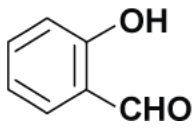
Date: 26/10/2021

Q1. Draw the structure of the compound named 4-methylpent-3-en-2-one.

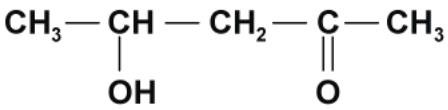
Q2. Write the structure of *p*-Methylbenzaldehyde molecule.

Q3. Write the structure of 3-methyl butanal.

Q4. Write the IUPAC name of the compound:



Q5. Write the IUPAC name of the compound:



Q6. Write the structure of 4-chloropentan-2-one.

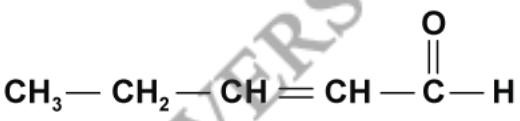
Q7. Write the IUPAC name of the following: $CH_3 — CH_2 — CHO$.

Q8. Write the structure of 2-methylbutanal.

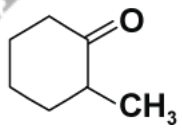
Q9. Draw the structure of 3-methylpentanal.

Q10. Write the IUPAC of $Ph — CH = CH — CHO$.

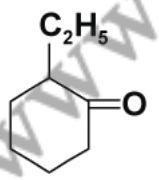
Q11. Write the IUPAC name of the following:



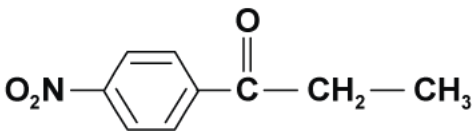
Q12. Write the IUPAC name of the following:



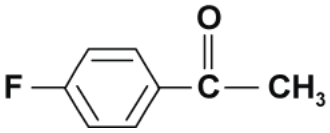
Q13. Write the IUPAC name of the following:



Q14. Write the IUPAC name of the following compound:

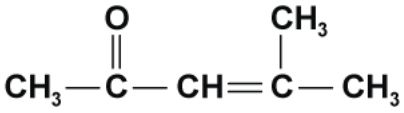


Q15. Write the IUPAC name of the following compound:

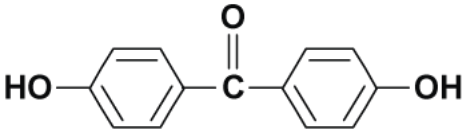


Q16. Draw the structural formula of 1-phenyl Propan-1-one molecule.

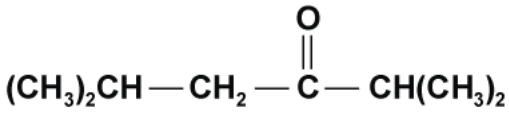
Q17. Write the IUPAC name of:



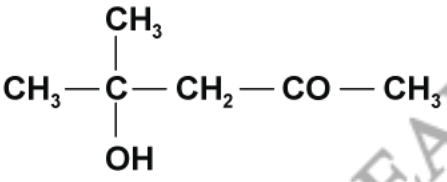
Q18. Write the IUPAC name of the following:



Q19. Write the IUPAC name of the following compound:



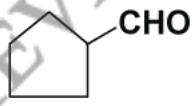
Q20. Write the IUPAC name of the following:



Q21. Write the structural formula of 1-phenylpentan-1-one.

Q22. Write the structure of 3-oxopentanal.

Q23. Write the IUPAC name of the following compound:

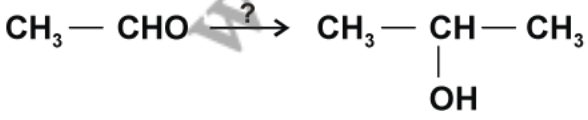


Q24. Account for the folowing: CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN.

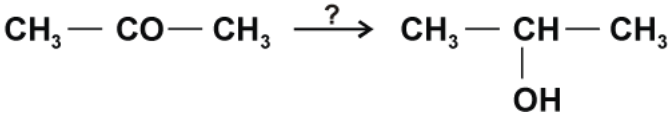
Q25. Draw the structure of the following derivatives:

(a) Propanone oxime (b) Semicarbazone of the CH_3CHO

Q26. Name the reagents used in the following reactions:



Q27. Name the regents used in the following reactions:



Q28. How would you account for the following: The boiling points of aldehydes and ketones are lower than of the corresponding acids.

Q29. Aldehydes and Ketones have lower boiling points than corresponding alcohols. Why?

Q30. How would you convert: Ethanol to acetone.

Q31. How is following obtained?

Benzaldehyde from toluene.

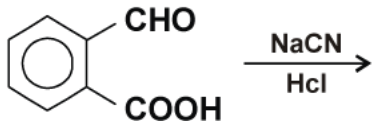
Q32. How will you obtain the following: Benzaldehyde from Phenol.

Q33. How do you convert the following: Ethylne to Ethanal.

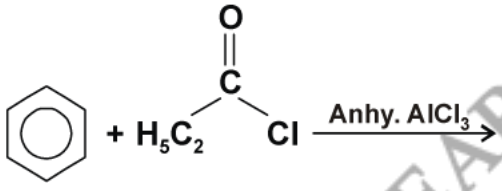
Q34. Write the product in the following reaction:

$$CH_3 - CH = CH - CH_2CN \xrightarrow[2.\ H_2O]{1.\ DIBAL\text{-}H}$$

Q35. Predict the organic product of the following reactions:



Q36. Write the structure of the product formed in the following reaction:



Q37. Arrange the following compounds in an increasing order of their property as indicated: Acetaldehyde, acetone, methyl tert-butyl ketone (reactivity towards HCN)

Q38. Arrange the following compounds in an increasing order of their reactivity in nucleophilic addition reactions: ethanal, propanal, propanone, butanone.

Q39. Give reason: pH of reaction should be carefully controlled while preparing ammonia derivatives of carbonyl compounds.

Q40. Give reason: Aldehydes are more reactive than ketones towards nucleophilic reagents.

Q41. Give simple tests to distinguish between the following pair of compounds: Propanal and Propanone.

Q42. Give simple chemical tests to distinguish between the following pairs of compounds:

(a) Benzaldehyde and benzoic acid. (b) Propanal and propanone.

Q43. Give chemical tests to distinguish between the following pairs of compounds: Benzaldehyde and Acetophenone.

Q44. Give a simple chemical test to distinguish between the following pair of compounds:

CH_3CH_2CHO and $CH_3CH_2COCH_3$

Q45. Distinguish between the following:

$C_6H_5 - COCH$ and $C_6H_5 - CHO$

Q46. Describe how the following conversions can be brought about:Cyclohexanol to cyclohexan-1-one.

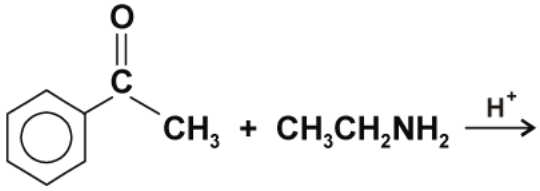
Q47. Write cannizzaro reaction giving an exampe.

Q48. Write chemical equations to illustrate the following name bearing reaction: Cannizzaro's reaction.

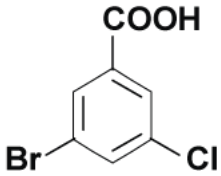
Q49. Illustrate the following name reaction: Wolff-Kishner reduction reaction.

Q50. What is Tollens' reagent? Write one usefulness of this reagent.

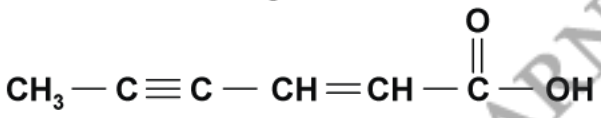
Q51. Predict the products of the following reactions



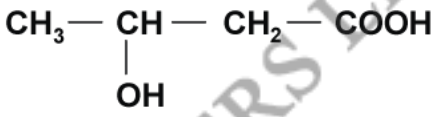
Q52. Write the IUPAC name of:



Q53. Write the IUPAC name of the following:



Q54. Write the IUPAC name of the compound:



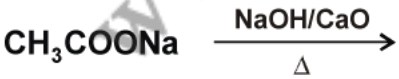
Q55. State chemical tests to distinguish between the following pairs of compounds: Propanal and propanone.

Q56. Give chemical tests to distinguish between Benzaphenone and acetophenone.

Q57. Give simple chemical tests to distinguish between the following pair of compounds: Ethanal and Propanal.

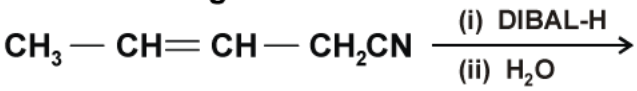
Q58. Give simple chemical tests to distinguish between the following pair of compounds. Propanal and Butan-2-one.

Q59. Predict the products of the following reaction:



Q60. Why carboxylic acid does not give reactions of carbonyl group?

Q61. Write the product in the following reaction:



Q62. Arrange the following in the increasing order of their boiling points.

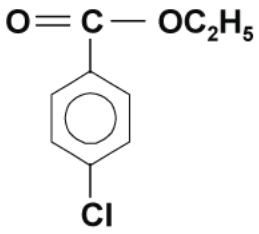
$$CH_3CHO, \quad CH_3COOH, \quad CH_3CH_2OH.$$

Q63. How will you obtain the following: Benzoic from Aniline.

Q64. How will you convert the following: Ethanal to 2-hydroxy propanoic acid.

Q65. How is the following obtained? Benzoic acid from ethyl benzene.

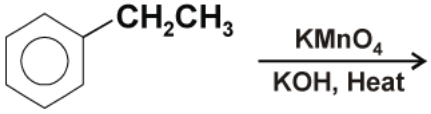
Q66. Write the IUPAC name of the following compound:



Q67. Name the reagents used in the following reaction:

$$C_6H_5 - CH_2 - CH_3 \xrightarrow{?} C_6H_5 - COO^-K^+$$

Q68. Predict the organic products of the following reaction:



Q69. How are the following conversions carried out: Acetic acid to methylamine.

Q70. Arrange the following compounds in increasing order of their acid strengths.

$$(CH_3)_2CHCOOH, \quad CH_3CH_2CH(Br)COOH, \quad CH_3CH(Br)CH_2COOH$$

Q71. How will you bring about the following conversion? Benzoic acid to Benzaldehyde.

Q72. Give simple chemical tests to distinguish between the following pairs of compounds: Benzoic acid and Ethyl benzoate.

Q73. Give simple chemical tests to distinguish between the following pairs of compounds: Benzoic acid and Phenol.

Q74. Distinguish between CH_3COOH and HCOOH.

Q75. How would you convert: Benzoic acid to benzamide.

Q76. Write one chemical equation for each to illustrate the following reaction: Fischer esterification.

Q77. Name the reagent used in the following reaction:

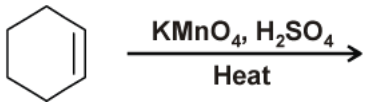
$$CH_3 - COOH \xrightarrow{?} CH_3 - COCl$$

Q78. Give reasons: Chloroacetic acid is stronger than acetic acid.

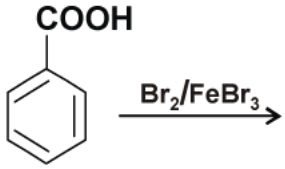
Q79. Write the main product in the following equation:

$$CH_3 - COOH \xrightarrow{PCl_5}$$

Q80. Predict the products of the following reaction:



Q81. Write the products of the following reaction:



Q82. Write the chemical equation to illustrate the following name reaction: Hell-Volhard-Zelinsky reaction.

Q83. Account for the following: Carboxylic acids do not give reactions of carbonyl group.

Q84. Describe the following giving chemical equation: De-carboxylation reaction.

Q85. Write the equations involved in the following reactions:

(a) Stephen reaction. **(b) Etard reaction.**

Q86. Draw the structures of the following:

(a) *p*-Methylbenzaldehyde **(b) 4-Methylpent-3-en-2-one.**

Q87. Write the structure of *A* and *B* in the following reaction:

$$CH_3COCl \xrightarrow{H_2,\ Pd-BaSO_4} A \xrightarrow{H_2N-OH} B$$

Q88. An organic compound *A*, having the formula, C_3H_8O, on treatment with copper at 573 K, gives *B*. *B* does not reduce Fehling's solution but gives a yellow precipitate of the compound *C* with I_2/NaOH. Deduce the structure of *A*, *B* and *C*.

Q89. Describe the following reactions:

(a) Acetylation. **(b) Aldol condensation.**

Q90. A compound '*A*' of molecular formula C_2H_3OCl undergoes a series of reactions as shown below. Write the structure of *A*, *B*, *C*, and *D* in the following reactions:

$$(C_2H_3OCl)\ A \xrightarrow{H_2/Pd-BaSO_4} B \xrightarrow{\text{dil. NaOH}} C \xrightarrow{\text{Heat}} D$$

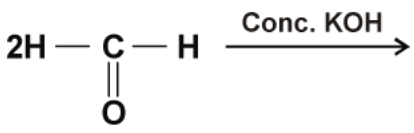
Q91. Predict the products of the following reactions:

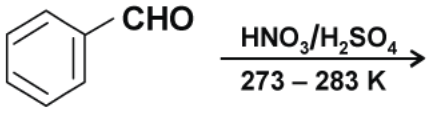
(a) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=O \xrightarrow[\text{(ii) KOH/Glycol, }\Delta]{\text{(i) } H_2N-NH_2} ?$ **(b)** $C_6H_5-CO-CH_3 \xrightarrow{NaOH/I_2} ? + ?$

Q92. Write the products of the following reactions:

(a) $CH_3-\underset{\displaystyle O}{\overset{\displaystyle ||}{C}}-CH_3 \xrightarrow[\text{Conc. HCl}]{Zn-Hg}$ **(b)** $CH_3-\underset{\displaystyle O}{\overset{\displaystyle ||}{C}}-Cl + H_2 \xrightarrow{Pd-BaSO_4} ?$

Q93. Complete the following reactions:

(a) 

(b) 

Q94. Write the chemical equation to illustrate each of the following name reactions:

(a) Rosenmund reduction. (b) Cannizzaro reaction.

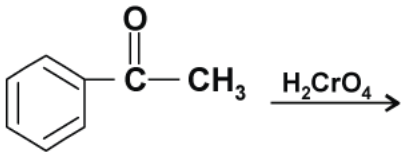
Q95. Account for the following:

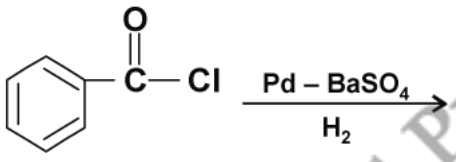
(a) CH_3CHO is more reactive than CH_3COCH_3 towards reaction with HCN.

(b) There are two — NH_2 groups in semicarbazide ($H_2NNHCONH_2$). However, only one is involved in the formation of semicarbazone.

Q96. Explain the mechanism of a nucleophilic attack on the carbonyl group of an aldehyde or a ketone.

Q97. Predict the products of the following reactions:

(a) 

(b) 

Q98. Illustrate the following name reactions giving a chemical equations in each case:

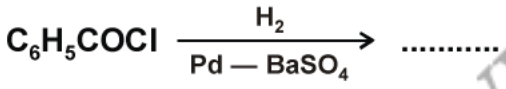
(a) Clemmensen reaction (b) Cannizzaro's reaction

Q99. How would you account for the folowing:

(a) Aldehydes are more reactive than ketones toward nucleophiles.

(b) The aldehydes and ketones undergo a number of a addition reactions.

Q100 Complete each synthesis by giving the missing material, reagent or products:

(a) 

(b) 

Q101 Give a chemical equation for each, illustrate the following processes:

(a) Cannizzaro reaction. (b) Acetylation.

Q102 Write one chemical equation for each to illustrate the following reactions:

(a) Rosenmund's reduction (b) Cannizaro reaction.

Q103 Give chemical test to distinguish between:

(a) Acetaldehyde and Benzaldehyde (b) Propanone and Propanal.

Q104 Give chemical tests to distinguish between:

(a) Propanal and Propanone, (b) Benzaldehyde and Acetophenone.

Q105 Give simple chemical test to distinguish between:

(a) Pentan-2-one and Pentan-3-one. (b) Ethanal and Propanal.

Q106 How would you bring about the following conversions:

(a) Propanone to Propene (b) Bromobenzene to 1-Phenylethanol.

Q107 How will you bring about the following conversions?

(a) Ethanol to 3-Hydroxybutanal. (b) Benzaldehyde to Benzophenone.

