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# CLASS XII CHEMISTRY NOTES

ALDEHYDES, KETONES  
AND CARBOXYLIC ACIDS

KEY NOTES AND IMPORTANT  
QUESTIONS WITH ANSWERS





## UNIT 12

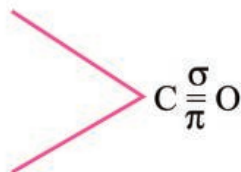
### ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

#### Points to Remember

1. Aldehydes, ketones, carboxylic acids and their derivatives are commonly called as carbonyl compounds.
2. In Rosenmund's reduction, poisoning of Pd with  $\text{BaSO}_4$  prevent reduction of  $\text{R}-\text{CHO}$  to  $\text{R}-\text{CH}_2\text{OH}$ .
3. In the reaction of toluene with  $\text{CrO}_3$ , acetic anhydride is used to protect benzaldehyde by forming benzylidenediacetate to avoid its oxidation to benzoic acid.
4. Order of reactivity of aldehydes and ketones towards nucleophilic addition is :
  - (i)  $\text{HCHO} > \text{CH}_3\text{CHO} > \text{CH}_3\text{CH}_2\text{CHO}$ .
  - (ii)  $\text{HCHO} > \text{RCHO} > \text{R CO R}$ .
  - (iii)  $\text{ArCHO} > \text{Ar COR} > \text{Ar CO Ar}$ .
5. Benzaldehyde does not reduce Fehling's reagent.
6. Aldehydes and ketones with atleast one  $\alpha$ -H atom get condensed in presence of a base. This is known as Aldol condensation.
7. Aldol condensation involves carbanion as intermediate.
8. Aldehydes with no  $\alpha$ -H atoms under Cannizzaro's reaction.
9. Ketones react with dihydric alcohols to form cyclic ketals.
10. Monocarboxylic acids having ( $\text{C}_{12}$ - $\text{C}_{18}$ ) carbon atoms, are called fatty acids.
11. Boiling points of carboxylic acids is greater than corresponding alcohols.
12. Presence of EWGs enhances the acidic character of carboxylic acids.
13.  $-\text{COOH}$  group is *m*-directing in electrophilic substitution reactions.
14. Compounds containing  $-\text{CHO}$  group are named as carbaldehydes if  $-\text{CHO}$  groups are three or more.
15. Isomerism : Chain, position and functional.

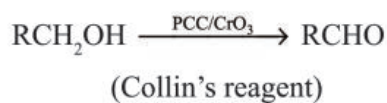


16. Structure of  $-\text{CHO}$  group  $sp^2$  hybridised.



### 17. General Methods of Preparation :

(i) Controlled oxidation of  $1^\circ$  alcohols :



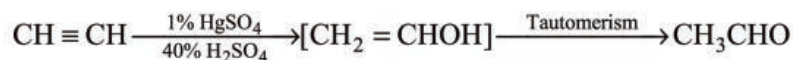
(ii) Dehydrogenation of  $1^\circ$  alcohols :



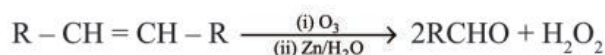
(iii) From Rosenmund reaction/reduction :



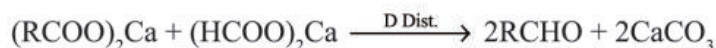
(iv) Hydration of alkynes :



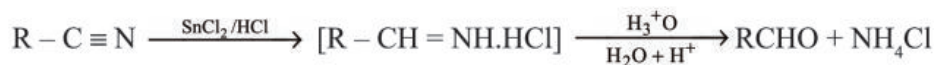
(v) Reductive ozonolysis of alkenes :



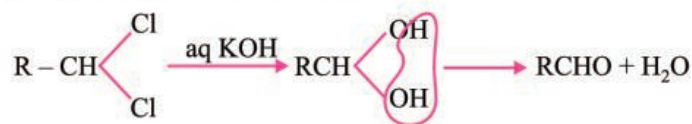
(vi) From salts of fatty acids :



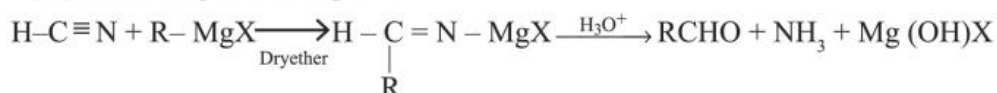
(vii) Stephen's reduction of nitrile compounds :



(viii) Hydrolysis of geminal halides :



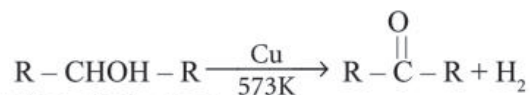
(ix) From Grignard's reagent :



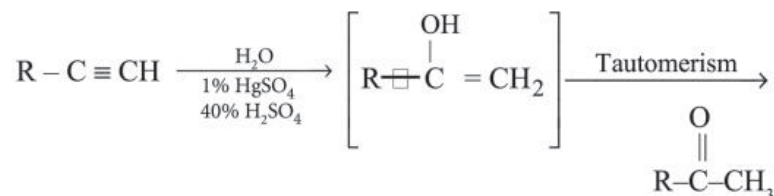
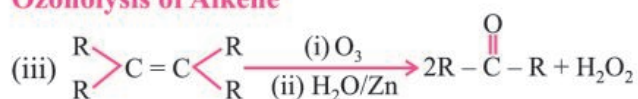


**General Methods of Preparation of Ketones only**

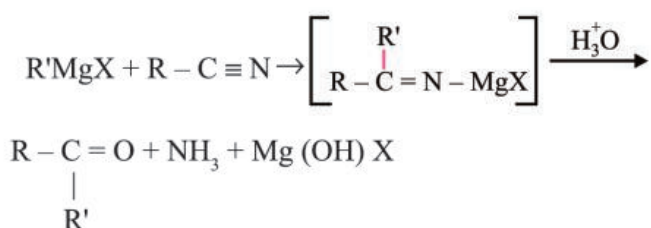
(i) Dehydrogenation of 2° alcohols :



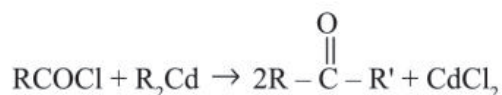
(ii) Hydration of alkynes :

**Ozonolysis of Alkene**

(iv) From Grignard's reagents :



(iv) From acid chlorides :

**Physical Properties :**

HCHO is a gas at normal temperature. Formalin is 40% as solution of HCHO. Due to polarity they have high values of boiling point. Solubility in water is only for lower members.

