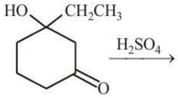
25

Alcohols, Phenols and Ethers

TOPIC 1 Preparation and Properties of Alcohols

1. The major product of the following reaction is : **[Sep. 05, 2020 (II)]**



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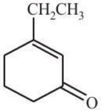

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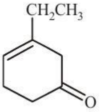

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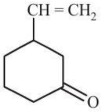

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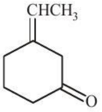
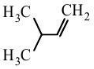


2. When neopentyl alcohol is heated with an acid, it slowly converted into an 85 : 15 mixture of alkenes A and B, respectively. What are these alkenes? **[Sep. 04, 2020 (I)]**

(a)

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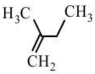

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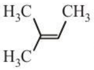
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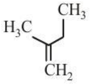

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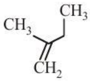
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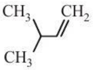

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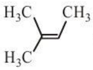
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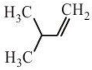
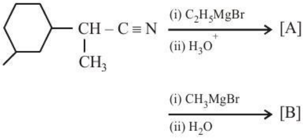
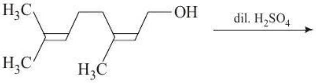


3. The number of chiral centres present in [B] is ________. **[Sep. 04, 2020 (I)]**



4. The major product of the following reaction is: **[Jan. 08, 2020 (I)]**



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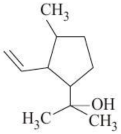

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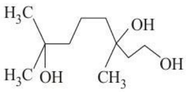
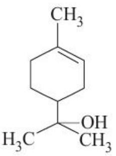
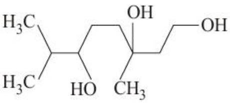
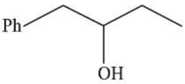
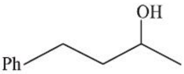


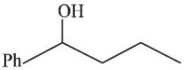
(c) 

(d) 

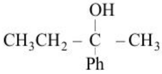
5. Heating of 2-chloro-1-phenylbutane with EtOK/EtOH gives X as the major product. Reaction of X with Hg $(OAc)_2/H_2O$ followed by $NaBH_4$ gives Y as the major product. Y is : **[April 12, 2019 (II)]**

(a) 

(b) 

(c) 

(d) 

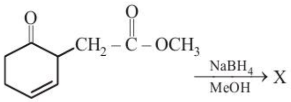
6. 
$CH_3CH_2-\underset{Ph}{\overset{OH}{\underset{|}{\overset{|}{C}}}}-CH_3$ cannot be prepared by: **[Jan. 12, 2019 (I)]**

(a) $CH_3CH_2COCH_3 + PhMgX$

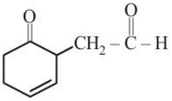
(b) $PhCOCH_2CH_3 + CH_3MgX$

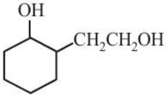
(c) $PhCOCH_3 + CH_3CH_2MgX$

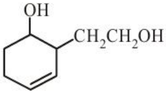
(d) $HCHO + PhCH(CH_3)CH_2MgX$

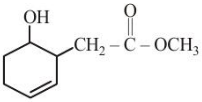
7. 

[Jan. 10, 2019 (I)]

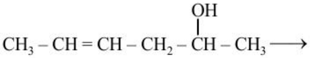
(a) 

(b) 

(c) 

(d) 

8. Which is the most suitable reagent for the following transformation? **[Jan. 10, 2019 (II)]**


$CH_3-CH=CH-CH_2-\overset{OH}{\overset{|}{C}H}-CH_3 \longrightarrow$

$CH_3-CH=CH-CH_2CO_2H$

(a) Tollen's reagent (b) $I_2/NaOH$

(c) CrO_2Cl_2/CS_2 (d) alkaline $KMnO_4$

9. The gas evolved on heating CH_3MgBr in methanol is : **[Online April 9, 2016]**

(a) Methane (b) Ethane

(c) Propane (d) HBr

10. The most suitable reagent for the conversion of $R-CH_2-OH \rightarrow R-CHO$ is: **[2014]**

(a) $KMnO_4$

(b) $K_2Cr_2O_7$

(c) CrO_3

(d) PCC (Pyridinium chlorochromate)

11. Which one of the following statements is not correct? **[Online April 11, 2014]**

(a) Alcohols are weaker acids than water

(b) Acid strength of alcohols decreases in the following $RCH_2OH > R_2CHOH > R_3COH$

(c) Carbon-oxygen bond length in methanol, CH_3OH is shorter than that of C – O bond length in phenol.

(d) The bond angle  in methanol is 108.9°.

12. In the Victor-Meyer's test, the colour given by 1°, 2° and 3° alcohols are respectively: **[Online April 12, 2014]**

(a) Red, colourless, blue (b) Red, blue, colourless

(c) Colourless, red, blue (d) Red, blue, violet

13. An unknown alchol is treated with the "Lucas reagent" to determine whether the alcohol is primary, secondary or tertiary. Which alcohol reacts fastest and by what mechanism : **[2013]**

(a) secondary alcohol by S_N1
(b) tertiary alcohol by S_N1
(c) secondary alcohol by S_N2
(d) tertiary alcohol by S_N2

14. Rate of dehydration of alcohols follows the order: **[Online April 9, 2013]**
(a) 2° > 1° > CH_3OH > 3° (b) 3° > 2° > 1° > CH_3OH
(c) 2° > 3° > 1° > CH_3OH (d) CH_3OH > 1° > 2° > 3°

15. Amongst the following alcohols which would react fastest with conc. HCl and $ZnCl_2$? **[Online April 22, 2013]**
(a) pentanol (b) 2-methyl butanol
(c) 2-pentanol (d) 2-methyl butan-2-ol

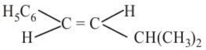
16. Reagent used to convert allyl alcohol to acrolein is **[Online May 19, 2012]**
(a) MnO_2 (b) H_2O_2
(c) OsO_4 (d) $KMnO_4$

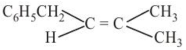
17. Consider thiol anion ($RS^{\ominus}$) and alkoxy anion ($RO^{\ominus}$). Which of the following statements is correct ? **[2011RS]**
(a) $RS^{\ominus}$ is less basic but more nucleophilic than $RO^{\ominus}$
(b) $RS^{\ominus}$ is more basic and more nucleophilic than $RO^{\ominus}$
(c) $RS^{\ominus}$ is more basic but less nucleophilic than $RO^{\ominus}$
(d) $RS^{\ominus}$ is less basic and less nucleophilic than $RO^{\ominus}$

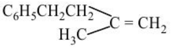
18. From amongst the following alcohols, the one that would react fastest with conc. HCl and anhydrous $ZnCl_2$, is **[2010]**
(a) 2-Butanol (b) 2- Methylpropan-2-ol
(c) 2-Methylpropanol (d) 1- Butanol

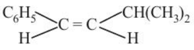
19. The main product of the following reaction is

$C_6H_5CH_2CH(OH)CH(CH_3)_2 \xrightarrow{conc.H_2SO_4} ?$ **[2010]**

(a) 

(b) 

(c) 

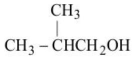
(d) 

20. In the following sequence of reactions, **[2007]**

$$CH_3CH_2OH \xrightarrow{P+I_2} A \xrightarrow[ether]{Mg} B \xrightarrow{HCHO} C \xrightarrow{H_2O} D$$

the compound D is
(a) propanal (b) butanal
(c) *n*-butyl alcohol (d) *n*-propyl alcohol.

