

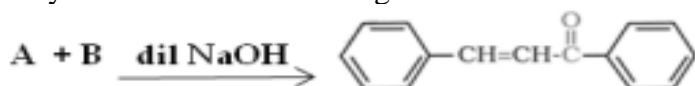


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|  | <b>INDIAN SCHOOL AL WADI AL KABIR</b>                                    |  |
| <b>Class: XII</b>   | <b>Department: SCIENCE 2023 – 24</b><br><b>SUBJECT: CHEMISTRY</b>        | <b>Date of submission:</b><br><b>20.08.2023</b>                                     |
| <b>Worksheet No: 03</b><br><b>WITH ANSWERS</b>                                    | <b>CHAPTER / UNIT: ALDEHYDES, KETONES AND</b><br><b>CARBOXYLIC ACIDS</b> | <b>Note:</b><br><b>A4 FILE FORMAT</b>   |
| <b>NAME OF THE STUDENT</b>  | <b>CLASS &amp; SEC:</b>  | <b>ROLL NO.</b>   |

### Multiple Choice Questions (1 M)

1. Identify A and B in the following reaction.



- (a) A = 1-phenylethanal, B = acetophenone  
 (b) A = Benzophenone B = formaldehyde  
 (c) A= Benzaldehyde, B = Acetophenone  
 (d) A = Benzophenone, B = Acetophenone
2. What is the IUPAC name of the ketone A, which undergoes iodoform reaction to give  $\text{CH}_3\text{CH}=\text{C}(\text{CH}_3)\text{COONa}$  and yellow precipitate of  $\text{CHI}_3$  ?
- (a) 3-Methylpent-3-en-2-one  
 (b) 3-Methylbut-2-en-1-one  
 (c) 2, 3-Dimethylethanone  
 (d) 3-Methylpent-4-one
3. Aspirin is obtained by the acetylation of which of the following compounds?
- (a) Salicylaldehyde  
 (b) Salicylic acid  
 (c) Acetyl salicylic acid  
 (d) Phenol
4. The reactivities of carbonyl compounds HCHO (I),  $\text{CH}_3\text{CHO}$  (II) and  $\text{CH}_3\text{COCH}_3$  (III) towards nucleophilic addition reaction decreases in the order.
- (a) III > II > I  
 (b) I > II > III  
 (c) II > III > I  
 (d) I > III > II

5. Which of the reactions below can result in ketones?

- (a) Oxidation of primary alcohols
- (b) Dehydrogenation of tertiary alcohols
- (c) Oxidation of secondary alcohols
- (d) Dehydrogenation of primary alcohols

6. The Rosenmund reaction can produce which of the following carbonyl compounds?

- (a) Methanal
- (b) Acetone
- (c) Butanone
- (d) Benzaldehyde

7. Which of the following is not a formaldehyde application?

- (a) Preservation of biological specimens
- (b) Preparation of acetic acid
- (c) Preparation of urea formaldehyde glues
- (d) Manufacturing of bakelite

**Assertion Reason type questions**

8. Given below are two statements labelled as Assertion (A) and Reason (R)

Assertion (A): Strong oxidising agents oxidise toluene and its derivatives to benzoic acids.

Reason (R): It is possible to stop the oxidation of toluene at the aldehyde stage with suitable reagents.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

9. Assertion (A) : The boiling points of aldehydes and ketones are higher than hydrocarbons and ethers of comparable molecular masses.

Reason (R) : There is a weak molecular association in aldehydes and ketones arising out of the dipole-dipole interactions.

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

10. Assertion (A) : Compounds containing  $-CHO$  group are easily oxidised to corresponding carboxylic acids.

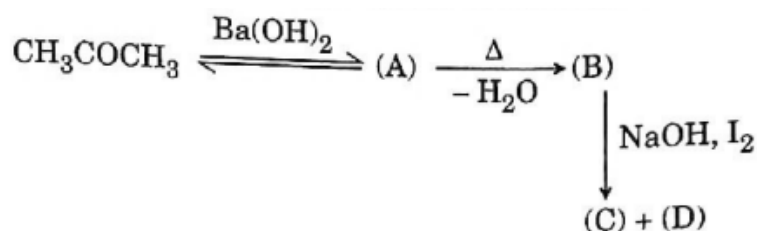
Reason (R) : Carboxylic acids can be reduced to alcohols by treatment with  $LiAlH_4$ .

