INDIAN SCHOOL AL WADI AL KABIR		
CLASS: XII	**DEPARTMENT: SCIENCE (2024-2025)** **SUBJECT: CHEMISTRY**	**DATE: 03-06-2024**
WORKSHEET NO: 3	**TOPIC: ALDEHYDES, KETONES AND CARBOXYLIC ACIDS**	**NOTE: A4 FILE FORMAT**
NAME OF THE STUDENT:	**CLASS & SEC:**	**ROLL NO.**

Multiple Choice Questions (1M)

1. Ketones can be obtained in one step by (where R and R′ are alkyl groups)
   (a) hydrolysis of esters
   (b) oxidation of primary alcohols
   (c) oxidation of secondary alcohols
   (d) reaction of alkyl halides with alcohols.

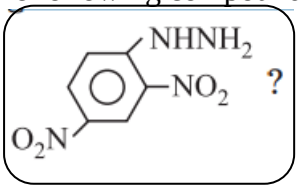
2. Aldehydes other than formaldehyde react with Grignard's reagent to give addition products which on hydrolysis give
   (a) tertiary alcohols (b) secondary alcohols (c) primary alcohols (d) carboxylic acids.

3. Which of the following compounds will undergo Cannizzaro reaction?
   (a) CH_3CHO (b) CH_3COCH_3 (c) C_6H_5CHO (d) $C_6H_5CH_2CHO$

4. Propanal on treatment with dilute sodium hydroxide gives
   (a) $CH_3CH_2CH_2CH_2CH_2CHO$
   (b) $CH_3CH_2CH(OH)CH_2CH_2CHO$
   (c) $CH_3CH_2CH(OH)CH(CH_3)CHO$
   (d) CH_3CH_2COOH

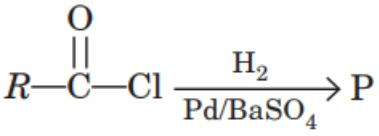
5. A compound (X) with a molecular formula $C_5H_{10}O$ gives a positive 2,4-DNP test but a negative Tollen's test. On oxidation it gives a carboxylic acid (Y) with a molecular formula $C_3H_6O_2$. Potassium salt of (Y) undergoes Kolbe's reaction and gives a hydrocarbon (Z). (X), (Y) and (Z) respectively are
   (a) Pentan-3-one, propanoic acid, butane
   (b) Pentanal, pentanoic acid, octane
   (c) 2-Methylbutanone, butanoic acid, hexane
   (d) 2, 2-Dimethylpropanone, propanoic acid, hexane

6. Which of the following compounds will give a coloured crystalline compound with



(a) CH_3COCl (b) $CH_3COOC_2H_5$ (c) CH_3COCH_3 (d) CH_3CONH_2

7. In the following reaction, product (P) is



(a) RCHO (b) RCH_3 (c) RCOOH (d) RCH2OH

8. Which of the following will not give aldol condensation?
   (a) Phenyl acetaldehyde
   (b) 2-Methylpentanal
   (c) Benzaldehyde
   (d) 1-Phenylpropanone

Questions 9- 10 are *Assertion Reason* type questions

(a) If both *Assertion* and *Reason* are correct and *Reason* is the correct explanation of *Assertion*.
(b) If both *Assertion* and *Reason* are correct but *Reason* is not the correct explanation of *Assertion*.
(c) If *Assertion* is correct and *Reason* is wrong.
(d) If *Assertion* is wrong and *Reason* is correct.

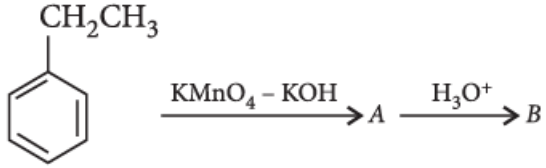
9. Assertion: Aromatic aldehydes and formaldehyde undergo Cannizzaro reaction.
   Reason: Aromatic aldehydes are almost as reactive as formaldehyde.
10. Assertion: Acetic acid in vapour state shows a molecular mass of 120.
    Reason: It undergoes intermolecular hydrogen bonding.
11. Assertion: Nitration of benzoic acid gives m-nitrobenzoic acid.
    Reason: Carboxyl group increases the electron density at the meta-position.
12. Assertion: Carboxylic acids are stabilised by resonance.
    Reason: Chloroacetic acid is weaker than acetic acid.

VERY SHORT ANSWER TYPE QUESTIONS (2M)

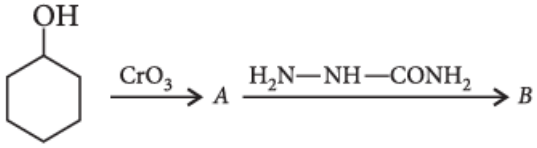
13.(a) Arrange the following in the increasing order of their boiling points.
   CH_3CHO, CH_3COOH, CH_3CH_2OH
   (b) Write chemical equations for the following reactions:

   Benzoyl chloride is hydrogenated in presence of Pd/BaSO4.

14.(a) Write structures of compounds A and B in each of the following reactions.



(b) Write structures of compounds A and B in each of the following reactions:



15. Write the equation of the reactions of ethanal with

(i) Fehling's solution (ii) Phenylhydrazine (iii) Hydroxylamine.

16. Illustrate the following name reactions giving a chemical equation in each case:
(i) Clemmensen reaction
(ii) Cannizzaro reaction

17. During practical exams, lab assistant provided two test tubes containing 5 mL benzoic acid and 5 mL acetaldehyde to every student. A student, Rahul found that test tubes given to him were unlabelled. He informed the teacher before performing any experiment with the given chemicals.
How can the chemicals be distinguished for correct labelling?

SHORT ANSWER TYPE QUESTIONS (3M)

18. (i) Write the equations involved in the following reactions:
(a) Stephen reaction (b) Etard reaction
(ii) Distinguish between CH_3COOH and HCOOH.

19 (a) Write the chemical reaction involved in Wolff-Kishner reduction.

(b) Arrange the following in the increasing order of their reactivity towards nucleophilic addition reaction.

$C_6H_5COCH_3$, CH_3CHO, CH_3COCH_3

(c) A and B are two functional isomers of compound C_3H_6O. On heating with NaOH and I_2, isomer B forms yellow precipitate of iodoform whereas isomer A does not form any precipitate. Write the formulae of A and B.

20. (a) Draw the structures of the following:

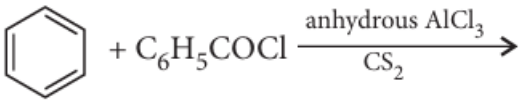
(i) p-Methylbenzaldehyde

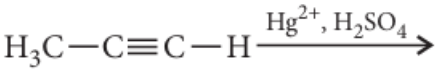
(ii) 4-Methylpent-3-en-2-one

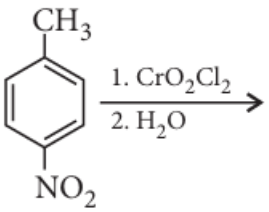
(b) Describe how the following conversions can be brought about:

Cyclohexanol to cyclohexan-1-one

21. Write the structures of the main products of the following reactions:

(i) 

(ii) 

(iii) 

PASSAGE BASED QUESTIONS (4M)

22. Carboxylic acids having an α-hydrogen atom when treated with chlorine or bromine in the presence of small amount of red phosphorus gives a halo carboxylic acid. The reaction is known as Hell-Volhard-Zelinsky reaction.

$$R—CH_2—COOH + X_2 \xrightarrow{\text{red P}} R—\underset{\underset{X}{|}}{CH}—COOH$$
$(X = Cl, Br)$

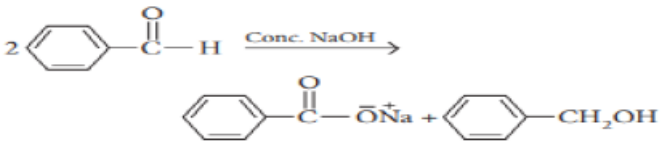
When sodium salt of carboxylic acid is heated with soda lime it loses carbon dioxide and gives hydrocarbon with less number of C-atoms.

$$\underset{\text{Carboxylic acid}}{R—COOH} \xrightarrow{NaOH} \underset{\text{Sod. carboxylate}}{R—COONa}$$

$$\xrightarrow[\Delta]{NaOH + CaO} \underset{\text{Alkane}}{R—H} + Na_2CO_3$$

(a) What is yielded when propionic acid reacts with Br_2/P?
(b) What is the major product obtained when 3-Methylbutanoic acid reacts with soda lime?
(c) Out of $C_6H_5COCH_2COOH$ and $C_6H_5COCOOH$ which one undergoes decarboxylation easier? Give the reaction involved.

23. When an aldehyde with no α-hydrogen reacts with concentrated NaOH, half the aldehyde is converted to carboxylic acid salt and other half is converted to an alcohol. In other words, half of the reactant is oxidized and another half is reduced. This reaction is known as Cannizzaro reaction.

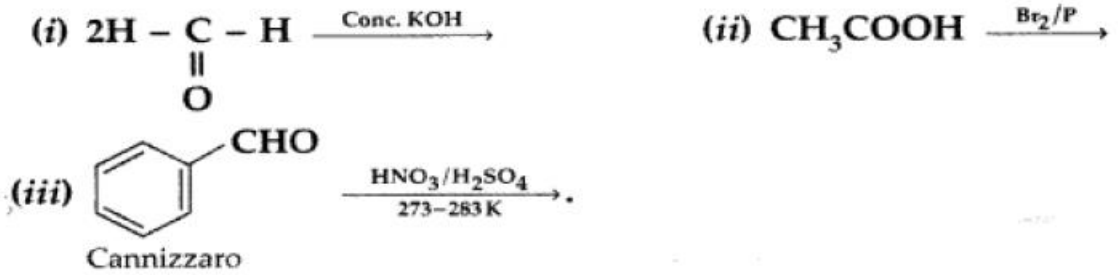


(a) What are the conditions required for undergoing Cannizzaro reaction?
(b) Trichloroacetaldehyde is subjected to Cannizzaro's reaction by using NaOH. The mixture of the products contains sodium trichloro acetate ion and another compound. What will be the other compound?
(c) Write the equation for the reaction between a mixture of benzaldehyde and formaldehyde on heating with conc. NaOH solution.

LONG ANSWER TYPE QUESTIONS (5M)

24. An organic compound 'A' having molecular formula $C_5H_{10}O$ gives negative Tollens test forms n-pentane on Clemmensen reduction but doesn't give iodoform test.
(a) Identify 'A' and give all the reactions involved.
(b) Carry out the following conversions:
(i) Propanoic acid to 2-Bromopropanoic acid
(ii) Benzoyl chloride to benzaldehyde
(c) How will you distinguish between benzaldehyde and acetaldehyde?

25. (a) Complete the following reactions:



(b) Account for the following:

(i) Aromatic carboxylic acids do not undergo Friedel-Crafts reaction.

(ii) pKa value of 4-nitrobenzoic acid is lower than that of benzoic acid.

26. (a) What happens when 2 moles of acetone are condensed in presence of $Ba(OH)_2$? Write chemical equation.

(b) What happens when acetic acid is heated with P_2O_5?

(c) What happens when salicylic acid is heated with zinc dust?

(d) Fluoroacetic acid is a stronger acid than acetic acid.

(e) Carboxylic acids have higher boiling points than alcohols of same no. of carbon atoms.

Answers

1.	(c) oxidation of secondary alcohols
2.	(b) secondary alcohols
3.	(c) C_6H_5CHO
4.	(c) $CH_3CH_2CH(OH)CH(CH_3)CHO$
5.	(a) pentan-3-one, propanoic acid, butane
6.	(c) CH_3COCH_3
7.	(a) RCHO
8.	(c) Benzaldehyde
9.	C
10	A
11	C
12	C
13	Increasing order of boiling point: a. CH3 CHO < C2H5OH < CH3 COOH b. $C_6H_5COCl \xrightarrow[Pd\text{-}BaSO_4]{H_2} C_6H_5CHO$ Benzaldehyde

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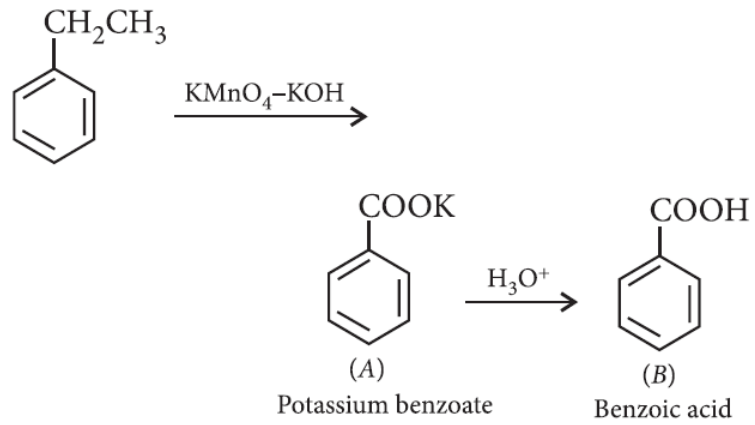
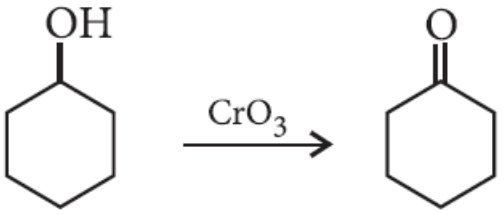
a.



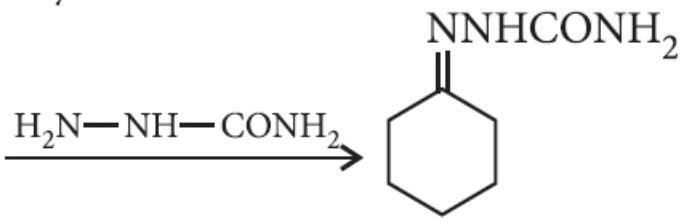
(*A*) Potassium benzoate

(*B*) Benzoic acid

b.



(*A*) Cyclohexanone

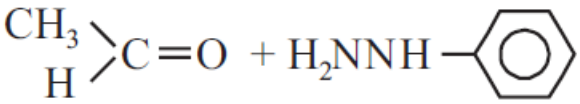


(*B*) Cyclohexanone-semicarbazone

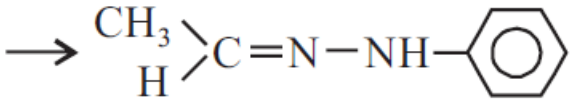
15

(i) $CH_3CHO + 2Cu^{2+} + 5OH^- \rightarrow CH_3COO^- + Cu_2O$ (Red ppt.) $+ 3H_2O$

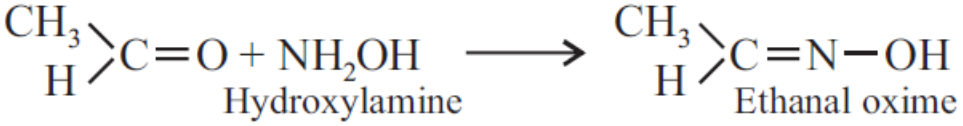
(ii)



Phenyl hydrozine

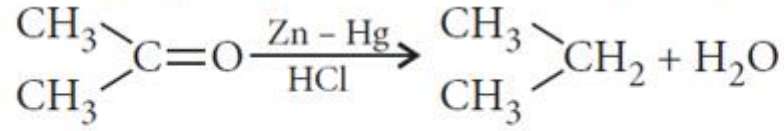
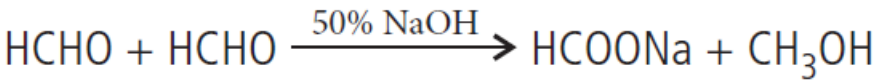
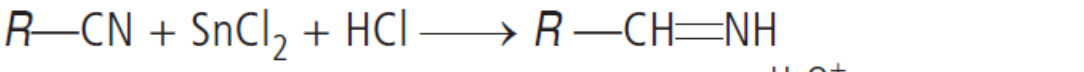
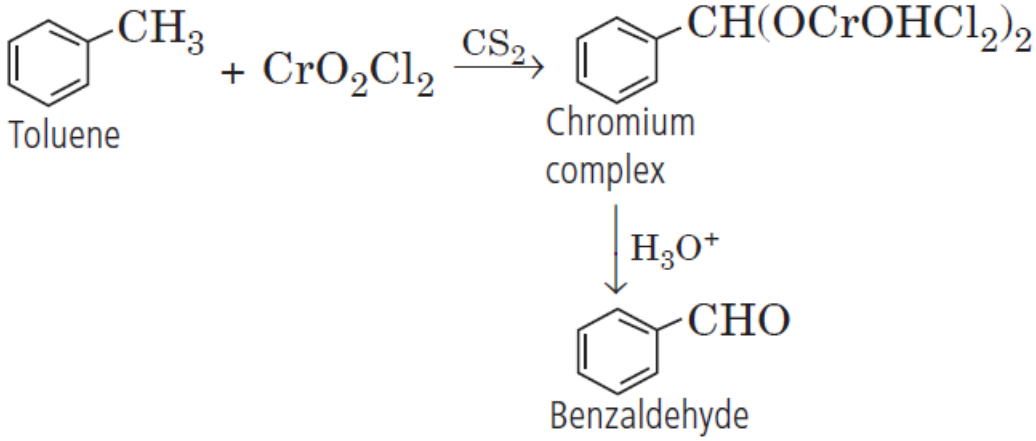


