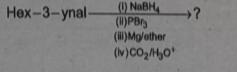


'A' formed in the above reaction is
[JEE (Main)-2023]

- (1) 
- (2) 
- (3) 
- (4) 

[Methods of Preparation of Carboxylic Acids and Derivatives]

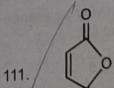
109. What is the product of following reaction?



- (1) 
- (2) 
- (3) 
- (4) 

110. Which one of the following reactions will not yield propionic acid? [JEE (Main)-2021]

- (1) $\text{CH}_3\text{CH}_2\text{CH}_3 + \text{KMnO}_4$ (Heat), $\text{OH}^-/\text{H}_3\text{O}^+$
- (2) $\text{CH}_3\text{CH}_2\text{COCH}_3 + \text{OH}^-/\text{H}_3\text{O}^+$
- (3) $\text{CH}_3\text{CH}_2\text{CH}_2\text{Br} + \text{Mg, CO}_2$ dry ether/ H_3O^+
- (4) $\text{CH}_3\text{CH}_2\text{CCl}_3 + \text{OH}^-/\text{H}_3\text{O}^+$



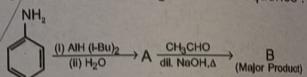
Maleic anhydride

Maleic anhydride can be prepared by

[JEE (Main)-2021]

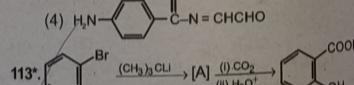
- (1) Treating cis-but-2-enedioic acid with alcohol and acid
- (2) Heating cis-but-2-enedioic acid
- (3) Treating trans-but-2-enedioic acid with alcohol and acid
- (4) Heating trans-but-2-enedioic acid

112. Consider the following reaction sequence :



The product 'B' is [JEE (Main)-2022]

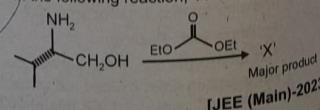
- (1) $\text{OHC}-\text{C}_6\text{H}_4-\text{N}=\text{CH}-\text{CH}_3$
- (2) $\text{H}_2\text{N}-\text{C}_6\text{H}_4-\text{CH}=\text{CH}-\text{CHO}$
- (3) $\text{H}_2\text{N}-\text{C}_6\text{H}_4-\text{CH}_2-\text{N}=\text{CH}-\text{CH}_3$
- (4) $\text{H}_2\text{N}-\text{C}_6\text{H}_4-\text{C}(=\text{O})-\text{N}=\text{CHCHO}$

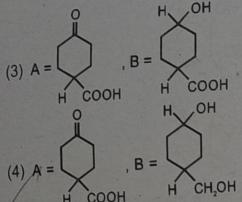


In the given conversion the compound A is [JEE (Main)-2022]

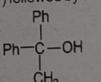
- (1) 
- (2) 
- (3) 
- (4) 

114. In the following reaction, 'A' is





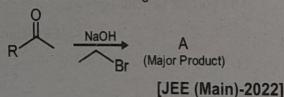
98* Which reactant will give the following alcohol on reaction with one mole of phenyl magnesium bromide (PhMgBr) followed by acidic hydrolysis?



[JEE (Main)-2022]

- (1) $\text{CH}_3-\text{C}\equiv\text{N}$ (2) $\text{Ph}-\text{C}\equiv\text{N}$
 (3) $\text{CH}_3-\overset{\text{O}}{\underset{\text{C}}{\text{C}}}-\text{Ph}$ (4) $\text{Ph}-\overset{\text{O}}{\underset{\text{C}}{\text{C}}}-\text{CH}_3$

99. The structure of A in the given reaction is



[JEE (Main)-2022]

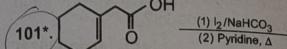
- (1) $\text{R}-\overset{\text{OH}}{\underset{\text{C}}{\text{C}}}-\text{CH}_3$ (2) $\text{R}-\overset{\text{OH}}{\underset{\text{C}}{\text{C}}}-\text{CH}_2\text{CH}_3$
 (3) $\text{R}-\overset{\text{O}}{\underset{\text{C}}{\text{C}}}-\text{CH}_2\text{CH}_3$ (4) $\text{R}-\text{C}(=\text{O})-\text{CH}_2\text{CH}_3$

100*. Match List-I with List-II.

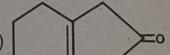
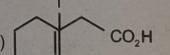
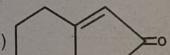
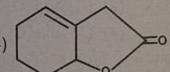
- List-I**
- (A) $\text{C}_6\text{H}_5\text{COCl} \xrightarrow[\text{Pd-BaSO}_4]{\text{H}_2} \text{C}_6\text{H}_5\text{CHO}$ (I) Gatterman-Koch reaction
 (B) $\text{CH}_3-\text{CN} \xrightarrow[\text{H}_2\text{O}^+]{\text{SnCl}_4/\text{HCl}} \text{CH}_3-\text{CHO}$ (II) Etard reaction
 (C) $\text{C}_6\text{H}_5\text{CH}_3 \xrightarrow[\text{H}_2\text{O}]{\text{CrO}_2\text{Cl}_2} \text{C}_6\text{H}_5\text{CHO}$ (III) Stephen reaction
 (D) $\text{C}_6\text{H}_5\text{Cl} \xrightarrow[\text{AlCl}_3 \text{ (anhyd.)}]{\text{CO, HCl}} \text{C}_6\text{H}_5\text{CHO}$ (IV) Rosenmund reaction

Choose the correct answer from the options given below [JEE (Main)-2022]

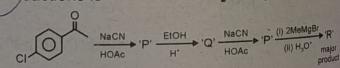
- (1) (A) - (IV), (B) - (III), (C) - (II), (D) - (I)
 (2) (A) - (I), (B) - (II), (C) - (III), (D) - (IV)
 (3) (A) - (II), (B) - (III), (C) - (IV), (D) - (I)
 (4) (A) - (III), (B) - (II), (C) - (I), (D) - (IV)

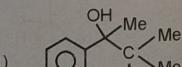
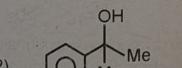
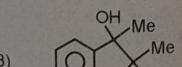
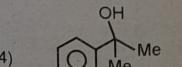


Find out the major product for the above reaction. [JEE (Main)-2022]

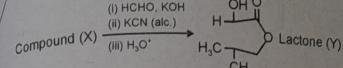
- (1) 
 (2) 
 (3) 
 (4) 

102. 'R' formed in the following sequence of reactions is [JEE (Main)-2023]



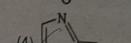
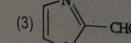
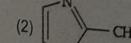
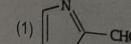
- (1) 
 (2) 
 (3) 
 (4) 

103. Compound (X) undergoes following sequence of reactions to give the Lactone (Y).

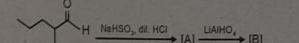


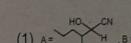
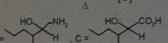
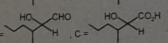
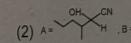
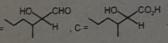
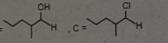
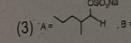
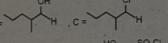
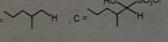
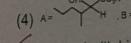
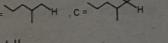
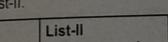
Compound (X) is [JEE (Main)-2023]

- (1) $\text{H}-\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}}}-\text{CHO}$
 (2) $\text{H}_2\text{C}-\text{CHO}-\text{CH}_2-\text{CH}_2-\text{CH}_2-\text{CHO}$
 (3) $\text{H}_2\text{C}-\text{CH}_2-\text{CHO}$
 (4) 



106. The structures of major products A, B and C in the following reaction are sequence. [JEE (Main)-2023]



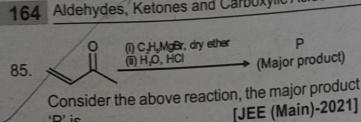
- (1) A =  B =  C = 
 (2) A =  B =  C = 
 (3) A =  B =  C = 
 (4) A =  B =  C = 

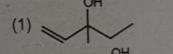
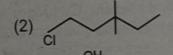
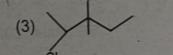
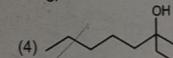
107. Match List-I with List-II.

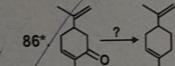
List-I Name of reaction	List-II Reagent used
A. Hell-Volhard-Zelinsky reaction	I. $\text{NaOH} + \text{I}_2$
B. Iodoform reaction	II. (i) CrO_2Cl_2 , CS_2 (ii) H_2O
C. Etard reaction	III. (i) $\text{Br}_2/\text{red phosphorus}$ (ii) H_2O
D. Gatterman-Koch reaction	IV. CO, HCl , anhyd. AlCl_3

Choose the correct answer from the options given below: [JEE (Main)-2023]

- (1) A \rightarrow III; B \rightarrow I; C \rightarrow II; D \rightarrow IV
 (2) A \rightarrow I; B \rightarrow II; C \rightarrow III; D \rightarrow IV
 (3) A \rightarrow III; B \rightarrow II; C \rightarrow I; D \rightarrow IV
 (4) A \rightarrow III; B \rightarrow I; C \rightarrow IV; D \rightarrow II



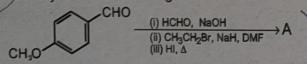
- (1) 
- (2) 
- (3) 
- (4) 



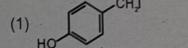
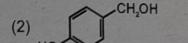
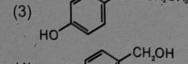
Which of the following reagent is suitable for the preparation of the product in the above reaction? [JEE (Main)-2021]

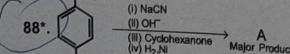
- (1) Red P + Cl₂ (2) Ni/H₂
 (3) NaBH₄ (4) NH₂ - NH₂/C₂H₅ONa

87. Identify A in the following chemical reaction.

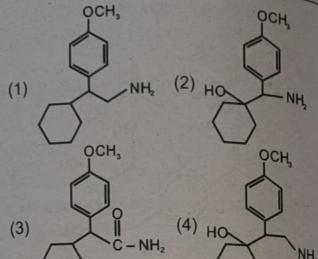


[JEE (Main)-2021]

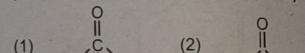
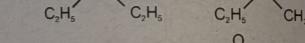
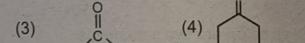
- (1) 
- (2) 
- (3) 
- (4) 

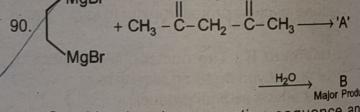


The major product of the above reactions is [JEE (Main)-2022]

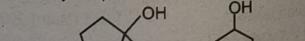
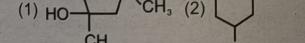
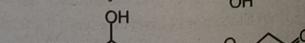
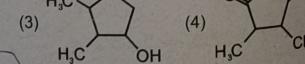


Which of the following ketone will NOT give enamine on treatment with secondary amines? [where t-Bu is -C(CH₃)₃] [JEE (Main)-2022]

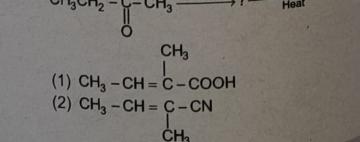
- (1) 
- (2) 
- (3) 
- (4) 