Select the most appropriate answer from the options given below:

- (a) Both A and R are true and R is the correct explanation of A
- (b) Both A and R are true but R is not the correct explanation of A.
- (c) A is true but R is false.
- (d) A is false but R is true.

### Very Short answer type (2 M)

11. (a) Out of p-tolualdehyde and p-nitrobenzaldehyde, which one is more reactive towards nucleophilic addition reactions, why?  
(b) Write the structure of the product formed when acetone reacts with 2,4 DNP reagent.
12. Convert the following  
(a) Benzene to m-nitrobenzaldehyde  
(b) Ethanal to 3-Hydroxybutanal
13. Give reasons for the following  
(a) Carboxylic carbon is less electrophilic than carbonyl carbon of aldehydes and ketones.  
(b) Benzoic acid does not give Friedel Crafts reaction.
14. Write the reaction involved in the following.  
(a) Wolff Kishner reduction  
(b) Hell Volhard Zelinsky reaction
15. Complete the following sequence of reactions.

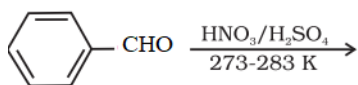


### Short answer type (3 M)

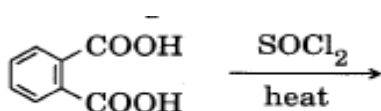
16. You are given four organic compounds "A", "B", "C" and "D". The compounds "A", "B" and "C" form an orange-red precipitate with 2,4 DNP reagent. Compounds "A" and "B" reduce Tollen's reagent while compounds "C" and "D" do not. Both "B" and "C" give a yellow precipitate when heated with iodine in the presence of NaOH. Compound "D" gives brisk effervescence with sodium bicarbonate solution. Identify "A", "B", "C" and "D" given the number of carbon atoms in three of these carbon compounds is three while one has two carbon atoms. Explain your answer.
17. How will you convert?  
(a) Toluene to Benzaldehyde  
(b) Ethanoic acid to 2-Chloroethanoic acid  
(c) Acetone to propane
18. Predict the products



(b)



(c)



19. An organic compound (X) having molecular formula  $C_5H_{10}O$  can show various properties depending on its structures. Draw each of the following structures of it.

- (a) gives positive iodoform test
- (b) shows Cannizzaro reaction
- (c) reduces Tollens reagent and has a chiral carbon

**Passage based questions (4 M)**

20. Carbon compounds containing a carboxyl functional group,  $-COOH$  are called carboxylic acids. The carboxyl group, consists of a carbonyl group attached to a hydroxyl group, hence its name carboxyl. In the IUPAC system, aliphatic carboxylic acids are named by replacing the ending  $-e$  in the name of the corresponding alkane with  $-oic$  acid. Carboxylic acids may be aliphatic ( $RCOOH$ ) or aromatic ( $ArCOOH$ ) depending on the group, alkyl or aryl, attached to carboxylic carbon.

Phthalic acid is a dicarboxylic acid with an aromatic ring.

Carboxylic acids are acidic in nature. The carboxylate anion formed is stable. Substituents may affect the stability of the conjugate base and thus, also affect the acidity of the carboxylic acids. Electron withdrawing groups increase acidity whereas electron releasing group decrease the acidity.

Answer the following questions.

- (a) Write the IUPAC name of phthalic acid.
- (b) Name the product obtained when phthalic acid is treated with  $NH_3$  followed by heat.
- (c) Although phenoxide ion has a greater number of resonating structures than carboxylate ion, carboxylic acid is a stronger acid than phenol

OR

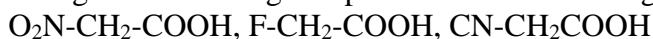
- (c) Aliphatic carboxylic acids have a higher boiling point and solubility (in water) than alcohols of similar molecular mass.

**Long answer type (5 M)**

21. (a) How can you convert each of the following compounds to benzoic acid?

