

# Aldehydes, Ketones and Carboxylic Acids JEE Main PYQ - 2

Total Time: 1 Hour

Total Marks: 100

## Instructions

### Instructions

1. Test will auto submit when the Time is up.
2. The Test comprises of multiple choice questions (MCQ) with one or more correct answers.
3. The clock in the top right corner will display the remaining time available for you to complete the examination.

### Navigating & Answering a Question

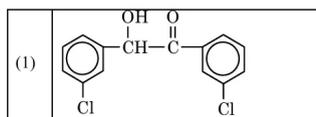
1. The answer will be saved automatically upon clicking on an option amongst the given choices of answer.
2. To deselect your chosen answer, click on the clear response button.
3. The marking scheme will be displayed for each question on the top right corner of the test window.

## Aldehydes, Ketones and Carboxylic Acids

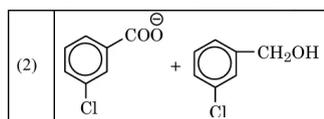
1. m-chlorobenzaldehyde on treatment with 50% KOH solution yields

(+4, -1)

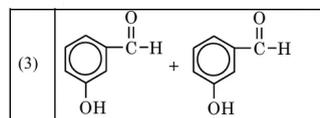
a.



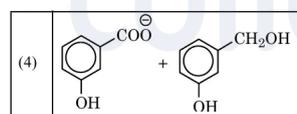
b.



c.



d.



2. Which of the following molecule is an acidic oxide?

(+4, -1)