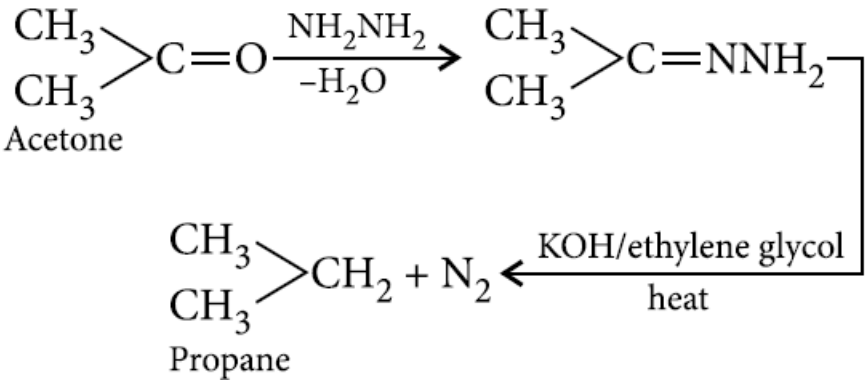
(iii)



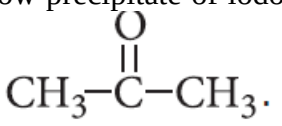
Hydroxylamine

Ethanal oxime

16	(i) Clemmensen reduction : The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with zinc amalgam and concentrated hydrochloric acid.  Propanone Propane (ii) Cannizzaro reaction : Aldehydes which do not contain α-H atom undergo disproportionation when heated with concentrated (50%) NaOH.  Methanal Sodium formate Methanol
17	Chemicals can be distinguished by sodium bicarbonate test and iodoform test. Benzoic acid will give brisk effervescence due to evolution of carbon dioxide gas with sodium bicarbonate solution while acetaldehyde does not. Acetaldehyde will give yellow precipitate of iodoform with iodine and sodium hydroxide solution while benzoic acid does not.
18	(i) (a) Stephen reduction :  (b) Etard reaction :  Toluene Chromium complex Benzaldehyde (ii) Add Tollens' reagent to formic acid and warm. Silver mirror is formed.
19	(a) Wolff-Kishner reduction: The carbonyl group of aldehydes and ketones is reduced to CH_2 group on treatment with hydrazine followed by heating with potassium hydroxide in a high boiling solvent such as ethylene glycol.



(b) Increasing order of reactivity towards nucleophilic addition reaction:
$C_6H_5COCH_3 < CH_3COCH_3 < CH_3CHO$

(c) Formula of compounds A and B is C_3H_6O. B forms yellow precipitate of iodoform. Hence, B must contain —$COCH_3$ group. Therefore, compound 'B' must be 

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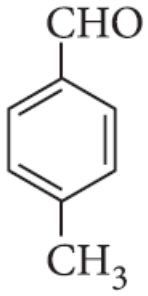
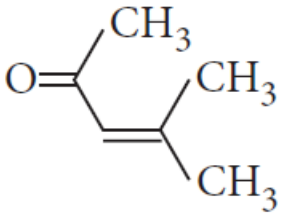
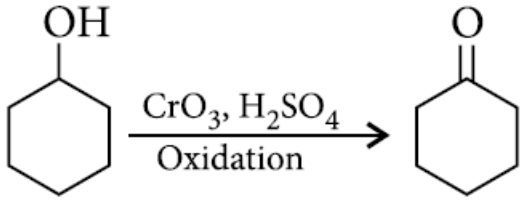
. (a) (i) 

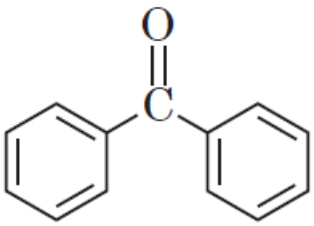
p-Methylbenzaldehyde

(ii) 4-Methylpent-3-en-2-one : 

(b) 

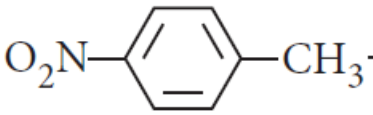
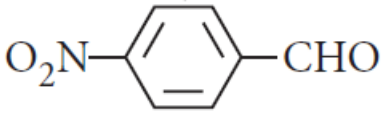
Cyclohexanol Cyclohexan-1-one

21

(i)  + C_6H_5COCl $\xrightarrow[CS_2]{\text{Anyhd. } AlCl_3}$ 

(ii) $CH_3-C\equiv CH \xrightarrow{Hg^{2+},\ H_2SO_4} CH_3-\overset{\overset{O}{\|}}{C}-CH_3$

Propanone

(iii)  $\xrightarrow[2.\ H_3O^+]{1.\ CrO_2Cl_2}$ 

p-Nitrobenzaldehyde

22

(a)

$CH_3-\overset{\alpha}{C}H_2-COOH \xrightarrow[-HBr]{Br_2/P} CH_3CHBr-COOH \xrightarrow[-HBr]{Br_2/P} CH_3-CBr_2-COOH$

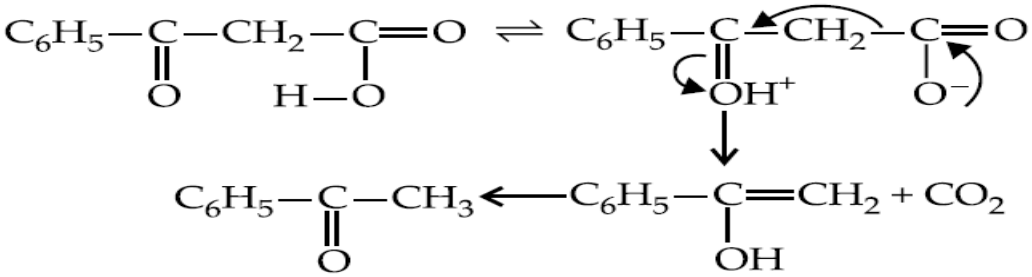
(b)

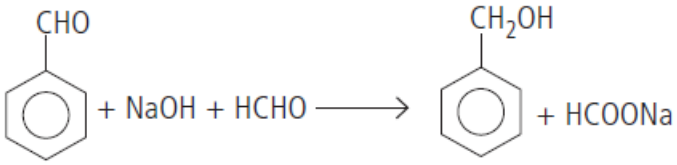
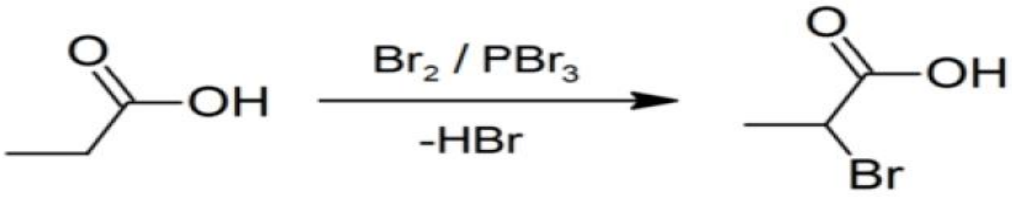
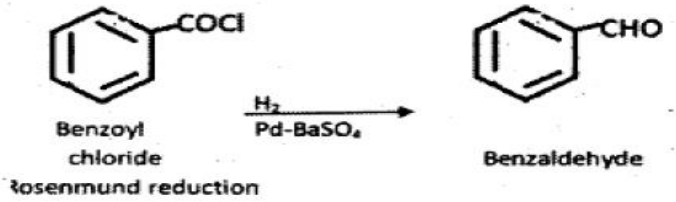
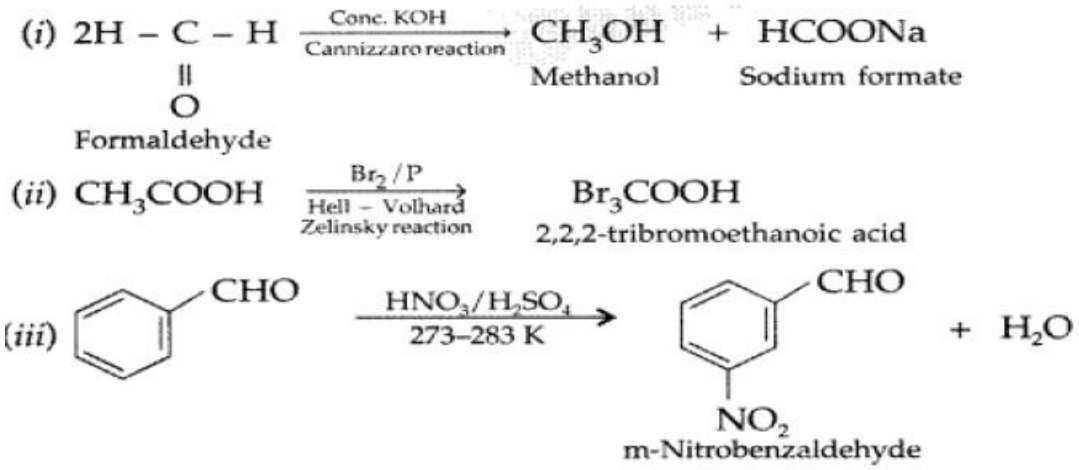
$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_2COOH \xrightarrow[\Delta]{NaOH/CaO}$

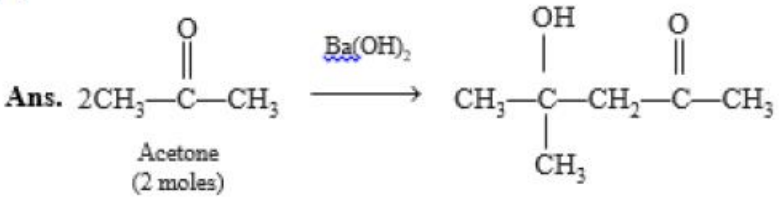
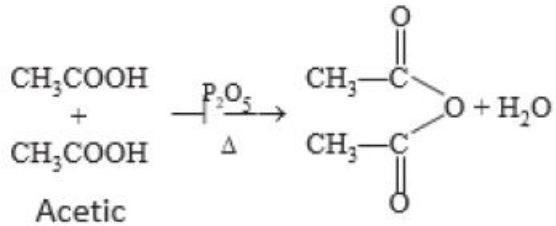
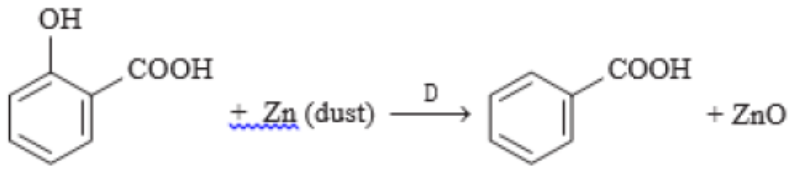
$CH_3-\underset{\underset{CH_3}{|}}{CH}-CH_3 + Na_2CO_3$

(c)

$C_6H_5COCH_2COOH$ is unstable hence decarboxylation occurs faster.



23	(a) Aldehydes without α Hydrogen The Cannizzaro product of given reaction yields (b) 2,2, 2-trichloroethanol. (c) 
24	(a) Since, the compound (A) gives a positive iodoform test but negative Tollen's test, so it must be a methyl ketone. From the given molecular formula C5H10O(A) can be 2-pentanone (b) (i)  (ii)  (c) Distinction between acetaldehyde and benzaldehyde: - Acetaldehyde and benzaldehyde can be distinguish by Fehling solution. Acetaldehyde gives red coloured precipitate with Fehling solution while benzaldehyde does not.
25 (a)	
(b)	(i) Aromatic carboxylic acids do not undergo Friedel-Crafts reaction as the carboxyl (−COOH) group is deactivating and Lewis acid catalyst $AlCl_3$ gets bonded to the carboxyl group. The carboxyl (−COOH) group withdraws electron density from benzene ring through inductive and resonance effects.

	(ii) pKa value of 4-nitrobenzoic acid (3.41) is lower than that of benzoic acid (4.19). Lower is the pKa value, greater is the acid strength. The electron withdrawing nitro (−NO2) group increases the acidity of benzoic acid.
26	(a) Ans.  Acetone (2 moles) 4–hydroxy–4 methyl pentan–2–one (b) Ans.  Acetic acid (2 moles) Acetic anhydride (c)  Salicylic acid Benzoic acid (d) In fluoroacetic acid, Fluorine being electron withdrawing group stabilizes the conjugate base through delocalization of the negative charge. (e) Carboxylic acids have more extensive association of molecules through intermolecular hydrogen bonding than alcohols.

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