CHAPTER : 12

ALDEHYDES, KETONES AND CARBOXYLIC ACID

Very Short Answer Type Questions

01. Write the structure of 3-methyl butanal.

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

03. Rearrange the following compounds in the increasing order of their boiling points

$CH_3-CHO, CH_3-CH_2-OH, CH_3-CH_2-CH_3$

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

05. Write the IUPAC name of the following.

$\overset{5}{CH_3}-\overset{4}{CH_2}-\overset{3}{CH}=\overset{2}{CH}-\overset{1}{\overset{O}{\overset{\|}{C}}}-H$

06. Arrange the following compounds in the increasing order of their reactivity towards nucleophilic addition reactions. Ethanal, Propanal, Propanone, Butanone.

07. Give a simple tests to distinguish between the following pair of compounds. Pentan-2-one and pentan-3-one.

08. Explain the mechanism of: Addition of Grignard's reagent to the carbonyl group forming an adduct followed by hydrolysis.

09. What is Tollen's reagent? Write one uses of this regent.

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

Short Answer Type Questions

11. Write the reagents required in the following reactions.

(i) $CH_2=CH-CH_2OH \xrightarrow{?} CH_2=CH-CHO$ (ii) $CH_3-COOH \xrightarrow{?} CH_3-CONH_2$

12. Name the reagents used in the following reactions.

(i) $CH_3-CO-CH_3 \xrightarrow{?} CH_3-\underset{\underset{OH}{|}}{CH}-CH_3$

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

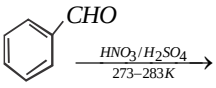
13. Give simple chemical tests to distinguish between the following pairs of compounds

(i) Benzaldehyde and benzoic acid

(ii) Propanal and propanone

14. Complete the following reactions

(i) $2H-\underset{\underset{O}{\|}}{C}-H \xrightarrow{Conc.KOH}$

(ii) 

15. Write reactions and conditions for the following conversions:

(i) Toluene to benzoic acid.

(ii) Acetic acid to ethylamine

16. Write reactions stating conditions for the following conversion:

(i) Benzene to acetophenone

(ii) Ethanal to propanone.

17. Why carboxylic acids do not give the characterstic reactions of carbonyl group?

18. Write the names of the reagents and equations in the conversion of:

(i) phenol to salicylaldehyde

(ii) anisole to p-methoxyacetophenone

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

(i) Acylation reaction

(ii) Rosenmund reduction.

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

(i) Propanoyl chloride and Propanoic acid

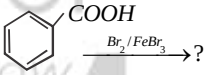
(ii) Benzaldehyde and Acetophenone.

Long Answer Type Questions

21. Predict the products of the following reactions.

(i) $CH_3-\underset{\underset{CH_3}{|}}{C}=O \xrightarrow{H_2N-NH_2} ?$

(ii) $C_6H_5-CH_3 \xrightarrow[(ii)H^+]{(i)KMnO_4/KOH} ?$

(iii) 

22. Predict the products of the following reactions.

(i) $CH_3-\underset{\underset{CH_3}{|}}{C}=O \xrightarrow[(ii)KOH/Glycol,\Delta]{(i)H_2N-NH_2} ?$

(ii) $C_6H_5-CO-CH_3 \xrightarrow{NaOH/I_2} ?+?$

(iii) $CH_3COONa \xrightarrow[\Delta]{NaOH/CaO} ?$

23. Draw the structures of the main products of following reactions.

(i) 

(ii) $H_3C-C\equiv C-H \xrightarrow[333K]{Hg^{2+},H_2SO_4}$

24. (i) Account for the following.

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

(b) Carboxylic acid is a stronger acid than phenol

(ii) Write the chemical equations to illustrate the following name reactions.

(a) Wolff-Kishner reduction (b) aldol condensation (c) Cannizzaro reaction

25. (a) An organic compound (A) having molecular formula $C_9H_{10}O$ forms an orange red precipitate (B) with 2, 4-DNP reagent. Compound (A) gives a yellow precipitate (C) when heated in the presence of iodine and NaOH along with a calourless compound (D). (A) does not reduce Tollens' reagent or Fehling's solution nor does it decolourise bromine water. On drastic oxidation of (A) with chromic acid, a carboxylic acid (E) of molecular formula $C_7H_6O_2$ is formed. Deduce the structures of the organic compounds (A) to (E).

(b) Give the chemical tests to distinguish between

(i) Propanol and propanone (ii) Benzaldehyde and acetophenone

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

26. (a) How would you account for the following:

(i) Aldehydes are more reactive than ketones towards nucleophiles.

(ii) The boiling points of aldehydes and ketones are lower than of the corresponding acids.

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

(b) What happen when

(i) Ethanal react with semicarbazide. (ii) Propanone react with phenylhydrazine

27. (a) llustrate the following name reactions:

(i) Clemensen Reduction (ii) Wolff-Kishner reduction reaction

(b) How are the following conversions carried out?

(i) Ethyl cyanide to ethanoic acid

(ii) Butan-I-ol to butanoic acid

(iii) Methybenzene to benzoic acid

Write chemical equations for the involved reactions.

28. (a) Write a suitable chemical equation to complete each of the following transformations:

(i) Butan-1-ol to butanoic acid

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

(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 vigorous oxidation it gives 1, 2-benzenedicarboxylic acid. Identify the compound.

OR

(a) Give chemical tests to distinguish between:

(i) Propanal and propanone (ii) Benzaldehyde and acetophenone

(b) Arrange the following compounds in an increasing order of their property as indicated :

(i) Acetaldehyde, Acetone, Methyl tert-butyl ketone (reactivity towards HCN)

(ii) Benzoic acid, 3, 4-Dinitrobenzoic acid, 4-Methoxybenzoic acid (acid strength)

(iii) $CH_3CH_2CH(Br)COOH$, $CH_3CH(Br)CH_2COOH$, $(CH_3)_2CHCOOH$ (acid strength).

29. (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 cyanohydrin in good yield but 2, 4, 6 trimethylcyclohexanone does not.

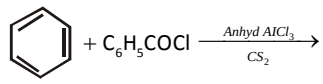
(b) An organic compound 'A' (C_3H_4) on hydration in presence of H_2SO_4/ $HgSO_4$ gives compound 'B' (C_3H_6O) compound 'B' gives white crystalline product (D) with sodium hydrogensulphite. It gives negative Tollen's test and positive idoform's test. On drastic oxidation 'B' gives compound 'C' ($C_2H_4O_2$) along with formic acid. Identify compounds 'A', 'B' and 'C' and explain all the reactions.

OR

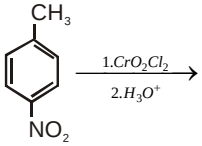
(a) Give chemical tests to distinguish between

(i) Phenol and Benzoic acid (ii) Benzophenone and Acetophenone

(b) Write the structures of the main products of following reactions :

(i) 

(ii) $H_3C-C\equiv C-H \xrightarrow{Hg^{2+},H_2SO_4}$

(iii) 

30. (a) Describe the mechanism of the addition of Grignard reagent to the carbonyl group of a compound to form an adduct which on hydrolysis yields an alcohol.

(b) Draw the structures of the following compounds :

(i) 3- Methylbutanal (ii) Hexane-1, 6-dioic acid (iii) p-Nitropropiophenone

OR

(a) Illustrate the following reactions giving a suitable chemical equation for each :

(i) Cannizzaro reaction (ii) Hell-Volhard-Zelinsky reaction

(b) How would you bring about the following conversions? Write the complete equation in each case.

(i) Ethanal to 3-hydroxybutanal

(ii) Benzoic acid to m-nitrobenzyl alcohol

(iii) Benzaldehyde to benzophenone

Model Questions

01. Draw the structure of 2-methybutanal.

02. Write the reagents required in the following reactions.

(i) $CH_2=CH-CH_2OH \xrightarrow{?} CH_2=CH-CHO$ (ii) $CH_3-COOH \xrightarrow{?} CH_3-CONH_2$

03. Arrange the following compounds in the increasing order of their property as indicated.

(i) $CH_3COCH_3, C_6H_5COCH_3, CH_3CHO$ (Reactivity towards nucleophilic addition reaction)

(ii) $Cl-CH_2-COOH, F-CH_2-COOH, CH_3-COOH$ (Acidic character)

04. Give reasons

(i) Chloroacetic acid is stronger than acetic acid

(ii) pH of reaction should be carefully controlled while preparing ammonia derivatives of carbonyl compounds.

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

(i) Ethanal and propanal (ii) Benzoic acid and phonol

06. Write structures of compounds A, B and C in each of the following reactions.

(i) $C_6H_5Br \xrightarrow{Mg/dry\ ether} A \xrightarrow[(b)H_3O^+]{CO_2(g)} B \xrightarrow{PCl_5} C$

(ii) $CH_3CN \xrightarrow[(b)H_3O^+]{(a)SnCl_2/HCl} A \xrightarrow{dil.NaOH} B \xrightarrow{\Delta} C$

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

08. Describe how the following conversions can be brought about?

(i) Cyclohexanol to cyclohexan-1-one. (ii) Ethyl benzene to benzoic acid

(iii) Bromobenzene to benzoic acid.

09. (i) Write the chemical equations for the reaction involved in Cannizzaro reaction.

(ii) Draw the structure of semicarbazone of ethanol

(iii) Why $pK_a \text{ of } F-CH_2-COOH$ is lower than that $Cl-CH_2-COOH$?

(iv) Write the product in the following reaction $CH_3-CH=CH-CH_2CN \xrightarrow[(ii)H_2O]{(i)DIBAL-H}$

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

10. 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.

11. (i) How would you account for the following?

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

(b) The boiling points of aldehydes and ketones are lower than that of the corresponding acids.

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

(ii) Give chemical tests to distringuish between

(a) Acetaldehyde and benzaldehyde (b) Propanone and propanol

12. Identify A, B, C, D and E in the following sequence of reactions.

$$A \xrightarrow{Cl_2} CHCl_3 \xrightarrow{NaOH} B \xrightarrow{C_6H_5COCl} C \xrightarrow{C_6H_6/AlCl_3} D+E$$

13. An organic compound A($C_7H_6Cl_2$) on treatment with NaOH solution gives another compound B(C_7H_6O). B on oxidation gives an acid C ($C_7H_6O_2$) which on treatment with a mixture of conc. HNO_3 and H_2SO_4 gives a compound D ($C_7H_5NO_4$). B on treatment with conc. NaOh gives a compound E (C_7H_8O) and C_6H_5COONa. Deduce the structures of A, B, C, D and E.