (b)



Phenol

32. (b)



$$\begin{matrix} H \\ H \end{matrix}\!\!>C=O + C_2H_5MgI \rightarrow \underset{\underset{C_2H_5}{|}}{CH_2}-O-MgI$$

$$\xrightarrow{\text{Hydrolysis}} C_2H_5-CH_2-OH \text{ or } C_3H_7OH + Mg<^{I}_{OH}$$

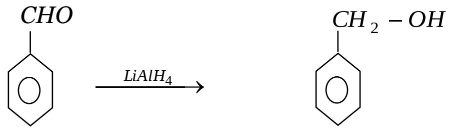
35. (d) $\underset{\text{Grignard reagent}}{RMgBr} + O_2 \rightarrow R-OMgBr \xrightarrow{\text{hydrolysis}} \underset{\text{Alcohol}}{R-OH} + Mg<^{Br}_{OH}$

39. (b) $\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$

During fermentation CO_2 gas is eliminated.

40. (c) $C_2H_5-NH_2 + HNO_2 \rightarrow C_2H_5OH + N_2 + H_2O$

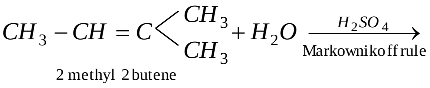
41. (b)



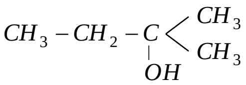
Benzyldehyde Benzyl alcohol

42. (a) $CO + H_2 \xrightarrow[573\,K,\ 200\ \text{atm}]{CuO-ZnO-Cr_2O_3} \underset{\text{Methanol}}{CH_3OH}$

43. (a)

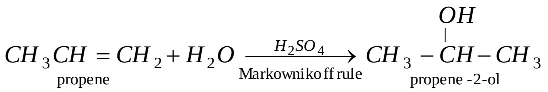


$$\underset{\text{2 methyl 2butene}}{CH_3-CH=C<^{CH_3}_{CH_3}} + H_2O \xrightarrow[\text{Markownikoff rule}]{H_2SO_4}$$



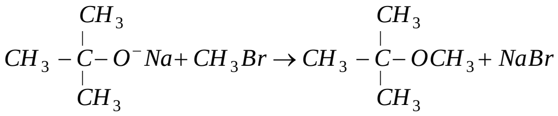
$$CH_3-CH_2-\underset{OH}{\underset{|}{C}}\lt\begin{matrix}CH_3\\CH_3\end{matrix}$$

2 methyl butan-2-ol



$$\underset{\text{propene}}{CH_3CH=CH_2}+H_2O\xrightarrow[\text{Markownikoff rule}]{H_2SO_4}\underset{\text{propene -2-ol}}{CH_3-\overset{OH}{\overset{|}{C}H}-CH_3}$$

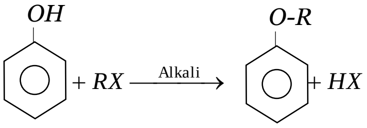
44. (c) $CH_3CONa+Br-CH_3\rightarrow\underset{\substack{\text{Dimethyl ether}\\\text{(symmetrical ether)}}}{CH_3-O-CH_3}+NaBr$



$$CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-O^-Na+CH_3Br\rightarrow CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-OCH_3+NaBr$$

Methyl ter-butyl ether
(unsymmetrical ether)

45. (c)



46. (b) $C_2H_5Br+\underset{\text{Sod. ethaoxide}}{C_2H_5ONa}\xrightarrow[-NaBr]{}\underset{\text{diethyl ether}}{C_2H_5-O-C_2H_5}$

47. (c) $RX+RONa\rightarrow\underset{\text{Ether}}{R-O-R}+NaX$

It is a Williamson's synthesis reaction.

48. (b) Williamson's synthesis –

$CH_3-CH_2-ONa+Cl-CH_2-CH_3\rightarrow$

$CH_3-CH_2-O-CH_2-CH_3$

49. (a) Dehydration of alcohols gives ethers.

50. (b) $2C_2H_5Br+\underset{\text{Dry}}{Ag_2O}\rightarrow C_2H_5-O-C_2H_5+2AgBr$

If we take moist Ag_2O then alcohol is formed

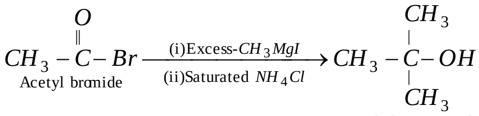
$Ag_2O+H_2O\rightarrow 2AgOH$

$C_2H_5Br+AgOH\rightarrow C_2H_5OH+AgBr$

51. (d) $\underset{\substack{\text{Methoxymethane}\\\text{(Lower ether)}}}{CH_3OCH_3}\xrightarrow{Cl_2/hv}\underset{\alpha-\text{Chlorodimethyl ether}}{CH_3OCH_2Cl}$

$\xrightarrow[-MgBr(Cl)]{CH_3MgBr}\underset{\substack{\text{Methoxyethane}\\\text{(Higher ether)}}}{CH_3OCH_2CH_3}$

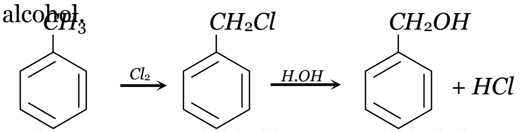
52. (a)



$$\underset{\text{Acetyl bromide}}{CH_3-\overset{O}{\overset{\|}{C}}-Br}\xrightarrow[\text{(ii)Saturated }NH_4Cl]{\text{(i)Excess-}CH_3MgI}CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-OH$$

2-methyl 2-propanol

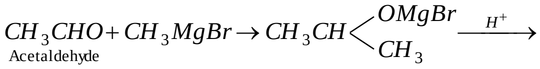
53. (d) When chlorine is passed in boiling toluene, substitution inside chain takes place and benzyl chloride is obtained which on hydrolysis give benzyl alcohol.



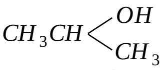
toluene   Benzyl chloride   Benzyl alcohol

54. (a) $\underset{\text{Benzaldehyde}}{2C_6H_5CHO}+NaOH\rightarrow\underset{\text{(Benzylalcohol)}}{C_6H_5CH_2OH}+C_6H_5COONa$

55. (c) Ethanal with CH_3MgBr gives propanol-2 (after hydrolysis) and with C_2H_5OH, it gives acetal.

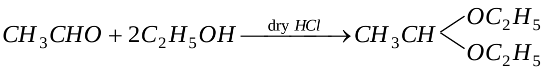


$$\underset{\text{Acetaldehyde}}{CH_3CHO}+CH_3MgBr\rightarrow CH_3CH\lt\begin{matrix}OMgBr\\CH_3\end{matrix}\xrightarrow{H^+}$$



$$CH_3CH\lt\begin{matrix}OH\\CH_3\end{matrix}$$

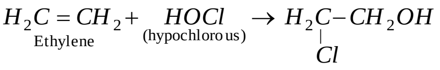
2 propanol



$$CH_3CHO+2C_2H_5OH\xrightarrow{\text{dry }HCl}CH_3CH\lt\begin{matrix}OC_2H_5\\OC_2H_5\end{matrix}$$

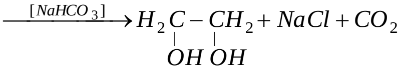
Acetal

56. (a)



$$\underset{\text{Ethylene}}{H_2C=CH_2}+\underset{\text{(hypochlorous)}}{HOCl}\rightarrow H_2\underset{Cl}{\underset{|}{C}}-CH_2OH$$

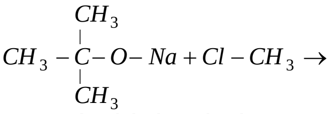
Ethylene chlorohydrine



$$\xrightarrow{[NaHCO_3]}H_2\underset{OH}{\underset{|}{C}}-\underset{OH}{\underset{|}{C}H_2}+NaCl+CO_2$$

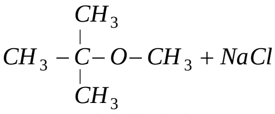
(Ethyleneglycol)

57. (b)



$$CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-O-Na+Cl-CH_3\rightarrow$$

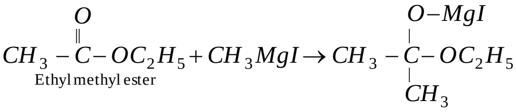
2, 2 dimethyl sodium ethoxide



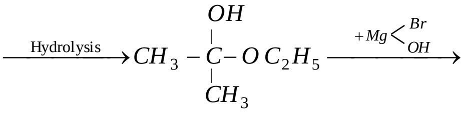
$$CH_3-\overset{CH_3}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-O-CH_3+NaCl$$

Methyl-*t* butyl ether

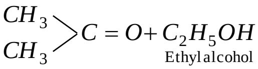
58. (c)



$$\underset{\text{Ethyl methyl ester}}{CH_3-\overset{O}{\overset{\|}{C}}-OC_2H_5}+CH_3MgI\rightarrow CH_3-\overset{O-MgI}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-OC_2H_5$$



$$\xrightarrow{\text{Hydrolysis}}CH_3-\overset{OH}{\overset{|}{\underset{CH_3}{\underset{|}{C}}}}-OC_2H_5\xrightarrow{+Mg\lt\begin{matrix}Br\\OH\end{matrix}}$$



$$\begin{matrix}CH_3\\CH_3\end{matrix}\gt C=O+\underset{\text{Ethyl alcohol}}{C_2H_5OH}$$

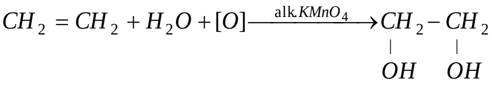
Acetone

59. (b) $NaBH_4$ and $LiAlH_4$ attacks only carbonyl group and reduce it into alcohol group. They do not attack on double bond.

$\underset{\text{cinnamicaldehyde}}{C_6H_5-CH=CHCHO}\xrightarrow{NaBH_4}$

$\underset{\text{cinnamic alcohol}}{C_6H_5-CH=CH.CH_2OH}$

60. (b,c)



$$CH_2=CH_2+H_2O+[O]\xrightarrow{\text{alk.}KMnO_4}\underset{OH}{\underset{|}{C}H_2}-\underset{OH}{\underset{|}{C}H_2}$$

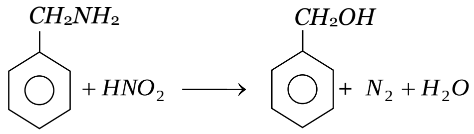
Glycol

$\underset{\text{Ethene}}{CH_2=CH_2}+H_2O\xrightarrow{\text{Conc. }H_2SO_4}\underset{\text{Ethanol}}{CH_3-CH_2-OH}$

61. (a) Wood $\xrightarrow[\text{distillation}]{\text{Destructive}}$ Wood gas + Tar + Charcoal

$+\underset{\text{(wood alcohol)}}{CH_3OH}+\underset{\text{(vinegar)}}{CH_3COOH}$

62. (d)



64. (a) $C_6H_6O^-+CH_3I\rightarrow C_6Hl5OCH_3+I^-$

Properties of alcohol, Phenol and Ethers

1. (c) $CH_3-OH + CH_3Mg-X \rightarrow CH_4 + CH_3O-Mg-X$

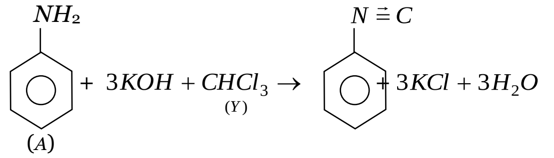
4. (c) $C_2H_5OH \xrightarrow[\text{Iodoform test}]{NaOH/I_2} CHI_3$ (yellowppt)

$CH_3OH \xrightarrow{NaOH/I_2}$ No ppt

5. (a) $\underset{X}{CH_3-CH_2-CH_2-OH} \xrightarrow{\text{Oxidation}} \underset{Y}{CH_3CH_2COOH}$

Since on oxidation same no. of carbon atoms are obtained in as therefore alcohol is primary

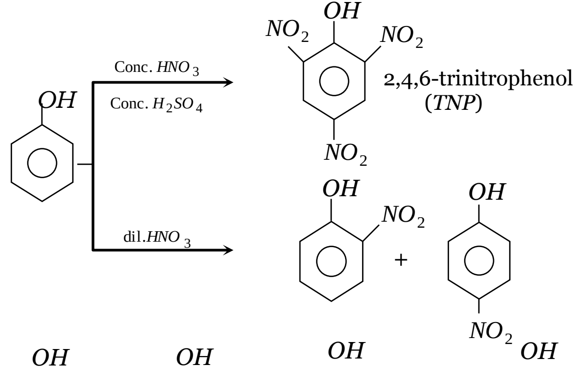
8. (b)



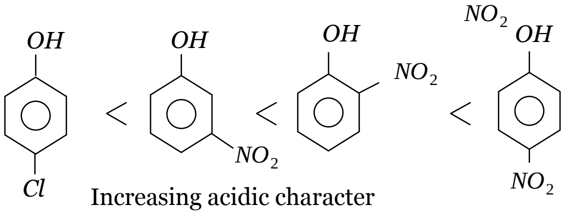
$\underset{(Z)}{C_2H_5OH} + Cl_2 \xrightarrow{Ca(OH)_2} \underset{\text{Acetaldehyde}}{CH_3CHO} \xrightarrow{Cl_2}$

$\underset{\text{Chloral}}{CCl_3CHO} \xrightarrow{Ca(OH)_2} \underset{\substack{\text{chloroform}\\(Y)}}{CHCl_3}$

12. (b)

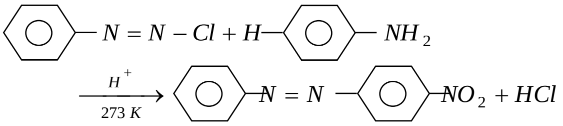


14. (c)



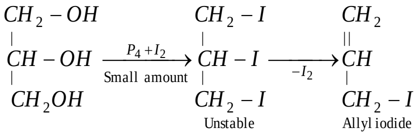
Increasing acidic character

15. (c)



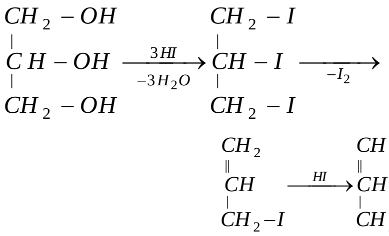
p–Aminoazobenzene (yellow ppt.)

16. (b)



$$\begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2OH \end{array} \xrightarrow[\text{Small amount}]{P_4+I_2} \underset{\text{Unstable}}{\begin{array}{l} CH_2-I \\ | \\ CH-I \\ | \\ CH_2-I \end{array}} \xrightarrow{-I_2} \underset{\text{Allyl iodide}}{\begin{array}{l} CH_2 \\ \| \\ CH \\ | \\ CH_2-I \end{array}}$$

18. (c)



$$\begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array} \xrightarrow[-3H_2O]{3HI} \begin{array}{l} CH_2-I \\ | \\ CH-I \\ | \\ CH_2-I \end{array} \xrightarrow{-I_2}$$

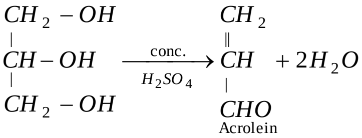
$$\begin{array}{l} CH_2 \\ \| \\ CH \\ | \\ CH_2-I \end{array} \xrightarrow{HI} \begin{array}{l} CH_3 \\ | \\ CH-I \\ | \\ CH_2-I \end{array} \xrightarrow{-I_2} \begin{array}{l} CH_3 \\ | \\ CH \\ \| \\ CH_2 \end{array}$$

19. (d) $HOOC-COOH \xrightarrow[\text{Decarboxylation}]{\text{Glycerol}} HCOOH + CO_2$

$HCOOH +$ Fehlingsolution $\rightarrow \underset{\text{Red ppt.}}{Cu_2O} + CO_2 + H_2O$

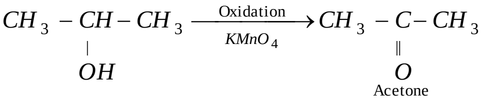
21. (b) Glycerol undergoes extensive hydrogen bonding due to the presence of 3 $-OH$ groups. As a result the glycerol molecules are highly associated and thus it has high viscosity.

22. (b)



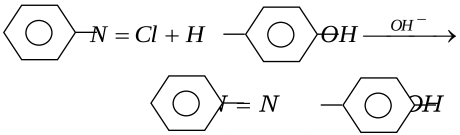
$$\begin{array}{l} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \end{array} \xrightarrow[H_2SO_4]{\text{conc.}} \underset{\text{Acrolein}}{\begin{array}{l} CH_2 \\ \| \\ CH \\ | \\ CHO \end{array}} + 2H_2O$$

23. (a)



$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[KMnO_4]{\text{Oxidation}} \underset{\text{Acetone}}{CH_3-\underset{\underset{O}{\|}}{C}-CH_3}$$

24. (b)



p-hydroxyazobenzene

25. (c) $(CH_3)_3C-OH + HCl \xrightarrow{Anhyd.\ ZnCl_2\ +\ HCl}$

$(CH_3)_3C-Cl + H_2O$ 3^o reacts immediately

$(CH_3)_3CH-OH + HCl \xrightarrow{Anhyd.\ ZnCl_2\ +\ HCl}$

$(CH_3)_2CH-Cl + H_2O$ 2^o reacts after 5 min.

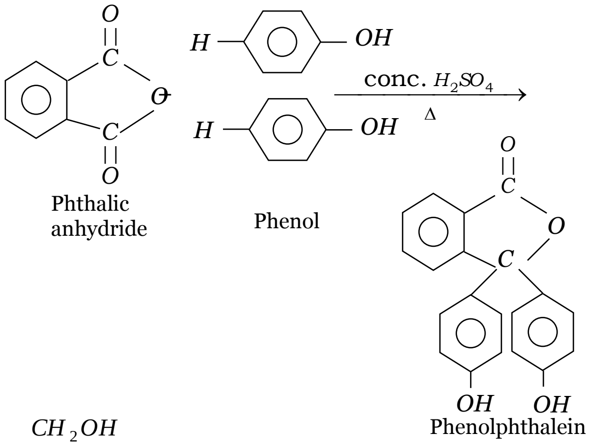
$CH_3CH_2CH_2-OH + HCl \xrightarrow{Anhyd.\ ZnCl_2\ +\ HCl}$

$CH_3CH_2CH_2-Cl + H_2O$ 1^o reacts only on heating.

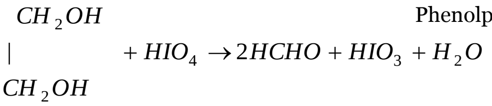
26. (b) $C_2H_5OH + R-Mg-X \rightarrow \underset{\text{Alkane}}{RH} + C_2H_5OMgX$

$C_3H_7OH + R-Mg-X \rightarrow RH + C_3H_7OMgX$

30. (d)

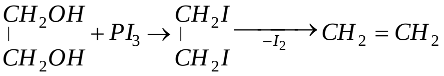


33. (c)



$$\begin{array}{l} CH_2OH \\ | \\ CH_2OH \end{array} + HIO_4 \rightarrow 2HCHO + HIO_3 + H_2O$$

35. (b)

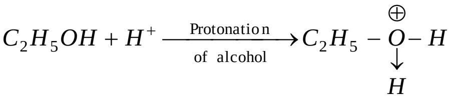


$$\begin{array}{l} CH_2OH \\ | \\ CH_2OH \end{array} + PI_3 \rightarrow \begin{array}{l} CH_2I \\ | \\ CH_2I \end{array} \xrightarrow{-I_2} CH_2=CH_2$$

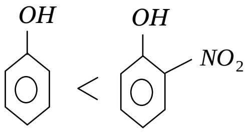
36. (a) $\underset{\text{alcohol}}{R-OH} + \underset{\text{Ceric amm. nitrate}}{(NH_4)_2Ce(NO_3)_6} \rightarrow \underset{\text{yellow } ppt.}{Ce(NO_3)_6(ROH)_9} + 2N + 14NO_3$

37. (d) $C_2H_5-O-C_2H_5 + O_2 \xrightarrow[25^oC]{hv} CH_3-CH(OOH)-O-C_2H_5$

38. (a) $H_2SO_4 \rightarrow H^+ + HSO_4^-$



$$C_2H_5OH + H^+ \xrightarrow[\text{of alcohol}]{\text{Protonation}} \underset{\text{Protonated alcohol}}{C_2H_5-\underset{\underset{H}{\downarrow}}{\overset{\oplus}{O}}-H}$$

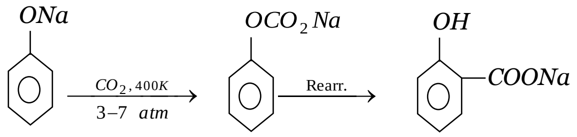


Nitro group is electron with-drawing. Hence, increases acidic nature.

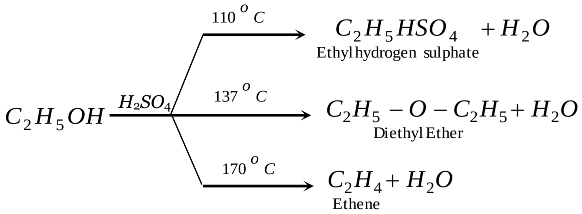
39. (c)

43. (d) $CH_3CH_2OH \xrightarrow[350^oC]{Al_2CO_3\ (X)} CH_2=CH_2+H_2O$

44. (a)



45. (c)



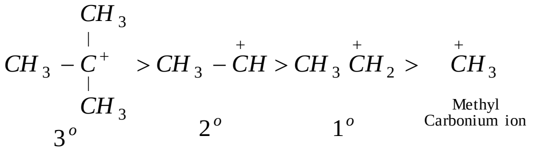
$C_2H_5OH \xrightarrow{H_2SO_4}$

$\xrightarrow{110^oC} \underset{\text{Ethyl hydrogen sulphate}}{C_2H_5HSO_4} + H_2O$

$\xrightarrow{137^oC} \underset{\text{Diethyl Ether}}{C_2H_5-O-C_2H_5} + H_2O$

$\xrightarrow{170^oC} \underset{\text{Ethene}}{C_2H_4} + H_2O$

46. (b)



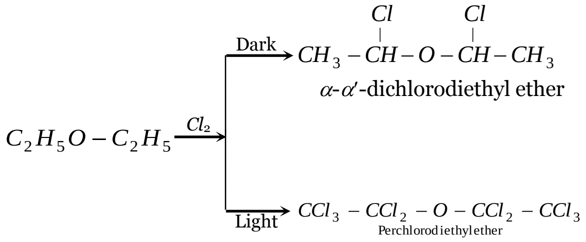
$\underset{3^o}{CH_3-\overset{CH_3}{\underset{CH_3}{C^+}}} > \underset{2^o}{CH_3-\overset{+}{C}H} > \underset{1^o}{CH_3\overset{+}{C}H_2} > \underset{\text{Methyl Carbonium ion}}{\overset{+}{C}H_3}$

47. (c) Alcohols having less number of carbon atoms are more soluble in water.

48. (a) $C_2H_5OH + Na \rightarrow C_2H_5ONa$

$2C_2H_5OH \xrightarrow[H_2SO_4]{\text{Conc.}} C_2H_5-O-C_2H_5+H_2O$

50. (a)



$C_2H_5O-C_2H_5 \xrightarrow{Cl_2}$

$\xrightarrow{\text{Dark}} CH_3-\overset{Cl}{CH}-O-\overset{Cl}{CH}-CH_3$

α-α′-dichlorodiethyl ether

$\xrightarrow[\text{Light}]{} \underset{\text{Perchlorodiethylether}}{CCl_3-CCl_2-O-CCl_2-CCl_3}$

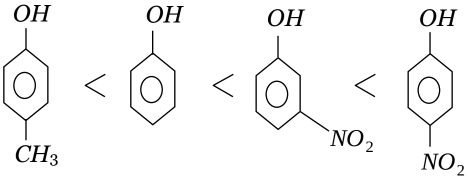
51. (d) $\underset{(A)}{C_2H_5OH} + PCl_5 \rightarrow \underset{(B)}{C_2H_5Cl} + POCl_3 + HCl$

$\underset{(B)}{C_2H_5Cl} + KCN \rightarrow C_2H_5CN + KCl$

$\downarrow$ Hydrolysi

C_2H_5-COOH

52. (c)



53. (b) Higher alcohols are stronger and have bitter taste.

