CBSE Test Paper - 02

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

1. Which of the following acids does not exhibit optical isomerism?
   a. Maleic acid
   b. Tartaric acid
   c. α – amino acids
   d. Lactic acid
2. The correct sequence of steps involved in the mechanism of Cannizzaro's reaction is
   a. electrophilic attack by OH^- , transfer of H^+ and transfer of H^-
   b. transfer of H^+, nucleophilic attack and transfer of H^-
   c. electrophilic attack by OH^- , transfer of H^+ and transfer of H^-
   d. nucleophilic attack, transfer of H^- and transfer of H^+
3. A mixture of benzaldehyde and formaldehyde on heating with aqueous NaOH solution gives
   a. benzyl alcohol and methyl alcohol
   b. benzyl alcohol and sodium formate
   c. sodium benzoate and methyl alcohol
   d. sodium benzoate and sodium formate
4. How to do the following conversion :
   RCOOCl + ? $\rightarrow$ RCHO
   a. Using H_2-Pd,$BaSO_4$
   b. Using DIBAL-H
   c. Using H_2 - Pd
   d. Using $NaBH_4$
5. CH_3CHO and $C_6H_5CH_2CHO$ can be distinguished chemically by:
   a. Iodoform test
   b. Benedict test
   c. 2,4 DNP test
   d. Tollen's reagent test

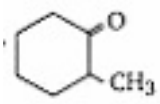
6. Write the IUPAC name of the following ketones and aldehyde. If possible, give also common name.
   $CH_3(CH_2)_5CHO$

7. Name two important uses of formalin.

8. Write the chemical name and structure of Rochelle salt.

9. Write the steps for the conversion of Acetaldehyde to Acetone.

10. Fluoroacetic acid is a stronger acid than acetic acid. Explain.

11. Write IUPAC name of 

12. Show conversion of Ethyl alcohol to acetone.

13. Why is that alkene undergo electrophilic addition while aldehyde/ketone undergo nucleophilic addition reaction?

14. Give chemical tests to distinguish between the following pairs of compounds.
    1. Propanoyl chloride and propanoic acid
    2. Benzaldehyde and Acetophenone

15. An organic compound 'A' with molecular formula C_8H_8O gives positive DNP test and iodoform test. It does not reduce Tollen's or Fehling's reagent and does not decolourise bromine water. On oxidation with chromic acid (H_2CrO_4) it gives a carboxylic acid (B) with molecular formula $C_7H_6O_2$. Deduce the structures of A and B.

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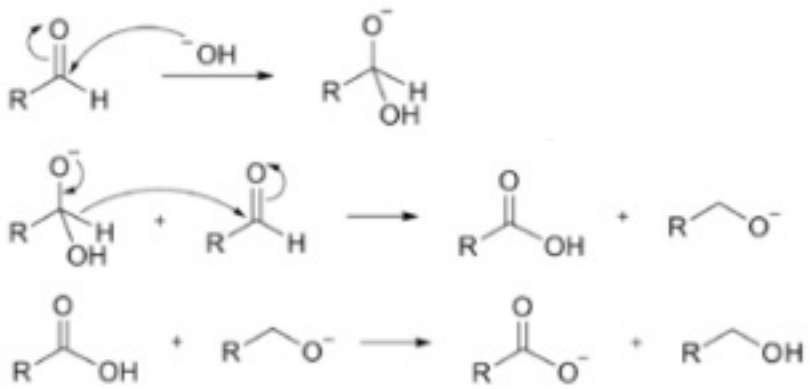
Solutions

1. (a) Maleic acid

   Explanation: Maleic Acid shows Geometrical Isomerism due restricted bond roation along C=C bond but does not give optical isomerism as it has horizontal plane of symmetry , as C=C bond is planar and thus do not form a non superimposable mirror image and is optically inactive .

2. (d) nucleophilic attack, transfer of H^- and transfer of H^+

   Explanation: In Cannizzaro reaction 1st nucleophile OH^- attacks on carbonyl carbon. Then hydride shifting takes place. Followed by proton transfer as shown below (in, RCHO, R group has no alpha hydrogen) :

   Cannizaro is a kind of disproportionation reaction where aldehyde or ketones having no alpha hydrogen get oxidised to acid and reduced to alcohol.

3. (b) benzyl alcohol and sodium formate

   Explanation: They will undergo cannizaro reaction as neither benzaldehyde nor formaldehyde has alpha hydrogen.

   HCHO will be more reactive towards cannizaro compared to benzaldehyde because of less steric hinderance.

   So, OH^- nucleophile will attck on HCHO first and then hydride shift from HCHO to benzaldehyde will occur. and thus HCHO will oxidise to $HCOO^-$ ion and benzaldehyde will reduce to benzylalcohol.

4. (a) Using H_2-Pd,$BaSO_4$

Explanation: Catalytic hydrogenation of acid chloride using H_2-Pd, $BaSO_4$ converts acid chloride selectively to aldehydes. This is known as Rosenmud Reduction.

5. (a) Iodoform test

   Explanation: CH_3CHO will give iodoform test and $C_6H_5CH_2CHO$ will not give iodoform test. Methyl aldehydes or ketones give iodoform test. In carbonyls like RCOR' one of R or R' should be a CH_3 group to give positive iodoform test.