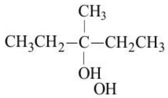
21. Among the following the one that gives positive iodoform test upon reaction with I_2 and NaOH is **[2006]**

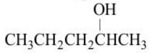
(a) 
$CH_3-\overset{CH_3}{\overset{|}{C}}HCH_2OH$

(b) $PhCHOHCH_3$
(c) $CH_3CH_2CH(OH)CH_2CH_3$
(d) $C_6H_5CH_2CH_2OH$

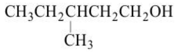
22. The best reagent to convert pent-3-en-2-ol into pent-3-en-2-one is **[2005]**
(a) Pyridinium chlorochromate
(b) Chromic anhydride in glacial acetic acid
(c) acidic dichromate
(d) Acidic permanganate

23. Among the following compounds which can be dehydrated very easily? **[2004]**

(a) 
$CH_3CH_2-\underset{OH}{\underset{|}{\overset{CH_3}{\overset{|}{C}}}}-CH_2CH_3$

(b) 
$CH_3CH_2CH_2\overset{OH}{\overset{|}{C}}HCH_3$

(c) $CH_3CH_2CH_2CH_2CH_2OH$

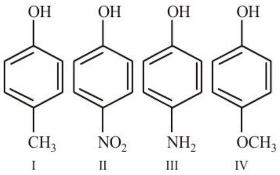
(d) 
$CH_3CH_2\underset{CH_3}{\underset{|}{C}}HCH_2CH_2OH$

24. During dehydration of alcohols to alkenes by heating with conc. H_2SO_4, the initiation step is **[2003]**
(a) formation of carbocation
(b) elimination of water
(c) formation of an ester
(d) protonation of alcohol molecule

TOPIC 2 Preparation and Properties of Phenols

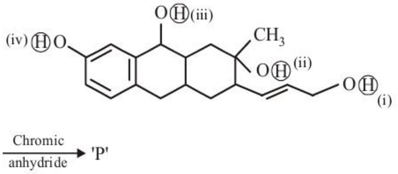
25. A solution of phenol in chloroform when treated with aqueous NaOH gives compound P as a major product. The mass percentage of carbon in P is ______ . (to the nearest integer) (Atomic mass: C = 12; H = 1; O = 16) **[NV, Sep. 06, 2020 (II)]**

26. The increasing order of boiling points of the following compounds is : **[Sep. 05, 2020 (II)]**



(a) I < III < IV < II (b) I < IV < III < II
(c) IV < I < II < III (d) III < I < II < IV

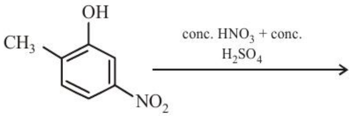
27. Consider the following reaction : **[Sep. 03, 2020 (II)]**



The product 'P' gives positive ceric ammonium nitrate test. This is because of the presence of which of these –OH group(s) ? **[Sep. 03, 2020 (II)]**

(a) (ii) only (b) (iii) and (iv)
(c) (iv) only (d) (ii) and (iv)

28. The major product of the following reaction is : **[Sep. 02, 2020 (II)]**



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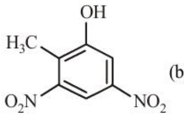

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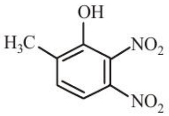

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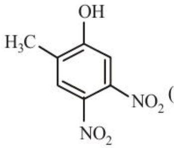

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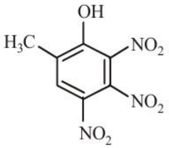
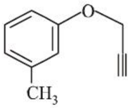


29. Arrange the following compounds in increasing order of C – OH bond length: methanol, phenol, *p*-ethoxyphenol **[Jan. 08, 2020 (I)]**

(a) methanol < *p*-ethoxyphenol < phenol
(b) phenol < methanol < *p*-ethoxyphenol
(c) phenol < *p*-ethoxyphenol < methanol
(d) methanol < phenol < *p*-ethoxyphenol

30. What will be the major product when m-cresol is reacted with propargyl bromide ($HC \equiv C — CH_2Br$) in presence of K_2CO_3 in acetone ? **[April 12, 2019 (II)]**

(a)


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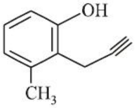

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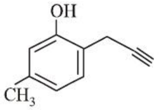

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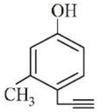
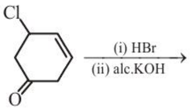


31. The major product of the following reaction is : **[Jan. 11, 2019 (I)]**



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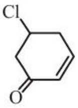

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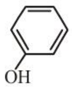

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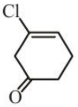

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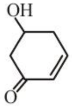
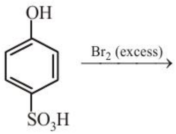
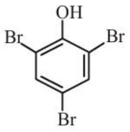
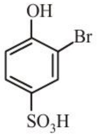


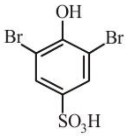
32. The major product of the following reaction is : **[Jan. 11, 2019 (I)]**



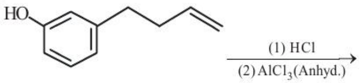
(a)


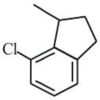
(b)


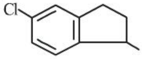
(c)

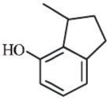

(d)


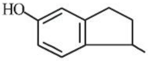
33. The major product of the following reaction is : **[Jan. 11, 2019 (II)]**



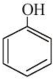
(a) 

(b) 

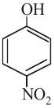
(c) 

(d) 

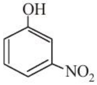
34. The increasing order of the pK_a values of the following compounds is: **[Jan. 10, 2019 (I)]**



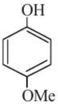
A



B



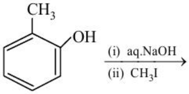
C



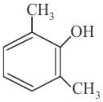
D

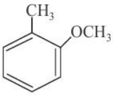
(a) C < B < A < D (b) B < C < D < A
(c) D < A < C < B (d) B < C < A < D

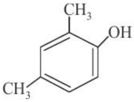
35. The major product of the following reaction is:

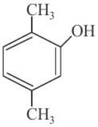


[Jan. 10, 2019 (II)]

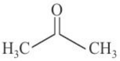
(a) 

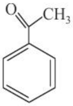
(b) 

(c) 

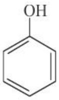
(d) 

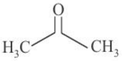
36. The products formed in the reaction of cumene with O_2 followed by treatment with dil. HCl are: **[Jan. 9, 2019 (II)]**

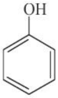
(a)  and 

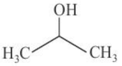
(b) 

and $CH_3 - OH$

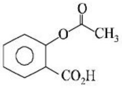
(c) 

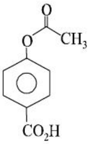
and 

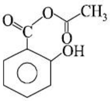
(d) 

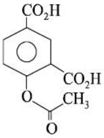
and 

37. Phenol on treatment with CO_2 in the presence of NaOH followed by acidification produces compound X as the major product. X on treatment with $(CH_3CO)_2O$ in the presence of catalytic amount of H_2SO_4 produces : **[2018]**

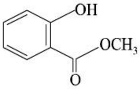
(a) 

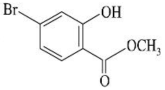
(b) 

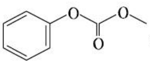
(c) 

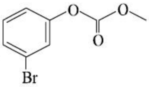
(d) 

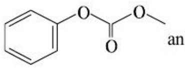
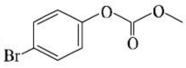
38. Phenol reacts with methyl chloroformate in the presence of NaOH to form product A. A reacts with Br_2 to form product B. A and B are respectively : **[2018]**