54. (c) Order of reactivity with alkali metal (*e.g.*-Sodium) follows the order $1^o > 2^o > 3^o$.

56. (c) $\underset{1\,mole}{CH_3OH} + \underset{\substack{1\,mole\\(23\,gms)}}{Na} \rightarrow CH_3ONa + \underset{1/2\,mole}{\frac{1}{2}H_2}$

57. (d) $3CH_3CH_2CH_2CH_2-OH+PBr_3 \rightarrow$

$3CH_3CH_2CH_2CH_2-Br+H_3PO_3$

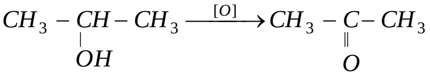
58. (a) $CH_3OH+Cl_2 \rightarrow$ No reaction

$CH_3OH+HCl \xrightarrow{ZnCl_2} CH_3Cl+H_2O$

$3CH_3OH+PCl_3 \rightarrow 3CH_3Cl+H_3PO_3$

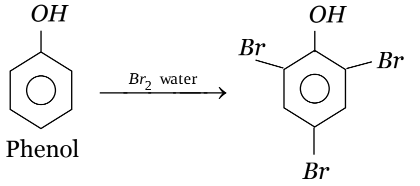
$CH_3OH+PCl_5 \rightarrow CH_3Cl+POCl_3+HCl$

59. (d)



$CH_3-\underset{OH}{CH}-CH_3 \xrightarrow{[O]} CH_3-\underset{\overset{\|}{O}}{C}-CH_3$

60. (c)



Phenol

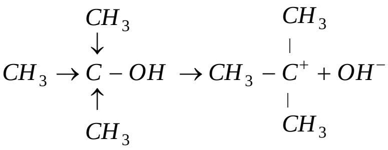
2,4,6 tribromophenol or white *ppt.*

61. (d) Due to hydrogen bonding.

62. (a) $C_2H_5OH \xrightarrow[\text{air}]{Pt} CH_3CHO$

63. (c) $CH_3-CH_2-OH \xrightarrow[170^oC]{\text{Conc. }H_2SO_4} CH_2=CH_2+H_2O$

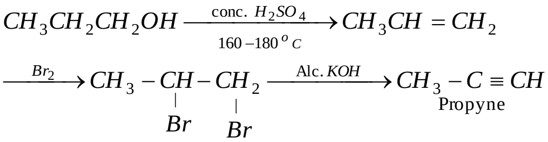
66. (b) Tertiary alcohol readily reacts with halogen acid



$CH_3 \rightarrow \overset{\overset{CH_3}{\downarrow}}{\underset{\underset{CH_3}{\uparrow}}{C}}-OH \rightarrow CH_3-\overset{CH_3}{\underset{CH_3}{C^+}}+OH^-$

Presence of 3 alkyl group increases electron density on 3^o carbon atom. Hence $-OH$ group is easily removed. After the removal of $-OH$ group 3^o carbonium ion is formed which is most stable

67. (d)

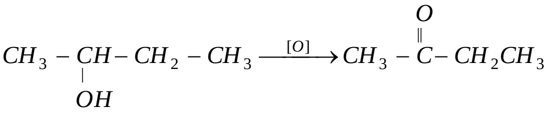


$CH_3CH_2CH_2OH \xrightarrow[160-180^oC]{\text{conc. }H_2SO_4} CH_3CH=CH_2$

$\xrightarrow{Br_2} CH_3-\underset{Br}{CH}-\underset{Br}{CH_2} \xrightarrow{\text{Alc. }KOH} \underset{\text{Propyne}}{CH_3-C\equiv CH}$

68. (b) Lower alcohols are soluble in all solvents.

69. (c)



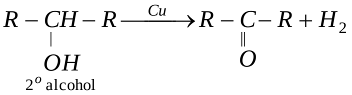
$CH_3-\underset{OH}{CH}-CH_2-CH_3 \xrightarrow{[O]} CH_3-\overset{\overset{O}{\|}}{C}-CH_2CH_3$

70. (b) Due to the resonance stabilisation of phenoxide ion.

73. (a) $\underset{1^o\text{ alcohol}}{R-CH_2-CH_2-OH} \xrightarrow[170^oC]{\text{Conc. }H_2SO_4}$

$\underset{\text{Alkene}}{R-CH=CH_2+H_2O}$

74. (a) $\underset{1^o\text{ alcohol}}{R\text{-}CH_2OH} \xrightarrow{Cu} R-CHO+H_2$



$\underset{2^o\text{ alcohol}}{R-\underset{OH}{CH}-R} \xrightarrow{Cu} R-\underset{\overset{\|}{O}}{C}-R+H_2$

75. (c) $CH_3OH \xrightarrow[H_2SO_4]{K_2Cr_2O_7} HCOOH$

76. (a) $CH_3CH_2OH \xrightarrow{K_2Cr_2O_7} CH_3COOH$

77. (a) Lucas test is used for the distinction of primary secondary and tertiary alcohols.

78. (a) $+ NH_3 \xrightarrow[300^{o}C]{ZnCl_2} + H_2O$

80. (a) A compound that undergoes bromination easily is phenol. Due to presence of $-OH$ group the ring becomes much more active in substitution reactions. The bromination occurs due to availability of electrons on ortho and para position.

81. (c) *o*-Nitrophenol has intramolecular *H*-bonding.

84. (b) C_2H_5OH gives iodoform test having α-hydrogen atom while CH_3OH does not give due to the absence of α-hydrogen atom.

85. (c) Phenol has higher boiling point than toluene because of hydrogen bonding.

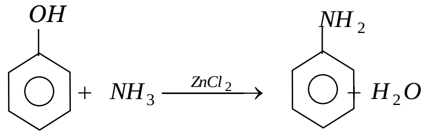
87. (b) $\underset{\text{Propene}-1}{CH_3-CH=CH_2} + aq.KOH \rightarrow \underset{\text{Propanol}-1}{CH_3-CH_2-CH_2OH}$

88. (d)

$$\begin{tikzcd} C_2H_5OH + PCl_5 \arrow[r] & C_2H_5Cl \arrow[r, "KCN"] & C_2H_5CN \arrow[d, "HCl/H_2O"] \\ & & C_6H_5COOH \end{tikzcd}$$

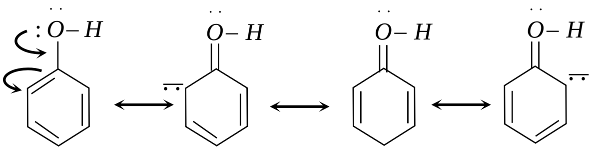
89. (b) $LiAlH_4$ + ether, is reducing agent.

97. (b)



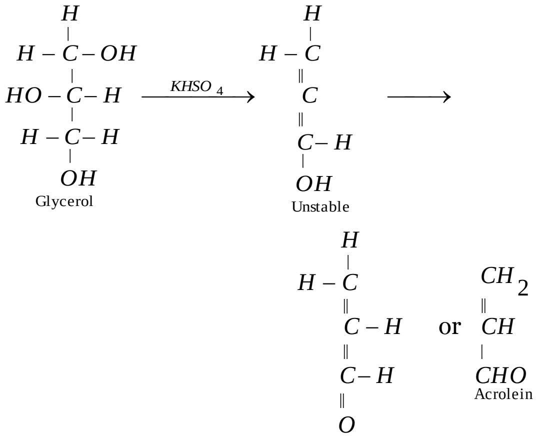
Aniline

98. (a)

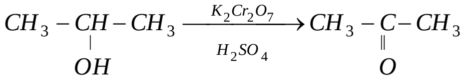


Oxygen atom of $-OH$ group acquires positive charge.

99. (c)



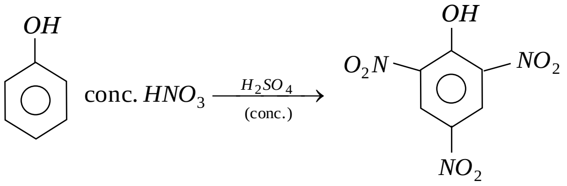
100. (d)



$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3-\underset{\underset{O}{\|}}{C}-CH_3$

$\xrightarrow[I_2]{NaOH} \underset{\text{Yellow } ppt}{CHI_3} + CH_3COONa$

101. (d)



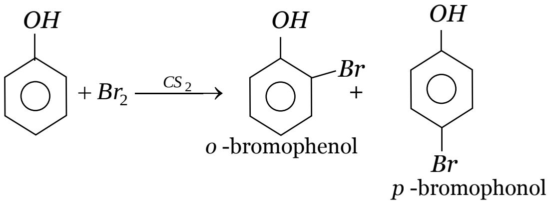
Picric

102. (c) Phenol is weaker acid than carbonic acid

$$\underset{K_a=10^{-8}-10^{-10}}{C_6H_5OH}, \quad \underset{K_a=10^{-7}}{H_2CO_3}, \quad \underset{K_a=10^{-5}}{CH_3COOH}$$

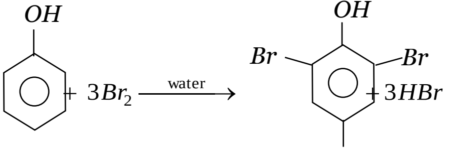
103. (a)

104. (b)



In presence of non-polar solvent (CS_2) the ionization of phenol is suppressed. The ring is slightly activated and hence mono substitution occurs.

On the other hand with Br_2 water phenol forms 2,4,6-tribromo phenol.

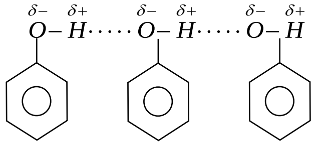


In aqueous solution phenol ionizes to give phenoxide ion. Due to the presence of negative charge on oxygen the benzene ring is highly activated and hence trisubstituted product is obtained.

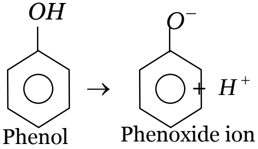
105. (d) $\underset{\text{Ethylalcohol}}{C_2H_5OH} \xrightarrow{CrO_3} \underset{\text{Aceticacid}}{CH_3COOH}$

107. (d) $\underset{\text{Ethanol}}{C_2H_5OH} \xrightarrow[170^{o}C]{Conc.H_2SO_4} \underset{\text{Ethane}}{C_2H_4} + H_2O$

108. (b)

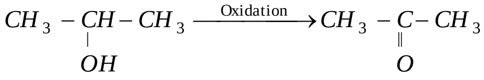


109. (a)



Phenol Phenoxide ion

110. (c) (a)



$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{\text{Oxidation}} CH_3-\underset{\underset{O}{\|}}{C}-CH_3$

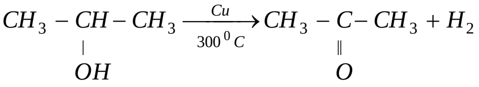
(b) $CH_3-CH_2-OH \xrightarrow[180^{o}C]{Conc.H_2SO_4} CH_2=CH_2+H_2O$

(d) $2CH_3CH_2OH + 2Na \rightarrow 2CH_3-CH_2-ONa + H_2$

112. (b) Carbylamine reaction

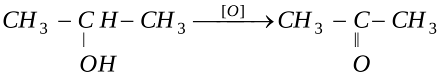
$CHCl_3 + CH_3NH_2 + \underset{\text{alc.}}{3KOH} \rightarrow \underset{\substack{\text{Methyl}\\ \text{isocyanide}}}{CH_3N \equiv C} + 3KCl + 3H_2O$

113. (a) Secondary alcohol on dehydrogenation gives acetone



$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[300^{0}C]{Cu} CH_3-\underset{\underset{O}{\|}}{C}-CH_3 + H_2$

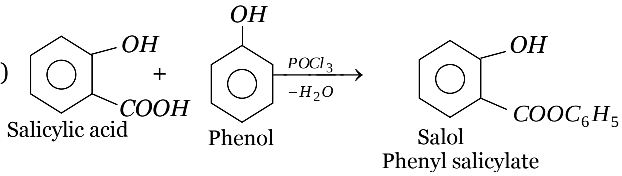
114. (a)



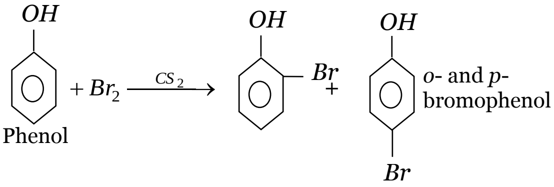
$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{[O]} CH_3-\underset{\underset{O}{\|}}{C}-CH_3$

118. (d) $C_2H_5OH + [O] \rightarrow CH_3CHO \rightarrow CH_3COOH$.

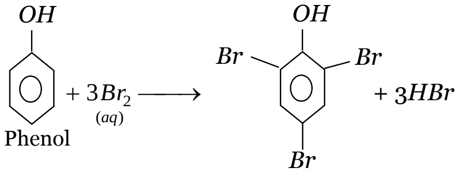
119. (a)



120. (c) (i)



(ii)

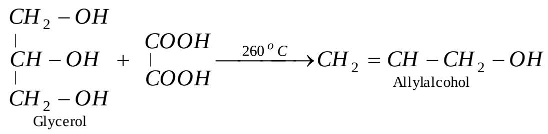


2, 4, 6-tribromophenol

In *aq*. solution phenol ionize to give phenoxide in which highly activates benzene ring and give trisubstituted product while in presence of CS_2 an inert solvent phenol is unable to ionize due to which benzene ring is slightly activated. Hence, monosubstituted product is obtained.

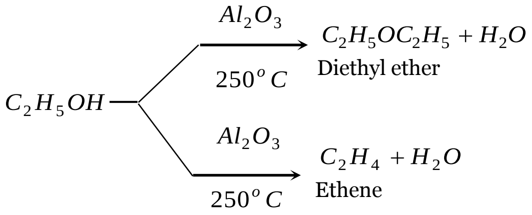
122. (d) Traces of water from ethanol is removed by reacting with *Mg* metal.

123. (a)

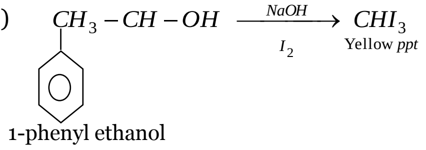


$$\begin{matrix} CH_2-OH \\ | \\ CH-OH \\ | \\ CH_2-OH \\ \text{Glycerol} \end{matrix} + \begin{matrix} COOH \\ | \\ COOH \end{matrix} \xrightarrow{260^oC} \underset{\text{Allylalcohol}}{CH_2=CH-CH_2-OH}$$

125. (c)

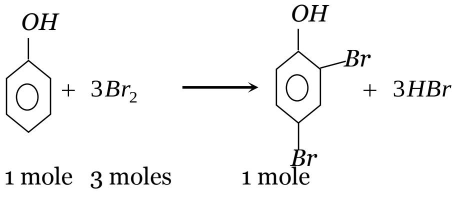


126. (b)



Iodoform test is given by compounds in which $\underset{OH}{\underset{|}{CH_3-CH-}}$ or $\underset{O}{\underset{\|}{CH_3-CH-}}$ group is present.

127. (c)



94 grams of phenol reacts with 480 *gms*. of Br_2.

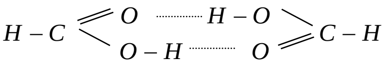
2 *gm*. of phenol — $\frac{480}{94}\times 2 = 10.22\,gms.$

128. (b) $2C_2H_5OH+2Na \rightarrow 2C_2H_5ONa+H_2$

130. (a) $CH_3COOH+CH_3OH \underset{\text{Esterificaion}}{\rightarrow} CH_3COOCH_3+H_2O$

131. (b) CH_3OH has highest boiling point because of hydrogen bonding.

132. (b)

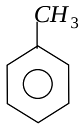


Formic acid forms dimer due to which strength of $H-$bond increases Hence, boiling point increases.

133. (c) Lower members are soluble in water and solubility decreases with increasing molecular mass because hydrophobic character increases.

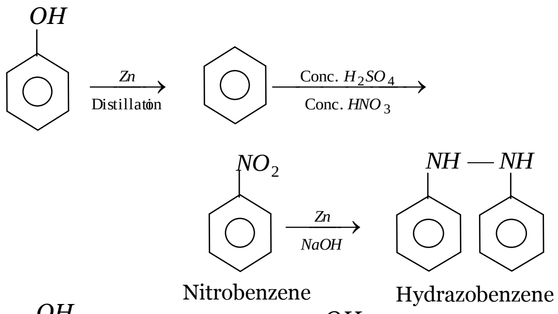
135. (d) Alcohols can not be dried using anhydrous $CaCl_2$ because it forms an addition compound $CaCl_2.4CH_3OH$.

137. (b)

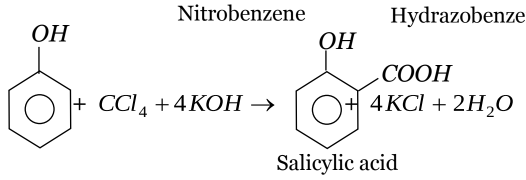


Presence of methyl group increases electron density at *o-* and *p-* positions. Hence, it undergoes nitration readily.

138. (d)



140. (b)



141. (a) $\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethylalcohol}}{2C_2H_5OH}+2CO_2$

144. (a) $C_2H_5OH+NH_3 \xrightarrow{Al_2O_3} C_2H_5NH_2+H_2O$

145. (b) $CH_3OH+\frac{1}{2}O_2 \xrightarrow{Cu} HCHO+H_2O$

146. (a) $CH_3COOH+C_2H_5OH \rightarrow \underset{\text{Ethyl acetate}}{CH_3COOC_2H_5}+H_2O$

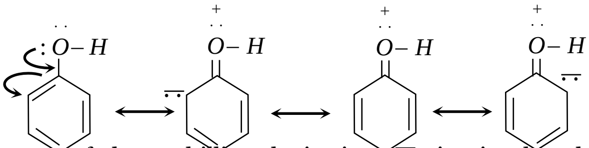
147. (a)

$$\begin{tikzcd} \underset{A}{\underset{1^o\text{alcohol}}{CH_3CH_2OH}} \arrow[r, "\text{Oxi.}"] & CH_3CHO \arrow[r, "\text{Oxi.}"] & CH_3COOH \arrow[d, "\text{Ammonical } AgNO_3"] \\ & & \text{Silver Mirror} \end{tikzcd}$$

150. (b) $CH_3CH_2-OH+HO-CH_2-CH_3 \xrightarrow[140^oC]{\text{Conc. } H_2SO_4}$

$$\underset{\text{Diethyl ether}}{CH_3CH_2-O-CH_2-CH_3}+H_2O$$

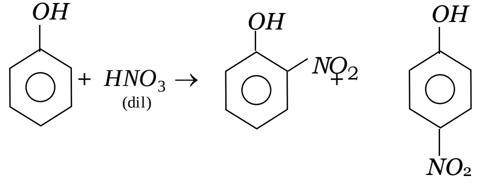
151. (b)



Rate of electrophillic substitution reaction in phenol is faster than in benzene because presence of $-OH$

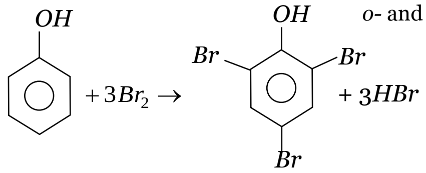
group increases electron density at *o*- and *p*-positions.

152. (b)



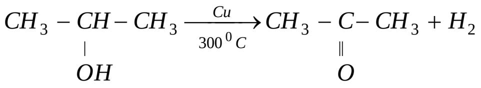
o- and *p*- nitrophenol

153. (b)



2,4,6 – tribromophenol

155. (b) Secondary alcohol on dehydrogenation gives acetone



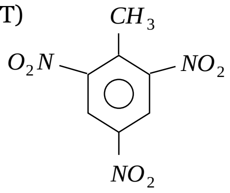
$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[300^0C]{Cu} CH_3-\underset{\underset{O}{\|}}{C}-CH_3+H_2$$

156. (c) $C_2H_5OH \xrightarrow{NaOH\ /\ I_2} CHI_3$

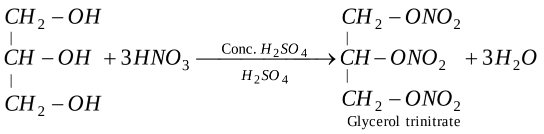
$CH_3COCH_3 \xrightarrow{NaOH\ /\ I_2} CHI_3$

$CH_3OH \xrightarrow{NaOH\ /\ I_2}$ No reaction.

157. (d) 2,4,6 Trinitro toulene (TNT)



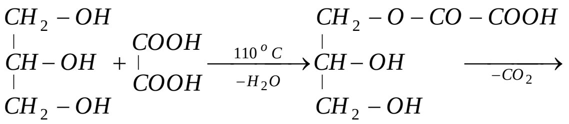
159. (c)



$$\begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} + 3HNO_3 \xrightarrow[H_2SO_4]{\text{Conc. } H_2SO_4} \begin{array}{l}CH_2-ONO_2\\ |\\ CH-ONO_2\\ |\\ CH_2-ONO_2\end{array} + 3H_2O$$

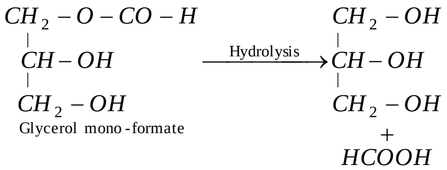
Glycerol trinitrate

160. (a)



$$\begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} + \begin{array}{l}COOH\\ |\\ COOH\end{array} \xrightarrow[-H_2O]{110^oC} \begin{array}{l}CH_2-O-CO-COOH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} \xrightarrow[-CO_2]{}$$

Glycerol mono-oxolate



$$\begin{array}{l}CH_2-O-CO-H\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} \xrightarrow{\text{Hydrolysis}} \begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\\ +\\ HCOOH\end{array}$$

Glycerol mono-formate

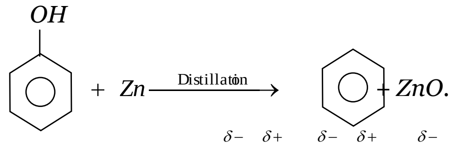
Formic acid

163. (b) $C_2H_5OH+CH_3COOH \xrightarrow[\text{Esterification}]{H_2SO_4}$

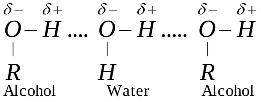
$CH_3COOC_2H_5+H_2O$

Ethylacetate

165. (a)



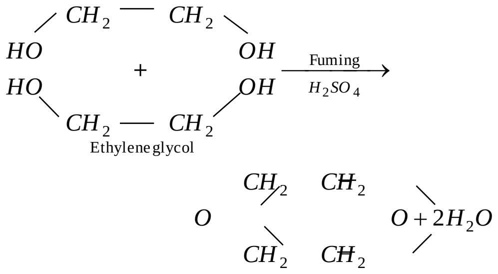
166. (b) Hydrogen bonding :



$$\overset{\delta-}{O}-\overset{\delta+}{H} \ldots\ldots \overset{\delta-}{O}-\overset{\delta+}{H} \ldots\ldots \overset{\delta-}{O}-\overset{\delta+}{H}$$

$$\begin{array}{ccc} | & | & | \\ R & H & R \\ \text{Alcohol} & \text{Water} & \text{Alcohol}\end{array}$$

167. (c)



168. (b) Tertiary carbonium ion is the most stable and it will be given by dehydration of tertiary alcohol.

169. (d) $CH_3CH_2OH \xrightarrow[\text{bond fission}]{\text{Heterolytic}} CH_3CH_2O^- + H^+$

170. (b) C_2H_5OH is soluble in water due to *H*-bonding.

173. (b) When ethanol dissolves in water then emission of heat and contraction in volume.

175. (a) Azeotropic distillation method –

Rectified spirit + Benzene + water

↓ Fractional distillation

First fraction at 331.8 *K* is ternary azeotrope

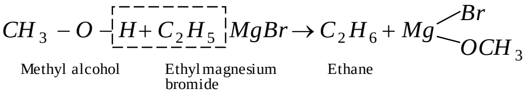
(H_2O 7.4% + Benzene 74% + alcohol 18.5%)

Second fraction 341.2 *K* is a binary azeotrope

(Benzene 67.7% + Alcohol 32.2%)

Last fraction at 351*K* is absolute alcohol.