a.  $N_2O_3$

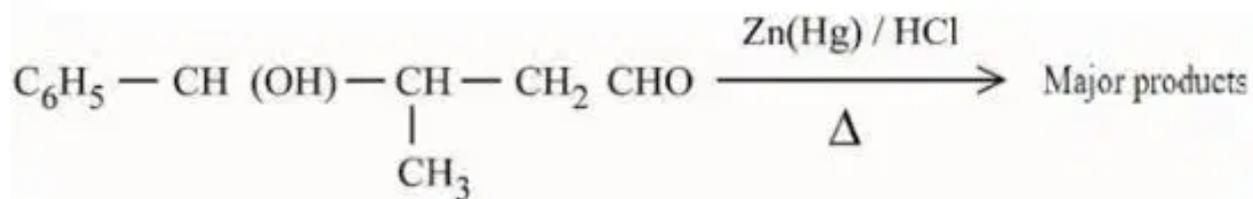
b.  $NO$

c.  $CO$

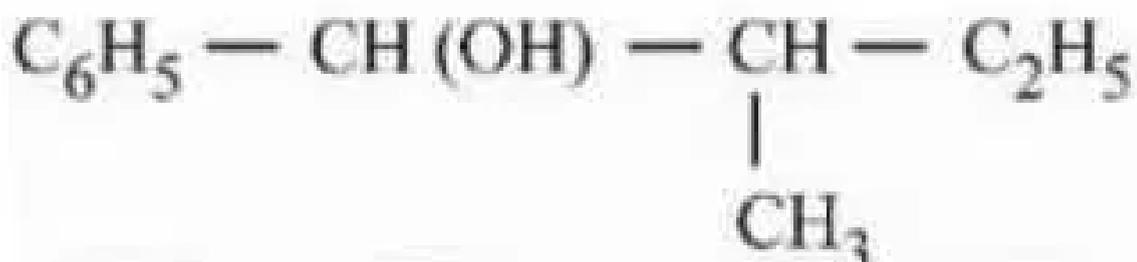
d.  $CaO$

3. The major product formed in the following reaction is

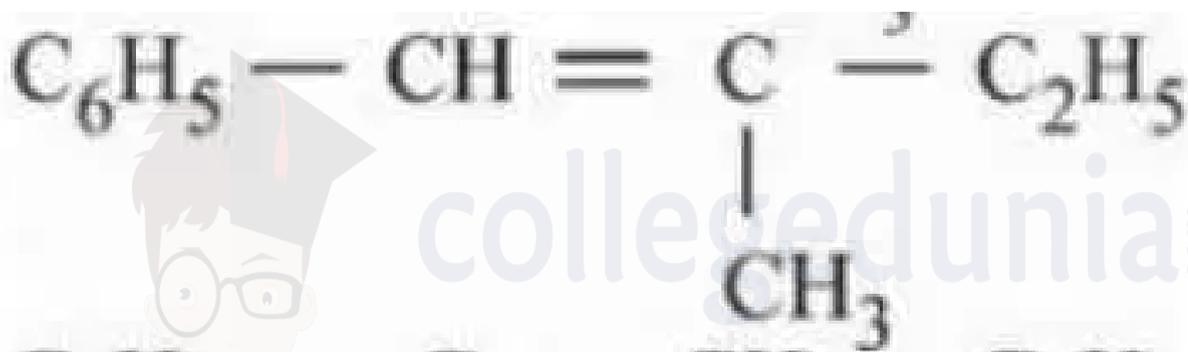
(+4, -1)



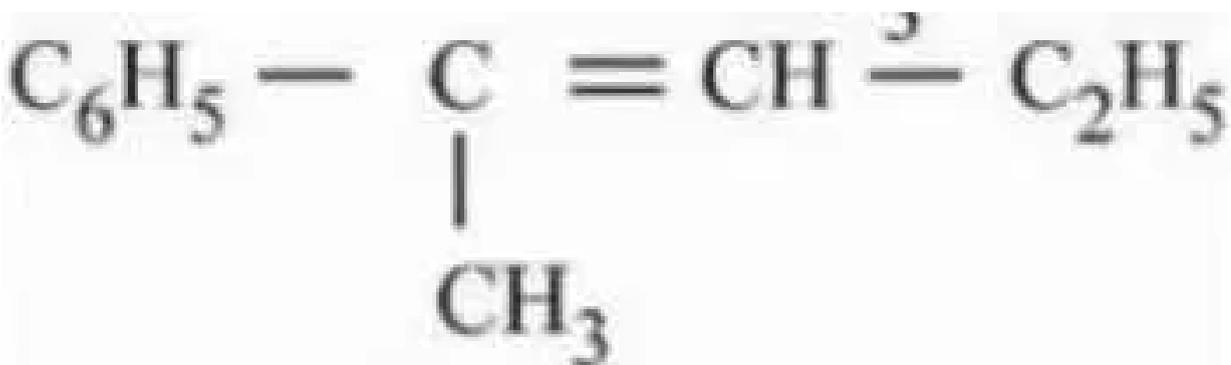
A.



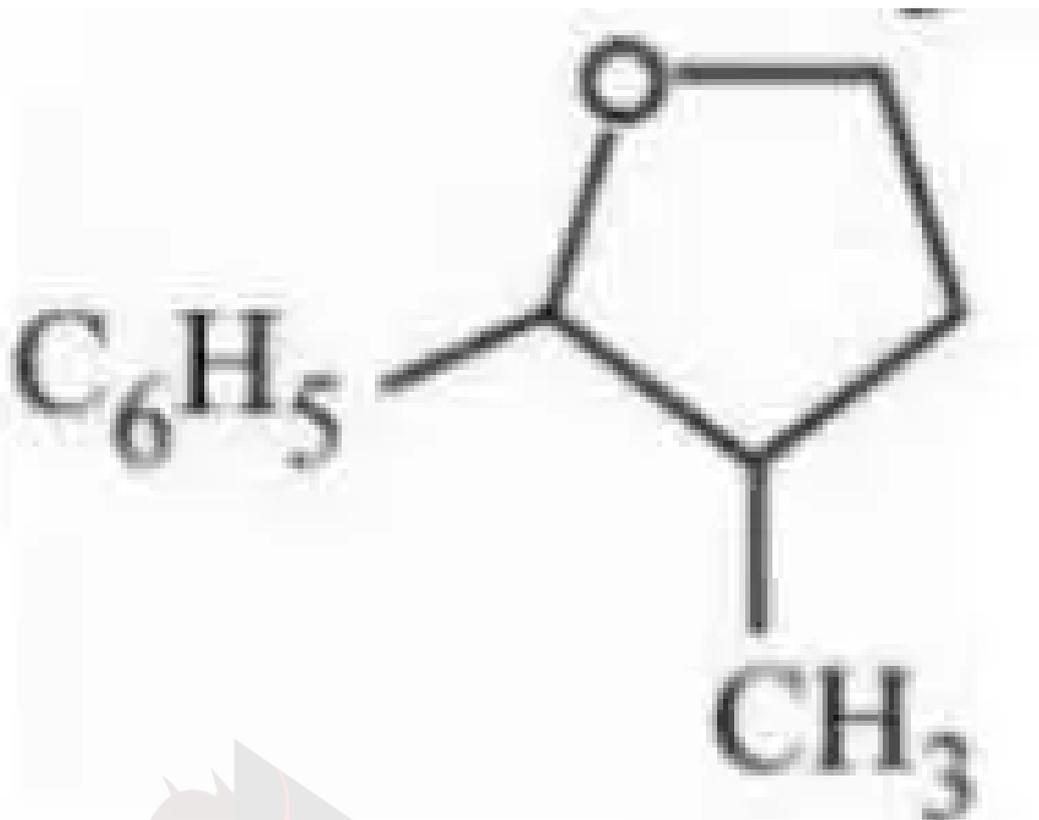
B.