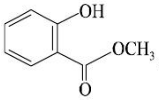
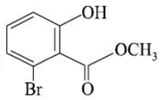
(a) 

and 

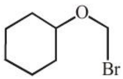
(b) 

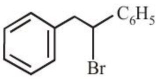
and 

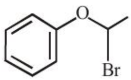
(c)  and 

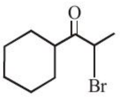
(d)  and 

39. Which of the following , upon treatment with tert-BuONa followed by addition of bromine water, fails to decolourize the colour of bromine? **[2017]**

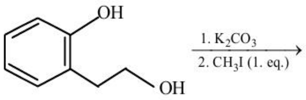
(a) 

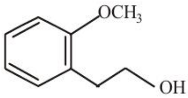
(b) 

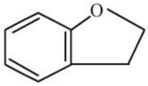
(c) 

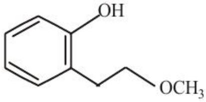
(d) 

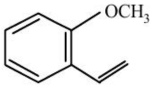
40. The major product of the following reaction is : **[Online April 8, 2017]**



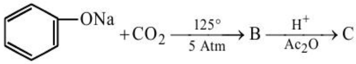
(a) 

(b) 

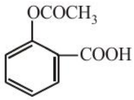
(c) 

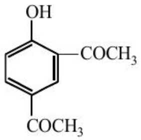
(d) 

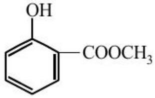
41. Sodium phenoxide when heated with CO_2 under pressure at 125 °C yields a product which on acetylation produces C **[2014]**

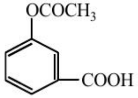


The major product C would be

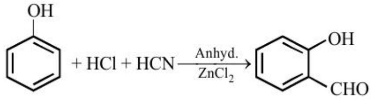
(a) 

(b) 

(c) 

(d) 

42. The following reaction



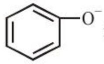
is known as: **[Online April 11, 2014]**

(a) Perkin reaction

(b) Gatterman-Koch Formylation

(c) Kolbe's reaction

(d) Gattermann reaction

43. Which one of the following substituents at *para*-position is most effective in stabilizing the phenoxide  ion? **[Online April 19, 2014]**

(a) $-CH_3$ (b) $-OCH_3$

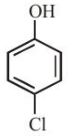
(c) $-COCH_3$ (d) $-CH_2OH$

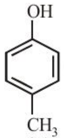
44. Which one of the following compounds will not be soluble in sodium bicarbonate? **[Online April 19, 2014]**

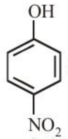
(a) 2, 4, 6 - Trinitrophenol (b) Benzoic acid

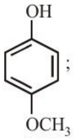
(c) *o* - Nitrophenol (d) Benzene sulphonic acid

45. Arrange the following compounds in order of decreasing acidity : **[2013]**

 ; (I)

 ; (II)

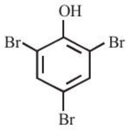
 ; (III)

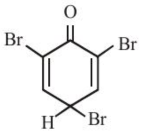
 ; (IV)

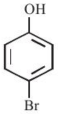
(a) II > IV > I > III (b) I > II > III > IV

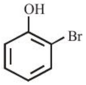
(c) III > I > II > IV (d) IV > III > I > II

46. What is the structure of the major product when phenol is treated with bromine water ? **[Online April 22, 2013]**

(a) 

(b) 

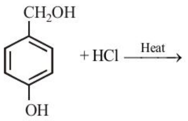
(c)


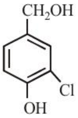
(d)


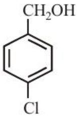
47. The reaction of phenol with benzoyl chloride to give phenyl benzoate is known as : **[Online April 23, 2013]**

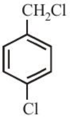
(a) Claisen reaction
(b) Schotten-Baumann reaction
(c) Reimer-Tiemann reaction
(d) Gatterman-Koch reaction

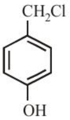
48. The major product in the following reaction is : **[Online April 25, 2013]**



(a)


(b)


(c)


(d)


49. Phenol on heating with $CHCl_3$ and NaOH gives salicylaldehyde. The reaction is called : **[Online April 25, 2013]**

(a) Reimer - Tiemann reaction
(b) Claisen reaction
(c) Cannizzaro's reaction
(d) Hell - Volhard - Zelinsky reaction

50. The correct order of acid strength of the following compounds : **[2011RS]**

(A) Phenol (B) *p*–Cresol
(C) *m*–Nitrophenol (D) *p*–Nitrophenol
(a) D > C > A > B (b) B > D > A > C
(c) A > B > D > C (d) C > B > A > D

51. Consider the following reaction :

$C_2H_5OH + H_2SO_4 \longrightarrow$ Product

Among the following, which one cannot be formed as a product under any conditions ? **[2011RS]**

(a) Ethylene (b) Acetylene
(c) Diethyl ether (d) Ethylhydrogen sulphate

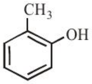
52. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is **[2009]**

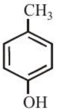
(a) salicylaldehyde
(b) salicylic acid
(c) phthalic acid
(d) benzoic acid

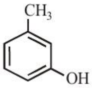
53. Phenol, when it reacts first with concentrated sulphuric acid and then with concentrated nitric acid, gives **[2008]**

(a) 2, 4, 6-trinitrobenzene
(b) *o*-nitrophenol
(c) *p*-nitrophenol
(d) nitrobenzene

54. The structure of the compound that gives a tribromo derivative on treatment with bromine water is **[2006]**

(a)


(b)


(c)


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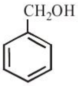
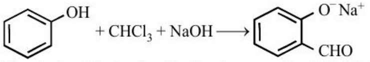
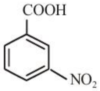


55.


The electrophile involved in the above reaction is **[2006]**

(a) trichloromethyl anion ($\overset{\ominus}{C}Cl_3$)
(b) formyl cation
(c) phenoxide ion
(d) dichlorocarbene

56. Picric acid is: **[2002]**

(a)


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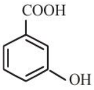
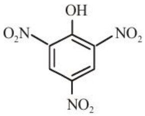


(c)


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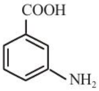
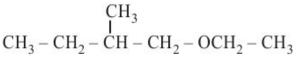


TOPIC 3 Preparation and Properties of Ethers

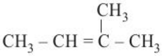
57. The major product [B] in the following reactions is : **[Sep. 04, 2020 (II)]**



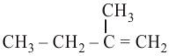
$CH_3-CH_2-\overset{CH_3}{\overset{|}{C}H}-CH_2-OCH_2-CH_3$

$\xrightarrow[\text{Heat}]{\text{HI}}$ [A] alcohol $\xrightarrow[\Delta]{H_2SO_4}$ [B]

(a) $CH_2=CH_2$

(b) 

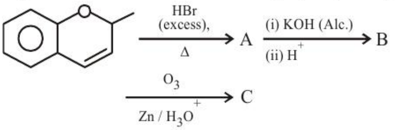
$CH_3-CH=\overset{CH_3}{\overset{|}{C}}-CH_3$

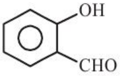
(c) 

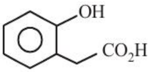
$CH_3-CH_2-\overset{CH_3}{\overset{|}{C}}=CH_2$

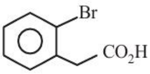
(d) $CH_3-CH_2-CH=CH-CH_3$

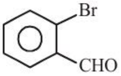
58. The major aromatic product C in the following reaction sequence will be : **[Sep. 02, 2020 (I)]**