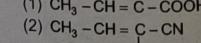


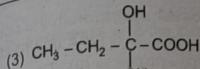
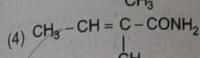
Consider the above reaction sequence and identify the product B. [JEE (Main)-2022]

- (1) 
- (2) 
- (3) 
- (4) 

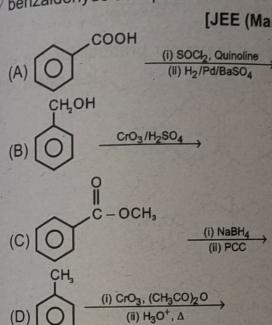
91. The final product 'A' in the following reaction sequence [JEE (Main)-2022]



- (1) 
- (2) 

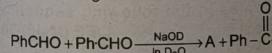
- (3) 
- (4) 

92*. Which of the following reactions will yield benzaldehyde as a product? [JEE (Main)-2022]

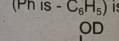
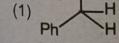
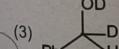
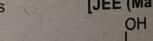


- (1) (B) and (C) (2) (C) and (D)
 (3) (A) and (D) (4) (A) and (C)

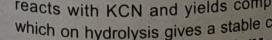
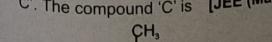
93. The correct structure of product 'A' formed in the following reaction,

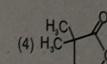
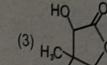


(Ph is -C₆H₅) is

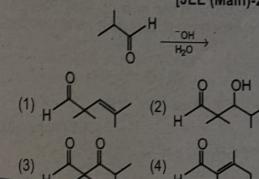
- (1) 
- (2) 
- (3) 
- (4) 

94*. Isobutyraldehyde on reaction with formaldehyde and K₂CO₃ gives compound 'A'. Compound 'A' reacts with KCN and yields compound 'B', which on hydrolysis gives a stable compound 'C'. The compound 'C' is [JEE (Main)-2022]

- (1) 
- (2) 

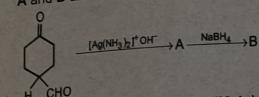


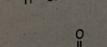
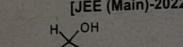
95. What is the major product of the following reaction? [JEE (Main)-2022]



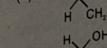
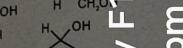
- (1) CH₃ - CH₂ - CH₂ - CH₃
 (2) CH₃ - CH₂ - C(=O) - CH₃
 (3) CH₃ - CH₂ - CH - CH₃
 (4) CH₃ - CH₂ - CH = CH₂

97. The products formed in the following reaction, A and B are

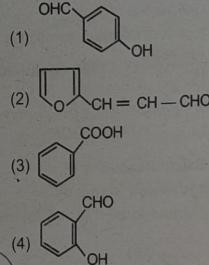


- (1) A = 
- (2) B = 

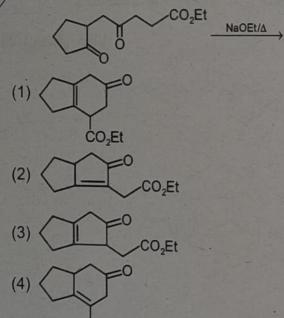
[JEE (Main)-2022]

- (1) A = 
- (2) B = 

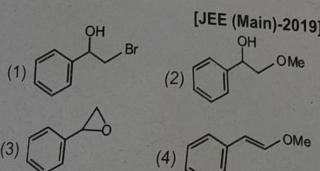
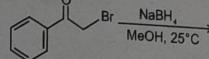
74. An aromatic compound 'A' having molecular formula $C_7H_6O_2$ on treating with aqueous ammonia and heating forms compound 'B'. The compound 'B' on reaction with molecular bromine and potassium hydroxide provides compound 'C' having molecular formula C_8H_7N . The structure 'A' is [JEE (Main)-2019]



75. The major product obtained in the following reaction is [JEE (Main)-2019]



76. The major product of the following reaction is

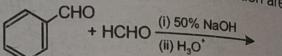


77. The major product of the following reaction is $\text{CH}_3\text{CH} = \text{CHCO}_2\text{CH}_3 \xrightarrow{\text{LiAlH}_4}$

- (1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$
 (2) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CHO}$
 (3) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CO}_2\text{CH}_3$
 (4) $\text{CH}_3\text{CH} = \text{CHCH}_2\text{OH}$

[JEE (Main)-2019]

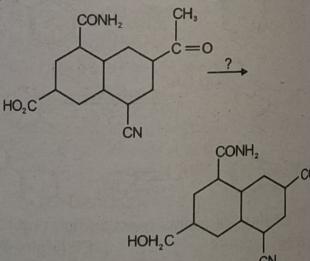
78. Major products of the following reaction are



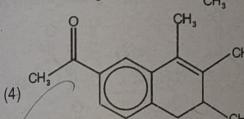
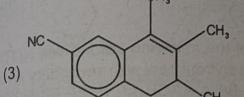
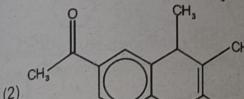
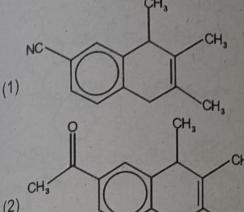
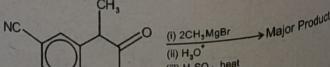
- (1) HCOOH and
- (2)
- (3) CH_3OH and
- (4) CH_3OH and HCO_2H

[JEE (Main)-2019]

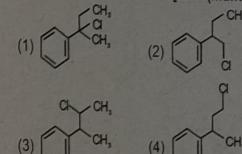
79. The most suitable reagent for the given conversion is [JEE (Main)-2020]



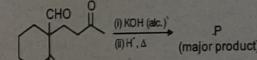
80*. Which one of the following is the major product of the given reaction? [JEE (Main)-2021]



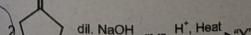
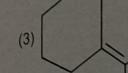
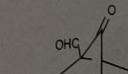
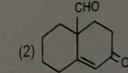
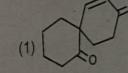
83. Reaction of Grignard reagent, $\text{C}_2\text{H}_5\text{MgBr}$ with $\text{C}_6\text{H}_5\text{O}$ followed by hydrolysis gives compound "A" which reacts instantly with Lucas reagent to give compound B, $\text{C}_{10}\text{H}_{13}\text{Cl}$. [JEE (Main)-2021]



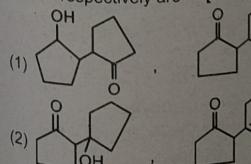
84*. The major product (P) in the following reaction is



[JEE (Main)-2021]



Consider the above reaction, the product 'X' and 'Y' respectively are [JEE (Main)-2021]



(II) Benzonitrile

(Q) H_2 , Pd-BaSO₄, S and quinoline

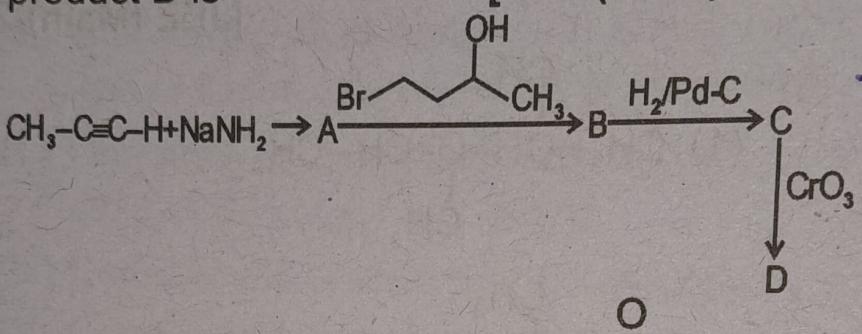
(III) Benzoyl chloride

(B) CO_2 , HCl and AlCl_3

- (1) (I) - (R), (II) - (P) and (III) - (Q)
 (2) (I) - (P), (II) - (Q) and (III) - (R)
 (3) (I) - (Q), (II) - (R) and (III) - (P)
 (4) (I) - (R), (II) - (Q) and (III) - (P)

58. In the following sequence of reactions, the final product D is [JEE (Main)-2021]

[JEE (Main)-2021]

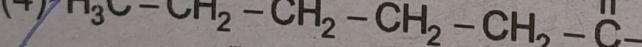


- (1) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \dot{\text{C}}\text{H}_2 - \text{CH}_2 - \overset{\text{||}}{\text{C}} - \text{CH}_3$

(2) $\text{H}_3\text{C} - \text{CH} =$

$\text{CH} - \text{CH}(\text{OH}) - \text{CH}_2 - \text{CH}_2 - \text{CH}_3$

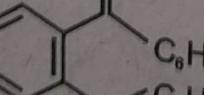
(3) $\text{CH}_3 - \text{CH} =$

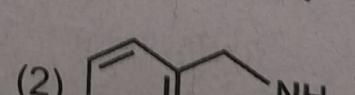
59. 

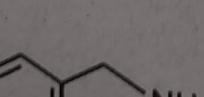
The structure of X is

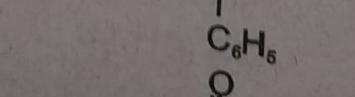
[JEE (Main)-2021]

- [JEE (Main)-2021]

(1) 

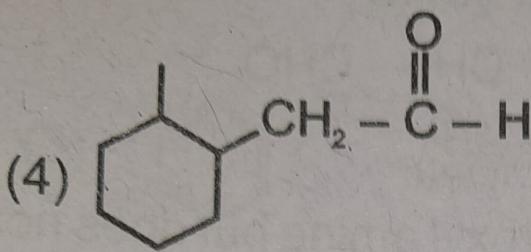
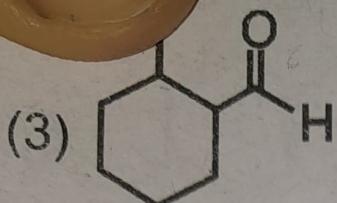
(2) 

(3) 

(4) 

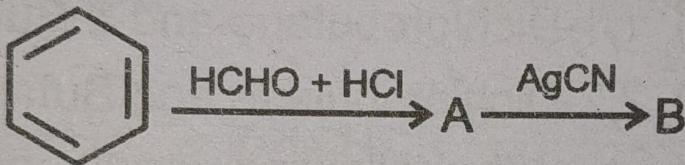
Galaxy F13
12:20 pm

60. $\text{R}-\text{CN} \xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) DIBAL-H}} \text{R}-\text{Y}$



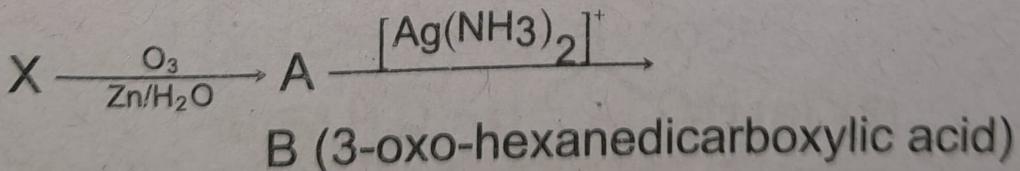
**[Methods of preparation for
Aldehydes and Ketones]**

