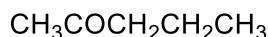
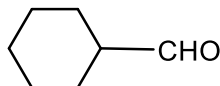
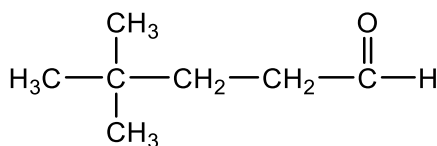
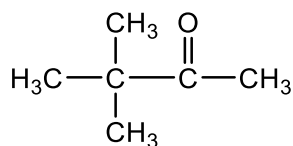


13.1 ALIPHATIC ALDEHYDES AND KETONES

<https://subarnam.com.np/>

Introduction and Nomenclature

1. Name the following compounds by the IUPAC system.



Cyclohexane carbaldehyde

2. Give the IUPAC name of $\text{CH}_3\text{COCOCH}_2\text{CH}_3$. 1
3. Give the structure of 3-hydroxybutanal. 1

Structural Isomerism in Aldehydes and Ketones

4. Give the functional isomer of CH_3COCH_3 . 1
5. Write the possible isomeric aldehydes and ketones that can be formed from $\text{C}_5\text{H}_{10}\text{O}$. Give their IUPAC names too. 2
6. Write the possible isomeric aldehydes and ketones that can be formed from $\text{C}_4\text{H}_8\text{O}$. Give their IUPAC names too. 2

General Methods of Preparation of Aldehydes & Ketones

1. From alcohols

a) By oxidation of alcohols

7. How is Ethanal converted into Ethanoic acid? 1
8. How is Propanone prepared from Propan-2-ol? 1
How is Propanone prepared from Isopropyl alcohol? 1

b) Catalytic dehydrogenation of alcohols (studied in properties of alcohols)

9. How is Propanone prepared from Propan-2-ol? 1
How is Propanone prepared from Isopropyl alcohol? 1
10. An organic compound gives H_2 gas with sodium metal. On treatment with alkaline iodine gives a yellow ppt., and on heating with Cu forms an aldehyde ($\text{C}_2\text{H}_4\text{O}$). Name the compound and write the reactions involved. How would you convert the compound into Ethene? 5

2. From alkenes (by ozonolysis)

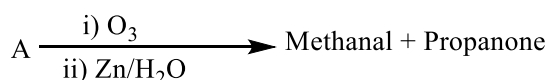
11. Identify A and B in the following reaction sequence. 2



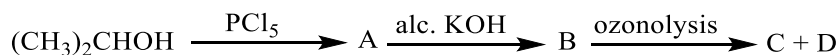
Identify A and B in the following reaction: 2



12. How is Ethanal prepared from But-2-ene? 1
13. Suggest the structure of A in the given reaction

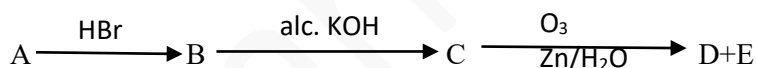


14. An alkene A undergoes ozonolysis to give Ethanal and Propanone as the major products. Identify A and write its IUPAC name. 2
15. An alkene A undergoes ozonolysis to give Ethanal and Methanal as major products. Identify A and give its IUPAC name. 2
16. Identify the organic compounds A, B, C and D.



2

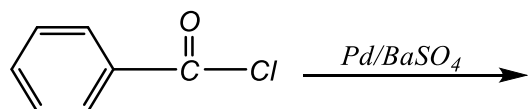
17. Treatment of 2-bromobutane with hot alcoholic KOH gives a mixture of two isomeric butenes, A and B. Ozonolysis of the minor product gives Methanal and another aldehyde C in equimolar proportions, whereas the major alkene gives a single product D, on ozonolysis. Identify A, B, C and D, giving pertinent equations. 5
18. An alcohol 'A' reacts with Thionyl chloride to produce 'B', which, on dehydrohalogenation, yields 'C'. The compound 'C' on ozonolysis gave a mixture of Ethanal and Methanal. If the alcohol 'A' responds to the iodoform test, identify A, B and C. How could you convert the above compound 'B' into propane? 5
19. A monohydric alcohol 'A' reacts with PBr_3 to give B. B, if heated with alc. KOH gives C. C on ozonolysis produces Ethanal and Methanal as major products. Compound A responds iodoform test. Identify A, B and C with reactions involved. What happens when B is heated with sodium in the presence of dry ether? 5
20. A secondary Haloalkane A gives compound B when heated with alc. KOH. B on ozonolysis produces Ethanal and Methanal as the major products. Identify A and B, and also write the chemical reaction. What product would you expect when A is heated with Sodium in the presence of dry ether?
21. A secondary alcohol X reacts with PCl_5 to give an alkyl halide Y, which on dehydrohalogenation yields an alkene Z. The alkene Z, upon ozonolysis, gives a mixture of Ethanal of Methanal. Identify X, Y and Z. Suggest an answer with chemical reactions. 5
22. An organic compound A reacts with PBr_3 to give B. Compound B produces C when heated with alc. KOH. Compound C undergoes ozonolysis to yield Ethanal and Methanal as major products. Compound A responds iodoform test. Identify A, B, C and write the reactions involved. 4
23. Identify A, B, C, D and E in the following sequence of reactions:



The compound A undergoes oxidation to give propanone, and the compound D is an aldehyde which gives the iodoform test. 5

3. From acid chlorides (Rosenmund's reduction)

24. Give an example of Rosenmund's reduction. 1
25. Predict the major product of the following reaction. 1
26. Give a chemical reaction for the preparation of Ethanal from Ethanoyl chloride. 1
27. Complete the following equations: 1



4. From alkynes (by hydration)

28. Give a chemical reaction for the preparation of Ethanal from Ethyne. 1
29. How is Propanone prepared from Propyne? 1

5. From gem-dihaloalkanes

30. How is Propanone prepared from 2,2-dichloropropane? 1
31. How is Ethanal prepared from 1,1-dichloroethane? 1
32. Give a chemical reaction for the preparation of Ethanal from 1,1-dibromoethane.
33. Give any three methods of preparation of Ethanal. 3
34. Give any three methods of preparation of Propanone. 3

Structure of the carbonyl group

General physical properties of aldehydes and ketones

35. Aldehydes and ketones have lower boiling points than alcohols and carboxylic acids with comparable molecular weights. Explain. 2

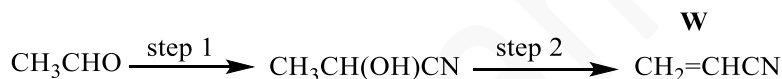
Chemical Properties of Aldehydes and Ketones

Nucleophilic addition reactions

1. Addition of hydrogen cyanide (HCN)

36. Identify X and Y in $\text{CH}_3\text{CHO} \xrightarrow{\text{HCN}} \text{X} \xrightarrow{\text{H}_2\text{O}/\text{H}^+} \text{Y}$ 2
37. How would you obtain 2-hydroxypropanoic acid from Ethanal? 2
38. How would you obtain 2-hydroxy-2-methylpropanoic acid from Propanone? 2
39. CH_3CHO is used in a two-step synthetic route to form W, as shown in the following figure.

In step 1, CH_3CHO is heated with HCN in the presence of KCN.



Name the mechanism for the reaction in step 1 in the above figure. 1

2. Addition of sodium bisulphite (NaHSO_3)

40. Write the action of sodium bisulphite on Propanone. 2

Nucleophilic addition followed by elimination (Addition of ammonia derivatives)

41. What happens when acetone reacts with hydroxylamine? 2
42. What happens when Propanone is treated with 2,4-DNPh? 1
- What happens when Propanone is treated with 2,4-DNP? 1
43. Give an example of DNPh test. 1
- Give an example of the DNP test. 1
- Write the chemical equation to illustrate the following reaction: 2,4-DNP test. 1
44. Acetone is the first member of ketones that belongs to carbonyl compounds.
- Draw the structural formula and IUPAC name of acetone.
 - Give a chemical reaction to show that acetone contains a carbonyl group.
 - Convert acetone into 2-hydroxy-2-methylpropanoic acid.
 - How would you prepare acetone from 2,2-dichloropropane?
 - Point out a major use of acetone in our daily life. 1+1+2+1

Reducing properties of aldehydes (Oxidation of aldehydes)