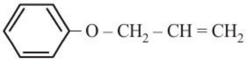
(a) 

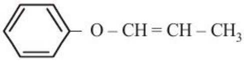
(b) 

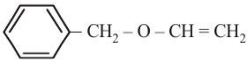
(c) 

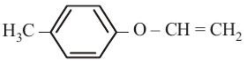
(d) 

59. An organic compound 'A' ($C_9H_{10}O$) when treated with conc. HI undergoes cleavage to yield compounds 'B' and 'C'. 'B' gives yellow precipitate with $AgNO_3$ where as 'C' tautomerizes to 'D'. 'D' gives positive iodoform test. 'A' could be : **[Sep. 02, 2020 (II)]**

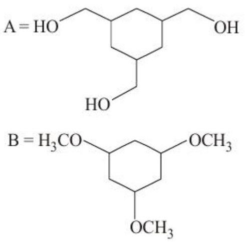
(a) 

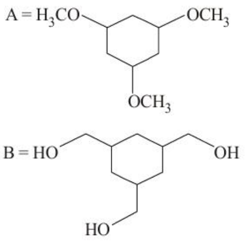
(b) 

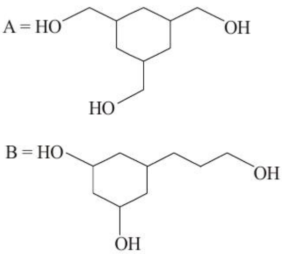
(c) 

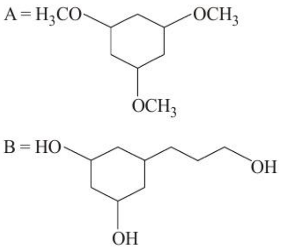
(d) 

60. Among the compounds *A* and *B* with molecular formula $C_9H_{18}O_3$, *A* is having higher boiling point the *B*. The possible structures of *A* and *B* are: **[Jan. 08, 2020 (II)]**

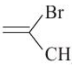
(a) 

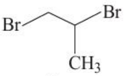
(b) 

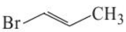
(c) 

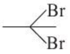
(d) 

61. 1-methyl ethylene oxide when treated with an excess of HBr produces: **[Jan. 07, 2020 (I)]**

(a) 

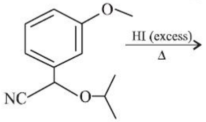
(b) 

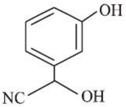
(c) 

(d) 

62. The major product of the following reaction is:

[April 10, 2019 (I)]



(a)


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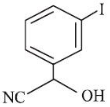

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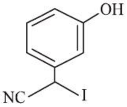
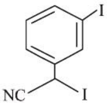
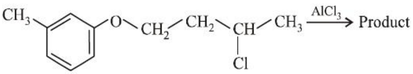
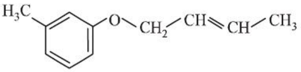


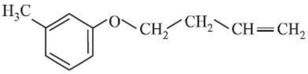
(d)


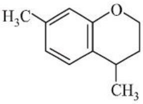
63. The major product obtained in the given reaction is :

[April 10, 2019 (II)]



(a)


(b)


(c)


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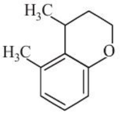
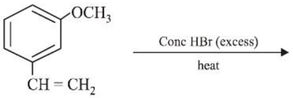
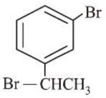
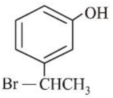


64. The major product of the following reaction is :

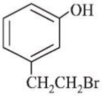


[April 8, 2019 (I)]

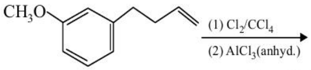
(a)


(b)


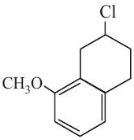
(c)


(d)


65. The major product of the following reaction is:



[Jan. 12, 2019 (I)]

(a)


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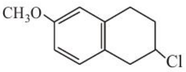
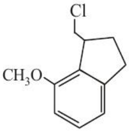


(c)


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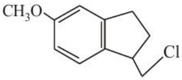
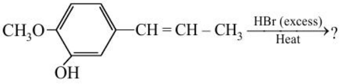
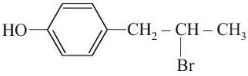


66. The major product in the following conversion is :

[Jan. 12, 2019 (II)]



(a)


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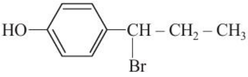
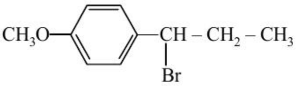
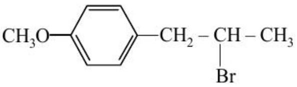
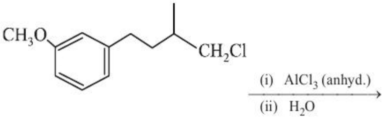
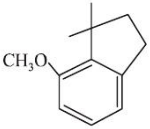


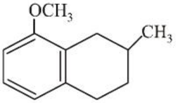
(c) 

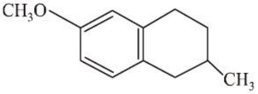
(d) 

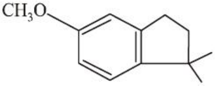
67. The major product of the following reaction is: **[Jan. 10, 2019 (I)]**



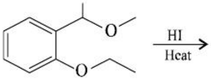
(a) 

(b) 

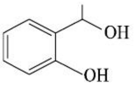
(c) 

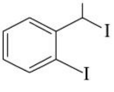
(d) 

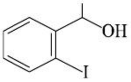
68. The major product formed in the following reaction is:

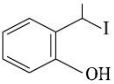


[2018]

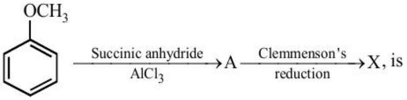
(a) 

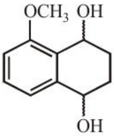
(b) 

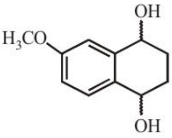
(c) 

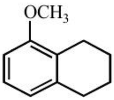
(d) 

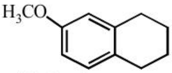
69. Consider the reaction sequence below : **[Online April 10, 2016]**



(a) 

(b) 

(c) 

(d) 

70. Allyl phenyl ether can be prepared by heating: **[Online April 9, 2014]**

(a) $C_6H_5Br + CH_2 = CH - CH_2 - ONa$
(b) $CH_2 = CH - CH_2 - Br + C_6H_5ONa$
(c) $C_6H_5 - CH = CH - Br + CH_3 - ONa$
(d) $CH_2 = CH - Br + C_6H_5 - CH_2 - ONa$

71. Williamson synthesis of ether is an example of: **[Online April 19, 2014]**

(a) Nucleophilic addition
(b) Electrophilic addition
(c) Electrophilic substitution
(d) Nucleophilic substitution

72. An ether (A), $C_5H_{12}O$, when heated with excess of hot concentrated HI produced two alkyl halides which when treated with NaOH yielded compounds (B) and (C). Oxidation of (B) and (C) gave a propanone and an ethanoic acid respectively. The IUPAC name of the ether (A) is : **[Online April 9, 2013]**

(a) 2-ethoxypropane (b) ethoxypropane
(c) methoxybutane (d) 2-methoxybutane

73. In Williamson synthesis of mixed ether having a primary and a tertiary alkyl group if tertiary halide is used, then : **[Online April 22, 2013]**

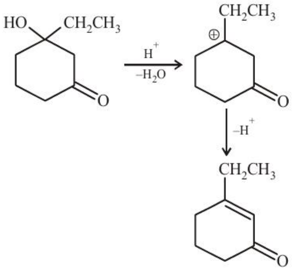
(a) Rate of reaction will be slow due to slow cleavage of carbon-halogen bond.
(b) Alkene will be the main product.
(c) Simple ether will form instead of mixed ether.
(d) Expected mixed ether will be formed.