Q108 How will you bring about the following conversions?

(a) Ethanal to but-2-enal. (b) Propanone to Propene

Q109 Write the chemical tests to distinguish between the following pairs of compounds:

(a) Acetophenone and Benzophenone (b) Ethanal and Propanal.

Q110 Account for the following: $Cl — CH_2COOH$ is a stronger acid than CH_3COOH.

Q111 (a) Write the product of the following reaction : $CH_3COOH \xrightarrow{Cl_2/P}$.

(b) Give simple chemical tests to distinguish between the following pairs of compounds: Benzaldehyde and benzoic acid.

Q112 Although phenoxide ion has more number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol. Give two reasons.

Q113 Write a suitable chemical equation to complete each of the following transformations:

(a) Butan-1-ol to butanoic acid.

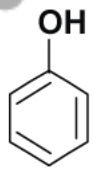
(b) 4-Methylacetophenone to benzene-1,4-dicarboxylic acid.

Q114 Give reasons:

(a) Electrophilic substitution in benzoic acid takes place at meta position.

(b) Carboxylic acids do not give the characteristic reactions of carbonyl group.

Q115 Which acid of each pair shown here would you expect to be stronger?

(a) $F — CH_2 — COOH$ or $Cl — CH_2 — COOH$ (b)  or CH_3COOH

Q116 Arrange the following compounds in an increasing order of their property as indicated:

(a) Benzoic acid, 3,4-dinitrobenzoic acid, 4-methoxybenzoic acid (acid strength).

(b) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)COOH$, $(CH_3)_2CHCOOH$ (acid strength)

Q117 Arrange the following compounds in an increasing order of their indicated property:

(a) Benzoic acid, 4-Nitrobenzoic acid, 3,4-Dinitrobenzoic acid. 4-Methyoxybenzoic acid (acid strength)

(b) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$, $CH_3CH_2CH_2COOH$ (acid strength)

Q118 Write the mechanism of esterification of carboxylic acids.

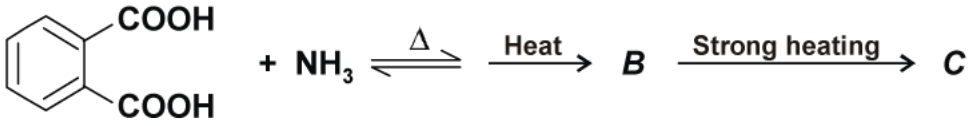
Q119 State reasons for the following:

(a) Monochloroethanoic acid has a higher pK_a value than dichloroethanoic acid.

(b) Ethanoic acid is a weaker acid than benzoic acid.

Q120 Two moles of organic compound '*A*' on treatment with a strong base gives two compound '*B*' and '*C*'. Compound '*B*' on dehydrogenation with Cu gives '*A*' while acidification of '*C*' yields carbosylic acid '*D*' with molecular formula of CH_2O_2. Identify the compounds *A*, *B*, *C* and *D* and write all chemical reactions involved.

Q121 Identify *A*, *B* and *C* in the following sequence of reactions:



Q122 Give chemical tests to distinguish between the following pairs of compounds:

(a) Methyl acetate and ethyl acetate. (b) Benzaldehyde and benzoic acid.

Q123 (a) Giving a chemical equation for the following process: Decarboxylation.

(b) State chemical tests to distinguish between the following pairs of compounds: Phenol and Benzoic acid.

Q124 Describe how the following conversions can be brought about:

(a) Ethylbenzene to benzoic acid. (b) Bromobenzene to benzoic acid.

Q125 How will you carry out the following conversions?

(a) Acetylene to Acetic acid. (b) Toluene to *m*-nitrobenzoic acid.

Q126 How will you convert the following:

(a) Propanone to Propan-2-ol. (b) Ethanal to 2-Hydroxypropanoic acid.

Q127 An organic compound (*A*) which has characteristic odour, on treatment with NaOH forms two compounds (*B*) and (*C*). Compound oxidation with CrO_3 gives back compound (*A*). Compound (*C*) is the sodium salt of the acid. Compound (*C*) when heated with soda lime yields and aromatic hydrocarbon (*D*). Deduce the structures of (*A*), (*B*), (*C*) and (*D*). Write chemical equations for all reactions taking place.

Q128 Write the products formed when ethanal reacts with the following reagents:

(a) CH_3MgBr and then H_3O^+. (b) Zn — Hg/conc. HCl.

(c) C_6H_5CHO in the presence of dilute NaOH.

Q129 (a) Write the chemical equations to illustrate the following name reactions:

(i) Resenmund reduction (ii) Cannizzaro's reaction

(b) Out of CH_3CH_2 — CO — CH_2 — CH_3 and CH_3CH_2 — CH_2 — CO — CH_3, which gives iodoform test?

Q130(a) Write the chemical reaction involved in Wolff-Kishner reduction.

(b) Arrrange the following the increasing order of their reacticity towards nucleophilic addition reaction.

$$C_6H_5COCH_3, \quad CH_3 — CHO, \quad CH_3COCH_3$$

(c) *A* and *B* are two functional isomers of compound C_2H_6O. On heating with NaOH and I_2, isomers *B* forms yellow precipitate of iodoform whereas isomer *A* does not form any precipitate. Write the formulae of *A* and *B*.

Q131 Write the structures of the main products when acetone ($CH_3 — CO — CH_3$) reacts with the following reagents:

(a) $Zn — Hg$/conc. HCl **(b)** $H_2N — NHCONH_2/H^+$ **(c)** CH_3MgBr and then H_2O^+

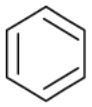
Q132(a) Write the chemical equation for the reaction involved in Cannizzaro reaction.

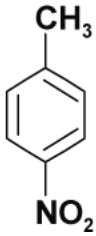
(b) Draw the structure of the semicarbazone of ethanal.

(c) How can you distinguish between propanal and propanone?

Q133 An organic compound with molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's regent and undergoes Cannizzaro's reaction. On vigorous oxidation it gives 1,2-benzenedicarboxylic acid. Identify the compound.

Q134 Write the structures of the main products of the following reactions:

(a)  $+ C_6H_5COCl \xrightarrow[CS_2]{\text{Anhydrous } AlCl_3}$ **(b)** $H_3C — C \equiv C — H \xrightarrow{Hg^{2+},\ H_2SO_4}$

(c)  $\xrightarrow[2.\ H_2O]{1.\ CrO_2Cl_2}$

Q135 How will you bring about the following conversions?

(a) Propanone to propane. **(b)** Benzoyl chloride to benzaldehyde

(c) Ethanal to but-2-enal.

Q136 How will you convert ethanal into the following compounds? Give the chemical equations involved.

(a) $CH_3 — CH_3$. **(b)** $CH_3 — \underset{\displaystyle OH}{\underset{|}{CH}} — CH_2 — CHO$. **(c)** CH_3CH_2OH.

Q137 An organic compound contains 69.77% carbon, 11.63% hydrogen and the rest is oxygen. The molecular mass of the compound is 86. It does not reduce Tollens' reagent but forms an addition compound with sodium hydrogen sulphite and gives a positive iodoform test. On vigorous oxidation it gives enthanoic and propanoic acids. Deduce the possible structure of the organic compound.

Q138 An organic compound *A* has the molecular formula $C_8H_{16}O_2$. It gets hydrolysed with dilute sulphuric acid and gives a carboxylic acid *B* and an alcohol *C*. Oxidation of *C* with chromic acid also produced *B*. *C* on dehydration reaction gives but-1-ene. Write equations for the reactions involved.

Q139 An organic compound with molecular formula $C_5H_{10}O$ does not reduce Tollens' reagent but forms an addition compound with sodium hydrogen sulphite and gives a positive iodoform test. On vigorous oxidation, it gives ethanoic acid and propanoic acid. Identify the compound and write all chemical equations for the reactions.

Q140 An organic compound (*A*) with molecular formula C_8H_8O forms an orange red precipitate with 2,4-DNP regent and gives yellow precipitate on heating with I_2 and NaOH. It neither reduces Tollens' reagent nor Fehling's reagent, nor does it decolourise bromine water or Baeyer's reagent. On drastic oxidation with chromic acid, it gives a carboxylic acid (*B*) having molecular formula $C_7H_6O_2$. Identify the compounds (*A*) and (*B*) and explain the reactions involved.

Q141 How will you bring about the following conversions?

(a) Ethanol to acetone

(b) Benzene to acetophenone

(c) Benzoic acid to benzaldehyde

Q142 How are the following conversions carried out:

(a) Ethyl cyanide to ethanoic acid.

(b) Butan-1-ol to butanoic acid.

(c) Methylbenzene to benzoic acid.

Write Chemical equations for the involved reactions.

Q143 How are the following conversions carried out?

(a) Ethyl cyanide to ethanoic acid.

(b) Butan-1-ol to butanoic acid.

(c) Benzoic acid to m-bromobenzoc acid.

Q144 (a) Give a plausible explanation for each one of the following:

(i) There are two — NH_2 groups in semicarbazide. However, only one such group is involved in the formation of semicarbazones.

(ii) Cyclohexanone forms cyanohydrins in good yield but 2,4,6-trimethylcyclohexanone does not.

(b) An organic compound with molecular formula $C_9H_{10}O$ forms 2,4-DNP derivative, reduces Tollen's reagent and undergoes Cannizzaro's reaction. On bigorous oxidation it gives 1,2-benzene-di-carboxylic acid. Identify the compound.

Q145 Identify *A*, *B*, *C*, *D* and *E* in following sequence of reactions:

$$A \xrightarrow{Cl_2} CHCl_3 \xrightarrow{NaOH} B \xrightarrow{C_2H_5COCl} C \xrightarrow{C_6H_6/AlCl_3} D + E$$

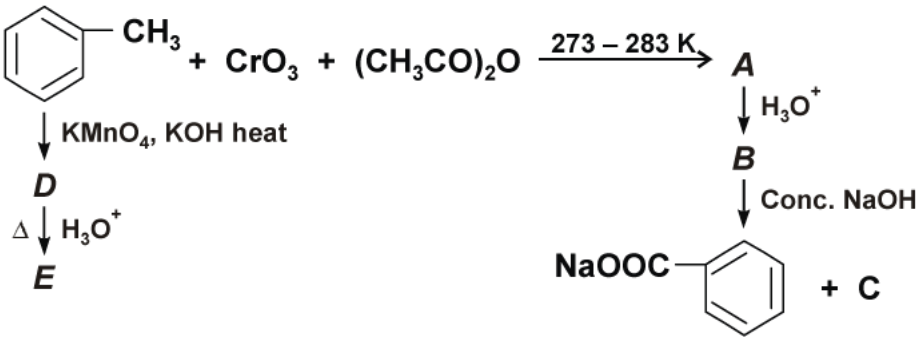
Q146 (a) Illustrate the following name reactions by giving example:

(i) Cannizzaro's reaction. (ii) Clemmensen reduction.

(b) An organic compound *A* contains 69.77% carbon, 11.63% hydrogen and rest oxygen. The molecular mass of the compound is 86. It does not reduce Tollen's reagent but form an addition compound with sodium hydrogen sulphite and gives positive iodoform test. On vigorous oxidation it gives enthanoic and propanoic acids. Derive the possible structure of compound *A*.

Q147 A ketone *A* (C_4H_8O), which undergoes a haloform reaction gives compound *B* on reduction. *B* on heating with sulphuric acid gives a compound *C* which forms monozonide *D*. *D* on hydrolysis in presence of zinc dust gives only acetaldehyde *E*. Identify *A*, *B*, *C*, *D* and *E*. Write the reactions involved.

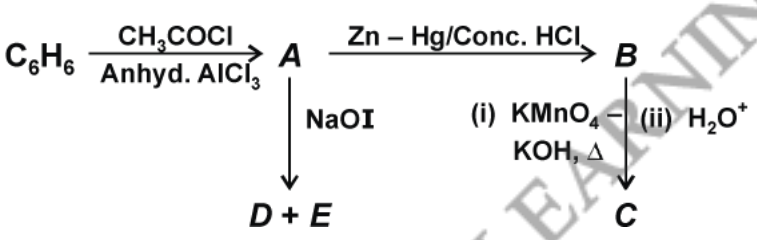
Q148 Identify *A* and *E* in the following series of reactions:



Q149 An organic compound (*A*) on treatment with acetic acid in the presence of sulphuric acid produces an ester (*B*). (*A*) on mild oxidation gives (*C*). (*C*) with 50% KOH followed by acidification with dilute HCl generates (*A*) and (*D*). (*D*) with PCl_5 followed by reaction with ammonia gives (*E*). (*E*) on dehydration produces hydrocyanic acid. Identify the compounds *A*, *B*, *C*, *D* and *E*.

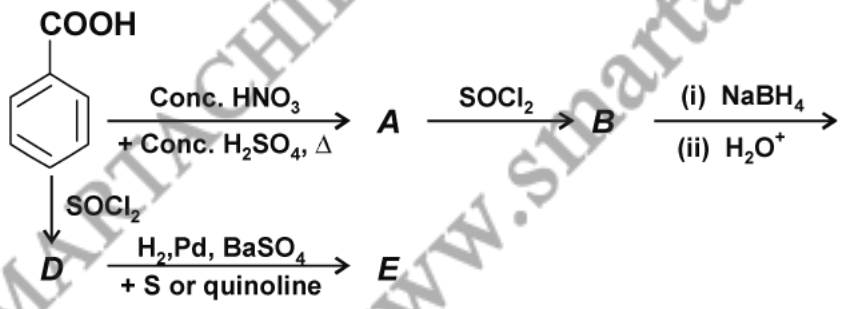
Q150 An organic compound (*A*) on treatment with ethyl alcohol gives a carboxylic acid (*B*) and compound (*C*). Hydrolysis of (*C*) under acidified conditions gives (*B*) and (*D*). Oxidation of (*D*) with $KMnO_4$ also gives (*B*). (*B*) on heating with $Ca(OH)_2$ gives (*E*) having molecular formula C_3H_6O. (*E*) does not give Tollen's test and does not reduce Fehling's solution but forms a 2,4-dinitrophenylhydrazone. Identify (*A*), (*B*) (*C*), (*D*) and (*E*).

Q151 Write the structures of *A*, *B*, *C*, *D* and *E* in the following reactions:

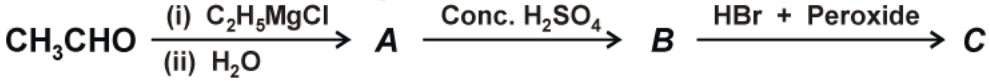


Q152 An organic compound *A* (C_3H_6O) is resistant to oxidation but forms compound *B* (C_3H_8O) on reduction. *B* reacts with HBr to form the compound *C*. *C* with Mg forms Grignard reagent *D* which reacts with *A* to form a product which on hydrolysis gives *E*. Identify *A* and *E*.

Q153 Identify *A* to *E* in the following reactions:



Q154 (a) Idendity *A*, *B* and *C* in the following sequence of reactions:

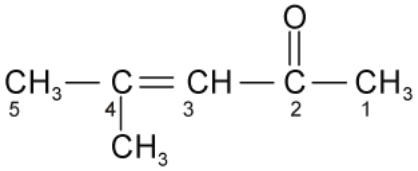


(b) Predict the structures of the products formed when benzaldehyde is treated with

(i) Conc. NaOH (ii) HNO_3/H_2SO_4 (at 273 – 383 K)

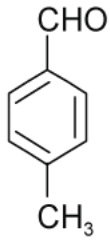
Date: 26/10/2021

S1.



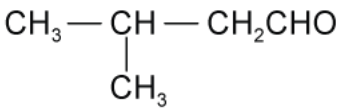
4-Methylpent-3-en-2-one

S2.



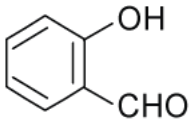
p-Methylbenzaldehyde

S3.



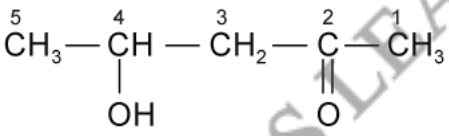
3-Methylbutanal

S4.



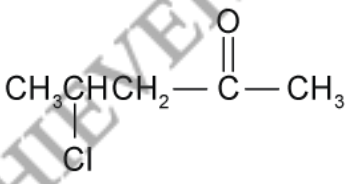
2-Hydroxybenzaldehyde

S5.



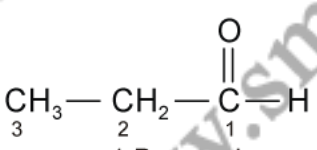
4-Hydroxypentan-2-one

S6.



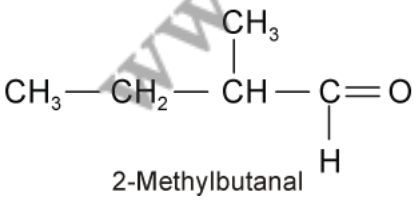
4-Chloropentan-2-one

S7.



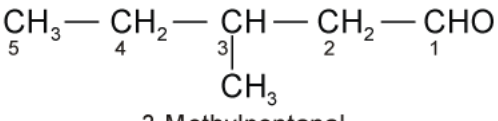
1-Propanal

S8.



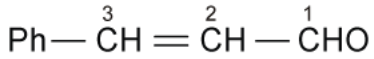
2-Methylbutanal

S9.



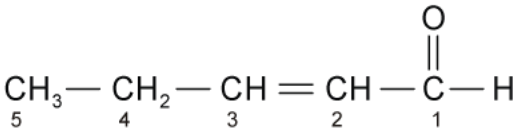
3-Methylpentanal

S10.



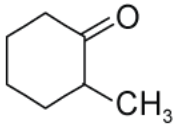
3-Phenylprop-2-enal

S11.



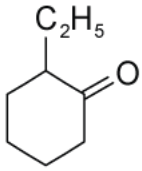
Pent-2-enal

S12.



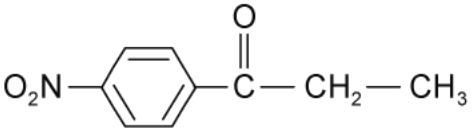
2-Methylchclohexanone

S13.



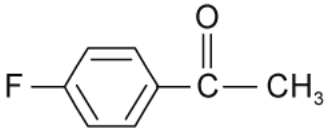
2-Ethylcyclohexanone

S14.



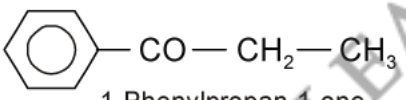
1-(4-nitrophenyl)propan-1-one

S15.



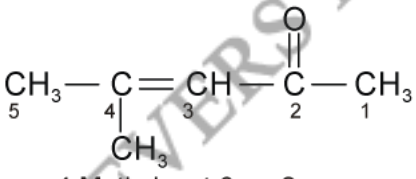
4-Fluoroacetophenone

S16.



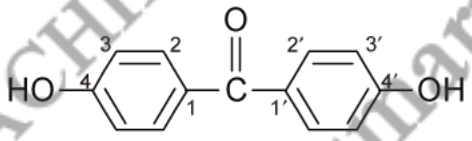
1-Phenylpropan-1-one

S17.



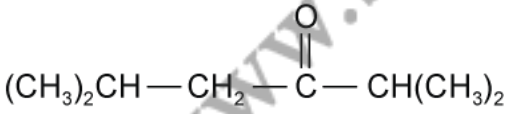
4-Methylpent-3-en-2-one

S18.



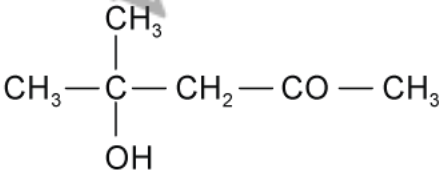
4,4′-dihydroxybenzophenone

S19.



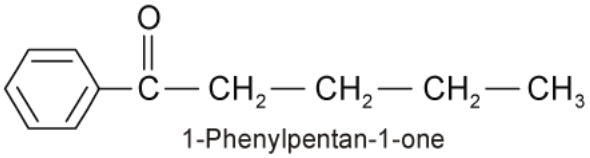
2,5-dimethylhexan-3-one

S20.



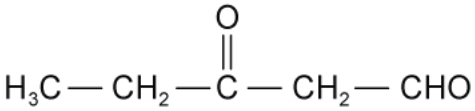
4-Hydroxy-4-Methylpentan-2-one

S21.



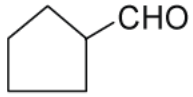
1-Phenylpentan-1-one

S22.



3-Oxopentanal

S23.

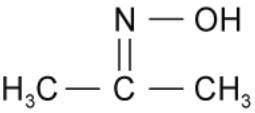


Cyclopentanecarbaldehyde

S24. It is a nucleophilic addition reaction, in which CN^- acts as a nucleophile. CH_3CHO undergoes nucleophilic addition reactions faster than CH_3COCH_3 as in CH_3COCH_3 there are two electron releasing methyl groups attached to the carbonyl carbon that hinders the approach of nucleophile to carbonyl carbon and reduce the electrophilicity of the carbonyl group whil in CH_3CHO, there is only one methyl group attached to carbonyl carbon.

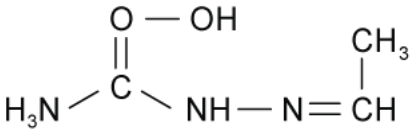
S25.

(a)



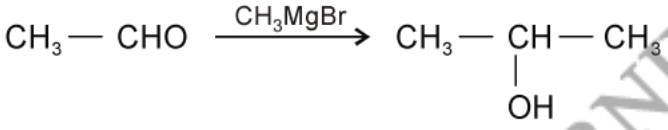
2-Propanone oxime

(b)



Semicarbazone

S26.

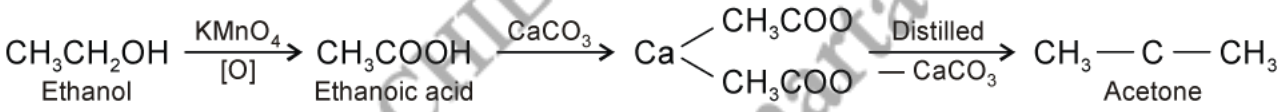


S27. Lithium aluminium hydride ($LiAlH_4$).

S28. The boiling points of aldehydes and ketones are lower than that of corresponding alcohols and acids due to absence of intermolecular H-bonding in aldehydes and ketonses.

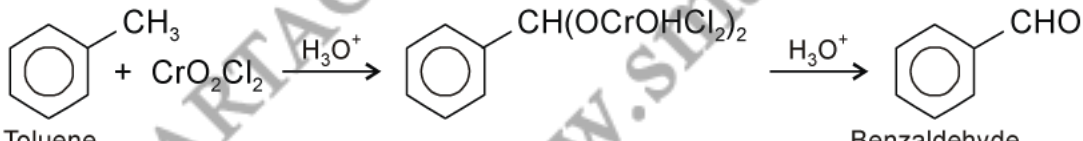
S29. The boiling points of aldehydes and ketones are lower than that of corresponding alcohols and acids due to absence of intermolecular H-bonding in aldehydes and ketonses.

S30. Ethanol to acetone:



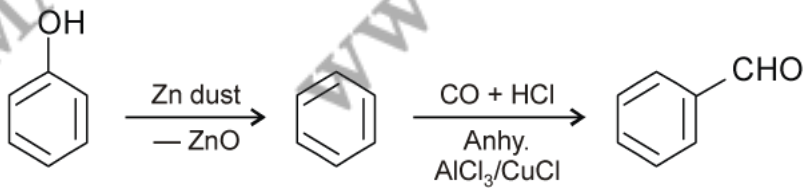
Ethanol — Ethanoic acid — Acetone

S31.

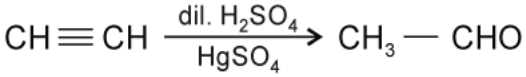


Toluene — Benzaldehyde

S32.

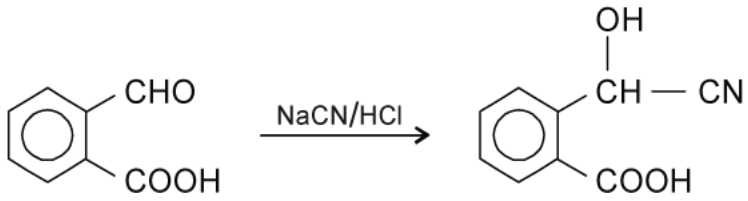


S33. Ethylne to Ethanal:

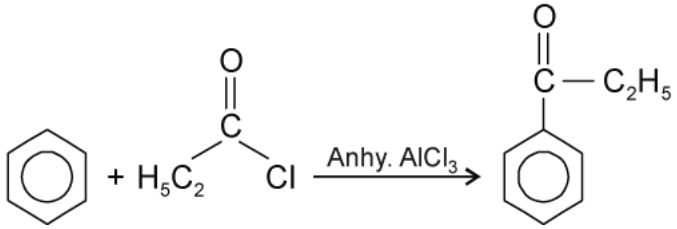


S34. $CH_3 - CH = CH - CH_2CN \xrightarrow[2.\ H_2O]{1.\ DIBAL\text{-}H} CH_3 - CH = CH - CH_2CHO$

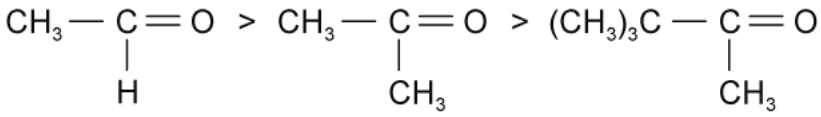
S35.



S36.



S37.



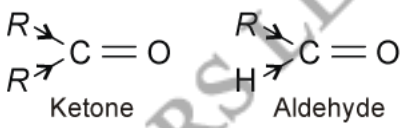
S38. Butanone < Propanone < Propanal < Ethanal.

S39. In strongly acidic medium ammonia derivatives being basic will react with acids and will not react with carbonyl compound. In basic medium, OH^- will attack carbonyl group.

Therefore, pH of a reaction should be carefully controlled.

S40. Ketones are less reactive than aldehydes towards nucleophilic addition reactions because:

The two electron releasing alkyl groups decrease the magnitude of positive charge on carbonyl carbon and make it less susceptible to nucleophilic attack.



The two bulkier alkyl groups hinder the approach of the nucleophile to the carbonyl carbon. This is called steric factor.

S41. Propanal and propanone can be distinguished by their reaction with Tollens' reagent.

Propanal will form the silver mirror, but propanone does not react.

S42. (a) Benzaldehyde and benzoic acid can be distinguished by sodium bicarbonate test.

Benzoic acid will give effervescence with $NaHCO_3$ but benzaldehyde will not react.

(b) Propanal and propanone can be distinguished by their reactions with Tollens' reagent.

Propanal will form the silver mirror, but propanone does not react.

S43. Benzaldehyde and acetophenone can be distinguished by Tollens' test.

Benzaldehyde will form silver mirror, on treatment with Tollens' reagent whereas acetophenone will not show Tollens' Test.

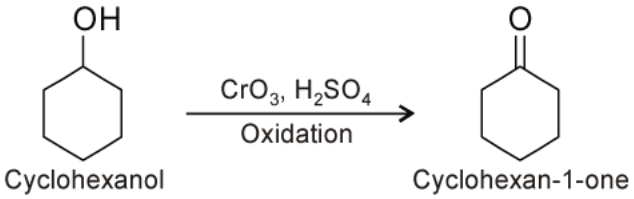
S44. Propanal and propanone can be distinguished by their reaction with Tollens' reagent.

Propanal will form the silver mirror, but propanone does not react.

S45. Benzaldehyde and acetophenone can be distinguished by Tollens' test.

Benzaldehyde will form silver mirror, on treatment with Tollens' reagent whereas acetophenone will not show Tollens' Test.

S46.



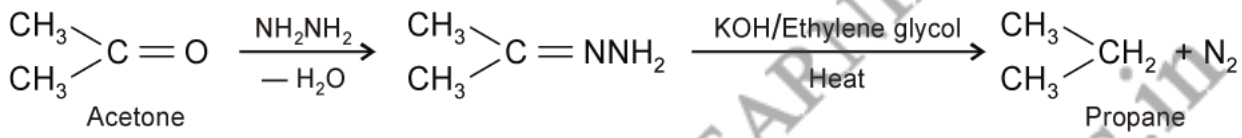
S47. Cannizzaro's reaction: Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

S48. Cannizzaro's reaction: Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

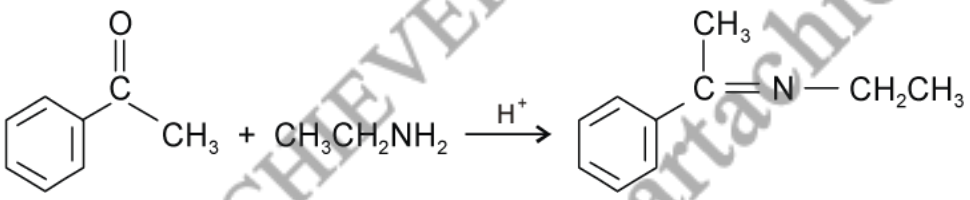
S49. Wolff-Kishner reduction reaction: The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with hydrazine followed by heating with potassium hydroxide in a high boiling solvent such as ethlene glycol.



S50. Tollens' regent is an ammoniacal silver nitrate solution.

Tollens' regent is used to test an aldehyde. Both aliphatic and aromatic aldehydes reduce Tollens' reagent and give silver mirror.

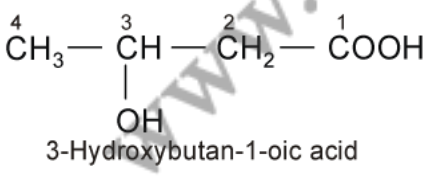
S51.



S52. 3-Bromo-5-chloro Benzoic acid.

S53. Hex-2-en-4yn-oic acid.

S54.



S55. Propanal reduces Tollen's reagent into silver mirror while propanone does not gives this test.

$$\underset{\text{Propanal}}{CH_3CH_2CHO} + 2[Ag(NH_3)_2]^+ + 2OH^- \longrightarrow \underset{\text{Tollen's reagent}}{CH_3CH_2COONH_4} + \underset{\text{Silver mirror}}{2Ag} + H_2O + 2NH_4$$

S56. Acetophenone and benzophenone can be distinguished by iodoform test.

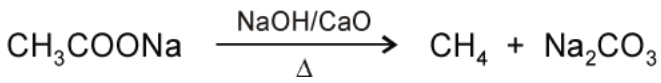
Acetophenone will give the yellow precipitate of iodoform, but benzophenone will not react.

S57. Ethanal and propanal can be distinguished by iodoform test.

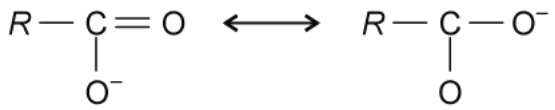
Yellow precipitate of iodoform will be formed form ethanal on heating with iodine and sodium hydroxide solution.

S58. Propanal and Butan-2-one can be distinguished by their reactions with tollen's reagent. Propanal will form the silver mirror, but Butan-2-one does not react.

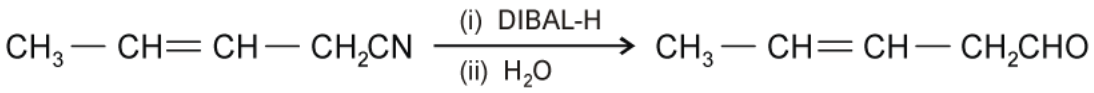
S59.



S60. The carbonyl group in — COOH is inert and does not show nucleophilic addition reaction like carbonyl compound. It is due to resonance stabilisation of carboxylate ion:



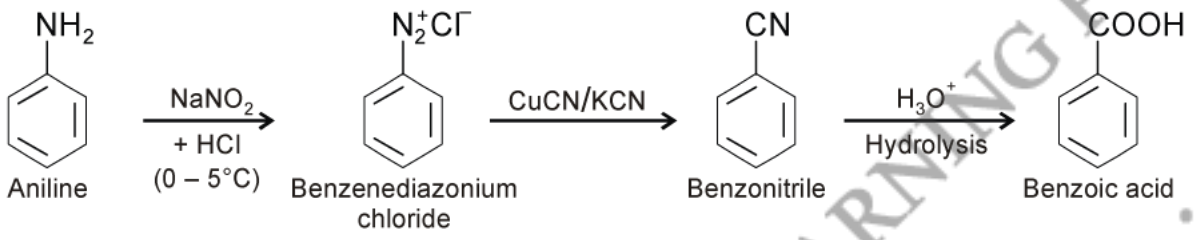
S61.