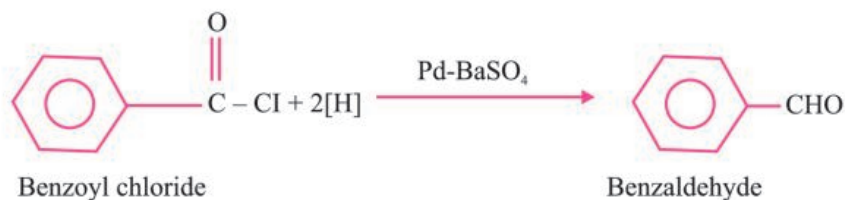
**Reactivity :**

- (i) +I effect of alkyl groups decreases the +ve charge on carbonyl carbon.
- (ii) Steric hindrance : Bulky group hinder approach of nucleophile.
- (iii)  $\alpha$ -hydrogen atom is acidic due to resonance.



**1. ROSENMUND REDUCTION:**

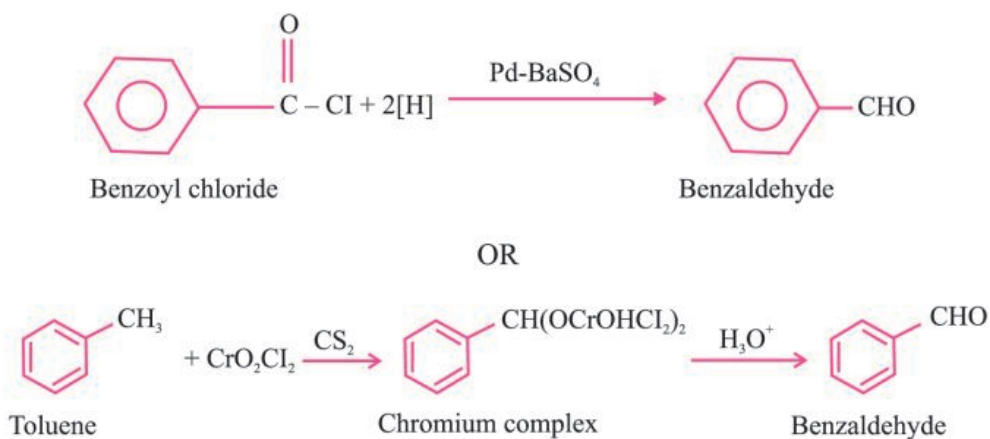
Acyl chlorides when hydrogenated over catalyst, palladium on barium sulphate yield aldehydes

**2. STEPHEN REACTION**

Nitriles are reduced to corresponding imines with stannous chloride in the presence of Hydrochloric acid, which on hydrolysis give corresponding aldehyde.

**3. ETARD REACTION**

On treating toluene with chromyl chloride  $\text{CrO}_2\text{Cl}_2$ , the methyl group is oxidized to a chromium complex, which on hydrolysis gives corresponding benzaldehyde.

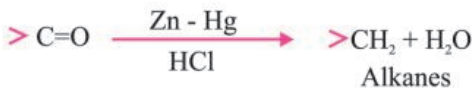


This reaction is called Etard reaction

**4. CLEMMENSEN REDUCTION**

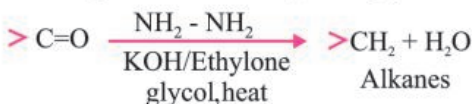
The carbonyl group of aldehydes and ketone is reduced to  $-\text{CH}_2$  group on treatment with zinc amalgam and cone. Hydrochloric acid.





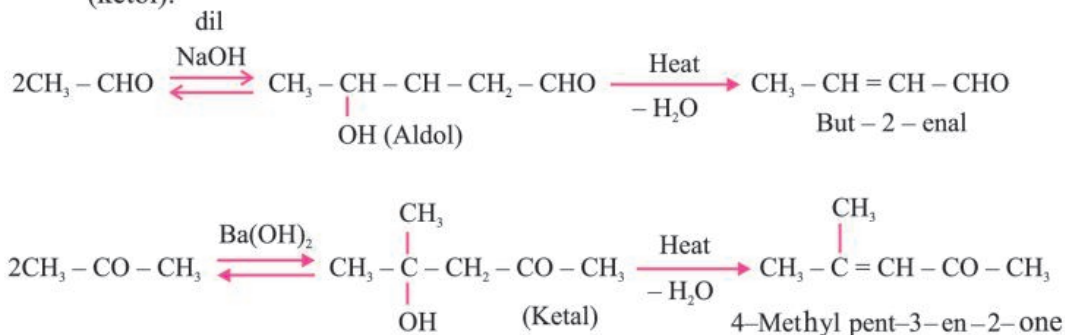
## 5. WOLFF- KISHNER REDUCTION

On treatment with hydrazine followed by heating with sodium or potassium hydroxide in high boiling solvent like ethylene glycol



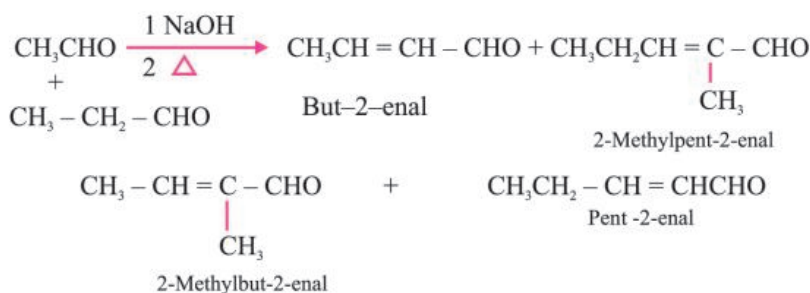
## 6. ALDOL CONDENSATION

Aldehydes and ketones having at least one  $\alpha$ -hydrogen condense in the presence of dilute alkali as catalyst to form  $\alpha$ -hydroxy ehydes (aldol) or  $\beta$ -hydroxy ketones (ketol).



## 7. CROSS-ALDOL CONDENSATION

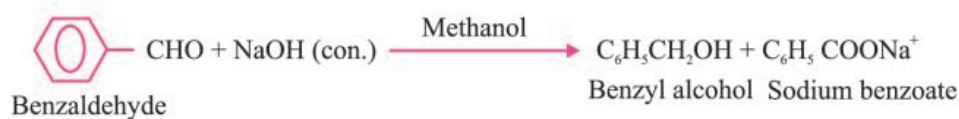
When aldol condensation is carried out between two different aldehydes and / or ketones, a mixture of self and cross-aldol products are obtained.



## 8. CANNIZZARO REACTION

Aldehydes which do not have an  $\alpha$ -hydrogen atom, undergo self oxidation and reduction (disproportionation) reaction on treatment with concentrated alkali, to yield carboxylic acid salt and an alcohol respectively.

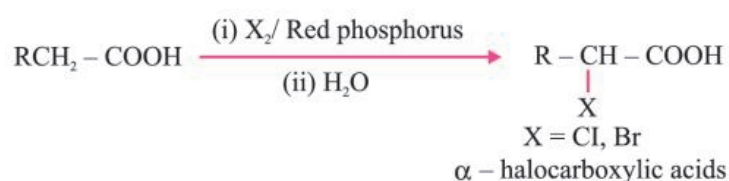




## CARBOXYLIC ACID

### 1. HELL-VOLHARD-ZELINSKY REACTION (HVZ)

Carboxylic acids having an  $\alpha$ -hydrogen are halogenated at the  $\alpha$ -position on treatment with chlorine or bromine in the presence of small amount of red phosphorus to give  $\alpha$ -halocarboxylic acids.



### 2. ESTERIFICATION

Carboxylic acids react with alcohols or phenols in the presence of a mineral acid such as conc.  $\text{H}_2\text{SO}_4$  as catalyst to form esters.



18. Vinegar is 8 to 10% solution of  $\text{CH}_3\text{COOH}$ .
19.  $\alpha$ -hydrogen atoms in carboxylic acid are acidic in nature and can be easily replaced by halogen atoms in HVZ reaction.
21. Relative acid strength of  $\text{RCOOH} > \text{HOH} > \text{ROH} > \text{HC} \equiv \text{CH} > \text{NH}_3$ . It is because a strong acid has weak conjugate base.
22. Some dicarboxylic acids bearing general formula  $\text{HOOC} - (\text{CH}_2)_n - \text{COOH}$  where  $n = 0, 1, 2, \dots$  etc.

$\text{HOOC} - \text{COOH}$       Oxalic acid 1, 2 ethanedioic acid

$\text{HOOC} - \text{CH}_2 - \text{COOH}$       Malonic acid      1, 3 propanedioic acid

$\text{HOOC} - (\text{CH}_2)_2 - \text{COOH}$       Succinic acid      1, 4 butanedioic acid

$\text{HOOC} - (\text{CH}_2)_3 - \text{COOH}$       Glutonic acid      1, 5 pentamdioic acid

$\text{HOOC} - (\text{CH}_2)_4 - \text{COOH}$       Adipic acid 1, 6 hexanedioic acid



23. Melting points : Higher : Even carbon atoms than next lower or higher homologues containing even number of carbon atoms due to symmetry and closer packing of molecules in the crystal lattice.

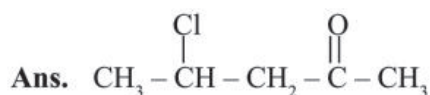
### VERY SHORT ANSWER TYPE QUESTIONS (1 Mark)

- Q. 1. Arrange the following compounds in increasing order of their acid strengths :



Ans.  $(\text{CH}_3)_2\text{CHCOOH} < \text{CH}_3\text{CH}(\text{Br})\text{CH}_2\text{COOH} < \text{CH}_3\text{CH}_2\text{CH}(\text{Br})\text{COOH}$

- Q. 2. Draw the structure of the compound whose IUPAC name is 4-chloropentan-2-one.



- Q. 3. Which type of aldehyde can go Cannizzaro reaction ?

Ans. Aromatic and aliphatic aldehydes which do not contain  $\alpha$ -hydrogen.

- Q. 4. Name the aldehyde which does not give Fehling's solution test.

Ans. Benzaldehyde.

- Q. 5. Arrange the following in order of their increasing reactivity towards HCN :

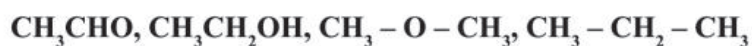


Ans.  $\text{C}_2\text{H}_5\text{COCH}_3 < \text{CH}_3\text{COCH}_3 < \text{CH}_3\text{CHO} < \text{HCHO}$

- Q. 6. Mention industrial product obtained from HCHO.

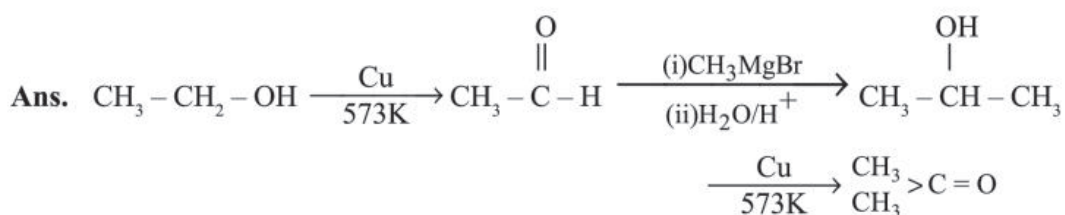
Ans. Bakelite

- Q. 7. Arrange the following compounds in increasing order of their boiling point :



Ans.  $\text{CH}_3 - \text{CH}_2 - \text{CH}_3 < \text{CH}_3 - \text{O} - \text{CH}_3 < \text{CH}_3\text{CHO} < \text{CH}_3\text{CH}_2\text{OH}$

- Q. 8. How is acetone obtained from ethanol ?

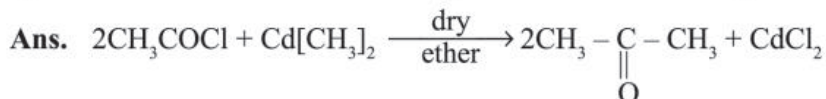




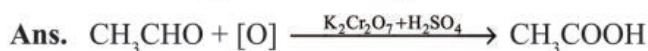
**Q. 9. Why do aldehydes and ketones have lower boiling point than alcohols ?**

**Ans.** Due to presence of associated molecules with H-bonding in alcohols.

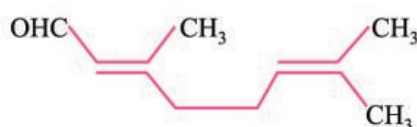
**Q. 10. Write reaction between acetyl chloride and dimethyl cadmium.**



**Q. 11. What happens when  $\text{CH}_3\text{CHO}$  is treated with  $\text{K}_2\text{Cr}_2\text{O}_7$  in presence of  $\text{H}_2\text{SO}_4$  ?**

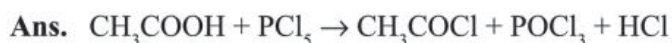


**Q. 12. Write the IUPAC name of**



**Ans.** 3, 7-Dimethylocta-2, 6 dien-1-al

**Q. 13. Give balanced equation and name of products when  $\text{CH}_3\text{COOH}$  is treated with  $\text{PCl}_5$  ?**



**Q. 14. What product is obtained when ethyl benzene is oxidized with alkaline  $\text{KMnO}_4$  ?**

**Ans.** Benzoic acid ( $\text{C}_6\text{H}_5\text{COOH}$ ) is obtained.

**Q. 15.  $\text{CH}_3\text{CHO}$  is more reactive than  $\text{CH}_3\text{COCH}_3$  towards reaction with  $\text{HCN}$ . Give reason.**

**Ans.** Because the positive charge on carbonyl carbon of  $\text{CH}_3\text{CHO}$  decreases to lesser extent due to one ERG ( $-\text{CH}_3$ ) and hence more reaction.