C.

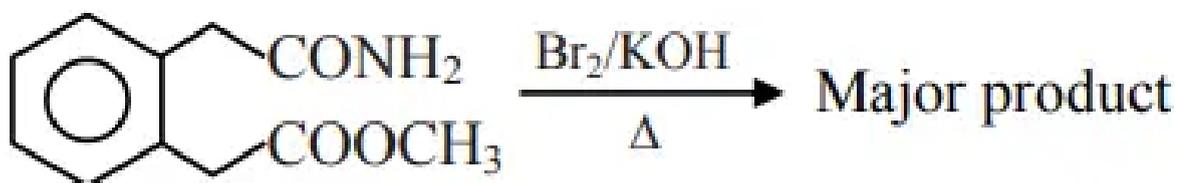


D.



Choose the correct answer from the options given below:

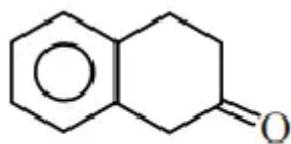
- a. C only
- b. A only
- c. D only
- d. B only



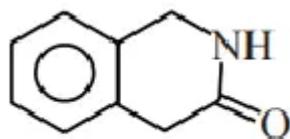
4.

Choose the correct option.

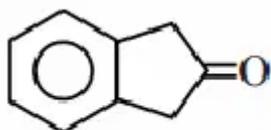
(+4, -1)



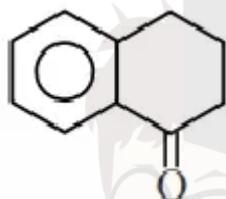
a.



b.



c.



d.

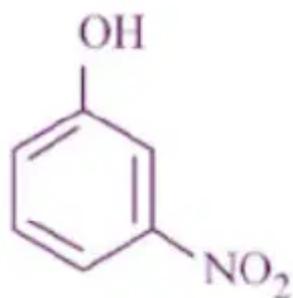
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5. Arrange the following in decreasing acidic strength.

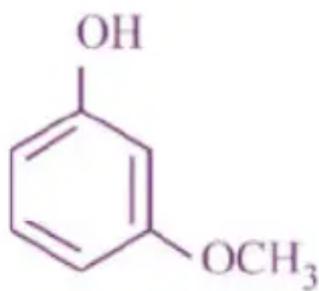
(+4, -1)



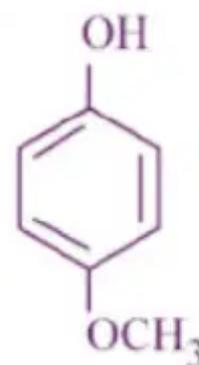
(A)



(B)



(C)



(D)