74. HBr reacts with $CH_2 = CH - OCH_3$ under anhydrous conditions at room temperature to give **[2006]**

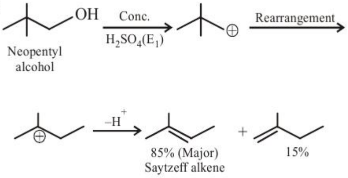
(a) $BrCH_2 - CH_2 - OCH_3$
(b) $H_3C - CHBr - OCH_3$
(c) CH_3CHO and CH_3Br
(d) $BrCH_2CHO$ and CH_3OH

Hints & Solutions

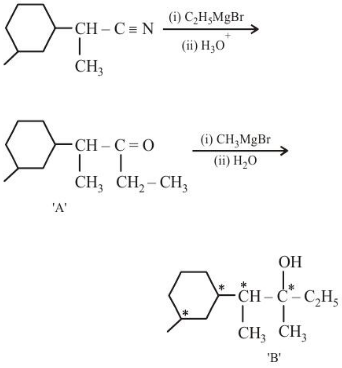
1. **(a)**



2. **(b)**

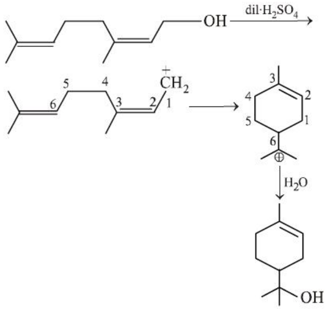


3. **(4)**

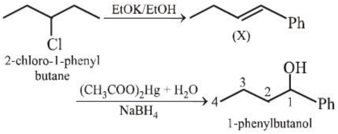


Number of chiral centres, represented as (*) in the product (B) = 4

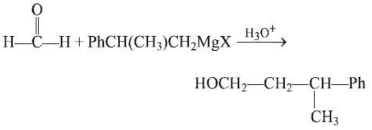
4. **(c)**



5. **(c)**

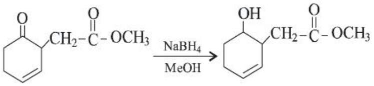


6. **(d)** Tertiary alcohol is prepared by the reaction of Grignard reagent with a ketone (formaldehyde is used to prepare primary alcohol).

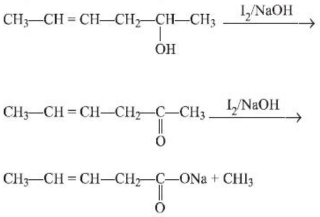


$$H-\overset{O}{\overset{\|}{C}}-H + PhCH(CH_3)CH_2MgX \xrightarrow{H_3O^+} HOCH_2-CH_2-\underset{CH_3}{\underset{|}{C}H}-Ph$$

7. **(d)** $NaBH_4$ is a selective reducing agent, used for the reduction of aldehydes and ketones, it does not affect alkene and ester.



8. **(b)** The most suitable reagent for the given reaction is I_2/NaOH (Iodoform reaction).

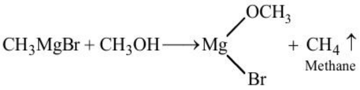


$$CH_3-CH=CH-CH_2-\underset{OH}{\underset{|}{CH}}-CH_3 \xrightarrow{I_2/NaOH}$$

$$CH_3-CH=CH-CH_2-\underset{O}{\underset{\|}{C}}-CH_3 \xrightarrow{I_2/NaOH}$$

$$CH_3-CH=CH-CH_2-\underset{O}{\underset{\|}{C}}-ONa + CHI_3$$

9. **(a)**



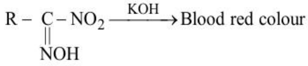
10. **(d)** An excellent reagent for oxidation of 1° alcohols to aldehydes is PCC (consult Q.3 also).

$$R-CH_2-OH \xrightarrow{PCC} R-CHO$$

11. **(c)** The C – O bond length in alcohols is 142 pm and in Phenol it is 136 pm. The C – O bond length in phenol is shorter than that in methanol due to the conjugation of unshared pair of electrons on oxygen with the ring, which imparts double bond character to the C – O bond.

12. **(b)** ***Victor Meyer's test:*** The various steps involved are

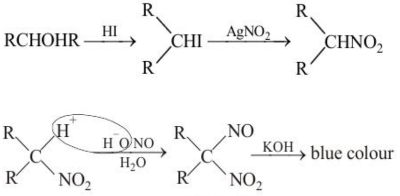
(i) $RCH_2OH \xrightarrow{HI} RCH_2I \xrightarrow{AgNO_2} RCH_2NO_2 \xrightarrow{HNO_2}$



$$R-\underset{NOH}{\underset{\|}{C}}-NO_2 \xrightarrow{KOH} \text{Blood red colour}$$

Nitrolic acid

(ii)



Preud-onitral

(iii) $R_3COH \xrightarrow{HI} R_3CI \xrightarrow{AgNO_2} R_3CNO_2$

$\xrightarrow{HNO_2}$ No reaction $\xrightarrow{KOH}$ Colourless $\longrightarrow$

13. **(b)** Reaction of alcohols with Lucas reagent proceeds through carbocation formation.
Further 3° carbocations (from tertiary alcohols) are highly stable thus reaction proceeds through S_N1 mechanism.

14. **(b)** The order of dehydration among three type of alcohols is $3° > 2° > 1° > CH_3OH$. This behaviour is related to the relative stabilities of carbocations ($3° > 2° > 1°$).

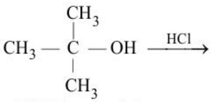
15. **(d)** $ZnCl_2$ + conc. HCl is Lucas reagent. Lucas reagent reacts fastest with tertiary alcohol.
3° alcohol + Lucas reagent = Immediate turbidity

16. **(a)** MnO_2 being a mild oxidising agent stops the oxidation of $-CH_2OH$ group at aldehyde stage.

17. **(a)** On moving down a group, the basicity & nucleophilicity are inversely related, i.e. nucleophilicity increases while basicity decreases. i.e $RS^{\ominus}$ is more nucleophilic but less basic than $RO^{\ominus}$. This opposite behaviour is because of the fact that basicity and nucleophilicity depends upon different factors. Basicity is directly related to the strength of the H–element bond, while nucleophilicity is indirectly related to the electronegativity of the atom to which proton is attached.

18. **(b)** Tertiary alcohols react fastest with conc. HCl and anhydrous $ZnCl_2$ (Lucas reagent) as its mechanism proceeds through the formation of stable tertiary carbocation.