53. The compounds A and B in the following reaction are, respectively [JEE (Main)-2019]



- (1) A = Benzyl alcohol, B = Benzyl isocyanide
- (2) A = Benzyl chloride, B = Benzyl cyanide
- (3) A = Benzyl chloride, B = Benzyl isocyanide
- (4) A = Benzyl alcohol, B = Benzyl cyanide

54. An unsaturated hydrocarbon X absorbs two hydrogen molecules on catalytic hydrogenation, and also gives following reaction



X will be

[JEE (Main)-2020]

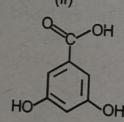
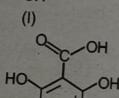
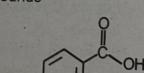
Corporate Office : Aakash Tower, 8, Pusa Road, New Delhi-110026

- 12:19 pm
heavy E
- Which one of the following orders of acid strength is correct?
- (1) $\text{RCOOH} > \text{HC} \equiv \text{CH} > \text{HOH} > \text{ROH}$
 - (2) $\text{RCOOH} > \text{ROH} > \text{HOH} > \text{HC} \equiv \text{CH}$
 - (3) $\text{RCOOH} > \text{HOH} > \text{ROH} > \text{HC} \equiv \text{CH}$
 - (4) $\text{COOH} > \text{HOH} > \text{HC} \equiv \text{CH} > \text{ROH}$

27. The correct order of acidic strength of the carboxylic acid is
- (1) Formic acid < Benzoic acid < Acetic acid
 - (2) Formic acid < Acetic acid < Benzoic acid
 - (3) Acetic acid < Formic acid < Benzoic acid
 - (4) Acetic acid < Benzoic acid < Formic acid

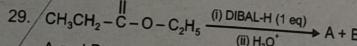
[Acid Derivatives (Preparation and reactions)]

28. Among the given compounds



The order of decreasing acidity is

- (1) $\text{III} > \text{IV} > \text{I} > \text{II}$
- (2) $\text{I} > \text{IV} > \text{II} > \text{III}$
- (3) $\text{II} > \text{I} > \text{IV} > \text{III}$
- (4) $\text{III} > \text{I} > \text{II} > \text{IV}$



A and B are respectively

- (1) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{C}_2\text{H}_5\text{OH}$
- (2) $\text{CH}_3\text{CH}_2\text{CHO} + \text{C}_2\text{H}_5\text{OH}$
- (3) $\text{CH}_3\text{CH}_2\text{CHO} + \text{CH}_3\text{CHO}$
- (4) $\text{CH}_3\text{CH}_2\text{CH}_2\text{OH} + \text{CH}_3\text{CHO}$

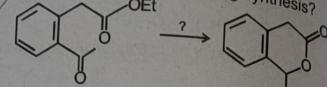
30. The compound which is not reduced by LiAlH_4 is

- (1) Cyclohexanone
- (2) 2-Methyl-1-butanol
- (3) Ethyl benzoate
- (4) ω -caprolactam

In esterification

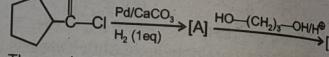
- (1) OH^- of acid is replaced by $\text{C}_6\text{H}_5\text{OH}$
- (2) H^+ of acid is replaced by sodium metal
- (3) OH^- of alcohol is replaced by chlorine
- (4) OH^- of acid is replaced by RO^- group

32. Which reagent or sequence of reagents would best accomplish the following synthesis?



- (1) (i) LiAlH_4 (ii) H^+, Δ
- (2) (i) NaBH_4 (ii) $\text{dil. H}_2\text{SO}_4$ (iii) $\text{conc. H}_2\text{SO}_4$
- (3) (i) Na / NH_3 (ii) $\text{NaBH}_4 / \text{H}^+, \Delta$
- (4) (i) $\text{Mg} / \text{Et}_2\text{O}$ (ii) LiAlH_4 , (iii) H^+, Δ

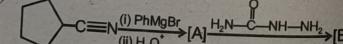
33. Consider the following sequence of reactions.



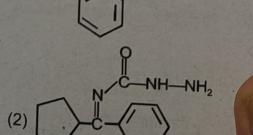
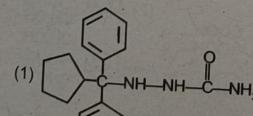
The products [A] and [B] are respectively

- (1) Cyclohexanone and
- (2) Cyclohexanone and
- (3) Cyclohexanone and
- (4) Cyclohexanone and

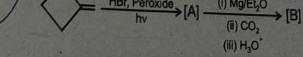
34. Consider the following sequence of reactions.



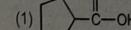
Major product [B] of the given reaction would be



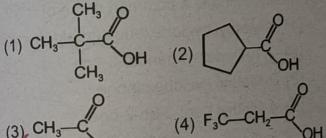
38. Consider the following sequence of reaction :



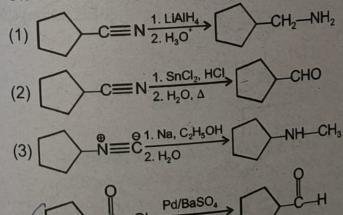
The final product [B] in the reaction would be :



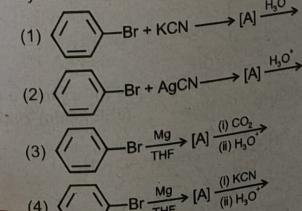
35. Which of the following carboxylic acids is most reluctant to form ester with a given alcohol in the presence of a catalytic amount of concentrated H_2SO_4 ?



36. Which of the following conversions is known as Steffen's reduction?



37. Which of the following would be the best synthesis of benzoic acid from bromobenzene?



- Numerical Value Based Questions

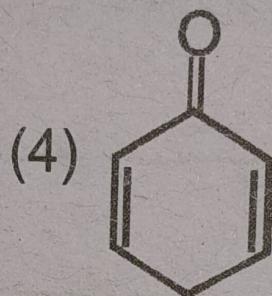
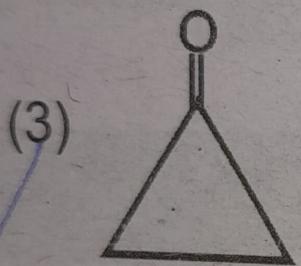
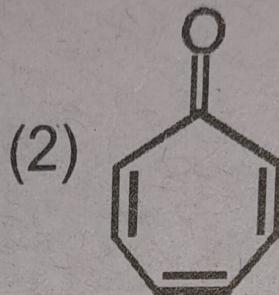
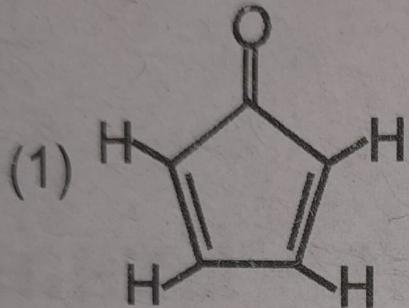
41. Consider the following reaction sequence.



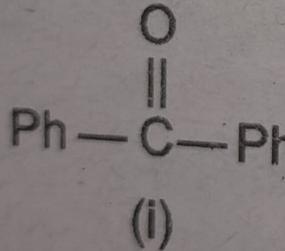
154

Aldehydes, Ketones and Carboxylic Acids

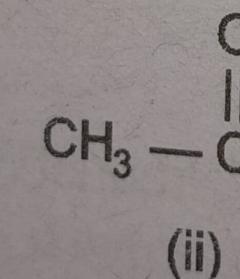
6. Which of the following carbonyl oxygen will form strongest hydrogen bond with H_2O molecule?



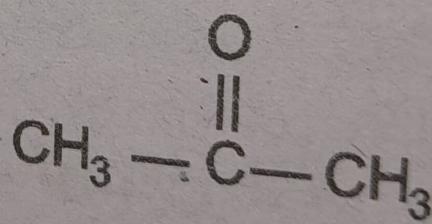
7. The correct order of reactivity of PhMgBr towards given compounds



(i)



(ii)



(iii)

(1) (i) > (ii) > (iii)

(2) (iii) > (ii) > (i)

(3) (ii) > (iii) > (i)

(4) (i) > (iii) > (ii)

8.

The increasing order of the rate of HCN addition to compounds (A) – (D) is

(A) HCHO (B) CH_3COCH_3 (C) PhCOCH_3 (D) PhCOPh

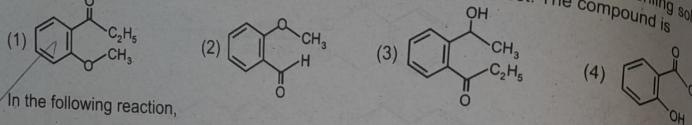
12:19 pm

(3) $\text{D} < \text{C} < \text{B} < \text{A}$ (2) $\text{D} < \text{B} < \text{C} < \text{A}$

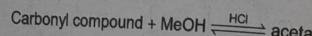
13

14

32. An organic compound neither reacts with neutral ferric chloride solution nor with Fehling solution however, reacts with Grignard reagent and gives positive iodoform test. The compound is



33. In the following reaction,



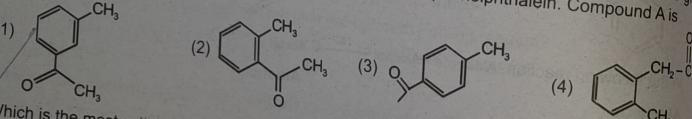
Rate of the reaction is the highest for

- (1) Acetone as substrate and methanol in excess
- (2) Propanal as substrate and methanol in stoichiometric amount
- (3) Propanal as substrate and methanol in excess
- (4) Acetone as substrate and methanol in stoichiometric amount

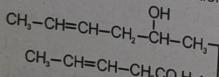
34. 2,4-DNP test can be used to identify

- (1) Aldehyde
- (2) Amine
- (3) Ether

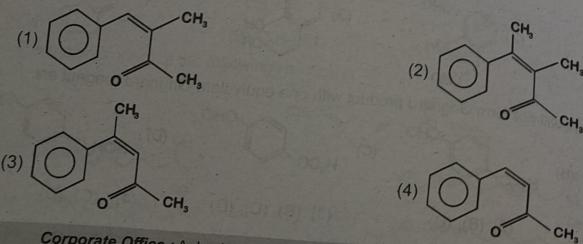
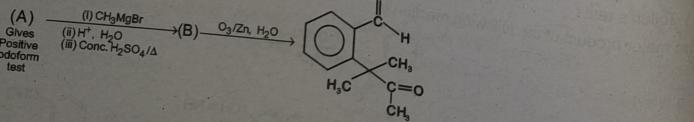
35. Compound A ($C_9H_{10}O$) shows positive iodoform test. Oxidation of A with $KMnO_4/KOH$ gives acid B ($C_8H_8O_4$). Anhydride of B is used for the preparation of phenolphthalein. Compound A is



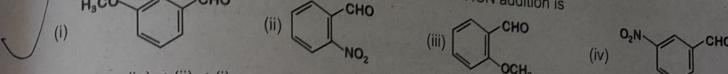
36. Which is the most suitable reagent for the following transformation?