a.  $A > B > C > D$

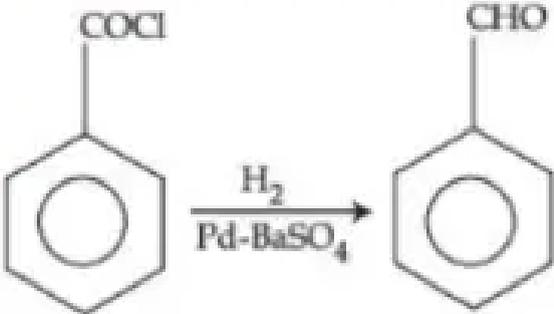
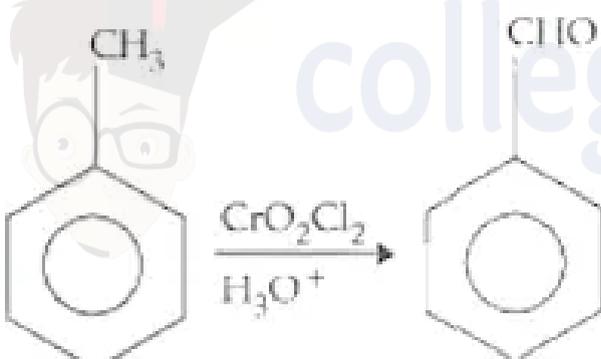
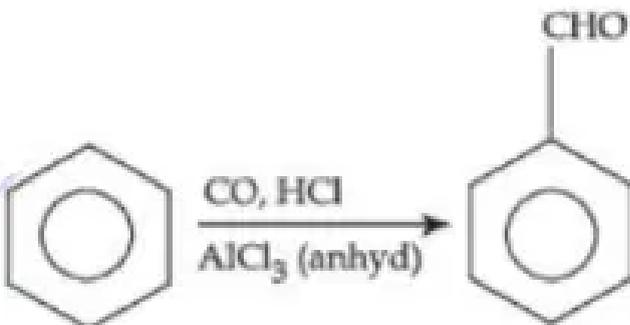
b.  $B > A > C > D$

c.  $D > C > A > B$

d.  $D > C > B > A$

6. Match List-I with List-II

(+4, -1)

	List-I		List-II
(A)		(I)	Gatterman Koch reaction
(B)	$\text{CH}_3 - \text{CN} \xrightarrow[\text{H}_3\text{O}^+]{\text{SnCl}_2 / \text{HCl}} \text{CH}_3 - \text{CHO}$	(II)	Etard reaction
(C)		(III)	Stephen reaction
(D)		(IV)	Rosenmund reaction

Choose the correct answer from the options given below:

a. A(IV), B(III), C(II), D(I)

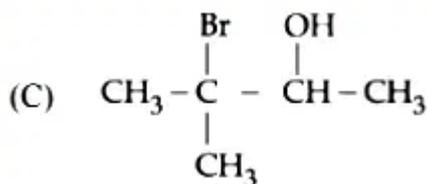
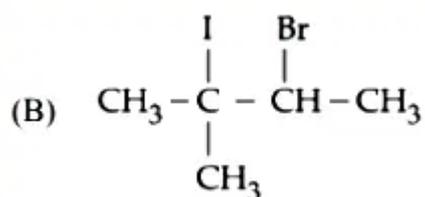
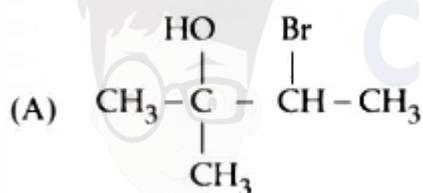
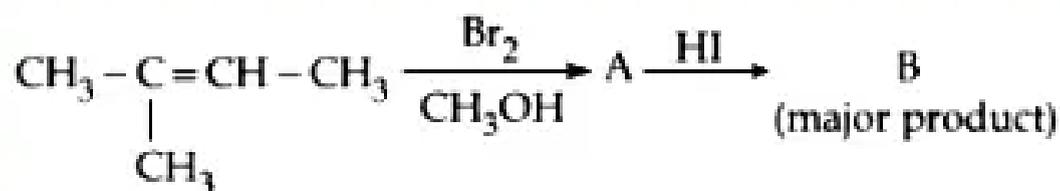
b. A(I), B(II), C(III), D(IV)

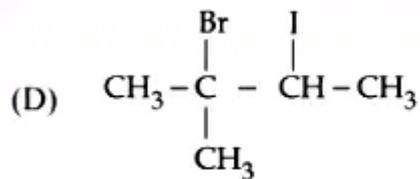
c. A(II), B(III), C(IV), D(I)

d. A(III), B(II), C(I), D(IV)

7. Major product 'B' of the following reaction sequence is

(+4, -1)