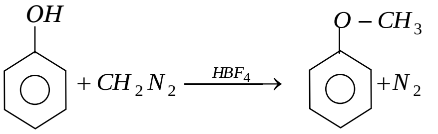
176. (a)



$$CH_3-O-\boxed{H+C_2H_5}MgBr \rightarrow C_2H_6+Mg\begin{array}{l}Br\\ OCH_3\end{array}$$

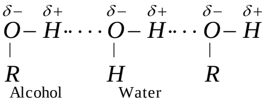
Methyl alcohol Ethylmagnesium bromide Ethane

177. (c)



Anisole

180. (c) Alcohol is soluble in water due to *H*-bonding



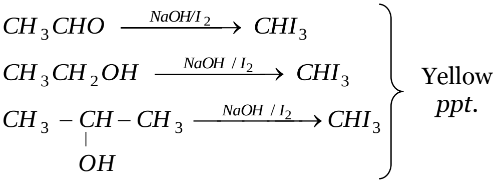
$$\overset{\delta-}{O}-\overset{\delta+}{H} \cdots\cdots \overset{\delta-}{O}-\overset{\delta+}{H} \cdots\cdots \overset{\delta-}{O}-\overset{\delta+}{H}$$

$$\begin{array}{ccc} | & | & | \\ R & H & R \\ \text{Alcohol} & \text{Water} & \end{array}$$

183. (c) $CH_3CH_2-OH+2Cl_2 \rightarrow CCl_3-CHO$

Oxidation will occur with chlorination of methyl group.

185. (d)



$$\left.\begin{array}{l} CH_3CHO \xrightarrow{NaOH/I_2} CHI_3 \\ CH_3CH_2OH \xrightarrow{NaOH\ /\ I_2} CHI_3 \\ CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{NaOH\ /\ I_2} CHI_3 \end{array}\right\} \text{Yellow } ppt.$$

$C_6H_5-CH_2-OH \xrightarrow{NaOH\ /\ I_2}$ No yellow *ppt.*

186. (c) Benzyl alcohol and cyclohexanol are not acidic while phenol and *m*-chlorophenol are acidic due to presence of electron withdrawing groups like $-NO_2$, $-Cl$, $-CN$ increases the acidic character of phenols. Hence, *m*-chlorophenol is more acidic than phenol.

187. (b) Three, these are

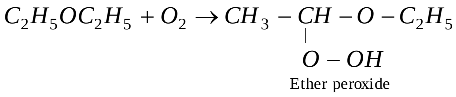
$CH_3CH_2OCH_2CH_3$ (I), $CH_3OCH_2CH_2CH_3$ (II)

and $CH_3OCH(CH_3)_2$ (III). Here I and II, I and III are pairs of metamers.

189. (c) CH_3OCH_3 and $C_2H_5OCH_3$ are gases while $C_2H_5OC_2H_5$ (b.p. 308 K) is low boiling liquid.

190. (a) $C_2H_5OC_2H_5 \xrightarrow[\text{Cleavage of ethers}]{\text{Red } P/HI} 2C_2H_5I \xrightarrow[\text{Reduction}]{\text{Red } P/HI} \underset{\text{Ethane}}{2C_2H_6}$

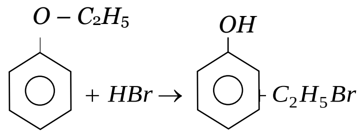
191. (d)



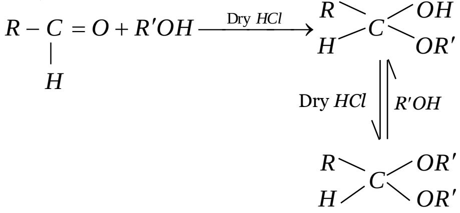
$C_2H_5OC_2H_5 + O_2 \rightarrow \underset{\text{Ether peroxide}}{CH_3-\underset{\underset{O-OH}{|}}{CH}-O-C_2H_5}$

192. (a) $C_2H_5OC_2H_5 + HI \rightarrow C_2H_5OH + C_2H_5I$

193. (a)



196. (d)



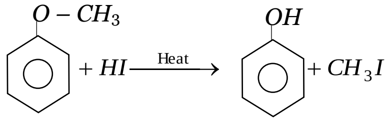
Acetal

198. (b) $CH_3-O-CH_3 + 2HI \rightarrow 2CH_3I + H_2O$

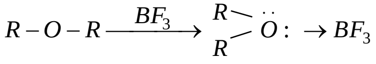
199. (b) Only alkyl aryl ethers *e.g.*, $C_6H_5OCH_3$ undergoes electrophilic substitution reactions.

200. (a) $CH_3COCl + C_2H_5O-C_2H_5 \rightarrow$ No reaction

201. (b)



202. (c)



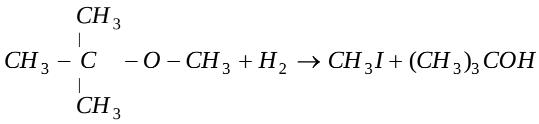
$R-O-R \xrightarrow{BF_3} \begin{matrix} R \\ R \end{matrix}\!\!>\ddot{O}: \rightarrow BF_3$

Etherate

203. (d) Due to inter-molecular hydrogen bonding in alcohols boiling point of alcohols is much higher than ether.

205. (b) CH_3-OCH_3 does not have replaceable H – atom.

206. (a)



$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{CH_3}{|}}{C}}-O-CH_3 + H_2 \rightarrow CH_3I + (CH_3)_3COH$

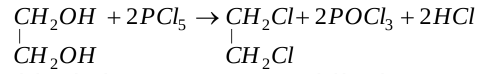
207. (b) $CH_3CH(OH)CH_2CH_3 \xrightarrow{\text{Conc. } H_2SO_4}$

$$\underset{(C_4H_8)}{CH_3CH=CHCH_3}$$

$$\underset{\text{2–Butanol}}{CH_3CHOHCH_2CH_3} \xrightarrow{[O]} \underset{\text{Butanone}}{CH_3COCH_2CH_3}$$

Butanone gives both an oxime and positive iodoform test, therefore, the original compound is 2-butanol.

208. (b)

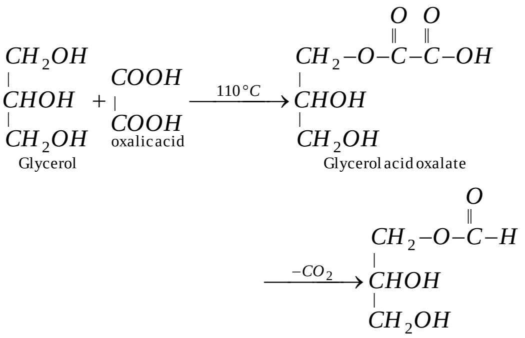


$\underset{\text{Ethylene glycol}}{\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix}} + 2PCl_5 \rightarrow \underset{\text{1, 2 dichloroethane}}{\begin{matrix} CH_2Cl \\ | \\ CH_2Cl \end{matrix}} + 2POCl_3 + 2HCl$

209. (b) C_2H_5OH (ethanol) is a very weak acid hence it does not react with $NaOH$. However it reacts with metallic sodium.

210. (b) Methanol has high boiling point than methyl thiol because there us intermolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol.

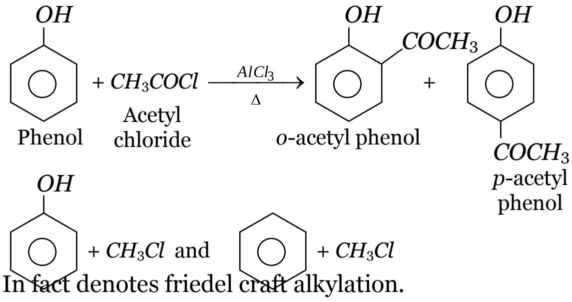
211. (a)



Glycerol monoformat e

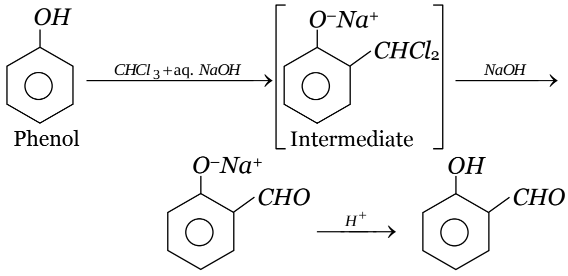
212. (a) Formation of a yellow precipitate on heating a compound with an alkaline solution of iodine is known as iodoform reaction. Methyl alcohol does not respond to this test. Iodoform test is exhibited by ethyl alcohol, acetaldehyde, acetone, methyl ketone and those alcohols which possess $CH_3CH(OH)-$ group.

213. (b) In friedal craft acylation, aromatic compounds such as benzene, phenol etc. undergo acylation with CH_3COCl in the presence of anhydrous $AlCl_3$ and gives ortho and para derivatives. Intermediate is $CH_3C^+=O$ (acylium ion) of this reaction.



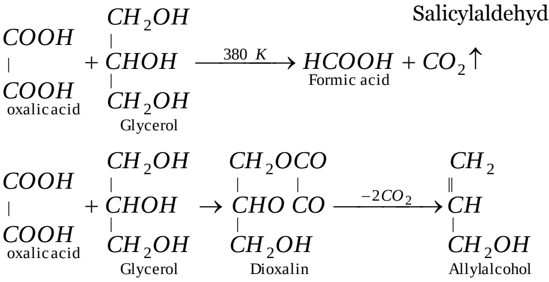
In fact denotes friedel craft alkylation.

214. (a) This reaction is known as Reimer Tiemann reaction.



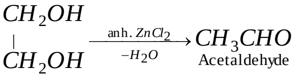
Salicylaldehyde

215. (a)



Thus at 530 K allyl alcohol is formed.

216. (c)



$\begin{matrix} CH_2OH \\ | \\ CH_2OH \end{matrix} \xrightarrow[-H_2O]{\text{anh. } ZnCl_2} \underset{\text{Acetaldehyde}}{CH_3CHO}$

217. (d) Ethyl alcohol give positive iodoform test (*i.e.* yellow ppt. with I_2 and $NaOH$)

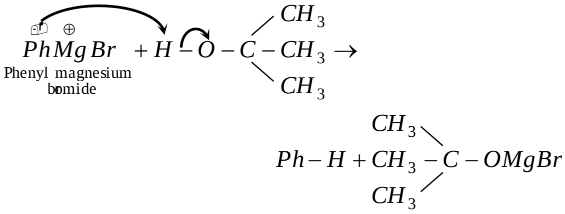
$$CH_3CH_2OH + 4I_2 + 6NaOH \rightarrow \underset{\text{yellow ppt.}}{CHI_3} + 5NaI + CH_3COONa + 3H_2O$$

218. (d) Tertiary alcohols react fastest with hydrogen halides 2 methyl propan-2-ol is a tertiary alcohol.

219. (a) When benzoic acid reacts with ethyl alcohol in the presence of sulphuric acid ethyl benzoate is formed. This is known as esterification.

$$\underset{\text{Benzoic acid}}{C_6H_5COOH} + \underset{\text{Ethyl alcohol}}{C_2H_5OH} \xrightarrow{H_2SO_4} \underset{\text{Ethyl benzoate}}{C_6H_5COOC_2H_5} + \underset{\text{water}}{H_2O}$$

220. (a)

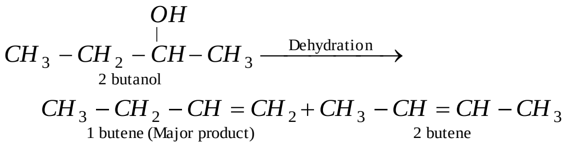


221. (b) $Mg + CH_3I \xrightarrow{\text{Dry ether}} CH_3MgI$

222. (a) Ethyl alcohol on dehydration with conc. H_2SO_4 at 170°*C* gives ethylene.

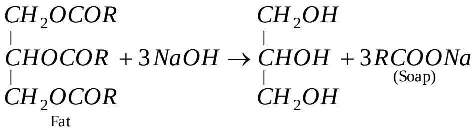
$$\underset{\text{Ethyl alcohol}}{CH_3CH_2OH} \xrightarrow[\text{conc. } H_2SO_4]{170°C} \underset{\text{Ethylene}}{CH_2=CH_2} + H_2O$$

223. (d)



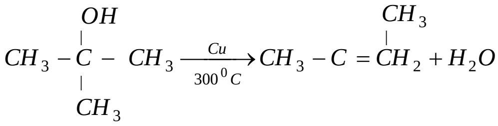
$$\underset{\text{2 butanol}}{CH_3-CH_2-\overset{\overset{OH}{|}}{CH}-CH_3} \xrightarrow{\text{Dehydration}} \underset{\text{1 butene (Major product)}}{CH_3-CH_2-CH=CH_2} + \underset{\text{2 butene}}{CH_3-CH=CH-CH_3}$$

224. (b) Fats are esters of higher fatty acids with glycerol, hence on alkaline hydrolysis they give back glycerol and sodium or potassium salt of acid (this is called soap).



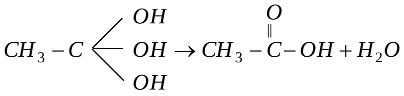
$$\underset{\text{Fat}}{\begin{array}{l}CH_2OCOR\\ |\\ CHOCOR\\ |\\ CH_2OCOR\end{array}} + 3NaOH \rightarrow \begin{array}{l}CH_2OH\\ |\\ CHOH\\ |\\ CH_2OH\end{array} + \underset{\text{(Soap)}}{3RCOONa}$$

225. (c)



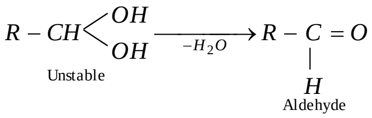
$$CH_3-\underset{\underset{CH_3}{|}}{\overset{\overset{OH}{|}}{C}}-CH_3 \xrightarrow[300^0C]{Cu} CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2+H_2O$$

227. (c)

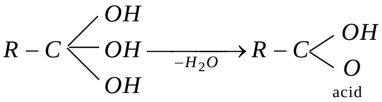


If two or more $-OH$ groups are present on carbon atom then it immediately looses water molecule and forms acid or aldehyde.

Two $-OH$ groups on the same carbon aldehyde is formed

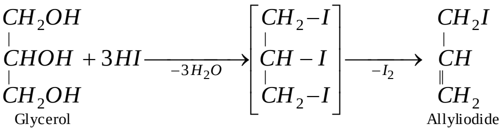


Three $-OH$ groups on the same carbon acid is formed.



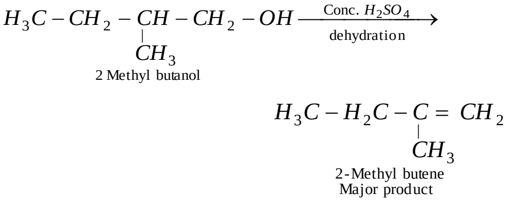
228. (d) H_2SO_4, Al_2O_3 and H_3PO_4 all can act as dehydrating agent.

229. (b)



$$\underset{\text{Glycerol}}{\begin{array}{l}CH_2OH\\ |\\ CHOH\\ |\\ CH_2OH\end{array}} + 3HI \xrightarrow[-3H_2O]{} \left[\begin{array}{l}CH_2-I\\ |\\ CH-I\\ |\\ CH_2-I\end{array}\right] \xrightarrow[-I_2]{} \underset{\text{Allyliodide}}{\begin{array}{l}CH_2I\\ |\\ CH\\ \parallel\\ CH_2\end{array}}$$

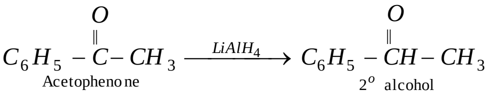
230. (a)



$$\underset{\text{2 Methyl butanol}}{H_3C-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_2-OH} \xrightarrow[\text{dehydration}]{\text{Conc. } H_2SO_4} \underset{\text{2-Methyl butene Major product}}{H_3C-H_2C-\underset{\underset{CH_3}{|}}{C}=CH_2}$$

233. (c) $CH_3CHO \xleftarrow[\Delta]{Cu} CH_3CH_2OH \xrightarrow[\Delta]{Al_2O_3} CH_2=CH_2$

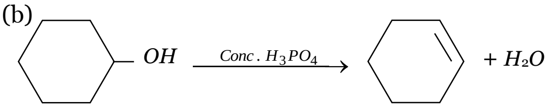
234. (b)



$$\underset{\text{Acetophenone}}{C_6H_5-\overset{\overset{O}{\|}}{C}-CH_3} \xrightarrow{LiAlH_4} \underset{2^o\text{ alcohol}}{C_6H_5-\overset{\overset{O}{\|}}{CH}-CH_3}$$

235. (d) $C_2H_5OH \xrightarrow[170^oC]{\text{Conc } H_2SO_4} C_2H_4 + H_2O$

236. (b)



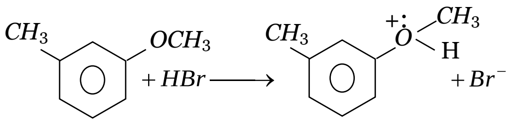
Because conc. H_3PO_4 acts as a dehydrating agent.

238. (c) $C_2H_5OH \xrightarrow[I_2]{NaOH} CHI_3$ yellow *ppt.*

$CH_3OH \xrightarrow[I_2]{NaOH}$ No reaction

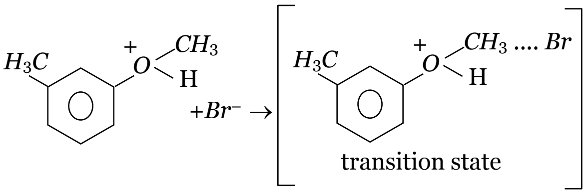
239. (d) It is not acetaldehyde or acetone as does not react with hydrazine. It is not CH_3OH as does not react with *Na*.

240. (a) The ether molecule gets protonated by the hydrogen of the acid to form protonated ether or oxonium salt.

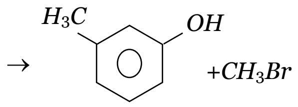


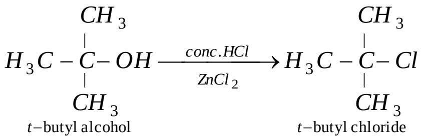
Protonated ether

The protonated ether undergoes nucleophilic attack by halide ion (X^-) and forms alkyl alcohol and alkyl halide



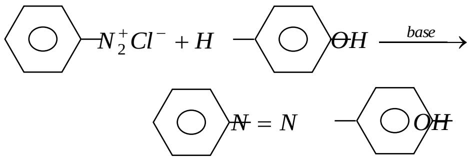
transition state



241. (a) 

$$H_3C-\overset{CH_3}{\underset{CH_3}{C}}-OH \xrightarrow[ZnCl_2]{conc.HCl} H_3C-\overset{CH_3}{\underset{CH_3}{C}}-Cl$$

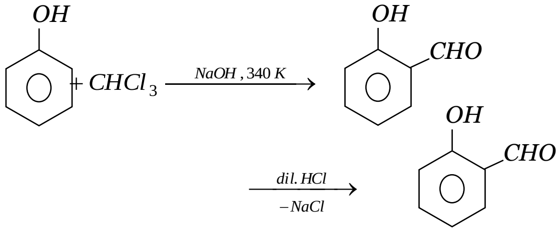
t−butyl alcohol   t−butyl chloride

242. (a) 

p-hydroxy azobenzene
(orange dye)

This is an example of coupling reaction

243. (b) Reimer-Tiemann reaction involves the carbon carbon bond formation.



salicylaldehyde

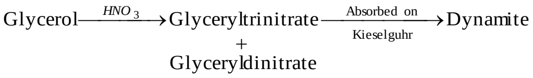
244. (a) This is Reimer-Tiemann reaction where the electrophile is dichlorocarbene $(:CCl_2)$ generated from chloroform by the action of a base.

$$OH^- + CHCl_3 \rightleftharpoons HOH + :CCl_3^- \to Cl^- + :CCl_2$$

245. (a) Phenols are much more acidic than alcohols but less so than carboxylic acids or even carbonic acid. This is indicated by the values of ionisation constants. The relative acidity follows the order:

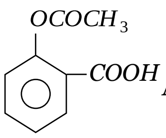
$$K_a \quad \underset{RCOOH}{10^{-5}} > \underset{H_2CO_3}{10^{-7}} > \underset{C_6H_5OH}{10^{-10}} > \underset{HOH}{10^{-14}} > \underset{ROH}{10^{-18}}$$

Uses of alcohol, Phenol and Ethers

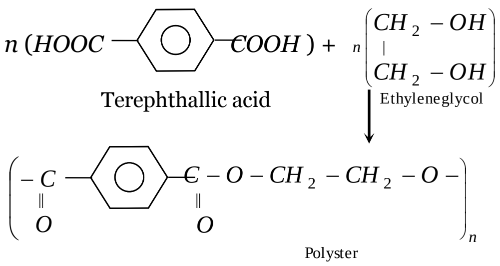
1. (a) 

$$\text{Glycerol} \xrightarrow{HNO_3} \underset{\text{Glyceryldinitrate}}{\text{Glyceryltrinitrate} \atop +} \xrightarrow[\text{Kieselguhr}]{\text{Absorbed on}} \text{Dynamite}$$

3. (d) $C_2H_5OH \xrightarrow[\text{Acetobactoracetii}]{\text{air}} CH_3COOH$

4. (b) 

Aspirin or Acetyl salicylic acid.

6. (a) 

9. (a) Ethylene glycol is added to lowering down the freezing point of water so that it does not freeze.

10. (b) Power alcohol 80% petrol and 20% ethyl alcohol

12. (d) $\text{Glucose} \xrightarrow[\text{(From yeast)}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$

16. (d) Glycerol is not used as an antiseptic agent.

18. (c) Denaturing can also be done by adding 0.5% pyridine, petroleum naptha, $CuSO_4$ etc.

20. (b) A mixture of glyceryl trinitrate and glyceryl dinitrate when absorbed on kieselgurh is called dynamite.

22. (c) Tonics have generally contains ethyl alcohol.

23. (c) Due to presence of methyl alcohol in liquor.

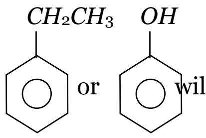
24. (d) An anaesthetic.

25. (c) Groundnut oil.

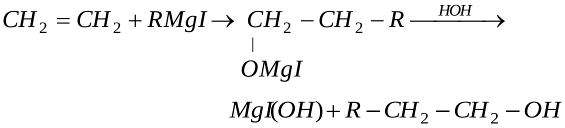
27. (a) $\underset{\text{Ethylbutyrate}}{C_3H_7COOC_2H_5} \xrightarrow{Na/C_2H_5OH} \underset{\text{Butylalcohol}}{C_3H_7CH_2OH}$

28. (a) Glycol is used as an antifreeze for automobile radiators because it lowers down the melting point of water.

Critical Thinking Questions

1. (c) 

will undergoes a Friedel Craft's alkylation on ortho or para position because of more electron density.

2. (c) 

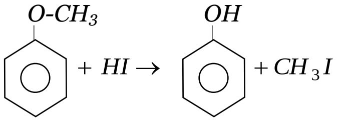
$$CH_2=CH_2+RMgI \to \underset{OMgI}{CH_2}-CH_2-R \xrightarrow{HOH} MgI(OH)+R-CH_2-CH_2-OH$$

3. (c) The liquids which decompose at its boiling point can be purified by vacuum distillation. Glycerol which decomposes at its boiling point (–563*K*) can be distilled without decomposition at 453*K* under 12*mm Hg* pressure.

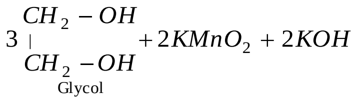
4. (a) Liebermann's reaction.

5. (a) 1^o alcohol $>$ 2^o alcohol $>$ 3^o alcohol

Boiling point of alcohols decreases as the number of branches increases.

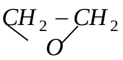
6. (c) 

7. (c) $3CH_2=CH_2+2KMnO_4+4H_2O \to$



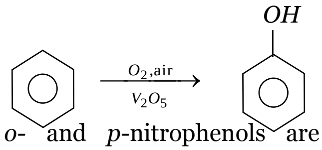
$$3\underset{\text{Glycol}}{\begin{matrix}CH_2-OH\\ |\\ CH_2-OH\end{matrix}} + 2KMnO_2 + 2KOH$$

8. (c) Correct order of dehydration in alcohols 3° > 2° > 1°.

9. (a) Oxiran is ethylene oxide, 

10. (c) $6CH_3-CH=CH_2+B_2H_6 \xrightarrow{H_2O_2} CH_3-CH_2-CH_2OH$

11. (d) Distinction between primary, secondary and tertiary alcohol is done by all three methods : oxidation, Victormeyer and Lucas test.

12. (b) 

13. (a) *o*- and *p*-nitrophenols are separated by steam distillation because *o*-nitrophenol is steam volatile while *p*-isomer is not.

14. (b) Benzoic acid.

15. (a) $R-O-R'\xrightarrow{O_2\ /\ \text{light}}$

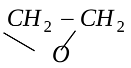
$$C_2H_5-O-CH(CH_3)-O-OH$$

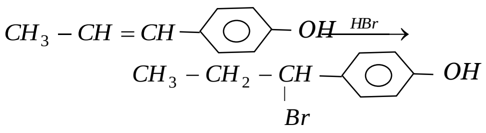
16. (d) $CH_3OH+CH_3OH\xrightarrow{H_2SO_4(Conc)}CH_3OCH_3$

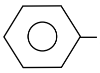
$CH_3OH+C_2H_5OH\xrightarrow{H_2SO_4(Conc)}CH_3OC_2H_5$

$C_2H_5OH+C_2H_5OH\xrightarrow{H_2SO_4(Conc)}C_2H_5OC_2H_5$

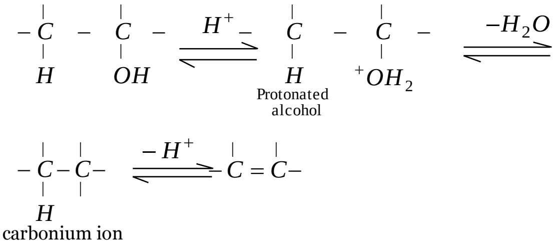
17. (b) IV > III > I > II.

18. (a) Cyclic ethers are called epoxides. 

19. (b) 

20. (c)  $-OCH_3$ on $KMnO_4$ oxidation does not give benzoic acid.

21. (c) Chromic anhydride in glacial acetic acid is the best reagent to convert pen-3-en-2-ol into pent-3-in-2-one.

22. (a) 

$$-\underset{H}{\overset{|}{\underset{|}{C}}}-\underset{OH}{\overset{|}{\underset{|}{C}}}-\underset{}{\overset{H^+}{\rightleftharpoons}}-\underset{\substack{H\\ \text{Protonated}\\ \text{alcohol}}}{\overset{|}{\underset{|}{C}}}-\underset{{}^+OH_2}{\overset{|}{\underset{|}{C}}}-\overset{-H_2O}{\rightleftharpoons}$$

$$\underset{\text{carbonium ion}}{-\underset{H}{\overset{|}{\underset{|}{C}}}-\overset{|}{\underset{|}{C}}-}\overset{-H^+}{\rightleftharpoons}-\overset{|}{C}=\overset{|}{C}-$$

In all cases intermediate is carbonium ion, and there may be 1, 2-hydride or 1, 2-methyl shift to form more stable carbonium ion.

Assertion & Reason

3. (a) It is correct that phenol is more reactive than benzene.

4. (c) It is correct that sodium phenoxide (sodium salt of phenol) and CO_2 on heating from sodium salicylate. This is known as Kolbe's reaction. Ethanol does not respond to this reaction. Therefore, assertion is true. But the reason that phenoxide ion is more basic than ethoxide ion is not correct.

5. (c) Lucas reagent is a mixture of anhydrous $ZnCl_2$ and coc. HCl is used for the distinction of monohydric alcohol. Tertiary alcohols on addition produce a precipitate immediately while secondary alcohols produce ppt. after 5 minutes. Primary alcohols do not produce any precipitate. Therefore, assertion is true but reason is false.

6. (a) Phenols on treatment with neutral $FeCl_3$ solution produce purple colour, resorcinol contains phenolic group hence in treatment with $FeCl_3$ solution it gives purple colour. Here both assertion and reason are correct and reason is a correct explanation of assertion.

7. (b) Glycerol is purified by distillation under reduced pressure because it decomposes on heating below its melting point. It is a trihydric alcohol. Here, both assertion and reason are true but reason is not a correct explanation of assertion.

8. (a) Alcohols and phenols can be distinguished by treating with $NaOH$. Phenols react with $NaOH$ to produce sodium phenoxide because phenols are acidic and alcohols are neutral. Both assertion and reason are true and reason is correct explanation.

9. (b) Zeolites are shape-selective porous solid acid catalysts, their catalytic activity originates from the presence of highly acidic $Al-O(H)-Si$ hydroxyl in the framework.

10. (a) $C_6H_5CH_2OCH_3\xrightarrow{H^+}C_6H_5CH_2^++CH_3OH$

$$\xrightarrow{I^-}C_6H_7CH_2I$$

This can be explained on the basis of S_N1 mechanism. The carbonium ion produced being benzylium ion. Since this type is more stable than alkylium ion.

11. (c) Lower the value of *pKa*, more acidic will be the compound. Acetic acid is more acidic than phenol. This indicates that carboxylate ion should be more stable than the phenoxide ion and it is clear that carboxylate ion has more equivalent resonating structures than the phenoxide ion.

12. (a) The conversion of sugar into ethyl alcohol by yeast is called alcoholic fermentation.

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

$$C_6H_{12}O_6\xrightarrow{\text{Zymase}}\underset{\text{Ethyl alcohol}}{2C_2H_5OH}+2CO_2$$

13. (b) The tendency to show *H*-bonding decreases with increasing hydrophobic character of carbon chain. The hydrophobic character of carbon chain increases with he length of carbon chain.

14. (e) Ethyl alcohol forms azeotropic mixture with water which distils with unchanged composition (about 75% ethanol) and thus absolute alcohol cannot be obtained by simple distillation.

15. (e) The dehydration of *t*-butanol involves the formation of 3° carbocation which is more stable than 1° carbocation in *n*-butanol. Thus, tendency to lose water becomes more in *t*-butanol.

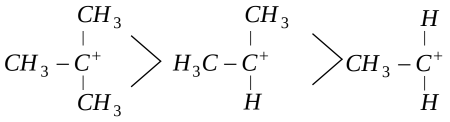
16. (c) A mixture of conc. HCl + anhyd. $ZnCl_2$ is called Lucas reagent.

17. (e) Electron withdrawing groups such as $-NO_2$, $-CN$, $-X$, increase the acidity. Greater the number of electron withdrawing groups more is the acidic character *i.e.* 2, 4, 6-trinitrophenol is more acidic than 4-nitrophenol.

18. (b) Phenols cannot be converted into esters by direct reaction with carboxylic acids since phenols are less nucleophilic than alcohols.

19. (b) Alcohol which forms the more stable carbocation undergoes dehydration more readily. Since tert-butyl alcohol forms more stable tert-butyl cation, therefore, it undergoes dehydration most readily than propanol.

20. (e) The ease of dehydration of alcohols can be explained on the basis of stability of the intermediate carbocation. Greater the stability of the carbonation formed, greater will be the rate of reaction. The order of stability of carbocation formed is



$$CH_3-\overset{CH_3}{\underset{CH_3}{C^+}} > H_3C-\overset{CH_3}{\underset{H}{C^+}} > CH_3-\overset{H}{\underset{H}{C^+}}$$

This is due to the electron releasing (+*I*) effect of the alkyl group. Therefore the ease of dehydration of alcohols follows the order.

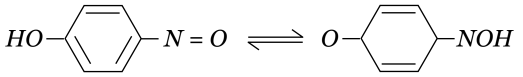
Tertiary > secondary > primary alcohol.

21. (c) Benzoylation in phenols is usually carried out in the presence of aqueous *NaOH* because benzoyl chloride is not readily hydrolysed by alkalies.

22. (b) In phenols, the lone pairs of electrons on the oxygen atom are delocalised over the benzene ring due to resonance and hence are not easily available for protonation. On the other hand, in alcohols, the lone pairs of electrons on oxygen atom are localized due to the absence of resonance and hence are easily available for ptotonation.

23. (c) *p*-Nitrophenolate ion is more stable than phenolate ion.

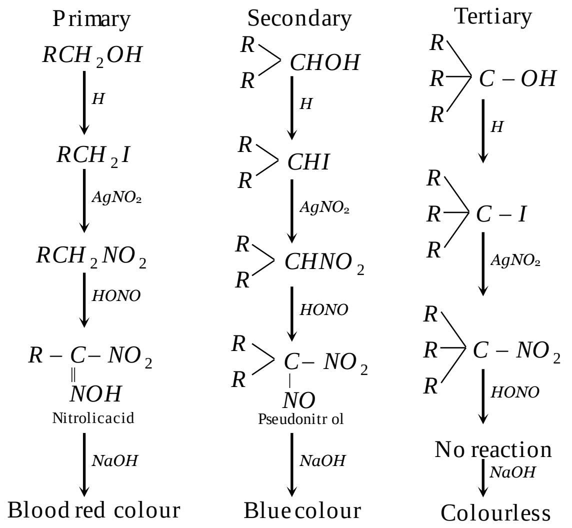
24. (b) Nitrous acid gives nitrosomine ion (NO^+) which attacks phenol at less hindered *p*-position of form *p*-nitrosophenol which is a tautomer of *p*-benzoquinone monoxide.



p-Nitrosophenol *p*-Benzoquinone monoxime

25. (c) Nucleophilic attack of phenolate ion through the ortho-carbon atom occurs on CCl_4 to form an intermediate which on hydrolysis gives salicylic acid.

26. (a) Victor-Meyer's test is used to distinguish primary, secondary and tertiary alcohols.



28. (b) Removal of two molecules of water gives a product which tautomerises to yield acrolein-an α, β-unsaturated aldehyde.

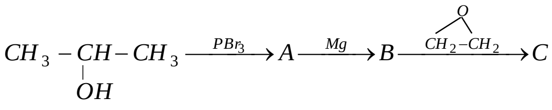
29. (b) Depending upon whether the alkyl halide and the alkoxide ion carry the same or different alkyl groups both symmetrical and unsymmetrical ethers can be prepared by Williamsons synthesis.

30. (c) Ethers being Lewis bases form etherates with Lewis acids.

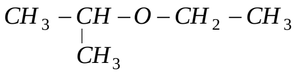
31. (d) $(CH_3)_3CONa$ and CH_3CH_2Br react to form $(CH_3)_3C-O-CH_2CH_3$. Good yields of ethers are obtained when primary alkyl halides are treated with alkoxides derived from any alcohol. 1°, 2° or 3°.

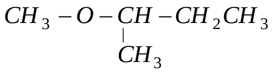
Alcohol, Phenol and Ether

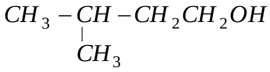
SET Self Evaluation Test - 26

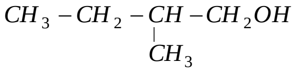
1. 
$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow{PBr_3} A \xrightarrow{Mg} B \xrightarrow{\overset{O}{CH_2-CH_2}} C$

$\xrightarrow{H_2O} D$ Here, D is **[BVP 2004]**

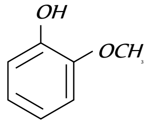
(a) 
$CH_3-\underset{\underset{CH_3}{|}}{CH}-O-CH_2-CH_3$

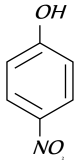
(b) 
$CH_3-O-\underset{\underset{CH_3}{|}}{CH}-CH_2CH_3$

(c) 
$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2CH_2OH$

(d) 
$CH_3-CH_2-\underset{\underset{CH_3}{|}}{CH}-CH_2OH$

2. Phenol is more acidic than **[Pb. CET 2003]**

(a) 

(b) 

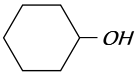
(c) C_2H_2 (d) Both (a) and (c)

3. In the reaction, $C_6H_5CHO+(CH_3CO)_2O \xrightarrow{CH_3COONa} (A)$ product (A) is **[Pb. CET 2000]**

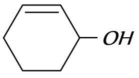
(a) Acetaldehyde (b) Cinnamic acid

(c) β-nephthol (d) Phenol

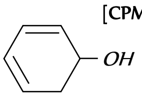
4. The correct order of ease of dehydration of following is **[CPMT 2004]**



I



II



III

(a) I > II > III (b) III > II > I

(c) I > III > II (d) III > I > II

5. PCl_5 reacts with a compound containing **[Pb. CET 2002]**

(a) $-SO_3$ group (b) $-OH$ group

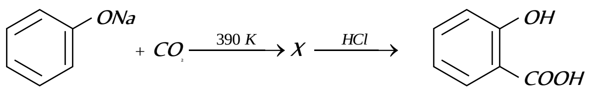
(c) $-NO_3$ group (d) $-NO$ group

6. Cumene process is the most important commercial method for the manufacture of phenol. Cumene is **[KCET 2004]**

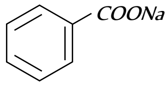
(a) 1-methyl ethyl benzene (b) Ethyl benzene

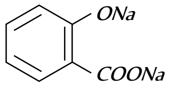
(c) Vinyl benzene (d) Propyl benzene

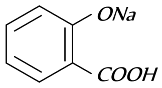
7. The compound X in the reaction **[Roorkee 1999]**

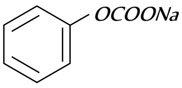


is

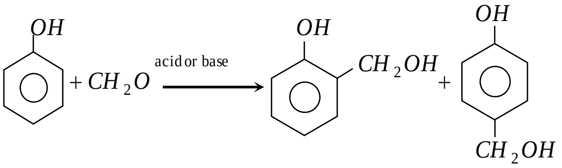
(a) 

(b) 

(c) 

(d) 

8. Reaction



is called **[MP PET 2003]**

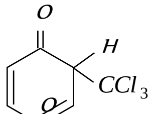
(a) Lederer Manasse reaction

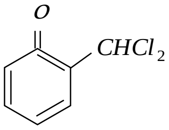
(b) Claisen condensation

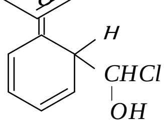
(c) Benzoin condensation

(d) Etard reaction

9. When phenol is reacted with $CHCl_3$ and $NaOH$ followed by acidification, salicyldehyde is obtained. Which of the following species are involved in the above mentioned reaction as inter mediate **[DCE 2000]**

(a) 

(b) 

(c) 

(d) All of these

10. The order of solubility of alkanols in water is

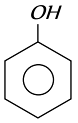
(a) Propanol < Butanol > Pentanol

(b) Propanol > Butanol > Pentanol

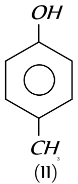
(c) Propanol > Butanol < Pentanol

(d) Propanol = Butanol = Pentanol

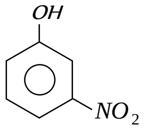
11. In the following compounds



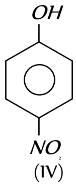
(I)



(II)



(III)



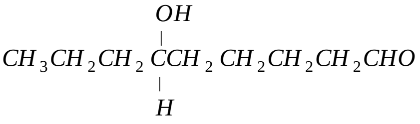
(IV)

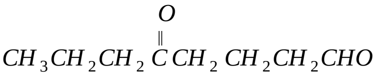
The order of acidity is **[IIT-JEE 1996]**

(a) $III > IV > I > II$ (b) $I > IV > III > II$

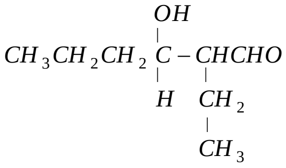
(c) $II > I > III > IV$ (d) $IV > III > I > II$

12. Butanal with dilute *NaOH* gives **[UPSEAT 2000]**

(a) 
$CH_3CH_2CH_2\underset{\underset{H}{|}}{\overset{\overset{OH}{|}}{C}}CH_2CH_2CH_2CH_2CHO$

(b) 
$CH_3CH_2CH_2\overset{\overset{O}{\|}}{C}CH_2CH_2CH_2CHO$

(c) $OHCCH_2CH_2CH_2CH_2CH_2CH_2CHO$

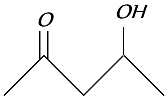
(d) 

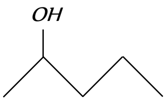
$CH_3CH_2CH_2\underset{H}{\overset{OH}{C}}-\underset{\substack{CH_2\\ CH_3}}{CH}CHO$

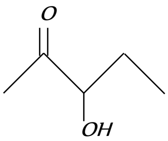
13. The correct order of the solubility of the different alcohols in water is [Pune CET 1998]

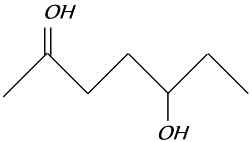
(a) *n*-propyl alcohol > ethyl alcohol > *n*-butyl alcohol
(b) Ethyl alcohol > *n*-butyl alcohol > *n*-propyl alcohol
(c) *n*-butyl alcohol > *n*-propyl alcohol > ethyl alcohol
(d) Ethanol > *n*-propanol > *n*-butyl alcohol

14. Which one of the following will most readily be dehydrated in acidic condition [IIT-JEE (Screening) 2000]

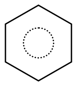
(a) 

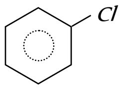
(b) 

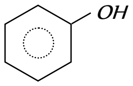
(c) 

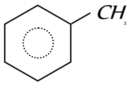
(d) 

15. Which of the following compounds will be most easily attacked by an electrophile [CBSE PMT 1998, 99]

(a) 

(b) 

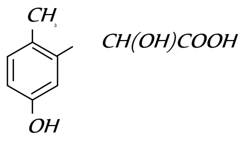
(c) 

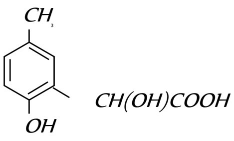
(d) 

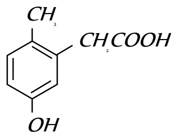
16. Fittig's reaction produces

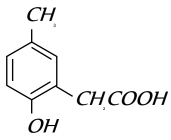
(a) Alkane
(b) Alcohol
(c) Diphenyl
(d) Diethyl ether

17. p-cresol reacts with chloroform in alkaline medium to give the compound A which adds hydrogen cyanide to form, the compound B. The latter on acidic hydrolysis gives chiral carboxylic acid. The structure of the carboxylic acid is [AIEEE 2005]

(a) 

(b) 

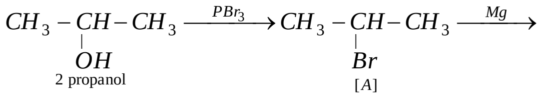
(c) 

(d) 

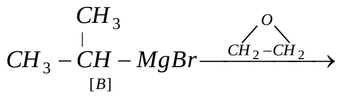
Answers and Solutions

(SET -26)

1. (c) The reaction sequence is as follows



$CH_3-\underset{\substack{OH\\ \text{2 propanol}}}{CH}-CH_3 \xrightarrow{PBr_3} CH_3-\underset{\substack{Br\\ [A]}}{CH}-CH_3 \xrightarrow{Mg}$



$$\underset{[B]}{CH_3-\overset{CH_3}{\overset{|}{C}}H-MgBr}\xrightarrow{\overset{O}{CH_2-CH_2}}$$

$$\underset{[C]}{(CH_3)_2CH.CH_2CH_2OMgBr}\xrightarrow[-Mg(OH)Br]{H_2O}\underset{[D]}{(CH_3)_2CH.CH_2CH_2OH}$$

isopentylalcohol
or 3 methyl butcane 2-ol

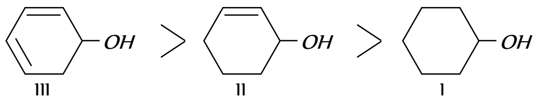
2. (d) Methoxy group due to $+I$ effect increase electron density on OH – group, thus making it less acidic. Thus *o*-methoxy phenol and acetylene are less acidic than phenol, *p*-nitrophenol is more acidic than phenol

3. (b) Perkin reaction is the condensation reaction in which an aromatic aldehyde is heated with an aromatic aldehyde is heated with an anhydride of an aliphatic acid in presence of sodium salt of same acid to form α, β unsaturated acid.

$$\underset{\text{Benzaldehyde}}{C_6H_5CHO}+\underset{\text{aceticanhydride}}{(CH_3CO)_2O}\xrightarrow{CH_3COONa}$$

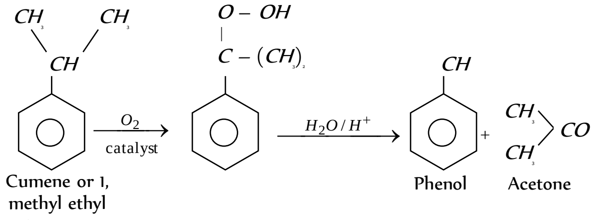
$$\underset{\text{cinnamicacid}}{C_6H_5CH=CHCOOH}+\underset{\text{aceticacid}}{CH_3COOH}$$

4. (b) The correct order of stability of carbocation is as follows

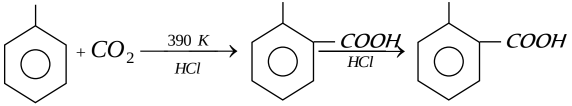


5. (b) PCl_5 is used in organic chemistry to replace the $-OH$ group by $-Cl$ and carbonylic oxygen by $(-Cl_2)$.

6. (a)



7. (b)

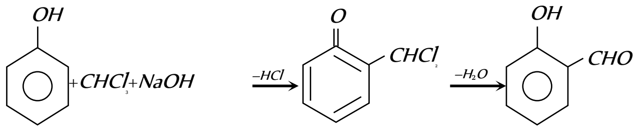


It is Kolbe's reaction.

8. (a) It is Lederer Manasse reaction.

***

9. (b)



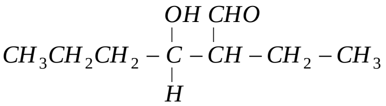
10. (b) Propanol > Butanol> Pentanol

The solubility of alcohols in water decreases as the molecular mass increases. As the size of alkyl group increases, hydrophobic character increases, Hence solubility decreases.

11. (d) IV > III > I > II.

$-NO_2$ group is electron withdrawing group while $-CH_3$ group is electron releasing group.

12. (d) $2CH_3-CH_2-CH_2-CHO+\text{dil.}NaOH\rightarrow$

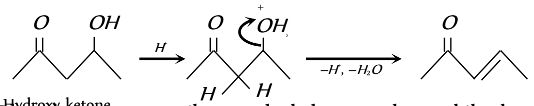


$$CH_3CH_2CH_2-\underset{H}{\overset{OH}{C}}-\overset{CHO}{CH}-CH_2-CH_3$$

13. (d) Ethanol > *n*-propanol > *n*-butyl alcohol

Solubility of alcohols in water decreases as the size of alkyl group increases because tendency to form hydrogen bonding decreases.

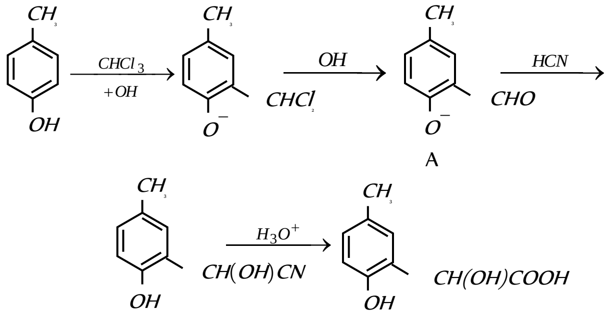
14. (a) Aldols (β-hydroxy aldehydes or β-hydroxy ketones) readily undergo dehydration to form α, β-unsaturated aldehydes or ketones.



15. (c) Phenol is most easily attacked by an electrophile because presence of $-OH$ group increases electron density at *o*- and *p*- positions.

16. (c) $$2C_6H_5Cl+2Na\xrightarrow[\text{ether}]{\text{Dry}}\underset{\text{diphenyl}}{C_6H_5-C_6H_5}+2NaCl$$

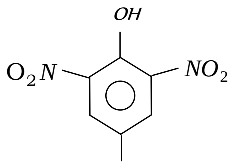
17. (b)



Answers and Solutions

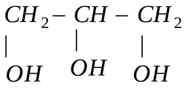
General introduction of alcohol, Phenol & Ethers

2. (d)



2, 4, 6-trinitrophenol or picric acid

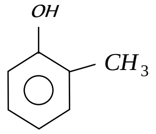
4. (d)



$$\begin{array}{ccccc} CH_2 & - & CH & - & CH_2 \\ | & & | & & | \\ OH & & OH & & OH \end{array}$$

Glycerol is trihydric alcohols.