Mechanism :



$$\text{Step 1 : } CH_3-\overset{\overset{CH_3}{|}}{\underset{\underset{CH_3}{|}}{C}}-OH \xrightarrow{HCl}$$

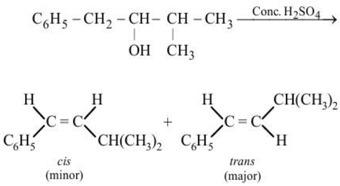
2 Methylpropane-2-ol

$$\rightleftharpoons (CH_3)_3C-\overset{+}{O}H_2 + Cl^-$$

$$\text{Step 2 : } (CH_3)_3C-\overset{+}{O}H_2 \rightleftharpoons \underset{3^\circ \text{ Carbocation}}{(CH_3)_3C^+} + H_2O$$

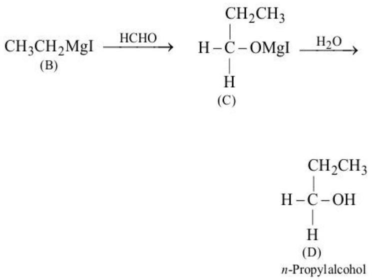
$$\text{Step 3 : } (CH_3)_3C^+ + Cl^- \rightleftharpoons \underset{t\text{-Butylchloride}}{(CH_3)_3C-Cl}$$

19. **(a)** Whenever dehydration can produce two different alkenes, major product is formed according to **Saytzeff rule** *i.e.* more substituted alkene (alkene having lesser number of hydrogen atoms on the two doubly bonded carbon atoms) is the major product.
Such reactions which can produce two or more structural isomers but one of them in greater amounts than the other are called **regioselective** *;* in case a reaction is 100% regioselective, it is termed as **regiospecific.**
In addition to being regioselective, alcohol dehydrations are **stereoselective** (*a reaction in which a single starting material can yield two or more stereoisomeric products, but gives one of them in greater amount than any other).*



$$C_6H_5-CH_2-\underset{OH}{CH}-\underset{CH_3}{CH}-CH_3 \xrightarrow{\text{Conc. } H_2SO_4}$$

20. **(d)** $CH_3CH_2OH \xrightarrow{P+I_2} \underset{(A)}{CH_3CH_2I} \xrightarrow[\text{Ether}]{Mg}$

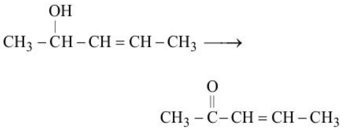


$$\underset{(B)}{CH_3CH_2MgI} \xrightarrow{HCHO} \underset{(C)}{H-\overset{CH_2CH_3}{\underset{H}{C}}-OMgI} \xrightarrow{H_2O} \underset{(D)}{H-\overset{CH_2CH_3}{\underset{H}{C}}-OH}$$

n-Propylalcohol

21. **(b)** Ethanol and only those 2° alcohols which contain –$CHOHCH_3$ group undergo haloform reaction.

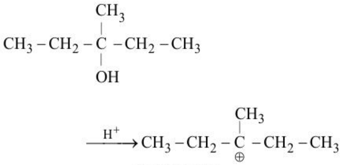
22. **(a)**



$$CH_3-\overset{OH}{CH}-CH=CH-CH_3 \longrightarrow CH_3-\overset{O}{\overset{\|}{C}}-CH=CH-CH_3$$

Pyridinium chlorochromate (PCC) oxidises 1° and 2° alcohols to aldehyde and ketones.

23. **(a)** 3-Methyl pentan-3-ol will be dehydrated most readily since it produces a very stable, tertiary carbonium ion as intermediate.

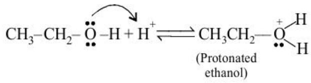


$$CH_3-CH_2-\overset{CH_3}{\underset{OH}{C}}-CH_2-CH_3 \xrightarrow{H^+} CH_3-CH_2-\overset{CH_3}{\underset{\oplus}{C}}-CH_2-CH_3$$

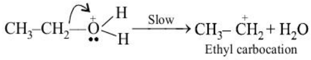
ter-Carbocation

24. **(d)** The dehydration of alcohol to form alkene occurs in following three steps. Step (1) is initiation step.

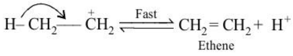
Step (1) Formation of protonated alcohol.



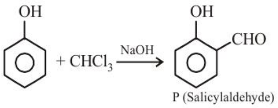
Step (2) Formation of carbocation



Step (3) Elimination of a proton to form alkene



25. **(69)**



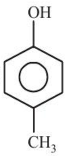
Molecular formula of product 'P' = $C_7H_6O_2$

So, mass % of C in 'P'

$$= \frac{12 \times 7}{84+6+32} \times 100 = 68.85\% \approx 69\%$$

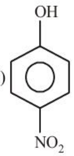
26. **(b)** (II) and (III) compounds almost have same boiling point. In the given options, option (b) will be the correct answer.

(I)

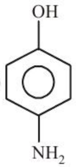


B.P. → 202 °C

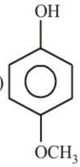
(II)



B.P. → 279 °C

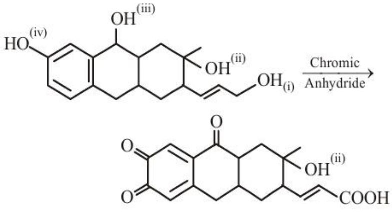
(III) 

B.P. → 284 °C

(IV) 

B.P. → 243 °C

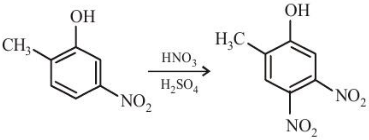
27. **(a)**



Product 'P'

Generally CAN test is done for alcohols which give pink or red colour. But for phenols and phenolic compounds it gives brown or black colour. So, this test helps to diffirentiate phenols from alcohols.

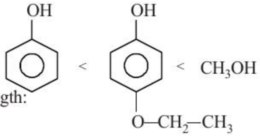
28. **(c)**



It is an example of electrophilic substitution reaction. Position of electrophile is directed by the strong ring activating group (–OH), present in the ring.

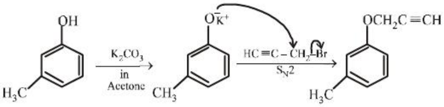
29. **(c)**

Order of C–OH bond length:

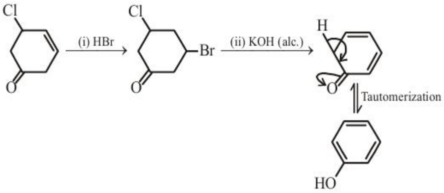


Resonance is a deciding factor to determine the order of bond length in given compounds. Phenol exhibits least C–OH bond length due to resonance, whereas methanol will show maximum bond length due to lack of resonance and *p*-ethoxyphenol will have some intermediate value of bond length.

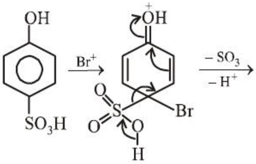
30. **(a)**

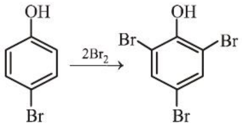


31. **(b)**

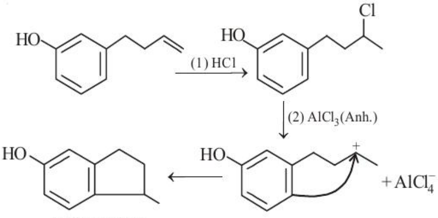


32. **(a)**





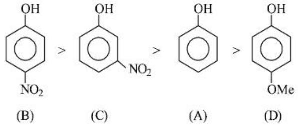
33. **(d)**



(Major product)

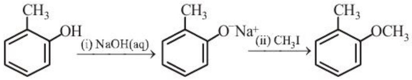
34. **(d)** Electron withdrawing substituents increase the acidic strength, while electron releasing groups decrease the acidic strength.