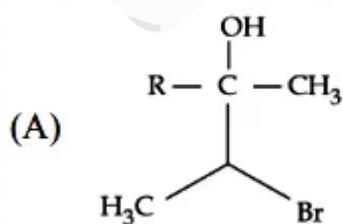
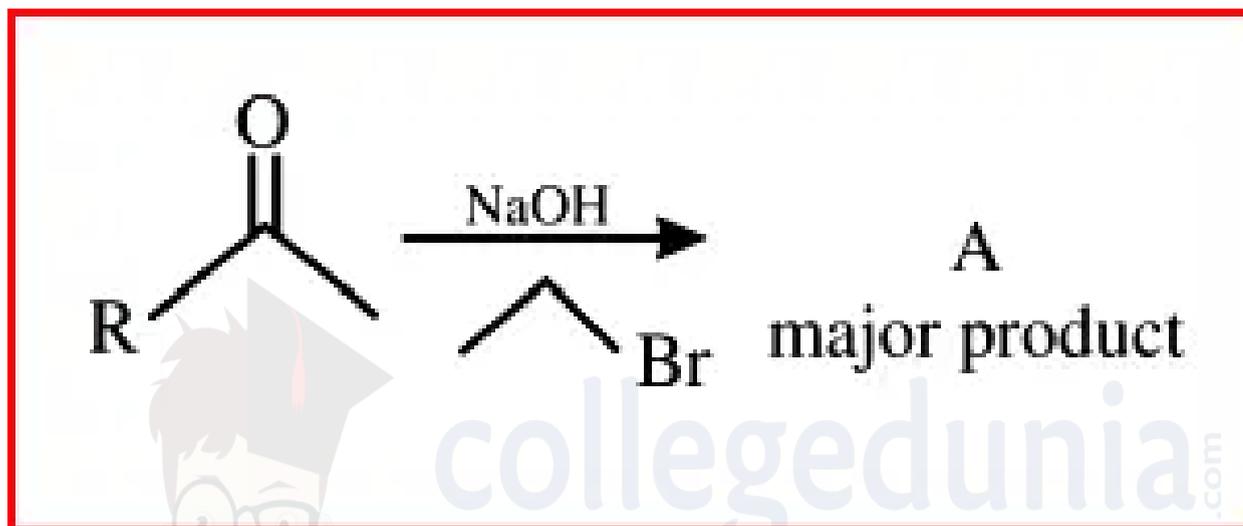




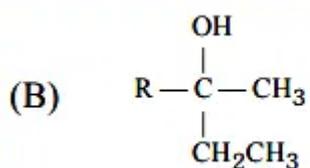
d.

8. The structure of A in the given reaction is:

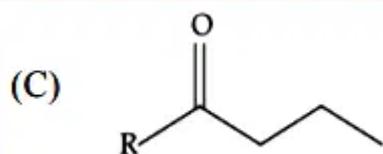
(+4, -1)



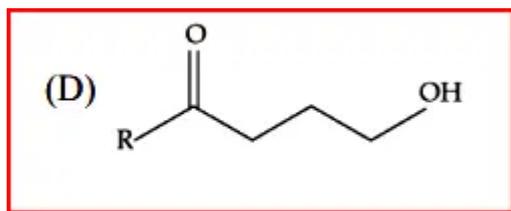
a.



b.



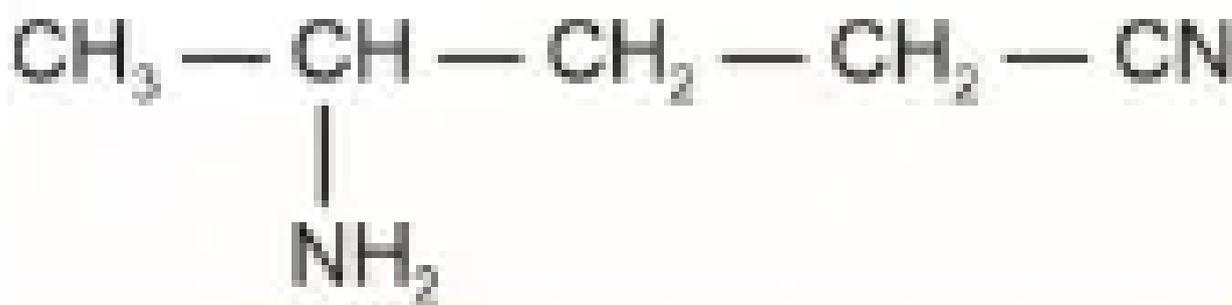
c.



d.