5. (a)



Hydroxy toluene

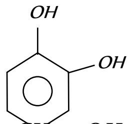
6. (c) $\% \text{ of } C = \frac{\text{Mass of } C}{\text{Mass of substance}} \times 100$

$$CCl_4 = \frac{12}{154} \times 100 = 7.79\,\%$$

$$C_6H_6Cl_6 = \frac{72}{291} \times 100 = 24.74\,\%$$

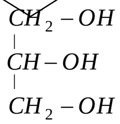
$$CH_2OH - CH_2OH = \frac{24}{62} \times 100 = 38.70\,\%.$$

7. (c)



o-dihydroxy benzene or catechol.

8. (b)



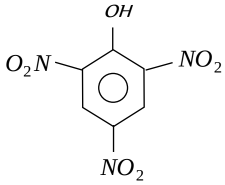
$$\begin{array}{l} CH_2 - OH \\ | \\ CH - OH \\ | \\ CH_2 - OH \end{array}$$

one secondary and two primary alcoholic groups.

11. (b) Carbinol is CH_3OH (Methanol).

12. (c) $-OH$ group is attached to primary carbon.

13. (c)

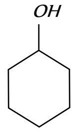


(Picric acid) or 2, 4, 6-trinitrophenol

Picric acid is phenolic while others are non phenolic.

15. (c) Butanal $CH_3 - CH_2 - CH_2 - CHO$, an aliphatic aldehyde.

16. (b)

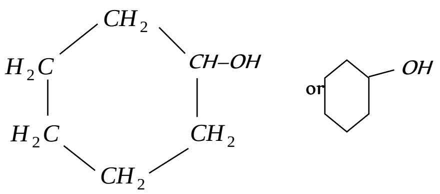


Cyclohexanol is a secondary alcohol because $-OH$ group is linked to 2^o carbon.

18. (b) C_2H_5OH and $CH_3 - O - CH_3$ are isomers.

20. (b) 5-10 % methyl and remaining ethanol is called methylated spirit. It is also known as denatured alcohol because it is unfit for drinking.

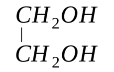
21. (a)



cyclohexanol

23. (a) 5% aqueous solution of phenol at room temperature is called as carbolic acid.

25. (b) Glycols are dihydric alcohols (having two hydroxyl groups). Ethylene glycol is the first member of this series.



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

(Ethyleneglycol)

26. (a) Methanol is also referred as wood alcohol or wood spirit or wood naphtha as the earliest method for its preparation was by destructive distillation of wood.

34. (b) Ether is basic because lone pairs of electrons are present on oxygen atom, $R - \ddot{\underset{\cdot\cdot}{O}} - R$.

39. (a) Thio alcohol is known as mercaptans.

Preparation of alcohol, Phenol and Ethers

1. (c) Hydration of alkenes

$$CH_2 = CH_2 + \overset{+}{H}\overset{-}{HSO_4} \rightarrow CH_3 - CH_2 - HSO_4$$

$$CH_3 - CH_2HSO_4 \xrightarrow[Boil]{H_2O} CH_3 - CH_2 - OH + H_2SO_4$$

Fermentation of sugars:

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

$$\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$$

2. (c) $CH_2 = CH_2 \xrightarrow{H_2SO_4} CH_3 - CH_2 - HSO_4 \xrightarrow{\text{Hydrolysis}}$

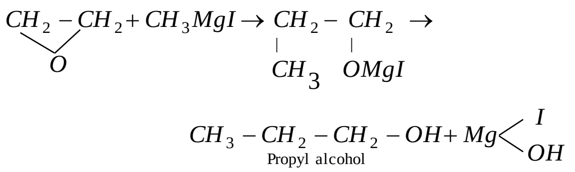
$$CH_3CH_2 - OH + H_2SO_4$$

3. (b) Hydroboration oxidation (Industrial preparation of alcohol)

$$3CH_3CH = CH_2 + \frac{1}{2}B_2H_6 \xrightarrow[\text{ether}]{\text{Dry}} (CH_3CH_2CH_3)_3B$$

$$(CH_3CH_2CH_3)_3B \xrightarrow{H_2O_2} 3CH_3CH_2CH_2 - OH$$

4. (c)



$$\underset{\diagdown O \diagup}{CH_2 - CH_2} + CH_3MgI \rightarrow \begin{array}{ccc} CH_2 & - & CH_2 \\ | & & | \\ CH_3 & & OMgI \end{array} \rightarrow$$

$$\underset{\text{Propyl alcohol}}{CH_3 - CH_2 - CH_2 - OH} + Mg\begin{smallmatrix} I \\ OH \end{smallmatrix}$$

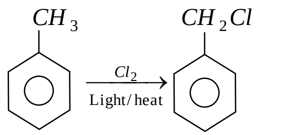
5. (d) $\text{Starch} \xrightarrow{\text{Enzymes}} \text{Alcohol}$

6. (c) Coconut oil + Alkali → Soap + Glycerol

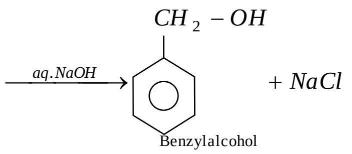
It is a saponification reaction.

7. (c) $\underset{\text{Glucose or Fructose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethylalcohol}}{2C_2H_5OH} + 2CO_2$

8. (d)



Benzylchloride



Benzylalcohol

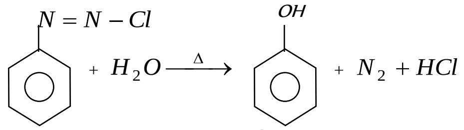
9. (a) $2(C_6H_{10}O_5)_n + nH_2O \xrightarrow[\text{(from germinated barley)}]{\text{Diastase}} n(C_{12}H_{22}O_{11})$ Starch, Maltose

$C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{(from yeast)}]{\text{Maltase}} 2C_6H_{12}O_6$ Glucose

$C_6H_{12}O_6 \xrightarrow[\text{(from yeast)}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$

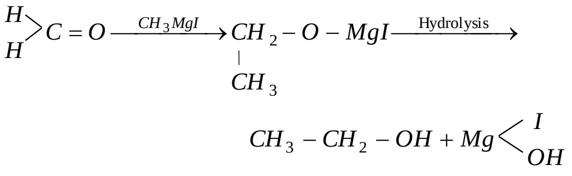
10. (b)

11. (c)



12. (c) $CH_3COOH + 4H \xrightarrow{LiAlH_4} CH_3CH_2OH + H_2O$

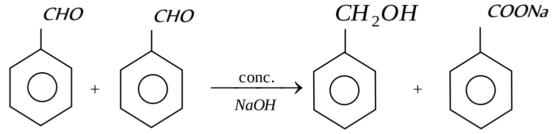
13. (b)



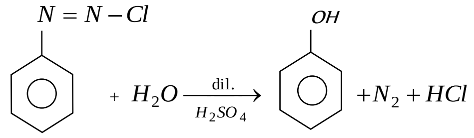
$$\begin{matrix} H \\ H \end{matrix}\!\!>C=O \xrightarrow{CH_3MgI} \underset{CH_3}{\underset{|}{CH_2}}-O-MgI \xrightarrow{\text{Hydrolysis}}$$

$$CH_3-CH_2-OH + Mg<^{I}_{OH}$$

14. (b)

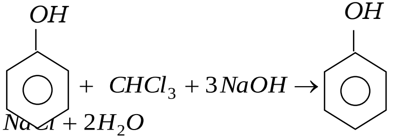


15. (d)



16. (c) $C_2H_5ONa + IC_2H_5 \rightarrow C_2H_5OC_2H_5 + NaI$

17. (b)



$+3NaCl + 2H_2O$

18. (c) $HCHO + HCHO \xrightarrow{\text{Conc. }KOH} CH_3OH + HCOOK$ Methyl alcohol, Potassium formate

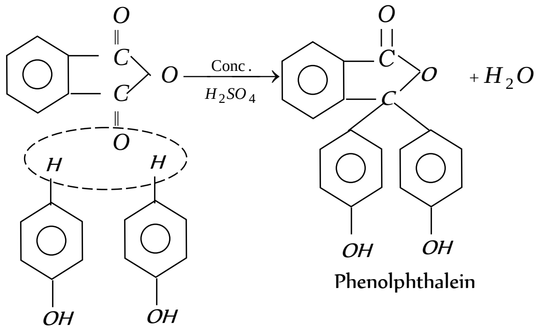
It is cannizzaro's reaction.

19. (d) Alcohol+ Benzene $\rightarrow$ Soluble (dry)

(Alcohol) $R-OH+Na \rightarrow R-ONa+H_2$

21. (c) $\underbrace{CO+H_2}_{\text{water gas}} + H_2 \xrightarrow[672\ K,\ 200\ atm]{Cr_2O_2\ /\ ZnO} CH_3OH$

23. (c)



Phenolphthalein

24. (c) $C_{12}H_{22}O_{11} + H_2O \xrightarrow[\text{(from yeast)}]{\text{Maltase}} 2C_6H_{12}O_6$. Maltose, Glucose

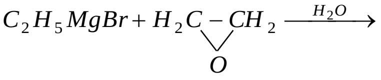
26. (d) Grignard reagent reacts with compounds containing multiple bonds like

$>C=O,\quad >C=S,\quad >C\equiv N$.

28. (d) Acetone reacts with Grignard's reagent to give tertiary alcohol.

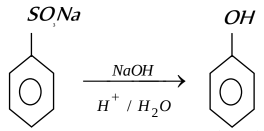
$(CH_3)_2C=O + CH_3MgBr \xrightarrow{H_2O} (CH_3)_3C-OH$ ter-butyl alcohol

29. (b)



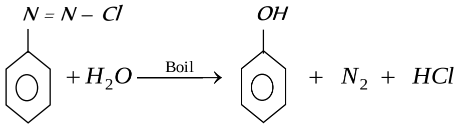
$C_2H_5CH_2CH_2OH + MgBr(OH)$
(A)
n-butyl alcohol

30. (a)



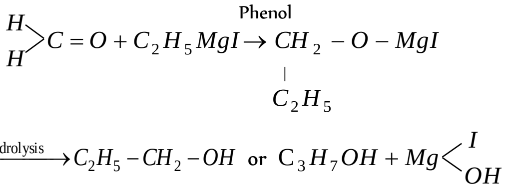
Phenol

31. (b)



Phenol

32. (b)



$$\begin{matrix} H \\ H \end{matrix}\!\!>C=O + C_2H_5MgI \rightarrow \underset{C_2H_5}{\underset{|}{CH_2}}-O-MgI$$

$$\xrightarrow{\text{Hydrolysis}} C_2H_5-CH_2-OH \text{ or } C_3H_7OH + Mg<^{I}_{OH}$$

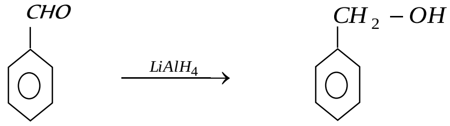
35. (d) $RMgBr + O_2 \rightarrow R-OMgBr \xrightarrow{\text{hydrolysis}} R-OH + Mg<^{Br}_{OH}$ Grignard reagent, Alcohol

39. (b) $C_6H_{12}O_6 \xrightarrow{\text{Zymase}} 2C_2H_5OH + 2CO_2$ Glucose

During fermentation CO_2 gas is eliminated.

40. (c) $C_2H_5-NH_2 + HNO_2 \rightarrow C_2H_5OH + N_2 + H_2O$

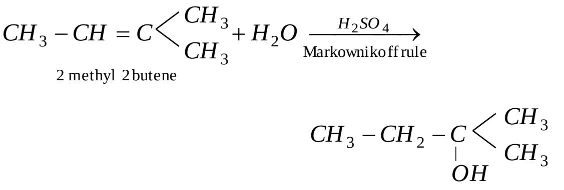
41. (b)



Benzyldehyde Benzyl alcohol

42. (a) $CO + H_2 \xrightarrow[573\ K,\ 200\ atm]{CuO-ZnO-Cr_2O_3} CH_3OH$ Methanol

43. (a)

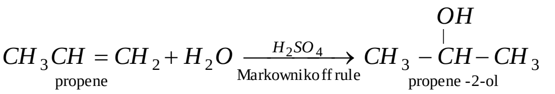


$$CH_3-CH=C<^{CH_3}_{CH_3} + H_2O \xrightarrow[\text{Markownikoff rule}]{H_2SO_4}$$

2 methyl 2butene

$$CH_3-CH_2-\underset{OH}{\underset{|}{C}}<^{CH_3}_{CH_3}$$

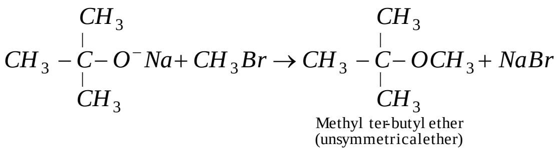
2 methyl butan-2-ol



$$CH_3CH=CH_2 + H_2O \xrightarrow[\text{Markownikoff rule}]{H_2SO_4} CH_3-\overset{OH}{\overset{|}{CH}}-CH_3$$

propene, propene -2-ol

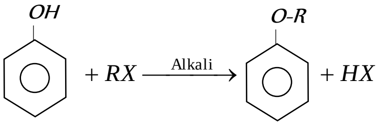
44. (c) $CH_3CONa + Br-CH_3 \rightarrow CH_3-O-CH_3 + NaBr$ Dimethyl ether (symmetrical ether)



$CH_3-\overset{CH_3}{\underset{CH_3}{C}}-O^{-}Na+CH_3Br \rightarrow CH_3-\overset{CH_3}{\underset{CH_3}{C}}-OCH_3+NaBr$

Methyl ter-butyl ether
(unsymmetricalether)

45. (c)



46. (b) $C_2H_5Br + \underset{\text{Sod. ethaoxide}}{C_2H_5ONa} \xrightarrow[-NaBr]{} \underset{\text{diethyl ether}}{C_2H_5-O-C_2H_5}$

47. (c) $RX + RONa \rightarrow \underset{\text{Ether}}{R-O-R} + NaX$

It is a Williamson's synthesis reaction.

48. (b) Williamson's synthesis –

$CH_3-CH_2-ONa+Cl-CH_2-CH_3 \rightarrow$

$CH_3-CH_2-O-CH_2-CH_3$

49. (a) Dehydration of alcohols gives ethers.

50. (b) $2C_2H_5Br+\underset{\text{Dry}}{Ag_2O} \rightarrow C_2H_5-O-C_2H_5+2AgBr$

If we take moist Ag_2O then alcohol is formed

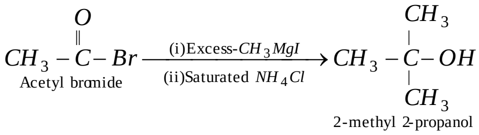
$Ag_2O+H_2O \rightarrow 2AgOH$

$C_2H_5Br+AgOH \rightarrow C_2H_5OH+AgBr$

51. (d) $\underset{\substack{\text{Methoxymethane}\\ \text{(Lower ether)}}}{CH_3OCH_3} \xrightarrow{Cl_2/hv} \underset{\alpha-\text{Chlorodimethyl ether}}{CH_3OCH_2Cl}$

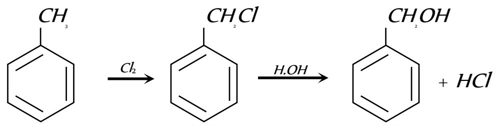
$\xrightarrow[-MgBr(Cl)]{CH_3MgBr} \underset{\substack{\text{Methoxyethane}\\ \text{(Higher ether)}}}{CH_3OCH_2CH_3}$

52. (a)



$\underset{\text{Acetyl bromide}}{CH_3-\overset{O}{\overset{\|}{C}}-Br} \xrightarrow[\text{(ii)Saturated } NH_4Cl]{\text{(i)Excess-}CH_3MgI} \underset{\text{2-methyl 2-propanol}}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-OH}$

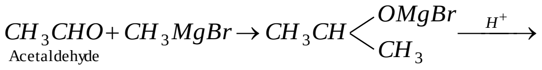
53. (d) When chlorine is passed in boiling toluene, substitution inside chain takes place and benzyl chloride is obtained which on hydrolysis give benzyl alcohol.



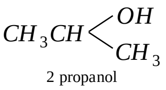
toluene Benzyl chloride Benzyl alcohol

54. (a) $2\underset{\text{Benzaldehyde}}{C_6H_5CHO}+NaOH \rightarrow \underset{\text{(Benzyl alcohol)}}{C_6H_5CH_2OH}+C_6H_5COONa$

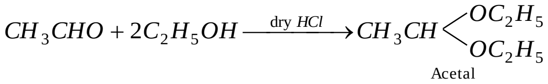
55. (c) Ethanal with CH_3MgBr gives propanol-2 (after hydrolysis) and with C_2H_5OH , it gives acetal.



$\underset{\text{Acetaldehyde}}{CH_3CHO}+CH_3MgBr \rightarrow CH_3CH\Big<\begin{matrix}OMgBr\\CH_3\end{matrix} \xrightarrow{H^+}$

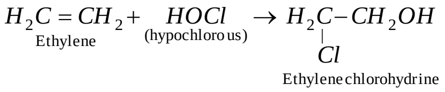


$\underset{\text{2 propanol}}{CH_3CH\Big<\begin{matrix}OH\\CH_3\end{matrix}}$

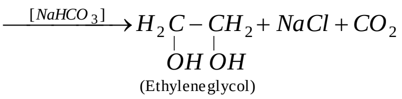


$CH_3CHO+2C_2H_5OH \xrightarrow{\text{dry } HCl} \underset{\text{Acetal}}{CH_3CH\Big<\begin{matrix}OC_2H_5\\OC_2H_5\end{matrix}}$

56. (a)

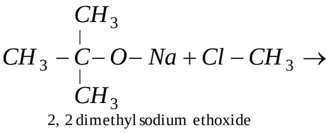


$\underset{\text{Ethylene}}{H_2C=CH_2}+\underset{\text{(hypochlorous)}}{HOCl} \rightarrow \underset{\text{Ethylene chlorohydrine}}{H_2\underset{Cl}{C}-CH_2OH}$

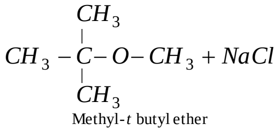


$\xrightarrow{[NaHCO_3]} \underset{\text{(Ethyleneglycol)}}{H_2\underset{OH}{C}-\underset{OH}{CH_2}}+NaCl+CO_2$

57. (b)

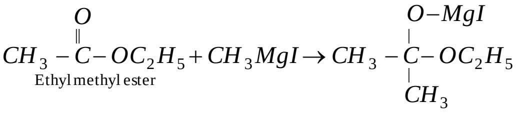


$\underset{\text{2, 2 dimethyl sodium ethoxide}}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-O-Na}+Cl-CH_3 \rightarrow$

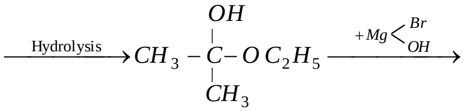


$\underset{\text{Methyl-}t\text{ butyl ether}}{CH_3-\overset{CH_3}{\underset{CH_3}{C}}-O-CH_3}+NaCl$

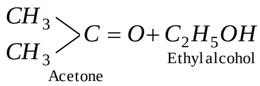
58. (c)



$\underset{\text{Ethyl methyl ester}}{CH_3-\overset{O}{\overset{\|}{C}}-OC_2H_5}+CH_3MgI \rightarrow CH_3-\overset{O-MgI}{\underset{CH_3}{C}}-OC_2H_5$



$\xrightarrow{\text{Hydrolysis}} CH_3-\overset{OH}{\underset{CH_3}{C}}-OC_2H_5 \xrightarrow{+Mg\big<\begin{smallmatrix}Br\\OH\end{smallmatrix}}$



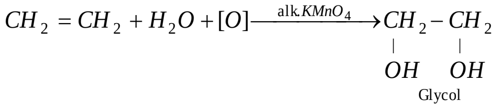
$\underset{\text{Acetone}}{\begin{matrix}CH_3\\CH_3\end{matrix}\Big>C=O}+\underset{\text{Ethyl alcohol}}{C_2H_5OH}$

59. (b) $NaBH_4$ and $LiAlH_4$ attacks only carbonyl group and reduce it into alcohol group. They do not attack on double bond.

$\underset{\text{cinnamic aldehyde}}{C_6H_5-CH=CHCHO} \xrightarrow{NaBH_4}$

$\underset{\text{cinnamic alcohol}}{C_6H_5-CH=CH.CH_2OH}$

60. (b,c)



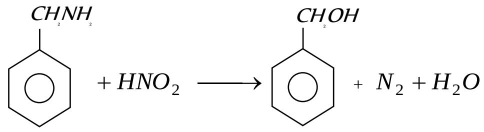
$CH_2=CH_2+H_2O+[O] \xrightarrow{\text{alk.}KMnO_4} \underset{\text{Glycol}}{\underset{OH}{CH_2}-\underset{OH}{CH_2}}$

$\underset{\text{Ethene}}{CH_2=CH_2}+H_2O \xrightarrow{\text{Conc.}H_2SO_4} \underset{\text{Ethanol}}{CH_3-CH_2-OH}$

61. (a) $\text{Wood} \xrightarrow[\text{distillation}]{\text{Destructive}} \text{Wood gas}+\text{Tar}+\text{Charcoal}$

$+\underset{\text{(wood alcohol)}}{CH_3OH}+\underset{\text{(vinegar)}}{CH_3COOH}$

62. (d)



64. (a) $C_6H_6O^-+CH_3I \rightarrow C_6Hl5OCH_3+I^-$

Properties of alcohol, Phenol and Ethers

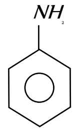
1. (c) $CH_3-OH + CH_3Mg-X \rightarrow CH_4+CH_3O-Mg-X$

4. (c) $C_2H_5OH \xrightarrow[\text{Iodoform test}]{NaOH/I_2} CHI_3$ (yellowppt)

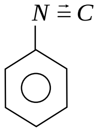
$CH_3OH \xrightarrow{NaOH/I_2} \text{No } ppt$

5. (a) $\underset{X}{CH_3-CH_2-CH_2-OH} \xrightarrow{\text{Oxidation}} \underset{Y}{CH_3CH_2COOH}$

Since on oxidation same no. of carbon atoms are obtained in as therefore alcohol is primary



(A)



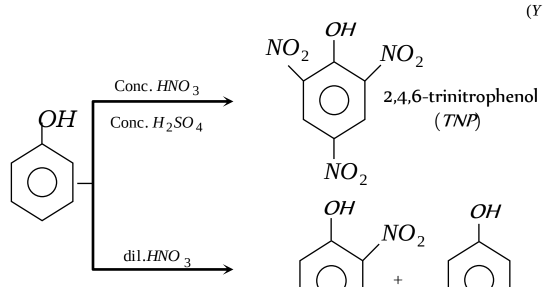
8. (b) $+ \underset{(Y)}{3KOH + CHCl_3} \to \; + 3KCl + 3H_2O$

$N = N$ OH

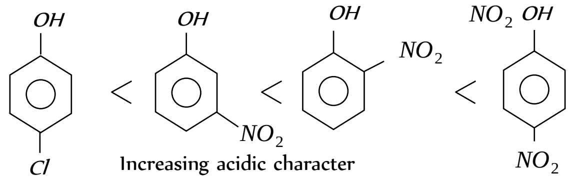
$\underset{(Z)}{C_2H_5OH} + Cl_2 \xrightarrow{Ca(OH)_2} \underset{\text{Acetaldehyde}}{CH_3CHO} \xrightarrow{Cl_2}$

$\underset{\text{Chloral}}{CCl_3CHO} \xrightarrow{Ca(OH)_2} \underset{\substack{\text{chloroform}\\(Y)}}{CHCl_3}$

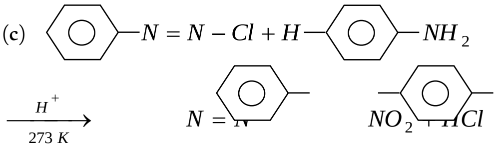
12. (b)



14. (c)

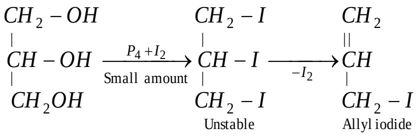


15. (c)



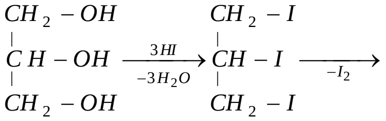
$p-$Aminoazobenzene (yellow ppt.)