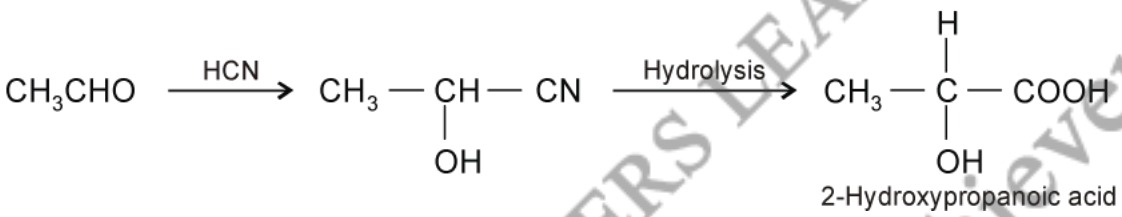
S62. Increasing order of boiling point:

$$CH_3 — CHO < C_2H_5OH < CH_3 — COOH.$$

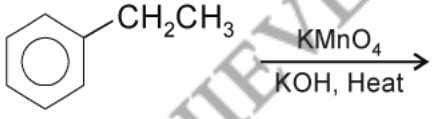
S63.



S64.



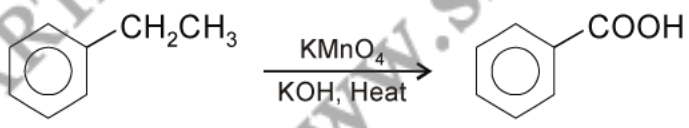
S65.



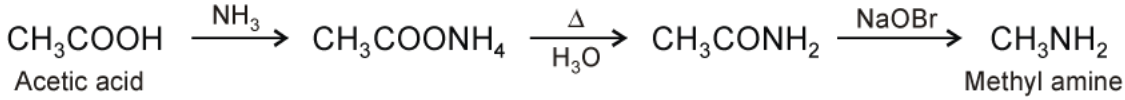
S66. Ethyl-4-chlorobenzoate.

S67. Alkaline potassium permanganate ($KMnO_4$, KOH)

S68.



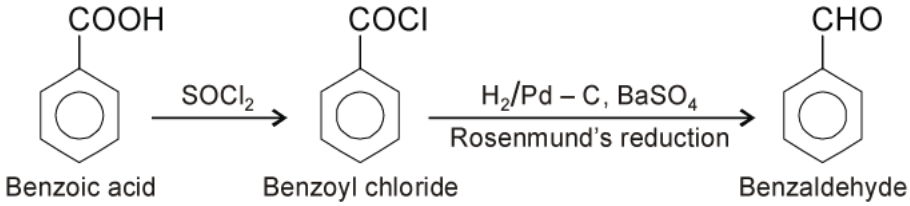
S69. Acetic acid to methylamine:



S70. We know that + I-effect decreases while – I-effectincreases the acid strength of carboxylic acids. The overall acid strength increase in the order.

$$(CH_3)_2CHCOOH < CH_3CH(Br)CH_2COOH < CH_3CH_2CH(Br)COOH.$$

S71.



S72. Benzoic acid and ethyl benzoate can be distinguished by their reactions with sodium bicarbonate solution. Benzoic acid will give effervescence with $NaHCO_3$.

S73. Phenol and benzoic acid can be distinguished by their reactions with sodium bicarbonate solution.

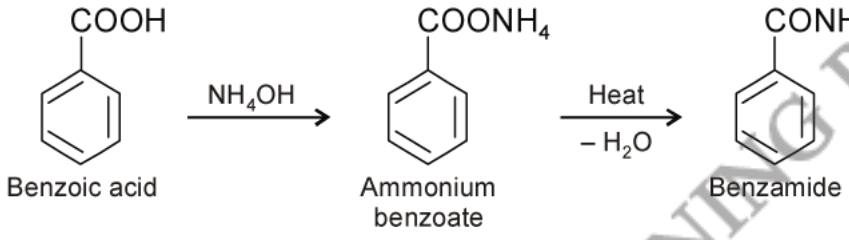
Benzoic acid will give effervescence with $NaHCO_3$ but phenol will not react.

S74. Add Tollens' reagent to formic acid and warm. Silver mirror is formed.

$$\underset{\text{Formic acid}}{HCOOH} + 2(Ag(NH_3)_2]^+ + 2OH^- \xrightarrow{\text{Warm}} \underset{\text{Silver mirror}}{2Ag} + CO_2 + 2NH_3 + 2NH_4OH$$

Acetic acid does not give this test.

S75. Benzoic acid to benzamide:



S76. Fischer esterification:

$$RCOOH + R'OH \rightleftharpoons R'COOR' + H_2O$$

S77.

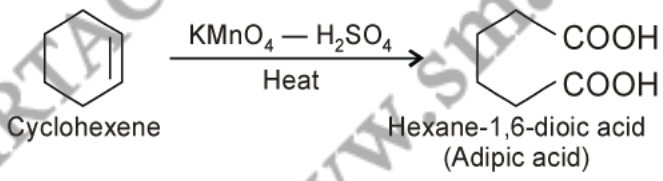
$$CH_3 - COOH \xrightarrow{PCl_5} CH_3 - COCl + POCl_3 + HCl$$

S78. Chloroacetic acid has lower pK_a value than acetic acid; 'Cl' in chloroacetic acid shows $-I$ effect, it creates less electron density on oxygen of carboxylic acid. Thus, release of proton becomes easier. In case of acetic acid, the state of affair is just opposite. Hence, chloroacetic acid is stronger than acetic acid.

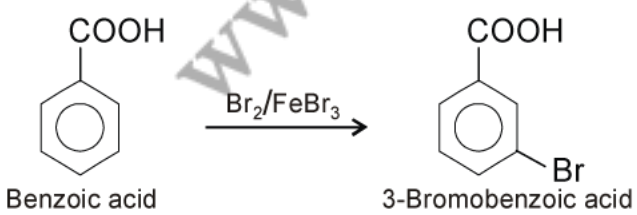
S79.

$$CH_3 - COOH \xrightarrow{PCl_5} CH_3 - COCl + POCl_3 + HCl$$

S80.



S81.



S82. Hell-Volhard-Zelinsky reaction: Carboxylic acids react with chlorine or bromine in the presence of phosphorous to give compounds in which α-hydrogen atom is replaced by halogen atom.

$$\underset{\text{Acetic acid}}{CH_3COOH} + Cl_2 \xrightarrow{\text{Red P}} \underset{\text{Chloroacetic acid}}{ClCH_2-COOH} + HCl$$

$$ClCH_2-COOH + Cl_2 \xrightarrow{\text{Red P}} \underset{\text{Dichloroacetic acid}}{Cl_2CHCOOH} + HCl$$

$$Cl_2CHCOOH + Cl_2 \xrightarrow{\text{Red P}} \underset{\text{Trichloroacetic acid}}{Cl_3CCOOH} + HCl$$

S83. In carboxylic acid C = O is in resonance and not available for reaction.

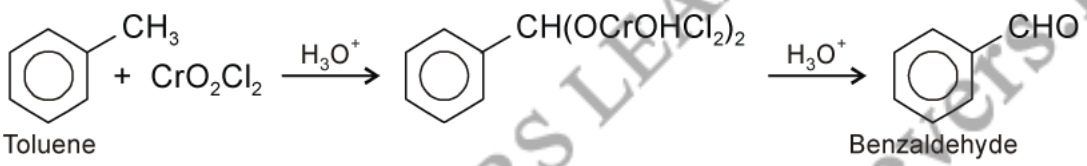
$$RCOOH \rightleftharpoons RCOO^- + H^+$$

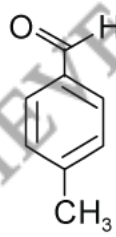
$$RCOO^- \longrightarrow R-C(=O)-O^- \longleftrightarrow R-C(-O^-)=O$$

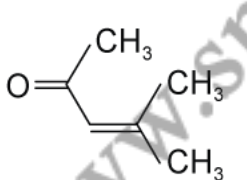
S84. De-carboxylation reaction: Sodium or potassium salt of carboxylic acids on heating with soda lime (NaOH and CaO), loses a molecule of carbon dioxide and alkanes are obtained as products.

$$R-\overset{\overset{O}{\|}}{C}-O^-Na^+ + NaOH \xrightarrow{CaO} R-H + Na_2CO_3$$

S85. (a) $\underset{\text{Alkane nitrile}}{R-C\equiv N} + SnCl_2 + HCl \longrightarrow \underset{\text{Imaine}}{R-C(=NH)} \xrightarrow{H_2O^+} R-CHO + NH_3$

(b) 

S86. (a) *p*-Methylbenzaldehyde: 

(b) 4-Methylpent-3-en-2-one: 

S87. $CH_3COCl \xrightarrow{H_2,\ Pd-BaSO_4} \underset{\text{A (Ethanal)}}{CH_3-\overset{\overset{H}{|}}{C}=O} \xrightarrow{H_2N-OH} \underset{\text{B (Ethanal oxime)}}{CH_3-\overset{\overset{H}{|}}{C}=N-OH}$

S88. Compound *B* gives positive iodoform test, it means it contains $-COCH_3$ (methyl ketone) group *i.e.*, it is a ketone. Moreover, *B* is obtained by the oxidation of *A*, thus *A* must be a 2 alcohol. (As only 2 alcohol give ketones on oxidation with Cu at 573 K. Hence, the structure of compound *A* is $RCH(OH)CH_3$. Comparing with the given molecular formula gives $R = CH_3$.

Thus, compound *A* is $CH_3CH(OH)CH_3$ (Propan-2-ol)

The reaction are as follows:

$$CH_3CH(OH)CH_3 \xrightarrow[574\ K]{Cu} CH_3-C(=O)-CH_3$$

(*A*) Acetone (*B*)

$$\text{Acetone} \xrightarrow[\text{Solution}]{\text{Fehling}} \text{No reaction}$$

$$CH_3COCH_3 + 3I + 4NaOH \longrightarrow CH_3COONa + 3NaI + \underset{\text{Iodoform}\ (C)}{CHI_3\downarrow} + 3H_2O$$

Thus, $A = CH_3CH(OH)CH_3$, $B = CH_3COCH_3$, $C = CH_3$.

S89.

(a) **Acetylation:** Introduction of acetyl group $\left(-\overset{O}{\overset{\|}{C}}-CH_3\right)$ in alcohols, phenols or amines is called their acetylation.

(b) **Aldol condensation:** Two molecules of an aldehyde or ketones having at least one α-hydrogen atom condense in the presence of a dilute alkali to give β-hydroxyaldehyde or β-hydroxyketone which upon heating give α,β-unsaturated aldehyde or ketone

$$CH_3-\overset{O}{\overset{\|}{C}}-H + HCH_2CHO \xrightarrow{\text{dil. NaOH}} CH_3-\underset{H}{\overset{OH}{\overset{|}{\overset{\|}{C}}}}-CH_2CHO \longrightarrow CH_3-\underset{H}{C}=CH-CHO$$

Ethanal Aldol

S90.

$$CH_3-\overset{O}{\overset{\|}{C}}-Cl \xrightarrow{H_2/Pd-BaSO_4} CH_3-\overset{O}{\overset{\|}{C}}-H \xrightarrow{\text{dil. NaOH}} CH_3-\underset{OH}{CH}-CH_2-\overset{O}{\overset{\|}{C}}-H \xrightarrow{\Delta} CH_3-CH=CH-\overset{O}{\overset{\|}{C}}-H$$

(*A*) (*B*) (*C*) (*D*)

S91. (a) $CH_3-\underset{CH_3}{C}=O \xrightarrow{\text{(i) } H_2N-NH_2} \underset{H_3C}{\overset{H_3C}{>}}C=NNH_2 \xrightarrow{\text{(ii) KOH/Glycol, } \Delta} \underset{H_3C}{\overset{H_3C}{>}}CH_2 + N_2$

(b) $C_6H_5-CO-CH_3 \xrightarrow{NaOH/I_2} \underset{\text{Iodoform}}{CHI_3\downarrow} + C_6H_5COONa$

S92.

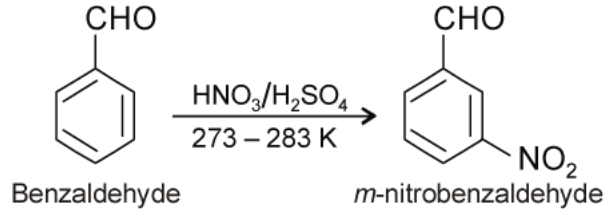
(a) $CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \xrightarrow[\text{Conc. HCl}]{Zn-Hg} CH_3-CH_2-CH_3$

Acetone — Propane

(b) $CH_3\overset{\overset{O}{\|}}{C}-Cl \xrightarrow[Pd-BaSO_4]{H_2} CH_3CHO$

S93.

(a) $2H-\overset{\overset{O}{\|}}{C}-H + \text{Conc. KOH} \longrightarrow \underset{\text{Methanol}}{CH_3OH} + \underset{\text{Potassium formate}}{HCOO^-K^+}$

(b) 

Benzaldehyde — *m*-nitrobenzaldehyde

S94. (a) **Rosenmund reduction:**

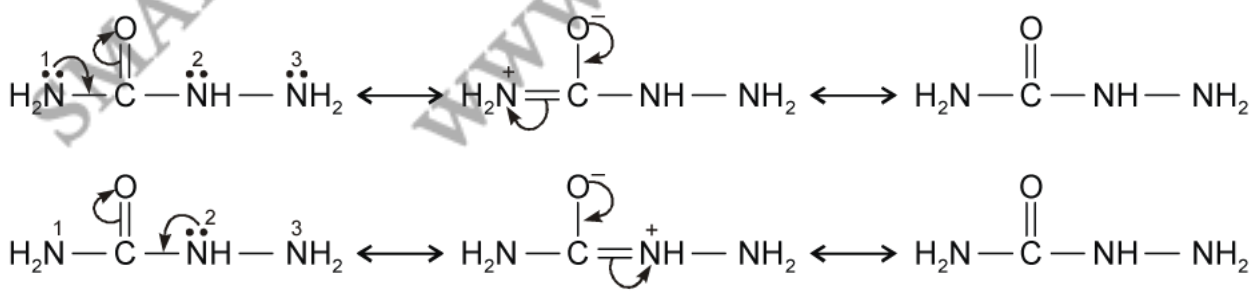
$\underset{\substack{\text{Ethanoyl chloride}\\\text{(Acetyl chloride)}}}{CH_3COCl} + H_2 \xrightarrow[\text{Boiling xylene}]{Pd/BaSO_4,\ S} \underset{\substack{\text{Ethanal}\\\text{(Acetaldehyde)}}}{CH_3CHO} + HCl$

(b) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$

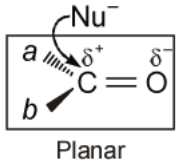
S95. (a) It is a nucleophilic addition reaction, in which CN^- acts as a nucleophile. CH_3CHO undergoes nucleophilic addition reactions faster than CH_3COCH_3 as in CH_3COCH_3 there are two electron releasing methyl groups attached to the carbonyl carbon that hinders the approach of nucleophile to carbonyl carbon and reduce the electrophilicity of the carbonyl group whil in CH_3CHO, there is only one methyl group attached to carbonyl carbon.

(b) Semicarbazide has the following resonance structures arising due to the electron withdrawing nature of the O atom.

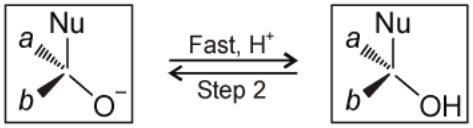


Lone pairs of N-1 and N-2 are involved in conjugation with $>C=O$ group while that of N-3 is not involved in resonance thus, it is involved in the formation of semicarbazone.

S96. Mechanism of nucleophilic addition reactions: Nucleophile attacks from the top face:



Planar



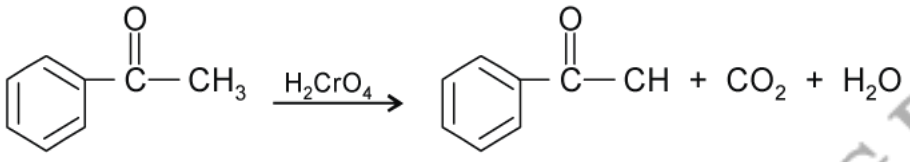
Tetrahedral intermediate Addition product

A nucleophile attacks the electrophilic carbon atom from a direction perpendicular to the plane of sp^2 hybridised orbital of carbonyl carbon. The hybridisation of carbon changes from sp^2 to sp^3 in this process and a tetrahedral alkoxide intermediate is produced.

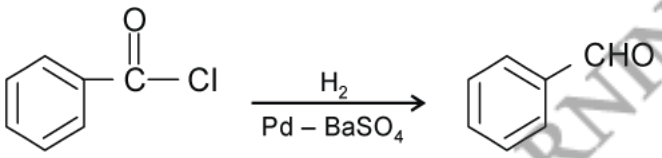
This intermediate captures a proton from the reaction medium to give the electrically neutral product. The net result is addition of Nu^- and H^+ across the carbon oxygen double bond.