9. What is the correct IUPAC name of the given compound?

(+4, -1)



- a. 4-Aminopentanenitrile
- b. 2-Aminopentanenitrile
- c. 3-Aminobutanenitrile
- d. 2-Aminobutanenitrile

10. Which reagent on reacting with phenol gives salicylaldehyde?

(+4, -1)

- a.  $\text{CO}_2, \text{NaOH}$
- b.  $\text{CHCl}_3, \text{NaOH}$
- c.  $\text{CCl}_4, \text{NaOH}$
- d.  $\text{H}_2\text{O}, \text{H}^+$

11. Sugar which does not give reddish brown precipitate with Fehling's reagent is:

(+4, -1)

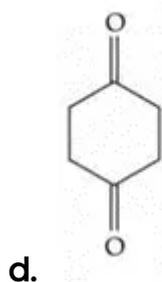
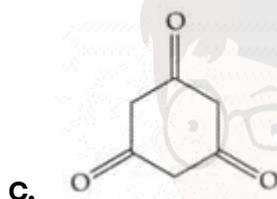
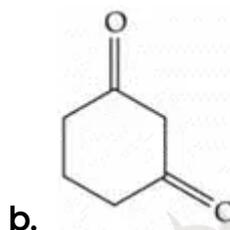
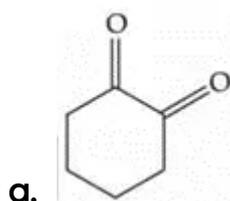
- a. Lactose
- b. Maltose

c. Sucrose

d. Glucose

12. Which will have the highest enol content?

(+4, -1)



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13.

(+4, -1)

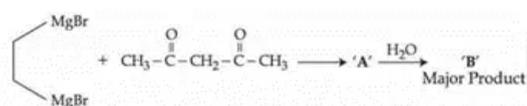
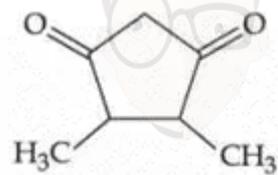
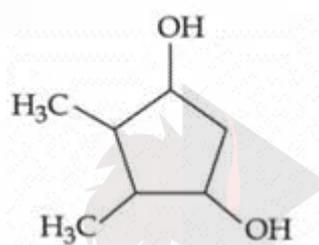
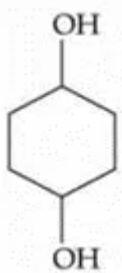
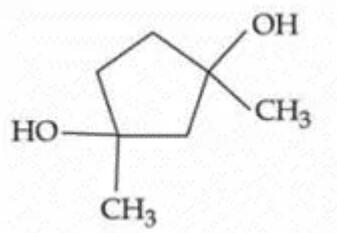


Fig. Chemical Reaction

Consider the above reaction sequence and identify the product B.

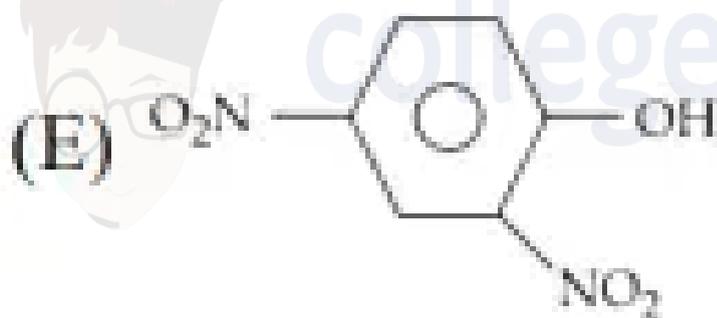
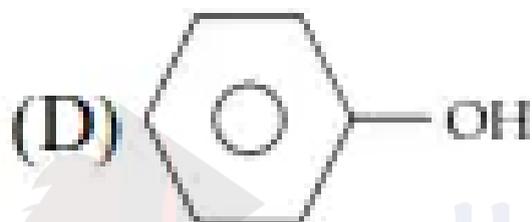
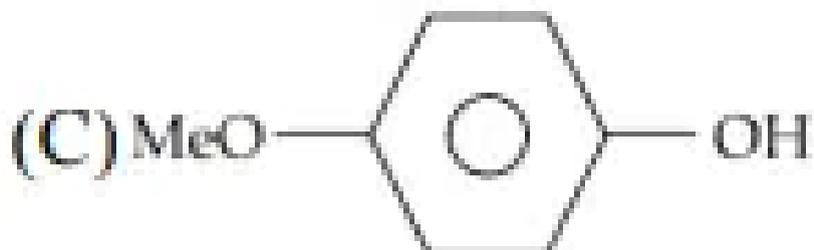
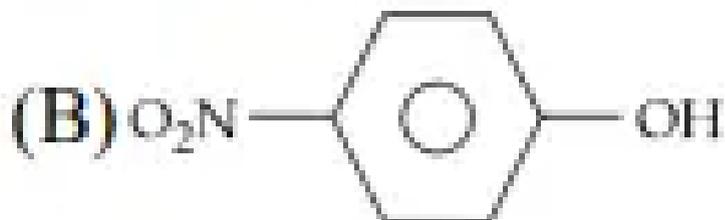