- (i) Acetophenone
- (ii) Ethylbenzene
- (iii) Bromobenzene

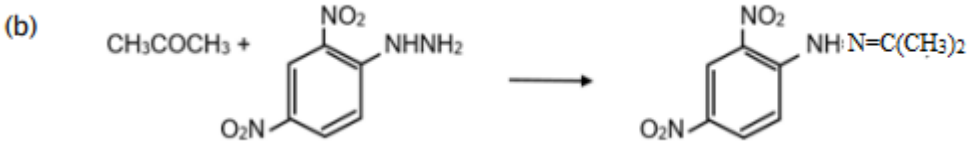
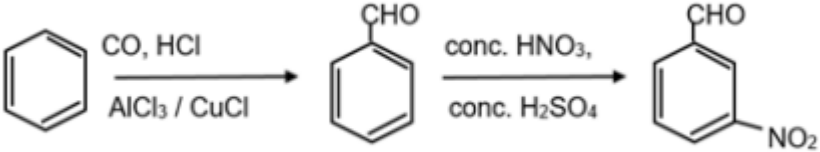
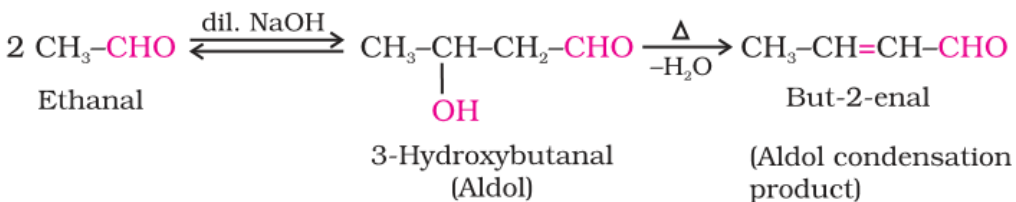
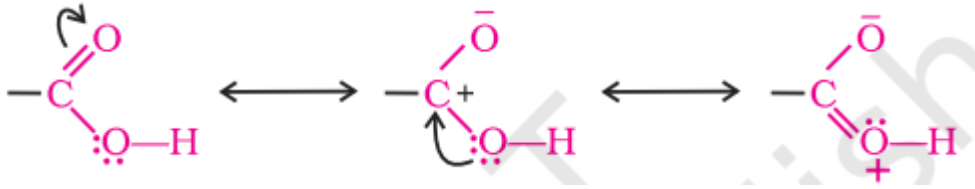
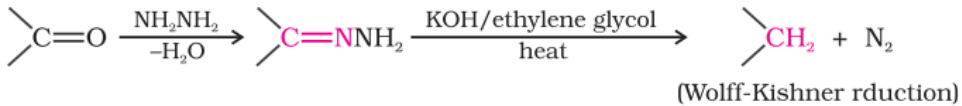
(b) Arrange the following compounds in the increasing order of acidic character.



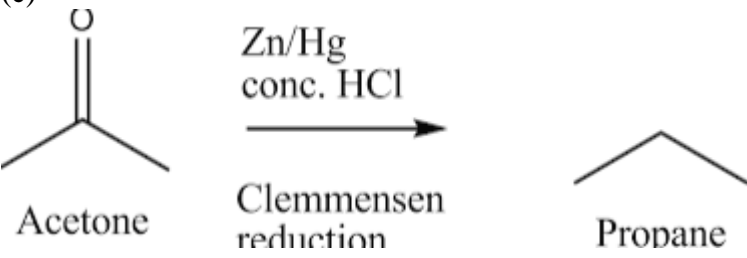
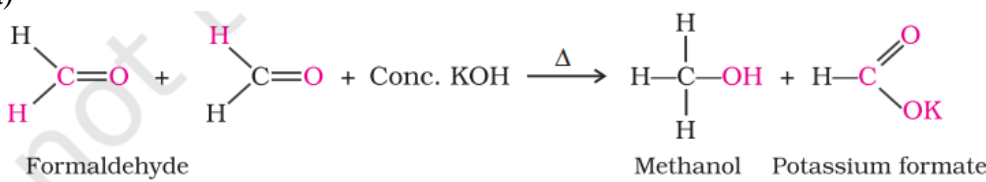
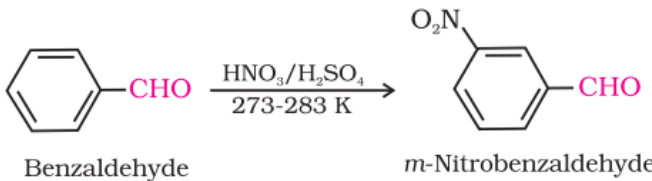
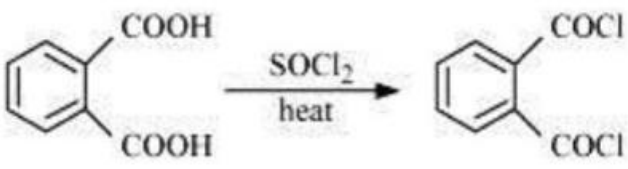
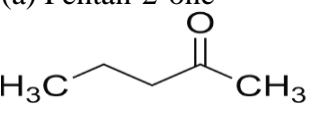
(c) Give a chemical test to distinguish between ethanol and propanone.