S97.

(a)

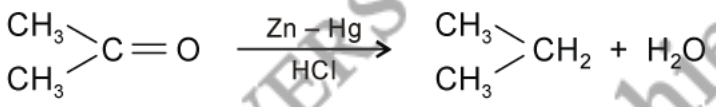


(b)



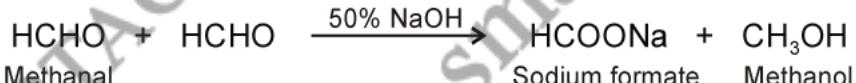
Benzoyl Chloride Benzaldehyde

S98. (a) **Clemmensen reaction:** The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with zinc amalgam and concentrated hydrochloric acid.



Propanone Propane

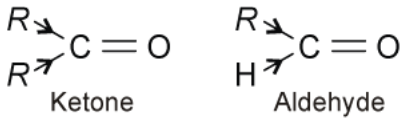
(b) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.



Methanal Sodium formate Methanol

S99. (a) Ketones are less reactive than aldehydes towards nucleophilic addition reactions because:

The two electron releasing alkyl groups decrease the magnitude of positive charge on carbonyl carbon and make it less susceptible to nucleophilic attack.

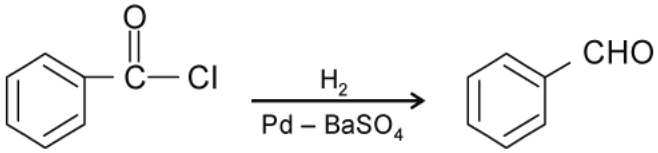


Ketone Aldehyde

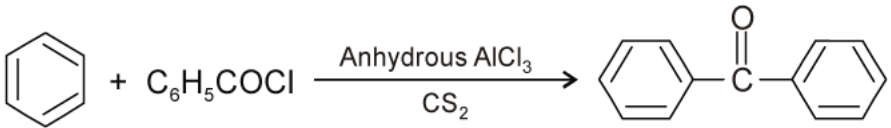
The two bulkier alkyl groups hinder the approach of the nucleophile to the carbonyl carbon. This is called steric factor.

(b) Aldehydes and ketones undergo a number of addition reactions as both possess the carbonyl functional group which reacts with a number of nucleopiles such as HCN, $NaHSO_3$, alcohols, ammonia derivatives and Grignard reagents.

S100.

(a) 

Benzoyl Chloride Benzaldehyde

(b) 

Benzophenone

S101. (a) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

(b) **Acetylation:** Introduction of acetyl group $\left(-\overset{O}{\overset{\|}{C}}-CH_3\right)$ in alcohols, phenols or amines is called their acetylation.

S102. (a) **Rosenmund reduction:**

$$\underset{\substack{\text{Ethanoyl chloride}\\ \text{(Acetyl chloride)}}}{CH_3COCl} + H_2 \xrightarrow[\text{Boiling xylene}]{Pd/BaSO_4,\ S} \underset{\substack{\text{Ethanal}\\ \text{(Acetaldehyde)}}}{CH_3CHO} + HCl$$

(b) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

S103. (a) **Distinction between acetaldehyde and benzaldehyde:** Acetaldehyde and benzaldehyde can be distinguish by Fehling solution.

Acetaldehyde gives red coloured precipitate with Fehling solution while benzaldehyde does not.

$$CH_3CHO + \underbrace{2Cu^{2+} + 5\bar{O}H}_{\text{Fehling solution}} \longrightarrow CH_3COO^- + \underset{\text{Red ppt.}}{Cu_2O} + 3O_2H$$

(b) Propanal and propanone can be distinguished by their reaction with Tollens' reagent.

Propanal will form the silver mirror, but propanone does not react.

S104. (a) Propanal and propanone can be distinguished by their reactions with Tollens' reagent.

Propanal will form the silver mirror, but propanone does not react.

(b) Benzaldehyde and acetophenone can be distinguished by Tollens' test.

Benzaldehyde will form silver mirror, on treatment with Tollens' reagent whereas acetophenone will not show Tollens' Test.

S105.

(a)

NaOI	$CH_3CH_2\overset{\overset{O}{\|\|}}{C}CH_2CH_3$ Pentan-3-one $\longrightarrow$ No reaction	$CH_3-\overset{\overset{O}{\|\|}}{C}-(CH_2)_2CH_3$ Pentan-2-one Gives iodoform test

(b)

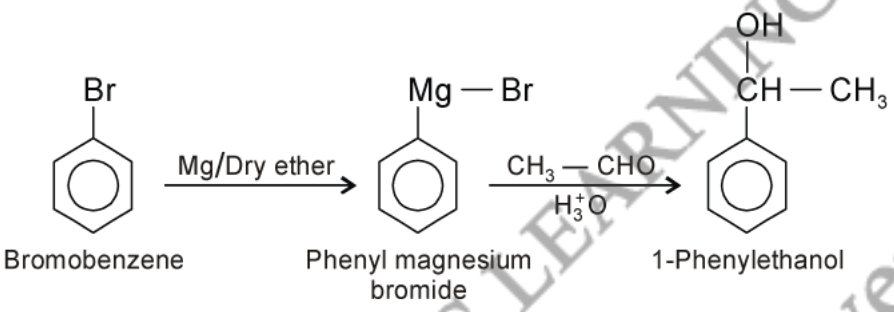
NaOI	CH_3CHO Ethanal Gives iodoform test	CH_3CH_2CHO Propanal $\longrightarrow$ No reaction

S106. (a) **Propanone to propene:**

$$CH_3-\overset{\overset{O}{\|\|}}{C}-CH_3 \xrightarrow[\text{Reduction}]{NaBH_4,\ CH_3OH} CH_3-\overset{OH}{\underset{|}{C}}H-CH_3 \xrightarrow[\text{Dehydration}]{\text{Conc. } H_2SO_4,\ 443\ K} CH_3-CH=CH_3$$

Propanone → 2-Propanol → Propene

(b) **Bromobenzene to 1-Phenylethanol:**



Bromobenzene → Phenyl magnesium bromide → 1-Phenylethanol

S107. (a) **Ethanol to 3-Hydroxybutanal:**

$$CH_3-CH_2-OH \xrightarrow{PCC} CH_3-\overset{\overset{O}{\|\|}}{C}-H \xrightarrow{\text{dil. NaOH}} CH_3-\overset{OH}{\underset{|}{C}}-CH_2-\overset{\overset{O}{\|\|}}{C}-H$$

Ethanol → Ethanal (Acetaldehyde) → 3-Hydroxybutanal

(b) **Benzaldehyde to Benzophenone:**

$$C_6H_5CHO \xrightarrow[H_2SO_4]{K_2Cr_2O_7} C_6H_5COOH \xrightarrow{CaCO_3} (C_6H_5COO)_2Ca \xrightarrow[-\ CaCO_3]{\text{Dry distil.}} C_6H_5-CO-C_6H_5$$

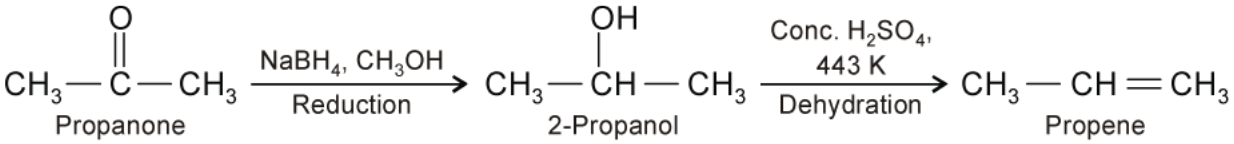
Benzaldehyde → Benzophenone

S108. (a) **Ethanal to but-2-enal:**

$$2CH_3-\overset{\overset{O}{\|\|}}{C}-H \xrightarrow[\text{Aldol condensation}]{OH^-} CH_3-\overset{OH}{\underset{|}{C}}H-CH_2-CHO \xrightarrow[\Delta]{H^+} CH_3-CH=CH-CHO$$

Ethanal → 2-Propanol → But-2-enal

(b) **Propanone to propene:**



S109. (a) Acetophenone and benzophenone can be distinguished by iodoform test.

Acetophenone will give the yellow precipitate of iodoform, but benzophenone will not react.

(b) Ethanal and propanal can be distinguished by iodoform test.

Yellow precipitate of iodoform will be formed form ethanal on heating with iodine and sodium hydroxide solution.

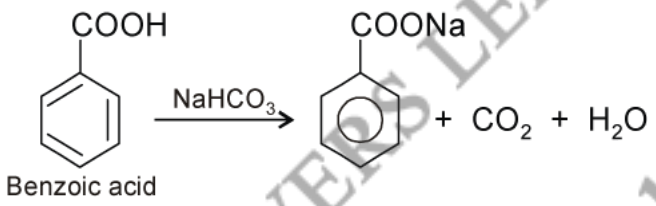
S110. Chloroacetic acid has lower pK_a value than acetic acid; 'Cl' in chloroacetic acid shows $-I$ effect, it creates less electron density on oxygen of carboxylic acid. Thus, release of proton becomes easier. In case of acetic acid, the state of affair is just opposite. Hence, chloroacetic acid is stronger than acetic acid.

S111. (a) $CH_3COOH \xrightarrow{Cl_2/P} \underset{Cl}{CH_2COOH}$

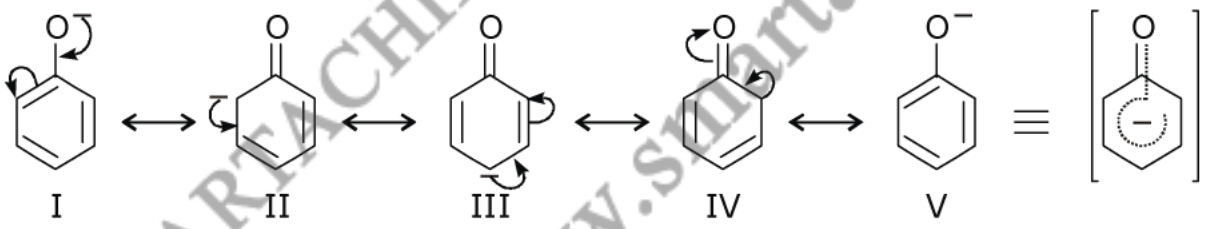
(b) Benzaldehyde when treated with ammoniacal silver nitrate gives silver mirror.

$$C_6H_5CHO + 2[Ag(NH_3)_2]^+ + 3OH^- \longrightarrow \underset{\text{Silver mirror}}{C_6H_5COO^-} + 2Ag + 4NH_3 + 2H_2O$$

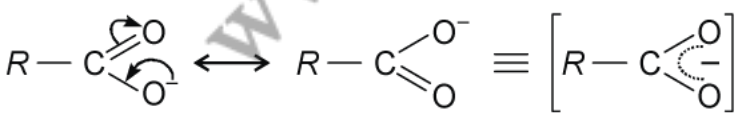
Benzoic acid reacts with sodium bicarbonate to liberate CO_2.



S112. Phenoxide ion has the following resonating structures:



Carboxylate ion has the following reaonating structures.

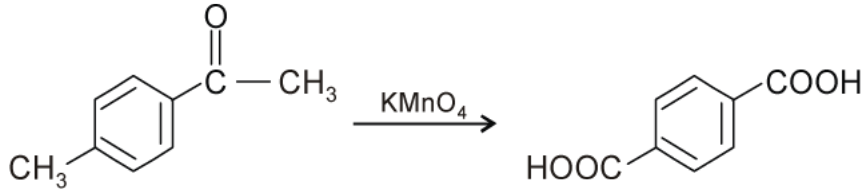


(a) Phenoxide ion is a resonance hybrid of structures I to V, where each structure has a contribution of 20% in the resonance hybrid. On the other hand, each of the two contributing structures of carboxylate ion contribute 50% towards the resonance hybrid. Therefore, the carboxylate ion tends to be more stable than the phenoxide ion and hence has hibher acidity.

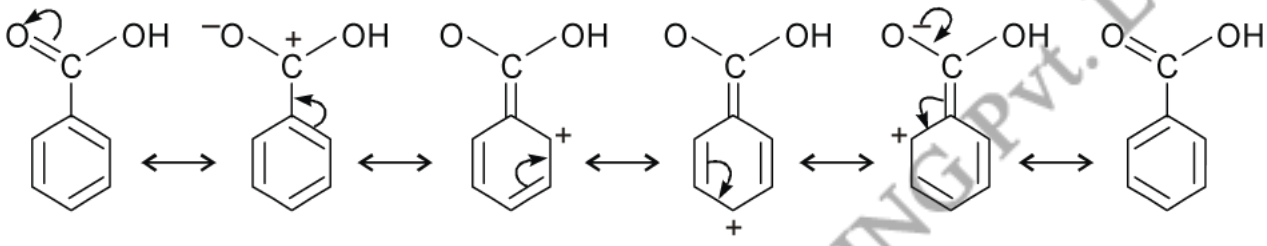
(b) The negative charge rests on the electronegative O atom in carboxylate ion. The presence of negative more stable. For the same reason $RCOO^-$ is more stable than the phenoxide ion where the carbon has negative charge on it. For the above two reasons carboxylate ion is more stable and has higher acidity than phenol.

S113. (a) $CH_3CH_2CH_2CH_2OH \xrightarrow[\text{Jones reagent}]{CrO_3 - H_2SO_4} CH_3CH_2CH_2COOH$

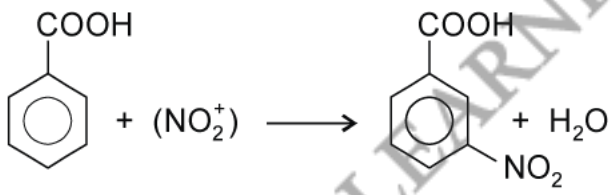
Butan-1-ol — Butanoic acid

(b) 

S114. (a) Electrophilic substitution in benzoic acid takes place at meta-position. Due to resonance in benzoic acid, there is high electron density at meta-position. Therefore, electrophilic substitution in benzoic acid takes place at meta-position.

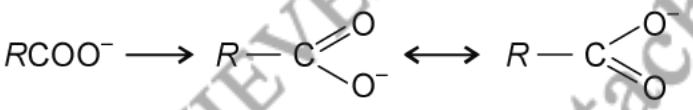


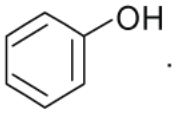
e.g.,



(b) In carboxylic acid C ═ O is in resonance and not available for reaction.

$$RCOOH \rightleftharpoons RCOO^- + H^+$$



S115. (a) $F - CH_2COOH > Cl - CH_2COOH$. (b) CH_3COOH is stronger than  .

S116. (a) The overall acid strength increases in the order.

4-methoxybenzoic acid < benzoic acid < 3,4-dinitrobenzoic acid.

(b) We know that + *I*-effect decreases while – *I*-effectincreases the acid strength of carboxylic acids. The overall acid strength increase in the order.

$(CH_3)_2CHCOOH < CH_3CH(Br)CH_2COOH < CH_3CH_2CH(Br)COOH$.

S117. (a) 4-Methyoxybenzoic acid < benzoic acid < 4-Nitrobenzoic acid < 3,4-Dinitrobenzoic acid.

(b) The overall acidic strength increases in the order:

$(CH_3)_2CHCOOH < CH_3CH_2CH_2COOH < CH_3CH(Br)CH_2COOH < CH_3CH_2CH(Br)COOH$.

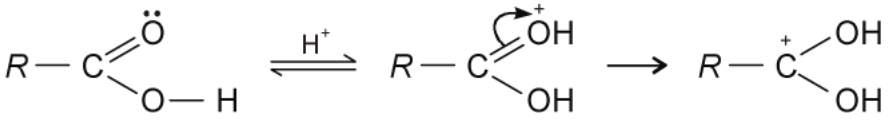
S118. **Esterification:** Carboxylic acids react with alcohols or phenols in the presence of a mineral acid like concentrated H_2SO_4 or HCl gas as catalyst and give ester.

$$R-COOH + R'OH \rightleftharpoons R-COOR' + H_2O$$

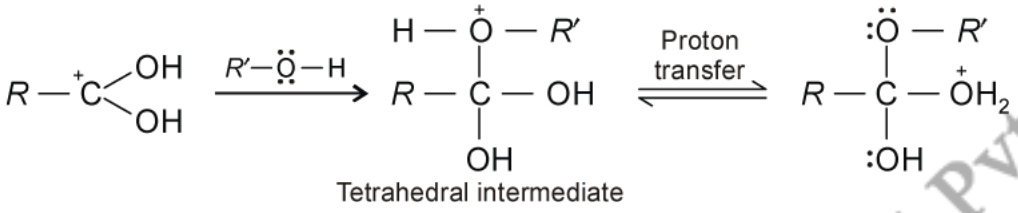
e.g.,
$$CH_3COOH + C_2H_5OH \xrightleftharpoons{H^+} CH_3COOC_2H_5 + H_2O$$
Ethanoic acid Ethanol Ethyl ethanoate

Mechanism of esterification: It is a nucleophilic acyl substitution.