16. (b)

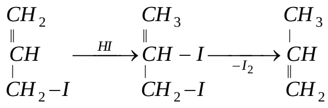


$$\begin{array}{l} CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2OH\end{array} \xrightarrow[\text{Small amount}]{P_4+I_2} \underset{\text{Unstable}}{\begin{array}{l}CH_2-I\\ |\\ CH-I\\ |\\ CH_2-I\end{array}} \xrightarrow[-I_2]{} \underset{\text{Allyl iodide}}{\begin{array}{l}CH_2\\ ||\\ CH\\ |\\ CH_2-I\end{array}}$$

18. (c)



$$\begin{array}{l} CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} \xrightarrow[-3H_2O]{3HI} \begin{array}{l}CH_2-I\\ |\\ CH-I\\ |\\ CH_2-I\end{array} \xrightarrow[-I_2]{}$$



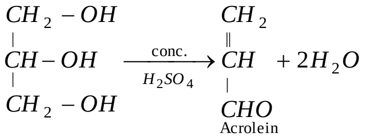
$$\begin{array}{l}CH_2\\ ||\\ CH\\ |\\ CH_2-I\end{array} \xrightarrow{HI} \begin{array}{l}CH_3\\ ||\\ CH-I\\ |\\ CH_2-I\end{array} \xrightarrow[-I_2]{} \begin{array}{l}CH_3\\ |\\ CH\\ ||\\ CH_2\end{array}$$

19. (d) $HOOC-COOH \xrightarrow[\text{Decarboxylation}]{\text{Glycerol}} HCOOH + CO_2$

$HCOOH + \text{Fehling solution} \to \underset{\text{Red ppt.}}{Cu_2O} + CO_2 + H_2O$

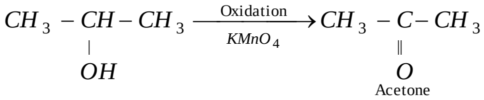
21. (b) Glycerol undergoes extensive hydrogen bonding due to the presence of 3 $-OH$ groups. As a result the glycerol molecules are highly associated and thus it has high viscosity.

22. (b)



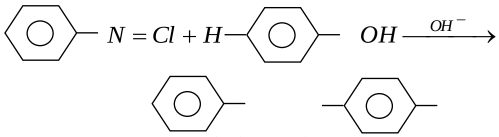
$$\begin{array}{l} CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} \xrightarrow[H_2SO_4]{\text{conc.}} \underset{\text{Acrolein}}{\begin{array}{l}CH_2\\ ||\\ CH\\ |\\ CHO\end{array}} + 2H_2O$$

23. (a)



$$\begin{array}{c} CH_3-CH-CH_3\\ |\\ OH\end{array} \xrightarrow[KMnO_4]{\text{Oxidation}} \underset{\text{Acetone}}{\begin{array}{c}CH_3-C-CH_3\\ ||\\ O\end{array}}$$

24. (b)



p-hydroxyazobenzene

25. (c) $(CH_3)_3C-OH + HCl \xrightarrow{Anhyd.\,ZnCl_2\,+\,HCl}$

$(CH_3)_3C-Cl + H_2O$ 3^o reacts immediately

$(CH_3)_3CH-OH + HCl \xrightarrow{Anhyd.\,ZnCl_2\,+\,HCl}$

$(CH_3)_2CH-Cl + H_2O$ 2^o reacts after 5 min.

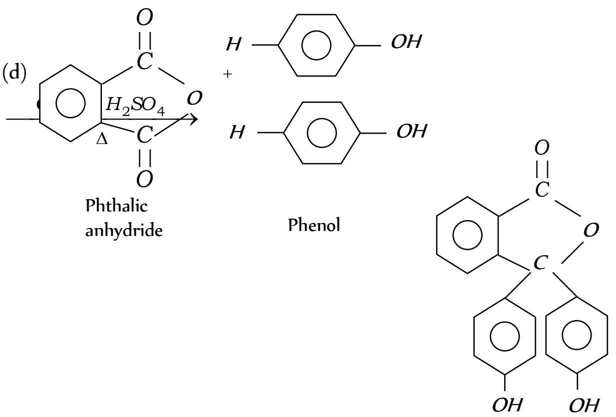
$CH_3CH_2CH_2-OH + HCl \xrightarrow{Anhyd.\,ZnCl_2\,+\,HCl}$

$CH_3CH_2CH_2-Cl + H_2O$ 1^o reacts only on heating.

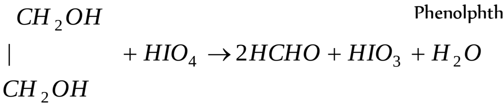
26. (b) $C_2H_5OH + R-Mg-X \to \underset{\text{Alkane}}{RH} + C_2H_5OMgX$

$C_3H_7OH + R-Mg-X \to RH + C_3H_7OMgX$

30. (d)

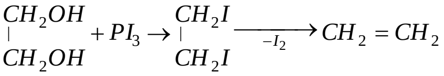


33. (c)



$$\begin{array}{l} CH_2OH\\ |\\ CH_2OH\end{array} + HIO_4 \to 2HCHO + HIO_3 + H_2O$$

35. (b)

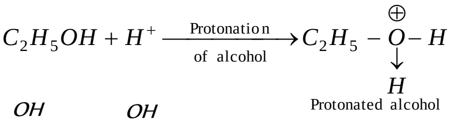


$$\begin{array}{l} CH_2OH\\ |\\ CH_2OH\end{array} + PI_3 \to \begin{array}{l}CH_2I\\ |\\ CH_2I\end{array} \xrightarrow[-I_2]{} CH_2=CH_2$$

36. (a) $\underset{\text{alcohol}}{R-OH} + \underset{\text{Ceric amm. nitrate}}{(NH_4)_2Ce(NO_3)_6} \to \underset{\text{yellow ppt.}}{Ce(NO_3)_6(ROH)_9} + 2N + 14NO_3$

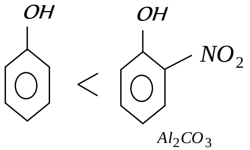
37. (d) $C_2H_5-O-C_2H_5 + O_2 \xrightarrow[25^oC]{hv} CH_3-CH(OOH)-O-C_2H_5$

38. (a) $H_2SO_4 \to H^+ + HSO_4^-$



$$C_2H_5OH + H^+ \xrightarrow[\text{of alcohol}]{\text{Protonation}} \underset{\text{Protonated alcohol}}{C_2H_5-\overset{\oplus}{\underset{\downarrow\\H}{O}}-H}$$

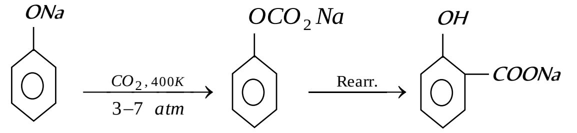
39. (c)

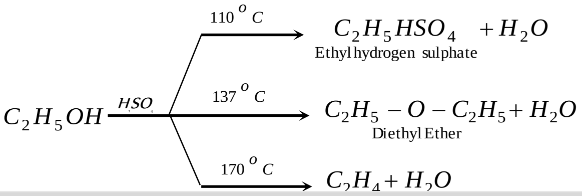


Nitro group is electron with-drawing. Hence, increases acidic nature.

43. (d) $CH_3CH_2OH \xrightarrow[350^oC]{\underset{(X)}{Al_2CO_3}} CH_2=CH_2 + H_2O$

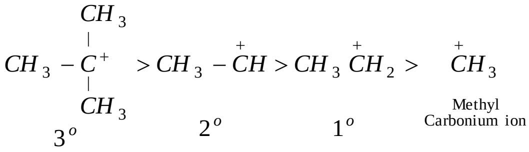
44. (a)





45. (c)

46. (b)



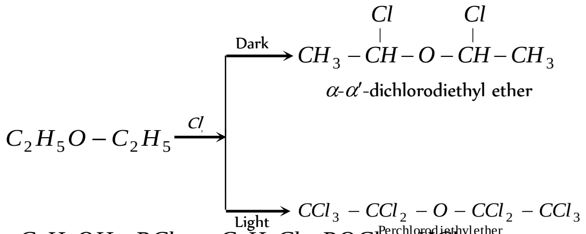
$\underset{3^o}{CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C^+}}} > \underset{2^o}{CH_3-\overset{+}{C}H} > \underset{1^o}{CH_3\overset{+}{C}H_2} > \underset{\text{Methyl Carbonium ion}}{\overset{+}{C}H_3}$

47. (c) Alcohols having less number of carbon atoms are more soluble in water.

48. (a) $C_2H_5OH + Na \rightarrow C_2H_5ONa$

$$2C_2H_5OH \xrightarrow[H_2SO_4]{\text{Conc.}} C_2H_5-O-C_2H_5+H_2O$$

50. (a)



$$C_2H_5O-C_2H_5 \xrightarrow{Cl} \begin{cases} \xrightarrow{\text{Dark}} CH_3-\overset{\overset{Cl}{|}}{C}H-O-\overset{\overset{Cl}{|}}{C}H-CH_3 \\ \xrightarrow[\text{Light}]{} CCl_3-CCl_2-O-CCl_2-CCl_3 \end{cases}$$

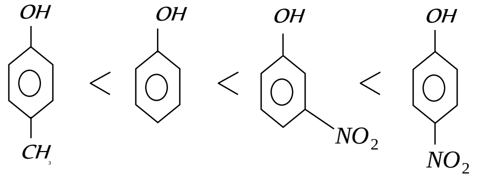
α-α'-dichlorodiethyl ether

Perchlorodiethylether

51. (d) $\underset{(A)}{C_2H_5OH} + PCl_5 \rightarrow \underset{(B)}{C_2H_5Cl} + POCl_3 + HCl$

$$\begin{tikzcd} \underset{(B)}{C_2H_5Cl} + KCN \rightarrow C_2H_5CN + KCl \arrow[d, "\text{Hydrolysis}"] \\ C_2H_5-COOH \end{tikzcd}$$

52. (c)



53. (b) Higher alcohols are stronger and have bitter taste.

54. (c) Order of reactivity with alkali metal (*e.g.*-Sodium) follows the order $1^o > 2^o > 3^o$.

56. (c) $\underset{1\,mole}{CH_3OH} + \underset{\substack{1\,mole \\ (23\,gms)}}{Na} \rightarrow CH_3ONa + \underset{1/2\,mole}{\frac{1}{2}H_2}$

57. (d) $3CH_3CH_2CH_2CH_2-OH + PBr_3 \rightarrow$

$$3CH_3CH_2CH_2CH_2-Br + H_3PO_3$$

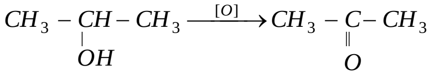
58. (a) $CH_3OH + Cl_2 \rightarrow$ No reaction

$CH_3OH + HCl \xrightarrow{ZnCl_2} CH_3Cl + H_2O$

$3CH_3OH + PCl_3 \rightarrow 3CH_3Cl + H_3PO_3$

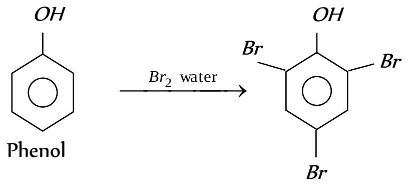
$CH_3OH + PCl_5 \rightarrow CH_3Cl + POCl_3 + HCl$

59. (d)



$CH_3-\underset{\underset{OH}{|}}{C}H-CH_3 \xrightarrow{[O]} CH_3-\underset{\underset{O}{\|}}{C}-CH_3$

60. (c)



Phenol

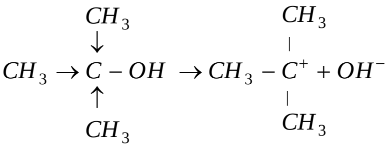
2,4,6 tribromophenol
or white *ppt.*

61. (d) Due to hydrogen bonding.

62. (a) $C_2H_5OH \xrightarrow[\text{air}]{Pt} CH_3CHO$

63. (c) $CH_3-CH_2-OH \xrightarrow[170\,^oC]{\text{Conc. } H_2SO_4} CH_2=CH_2+H_2O$

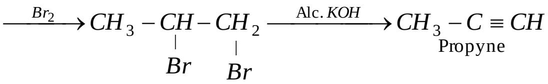
66. (b) Tertiary alcohol readily reacts with halogen acid



$CH_3 \rightarrow \overset{\overset{CH_3}{\downarrow}}{\underset{\underset{CH_3}{\uparrow}}{C}}-OH \rightarrow CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C^+}}+OH^-$

Presence of 3 alkyl group increases electron density on 3^o carbon atom. Hence $-OH$ group is easily removed. After the removal of $-OH$ group 3^o carbonium ion is formed which is most stable

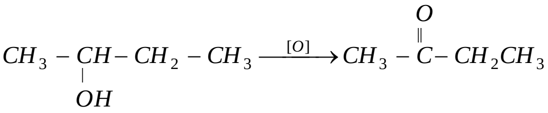
67. (d) $CH_3CH_2CH_2OH \xrightarrow[160-180\,^oC]{\text{conc. } H_2SO_4} CH_3CH=CH_2$



$\xrightarrow{Br_2} CH_3-\underset{\underset{Br}{|}}{C}H-\underset{\underset{Br}{|}}{C}H_2 \xrightarrow{\text{Alc. } KOH} \underset{\text{Propyne}}{CH_3-C\equiv CH}$

68. (b) Lower alcohols are soluble in all solvents.

69. (c)



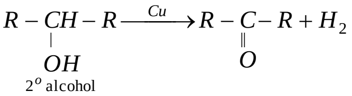
$CH_3-\underset{\underset{OH}{|}}{C}H-CH_2-CH_3 \xrightarrow{[O]} CH_3-\overset{\overset{O}{\|}}{C}-CH_2CH_3$

70. (b) Due to the resonance stabilisation of phenoxide ion.

73. (a) $\underset{1^o\,\text{alcohol}}{R-CH_2-CH_2-OH} \xrightarrow[170\,^oC]{\text{Conc. } H_2SO_4}$

$$\underset{\text{Alkene}}{R-CH=CH_2+H_2O}$$

74. (a) $\underset{1^o\,\text{alcohol}}{R\text{-}CH_2OH} \xrightarrow{Cu} R-CHO+H_2$



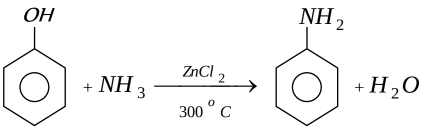
$\underset{2^o\,\text{alcohol}}{R-\underset{\underset{OH}{|}}{C}H-R} \xrightarrow{Cu} R-\underset{\underset{O}{\|}}{C}-R+H_2$

75. (c) $CH_3OH \xrightarrow[H_2SO_4]{K_2Cr_2O_7} HCOOH$

76. (a) $CH_3CH_2OH \xrightarrow{K_2Cr_2O_7} CH_3COOH$

77. (a) Lucas test is used for the distinction of primary secondary and tertiary alcohols.

78. (a)



80. (a) A compound that undergoes bromination easily is phenol. Due to presence of $-OH$ group the ring becomes much more active in substitution reactions. The bromination occurs due to availability of electrons on ortho and para position.

81. (c) *o*-Nitrophenol has intramolecular *H*-bonding.

84. (b) C_2H_5OH gives iodoform test having α-hydrogen atom while CH_3OH does not give due to the absence of α-hydrogen atom.

85. (c) Phenol has higher boiling point than toluene because of hydrogen bonding.

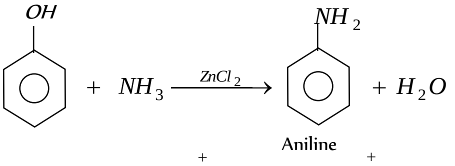
87. (b) $\underset{\text{Propene}-1}{CH_3-CH=CH_2} + aq.\,KOH \rightarrow \underset{\text{Propanol}-1}{CH_3-CH_2-CH_2OH}$

88. (d)

$$\begin{tikzcd} C_2H_5OH + PCl_5 \rightarrow C_2H_5Cl \arrow[r, "KCN"] & C_2H_5CN \arrow[d, "HCl/H_2O"] \\ & C_6H_5COOH \end{tikzcd}$$

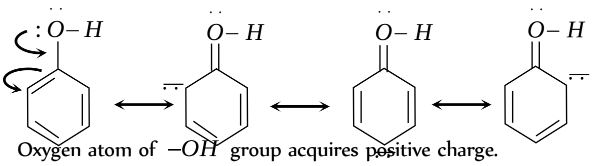
89. (b) $LiAlH_4$ + ether, is reducing agent.

97. (b)



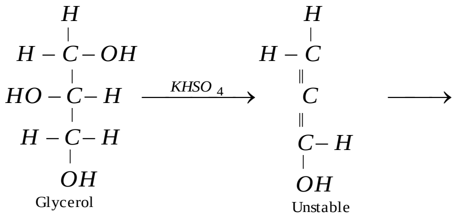
Aniline

98. (a)



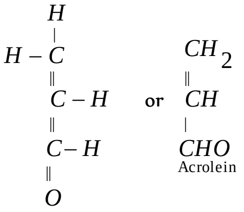
Oxygen atom of $-OH$ group acquires positive charge.

99. (c)



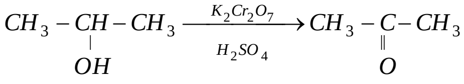
Glycerol

Unstable



Acrolein

100. (d)

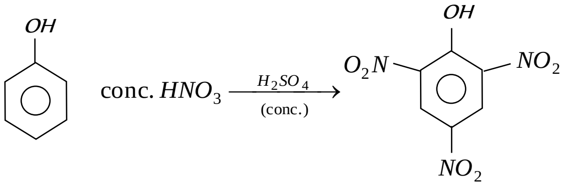


$CH_3-\underset{OH}{CH}-CH_3 \xrightarrow[H_2SO_4]{K_2Cr_2O_7} CH_3-\underset{O}{\overset{\|}{C}}-CH_3$

$\xrightarrow[I_2]{NaOH} CHI_3 + CH_3COONa$

Yellow *ppt*

101. (d)



Picric acid

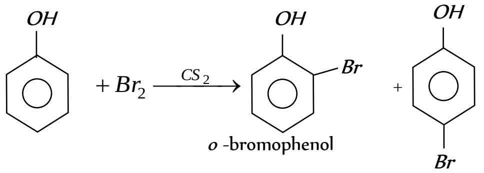
102. (c) Phenol is weaker acid than carbonic acid

C_6H_5OH $\quad$ H_2CO_3 $\quad$ CH_3COOH

$K_a = 10^{-8} - 10^{-10}$, $K_a = 10^{-7}$, $K_a = 10^{-5}$

103. (a)

104. (b)

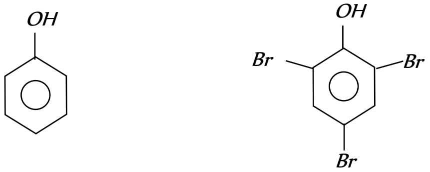


o -bromophenol

p -bromophenol

In presence of non-polar solvent (CS_2) the ionization of phenol is suppressed. The ring is slightly activated and hence mono substitution occurs.

On the other hand with Br_2 water phenol forms 2,4,6-tribromo phenol.



$+ 3Br_2 \xrightarrow{\text{water}} \qquad + 3HBr$

In aqueous solution phenol ionizes to give phenoxide ion. Due to the presence of negative charge on oxygen the benzene ring is highly activated and hence trisubstituted product is obtained.

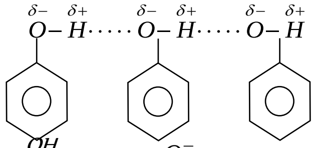
105. (d) $C_2H_5OH \xrightarrow{CrO_3} CH_3COOH$

Ethylalcohol $\qquad$ Aceticacid

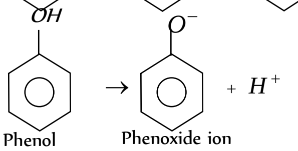
107. (d) $C_2H_5OH \xrightarrow[170^oC]{Conc.\,H_2SO_4} C_2H_4 + H_2O$

Ethanol $\qquad$ Ethane

108. (b)

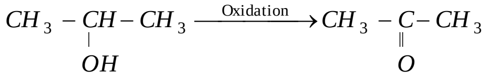


109. (a)



Phenol $\qquad$ Phenoxide ion

110. (c) (a)



$CH_3-\underset{OH}{CH}-CH_3 \xrightarrow{\text{Oxidation}} CH_3-\underset{O}{\overset{\|}{C}}-CH_3$

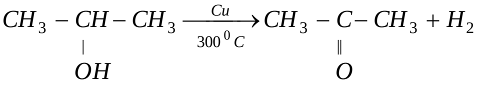
(b) $CH_3 - CH_2 - OH \xrightarrow[180^oC]{Conc.\,H_2SO_4} CH_2 = CH_2 + H_2O$

(d) $2CH_3CH_2OH + 2Na \rightarrow 2CH_3 - CH_2 - ONa + H_2$

112. (b) Carbylamine reaction

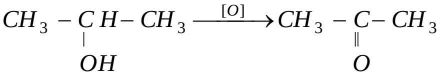
$CHCl_3 + CH_3NH_2 + \underset{\text{alc.}}{3KOH} \rightarrow \underset{\substack{\text{Methyl}\\\text{isocyanide}}}{CH_3N \equiv C} + 3KCl + 3H_2O$

113. (a) Secondary alcohol on dehydrogenation gives acetone



$CH_3-\underset{OH}{CH}-CH_3 \xrightarrow[300^0C]{Cu} CH_3-\underset{O}{\overset{\|}{C}}-CH_3 + H_2$

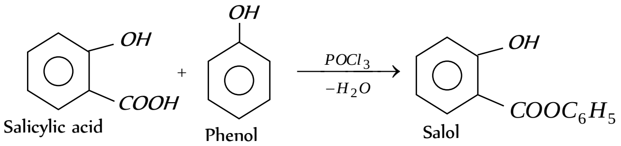
114. (a)



$CH_3-\underset{OH}{CH}-CH_3 \xrightarrow{[O]} CH_3-\underset{O}{\overset{\|}{C}}-CH_3$

118. (d) $C_2H_5OH + [O] \rightarrow CH_3CHO \rightarrow CH_3COOH$.

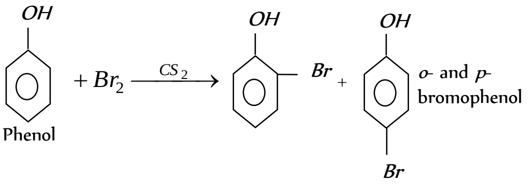
119. (a)



Salicylic acid $\qquad$ Phenol $\qquad$ Salol

Phenyl salicylate

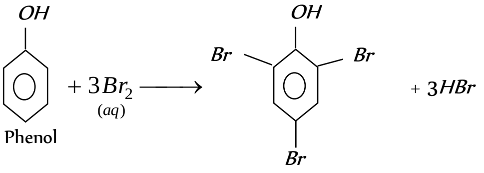
120. (c) (i)



Phenol

o- and *p-* bromophenol

(ii)



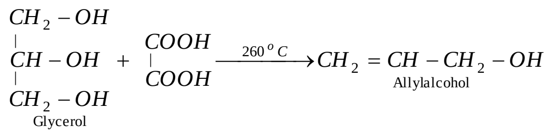
Phenol

2, 4, 6-tribromophenol

In *aq.* solution phenol ionize to give phenoxide in which highly activates benzene ring and give trisubstituted product while in presence of CS_2 an inert solvent phenol is unable to ionize due to which benzene ring is slightly activated. Hence, monosubstituted product is obtained.

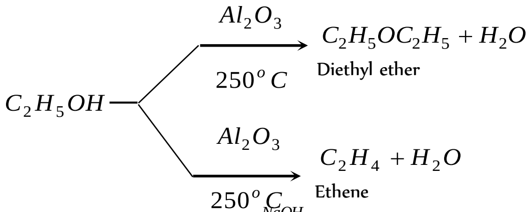
122. (d) Traces of water from ethanol is removed by reacting with *Mg* metal.

