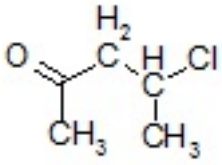
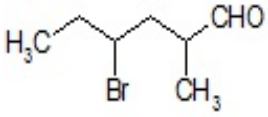
CBSE Test Paper - 03

Class - 12 Chemistry (Aldehydes, Ketones and Carboxylic Acids)

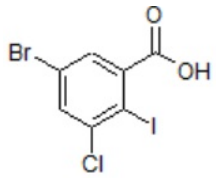
1. The aldehydes and ketones undergo one of the following reactions:
   a. None of these
   b. electrophilic addition reaction
   c. substitution reaction
   d. nucleophilic addition reactions
2. A strong base can abstract an α – hydrogen from
   a. Alkene
   b. Amine
   c. Alkane
   d. Ketone
3. Aldehydes are prepared by reducing nitriles to corresponding imines with stannous chloride in the presence of hydrochloric acid. This reaction is called
   a. Gatterman – Koch reaction
   b. Etard reaction
   c. Stephens reaction
   d. Friedel – Crafts reaction
4. In Hell – Volhard Zelinsky reaction, halogen reacts with
   a. aldehydes
   b. ketones
   c. carboxylic acids
   d. ethers
5. The product formed in Aldol condensation is
   a. a beta – hydroxy aldehyde or a beta – hydroxy ketone.
   b. an alpha – hydroxy aldehyde or ketone.
   c. a beta – hydroxy acid
   d. an alpha, beta unsaturated ester
6. Write a chemical test to distinguish between aldehyde and ketone.
7. What IUPAC name would you give to the following compound?

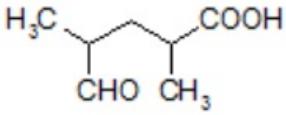


8. Write the IUPAC name of the following aldehyde. If possible, give also common name.

   $CH_3CH_2CH(Br)CH_2$ $CH(CH_3)CHO$ or 

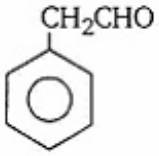
9. Write IUPAC names of:

   i. 

   ii. 

10. How is acetone obtained from ethanol?

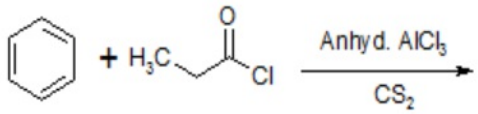
11. Write the IUPAC names for the following:

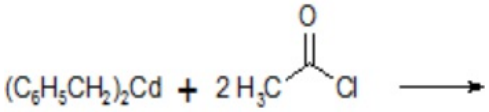
    i. 

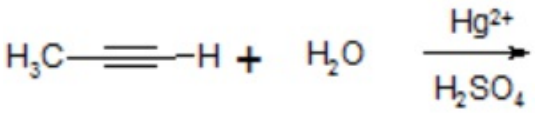
    ii. $CH_3CH_2 - \underset{\underset{Br}{|}}{CH} - COOH$

12. Give reasons for the following:
    a. Carboxylic acids do not give characteristic reactions of carbonyl group.
    b. Treatment of benzaldehyde with HCN gives a mixture of two isomers which cannot be separated even by careful fractional distillation.
    c. Sodium bisulphite is used for the purification of aldehydes and ketones.

13. Write the structures of products of the following reactions:

    i. 

    ii. 

iii. 

14. a. Explain the mechanism of a nucleophilic attack on the carbonyl group of an aldehyde or a ketone.
    b. Identify A, B and C in the following sequence of reactions:

$$CH_3CHO \xrightarrow[H_2O]{C_2H_5MgCl} A \xrightarrow{Conc.\ H_2SO_4} B \xrightarrow{HBr+Peroxide} C$$

    c. Predict the structure of the product formed when benzaldehyde is treated with
        i. Conc. NaOH
        ii. HNO_3,H_2SO_4 (at 23-383 K)

15. An organic compound contains 69.77% carbon, 11.63% hydrogen and rest 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 give positive iodoform test. On vigorous oxidation it gives ethanoic and propanoic acid. Write the possible structure of the compound.