1) Oxidation with **Tollens' reagent**

45. Write a correct example of Tollens' test. 1
Give an example of Tollens' test. 1
46. What is Tollens' reagent? What happens when acetaldehyde (Ethanal) is heated with Tollens' reagent? 2
47. What action takes place when Methanal is treated with Tollens' reagent? 2
48. What functional group is present in a compound that gives a positive Tollens' test? Write an equation showing the reaction involved in a positive Tollens' test. 2
49. Application of Tollens' test. 2
50. What happens when the product obtained by dehydrogenation of Ethanol is allowed to react with Tollens' reagent? 2
51. An organic compound C_3H_6O gives an orange precipitate with 2,4-dinitrophenylhydrazine but does not produce a silver mirror with Tollens' reagent. Identify the compound and write the reaction involved. 3
52. An alkene P undergoes addition with HBr, giving a compound Q. Q gives R on reacting with aqueous sodium hydroxide. R reacts with acidified potassium dichromate, giving S. S responds to the DNP test but does not give Tollens' test. The alkene P can be prepared by heating Chloropropane with an alcoholic solution of potassium hydroxide. Identify P, Q, R and S with all reactions involved. 3
53. An organic compound W undergoes addition with HCl, resulting in X. X, on treatment with aqueous sodium hydroxide, gives Y. Y undergoes oxidation with $K_2Cr_2O_7$ to produce Z. Z produces Propane on Wolff-Kishner reduction. Z gives a positive DNP test but a negative Tollens' test. Identify W, X, Y, and Z along with pertinent equations. 3

2. Oxidation with **Fehling's solution**

54. What reagent is used to diagnose diabetes in human urine? 2

Iodoform test

55. Complete and balance the following equation: 2
 $CH_3-CO-CH_3 + I_2 + NaOH \longrightarrow$
56. What happens when Propanone is warmed with iodine and sodium hydroxide? 2
57. Give a balanced chemical equation for ethanal heated with Iodine and aqueous sodium hydroxide. 2
58. Identify X and Y in the following reaction: 2
 $CH_3CHO \xrightarrow{I_2/NaOH/heat} X \xrightarrow{Ag/heat} Y$
59. Write the aldehydes and ketones that can be formed from C_4H_8O . Give their IUPAC names. Which one of these isomers gives the iodoform test and why? 3
60. An organic compound A (C_4H_8O) forms Phenylhydrazone with phenylhydrazine and reduces Fehling's solution. It has a negative iodoform test. Identify A. 3
61. An organic compound C_3H_6O does not give a silver mirror with Tollens' reagent but gives a yellow precipitate with NaOH and I_2 . Identify the compound and write the reaction involved. 3
62. A carbonyl compound (X) gives the iodoform test and can be obtained by oxidation of a monohydric alcohol containing three carbon atoms. 3
- Write down the structural formula of (X).
 - Give a functional isomer of (X), giving the IUPAC name.
 - How is (X) prepared from 2,2-dichloropropane?
 - Write down the reactions for the conversion of (X) into 2-hydroxy-2-methylpropanoic acid.
 - What is the laboratory test for carbonyl compounds? 1 x 5 = 5
63. An organic compound C_3H_6O does not give a silver mirror with Tollens' reagent but gives a yellow precipitate with NaOH and I_2 . Identify the compound and write the reaction involved. 3

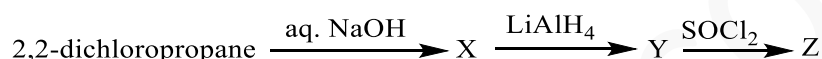
64. An organic compound A (C_4H_8O) forms Phenylhydrazone with phenylhydrazine and reduces Fehling's solution. It has a negative iodoform test. Identify A. 3
65. Write the possible isomeric aldehydes and ketones that can be formed from C_4H_8O . Give their IUPAC names. Which one of these isomers gives the iodoform test and why? 3
66. Write the functional isomer of CH_3COCH_3 and give a chemical test to distinguish them. 2
67. Suggest a suitable chemical test to distinguish Ethanal from Propanone. Give the chemical reactions too. 2
68. A carbonyl compound 'A' gives both Tollen's iodoform tests positively.
69. Identify the compound 'A'. 1
70. How does the compound 'A' react with dil. NaOH? Give the chemical equation involved. 1
71. Write the chemical equation when compound 'A' reacts with HCN followed by hydrolysis. 2
72. How is Ethanal converted into 2-hydroxy-2-methylbutanoic acid? 5

Reduction of Aldehydes and Ketones

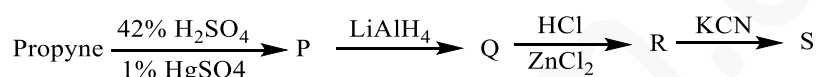
1. Reduction by H_2/Ni (Catalytic reduction) (or addition of H_2)