**Answers**

| Q.NO | Answers  | Marks |
|------|--|-------|
| 1    | (c) A= Benzaldehyde, B = Acetophenone                                | 1     |
| 2    | (a) 3-Methylpent-3-en-2-one  | 1     |
| 3    | (b) Salicylic acid   | 1     |
| 4    | (b) I > II > III   | 1     |
| 5    | (c) Oxidation of secondary alcohols                                  | 1     |
| 6    | (d) Benzaldehyde   | 1     |
| 7    | (b) Preparation of acetic acid                                       | 1     |
| 8    | (b) Both A and R are true but R is not the correct explanation of A. | 1     |
| 9    | (a) Both A and R are true and R is the correct explanation of A      | 1     |

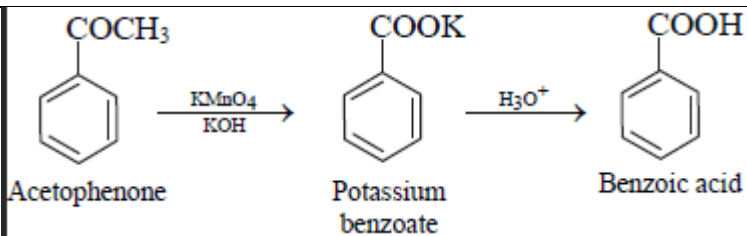
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| 10 | (b) Both A and R are true but R is not the correct explanation of A.  | 1 |
| 11 | <p>(a) p-nitrobenzaldehyde is more reactive towards the nucleophilic addition reaction than p-tolualdehyde as Nitro group is electron withdrawing in nature. Presence of nitro group decrease electron density, hence facilitates the attack of nucleophile. Presence of <math>-CH_3</math> leads to +I effect as <math>-CH_3</math> is electron releasing group.</p> <p>(b)</p>  | 1 |
| 12 | <p>(a)</p>  <p>(b)</p>   | 1 |
| 13 | <p>(a) The carboxylic carbon is less electrophilic than carbonyl carbon because of the possible resonance structure shown below</p>  <p>b. Carboxylic acids do not undergo Friedel-Crafts reaction (because the carboxyl group is deactivating and the catalyst aluminium chloride (Lewis acid) gets bonded to the carboxyl group).</p>   | 1 |
| 14 | <p>(a)</p>  <p>(b)</p>  | 1 |