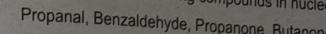
- (1) $I_2/NaOH$
- (2) Alkaline $KMnO_4$
- (3) Tollen's reagent
- (4) CrO_2Cl_2/CS_2



38. The increasing order of the following compounds towards HCN addition is

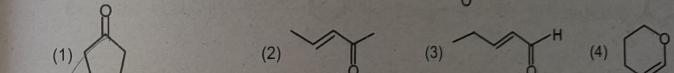
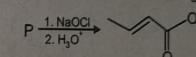


39. The increasing order of the reactivity of the following compounds in nucleophilic addition reaction is

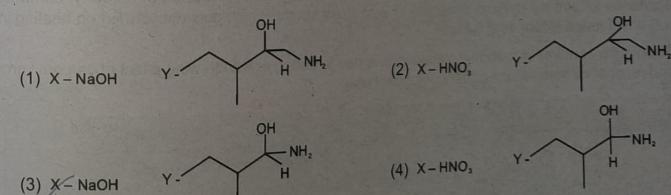
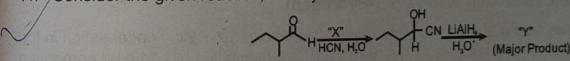


- (1) Propanal < Propanone < Butanone < Benzaldehyde
- (2) Benzaldehyde < Propanal < Propanone < Butanone
- (3) Benzaldehyde < Butanone < Propanone < Propanal
- (4) Butanone < Propanone < Benzaldehyde < Propanal

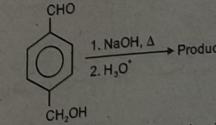
40. The structure of the starting compound P used in the reaction given below is



41. Consider the given reaction, identify "X" and "Y".

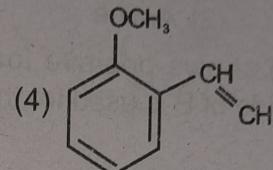
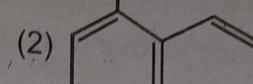
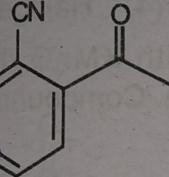
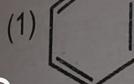


42. For the reaction given below :



The compound which is not formed as a product in the reaction is a

- (1) Dicarboxylic acid
- (2) Monocarboxylic acid
- (3) Compound with both alcohol and acid functional groups
- (4) Diol



28. In the following reaction, Aldehyde + Alcohol $\xrightarrow{\text{HCl}}$ Acetal

Aldehyde

HCHO

CH₃CHO

Alcohol

^tBuOH

MeOH

The best combination is

(1) HCHO and MeOH

(2) HCHO and ^tBuOH

(3) CH₃CHO and ^tBuOH

(4) CH₃CHO and MeOH

29. A reaction of benzonitrile with one equivalent CH₃MgBr followed by hydrolysis produces a yellow liquid "P". The compound "P" will give positive _____.

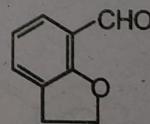
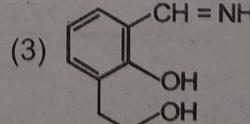
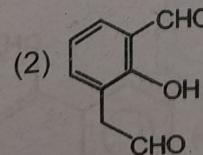
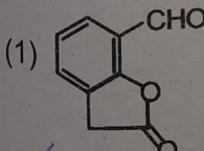
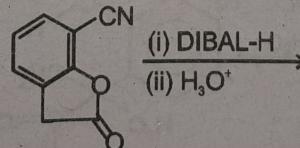
(1) Tollen's test

(2) Schiff's test

(3) Ninhydrin's test

(4) Iodoform test

30. The major product of the following reaction is



Form Grignard product with one equivalent Grignard reagent are

110. 2-Methyl propyl bromide reacts with $C_2H_5O^-$ and gives 'A' whereas on reaction with C_2H_5OH it gives 'B'. The mechanism followed in these reactions and the products 'A' and 'B' respectively are [JEE (Main)-2023]

- (1) S_N2 , A = iso-butyl ethyl ether; S_N1 , B = tert-butyl ethyl ether
- (2) S_N1 , A = tert-butyl ethyl ether; S_N1 , B = 2-butyl ethyl ether
- (3) S_N2 , A = 2-butyl ethyl ether; S_N2 , B = iso-butyl ethyl ether
- (4) S_N1 , A = tert-butyl ethyl ether; S_N2 , B = iso-butyl ethyl ether

Numerical Value Based Questions

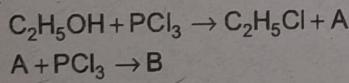
[Alcohols (Reaction)]

111. To synthesise 1.0 mole of 2-methylpropan-2-ol from Ethylethanoate _____ equivalents of CH_3MgBr reagent will be required. (Integer value) [JEE (Main)-2021]

112*. A sample of 4.5 mg of an unknown monohydric alcohol, R-OH was added to methylmagnesium iodide. A gas is evolved and is collected and its volume measured to be 3.1 mL. The molecular weight of the unknown alcohol is ____ g/mol. [Nearest integer] [JEE (Main)-2022]

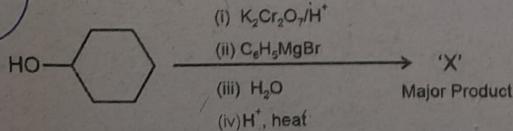


113. The number of non-ionisable protons present in the product B obtained from the following reactions is _____. [JEE (Main)-2022]



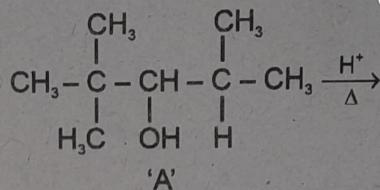
114. A 1.84 mg sample of polyhydric alcoholic compound 'X' of molar mass 92.0 g/mol gave 1.344 mL of H_2 gas at STP. The number of alcoholic hydrogens present in compound 'X' is _____. [JEE (Main)-2022]

115. In the given reaction,



the number of sp^2 hybridised carbon(s) in compound 'X' is _____. [JEE (Main)-2022]

116. For the given reaction, [JEE (Main)-2023]



The total number of possible products formed by tertiary carbocation of A is _____. [JEE (Main)-2023]

[Phenols (Preparation and Reactions)]

117. 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) [JEE (Main)-2020]

(Atomic mass : C = 12; H = 1; O = 16)

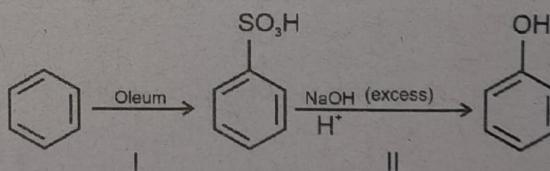
[JEE (Main)-2020]

118*. Compound 'P' on nitration with dil. HNO_3 yields two isomers (A) and (B) show the intramolecular and intermolecular hydrogen bonding respectively. Compound (P) on reaction

with conc. HNO_3 yields a yellow compound 'C', a strong acid. The number of oxygen atoms present in compound 'C' is _____. [JEE (Main)-2022]



119*. In the following reaction,



the % yield for reaction I is 60% and that of reaction II is 50%. The overall yield of the complete reaction is ____ %. [Nearest integer] [JEE (Main)-2022]

120. A trisubstituted compound 'A', $C_{10}H_{12}O_2$ gives neutral $FeCl_3$ test positive. Treatment of compound 'A' with NaOH and CH_3Br gives $C_{11}H_{14}O_2$, with hydroiodic acid gives methyl iodide and with hot conc. NaOH gives a compound B, $C_{10}H_{12}O_2$. Compound 'A' also decolorises alkaline $KMnO_4$. The number of π bond/s present in the compound 'A' is _____. [JEE (Main)-2023]

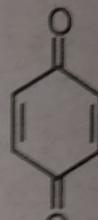
87. Hydrolysis of which compound will give carbolic acid?
[JEE (Main)-2022]

(1)  and

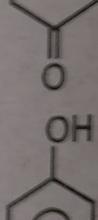
- (1) Cumene
- (2) Benzenediazonium chloride
- (3) Benzal chloride
- (4) Ethylene glycol ketal

88*. An organic compound 'A' contains nitrogen and chlorine. It dissolves readily in water to give a solution that turns litmus red. Titration of compound 'A' with standard base indicates that the molecular weight of 'A' is 131 ± 2 . When a sample of 'A' is treated with aq. NaOH, a liquid separates which contains N but not Cl. Treatment of the obtained liquid with nitrous acid followed by phenol gives orange precipitate. The compound A is

[JEE (Main)-2022]

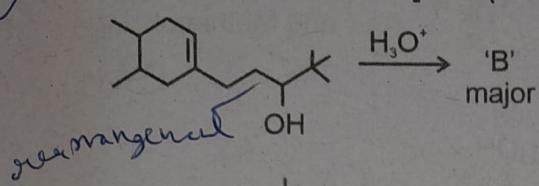
(2)  and

(3)  and 

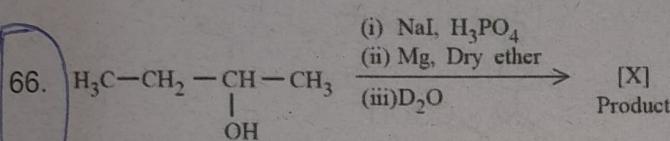
(4)  and 

65. In the following reaction, 'B' is

[JEE (Main)-2023]



- (1) (2)
- (3) (4)

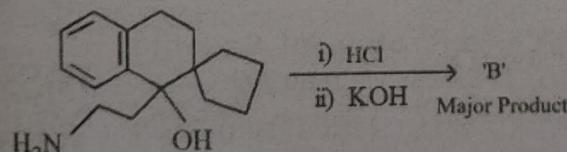


Product [X] formed in the above reaction is

[JEE (Main)-2023]

- (1) $\text{H}_3\text{C}-\text{CH}_2-\underset{\substack{\text{H} \\ | \\ \text{OH}}}{\text{C}}-\text{CH}_3$
- (2) $\text{H}_3\text{C}-\text{CH}=\text{CH}-\text{CH}_3$
- (3) $\text{H}_3\text{C}-\text{CH}_2-\underset{\substack{\text{D}}}{\text{CH}}-\text{CH}_3$
- (4) $\text{H}_3\text{C}-\text{CH}_2-\text{CH}=\text{CH}_2$

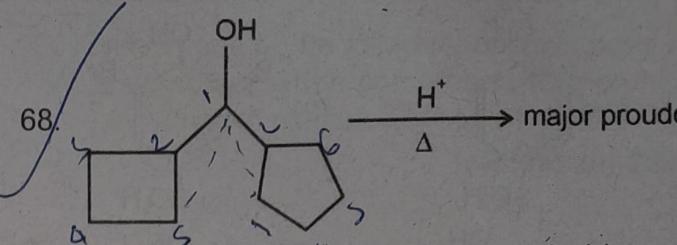
67. In the reaction given below



'B' is

[JEE (Main)-2023]