123. (a)



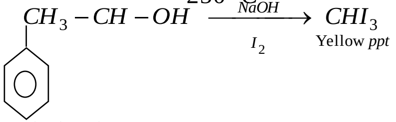
$$\underset{\text{Glycerol}}{\begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array}} + \begin{array}{l}COOH\\ |\\ COOH\end{array} \xrightarrow{260^{o}C} \underset{\text{Allylalcohol}}{CH_2=CH-CH_2-OH}$$

125. (c)



$$C_2H_5OH\begin{cases}\xrightarrow[250^{o}C]{Al_2O_3}\underset{\text{Diethyl ether}}{C_2H_5OC_2H_5+H_2O}\\ \xrightarrow[250^{o}C]{Al_2O_3}\underset{\text{Ethene}}{C_2H_4+H_2O}\end{cases}$$

126. (b)

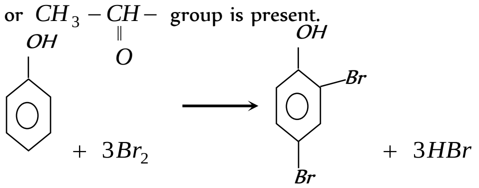


$$CH_3-CH-OH \xrightarrow[I_2]{NaOH} \underset{\text{Yellow } ppt}{CHI_3}$$

1-phenyl ethanol

Iodoform test is given by compounds in which $CH_3-\underset{\underset{OH}{|}}{CH}-$ or $CH_3-\underset{\underset{O}{\|}}{CH}-$ group is present.

127. (c)



$$+\ 3Br_2 \longrightarrow \quad +\ 3HBr$$

1 mole 3 moles 1 mole

94 grams of phenol reacts with 480 *gms.* of Br_2.

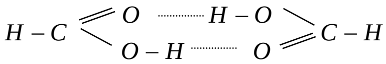
2 *gm.* of phenol — $\frac{480}{94}\times 2 = 10.22$ *gms.*

128. (b) $2C_2H_5OH + 2Na \rightarrow 2C_2H_5ONa + H_2$

130. (a) $CH_3COOH + CH_3OH \rightarrow \underset{\text{Esterification}}{CH_3COOCH_3} + H_2O$

131. (b) CH_3OH has highest boiling point because of hydrogen bonding.

132. (b)

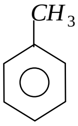


Formic acid forms dimer due to which strength of $H-$bond increases Hence, boiling point increases.

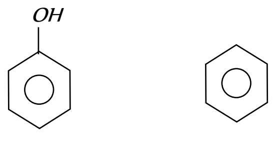
133. (c) Lower members are soluble in water and solubility decreases with increasing molecular mass because hydrophobic character increases.

135. (d) Alcohols can not be dried using anhydrous $CaCl_2$ because it forms an addition compound $CaCl_2.4CH_3OH$.

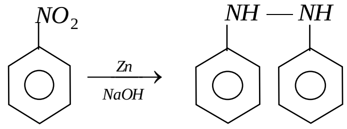
137. (b)



Presence of methyl group increases electron density at *o-* and *p-* positions. Hence, it undergoes nitration readily.

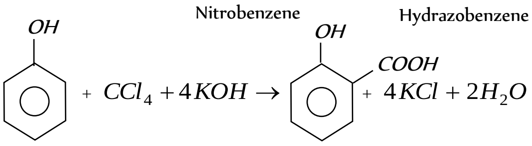


138. (d) $\xrightarrow[\text{Distillation}]{Zn}$ $\xrightarrow[\text{Conc. } HNO_3]{\text{Conc. } H_2SO_4}$



Nitrobenzene Hydrazobenzene

140. (b)



$$+\ CCl_4 + 4KOH \rightarrow \quad +\ 4KCl + 2H_2O$$

Salicylic acid

141. (a) $\underset{\text{Glucose}}{C_6H_{12}O_6} \xrightarrow{\text{Zymase}} \underset{\text{Ethylalcohol}}{2C_2H_5OH} + 2CO_2$

144. (a) $C_2H_5OH + NH_3 \xrightarrow{Al_2O_3} C_2H_5NH_2 + H_2O$

145. (b) $CH_3OH + \frac{1}{2}O_2 \xrightarrow{Cu} HCHO + H_2O$

146. (a) $CH_3COOH + C_2H_5OH \rightarrow \underset{\text{Ethyl acetate}}{CH_3COOC_2H_5} + H_2O$

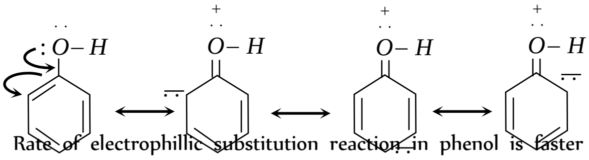
147. (a)

$$\begin{tikzcd} \underset{A}{\underset{1^{o}\text{alcohol}}{CH_3CH_2OH}} \arrow[r, "\text{Oxi.}"] & CH_3CHO \arrow[r, "\text{Oxi.}"] & CH_3COOH \arrow[d, "\text{Ammonical } AgNO_3"] \\ & & \text{Silver Mirror} \end{tikzcd}$$

150. (b) $CH_3CH_2-OH + HO-CH_2-CH_3 \xrightarrow[140^{o}C]{\text{Conc. } H_2SO_4}$

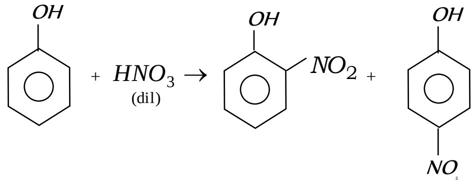
$$\underset{\text{Diethyl ether}}{CH_3CH_2-O-CH_2-CH_3} + H_2O$$

151. (b)



Rate of electrophillic substitution reaction in phenol is faster than in benzene because presence of $-OH$ group increases electron density at *o-* and *p-* positions.

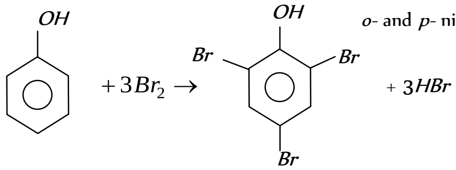
152. (b)



$$+\ \underset{\text{(dil)}}{HNO_3} \rightarrow$$

o- and *p-* nitrophenol

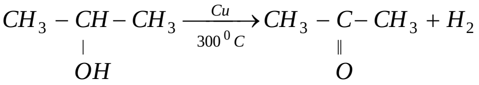
153. (b)



$$+3Br_2 \rightarrow \quad + 3HBr$$

2,4,6 – tribromophenol

155. (b) Secondary alcohol on dehydrogenation gives acetone



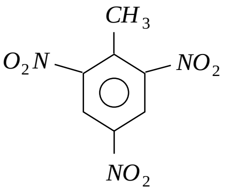
$$CH_3-\underset{\underset{OH}{|}}{CH}-CH_3 \xrightarrow[300^{0}C]{Cu} CH_3-\underset{\underset{O}{\|}}{C}-CH_3+H_2$$

156. (c) $C_2H_5OH \xrightarrow{NaOH\ /\ I_2} CHI_3$

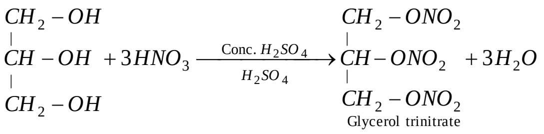
$CH_3COCH_3 \xrightarrow{NaOH\ /\ I_2} CHI_3$

$CH_3OH \xrightarrow{NaOH\ /\ I_2}$ No reaction.

157. (d) 2,4,6 Trinitro toulene (TNT)



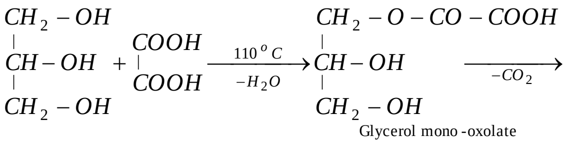
159. (c)



$$\begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} + 3HNO_3 \xrightarrow[H_2SO_4]{\text{Conc. } H_2SO_4} \begin{array}{l}CH_2-ONO_2\\ |\\ CH-ONO_2\\ |\\ CH_2-ONO_2\end{array} + 3H_2O$$

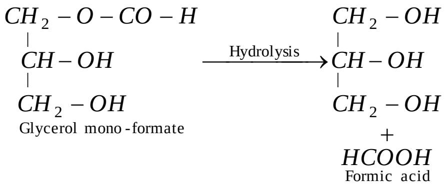
Glycerol trinitrate

160. (a)



$$\begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} + \begin{array}{l}COOH\\ |\\ COOH\end{array} \xrightarrow[-H_2O]{110^oC} \begin{array}{l}CH_2-O-CO-COOH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} \xrightarrow{-CO_2}$$

Glycerol mono-oxolate



$$\begin{array}{l}CH_2-O-CO-H\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} \xrightarrow{\text{Hydrolysis}} \begin{array}{l}CH_2-OH\\ |\\ CH-OH\\ |\\ CH_2-OH\end{array} + HCOOH$$

Glycerol mono-formate

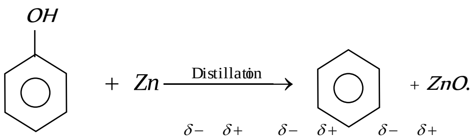
Formic acid

163. (b) $C_2H_5OH + CH_3COOH \xrightarrow[\text{Esterification}]{H_2SO_4}$

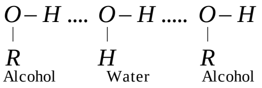
$CH_3COOC_2H_5 + H_2O$

Ethylacetate

165. (a)

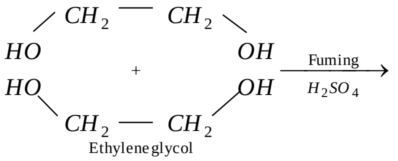


166. (b) Hydrogen bonding :

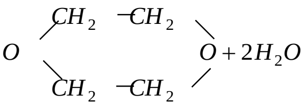


$$\begin{array}{ccccc}\overset{\delta-}{O}-\overset{\delta+}{H} & \ldots\ldots & \overset{\delta-}{O}-\overset{\delta+}{H} & \ldots\ldots & \overset{\delta-}{O}-\overset{\delta+}{H}\\ | & & | & & |\\ R & & H & & R\\ \text{Alcohol} & & \text{Water} & & \text{Alcohol}\end{array}$$

167. (c)



Ethyleneglycol



168. (b) Tertiary carbonium ion is the most stable and it will be given by dehydration of tertiary alcohol.

169. (d) $CH_3CH_2OH \xrightarrow[\text{bond fission}]{\text{Heterolytic}} CH_3CH_2O^- + H^+$

170. (b) C_2H_5OH is soluble in water due to *H*-bonding.

173. (b) When ethanol dissolves in water then emission of heat and contraction in volume.

175. (a) Azeotropic distillation method –

Rectified spirit + Benzene + water

↓ Fractional distillation

First fraction at 331.8 *K* is ternary azeotrope

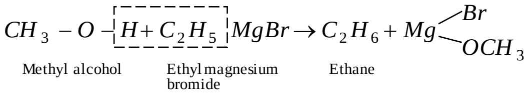
(H_2O 7.4% + Benzene 74% + alcohol 18.5%)

Second fraction 341.2 *K* is a binary azeotrope

(Benzene 67.7% + Alcohol 32.2%)

Last fraction at 351*K* is absolute alcohol.

176. (a)



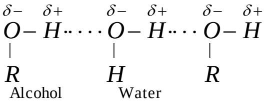
$$CH_3-O-\boxed{H + C_2H_5}MgBr \rightarrow C_2H_6 + Mg\begin{array}{l}Br\\ OCH_3\end{array}$$

Methyl alcohol　Ethylmagnesium bromide　Ethane

Anisole

177. (c) $+ CH_2N_2 \xrightarrow{HBF_4}$ $+ N_2$

180. (c) Alcohol is soluble in water due to *H*-bonding

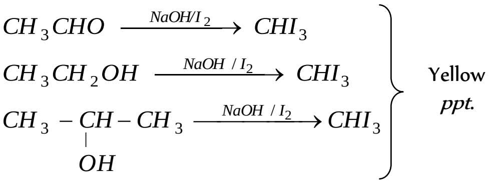


$$\begin{array}{ccccc}\overset{\delta-}{O}-\overset{\delta+}{H} & \cdots\cdots & \overset{\delta-}{O}-\overset{\delta+}{H} & \cdots & \overset{\delta-}{O}-\overset{\delta+}{H}\\ | & & | & & |\\ R & & H & & R\\ \text{Alcohol} & & \text{Water} & & \end{array}$$

183. (c) $CH_3CH_2-OH + 2Cl_2 \rightarrow CCl_3-CHO$

Oxidation will occur with chlorination of methyl group.

185. (d)



$$\left.\begin{array}{l}CH_3CHO \xrightarrow{NaOH/I_2} CHI_3\\ CH_3CH_2OH \xrightarrow{NaOH\ /\ I_2} CHI_3\\ CH_3-\underset{OH}{\underset{|}{CH}}-CH_3 \xrightarrow{NaOH\ /\ I_2} CHI_3\end{array}\right\}\ \text{Yellow } ppt.$$

$C_6H_5-CH_2-OH \xrightarrow{NaOH\ /\ I_2}$ No yellow *ppt.*

186. (c) Benzyl alcohol and cyclohexanol are not acidic while phenol and *m*-chlorophenol are acidic due to presence of electron withdrawing groups like $-NO_2$, $-Cl$, $-CN$ increases the acidic character of phenols. Hence, *m*-chlorophenol is more acidic than phenol.

187. (b) Three, these are

$CH_3CH_2OCH_2CH_3$ (I), $CH_3OCH_2CH_2CH_3$ (II)

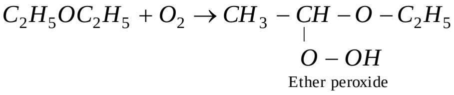
and $CH_3OCH(CH_3)_2$ (III). Here I and II, I and III

are pairs of metamers.

189. (c) CH_3OCH_3 and $C_2H_5OCH_3$ are gases while $C_2H_5OC_2H_5$ (b.p. 308 *K*) is low boiling liquid.

190. (a) $C_2H_5OC_2H_5 \xrightarrow[\text{Cleavage of ethers}]{\text{Red } P\ /\ HI} 2C_2H_5I \xrightarrow[\text{Reduction}]{\text{Red } P\ /\ HI} \underset{\text{Ethane}}{2C_2H_6}$

191. (d)

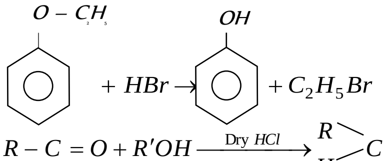


$$C_2H_5OC_2H_5 + O_2 \rightarrow CH_3-\underset{O-OH}{\underset{|}{CH}}-O-C_2H_5$$

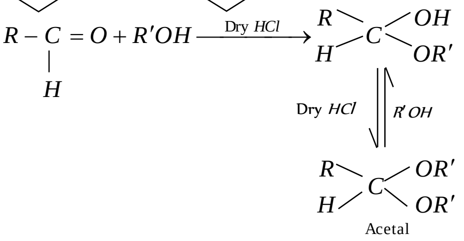
Ether peroxide

192. (a) $C_2H_5OC_2H_5 + HI \rightarrow C_2H_5OH + C_2H_5I$

193. (a)



196. (d)



$$R-\underset{H}{\underset{|}{C}}=O + R'OH \xrightarrow{\text{Dry } HCl} \begin{array}{l}R\\ H\end{array}\!\!>C<\!\!\begin{array}{l}OH\\ OR'\end{array} \xrightarrow[\text{Dry } HCl]{R'OH} \begin{array}{l}R\\ H\end{array}\!\!>C<\!\!\begin{array}{l}OR'\\ OR'\end{array}$$

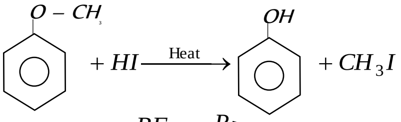
Acetal

198. (b) $CH_3-O-CH_3 + 2HI \rightarrow 2CH_3I + H_2O$

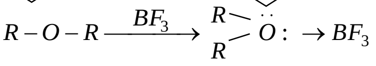
199. (b) Only alkyl aryl ethers *e.g.*, $C_6H_5OCH_3$ undergoes electrophilic substitution reactions.

200. (a) $CH_3COCl + C_2H_5O-C_2H_5 \rightarrow$ No reaction

201. (b)



202. (c)



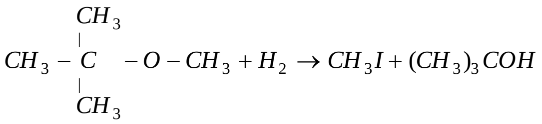
$$R-O-R \xrightarrow{BF_3} \begin{array}{l}R\\ R\end{array}\!\!>\ddot{O}: \rightarrow BF_3$$

Etherate

203. (d) Due to inter-molecular hydrogen bonding in alcohols boiling point of alcohols is much higher than ether.

205. (b) CH_3-OCH_3 does not have replaceable H – atom.

206. (a)



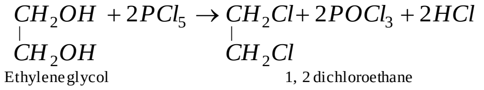
$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-O-CH_3+H_2\rightarrow CH_3I+(CH_3)_3COH$$

207. (b) $CH_3CH(OH)CH_2CH_3\xrightarrow{\text{Conc. }H_2SO_4}\underset{(C_4H_8)}{CH_3CH=CHCH_3}$

$$\underset{2-\text{Butanol}}{CH_3CHOHCH_2CH_3}\xrightarrow{[O]}\underset{\text{Butanone}}{CH_3COCH_2CH_3}$$

Butanone gives both an oxime and positive iodoform test, therefore, the original compound is 2-butanol.

208. (b)

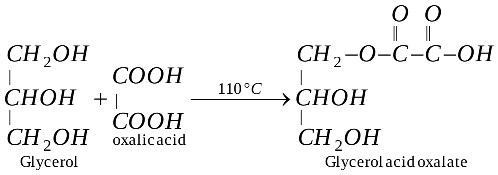


$$\underset{\text{Ethyleneglycol}}{\begin{array}{l}CH_2OH\\|\\CH_2OH\end{array}}+2PCl_5\rightarrow\underset{1,\,2\text{ dichloroethane}}{\begin{array}{l}CH_2Cl\\|\\CH_2Cl\end{array}}+2POCl_3+2HCl$$

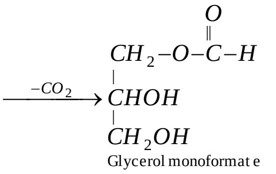
209. (b) C_2H_5OH (ethanol) is a very weak acid hence it does not react with *NaOH*. However it reacts with metallic sodium.

210. (b) Methanol has high boiling point than methyl thiol because there us intermolecular hydrogen bonding in methanol and no hydrogen bonding in methyl thiol.

211. (a)



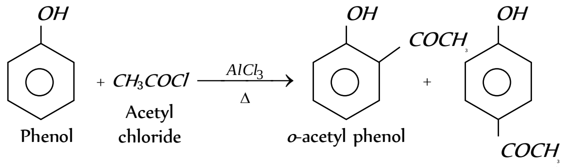
$$\underset{\text{Glycerol}}{\begin{array}{l}CH_2OH\\|\\CHOH\\|\\CH_2OH\end{array}}+\underset{\text{oxalic acid}}{\begin{array}{l}COOH\\|\\COOH\end{array}}\xrightarrow{110^\circ C}\underset{\text{Glycerol acid oxalate}}{\begin{array}{l}CH_2-O-\overset{\overset{O}{\|}}{C}-\overset{\overset{O}{\|}}{C}-OH\\|\\CHOH\\|\\CH_2OH\end{array}}$$



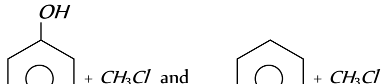
$$\xrightarrow{-CO_2}\underset{\text{Glycerol monoformate}}{\begin{array}{l}CH_2-O-\overset{\overset{O}{\|}}{C}-H\\|\\CHOH\\|\\CH_2OH\end{array}}$$

212. (a) Formation of a yellow precipitate on heating a compound with an alkaline solution of iodine is known as iodoform reaction. Methyl alcohol does not respond to this test. Iodoform test is exhibited by ethyl alcohol, acetaldehyde, acetone, methyl ketone and those alcohols which possess $CH_3CH(OH)-$ group.

213. (b) In friedal craft acylation, aromatic compounds such as benzene, phenol etc. undergo acylation with CH_3COCl in the presence of anhydrous $AlCl_3$ and gives ortho and para derivatives. Intermediate is $CH_3C^+=O$ (acylium ion) of this reaction.

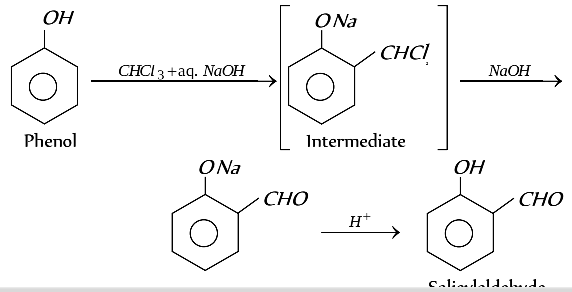


Phenol
Acetyl chloride
o-acetyl phenol
p-acetyl phenol



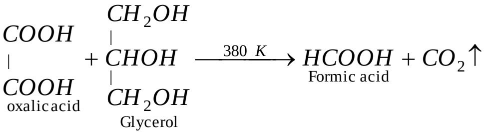
In fact denotes friedel craft alkylation.

214. (a) This reaction is known as Reimer Tiemann reaction.

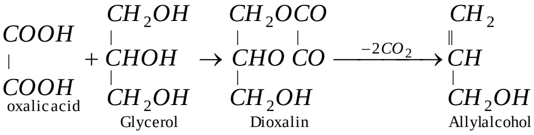


Phenol
Intermediate
Salicylaldehyde

215. (a)



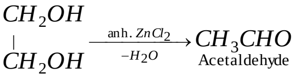
$$\underset{\text{oxalic acid}}{\begin{array}{l}COOH\\|\\COOH\end{array}}+\underset{\text{Glycerol}}{\begin{array}{l}CH_2OH\\|\\CHOH\\|\\CH_2OH\end{array}}\xrightarrow{380\ K}\underset{\text{Formic acid}}{HCOOH}+CO_2\uparrow$$



$$\underset{\text{oxalic acid}}{\begin{array}{l}COOH\\|\\COOH\end{array}}+\underset{\text{Glycerol}}{\begin{array}{l}CH_2OH\\|\\CHOH\\|\\CH_2OH\end{array}}\rightarrow\underset{\text{Dioxalin}}{\begin{array}{ll}CH_2OCO&\\|\quad\ \ |&\\CHO\ CO&\\|&\\CH_2OH&\end{array}}\xrightarrow{-2CO_2}\underset{\text{Allylalcohol}}{\begin{array}{l}CH_2\\\|\\CH\\|\\CH_2OH\end{array}}$$

Thus at 530 K allyl alcohol is formed.

216. (c)



$$\begin{array}{l}CH_2OH\\|\\CH_2OH\end{array}\xrightarrow[-H_2O]{\text{anh. }ZnCl_2}\underset{\text{Acetaldehyde}}{CH_3CHO}$$

217. (d) Ethyl alcohol give positive iodoform test (*i.e.* yellow ppt. with I_2 and *NaOH*)

$$CH_3CH_2OH+4I_2+6NaOH\rightarrow$$

$$\underset{\text{yellow ppt.}}{CHI_3}+5NaI+CH_3COONa+3H_2O$$

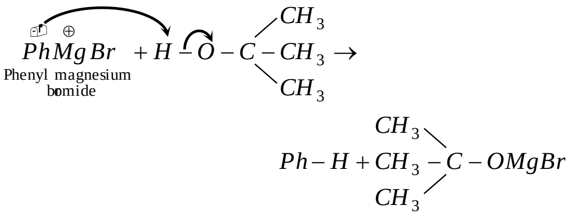
218. (d) Tertiary alcohols react fastest with hydrogen halides 2 methyl propan-2-ol is a tertiary alcohol.

219. (a) When benzoic acid reacts with ethyl alcohol in the presence of sulphuric acid ethyl benzoate is formed. This is known as esterification.

$$\underset{\text{Benzoic acid}}{C_6H_5COOH}+\underset{\text{Ethyl alcohol}}{C_2H_5OH}\xrightarrow{H_2SO_4}$$

$$\underset{\text{Ethyl benzoate}}{C_6H_5COOC_2H_5}+\underset{\text{water}}{H_2O}$$

220. (a)



$$\underset{\text{Phenyl magnesium bomide}}{PhMgBr}+H-O-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3\rightarrow$$

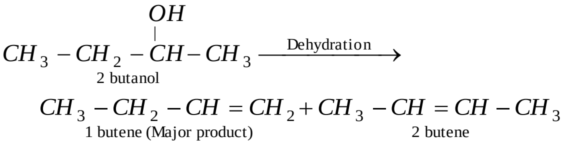
$$Ph-H+CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OMgBr$$

221. (b) $Mg+CH_3I\xrightarrow{\text{Dry ether}}CH_3MgI$

222. (a) Ethyl alcohol on dehydration with conc. H_2SO_4 at 170°C gives ethylene.

$$\underset{\text{Ethyl alcohol}}{CH_3CH_2OH}\xrightarrow[\text{conc. }H_2SO_4]{170^\circ C}\underset{\text{Ethylene}}{CH_2=CH_2}+H_2O$$

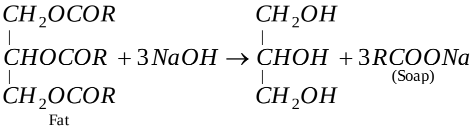
223. (d)



$$\underset{2\text{ butanol}}{CH_3-CH_2-\overset{\overset{OH}{|}}{CH}-CH_3}\xrightarrow{\text{Dehydration}}$$

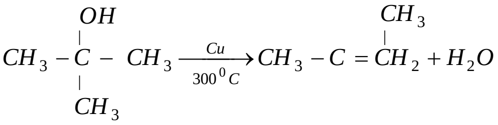
$$\underset{1\text{ butene (Major product)}}{CH_3-CH_2-CH=CH_2}+\underset{2\text{ butene}}{CH_3-CH=CH-CH_3}$$

224. (b) Fats are esters of higher fatty acids with glycerol, hence on alkaline hydrolysis they give back glycerol and sodium or potassium salt of acid (this is called soap).



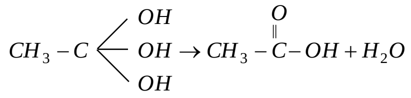
$$\underset{\text{Fat}}{\begin{array}{l}CH_2OCOR\\|\\CHOCOR\\|\\CH_2OCOR\end{array}}+3NaOH\rightarrow\begin{array}{l}CH_2OH\\|\\CHOH\\|\\CH_2OH\end{array}+\underset{\text{(Soap)}}{3RCOONa}$$

225. (c)



$$CH_3-\overset{\overset{OH}{|}}{\underset{\underset{CH_3}{|}}{C}}-CH_3\xrightarrow[300^0C]{Cu}CH_3-\overset{\overset{CH_3}{|}}{C}=CH_2+H_2O$$

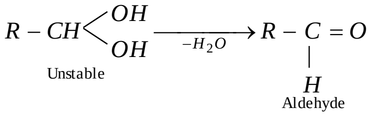
227. (c)



$$CH_3-C\begin{cases}OH\\OH\\OH\end{cases}\rightarrow CH_3-\overset{\overset{\Large O}{\|}}{C}-OH+H_2O$$

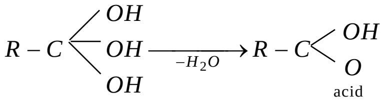
If two or more $-OH$ groups are present on carbon atom then it immediately looses water molecule and forms acid or aldehyde.

Two $-OH$ groups on the same carbon aldehyde is formed



$$\underset{\text{Unstable}}{R-CH\begin{cases}OH\\OH\end{cases}}\xrightarrow{-H_2O}\underset{\text{Aldehyde}}{R-\underset{\underset{\Large H}{|}}{C}=O}$$

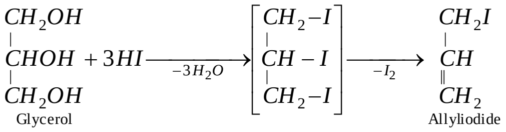
Three $-OH$ groups on the same carbon acid is formed.



$$R-C\begin{cases}OH\\OH\\OH\end{cases}\xrightarrow{-H_2O}\underset{\text{acid}}{R-C\begin{cases}OH\\O\end{cases}}$$

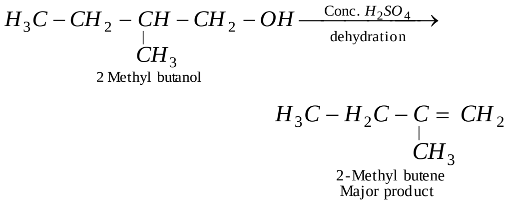
228. (d) H_2SO_4, Al_2O_3 and H_3PO_4 all can act as dehydrating agent.

229. (b)



$$\underset{\text{Glycerol}}{\begin{matrix}CH_2OH\\|\\CHOH\\|\\CH_2OH\end{matrix}}+3HI\xrightarrow[-3H_2O]{}\left[\begin{matrix}CH_2-I\\|\\CH-I\\|\\CH_2-I\end{matrix}\right]\xrightarrow{-I_2}\underset{\text{Allyliodide}}{\begin{matrix}CH_2I\\|\\CH\\\|\\CH_2\end{matrix}}$$

230. (a)

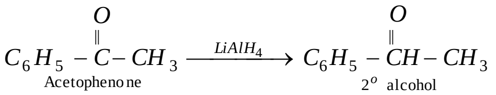


$$\underset{\text{2 Methyl butanol}}{H_3C-CH_2-\underset{\underset{\Large CH_3}{|}}{CH}-CH_2-OH}\xrightarrow[\text{dehydration}]{\text{Conc. }H_2SO_4}$$

$$\underset{\substack{\text{2-Methyl butene}\\\text{Major product}}}{H_3C-H_2C-\underset{\underset{\Large CH_3}{|}}{C}=CH_2}$$

233. (c) $CH_3CHO\xleftarrow[\Delta]{Cu}CH_3CH_2OH\xrightarrow[\Delta]{Al_2O_3}CH_2=CH_2$

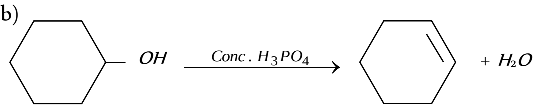
234. (b)



$$\underset{\text{Acetophenone}}{C_6H_5-\overset{\overset{\Large O}{\|}}{C}-CH_3}\xrightarrow{LiAlH_4}\underset{2^o\text{ alcohol}}{C_6H_5-\overset{\overset{\Large O}{\|}}{CH}-CH_3}$$

235. (d) $C_2H_5OH\xrightarrow[170^oC]{Conc\ H_2SO_4}C_2H_4+H_2O$

236. (b)



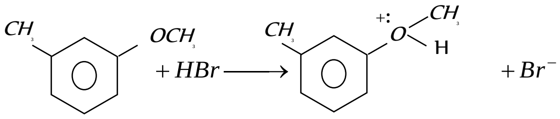
Because conc. H_3PO_4 acts as a dehydrating agent.

238. (c) $C_2H_5OH\xrightarrow[I_2]{NaOH}CHI_3$ yellow *ppt.*

$CH_3OH\xrightarrow[I_2]{NaOH}$ No reaction

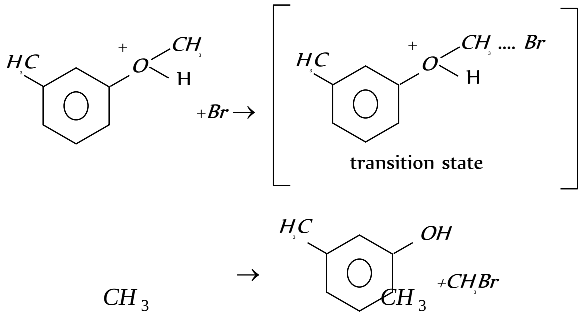
239. (d) It is not acetaldehyde or acetone as does not react with hydrazine. It is not CH_3OH as does not react with *Na*.

240. (a) The ether molecule gets protonated by the hydrogen of the acid to form protonated ether or oxonium salt.

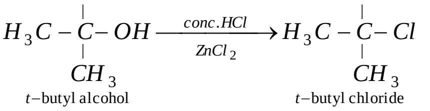


Protonated ether

The protonated ether undergoes nucleophilic attack by halide ion (X^-) and forms alkyl alcohol and alkyl halide

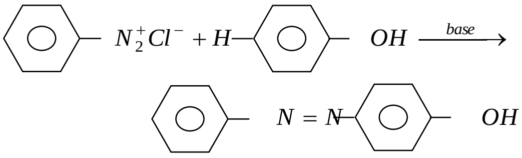


241. (a)



$$\underset{t-\text{butyl alcohol}}{H_3C-\underset{\underset{\Large CH_3}{|}}{\overset{\overset{\Large CH_3}{|}}{C}}-OH}\xrightarrow[ZnCl_2]{conc.HCl}\underset{t-\text{butyl chloride}}{H_3C-\underset{\underset{\Large CH_3}{|}}{\overset{\overset{\Large CH_3}{|}}{C}}-Cl}$$

242. (a)

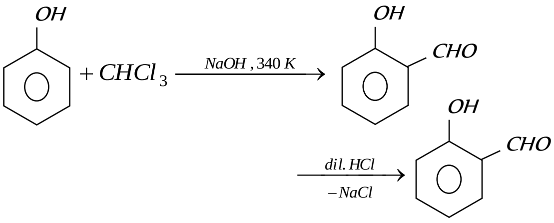


p-hydroxy azobenzene

(orange dye)

This is an example of coupling reaction

243. (b) Reimer-Tiemann reaction involves the carbon carbon bond formation.



salicylaldehyde

244. (a) This is Reimer-Tiemann reaction where the electrophile is dichlorocarbene $(:CCl_2)$ generated from chloroform by the action of a base.

$$OH^-+CHCl_3\rightleftharpoons HOH+:CCl_3^-\rightarrow Cl^-+:CCl_2$$

245. (a) Phenols are much more acidic than alcohols but less so than carboxylic acids or even carbonic acid. This is indicated by the values of ionisation constants. The relative acidity follows the order:

$$K_a\ \underset{RCOOH}{10^{-5}}>\underset{H_2CO_3}{10^{-7}}>\underset{C_6H_5OH}{10^{-10}}>\underset{HOH}{10^{-14}}>\underset{ROH}{10^{-18}}$$

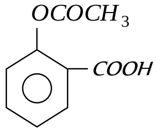
Uses of alcohol, Phenol and Ethers

1. (a) $\text{Glycerol}\xrightarrow{HNO_3}\text{Glyceryltrinitrate}\xrightarrow[\text{Kieselguhr}]{\text{Absorbed on}}\text{Dynamite}$

$\quad\quad\quad\quad\quad\quad\quad + \text{Glyceryldinitrate}$

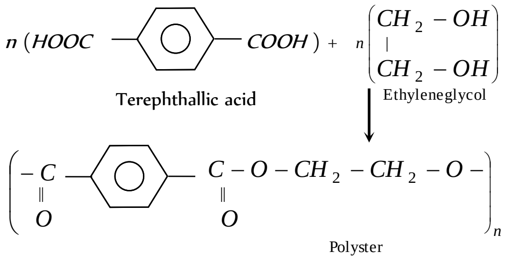
3. (d) $C_2H_5OH\xrightarrow[\text{Acetobactoracetii}]{\text{air}}CH_3COOH$

4. (b)



Aspirin or Acetyl salicylic acid.

6. (a)



9. (a) Ethylene glycol is added to lowering down the freezing point of water so that it does not freeze.

10. (b) Power alcohol 80% petrol and 20% ethyl alcohol

12. (d) Glucose $\xrightarrow[\text{(From yeast)}]{\text{Zymase}} 2C_2H_5OH + 2CO_2$

16. (d) Glycerol is not used as an antiseptic agent.

18. (c) Denaturing can also be done by adding 0.5% pyridine, petroleum naptha, $CuSO_4$ etc.

20. (b) A mixture of glyceryl trinitrate and glyceryl dinitrate when absorbed on kieselgurh is called dynamite.

22. (c) Tonics have generally contains ethyl alcohol.

23. (c) Due to presence of methyl alcohol in liquor.

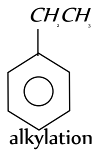
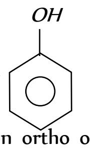
24. (d) An anaesthetic.

25. (c) Groundnut oil.

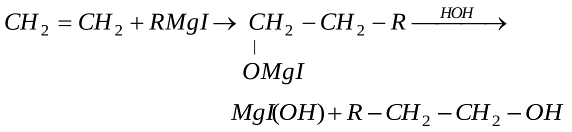
27. (a) $\underset{\text{Ethylbutyrate}}{C_3H_7COOC_2H_5} \xrightarrow{Na / C_2H_5OH} \underset{\text{Butylalcohol}}{C_3H_7CH_2OH}$

28. (a) Glycol is used as an antifreeze for automobile radiators because it lowers down the melting point of water.

Critical Thinking Questions

1. (c)  or  will undergoes a Friedel Craft's alkylation on ortho or para position because of more electron density.

2. (c)



$$CH_2 = CH_2 + RMgI \rightarrow \underset{\substack{| \\ OMgI}}{CH_2} - CH_2 - R \xrightarrow{HOH}$$

$$MgI(OH) + R - CH_2 - CH_2 - OH$$

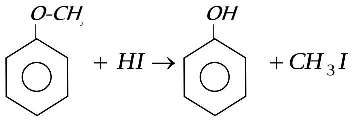
3. (c) The liquids which decompose at its boiling point can be purified by vacuum distillation. Glycerol which decomposes at its boiling point $(-563K)$ can be distilled without decomposition at $453K$ under 12 $mm\ Hg$ pressure.

4. (a) Liebermann's reaction.

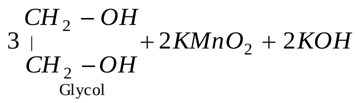
5. (a) 1^o alcohol $> 2^o$ alcohol $> 3^o$ alcohol

Boiling point of alcohols decreases as the number of branches increases.

6. (c)

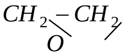


7. (c) $3CH_2 = CH_2 + 2KMnO_4 + 4H_2O \rightarrow$



$$3\underset{\text{Glycol}}{\begin{array}{l} CH_2 - OH \\ | \\ CH_2 - OH \end{array}} + 2KMnO_2 + 2KOH$$

8. (c) Correct order of dehydration in alcohols 3° > 2° > 1°.

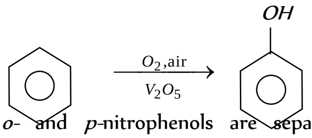
9. (a) Oxiran is ethylene oxide, 

10. (c) $6CH_3 - CH = CH_2 + B_2H_6 \xrightarrow{H_2O_2}$

$$CH_3 - CH_2 - CH_2OH$$

11. (d) Distinction between primary, secondary and tertiary alcohol is done by all three methods : oxidation, Victormeyer and Lucas test.

12. (b)



13. (a) *o-* and *p*-nitrophenols are separated by steam distillation because *o*-nitrophenol is steam volatile while *p*-isomer is not.

14. (b) Benzoic acid.

15. (a) $R - O - R' \xrightarrow{O_2 \text{ / light}}$

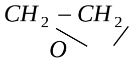
$$C_2H_5 - O - CH(CH_3) - O - OH$$

16. (d) $CH_3OH + CH_3OH \xrightarrow{H_2SO_4(Conc)} CH_3OCH_3$

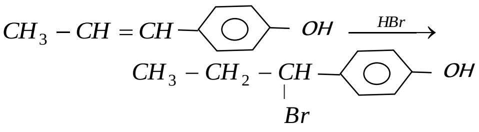
$CH_3OH + C_2H_5OH \xrightarrow{H_2SO_4(Conc)} CH_3OC_2H_5$

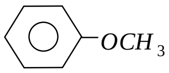
$C_2H_5OH + C_2H_5OH \xrightarrow{H_2SO_4(Conc)} C_2H_5OC_2H_5$

17. (b) IV > III > I > II.

18. (a) Cyclic ethers are called epoxides. 

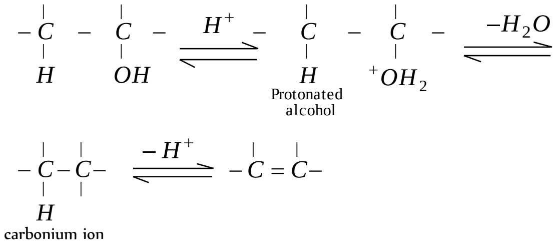
19. (b)



20. (c)  on $KMnO_4$ oxidation does not give benzoic acid.

21. (c) Chromic anhydride in glacial acetic acid is the best reagent to convert pen-3-en-2-ol into pent-3-in-2-one.

22. (a)



In all cases intermediate is carbonium ion, and there may be 1, 2-hydride or 1, 2-methyl shift to form more stable carbonium ion.

Assertion & Reason

3. (a) It is correct that phenol is more reactive than benzene.

4. (c) It is correct that sodium phenoxide (sodium salt of phenol) and CO_2 on heating from sodium salicylate. This is known as Kolbe's reaction. Ethanol does not respond to this reaction. Therefore, assertion is true. But the reason that phenoxide ion is more basic than ethoxide ion is not correct.

5. (c) Lucas reagent is a mixture of anhydrous $ZnCl_2$ and coc. *HCl* is used for the distinction of monohydric alcohol. Tertiary alcohols on addition produce a precipitate immediately while secondary alcohols produce ppt. after 5 minutes. Primary alcohols do not produce any precipitate. Therefore, assertion is true but reason is false.

6. (a) Phenols on treatment with neutral $FeCl_3$ solution produce purple colour, resorcinol contains phenolic group hence in treatment with $FeCl_3$ solution it gives purple colour. Here both assertion and reason are correct and reason is a correct explanation of assertion.

7. (b) Glycerol is purified by distillation under reduced pressure because it decomposes on heating below its melting point. It is a trihydric alcohol. Here, both assertion and reason are true but reason is not a correct explanation of assertion.

8. (a) Alcohols and phenols can be distinguished by treating with *NaOH*. Phenols react with *NaOH* to produce sodium phenoxide because phenols are acidic and alcohols are neutral. Both assertion and reason are true and reason is correct explanation.

9. (b) Zeolites are shape-selective porous solid acid catalysts, their catalytic activity originates from the presence of highly acidic $Al-O(H)-Si$ hydroxyl in the framework.

10. (a) $C_6H_5CH_2OCH_3 \xrightarrow{H^+} C_6H_5CH_2^+ + CH_3OH$

$$\xrightarrow{I^-} C_6H_7CH_2I$$

This can be explained on the basis of S_N1 mechanism. The carbonium ion produced being benzylium ion. Since this type is more stable than alkylium ion.

11. (c) Lower the value of *pKa*, more acidic will be the compound. Acetic acid is more acidic than phenol. This indicates that carboxylate ion should be more stable than the phenoxide ion and it is clear that carboxylate ion has more equivalent resonating structures than the phenoxide ion.

12. (a) The conversion of sugar into ethyl alcohol by yeast is called alcoholic fermentation.

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

$$C_6H_{12}O_6 \xrightarrow{\text{Zymase}} \underset{\text{Ethyl alcohol}}{2C_2H_5OH} + 2CO_2$$

13. (b) The tendency to show *H*-bonding decreases with increasing hydrophobic character of carbon chain. The hydrophobic character of carbon chain increases with he length of carbon chain.

14. (e) Ethyl alcohol forms azeotropic mixture with water which distils with unchanged composition (about 75% ethanol) and thus absolute alcohol cannot be obtained by simple distillation.

15. (e) The dehydration of *t*-butanol involves the formation of 3° carbocation which is more stable than 1° carbocation in *n*-butanol. Thus, tendency to lose water becomes more in *t*-butanol.

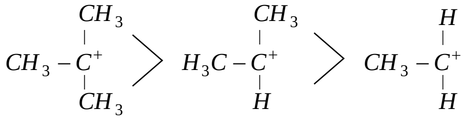
16. (c) A mixture of conc. *HCl* + anhyd. $ZnCl_2$ is called Lucas reagent.

17. (e) Electron withdrawing groups such as $-NO_2$, $-CN$, $-X$, increase the acidity. Greater the number of electron withdrawing groups more is the acidic character *i.e.* 2, 4, 6-trinitrophenol is more acidic than 4-nitrophenol.

18. (b) Phenols cannot be converted into esters by direct reaction with carboxylic acids since phenols are less nucleophilic than alcohols.

19. (b) Alcohol which forms the more stable carbocation undergoes dehydration more readily. Since tert-butyl alcohol forms more stable tert-butyl cation, therefore, it undergoes dehydration most readily than propanol.

20. (e) The ease of dehydration of alcohols can be explained on the basis of stability of the intermediate carbocation. Greater the stability of the carbonation formed, greater will be the rate of reaction. The order of stability of carbocation formed is



$$CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C^+}} > H_3C-\overset{\overset{CH_3}{|}}{\underset{\underset{H}{|}}{C^+}} > CH_3-\overset{\overset{H}{|}}{\underset{\underset{H}{|}}{C^+}}$$

This is due to the electron releasing (+*I*) effect of the alkyl group. Therefore the ease of dehydration of alcohols follows the order.

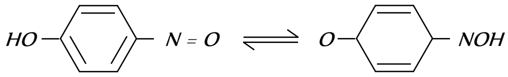
Tertiary > secondary > primary alcohol.

21. (c) Benzoylation in phenols is usually carried out in the presence of aqueous *NaOH* because benzoyl chloride is not readily hydrolysed by alkalies.

22. (b) In phenols, the lone pairs of electrons on the oxygen atom are delocalised over the benzene ring due to resonance and hence are not easily available for protonation. On the other hand, in alcohols, the lone pairs of electrons on oxygen atom are localized due to the absence of resonance and hence are easily available for ptotonation.

23. (c) *p*-Nitrophenolate ion is more stable than phenolate ion.

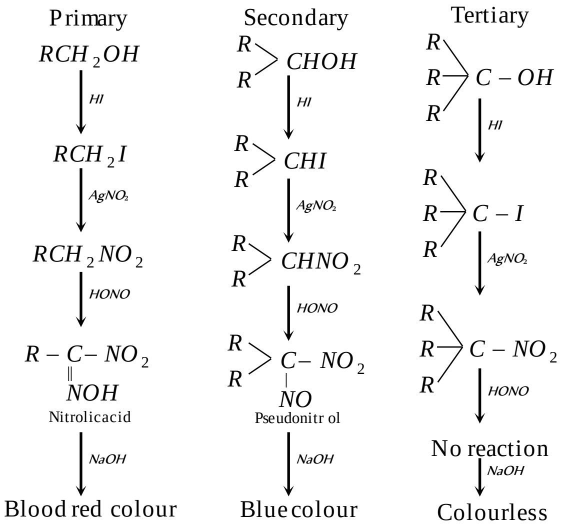
24. (b) Nitrous acid gives nitrosomine ion (NO^+) which attacks phenol at less hindered *p*-position of form *p*-nitrosophenol which is a tautomer of *p*-benzoquinone monoxide.



p-Nitrosophenol *p*-Benzoquinone monoxime

25. (c) Nucleophilic attack of phenolate ion through the ortho-carbon atom occurs on CCl_4 to form an intermediate which on hydrolysis gives salicylic acid.

26. (a) Victor-Meyer's test is used to distinguish primary, secondary and tertiary alcohols.



28. (b) Removal of two molecules of water gives a product which tautomerises to yield acrolein-an α, β-unsaturated aldehyde.

29. (b) Depending upon whether the alkyl halide and the alkoxide ion carry the same or different alkyl groups both symmetrical and unsymmetrical ethers can be prepared by Williamsons synthesis.

30. (c) Ethers being Lewis bases form etherates with Lewis acids.

31. (d) $(CH_3)_3CONa$ and CH_3CH_2Br react to form $(CH_3)_3C-O-CH_2CH_3$. Good yields of ethers are obtained when primary alkyl halides are treated with alkoxides derived from any alcohol. 1°, 2° or 3°.