2. Reduction with $LiAlH_4$

73. How is Ethanol prepared from 1,1-dichloroethane? 2
74. Make the following conversion:



75. Identify P, Q, R and S in the following reaction sequence



What happens when the compound P is treated with HCN? 5

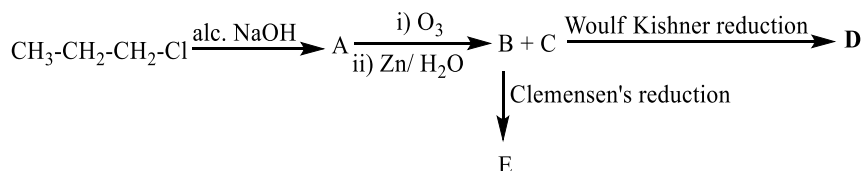
3. Clemmensen's reduction

76. An alkene 'A' undergoes ozonolysis to give an aldehyde and a ketone. The aldehyde and the ketone further undergo Clemmensen's reduction to yield ethane and propane, respectively. Identify A and give its IUPAC name. What product would you expect when 'A' is treated with HBr? 4
77. A Haloalkane P reacts with aq. KOH to give Q. The compound Q, on oxidation with $K_2Cr_2O_7/H^+$ gives R, and R undergoes Clemmensen's reduction to produce S. The compound P reacts with sodium in the presence of dry ether to form 2,3-dimethylbutane. Write the chemical reactions involved and identify P, Q, R and S. 5
78. An organic compound A reacts with HCN to give B. Hydrolysis of B in an acidic medium gives C. 'A' also produces Propane when treated with Zn amalgam and HCl. Identify A, B and C with reactions and IUPAC names. What product would you expect when A is treated with Trichloromethane in an alkaline medium? 5
79. An organic compound ($C_5H_{10}O$) reacts with phenylhydrazine to form phenylhydrazone. The compound does not reduce Fehling's solution but gives the Iodoform test. The compound, on Clemmensen's reduction, gives Pentane. Identify the organic compound, giving necessary chemical equations. 5
80. An alkene 'A' undergoes ozonolysis to give an aldehyde and a ketone. The aldehyde gives a positive iodoform test, and the ketone undergoes Clemmensen's reduction to yield Propane. Identify 'A' and give its IUPAC name. Also write the reactions involved. 5

4. Wolff - Kishner reduction

81. Give an example of Wolff - Kishner reduction. 2

82. Identify A, B, C, D, and E in the following reaction sequence.



Other reactions of aldehydes and ketones

Reaction of Aldehydes and Ketones with PCl_5

83. What happens when Propanone is reacted with PCl_5 ? 1

Aldol condensation reaction

84. What happens when Propanone is treated with dil. NaOH solution?

85. Give an example (with formula) each from aliphatic and aromatic aldehydes which give an aldol condensation reaction.

Write an example of an aldol condensation reaction, giving appropriate conditions.

86. How is 3-hydroxybutanal obtained from Ethanal?

How is Ethanal converted into 3-hydroxybutanal? 2

Cannizzaro's reaction

87. Give an example (with formula) each from aliphatic and aromatic hydrocarbons which gives Cannizzaro's reaction. 2

88. How does Methanal react with conc. NaOH? 2

89. What happens when Benzaldehyde is heated with conc. NaOH? 1

90. Write short notes on Cannizzaro's reaction. 2

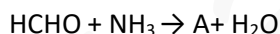
Show your acquaintance with Cannizzaro's reaction. 2

Write an example of the following reaction, giving appropriate conditions: Cannizzaro's reaction 1

Reaction of Methanal with Ammonia

91. Give the action of Methanal on ammonia. 1

92. Identify A and give one of its uses.



2

Reaction of Formaldehyde with Phenol

93. What happens when Phenol is treated with Methanal in an acidic medium? 2

Formalin and its uses

94. Formaldehyde is the first member of aldehydes which does not contain an alkyl group.

i) Write the molecular structure and IUPAC name of formaldehyde. 1

ii) Write down the chemical reaction for the preparation of formaldehyde from methanol. 1

iii) How is formalin prepared from formaldehyde? Give a laboratory use of formalin. 1+1

iv) What happens when formaldehyde is treated with ammonia? 1

95. Convert Ethanal into Methanal. 4

*** ... ***

<https://subarnam.com.np/>