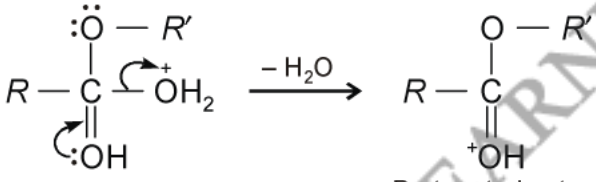
(a) **Protonation of carboxyl oxygen:**



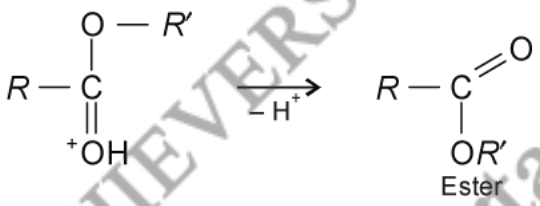
(b) **Nucleophilic addition of alcohol:**



(c) **Elimination of water molecule:**



(d) **Protonated ester loses a proton to give ester:**



S119. (a) The strength of an acid is indicated by pK_a value, where pK_a = – log K_a.

Since monochloroethanoic acid is weaker than dichloroethanoic acid so it has lower value of dissociation constant K_a.

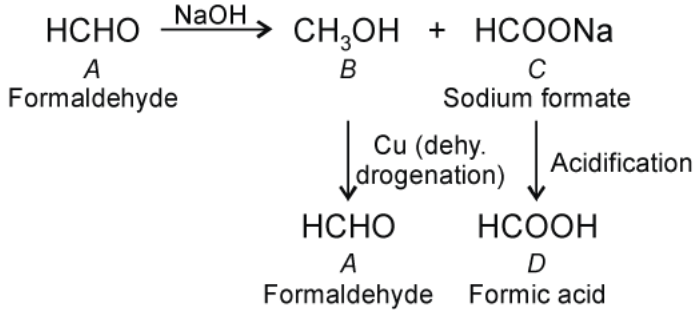
Therefore, it has higher valoue of pK_a.

(b) The — COOH group in benzoic acid is attached to sp^2 – carbon of the phenyl ring and is more acidic than acetic acid in which — COOH group is attached to sp^3 – carbon atom of CH_3 group.

So, benzoic acid is stronger than acetic or acetic acid is weaker acid than benzoic acid.

S120. Since the molecular formula of *D* is CH_2O_2, thus, *D* is HCOOH (formic acid), *D* is obtained by the acidification of *C*, so, *C* is sodium formate (HCOONa).

Thus *A* must be formaldehyde (as it undergoes Cannizzaro reaction with a strong base).



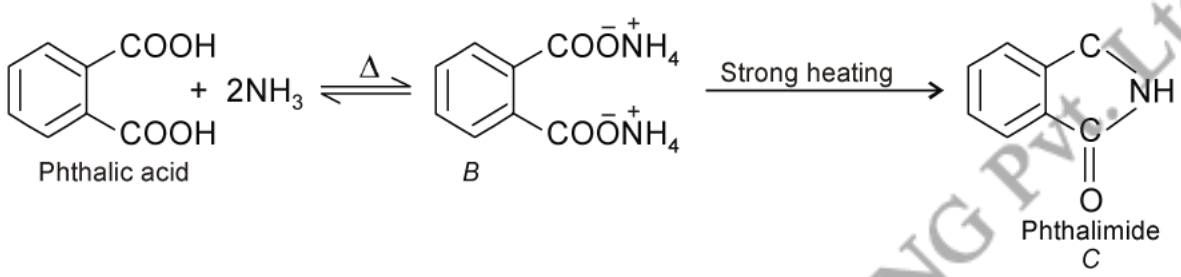
Thus, *A* = Formaldehyde (HCHO)

B = Methanol (CH_3OH)

C = Sodium formate (HCOONa)

D = Formic acid (HCOOH)

S121.



S122. (a) Ethylacetate is hydrolysed slowly by water to form ethyl aocohol while methyl acetate gives methyl alcohol.

$$\underset{\text{Ethyl acetate}}{CH_3COOC_2H_5} + H_2O \longrightarrow CH_3COOH + \underset{\text{Ethyl alcohol}}{C_2H_5OH}$$

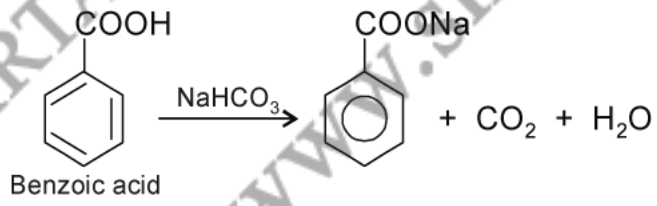
$$\underset{\text{Methyl acetate}}{CH_3COOCH_3} + H_2O \longrightarrow CH_3COOH + \underset{\text{Methyl alcohol}}{CH_3OH}$$

The hydrolysis product of ethyl acetate undergo iodoform test with iodine and alkali.

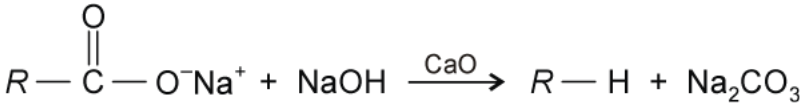
(b) Benzaldehyde when treated with ammoniacal silver nitrate gives silver mirror.

$$C_6H_5CHO + 2[Ag(NH_3)_2]^+ + 3OH^- \longrightarrow C_6H_5COO^- + \underset{\text{Silver mirror}}{2Ag} + 4NH_3 + 2H_2O$$

Benzoic acid reacts with sodium bicarbonate to liberate CO_2.



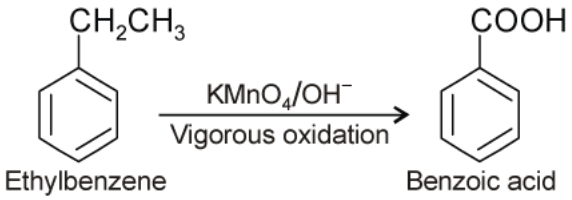
S123. (a) **De-carboxylation reaction:** Sodium or potassium salt of carboxylic acids on heating with soda lime (NaOH and CaO), loses a molecule of carbon dioxide and alkanes are obtained as products.



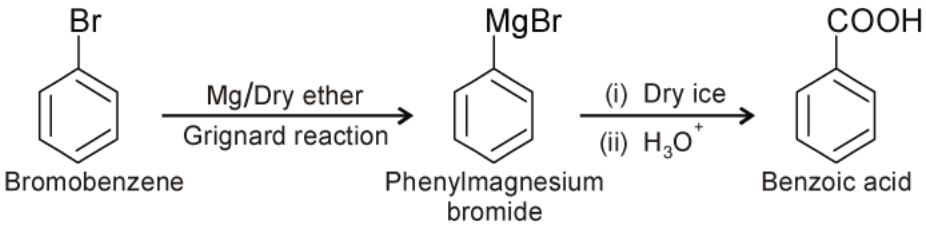
(b) Phenol and benzoic acid can be distinguished by their reactions with sodium bicarbonate solution.

Benzoic acid will give effervescence with $NaHCO_3$ but phenol will not react.

S124. (a)

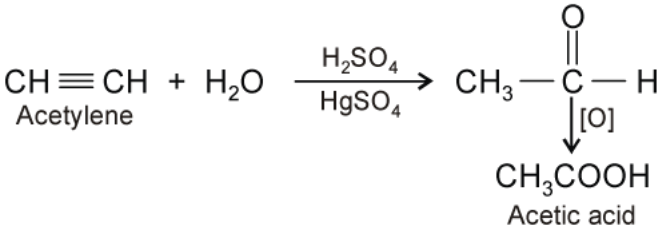


(b)

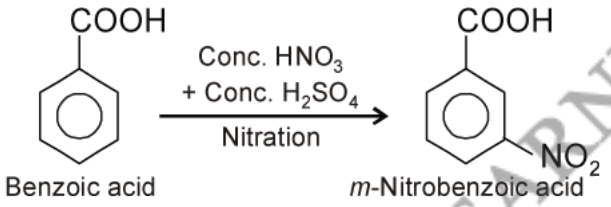


S125.

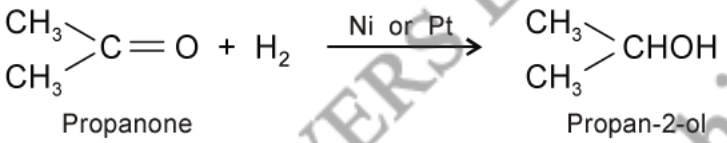
(a)



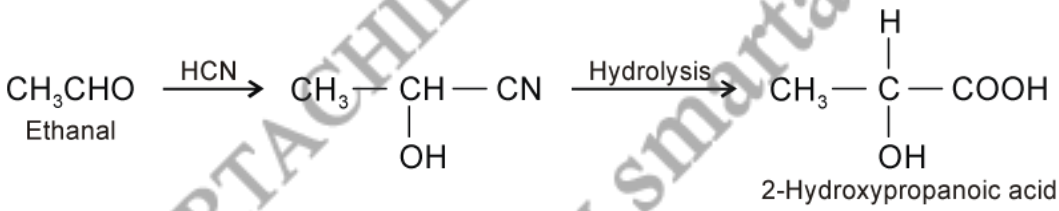
(b)



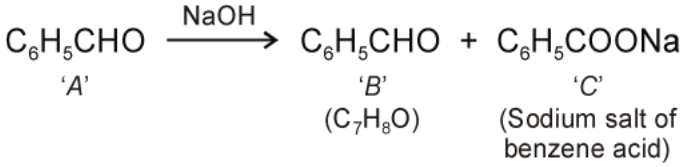
S126. (a) **Propanone to Propan-2-ol:**



(b) **Ethanal to 2-Hydroxypropanoic acid:**



S127. Benzaldehyde has a characteristic odour. Reaction of '*A*' with NaOH appears to be Cannizzaro reaction which give '*B*' (benzyl alcohol) and '*C*' (Sodium salt of benzoic acid). Oxidation of alcohols gives aldehydes. Sodium salt of benzoic acid on heating with soda lime given benzene (*D*).



$$C_6H_5CH_2OH \xrightarrow{CrO_3} C_6H_5CHO$$
'B' 'A'

$$C_6H_5COONa \xrightarrow[\Delta]{NaOH/CaO} C_6H_5 + Na_2CO_3$$
'C' 'D' (Benzene) (Aromatic)

S128.

(a) $CH_3 - CHO + CH_3MgBr \xrightarrow{H_3O^+} CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - CH_3$

(b) $CH_3CHO \xrightarrow[\text{Conc. HCl}]{\text{Zn – Hg}} CH_3 - CH_3$

(c) $CH_3 - CHO + C_6H_5CHO \xrightarrow{\text{dil. NaOH}} CH_3 - \underset{\displaystyle OH}{\underset{|}{CH}} - C_6H_5CHO$

S129. (a) (i) **Rosenmund reduction:**

$$\underset{\text{Ethanoyl chloride (Acetyl chloride)}}{CH_3COCl} + H_2 \xrightarrow[\text{Boiling xylene}]{Pd/BaSO_4,\ S} \underset{\text{Ethanal (Acetaldehyde)}}{CH_3CHO} + HCl$$

(ii) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

(b) $CH_3CH_2 - CO - CH_3$ will give iodoform test because it contains acetyl group.

S130. (a) **Wolff-Kishner reduction reaction:** The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with hydrazine followed by heating with potassium hydroxide in a high boiling solvent such as ethlene glycol.

$$\underset{\text{Acetone}}{CH_3-\underset{CH_3}{\overset{}{C}}=O} \xrightarrow[-H_2O]{NH_2NH_2} CH_3-\underset{CH_3}{\overset{}{C}}=NNH_2 \xrightarrow[\text{Heat}]{KOH/\text{Ethylene glycol}} \underset{\text{Propane}}{CH_3-\underset{CH_3}{\overset{}{C}}H_2} + N_2$$

(b) Increasing order of reactivity towards nucleophilic addition reaction:

$$C_6H_5COCH < CH_3COCH_3 < CH_3CHO$$

(c) Formula of compounds *A* and *B* = C_3H_6O, *B* forms yellow percipitate of iodoform. Hence, *B* must conatin — $COCH_3$ group. Therefore, compound '*B*' must be $CH_3 - \overset{\displaystyle O}{\overset{\|}{C}} - CH_3$.

S131. (a) $\underset{\text{Acetone}}{CH_3-\underset{CH_3}{\overset{}{C}}=O} \xrightarrow{Zn - Hg/\text{Conc. HCl}} \underset{\text{Propane}}{CH_3CH_2CH_3}$

(b) $(CH_3)_2C{=}O + H_2N{-}NHCONH_2 \xrightarrow{H^+} (CH_3)_2C{=}N{-}NHCONH_2$
Acetone semicarbazone

(c) $(CH_3)_2C{=}O + CH_3MgBr \longrightarrow (CH_3)_2C(OMgBr)CH_3 \xrightarrow{H_3O^+} (CH_3)_2C(OH)CH_3$
2-Methylpropan-2-ol

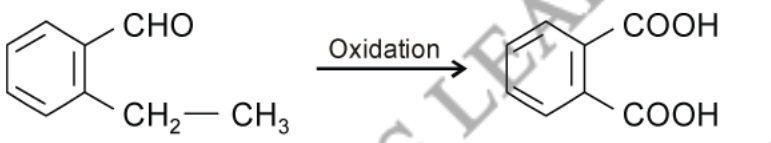
S132. (a) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

(b) $H_3CCH{=}O + H_2N{-}C(=O){-}NH{-}NH_2 \longrightarrow H_3C{-}CH{=}N{-}NH{-}C(=O){-}NH_2$
Ethanal; Semicarbazide; (Semicarbazone of ethanal)

(c) Propanal and propanone can be distinguished by their reaction with Tollens' reagent.
Propanal will form the silver mirror, but propanone does not react.

S133. The compound froms 2,4-DNP derivative. It shows that it is a carbonyl compound. Further it reduces Tollen's reagent which shows that it caontains aldehydic group. It undergoes Cannizzaro reaction indicating that aldehyde group is without any α-hydrogen. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid which shows that there are two carbon residues on benzene rign. Since the molecular formula is $C_9H_{10}O$, it fits into the structure, 2-ethylbenzaldehyde.



2-Ethylbenzaldehyde; 1,2-Benzenedicarboxylic acid

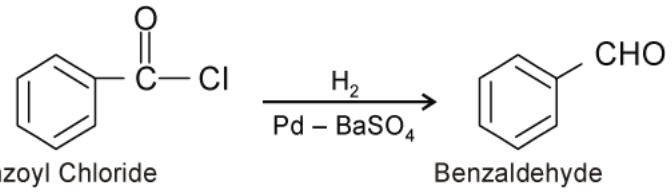
S134.

(a) $C_6H_6 + C_6H_5COCl \xrightarrow[CS_2]{\text{Anhydrous } AlCl_3} C_6H_5{-}CO{-}C_6H_5$
Benzophenone

(b) $CH_3{-}C{\equiv}CH \xrightarrow{Hg^{2+},\ H_2SO_4} CH_3{-}CO{-}CH_3$
Propanone

(c) $O_2N{-}C_6H_4{-}CH_3 \xrightarrow[2.\ H_2O]{1.\ CrO_2Cl_2} O_2N{-}C_6H_4{-}CHO$
p-Nitrobenzaldehyde

S135. (a) $CH_3{-}CO{-}CH_3 \xrightarrow[\text{Condensation reduction}]{Zn - Hg + \text{conc. } HCl} CH_3{-}CH_2{-}CH_3$

(b) 

Benzoyl Chloride — Benzaldehyde

(c) $2CH_3-CH(H)=O \xrightarrow[\text{(i) Aldol condensation}\ \text{(ii) Heat}]{OH^-} CH_3-CH(H)=CH-C(H)=O$

S136. (a) $CH_3CHO \xrightarrow{Zn-Hg/Conc.\ HCl} CH_3-CH_3$

(b) $2CH_3CHO \xrightarrow{dil.\ NaOH} CH_3-CH(OH)-CH_2-CHO$

(c) $CH_3CHO \xrightarrow{H_2/Ni} CH_3-CH_2-OH$

S137. Calculation of the empirical formula of the compound:

Element	Percentage	Atomic mass	Relative numbers of atoms	Simple molar ratio
C	69.77	12	$\frac{69.77}{12} = 5.814$	5
H	11.63	1	$\frac{11.63}{1} = 11.63$	10
O	18.6	16	$\frac{18.6}{16} = 1.163$	1

So, the empirical formula is $C_5H_{10}O$

Empirical formula mass = $(5 \times 12) + (10 \times 1) + (1 \times 16) = 86$

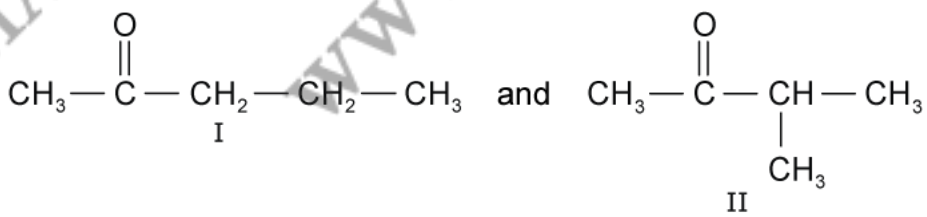
Given that molecular mass of the compound = 86.