$\therefore$ Acidic strength $\propto K_a \propto \dfrac{1}{pK_a}$

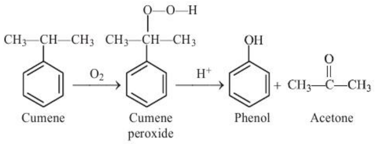


$pK_a : B < C < A < D$

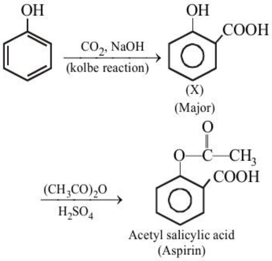
35. **(b)** Reaction involved:



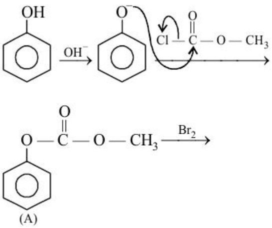
36. **(3)** Reaction involved:

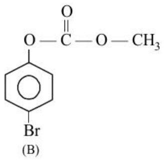


37. **(a)**

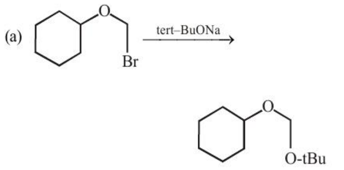


38. **(c)**

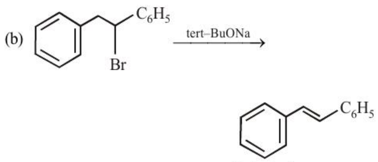




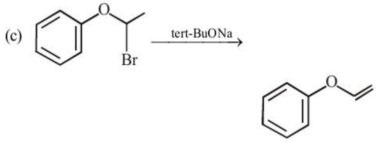
39. **(a)**



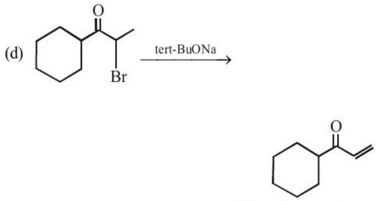
(fails to decolorise the colour of bromine due to absence of unsaturation)



(it decolorises bromine solution)

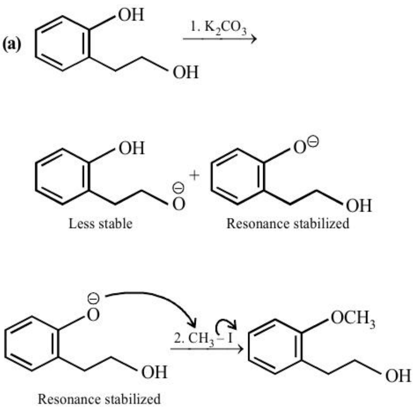


(it decolorises bromine solution)

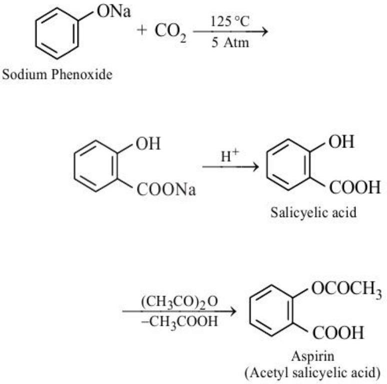


(it decolorises bromine solution)

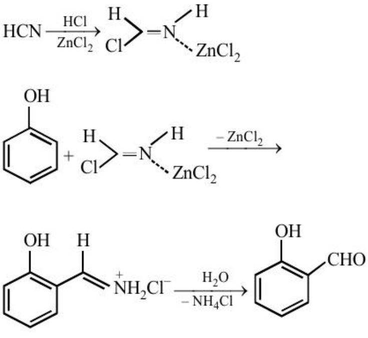
40. **(a)**



41. **(a)**



42. **(d)**

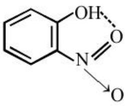


Note : Gattermann Koch reaction is a variation of Gattermann reaction, and this reaction involves the use of carbon monoxide instead of HCN.

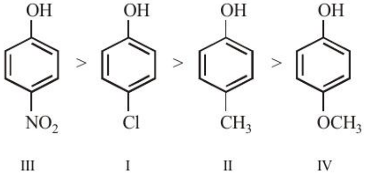
43. **(c)** Electron withdrawing group stabilises the benzene ring due to delocalisation of charge.

–CH_3 and –CH_2OH are electron donating group and hence decrease the stability of benzene ring –OCH_3 is weaker electron withdrawing group than –$COCH_3$. Hence –$COCH_3$ group more stabilizes the phenoxide ion at *p*-position.

44. **(b)** Due to intramolecular hydrogen bonding this will not be soluble in sodium bicarbonate.

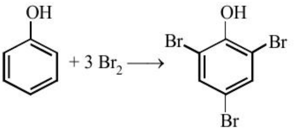


45. **(c)** Electron withdrawing substituents like –NO_2, –Cl increase the acidity of phenol while electron releasing substituents like – CH_3, – OCH_3 decrease acidity. hence the correct order of acidity will be



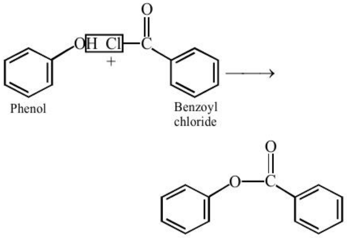
(–M, –I) (–I > +M) (+I, +HC) (+M)

46. **(a)** Phenol has activating (electron releasing) –OH group and bromine water supplies Br^+ ion easily, hence under such conditions reaction does not stop at monobromo or dibromo stage but a fully brominated (2,4,6,-tribromophenol) compound is the final product.



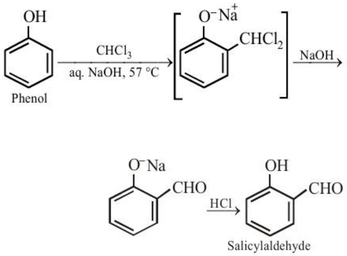
2, 4, 6-Tribromophenol

47. (b)

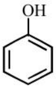


48. (c)

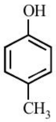
49. (a)



50. (a)

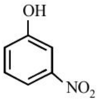


(A)



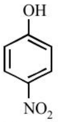
+I effect

(B)



– I effect

(C)



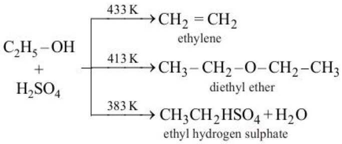
– M, – I effect

(D)

Electron withdrawing substituents increase the acidity of phenols; while electron releasing substituents decrease acidity. Thus the correct order is

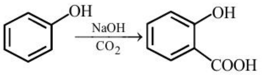
D > C > A > B

51. (b)

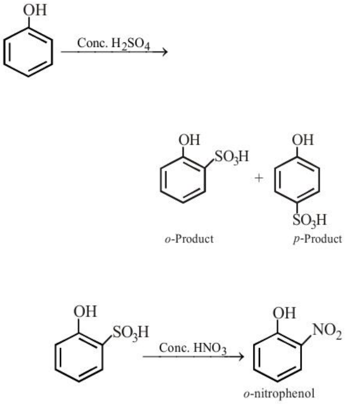


Acetylene is not formed under any condition.

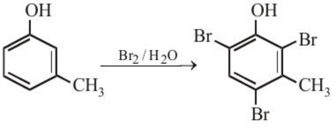
52. (b)



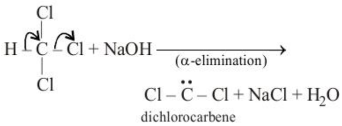
53. (b) Phenol on reaction with conc. H_2SO_4 gives a mixture of *o*- and *p*- products (i.e., $-SO_3H$ group occupies *o*-, *p*-position). At room temperature, *o*-product is more stable, which on treatment with conc. HNO_3 will yield *o*-nitrophenol.



54. (c) In (c) both groups are activavating and undergo electrophilic substitution in the same positions.