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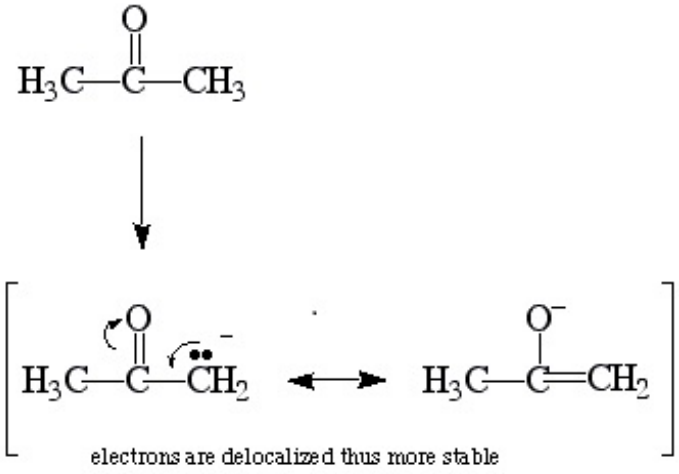
Solutions

1. (d) nucleophilic addition reactions

   Explanation: Aldehydes and Ketones undergoes the characteristic nucleophilic addition reaction. this is because of presence of polar>C=O bond in aldehydes and ketones. due to electronegativity difference between C and O, O bears a small (delta) negative charge while C bears a small (delta) positive charge. now because of delta positive charge on C nucleophile can add to >C=O bond giving nucleophilic addition reaction

2. (d) Ketone

   Explanation: Conjugate base of ketone which is formed is stable due to electron with drawing nature of adjacent CO group and resonance.



3. (c) Stephens reaction

   Explanation: Reaction for preparation of aldehydes by reducing RCN in presence of $SnCl_2$ is Stephen's Reaction.

   The mechanism of the reaction is as shown below.

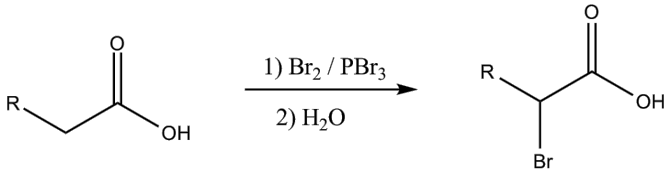
   $SnCl_2 + 2HCl \longrightarrow SnCl_2 + 2[H]$

   $$R - C \equiv N + 2[H] + HCl \longrightarrow R - CH = NH.HCl \xrightarrow{\text{Boiling } H_2O} \underset{R-C-H}{\overset{O}{\overset{\|}{}}} + NH_4Cl$$

4. (c) carboxylic acids

   Explanation: Alpha Hydrogen containing carboxylic acids undergo HVZ reaction.

HVZ reaction is used for alpha halogenation of carboxylic acid.



5. (a) a beta – hydroxy aldehyde or a beta – hydroxy ketone.
   Explanation: In aldol, we get beta hydroxyl aldehyde/Ketone which undergo further dehydration to give alpha beta unsaturated aldehyde / ketone.

6. Aldehydes and ketones are distinguished using Tollen's test. Aldehydes give a silver mirror on reacting with Tollen's reagent whereas ketones do not react. The reaction is $RCHO + 2[Ag(NH_3)_2]^+ + 3OH^- \rightarrow RCOO^- + 2Ag$ (silver mirror) $+ 2H_2O + 4NH_3$

7. The IUPAC name for the compound is 4-Chloropentan-2-one.

8. **IUPAC Name:** 4-Bromo-2-methylhexanal; **Common Name:** γ-Bromo-α-methyl caproaldehyde

9. i. 5-Bromo-3-chloro-2-iodobenzoic acid
   ii. 4-Formyl-2-methylpentanoic acid

10. $$\underset{Ethanol}{CH_3CH_2OH} \xrightarrow[573K]{Cu} \underset{Ethanal}{CH_3CHO} \xrightarrow[(ii)H_2O/H^+]{(i)CH_3MgBr}$$
    $$CH_3-\underset{Propan-2-ol}{\overset{OH}{\overset{|}{C}}H}-CH_3 \xrightarrow[Cu]{573K} CH_3-\underset{Acetone}{\overset{O}{\overset{||}{C}}}-CH_3$$

11. i. 2-Phenylacetaldehyde
    ii. 2-Bromobutanoic acid

12. a. This is due to the lone pairs on oxygen atom attached to the hydrogen atom in the -COOH group, are involved in resonance and hence making the carbon atom less electrophilic. Hence, carboxylic acids do not give their action of carbonyl groups

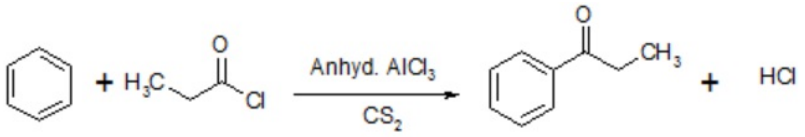
    b. C_6H_5CHO reacts with HCN to form isomeric benzaldehyde cyanohydrins because an asymmetric carbon atom is introduced