Hence, the molecular formula of the compound is $C_5H_{10}O$

The given compound does not reduce Tollen's reagent, so it is not an aldehyde but the formation of addition compound with sodium hydrogen sulphatite indicates it to be carbonyl compound.

Since this compound give positive iodoform test, so it should contain $-C(=O)-CH_3$ group.

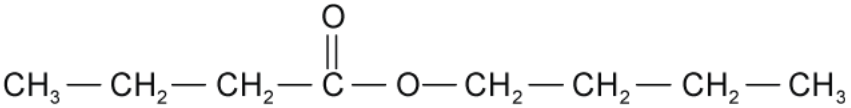
On the basis of this information, two possible structures are written as under:



I and II

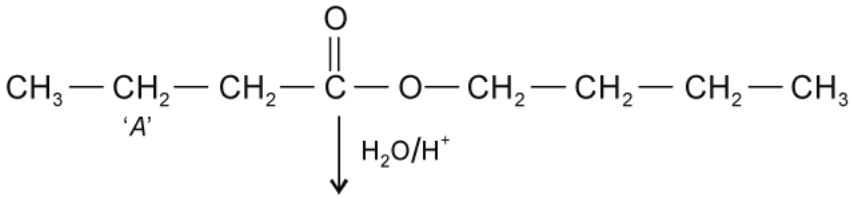
On oxidation, this compound gives ethanoic and propanoic acids which confirm its structure to be I.

S138. Compound '*A*' ($C_8H_{16}O_2$) on hydrolysis gives an acid '*B*' and an alcohol '*C*'. It shows that '*A*' is an ester. Since, the oxidation of alcohol '*C*' also gives the acid '*B*' indicates that '*B*' and '*C*' both contain same number of carbon atoms, *i.e.*, four carbon atoms each and same arrangement of atoms. Formation of but-1-ene on dehydration of 'C' incdicates it to be butan-1-ol, so the possible structure for '*A*' could be

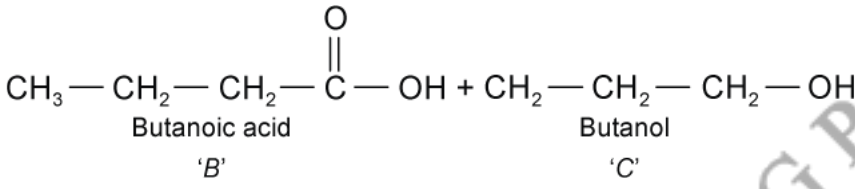


Butyl butanoate

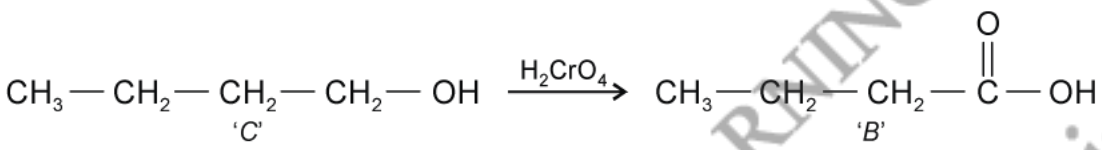
The various reactions involved are written as follows:



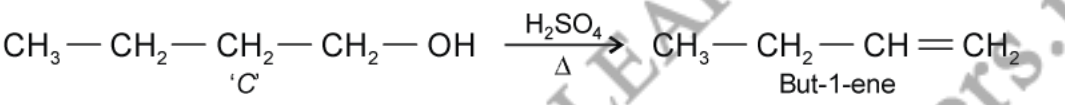
'*A*'



Butanoic acid '*B*' Butanol '*C*'



'*C*' '*B*'

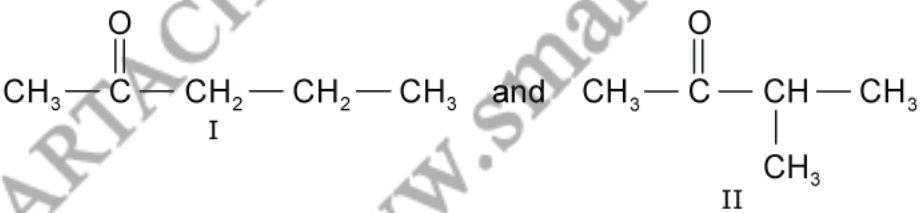


'*C*' But-1-ene

S139. The given compound does not reduce Tollen's reagent, so it is not an aldehyde but the formation of addition compound with sodium hydrogen sulphatite indicates it to be carbonyl compound.

Since this compound give positive iodoform test, so it should contain  group.

On the basis of this information, two possible structures are written as under:

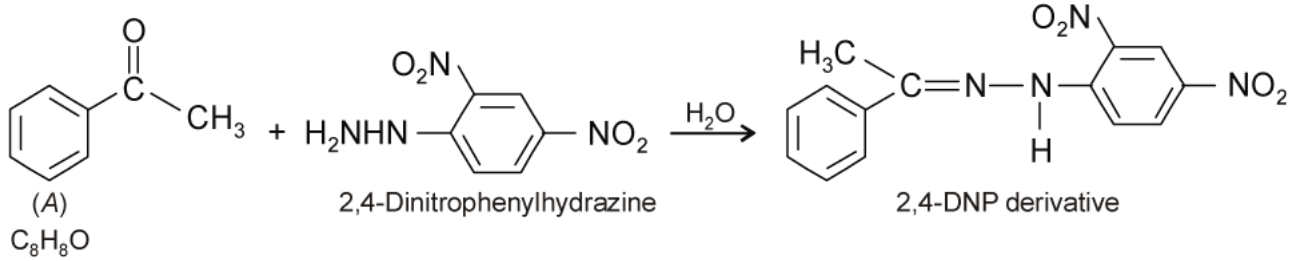


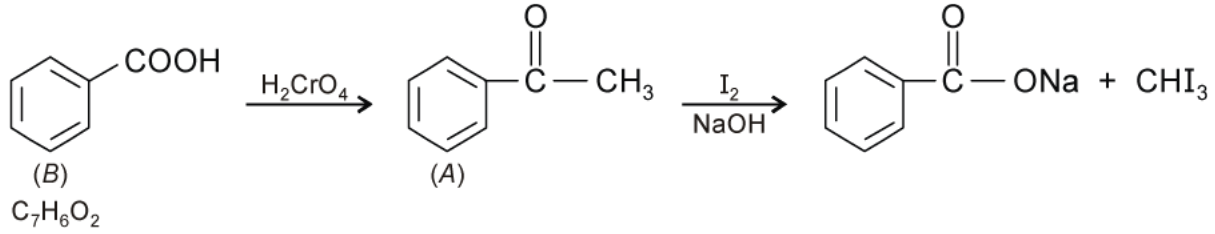
I and II

On oxidation, this compound gives ethanoic and propanoic acids whivch confirm its structure to be I.

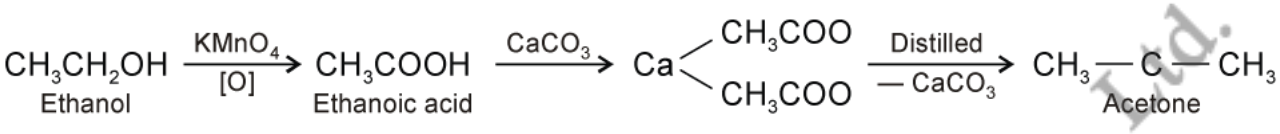
S140. (*A*) forms, 2,4-DNP derivative. THerefore, it is an aldehyde or a ketone. Since, it does no reduce Tolen's or Fehling reagent, (*A*) must be a ketone. (*A*) responds to iodoform test.

Compound (*B*), being an oxidation product of a ketone should be a carboxylic acid. The molecular formula of (*B*) indicates that it should be benzoic acid and compound (*A*) should, therefore, be a mono-substituted aromatic methyl ketone.

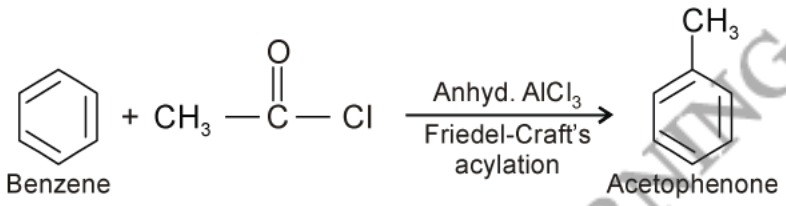




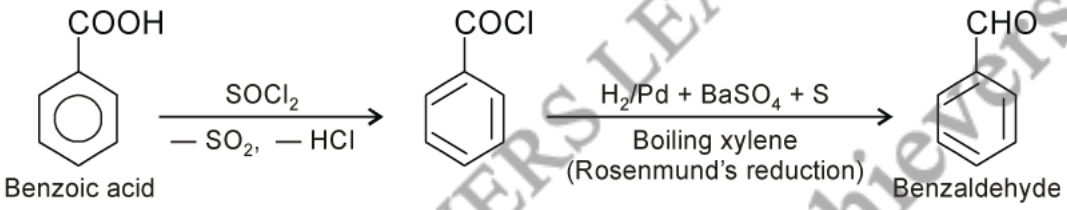
S141. (a) Ethanol to acetone:



(b) Benzene to acetophenone:

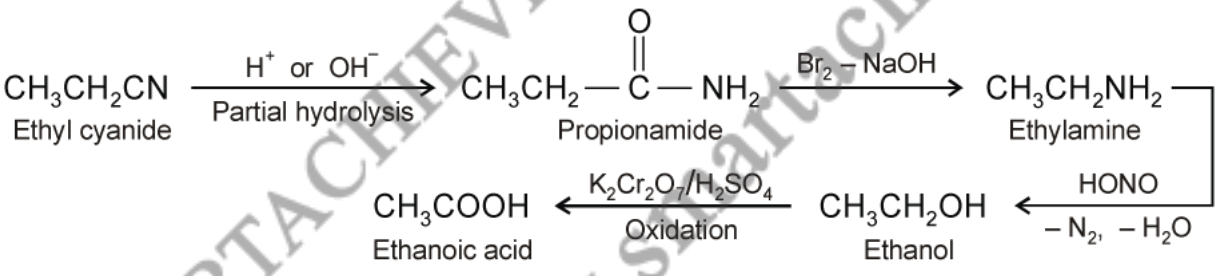


(c) Benzoic acid to benzaldehyde:

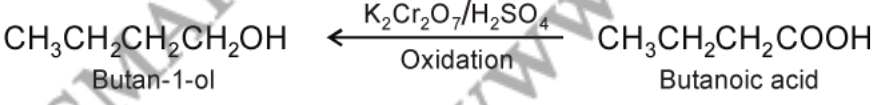


S142.

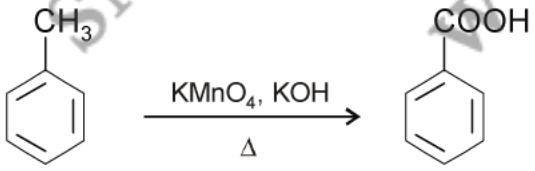
(a)



(b)



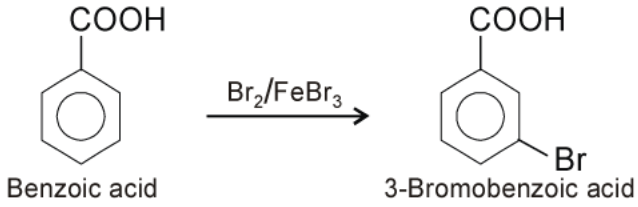
(c)



S143.

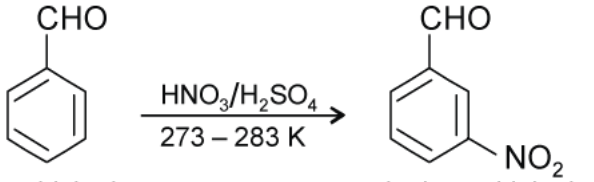
(a) CH_3CH_2CN (Ethyl cyanide) $\xrightarrow[\text{Partial hydrolysis}]{H^+ \text{ or } OH^-}$ $CH_3CH_2-\overset{\overset{O}{\|}}{C}-NH_2$ (Propionamide) $\xrightarrow{Br_2 - NaOH}$ $CH_3CH_2NH_2$ (Ethylamine) $\xrightarrow[-N_2,\ -H_2O]{HONO}$ CH_3CH_2OH (Ethanol) $\xrightarrow[\text{Oxidation}]{K_2Cr_2O_7/H_2SO_4}$ CH_3COOH (Ethanoic acid)

(b) $CH_3CH_2CH_2CH_2OH$ (Butan-1-ol) $\xleftarrow[\text{Oxidation}]{K_2Cr_2O_7/H_2SO_4}$ $CH_3CH_2CH_2COOH$ (Butanoic acid)

(c) 

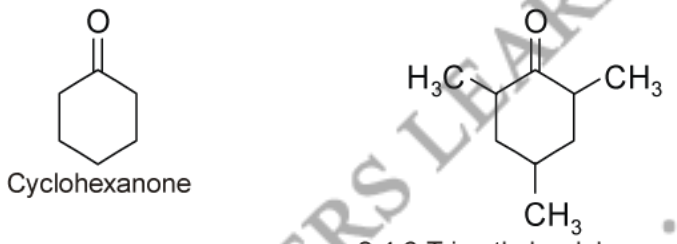
Benzoic acid — 3-Bromobenzoic acid

S144. (a) (i)



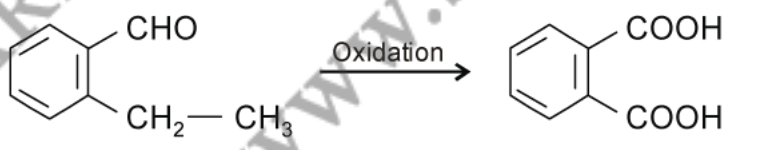
Benzaldehyde — *m*-nitrobenzaldehyde

(ii) Formation of cyanohydrin involves the nucleophilic attack of cyanide ions (CN^-) at the carbonyl carbon. In cyclohexanone, reaction proceeds but in 2,4,6-trimethylclohexanone, the methyl groups cause steric hindrance and yields are poor.



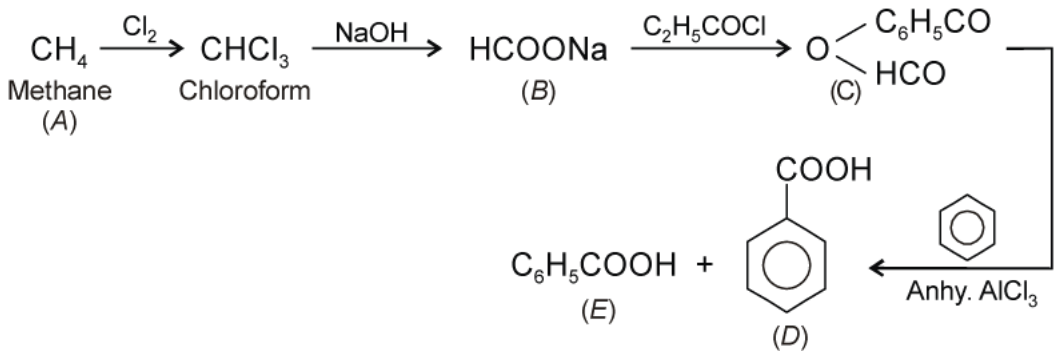
Cyclohexanone — 2,4,6-Trimethylcyclohexanone

(b) The compound froms 2,4-DNP derivative. It shows that it is a carbonyl compound. Further it reduces Tollen's reagent which shows that it caontains aldehydic group. It undergoes Cannizzaro reaction indicating that aldehyde group is without any α-hydrogen. On vigorous oxidation, it gives 1,2-benzenedicarboxylic acid which shows that there are two carbon residues on benzene rign. Since the molecular formula is $C_9H_{10}O$, it fits into the structure, 2-ethylbenzaldehyde.