|    |   |   |
|----|---|---|
|    | $\text{R-CH}_2\text{-COOH} \xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) X}_2/\text{Red phosphorus}} \text{R-CH(X)-COOH}$ <p style="text-align: center;"> <math>\text{X = Cl, Br}</math><br/> <math>\alpha</math> - Halocarboxylic acid         </p>  |   |
| 15 | <p>A 4-Hydroxy-4-methylpentan-2-one</p> $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3\text{-C-CH}_2\text{CO-CH}_3 \\   \\ \text{OH} \end{array}$ <p>B-</p> $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3\text{-C=CH-CO-CH}_3 \end{array}$ <p>4-Methylpent-3-en-2-one</p> <p>C-</p> $\begin{array}{c} \text{CH}_3 \\   \\ \text{CH}_3\text{-C=CH-COONa} \end{array}$ <p>D- <math>\text{CHI}_3</math></p>   | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> |
| 16 | <p>A, B and C contain carbonyl group as they give positive 2,4 DNP test.</p> <p>A and B are aldehydes as aldehydes reduce Tollen's reagent</p> <p>C is a ketone, as it contains carbonyl group but does not give positive Tollen's test</p> <p>C is a methyl ketone as it gives positive iodoform test B is an aldehyde that gives positive iodoform test</p> <p>D is a carboxylic acid.</p> <p>Since the number of carbons in the compounds A,B,C and D is three or two B is <math>\text{CH}_3\text{CHO}</math> as this is only aldehyde which gives a positive iodoform test</p> <p>The remaining compounds A, C and D have three carbons A is <math>\text{CH}_3\text{CH}_2\text{CHO}</math>, C is <math>\text{CH}_3\text{COCH}_3</math> and D is <math>\text{CH}_3\text{CH}_2\text{sCOOH}</math></p> | <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2}</math></p> <p><math>\frac{1}{2} \times 3</math></p>                        |
| 17 | <p>(a)</p> <p style="text-align: center;">     Toluene + <math>\text{CrO}_2\text{Cl}_2 \xrightarrow{\text{CS}_2}</math> Chromium complex <math>\xrightarrow{\text{H}_3\text{O}^+}</math> Benzaldehyde   </p> <p style="text-align: center;">This reaction is called <b>Etard reaction</b>.</p>  | 1   |

|    |   |                     |
|----|---|---------------------|
|    | <p>(b)</p> $\text{CH}_3\text{-COOH} \xrightarrow[\text{(ii) H}_2\text{O}]{\text{(i) Cl}_2/\text{Red phosphorus}} \text{CH}_2\text{-COOH}$ <p style="text-align: center;"> <br/>Cl</p> <p>(c)</p>  <p style="text-align: center;">Acetone <span style="margin-left: 150px;">Clemmensen reduction</span> <span style="margin-left: 150px;">Propane</span></p>  | 1<br><br>1          |
| 18 | <p>(a)</p>  <p style="text-align: center;">Formaldehyde <span style="margin-left: 150px;">Methanol</span> <span style="margin-left: 50px;">Potassium formate</span></p> <p>(b)</p>  <p style="text-align: center;">Benzaldehyde <span style="margin-left: 150px;">m-Nitrobenzaldehyde</span></p> <p>(c)</p>  | 1<br><br>1<br><br>1 |
| 19 | <p>(a) Pentan-2-one</p>  <p>(b)</p> $\text{H}_3\text{C} - \overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{C}^\alpha}} - \text{CHO}$ <p style="text-align: center;">2,2-Dimethylpropanal</p> <p>(c) 2-Methylbutanal</p>  | 1<br><br>1<br><br>1 |

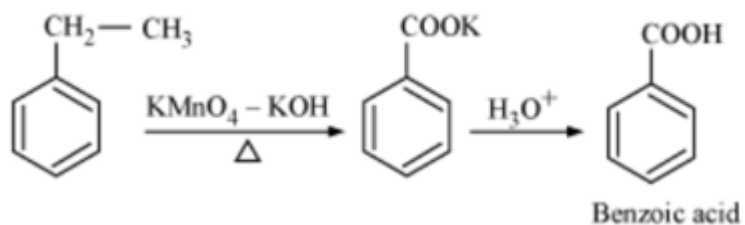






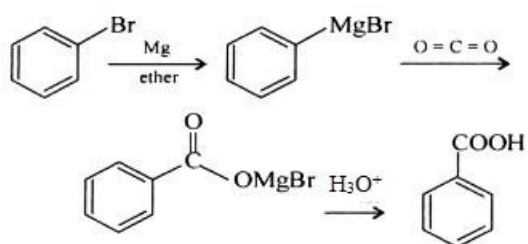
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(ii)



1

(iii)



1

1

(b)  $\text{F-CH}_2\text{-COOH} < \text{CN-CH}_2\text{COOH} < \text{O}_2\text{N-CH}_2\text{-COOH}$

(c) Ethanol does not react with 2,4-DNP reagent

Propanone give an orange red ppt with 2,4-DNP reagent.

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