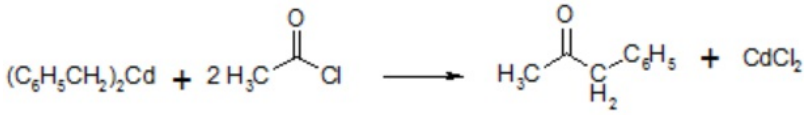
$$C_6H_5\overset{H}{\underset{|}{C}}=O + HCN \rightarrow C_6H_5-\overset{H}{\underset{CN}{\overset{|}{\underset{|}{C}}}}*-OH \text{ (Asymmetric carbon atom)}$$

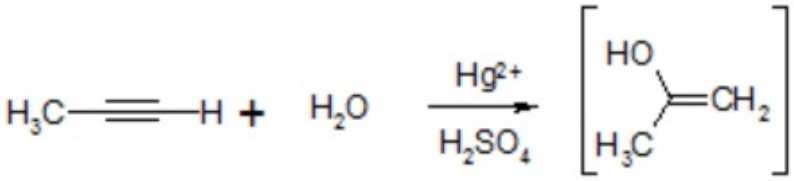
These two isomers are enantiomers and therefore, cannot be separated by physical methods like fractional distillation.

c. Aldehydes and ketones form addition compounds with $NaHSO_3$ whereas impurities do not. On hydrolysis, we get pure aldehydes and ketones back.

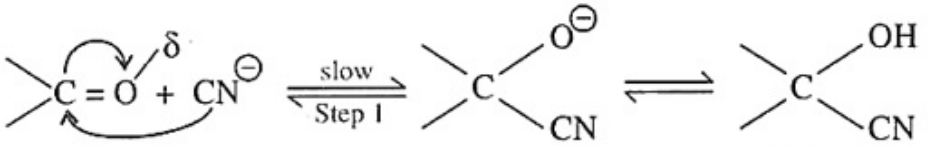
$$CH_3-\overset{O}{\overset{||}{C}}-H + NaHSO_3 \rightarrow CH_3\text{ - CH - }SO_3Na \xrightarrow{H_2O/H} CH_3-\overset{C}{\overset{||}{O}}-H + NaHSO_3$$

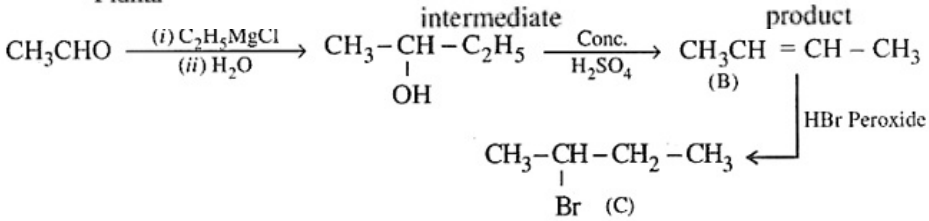
13. i. 

ii. 

iii. 

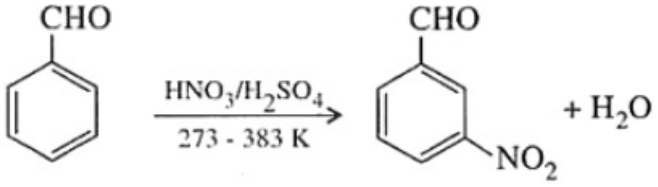
14. a. $HCN \rightarrow H^+ + CN^-$



b. 

c. In this part, first one is cannizzaro reaction and the other one is nitration of benzaldehyde.

i. $2C_6H_5CHO \xrightarrow[NaOH]{Conc.} C_6H_5\text{-}CH_2OH + C_6H_5COONa$

ii. 

15. Percentage of carbon = 69.77 %, Percentage of hydrogen = 11.63 %, Percentage of oxygen = {100 - (69.77 + 11.63)}% = 18.6 %

Thus, the ratio of the number of carbon, hydrogen, and oxygen atoms in the organic compound is given as: $C : H : O = \frac{69.77}{12} : \frac{11.63}{1} : \frac{18.6}{16}$ =5.81: 11.63: 1.16 =5:10:1

Therefore, the empirical formula of the compound is $C_5H_{10}O$. Now, the empirical formula mass of the compound can be given as: $5 \times 12 + 10 \times 1 + 1 \times 16$ = 86

Molecular mass of the compound = 86 Therefore, the molecular formula of the compound is given $C_5H_{10}O$. Since the given compound does not reduce Tollen's reagent, it is not an aldehyde. Again, the compound forms sodium hydrogen sulphate addition products and gives a positive iodoform test. Since the compound is not an aldehyde, it must be a methyl ketone. The given compound also gives a mixture of ethanoic acid and propanoic acid. Hence, the given compound is Pentan-2-one.

$$\underset{\text{Pentan - 2 - ol}}{CH_3 - \overset{\overset{O}{||}}{C} - CH_2 - CH_2 - CH_3}$$

The given reactions can be explained by the following equations: