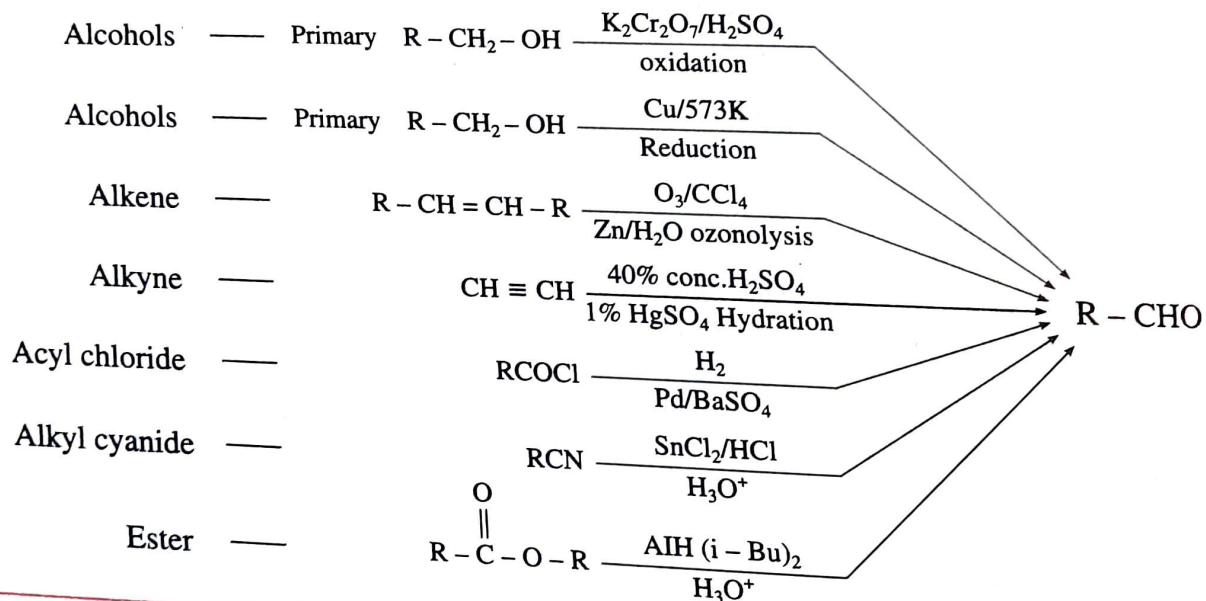
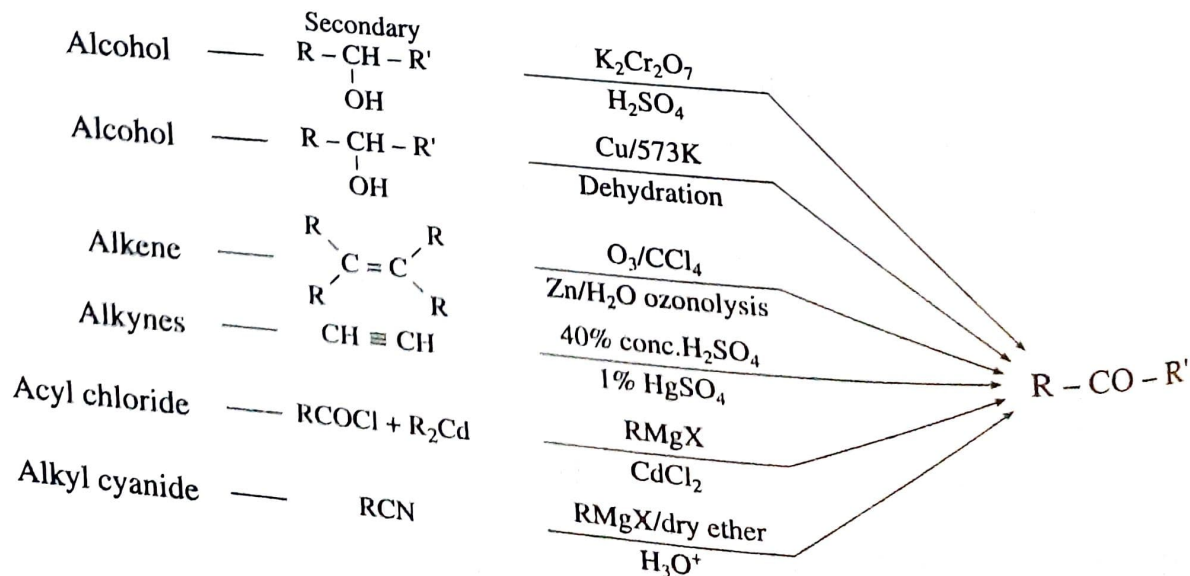


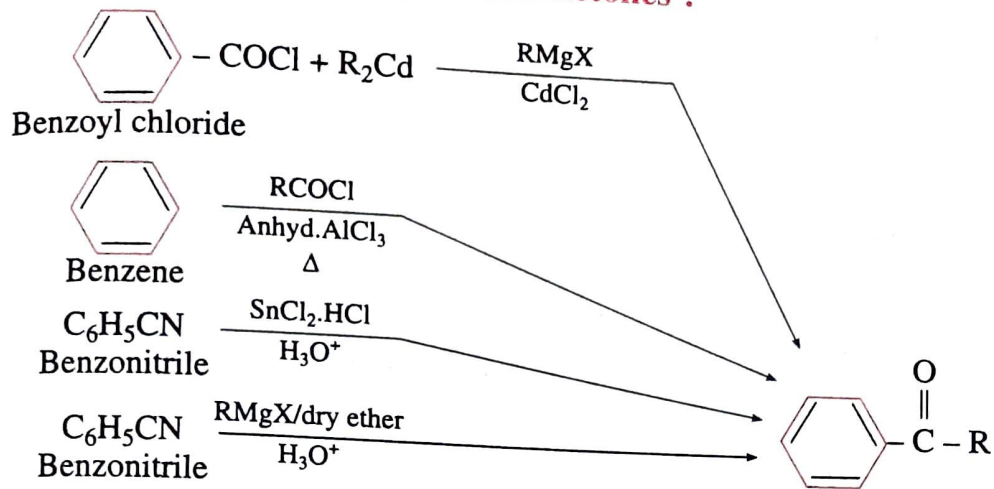
1. General methods of preparation of aldehydes :



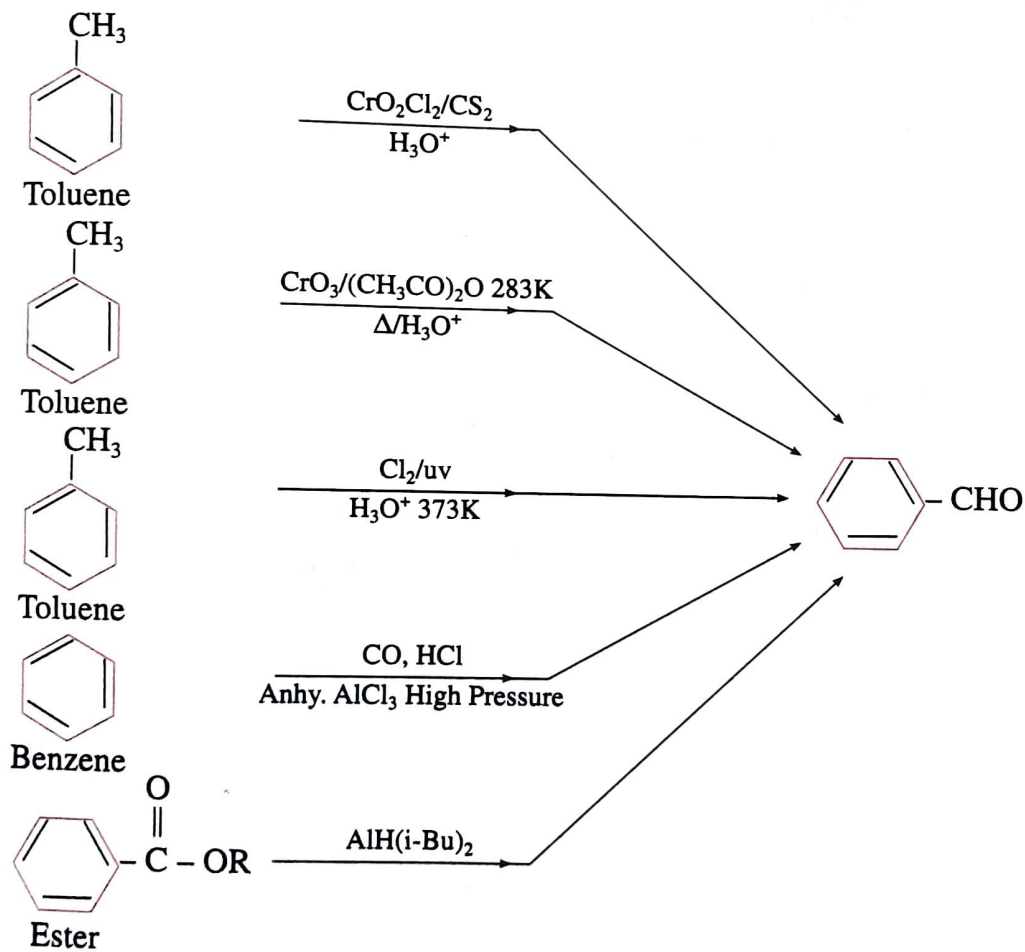
2. General methods of preparation of ketones :



3. Preparation of Aromatic aldehydes and ketones :

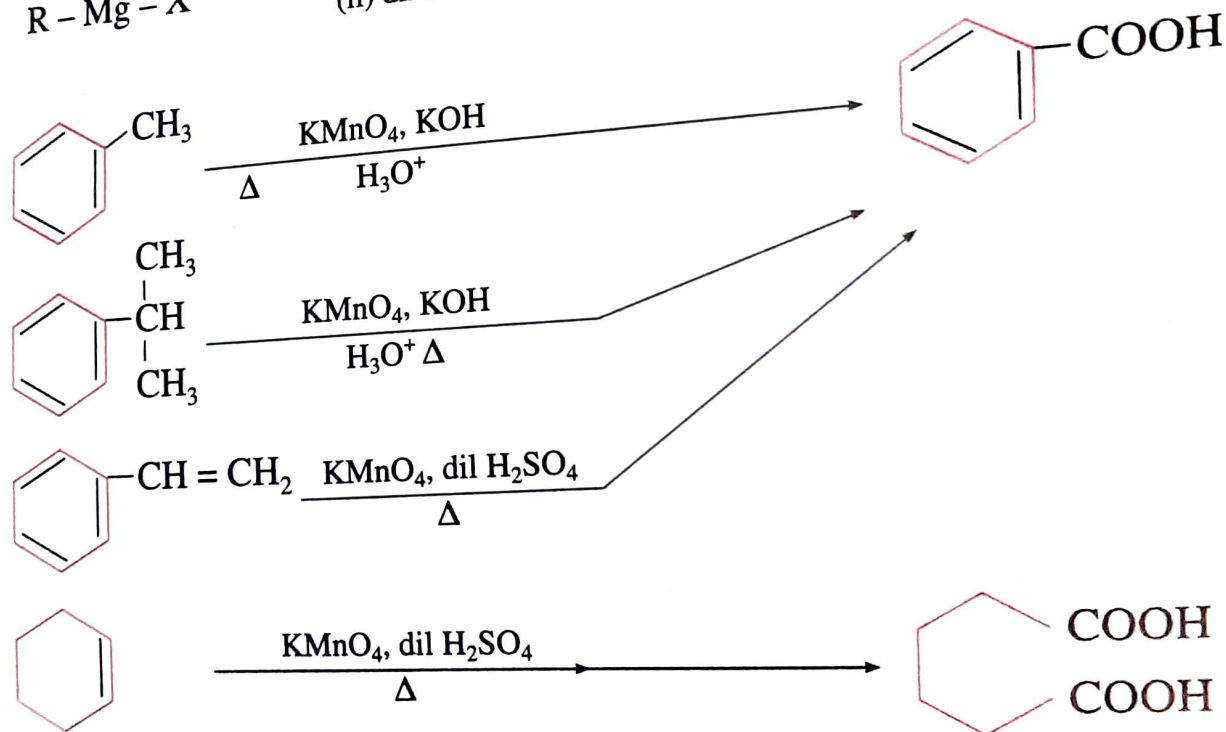
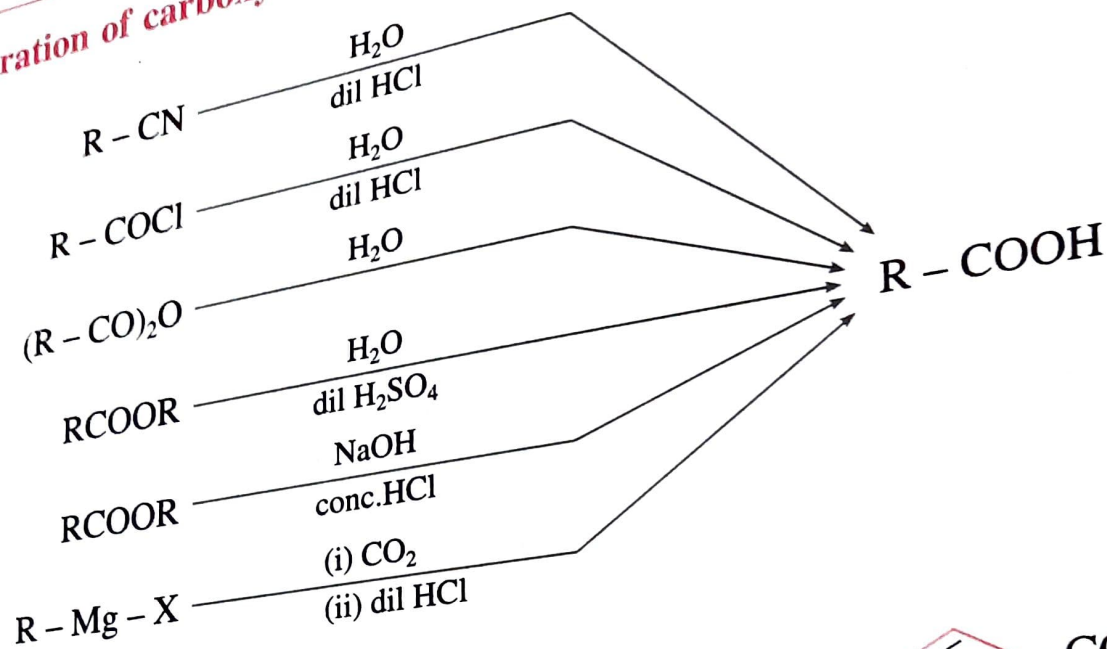


4.



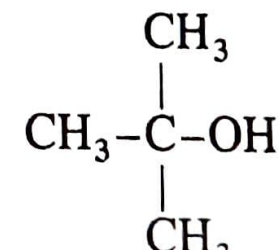
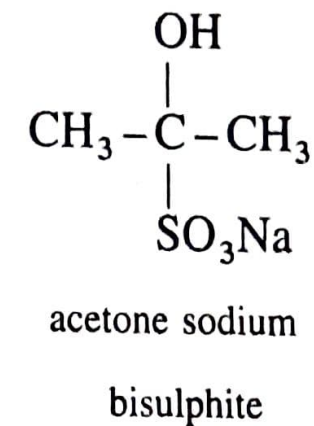
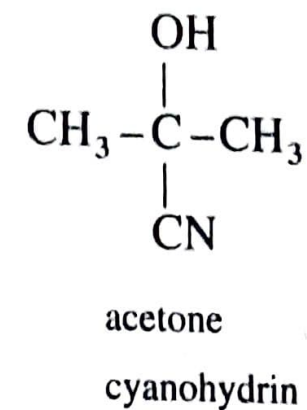
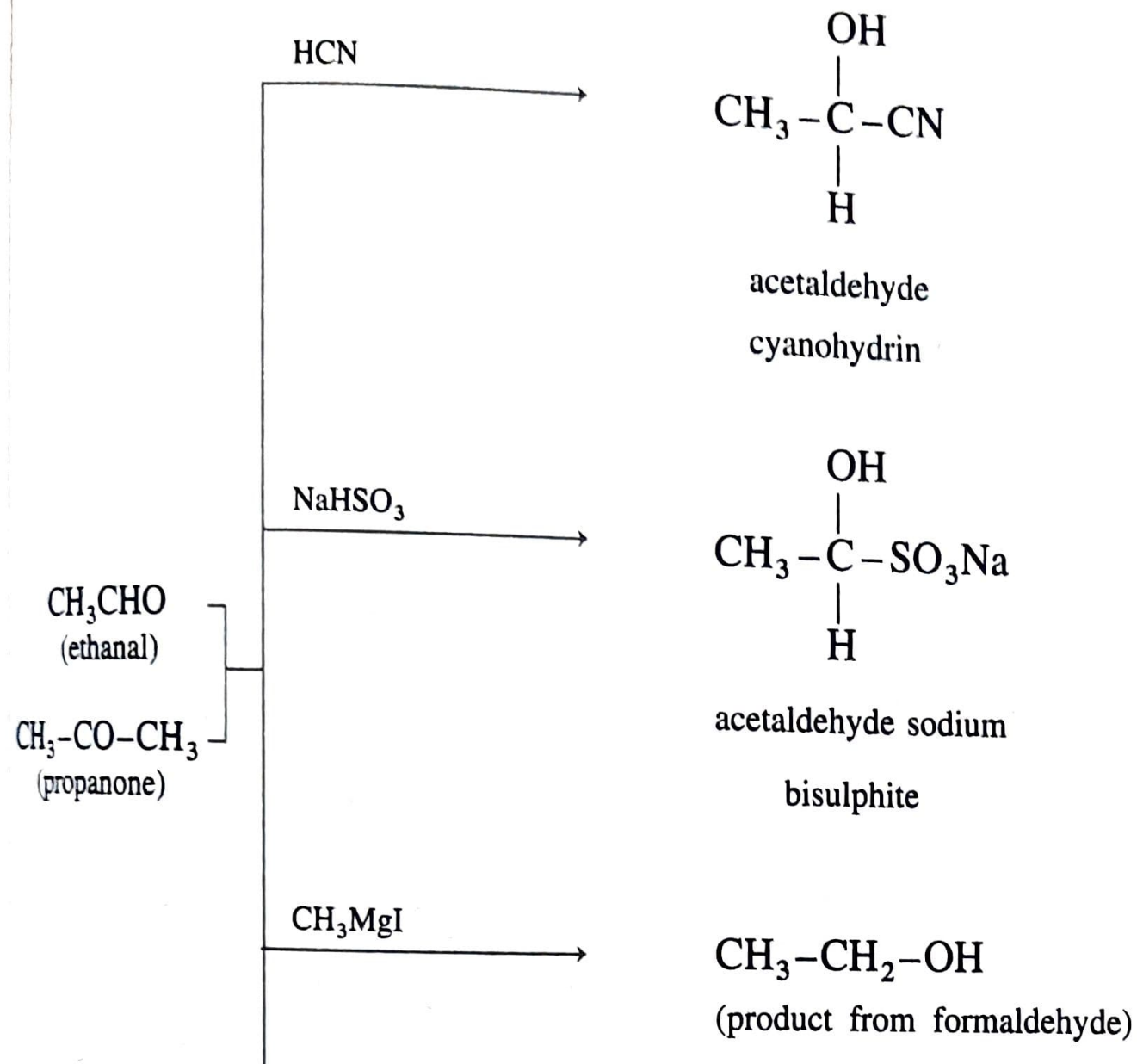
nucleophilic sub.

5. Preparation of carboxylic acids :



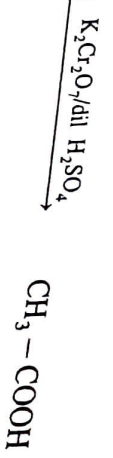
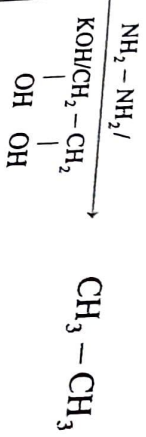
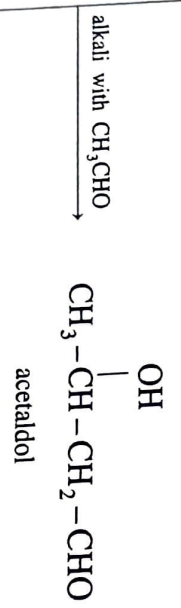
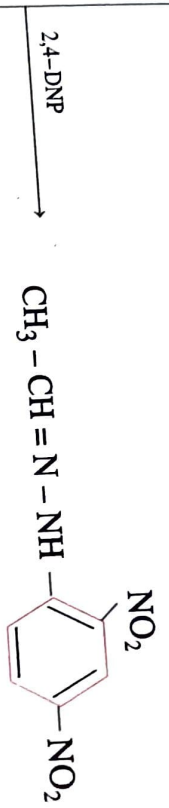
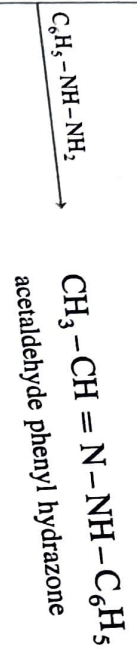
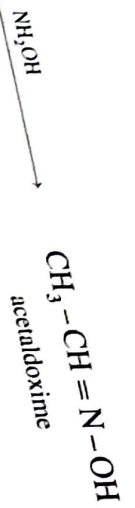
Products from acetaldehyde (ethanal)

Products from acetone (propanone)



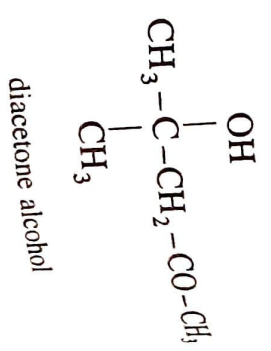
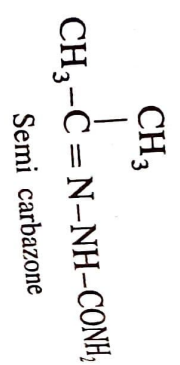
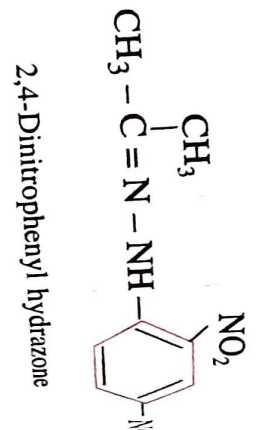
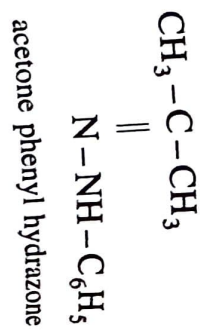
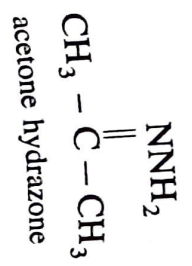
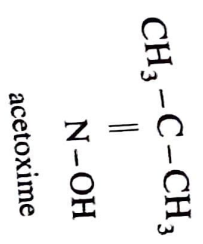
Handwritten: *Handwritten: 2,4-DNP*

Products from acetaldehyde
(ethanal)



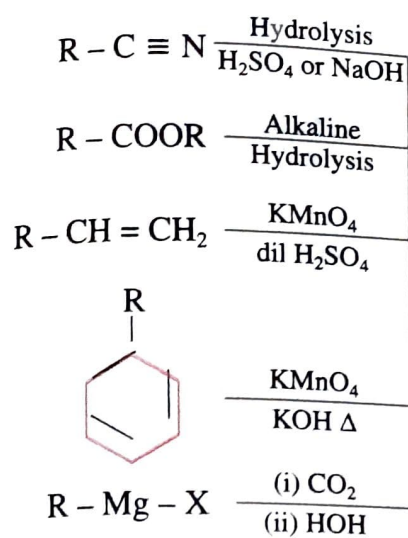
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(propanone)

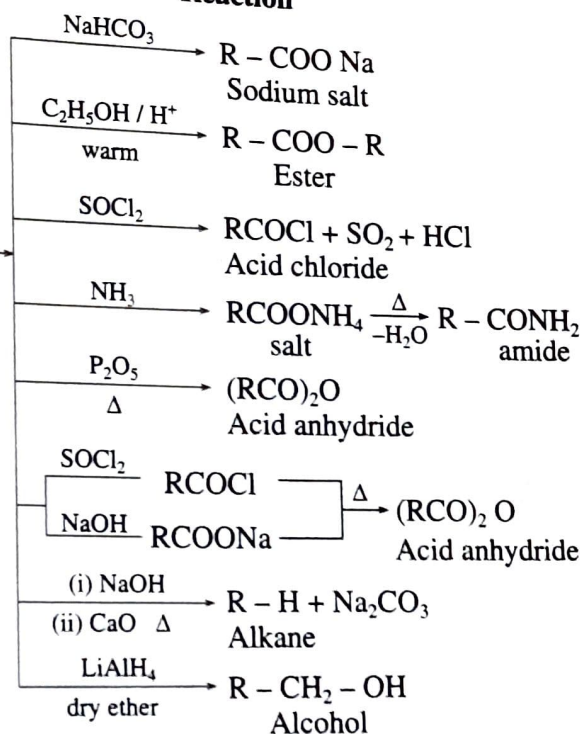


8. Reactions of carboxylic acid :

Preparation



Reaction



EXERCISES

(★) Indicates question from the textbook.

Unit

12.1 Introduction

(1 mark)

Q. 1. What is a carbonyl group?

Ans. **Carbonyl group** : A functional group in which a carbon atom is attached to an oxygen atom by a double bond and remaining two valencies of carbon atom are free is called a carbonyl group and represented as $>\text{C}=\text{O}$.

Carbonyl group is present in aldehydes and ketones.

(1 mark)

Q. 2. What are carbonyl compounds?

Ans. The organic compounds containing a carbonyl group ($>\text{C}=\text{O}$) are called carbonyl compounds. For example,

acetaldehyde, $\text{CH}_3 - \text{C} \begin{smallmatrix} \text{O} \\ \parallel \\ \text{H} \end{smallmatrix}$, acetone, $\text{CH}_3 - \text{C} \begin{smallmatrix} \text{O} \\ \parallel \\ \text{CH}_3 \end{smallmatrix}$. As carbonyl group is common in aldehydes and ketones,

(1 mark)

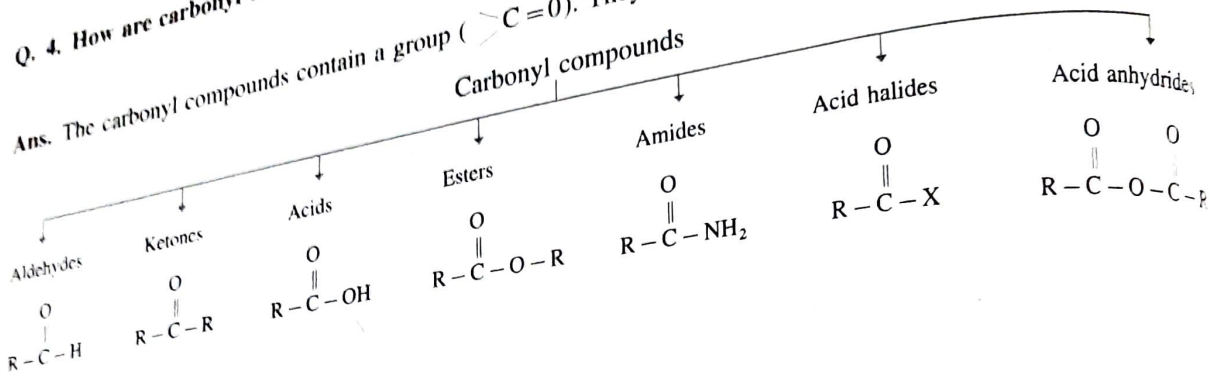
their methods of preparation and properties show similarities.

Q. 3. What are carboxylic compounds?

Ans. The compounds in which the functional group is $-\text{COOH}$ are known as carboxylic compounds. Due to the $-\text{OH}$ group bonded to ($>\text{C}=\text{O}$) group, carboxylic acids are distinct from aldehydes and ketones.

Q. 4. How are carbonyl compounds classified? OR Name the compounds containing carbonyl group. (1/2 mark each)

Ans. The carbonyl compounds contain a group ($>C=O$). They are classified as follows:



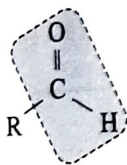
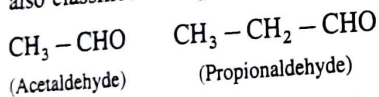
Units

12.2 Classification of aldehydes, ketones and carboxylic acids

12.2.1 Classification of aldehydes

Q. 5. What are aliphatic aldehydes?

Ans. The compounds in which the $-CHO$ group (formyl group or aldehyde group) is attached directly to sp^3 hybridized carbon atom that is saturated carbon atom are called aliphatic aldehydes. (Exception: Formaldehyde, $H-CHO$, also classified as aliphatic aldehyde though $-CHO$ group is not attached to any carbon). For example:

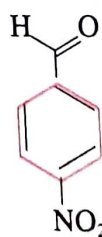
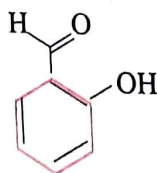


General formula
($R=H$ or alkyl group)

Q. 6. What are aromatic aldehydes?

Ans. The compounds in which $-CHO$ group is attached directly to an aromatic ring are called aromatic aldehydes.

For example:



(Benzaldehyde) (Salicylaldehyde) (p-Nitrobenzaldehyde)

Q. 7. Explain the structure of carbonyl functional group.

(2 marks)

Ans.

- (1) In the carbonyl functional group, carbon atom is attached to an oxygen atom by a double bond and remaining two valencies of carbon atom are free, and it is represented as $>C=O$.
- (2) The carbonyl carbon atom is sp^2 -hybridised forming coplanar three sigma (σ) bonds with the bond angle 120° .
- (3) One sigma bond is formed with oxygen atom while other two sigma (σ) bonds are formed with hydrogen or carbon atoms.
- (4) The remaining unhybridised $2p_z$ orbital of carbon atom overlaps with p orbital of oxygen atom colaterally forming a pi (π) bond. Hence, carbon atom is joined to oxygen atom by a double bond of which one is sigma and another is π .
- (5) The oxygen atom in the carbonyl group has two lone pairs of electrons.
- (6) The carbonyl bond is strong, short and polarized.
- (7) The polarity of the carbonyl group is explained on the basis of resonance involving a neutral and dipolar structures as shown below :

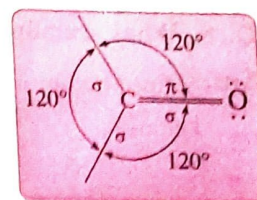
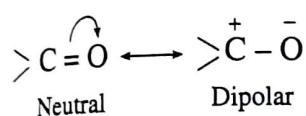


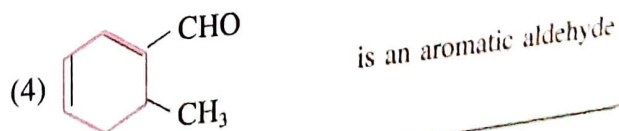
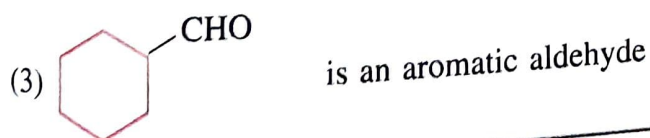
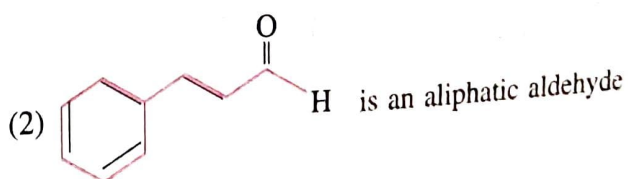
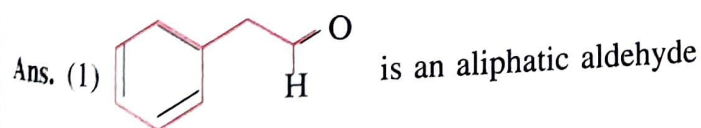
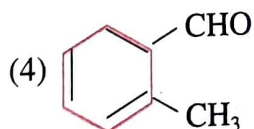
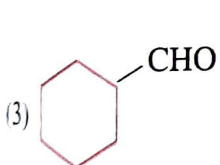
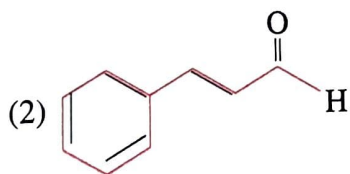
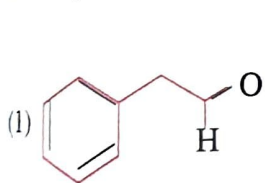
Fig. 12.1 : sp^2 -hybridised carbonyl carbon atom



Use your brain power !

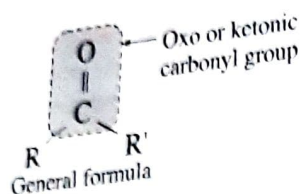
(Textbook page 254)

Classify the following as aliphatic and aromatic aldehydes.



Q. 8. What are aliphatic ketones? How are they classified?

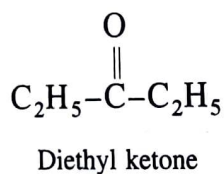
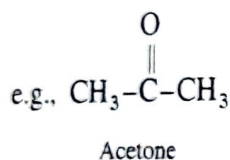
Ans. Aliphatic ketones : The compounds in which $>C=O$ group is attached to two alkyl groups are called aliphatic ketones.



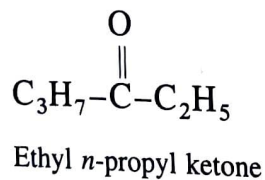
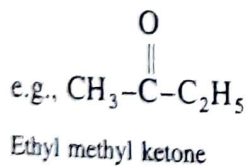
(Where R, R' = alkyl group, identical or different)

Ketones are classified into two types : (1) Simple or symmetrical ketones and (2) mixed or unsymmetrical ketones.

(1) Simple or symmetrical ketone : The ketone in which the carbonyl carbon is attached to two identical alkyl groups is called a simple or symmetrical ketone.

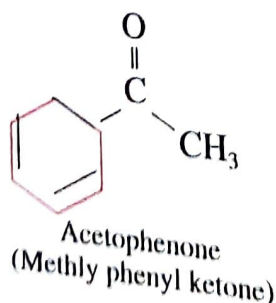
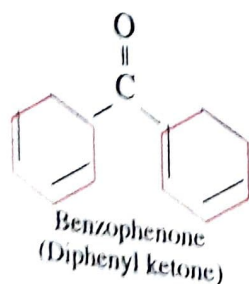


(2) Mixed or unsymmetrical ketone : The ketone in which the carbonyl carbon is attached to two different alkyl groups is called a mixed or unsymmetrical ketone.



★ Q. 9. What are aromatic ketones?

Ans. The compounds in which a $>C=O$ group is attached to either two aryl groups or one aryl and one alkyl group are called aromatic ketones. For example :



	Ans.	Type
(1) $\text{CH}_3 - \text{CH}_2 - \overset{\text{O}}{\parallel} \text{C} - \text{CH}_3$		Mixed (unsymmetrical) ketone
(2) $\text{CH}_3 - \underset{\text{CH}_3}{\text{CH}} - \overset{\text{O}}{\parallel} \text{C} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$		Simple ketone
(3) $\text{CH}_3 - \text{CH}_2 - \text{CH}_2 - \overset{\text{O}}{\parallel} \text{C} - \underset{\text{CH}_3}{\text{CH}} - \text{CH}_3$		Mixed (unsymmetrical) ketone
(4) $\text{C}_2\text{H}_5 - \overset{\text{O}}{\parallel} \text{C} - \text{C}_2\text{H}_5$		Simple ketone

Use your brain power!

(Textbook page 255)

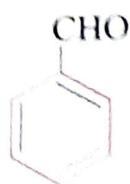
- Classify the followings as simple and mixed ketones.
Benzophenone, acetone, butanone, acetophenone.

Compound	Ans.
Benzophenone	Simple ketone
Acetone	Simple ketone
Butanone	Mixed ketone
Acetophenone	Mixed ketone

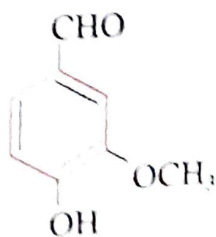
Do you know?

(Textbook page 255)

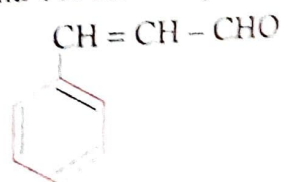
- Aldehydes and ketones are responsible for many flavours and odours that you will readily recognize:



Benzaldehyde
(Bitter almond flavour)



Vanillin
(Vanilla flavour)



Cinnamaldehyde
(Cinnamon flavour)



Camphor
(Camphor fragrance)

- Structures of many important biological compounds contain carbonyl moiety. For example, progesterone and testosterone, the female and male sex hormones respectively.
- Butyraldehyde is used in margarine and food for its buttery odour.
- Acetophenone has smell of pistachio and is used in ice-cream. Muscone has musky aroma and is used in perfumes. Popcorn has butter flavour which contains butane-2,3-dione.