**Q. 16. What is RDX ?**

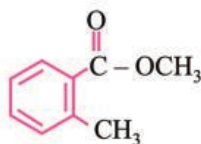
**Ans.** RDX is Research and Development Explosive which is prepared by the nitration of hexamethylene under controlled conditions.

**Q. 17. Write IUPAC names of the following compound :**



**Ans.** But-2-ene-1, 4-dioic acid

**Q. 18. Write the IUPAC name of**



**Ans.** Methyl-2-methylbenzoate.

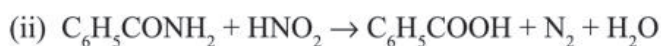
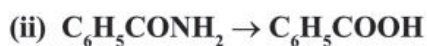
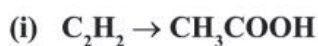


**Q. 19. Why does benzoic acid not undergo Friedel-Craft reaction ?**

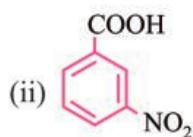
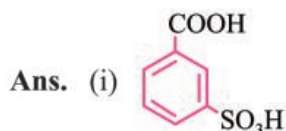
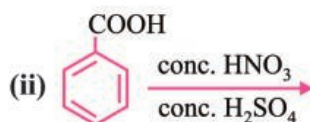
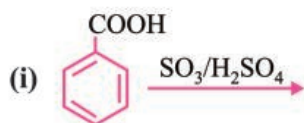
**Ans.** – COOH group in  $C_6H_5COOH$  is an E. W. G. which deactivates the benzene ring.  
Hence electrophilic substitution becomes difficult.

### SHORT ANSWER-I TYPE QUESTIONS (2 Marks)

**Q. 1. How will you convert :**



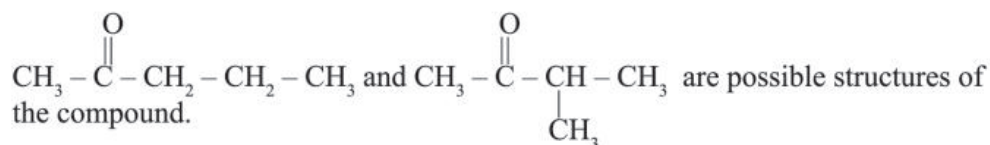
**Q. 2. Complete the following :**



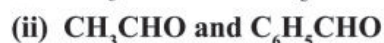
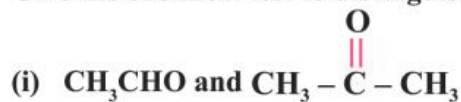
**Q. 3. An organic compound X has molecular formula  $C_5H_{10}O$ . It does not reduce Fehling's solution but forms a bisulphate compound. It also gives positive Iodoform test. What are possible structures of X ? Explain your reasoning relating structure.**



**Ans.** Ketone give +ve test with Iodoform. It is methyl-ketone.



**Q. 4.** Give the chemical test to distinguish between :



**Ans.** (i)  $\text{CH}_3\text{CHO}$  gives Tollen's reagent test.



Silver mirror

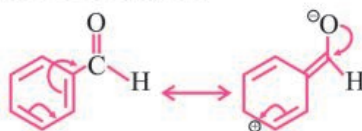
(ii)  $\text{CH}_3\text{CHO}$  gives brick red ppt.



Brick red ppt.

**Q. 5.** Would you expect benzaldehyde to be more reactive or less reactive in nucleophilic addition reactions than propanal ? Explain your answer.

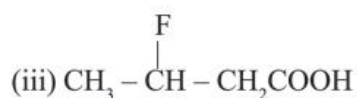
**Ans.** Carbon atom of carbonyl in  $\text{C}_6\text{H}_5\text{CHO}$  is less reactive than that of propanal.  $\text{C}_6\text{H}_5\text{CHO}$  less polar due to resonance.



**Q. 6.** Which acid of each pair shown here would you expect to be stronger ?



**Ans.** (i)  $\text{FCH}_2\text{COOH}$  (ii)  $\text{CH}_2\text{FCOOH}$



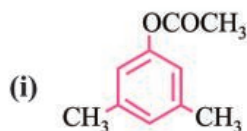




**Q. 7. Carboxylic acids do not give reactions of aldehydes and ketones why ?**

**Ans.** It is due to resonance  $\text{R}-\text{C}(=\text{O})-\ddot{\text{O}}\text{H} \longleftrightarrow \text{R}-\text{C}(\text{O}^-)=\overset{+}{\text{O}}\text{H}$  Position of  $>\text{C}=\text{O}$  group keep changing.

**Q. 8. Write IUPAC name of the following :**



**Ans.** (i) 3, 5 Dimethylphenylethanoate  
(ii) 5 bromo 3-chloro-2-iodobenzoic acid

**Q. 9. Account for the following :**

- (i) Oxidation of toluene to  $\text{C}_6\text{H}_5\text{CHO}$  with  $\text{CrO}_3$  is carried out in presence of acetic anhydride.
- (ii) Melting point of an acid with even number is higher than those of its neighbours with odd number of carbon atoms.

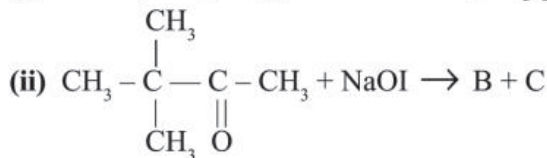
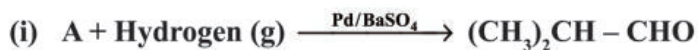
**Ans.** (i) It is used to prevent oxidation to benzoic acid.  
(ii) Acids with even number of carbon atoms fit into crystal lattice.

**Q. 10. Distinguish between :**

- (i)  $\text{C}_2\text{H}_5\text{OH}$  and  $\text{CH}_3\text{CHO}$
- (ii)  $\text{C}_6\text{H}_5\text{COCH}_3$  and  $\text{C}_6\text{H}_5\text{CH}_2\text{CHO}$

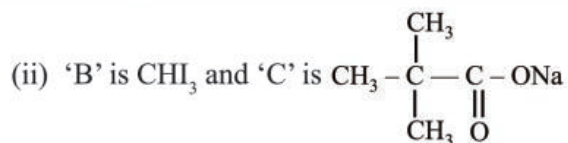
**Ans.** (i)  $\text{C}_2\text{H}_5\text{OH}$  evolves  $\text{H}_2$  gas with Na,  $\text{CH}_3\text{CHO}$  not.  
(ii) Acetophenone will give yellow ppt. of iodoform while  $\text{C}_6\text{H}_5\text{CH}_2\text{CHO}$  will not.

**Q. 11. Complete the following reactions by identifying A, B and C :**



**Ans.** (i) 'A' is  $\text{CH}_3-\overset{\text{CH}_3}{\underset{\text{CH}_3}{\text{CH}}}-\overset{\text{O}}{\underset{\text{O}}{\text{C}}}-\text{Cl}$



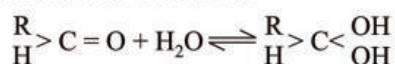


**Q. 12. Benzaldehyde gives a positive test with Tollen's reagent but not with Fehling's and Benedict solutions. Why ?**

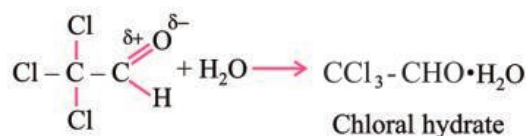
**Ans.** It is due to stronger oxidizing nature of Tollen's reagent as compared to Fehling and Benedict's solution and cannot oxidise benzaldehyde to benzoic acid. In general, all these three can oxidise aliphatic aldehydes.

**Q. 13. Aldehydes usually do not form stable hydrates but chloral normally exists as chloral hydrate. Give reason.**

**Ans.** In case of aldehyde reaction is reversible.



In case of  $\text{CCl}_3\text{CHO}$ , Cl atoms increases +ve charge on carbonyl carbon. Therefore, weak nucleophiles like water readily added to the carbonyl group.

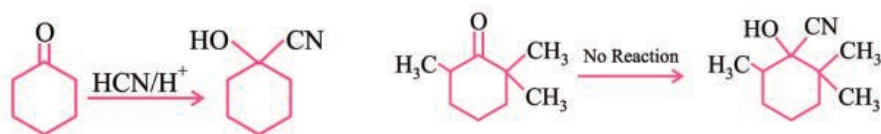


**Q. 14. Give possible explanation for the following :**

(i) Cyclohexanone forms cyanohydrins in good yield but 2, 2, 6 trimethylcyclohexanone does not.

(ii) There are two  $-\text{NH}_2$  groups in semicarbazide. However, only one is involved in formation of semi carbozone.

**Ans.** (i) Due to steric hindrance for  $\text{CN}^-$  at  $\text{C} = \text{O}$  and not of 3-methyl groups at  $\alpha$ -position but in case of



(ii) Only one  $-\text{NH}_2$  group attached to  $\text{C} = \text{O}$  is involved in resonance. As result electron density on these  $\text{NH}_2$  group decreases and hence does not act as nucleophile.



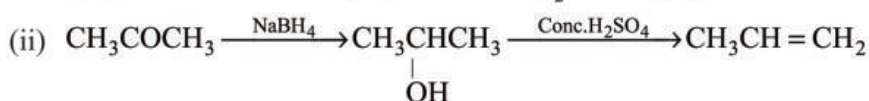
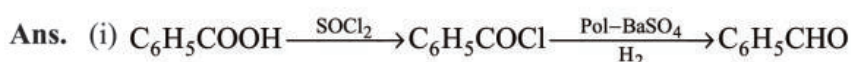


**Q. 15.** Aldehydes are easily oxidisable yet propanal can conveniently be prepared by the oxidation of propanol by acidic  $K_2Cr_2O_7$ .

**Ans.** Aldehydes having boiling points less than 373 K can be removed by distillation therefore propanal can easily be prepared from propanol by distillation from the alcohol acid dichromate solution.

**Q. 16.** Do the following conversions in not more than two steps

(i) Benzoic acid to Benzaldehyde (ii) Propanone to propene



**Q. 17.** Write the reactions involved in the following reactions:

(i) Clemmensen reduction (ii) Cannizzaro reaction



**Q. 18.** Convert the following (i) Ethyl benzene to benzoic acid (ii) Ethanal to but-2-enal



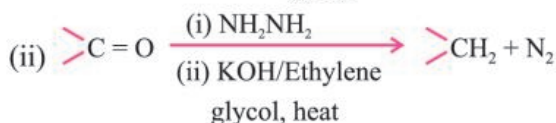
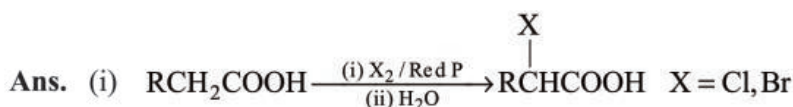
## SHORT ANSWER-II TYPE QUESTIONS (3 Marks)

**Q. 1.** Illustrate the following name reactions :

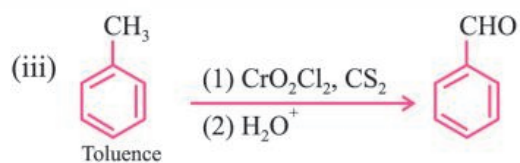
(i) Hell-Volhard Zelinsky reaction

(ii) Wolff kishner reduction

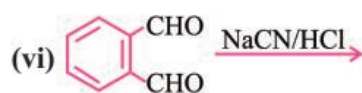
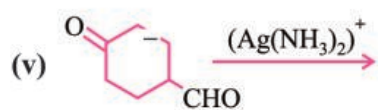
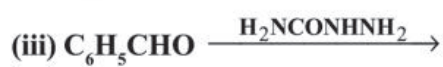
(iii) Etard reaction



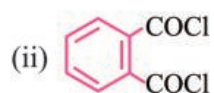




**Q. 2. Predict the organic products of the following reactions :**

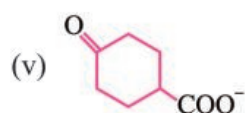


**Ans.** (i)  $\text{C}_6\text{H}_5 - \text{COOK}$

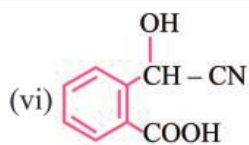


(iii)  $\text{C}_6\text{H}_5\text{CH} = \text{N} - \text{NHCONH}_2$

(iv)  $\text{C}_6\text{H}_5\text{COCl}/\text{AlCl}_3$







**Q. 3. Write chemical reaction to affect the following transformations :**

(i) Butan-1-ol  $\rightarrow$  Butanoic acid

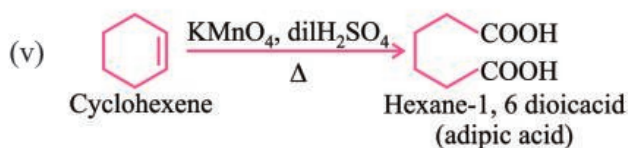
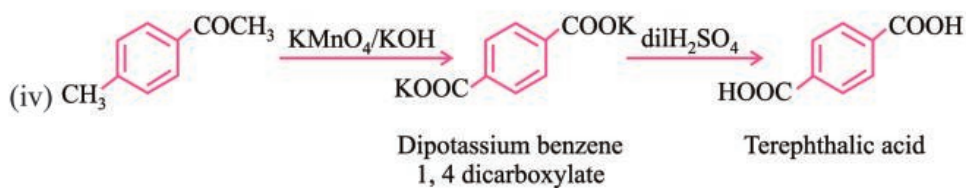
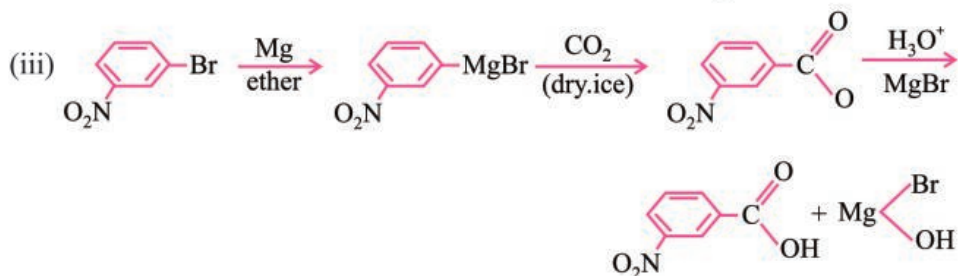
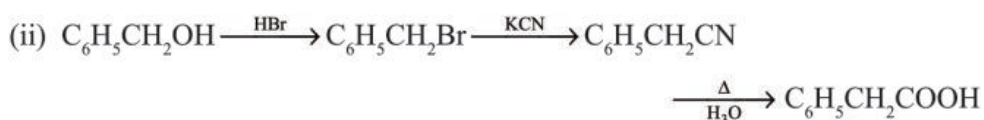
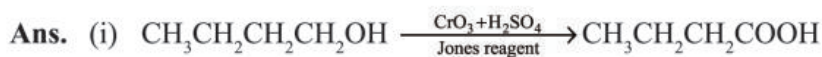
(ii) Benzyl alcohol to phenylethanoic acid

(iii) 3-Nitrobromobenzene to 3-nitrobenzoic acid

(iv) 4-methylacetophenone to Terephthalic acid

(v) Cyclohexene  $\rightarrow$  Hexane-1, 6 dioic acid

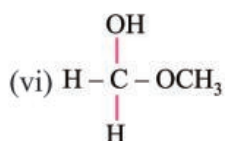
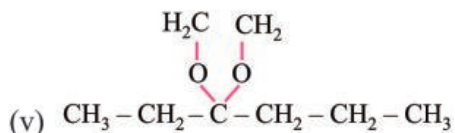
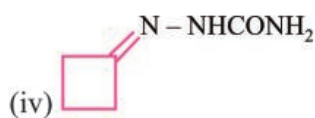
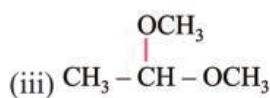
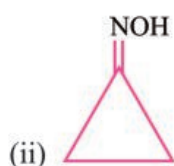
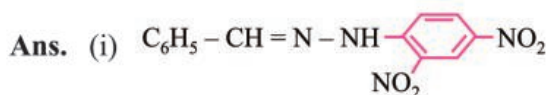
(vi) Butanal  $\rightarrow$  Butanoic acid





**Q. 4. Draw the structure of the following derivatives :**

- (i) 2, 4-dinitrophenylhydrazone of  $C_6H_5CHO$
- (ii) Cyclopropanone oxime
- (iii) Acetaldehydedimethylacetal
- (iv) Semicarbazone to cyclobutanone
- (v) Ethylene ketal of hexan-3-one
- (vi) Methylhemiacetal of formaldehyde

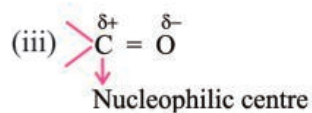
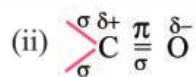


**Q. 5. Draw the structure of a carbonyl group and indicate :**

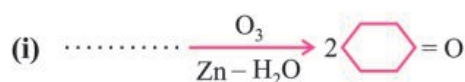
- (i) hybridized state of carbon
- (ii) the  $\sigma$  and  $\pi$  bonds
- (iii) the electrophilic and nucleophilic centres







**Q. 6. Complete the following as missing starting material, reagent or products :**



**Ans.** (i) (Ozonolysis)  
1, 2 Dicyclohexylethene

(ii)  $\text{B}_2\text{H}_6/\text{THF}, \text{H}_2\text{O}_2/\text{OH}^-, \text{PCC}$  (Hydroboration)

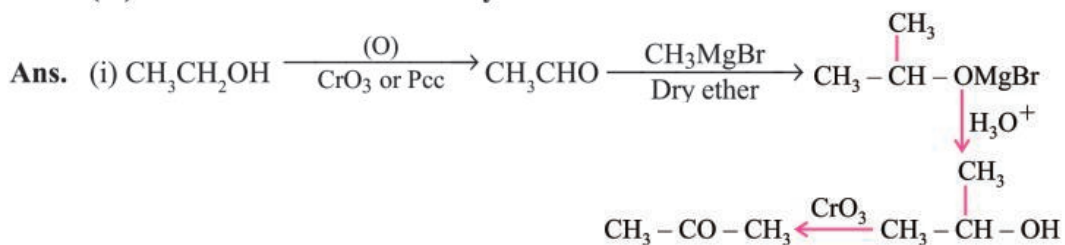
(iii) (Oxidation)  
Potassium benzoate

**Q. 7. How can the following converted :**

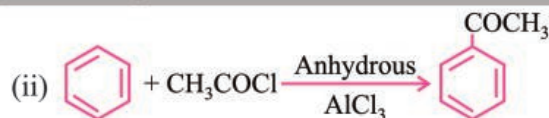
(i) Ethanol  $\rightarrow$  Acetone

(ii) Benzene  $\rightarrow$  Acetophenone

(iii) Benzoic acid  $\rightarrow$  Benzaldehyde

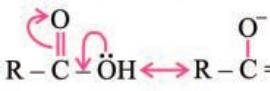




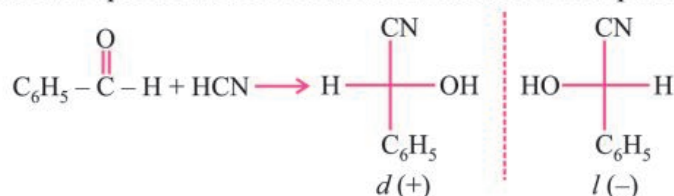


**Q. 8. Give reasons for the following :**

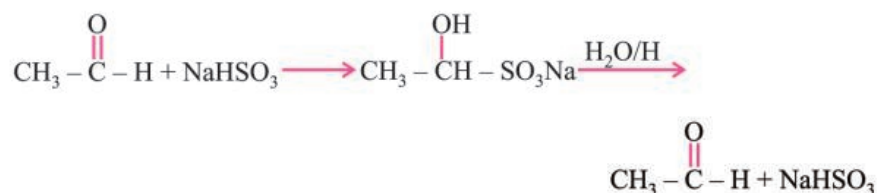
- Carboxylic acids do not give characteristic reactions of carbonyl group.
- Treatment of C<sub>6</sub>H<sub>5</sub>CHO with HCN gives a mixture of two isomers which cannot be separated even by fractional distillation.
- Sodium bisulphate is used for purification of ketones and aldehydes.

**Ans.** (i)  Because of resonance, the position of >C=O group is changing.

(ii) Due to two optical isomers fractional distillation is not possible.



(iii) Due to formation of additional compound with NaHSO<sub>3</sub> whereas impurities do not.



**Q. 9. Write tests to distinguish between :**

- CH<sub>3</sub>CHO and C<sub>6</sub>H<sub>5</sub>CHO
- C<sub>6</sub>H<sub>5</sub>-OH and CH<sub>3</sub>COOH
- Pentanal and Pentan-2-one

**Ans.** (i) CH<sub>3</sub>CHO gives brick red ppt. with Fehling, C<sub>6</sub>H<sub>5</sub>CHO not.  
 (ii) Phenol does not give brisk effervescence but CH<sub>3</sub>COOH gives this test with NaHCO<sub>3</sub>.  
 (iii) Pentanal forms silver mirror but pentan-2-one does not.

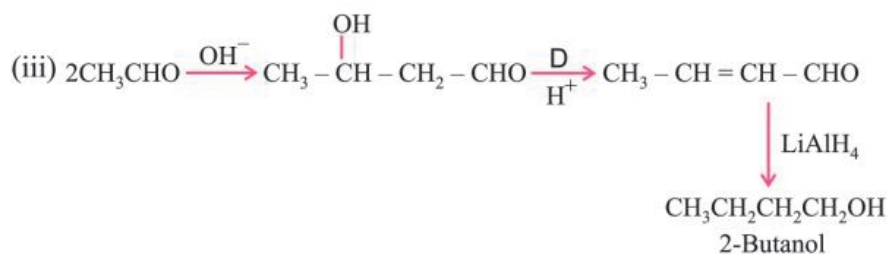
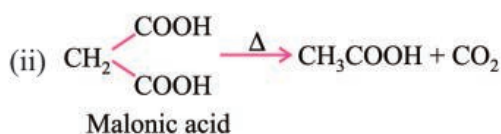
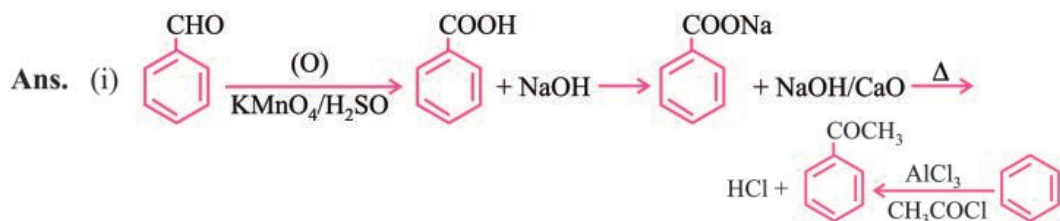
**Q. 10. Convert :**

- Benzaldehyde to acetophenone

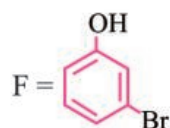
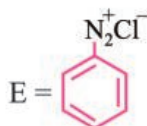
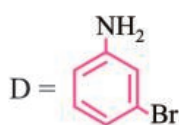
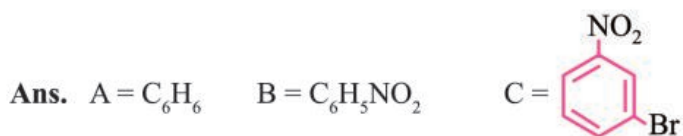
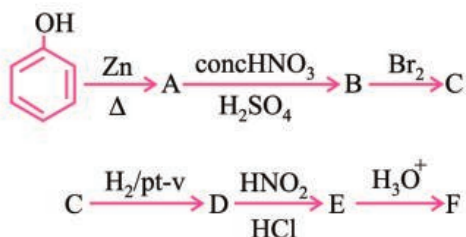


(ii) Malonic acid to acetic acid

(iii) Acetaldehyde to 2-butanol



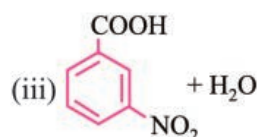
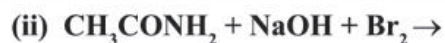
Q. 11. Write the structures of organic compound A to F in the following sequence of reactions :



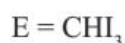
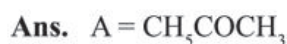
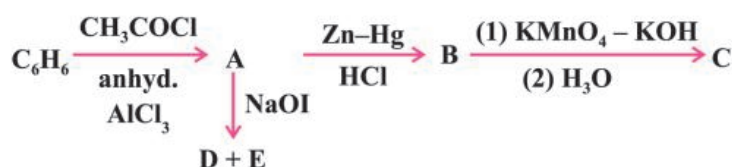
Q. 12. Complete the following :







Q. 13. Write the structures of A, B, C, D and E in the following reactions:



### LONG ANSWER TYPE QUESTIONS (5 Marks)

Q. 1. Which of the following compounds would undergo Aldol condensation, which the Cannizzaro reaction and which neither? Write the structures of the expected products of aldol condensation and Cannizzaro reaction :

(i) Methanal

(ii) 2-Methylpentanal

(iii) Benzaldehyde

(iv) Benzophenone

(v) Cyclohexanone

(vi) 1-Phenylpropanone

(vii) Phenylacetaldehyde

(viii) Butan-1-ol

(ix) 2, 2 Dimethylbutanal

Ans. (i), (iii) and (ix) will give Cannizzaro reaction due to absence of  $\alpha$ -hydrogen.