2-Ethylbenzaldehyde — 1,2-Benzenedicarboxylic acid

S145.



S146. (a) (i) **Cannizzaro's reaction:** Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.

$$\underset{\text{Methanal}}{HCHO} + HCHO \xrightarrow{50\%\ NaOH} \underset{\text{Sodium formate}}{HCOONa} + \underset{\text{Methanol}}{CH_3OH}$$

(ii) **Clemmensen reaction:** The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with zinc amalgam and concentrated hydrochloric acid.

$$\underset{\text{Propanone}}{CH_3COCH_3} \xrightarrow[HCl]{Zn-Hg} \underset{\text{Propane}}{CH_3CH_2CH_3} + H_2O$$

(b) **Calculation of the empirical formula of the compound:**

Element	Percentage	Atomic mass	Relative numbers of atoms	Simple molar ratio
C	69.77	12	$\frac{69.77}{12} = 5.814$	5
H	11.63	1	$\frac{11.63}{1} = 11.63$	10
O	18.6	16	$\frac{18.6}{16} = 1.163$	1

So, the empirical formula is $C_5H_{10}O$

Empirical formula mass = $(5 \times 12) + (10 \times 1) + (1 \times 16) = 86$

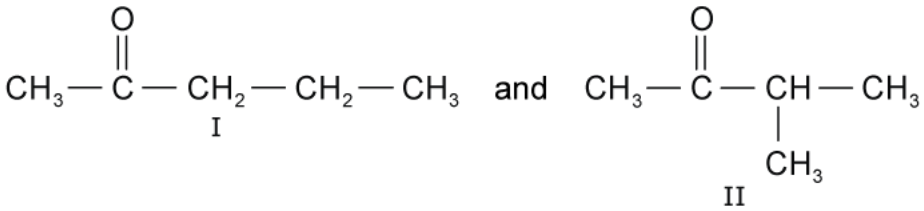
Given that molecular mass of the compound = 86.

Hence, the molecular formula of the compound is $C_5H_{10}O$

The given compound does not reduce Tollen's reagent, so it is not an aldehyde but the formation of addition compound with sodium hydrogen sulphatite indicates it to be carbonyl compound.

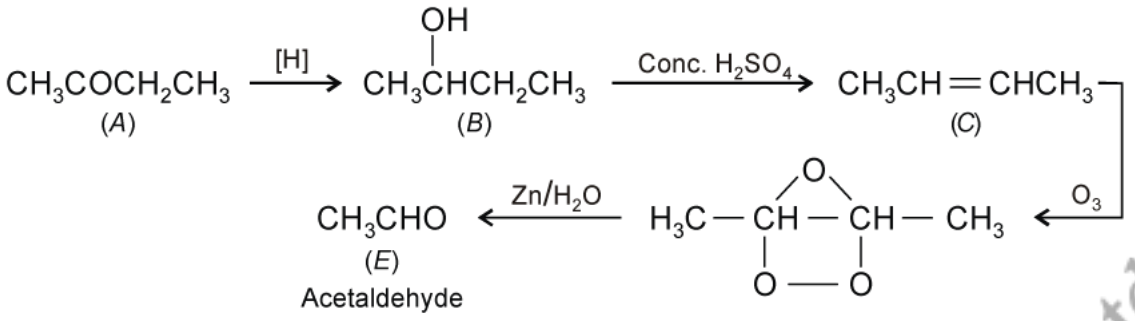
Since this compound give positive iodoform test, so it should contain $-\overset{\overset{O}{\|}}{C}-CH_3$ group.

On the basis of this information, two possible structures are written as under:

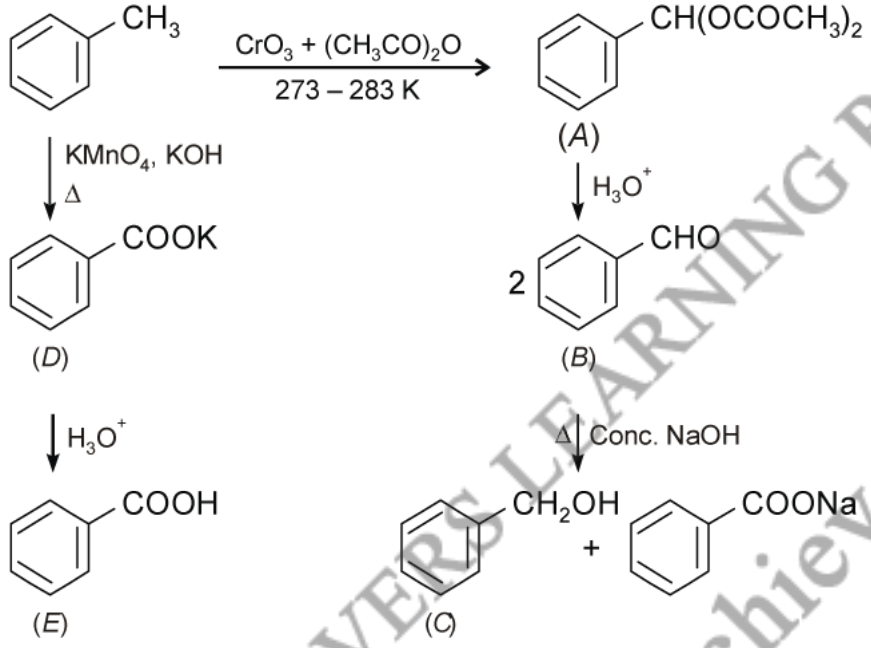


On oxidation, this compound gives ethanoic and propanoic acids which confirm its structure to be I.

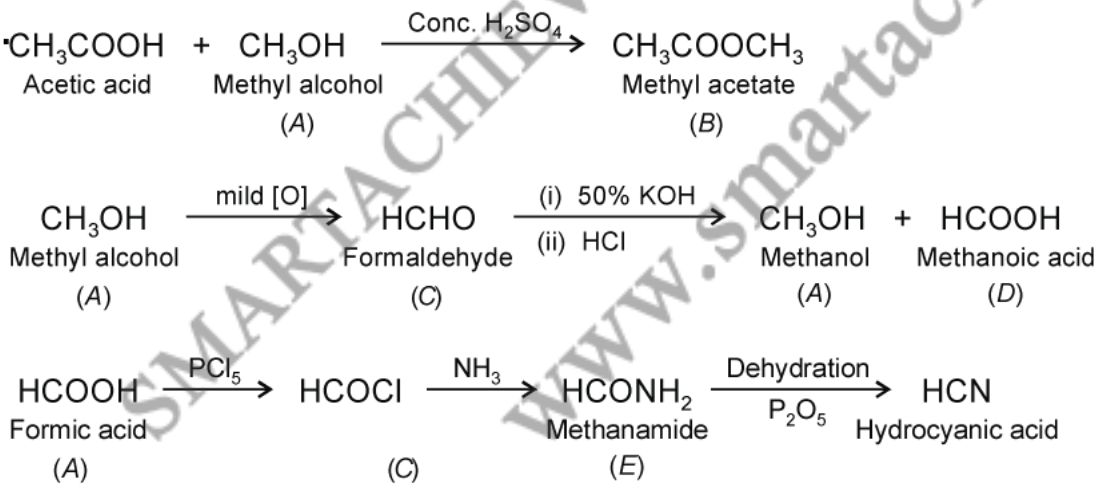
S147.



S148.



S149.



Therefore,

(*A*) : Methyl alcohol (*B*) : Methyl acetate (*C*) : Formaldehyde (*D*) : Formic acid (*E*) : Formamide

S150. $(CH_3CO)_2O$ + C_2H_5OH ⟶ $CH_3COOC_2H_5$ + CH_3COOH

$(CH_3CO)_2O$ = *A*; C_2H_5OH = Ethanol; $CH_3COOC_2H_5$ = Ethyl ethanoate (*C*); CH_3COOH = Ethanoic acid (*B*)

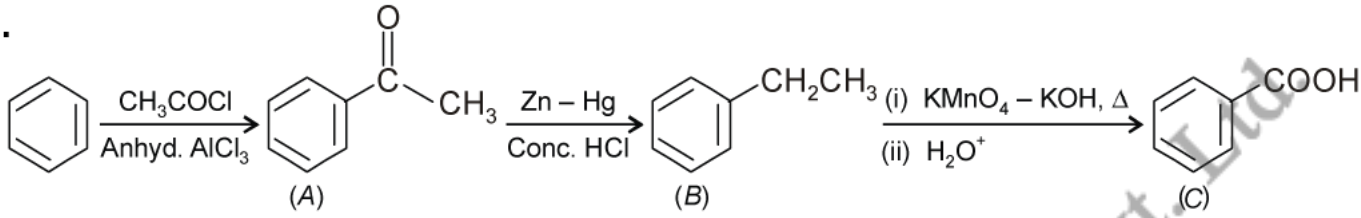
$$CH_3COOC_2H_5 + H_2O \xrightarrow{H^+} \underset{B}{CH_3COOH} + \underset{D}{CH_3CH_2OH}$$

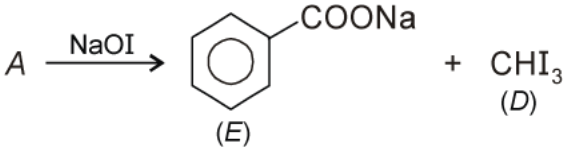
$$\underset{D}{CH_3CH_2OH} \xrightarrow{KMnO_4} \underset{B}{CH_3COOH} \xrightarrow[Ca(OH)_2]{\text{Dry distillation}} \underset{E}{CH_3COCH_3} + CaCO_3$$

E does not give Tollen's reagent test and does not reduce Fehling's solution as it is ketone.

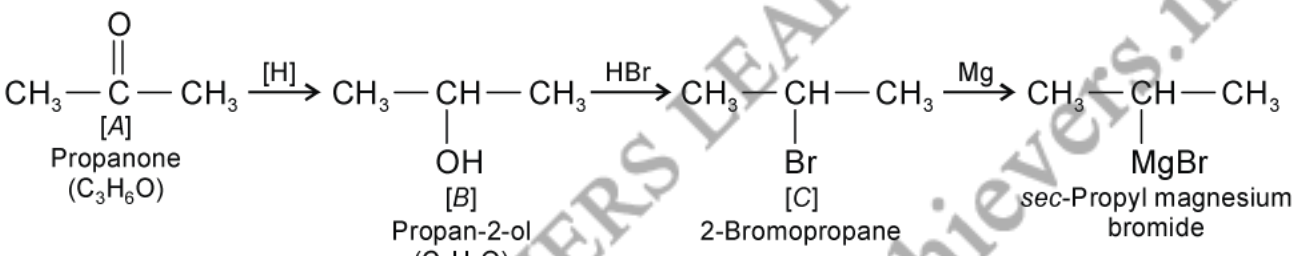
$A = (CH_3CO)_2O$, $B = CH_3COOH$, $C = CH_3COOC_2H_5$, $D = CH_3CH_2OH$, $E = CH_3COCH_3$

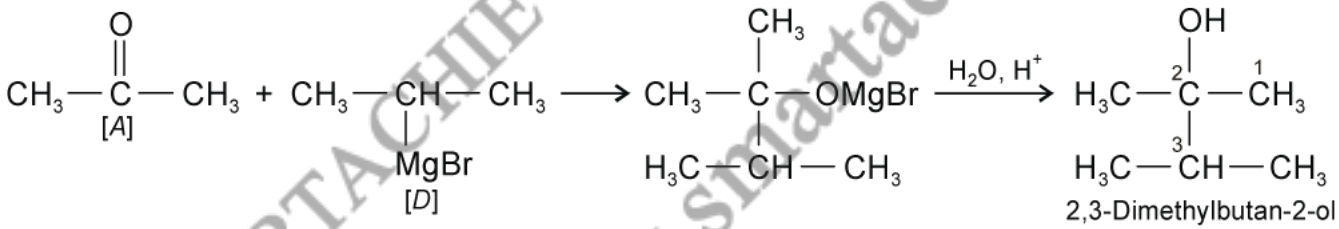
S151.





S152. Ketones are oxidised under vigrous conditions.





Therefore, (*A*) : Propanone.

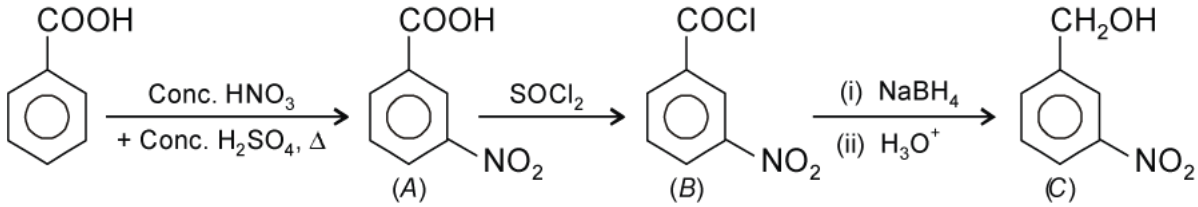
(*B*) : Propan-2-ol.

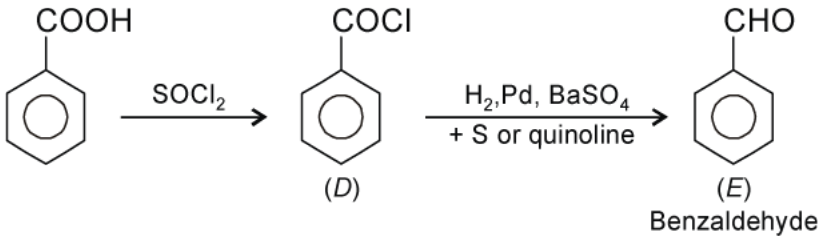
(*C*) : 2-Bromopropane.

(*D*) : dec-Propyl magnesium bromide.

(*E*) : 2,3-Dimethylbutan-2-ol.

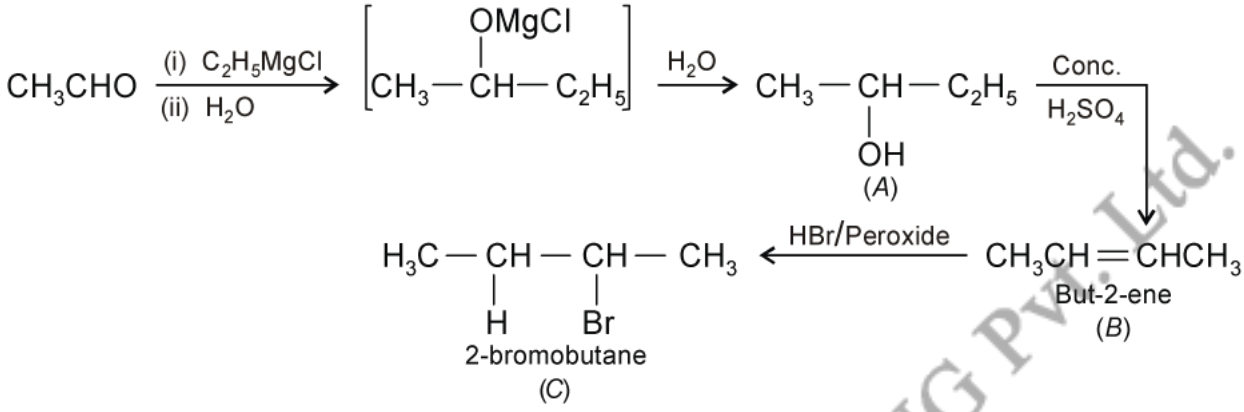
S153.



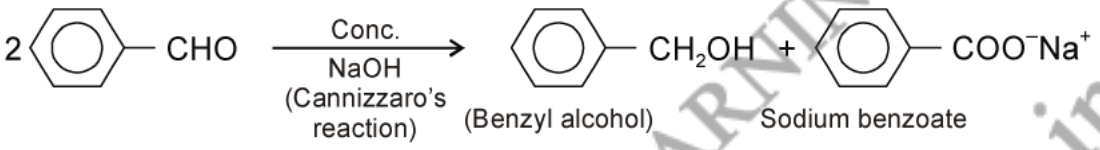


S154.

(a)



(b) (i)



(ii)