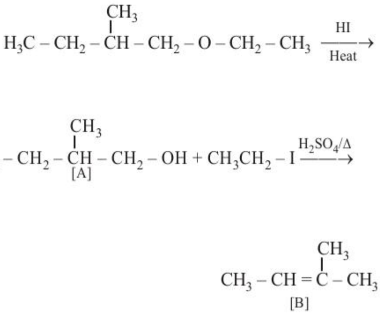
55. **(d)** This is Riemer-Tiemann reaction and the electrophile is dichlorocarbene.



$$H-\overset{Cl}{\underset{Cl}{C}}-Cl + NaOH \xrightarrow[(\alpha\text{-elimination})]{} \underset{\text{dichlorocarbene}}{Cl-\ddot{C}-Cl} + NaCl + H_2O$$

56. **(c)** 2,4,6 Trinitrophenol is also known as picric acid.

57. **(b)**

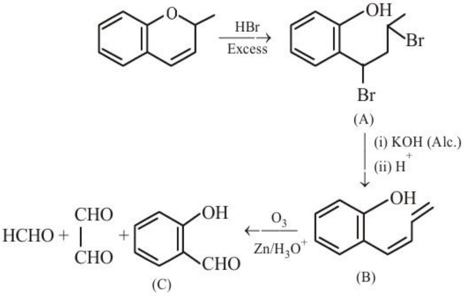


$$H_3C-CH_2-\overset{CH_3}{\overset{|}{CH}}-CH_2-O-CH_2-CH_3 \xrightarrow[\text{Heat}]{HI}$$

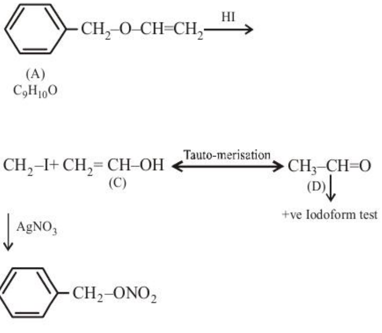
$$CH_3-CH_2-\underset{[A]}{\overset{CH_3}{\overset{|}{CH}}}-CH_2-OH + CH_3CH_2-I \xrightarrow{H_2SO_4/\Delta}$$

$$\underset{[B]}{CH_3-CH=\overset{CH_3}{\overset{|}{C}}-CH_3}$$

58. **(a)**

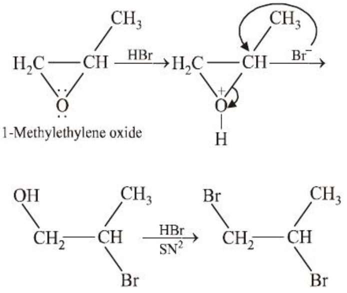


59. **(c)**

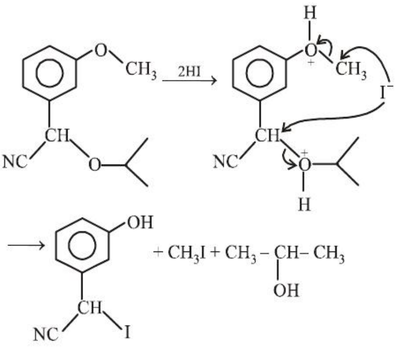


60. **(a)** In (A), –OH group is present, so inter-molecular H-bonding is possible while in (B), due to methoxy group there is no possibility of Inter-molecular H-bonding. So A is having higher boiling point than B.

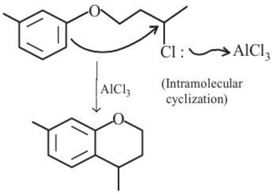
61. **(b)**



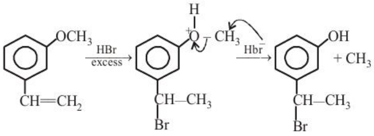
62. **(c)**



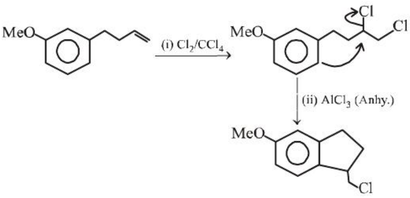
63. (3)



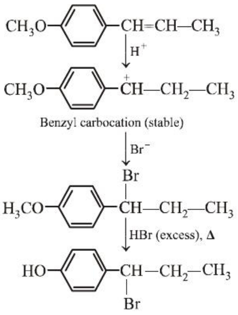
64. **(b)**



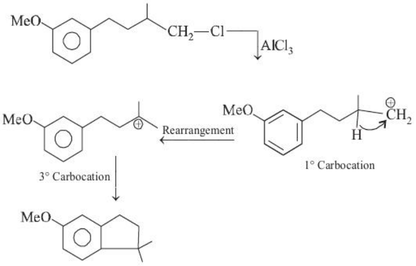
65. **(d)**



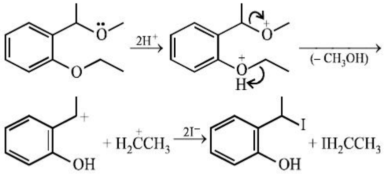
66. **(b)**



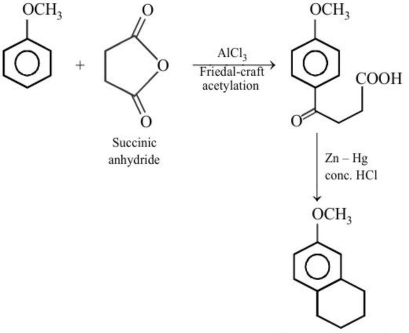
67. **(d)**



68. **(d)**



69. **(d)**



(Clemmenson's reduction)

70. **(b)** $C_6H_5ONa + Br - CH_2 - CH = CH_2 \longrightarrow$

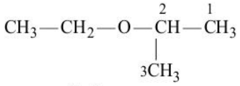
$$\underset{\text{Allyl phenyl ether}}{C_6H_5 - O - CH_2 - CH = CH_2} + NaBr$$

71. **(d)** This method is suitable for the preparation of a wide variety of unsymmetrical ethers. The nucleophilic substitution of halides with alkoxide leads to desired product.

72. **(a)**

$$\begin{tikzcd}
\underset{(A)}{CH_3CH_2OCH(CH_3)_2} \arrow[r, "\text{Conc. HI}"] & \underset{(B)}{CH_3CH_2I} \arrow[d, "NaOH"] & + & \underset{(C)}{(CH_3)_2CHI} \arrow[d, "NaOH"'] \\
& CH_3CH_2OH \arrow[d, "{[O]}"] & & (CH_3)_2CHOH \arrow[d, "{[O]}"] \\
& CH_3COOH & & (CH_3)_2CO
\end{tikzcd}$$

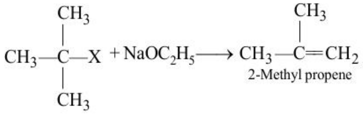
Hence the IUPAC name of compound (A) is



$$CH_3-CH_2-O-\overset{2}{C}H(\,^{3}CH_3)-\overset{1}{C}H_3$$

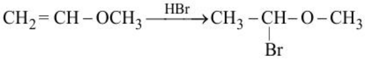
2–ethoxy propane

73. **(b)** The tertiary alkyl halide undergo elimination reaction to give alkenes.



$$(CH_3)_3C-X + NaOC_2H_5 \longrightarrow \underset{\text{2-Methyl propene}}{CH_3-C(CH_3)=CH_2}$$

74. **(b)** Methyl vinyl ether under anhydrous condition at room temperature undergoes addition reaction.



$$CH_2 = CH - OCH_3 \xrightarrow{HBr} CH_3 - \underset{\displaystyle Br}{\underset{|}{C}H} - O - CH_3$$