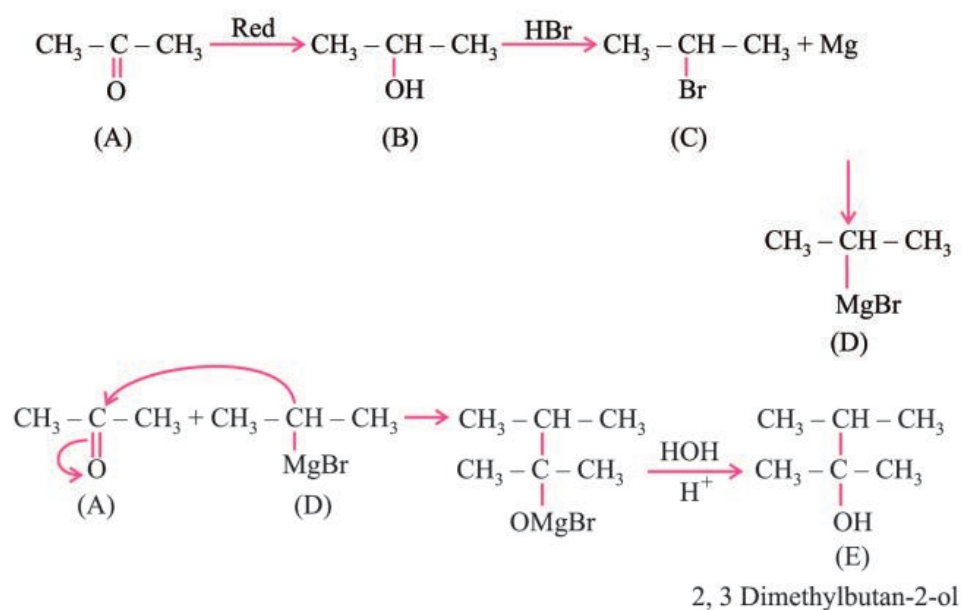


(ii), (v), (vi) and (vii) will give aldol condensation due to presence of  $\alpha$ -hydrogen.

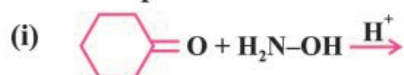
(iv) and (viii) will neither undergo Cannizzaro's reaction nor Aldol condensation because benzophenone does not give  $\alpha$ -hydrogen and butanol is alcohol, not aldehyde which cannot undergo aldol condensation.

**Q. 2.** An organic compound 'A' ( $C_3H_6O$ ) is resistant to oxidation but forms compound 'B' ( $C_3H_8O$ ) on reduction. 'B' reacts with HBr to form the compound 'C'. 'C' with Mg forms Grignard's reagent 'D' which reacts with 'A' to form a product which on hydrolysis gives 'E'. Identify 'A' to 'E'.

**Ans.** 'A' must be ketone.



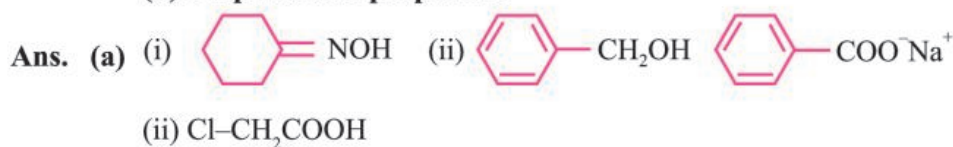
**Q. 3. (a) Write the products of the following reactions:**



(b) Give simple tests to distinguish between the following pairs of compounds.

**(i) Benzaldehyde and Benzoic acid**

**(ii) Propanal and propanone**



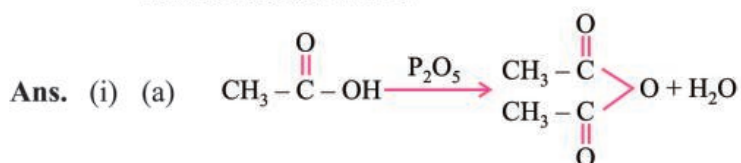


(b) (i) Add  $\text{NaHCO}_3$ , benzoic acid will give brisk effervescence whereas benzaldehyde will not give this test.

(ii) Refer Q.7(e) of long answer type questions.

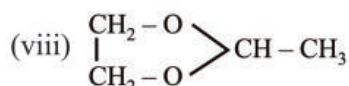
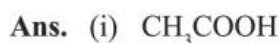
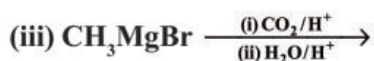
**Q. 4. (i) How will you prepare (a) acetic anhydride and (b) acetyl chloride from  $\text{CH}_3\text{COOH}$  ? Write the equation involved in each case.**

**(ii) Why is the boiling point of acid anhydride higher than the acid from which it is obtained ?**

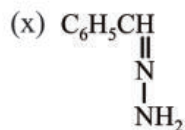
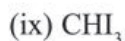


(ii) Acid anhydride bigger size than corresponding acids and stronger van der Waal's forces of attraction than their corresponding acids.

**Q. 5. Complete the following reactions and write main products :**

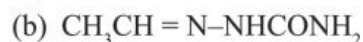
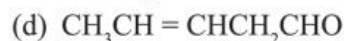




**Q. 6. Give reasons for the following :**

- (i)  $\text{C}_6\text{H}_5\text{COOH}$  is weaker than formic acid.
- (ii)  $\text{HCOOH}$  and  $\text{CH}_3\text{COOH}$  differentiated by Tollen's reagent.
- (iii)  $\text{R}-\text{COOH}$  do not give characteristic reaction with  $>\text{C}=\text{O}$ .
- (iv) Carboxylic acids are stronger acids than phenols.
- (v) Acid amides are weakly basic in nature.

- Ans.** (i) Due to unstability of carboxylate anion due to conjugation.  
 (ii)  $\text{HCOOH}$  acid is a stronger acid than  $\text{CH}_3\text{COOH}$ .  
 (iii)  $>\text{C}=\text{O}$  group is sterically hindered in carboxylic acid.  
 (iv) Dispersal of  $-ve$  charge on carboxylate ions than phenate ion.  
 (v) Acid amides are basic due to lone pair of electrons on nitrogen atom.

**Q. 6. (a) Write the chemical equation for the reaction involved in cannizzaro reaction.****(b) Draw the structure of semicarbazone of ethanal****(c) Why  $pK_a$  of  $\text{F}-\text{CH}_2\text{COOH}$  is lower than that of  $\text{Cl}-\text{CH}_2\text{COOH}$** **(d) Write the product in the following reaction****(e) How can you distinguish between propanal and propanone?**(c) Stronger  $-I$  effect of fluorine makes  $\text{F}-\text{CH}_2\text{COOH}$  to be stronger acid than  $\text{Cl}-\text{CH}_2\text{COOH}$  and less  $pK_a$ 

(e) Silver mirror formed on adding ammoniacal silver nitrate to propanal and not with propanone.