   $CH_3CHO + NaOI \rightarrow CHI_3 + HCOO^-Na^+$

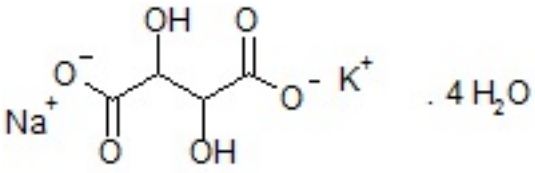
   CHI_3 formed is known as iodoform and is yellow precipitate.

   $C_6H_5CH_2CHO + NaOI \rightarrow$ no reaction

6. **IUPAC Name:** Heptanal; **Common name:** Oenanthaldehyde, Heptylaldehyde, Enanthole

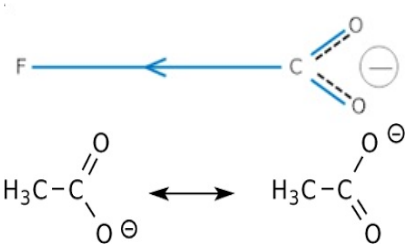
7. The important uses of Formalin are:
   i. to preserve biological specimens.
   ii. as an antiseptic and disinfectant.

8. Rochelle salt is a double salt of tartaric acid, chemically known as potassium sodium tartrate tetrahydrate.



9. $CH_3CHO \xrightarrow[KMnO_4]{(O)} CH_3COOH \xrightarrow{slaked\ lime,\ Ca(OH)_2} (CH_3COO)_2Ca \xrightarrow{Heat} CH_3 - \overset{O}{\overset{\|}{C}} - CH_3$

10. $F - CH_2 - \overset{O}{\overset{\|}{C}} - OH$ *Fluroacetic acid* and $CH_3 - \overset{O}{\overset{\|}{C}} - OH$ *acetic acid*
    In fluoroacetic acid, Fluorine is an electron withdrawing group. It stabilizes the conjugate base through de-localization of the negative charge by decreasing the electron density on carbonyl carbon atom. On the other hand, acetic acid has methyl group which is electron donating group, increases the electron density on carbonyl carbon atom which destabilizes the conjugate base.

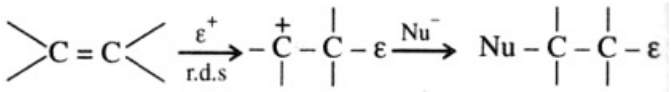


Therefore, fluoroacetic acid is a stronger acid than acetic acid.

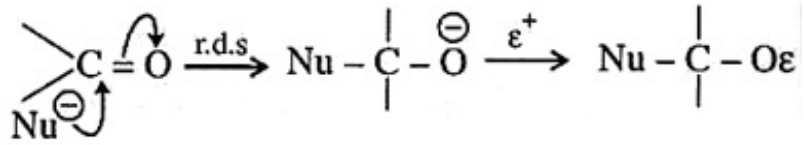
11. The IUPAC name is 2-Methylcyclohexanone

12. $CH_3COOH \xrightarrow[(ii)\ H_3O^+]{(i)\ LiAlH_4/ether} CH_3CH_2OH \xrightarrow{red\ P/I_2} CH_3CH_2I \xrightarrow{KCN} CH_3CHCN \xrightarrow[H_2O]{H^+} CH_3CH_2COOH$

13. In alkenes, the C=C bond is non-polar and contain π electron cloud present above and below the plane. This π bond of C = C is an electron source and is a nucleophilic site. Therefore, it is easier for an electrophile to attack.



In aldehydes/ketones, the carbonyl group is polar due to the electronegative difference. The carbonyl carbon (> C = O) is an electrophilic site and is attacked by a nucleophile; undergoes addition reaction.



14. i. On adding $NaHCO_3$ solution to each of them, propanoyl chloride will not react whereas propanoic acid will give brisk effervescence due to CO_2.

$$CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - Cl \ + \ NaHCO_3 \ \rightarrow \ No\ reaction$$

$$CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - OH + \ NaHCO_3$$

$$\rightarrow CH_3 - CH_2 - \overset{O}{\overset{\|}{C}} - \bar{O}\,\overset{+}{Na} \ + \ H_2O \ + \ CO_2$$

ii. On adding I_2 and NaOH, Acetophenone will give yellow ppt of iodoform whereas benzaldehyde will not react.

Benzaldehyde + I_2 + NaOH $\rightarrow$ No reaction

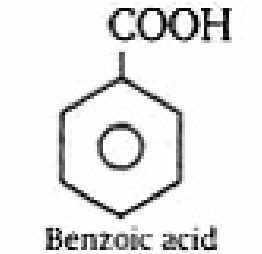
$$\underset{Acetophenone}{C_6H_5COCH_3} + \underset{Sodium\ hypoiodite}{3NaOH}$$
$$\rightarrow \underset{Sodium\ benzoate}{C_6H_5COONa} + \underset{Iodoform(yellow\ ppt)}{CHI_3} + 2NaOH$$

15. As 'A' does not give Fehling's or Tollen's test so it does not have - CHO group but it gives positive iodo form test and DNP test so it has $CH_3 - \underset{\underset{O}{\|}}{C}-$ group.

So 'A' is

Acetophenone

B is carboxylic acid obtained by the oxidation of 'A' with H_2CrO_4. So 'B' is



Benzoic acid