- (1) (2)
- (3) (4)



In the above reaction, left hand side and right hand side rings are named as 'A' and 'E' respectively. They undergo ring expansion. The correct statement for this process is

[JEE (Main)-2023]

- (1) Ring expansion can go upto seven membered rings
- (2) Finally both rings will become six membered each
- (3) Finally both rings will become five membered each
- (4) Only A will become 6 membered

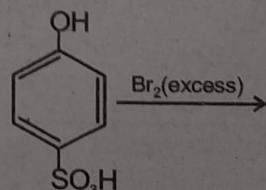
[Phenols (Preparation and Reactions)]

69. The products formed in the reaction of cumene with O_2 followed by treatment with dil. HCl are

[JEE (Main)-2019]

- (1) and
- (2) and
- (3) and
- (4) and

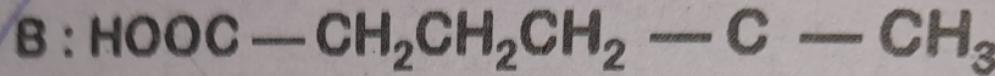
70. The major product of the following reaction is



[JEE (Main)-2019]

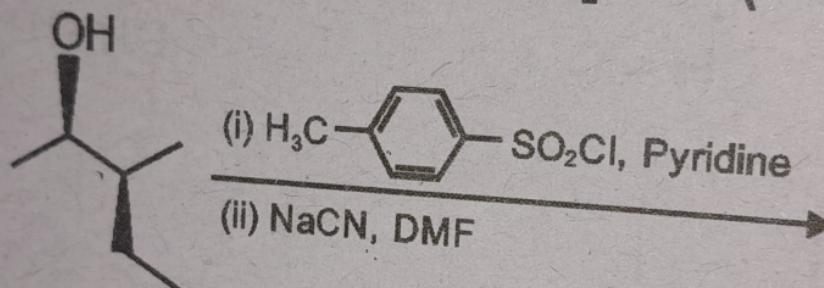
51*

64

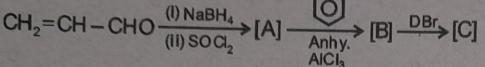


61. Most stable product of the following reaction is

[JEE (Main)-2022]

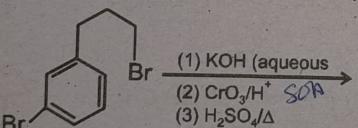


48. *clear* The major product [C] of the following reaction sequence will be [JEE (Main)-2020]



- (1)
- (2)
- (3)
- (4)

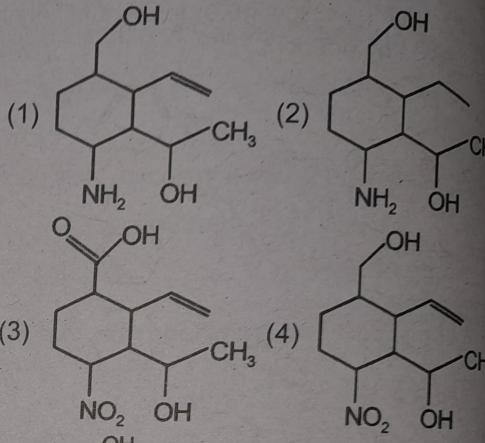
49. The major product of the following reaction is [JEE (Main)-2019]



- (1)
- (2)
- (3)
- (4)

50. Which is the most suitable reagent for the following transformation? [JEE (Main)-2019]

OH

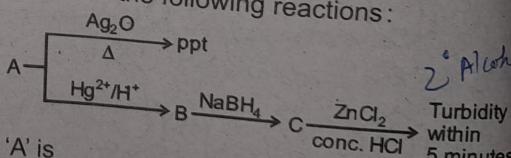


52. $\text{CH}_3\text{CH}_2-\underset{\text{Ph}}{\underset{|}{\text{C}}}-\text{CH}_3$ cannot be prepared by

[JEE (Main)-2019]

- (1) $\text{PhCOCH}_2\text{CH}_3 + \text{CH}_3\text{MgX}$
 (2) $\text{CH}_3\text{CH}_2\text{COCH}_3 + \text{PhMgX}$
 (3) $\text{HCHO} + \text{PhCH}(\text{CH}_3)\text{CH}_2\text{MgX}$
 (4) $\text{PhCOCH}_3 + \text{CH}_3\text{CH}_2\text{MgX}$

53. Consider the following reactions:



'A' is

- (1) $\text{CH}_3-\text{C}\equiv\text{CH}$ (2) $\text{CH}_3-\text{C}\equiv\text{C}-\text{CH}_3$
 (3) $\text{CH}_2=\text{CH}_2$ (4) $\text{CH}\equiv\text{CH}$

54*. Among the compounds A and B with molecular formula $\text{C}_9\text{H}_{18}\text{O}_3$, A is having higher boiling point than B. The possible structures of A and B are

- (1) $\text{A} = \text{H}_3\text{CO}-\text{CH}_2-\text{CH}_2-\text{OCH}_3$ [JEE (Main)-2020]

JEE (Main) & Sta

(3) $\text{A} = \text{H}_3\text{CO}-\text{CH}_2-\text{CH}_2-\text{OCH}_3$

$\text{B} = \text{HO}-\text{CH}_2-\text{CH}_2-\text{OCH}_3$

(4) $\text{A} = \text{HO}-\text{CH}_2-\text{CH}_2-\text{OCH}_3$

$\text{B} = \text{H}_3\text{CO}-\text{CH}_2-\text{CH}_2-\text{OCH}_3$

55* Two compounds A and B with molecular formula $\text{C}_9\text{H}_{18}\text{O}_3$ with methyl groups in different positions give the following products on reaction with NaBH_4 :

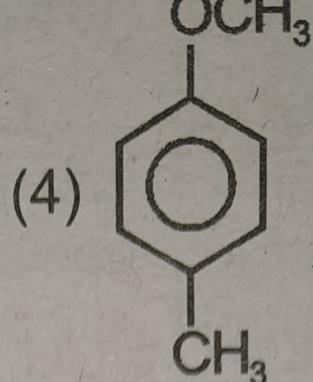
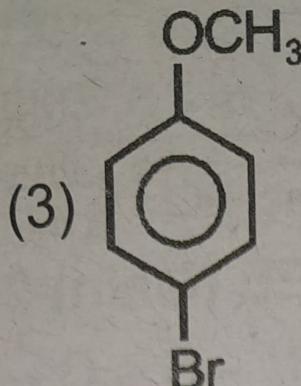
Test

Ceric ammonium nitrate Test

Lucas Test

Odorform Test

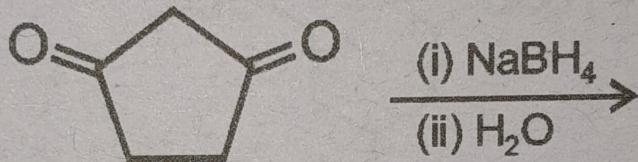
and D re



Numerical Value Based Questions

[Alcohols (Preparation)]

40. In the following reaction how many different diols, are formed (including stereoisomers)?



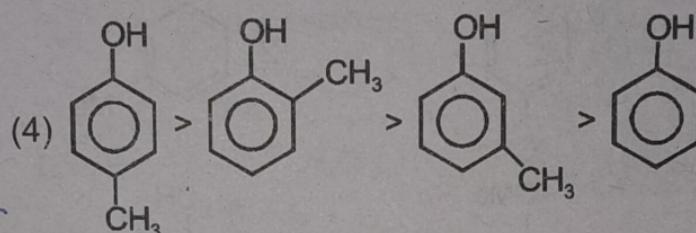
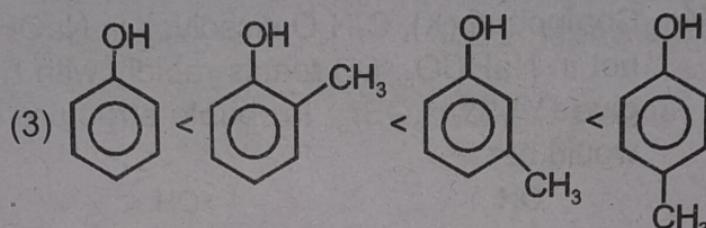
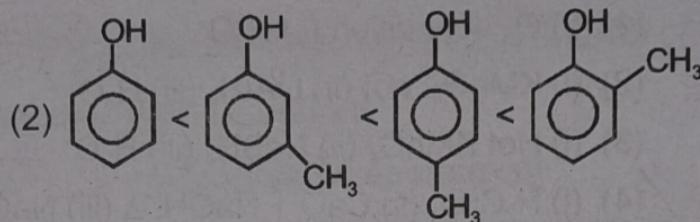
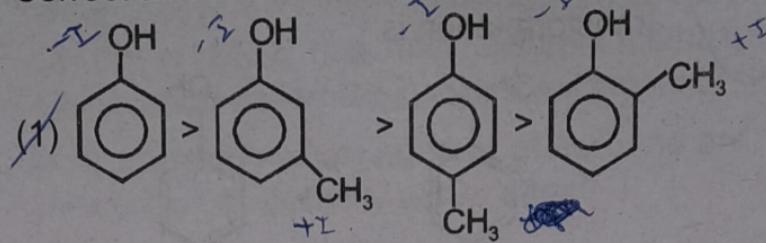
[Alcohols (Reaction)]

41. An alcohol $X(C_4H_{10}O_3)$ is chiral and absorbs two moles of HIO_4 per mole of X . How many stereoisomers exist for X ?
42. An organic compound A ($C_{10}H_{18}O_8$) on treatment with excess of CH_3COCl gives a fully acetylated product whose molar mass is found to be 518 g/mol. How many hydroxyl functional groups are present in A?
43. A 100 mL solution of CH_3CH_2MgBr on treatment with methanol produces 2.24 mL of a gas at STP. The weight of gas produced is _____ mg.

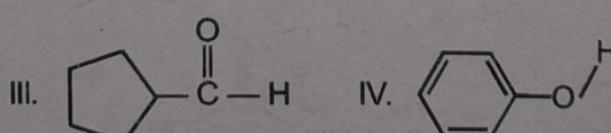
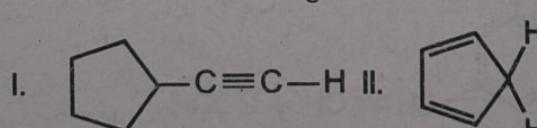
Galaxy F13 [nearest integer]

12:16 pm

26*. Correct acidic order is



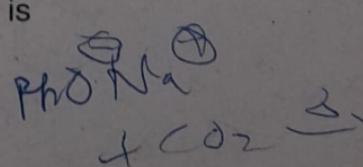
27. A compound of molecular formula C_6H_6O turns ferric chloride solution violet and produces no effervescence with $NaHCO_3$. The compound is



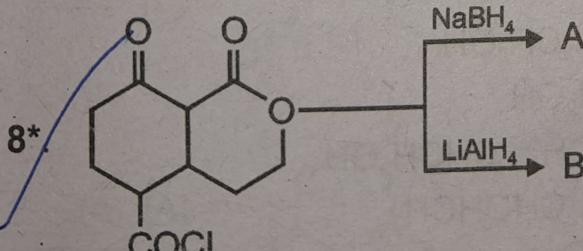
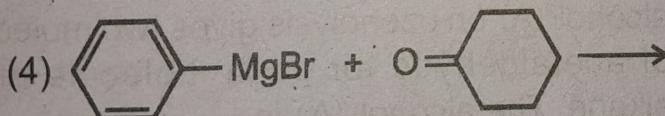
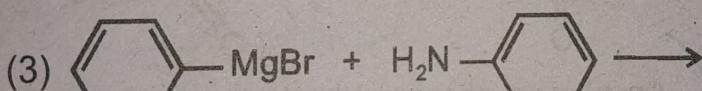
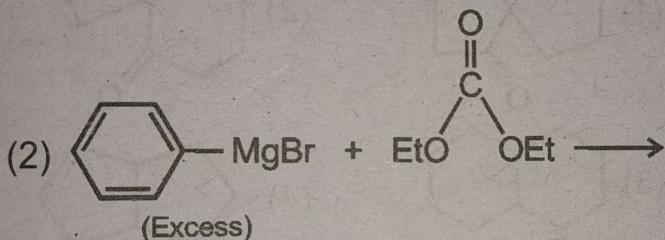
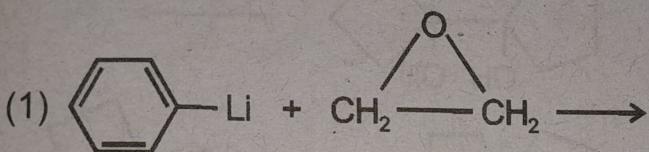
- (1) $| < || < ||| < |||$ (2) $| < ||| < || < |||$
 (3) $||| < || < | < |||$ (4) $|| < ||| < | < |||$

29. When sodium phenoxide is heated with CO_2 under pressure followed by acidification with HCl , the product obtained is

- (1) Salicylic acid
 - (2) Salicylaldehyde
 - (3) Benzoic acid
 - (4) Cinnamic acid



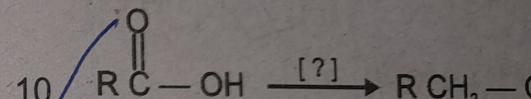
7*. Which of the following reactions will not yield alcohol as the major product?



A and B are respectively

(3) LiAlH_4 can reduce isolated double bond

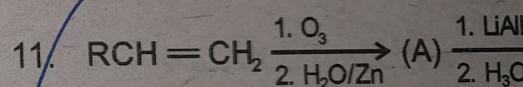
(4) LiAlH_4 is a weak hydride do



Here reagent is

(1) LiAlH_4 (2) NaE

(3) Both (1) & (2) (4) Red



Product (B) is

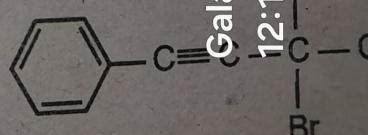
(1) $\text{RCHO} + \text{HCHO}$

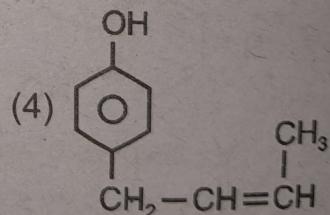
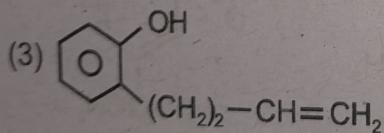
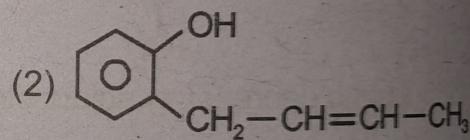
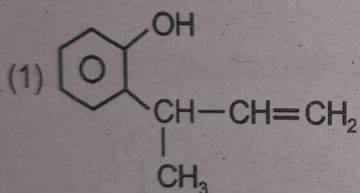
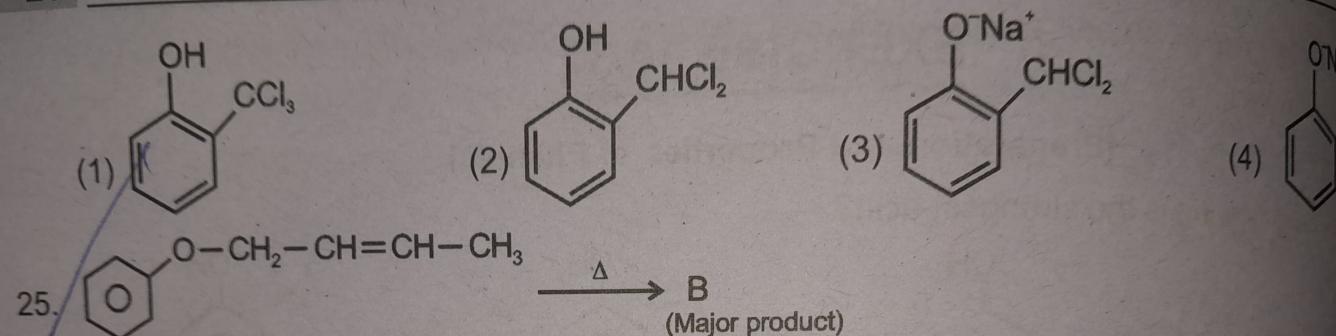
(2) $\text{RCHO} + \text{HCOOH}$

(3) $\text{RCOOH} + \text{HCOOH}$

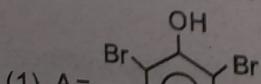
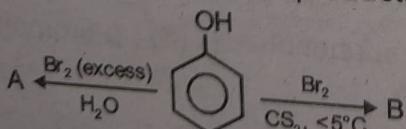
(4) $\text{RCH}_2\text{OH} + \text{CH}_3\text{OH}$

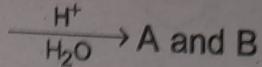
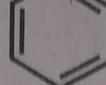
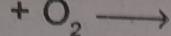
12*. What would be the major product in the following reaction?



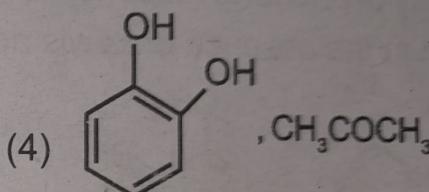
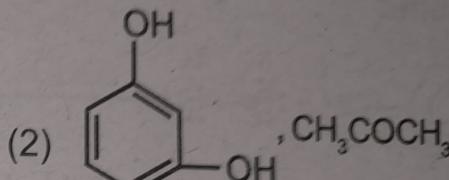
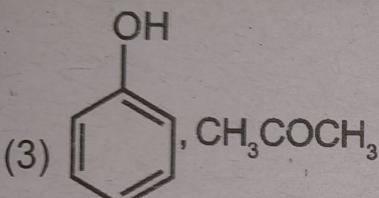
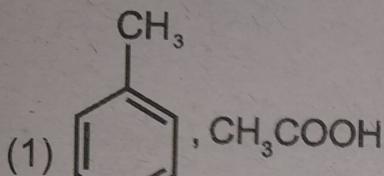


26. The correct option for the products A and B of the following reactions is

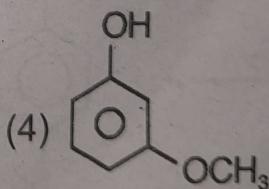
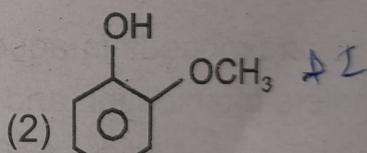
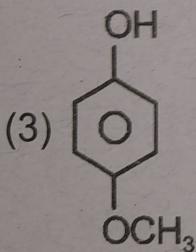
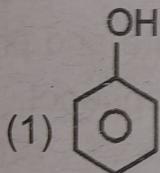


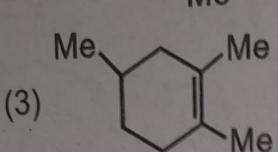


The compounds A and B respectively are

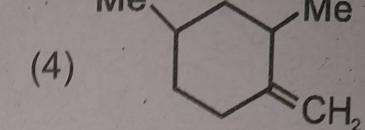
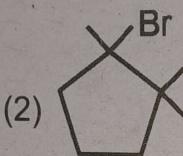
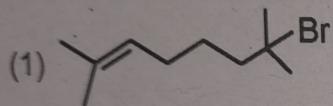
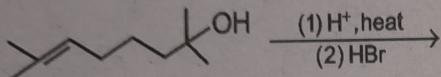


16. Which of the following is most acidic?

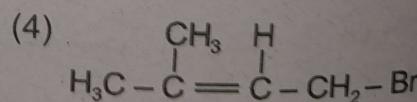
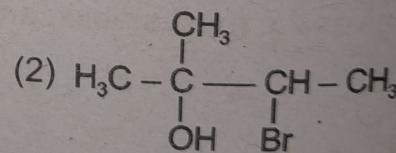
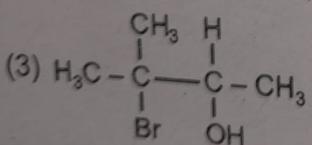
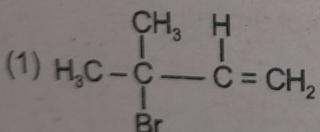
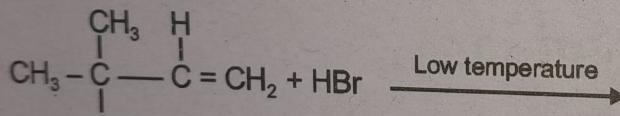


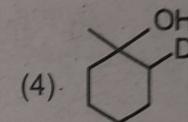
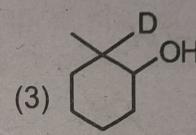
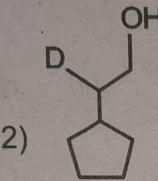
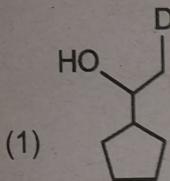
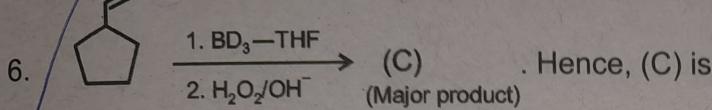
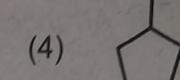
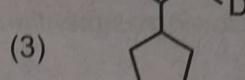
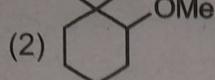
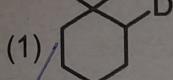


11. The major product in the given reaction is



12. The major product formed in the reaction is





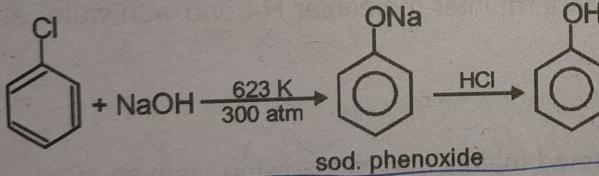
Preparation of Phenols

Phenols can be prepared from benzene derivatives by any of the following methods :

1. From haloarenes :

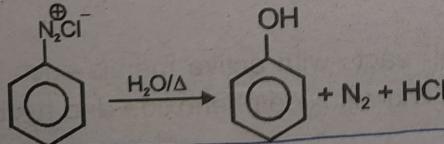
Chlorobenzene is fused with NaOH at 623 K and around 300 atmospheric pressure, phenol is obtained on acidification of sodium phenoxide.

* *Limitation -*
① *Halophenols formed can not be by this method*



2. From diazonium salt :

Diazonium salts are hydrolysed to phenols by warming with water or by treating with dil. acids.



3. From benzene sulphonic acid :

Benzene sulphonic acid is fused with NaOH. Acidification of the sodium salt gives phenol.



- 108*. The osmotic pressure of a solution of NaCl is 0.10 atm and that of a glucose solution is 0.20 atm. The osmotic pressure of a solution formed by mixing 1 L of the sodium chloride solution with 2 L of the glucose solution is $x \times 10^{-3}$ atm. x is _____. (nearest integer) [JEE (Main)-2020]

109. 1.46 g of a biopolymer dissolved in a 100 mL water at 300 K exerted an osmotic pressure of 2.42×10^{-3} bar.

The molar mass of the biopolymer is ____ $\times 10^4$ g mol $^{-1}$. (Round off to the Nearest Integer)
[Use : $R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$]

[JEE (Main)-2021]

110. The osmotic pressure of blood is 7.47 bar at 300 K. To inject glucose to a patient intravenously, it has to be isotonic with blood. The concentration of glucose solution in g L $^{-1}$ is _____. (Molar mass of glucose = 180 g mol $^{-1}$)
 $R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1}$ (Nearest integer)

[JEE (Main)-2022]

111. The osmotic pressure exerted by a solution prepared by dissolving 2.0 g of protein of molar mass 60 kg mol $^{-1}$ in 200 mL of water at 27°C is ____ Pa. [Integer value]

(use $R = 0.083 \text{ L bar mol}^{-1} \text{ K}^{-1}$)

[JEE (Main)-2022]

- 112*. 2.5 g of protein containing only glycine ($\text{C}_2\text{H}_5\text{NO}_2$) is dissolved in water to make 500 mL of solution. The osmotic pressure of this solution at 300 K is found to be 5.03×10^{-3} bar.

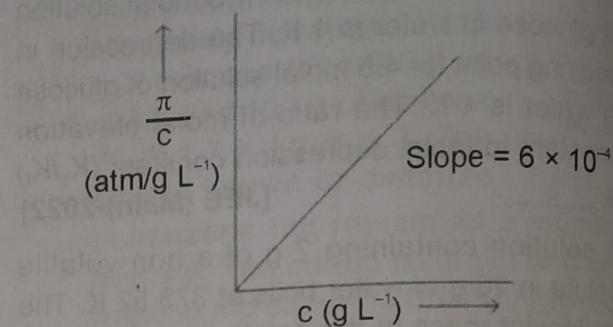
The total number of glycine units present in the protein is _____. (Given : $R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1}$)

[JEE (Main)-2022]



113. The osmotic pressure of solutions of PVC in cyclohexanone at 300 K are plotted on the graph.

The molar mass of PVC is ____ g mol $^{-1}$ (Nearest integer)



(Given : $R = 0.083 \text{ L atm K}^{-1} \text{ mol}^{-1}$)

[JEE (Main)-2023]

- 114*. The number of pairs of the solutions having the same value of the osmotic pressure from the following is _____. (Assume 100% ionization)

- A. 0.500 M $\text{C}_2\text{H}_5\text{OH}$ (aq) and 0.25 M KBr (aq)
- B. 0.100 M $\text{K}_4[\text{Fe}(\text{CN})_6]$ (aq) and 0.100 M $\text{FeSO}_4(\text{NH}_4)_2\text{SO}_4$ (aq)
- C. 0.05 M $\text{K}_4[\text{Fe}(\text{CN})_6]$ (aq) and 0.25 M NaCl (aq)
- D. 0.15 M NaCl (aq) and 0.1 M BaCl_2 (aq)
- E. 0.02 M KCl . $\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ (aq) and 0.05 M KCl (aq)

[JEE (Main)-2023]

115. At 27°C, a solution containing 2.5 g of solute in 250.0 mL of solution exerts an osmotic pressure of 400 Pa. The molar mass of the solute is ____ g mol $^{-1}$. (Nearest integer)

(Given : $R = 0.083 \text{ L bar K}^{-1} \text{ mol}^{-1}$)

[JEE (Main)-2023]

116. Consider the following pairs of solution which will be isotonic at the same temperature. The number of pairs of solutions is/are _____. (Assume 100% ionization)

- A. 1 M aq. NaCl and 2 M aq. urea
- B. 1 M aq. CaCl_2 and 1.5 M aq. KCl
- C. 1.5 M aq. AlCl_3 and 2 M aq. Na_2SO_4
- D. 2.5 M aq. KCl and 1 M aq. $\text{Al}_2(\text{SO}_4)_3$

[JEE (Main)-2023]

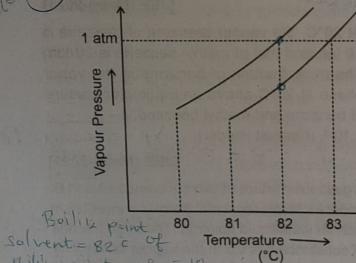


[Vapour Pressure and Relative Lowering in Vapour Pressure]

86. 224 mL of $\text{SO}_{2(\text{g})}$ at 298 K and 1 atm is passed through 100 mL of 0.1 M NaOH solution. The non-volatile solute produced is dissolved in 36 g of water. The lowering of vapour pressure of solution (assuming the solution is dilute) ($P_{(\text{H}_2\text{O})}^0 = 24 \text{ mmHg}$) is $x \times 10^{-2}$ mm of Hg, the value of x is _____. (Integer answer) [JEE (Main)-2021]

87. When a certain amount of solid A is dissolved in 100 g of water at 25°C to make a dilute solution, the vapour pressure of the solution is reduced to one-half of that of pure water. The vapour pressure of pure water is 23.76 mmHg. The number of moles of solute A added is _____. (Nearest Integer) [JEE (Main)-2022]

88. The vapour pressure vs. temperature curve for a solution solvent system is shown below.



- The boiling point of the solvent is ____ °C. [JEE (Main)-2023]

89. 80 mole percent of MgCl_2 is dissociated in aqueous solution. The vapour pressure of 1.0 molal aqueous solution of MgCl_2 at 38°C is ____ mm Hg. (Nearest integer)

Given: Vapour pressure of water at 38°C is 50 mm Hg [JEE (Main)-2023]

[Elevation in Boiling Point]

90. The elevation of boiling point of 0.10 mol aqueous $\text{CrCl}_3 \cdot x\text{NH}_3$ solution is two times that of 0.05 mol aqueous CaCl_2 solution. The value of x is _____. [Assume 100% ionisation of the complex and CaCl_2 , coordination number of Cr as 6, and that all NH_3 molecules are present inside the coordination sphere] [JEE (Main)-2020]

- 91*. 1.22 g of an organic acid is separately dissolved in 100 g of benzene ($K_b = 2.6 \text{ K kg mol}^{-1}$) and 100 g of acetone ($K_b = 1.7 \text{ K kg mol}^{-1}$). The acid is known to dimerize

in benzene but remain as a monomer in acetone. The boiling point of the solution in acetone increases by 0.17°C . The increase in boiling point of solution in benzene in ${}^\circ\text{C}$ is $x \times 10^{-2}$. The value of x is _____. (Nearest integer) [Atomic mass : C = 12.0, H = 1.0, O = 16.0] [JEE (Main)-2021]

- 92*. A 1 molal $\text{K}_3\text{Fe}(\text{CN})_6$ solution has a degree of dissociation of 0.4. Its boiling point is equal to that of another solution which contains 18.1 weight percent of a non-electrolytic solute A. The molar mass of A is ____ u. (Round off to the Nearest Integer). [Density of water = 1.0 g cm^{-3}] [JEE (Main)-2021]

93. AB_2 is 10% dissociated in water to A^{2+} and B^- . The boiling point of a 10.0 molal aqueous solution of AB_2 is ____ °C. (Round off to the Nearest Integer)

[Given : Molal elevation constant of water $K_b = 0.5 \text{ K kg mol}^{-1}$ boiling point of pure water = 100°C] [JEE (Main)-2021]

94. A solute A dimerizes in water. The boiling point of a 2 molal solution of A is 100.52°C . The percentage association of A is _____. (Round off to the Nearest Integer).

[Use : K_b for water = $0.52 \text{ K kg mol}^{-1}$
Boiling point of water = 100°C] [JEE (Main)-2021]

95. When 3.00 g of a substance 'X' is dissolved in 100 g of CCl_4 , it raises the boiling point by 0.60 K . The molar mass of the substance 'X' is ____ g mol^{-1} . (Nearest integer)

[Given K_b for CCl_4 is $5.0 \text{ K kg mol}^{-1}$] [JEE (Main)-2021]

96. 2 g of a non-volatile non-electrolyte solute is dissolved in 200 g of two different solvents A and B whose ebullioscopic constants are in the ratio of 1 : 8. The elevation in boiling points of A and B are in the ratio $\frac{x}{y}$ ($x : y$). The value of y is _____. (Nearest Integer) [JEE (Main)-2022]

97. Elevation in boiling point for 1.5 molal solution of glucose in water is 4 K . The depression in freezing point for 4.5 molal solution of glucose in water is 4 K . The ratio of molal elevation constant to molal depression constant (K_e/K_f) is _____. [JEE (Main)-2022]

98. A solution containing 2 g of a non-volatile solute in 20 g of water boils at 373.52 K . The molecular mass of the solute is ____ g mol^{-1} . (Nearest integer)

Given, water boils at 373 K , K_b for water = $0.52 \text{ K kg mol}^{-1}$ [JEE (Main)-2023]

99. If the boiling points of two solvents X and Y (having same molecular weights) are in the ratio 2 : 1 and their enthalpy of vaporizations are in the ratio 1 : 2, then the boiling point elevation constant of X is m times the boiling point elevation constant of Y. The value of m is (nearest integer). [JEE (Main)-2023]

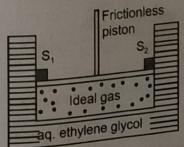
- 100*. Sea water contains 29.25% NaCl and 19% MgCl_2 by weight of solution. The normal boiling point of the sea water is ____ °C (Nearest integer)

Assume 100% ionization for both NaCl and MgCl_2

Given: $K_b \text{H}_2\text{O} = 0.52 \text{ K kg mol}^{-1}$
Molar mass of NaCl and MgCl_2 is 58.5 and 95 g mol^{-1} respectively. [JEE (Main)-2023]

[Depression in Freezing Point]

- 101*. A cylinder containing an ideal gas (0.1 mol of 1.0 dm^3) is in thermal equilibrium with a large volume of 0.5 molal aqueous solution of ethylene glycol at its freezing point. If the stoppers S_1 and S_2 (as shown in the figure) are suddenly withdrawn, the volume of the gas in litres after equilibrium is achieved will be _____. (Given: K_f (water) = $2.0 \text{ K kg mol}^{-1}$, $R = 0.08 \text{ dm}^3 \text{ atm K}^{-1} \text{ mol}^{-1}$) [JEE (Main)-2020]



102. Of the following four aqueous solutions, total number of those solutions whose freezing point is lower than that of 0.10 M $\text{C}_2\text{H}_5\text{OH}$ is _____. (Integer answer) [JEE (Main)-2021]

- (i) 0.10 M $\text{Ba}_3(\text{PO}_4)_2$
(ii) 0.10 M Na_2SO_4
(iii) 0.10 M KCl
(iv) 0.10 M Li_3PO_4

103. C_6H_6 freezes at 5.5°C . The temperature at which a solution of 10 g of C_6H_6 in 200 g of C_6H_6 freeze is ____ °C. (The molal freezing point depression constant of C_6H_6 is 5.12°C/m) [JEE (Main)-2021]

104. When 9.45 g of CICH_2COOH is added to 500 mL of water, its freezing point drops by 0.5°C . The dissociation constant of CICH_2COOH is $x \times 10^{-3}$. The value of x is _____. (Rounded off to the nearest integer) [$K_f(\text{H}_2\text{O}) = 1.86 \text{ K kg mol}^{-1}$] [JEE (Main)-2021]

- 105*. Solid Lead nitrate is dissolved in 1 litre of water. The solution was found to boil at 100.15°C . When 0.2 mol of NaCl is added to the resulting solution, it was observed that the solution froze at -0.8°C . The solubility product of PbCl_2 formed is $\text{_____} \times 10^{-6}$ at 298 K. (Nearest integer)

Given : $K_b = 0.5 \text{ K kg mol}^{-1}$ and $K_f = 1.8 \text{ K kg mol}^{-1}$. Assume molality to be equal to molarity in all cases. [JEE (Main)-2023]

106. 25 mL of an aqueous solution of KCl was found to require 20 mL of 1 M AgNO_3 solution when titrated using K_2CrO_4 as an indicator. What is the depression in freezing point of KCl solution of the given concentration? _____. (Nearest integer).

(Given: $K_f = 2.0 \text{ K kg mol}^{-1}$)
Assume (1) 100% ionization and
(2) Density of the aqueous solution as 1 g mL^{-1} [JEE (Main)-2023]

[Osmosis and Osmotic Pressure]

107. If 250 cm^3 of an aqueous solution containing 0.73 g of a protein A is isotonically mixed with another aqueous solution containing 1.0 g of a protein B, at 298 K, the ratio of the molecular masses of A and B is $\text{_____} \times 10^{-1}$ (the nearest integer). [JEE (Main)-2020]

cups of water and 2 cups of pure milk

cup of water and 2 cups of pure milk

cups of water to 3 cups of pure milk

cup of water to 3 cups of pure milk

freezing point of a 4% aqueous solution is equal to freezing point of 12% aqueous solution of Y. If molecular weight of X is A, then molecular weight of Y is [JEE (Main)-2019]

- A (1) 3A
(2) 3A
(3) 1.9
(4) 4A

Density of solutions are not given before assuming molality to be equal to 'm' and given % as W/V

Molecules of benzoic acid (C_6H_5COOH) dissolve in benzene. 'w/g' of the acid dissolved in 100 g of benzene shows a depression in freezing point equal to 2 K. If the percentage dissociation of the acid to form dimer in the solution is 80, then w isGiven that $K_f = 5 \text{ K kg mol}^{-1}$, Molar mass of benzoic acid = 122 g mol $^{-1}$ [JEE (Main)-2019]

- 1.5 g (1) 2.4 g
1.8 g (2) 4.0 g

Molar depression constant for a solvent is $K \text{ K mol}^{-1}$. The depression in the freezing point of the solvent for 0.03 mol kg $^{-1}$ solution of K_2SO_4 is (Assume complete dissociation of electrolyte) [JEE (Main)-2019]

- 0.36 K (1) 0.18 K
0.12 K (2) 0.24 K

A solution containing 62 g ethylene glycol in 100 g water is cooled to -10°C . If K_f for water = $1.86 \text{ K g mol}^{-1}$, the amount of water (in g) separated as ice is [JEE (Main)-2019]

- 64 (1) 32
16 (2) 48

Which one of the following 0.10 M aqueous solutions will exhibit the largest freezing point depression? [JEE (Main)-2021]

- Glycine (1) $KHSO_4$ (2) $Al_2(SO_4)_3$
Hydrazine (3) Glucose (4) C_6H_5COOH

Which one of the following 0.06 M aqueous solutions has lowest freezing point? [JEE (Main)-2021]

- KI (1) $i=2$
 C_6H_5COOH (2) $Al_2(SO_4)_3$ (3) $i=5$
 K_2SO_4 (4) $i=3$

69. The depression in freezing point observed for a formic acid solution of concentration 0.5 mol L^{-1} is 0.0405°C . Density of formic acid is 1.05 g mL^{-1} .The van't Hoff factor of the formic acid solution is nearly (Given for water $K_f = 1.86 \text{ K kg mol}^{-1}$) [JEE (Main)-2022]

- (1) 0.8 (2) 1.1
(3) 1.9 (4) 2.4

70. Two solutions A and B are prepared by dissolving 1 g of non-volatile solutes X and Y, respectively in 1 kg of water. The ratio of depression in freezing points for A and B is found to be 1 : 4. The ratio of molar masses of X and Y is [JEE (Main)-2022]

- (1) 1 : 4 (2) 1 : 0.25
(3) 1 : 0.20 (4) 1 : 5

In the depression of freezing point experiment

- A. Vapour pressure of the solution is less than that of pure solvent
B. Vapour pressure of the solution is more than that of pure solvent
C. Only solute molecules solidify at the freezing point
D. Only solvent molecules solidify at the freezing point

Choose the most appropriate answer from the options given below: [JEE (Main)-2023]

- (1) A and D only (2) B and C only
(3) A only (4) A and C only

Osmosis and Osmotic Pressure

72. The osmotic pressure of a dilute solution of an ionic compound XY in water is four times that of a solution of 0.01 M $BaCl_2$ in water. Assuming complete dissociation of the given ionic compounds in water, the concentration of XY (in mol L $^{-1}$) in solution is [JEE (Main)-2019]

- (1) 16×10^{-4} (2) 4×10^{-4}
(3) 6×10^{-2} (4) 4×10^{-2}

73. A solution is prepared by dissolving 0.6 g of urea (molar mass = 60 g mol^{-1}) and 1.8 g of glucose (molar mass = 180 g mol^{-1}) in 100 mL of water at 27°C . The osmotic pressure of the solution is

$$(R = 0.08206 \text{ L atm K}^{-1} \text{ mol}^{-1})$$

- (1) 1.64 atm (2) 2.46 atm
(3) 8.2 atm (4) 4.92 atm



74. The size of a raw mango shrinks to a much smaller size when kept in a concentrated salt solution. Which one of the following processes can explain this? [JEE (Main)-2020]

- (1) Osmosis (2) Reverse osmosis
(3) Diffusion (4) Dialysis

Numerical Value Based Questions

[Concentration Terms]

75. The mole fraction of a solute in a 100 molal aqueous solution is $\text{_____} \times 10^{-2}$. (Round off to the Nearest Integer). [Given : Atomic masses : H : 1.0 u, O : 16.0 u]

[Henry's Law]

76. The oxygen dissolved in water exerts a partial pressure of 20 kPa in the vapour above water. The molar solubility of oxygen in water is $\text{_____} \times 10^{-5} \text{ mol dm}^{-3}$. (Round off to the Nearest Integer).[Given : Henry's law constant = K_H
 $= 8.0 \times 10^4 \text{ kPa for O}_2$ Density of water with dissolved oxygen
 $= 1.0 \text{ kg dm}^{-3}$ [JEE (Main)-2021]77. CO_2 gas is bubbled through water during a soft drink manufacturing process at 298 K. If CO_2 exerts a partial pressure of 0.835 bar then x mol of CO_2 would dissolve in 0.9 L of water. The value of x is _____.(Nearest integer)
(Henry's law constant for CO_2 at 298 K is $1.67 \times 10^3 \text{ bar}$) [JEE (Main)-2021]78. A company dissolves 'x' amount of CO_2 at 298 K in 1 litre of water to prepare soda water. $X = \text{_____} \times 10^{-3} \text{ g}$. (nearest integer)(Given : partial pressure of CO_2 at 298 K = 0.835 bar)Henry's law constant for CO_2 at 298 K = 1.67 kbar . Atomic mass of H, C and O is 1, 12, and 16 g mol $^{-1}$, respectively) [JEE (Main)-2022]79. If O_2 gas is bubbled through water at 303 K, the number of millimoles of O_2 gas that dissolve in 1 litre of water is _____.(Nearest integer)
(Given : Henry's Law constant for O_2 at 303 K is 46.82 k bar and partial pressure of $O_2 = 0.920$ bar)(Assume solubility of O_2 in water is too small, nearly negligible) [JEE (Main)-2022]

[Raoult's Law and Ideal and Non-Ideal Solutions]

80. At 300 K, the vapour pressure of a solution containing 1 mole of n-hexane and 3 moles of n-heptane is 550 mm of Hg. At the same temperature, if one more mole of n-heptane is added to this solution, the vapour pressure of the solution increases by 10 mm of Hg. What is the vapour pressure in mm Hg of n-heptane in its pure state? [JEE (Main)-2020]



81. At 363 K, the vapour pressure of A is 21 kPa and that of B is 18 kPa. One mole of A and 2 moles of B are mixed. Assuming that this solution is ideal, the vapour pressure of the mixture is _____ kPa. (Round off to the Nearest Integer)

[JEE (Main)-2021]

82. At 20°C, the vapour pressure of benzene is 70 torr and that of methyl benzene is 20 torr. The mole fraction of benzene in the vapor phase at 20°C above an equimolar mixture of benzene and methyl benzene is $\text{_____} \times 10^{-2}$. (Nearest integer) [JEE (Main)-2021]

[JEE (Main)-2021]

83. A gaseous mixture of two substances A and B, under a total pressure of 0.8 atm is in equilibrium with an ideal liquid solution. The mole fraction of substance A is 0.5 in the vapour phase and 0.2 in the liquid phase. The vapour pressure of pure liquid A is _____ atm. (Nearest integer) [JEE (Main)-2022]

[JEE (Main)-2022]

84. The total pressure observed by mixing two liquids A and B is 350 mm Hg when their mole fractions are 0.7 and 0.3 respectively.

The total pressure becomes 410 mm Hg if the mole fractions are changed to 0.2 and 0.8 respectively for A and B. The vapour pressure of pure A is _____ mm Hg. (Nearest integer). Consider the liquids and solutions behave ideally. [JEE (Main)-2023]

[van't Hoff Factor]

85. In a solvent 50% of an acid HA dimerizes and the rest dissociates. The van't Hoff factor for the acid is $\text{_____} \times 10^{-2}$. (Round off to the Nearest Integer) [JEE (Main)-2021]

[JEE (Main)-2021]