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14. The molecular formula of second homologue in the homologous series of monocarboxylic acid is (+4, -1)

- a.  $C_2H_2O_2$
- b.  $CH_2O$
- c.  $C_2H_4O_2$
- d.  $C_3H_6O_2$

15. The ascending order of acidity of  $-OH$  group in the following compounds is: (+4, -1)

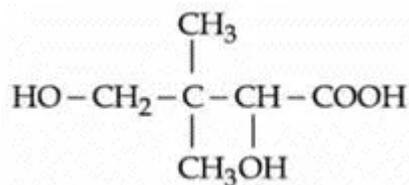


Choose the correct answer from the options given below :

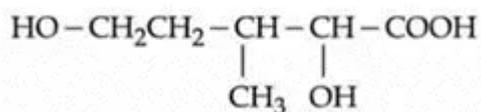
- $(A) < (D) < (C) < (B) < (E)$
- $(C) < (A) < (D) < (B) < (E)$
- $(C) < (D) < (B) < (A) < (E)$
- $(A) < (C) < (D) < (B) < (E)$

16. Isobutyraldehyde on reaction with formaldehyde and  $K_2CO_3$  gives compound 'A'. Compound 'A' reacts with KCN and yields compound 'B', which on hydrolysis gives a stable compound 'C'. The compound 'C' is

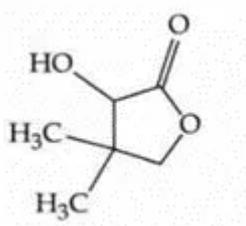
(+4, -1)



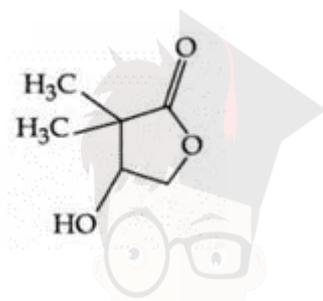
a.



b.



c.



d.

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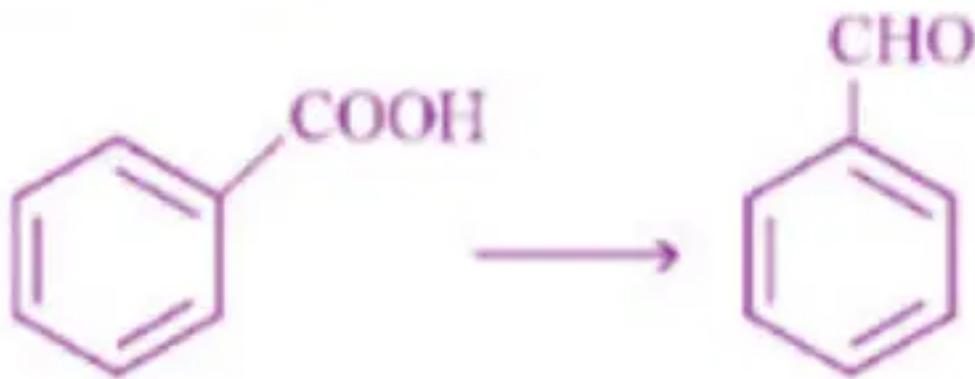
17. Decarboxylation of all six possible forms of diaminobenzoic acid (+4, -1)

$C_6H_3(NH_2)_2COOH$  yields three products A, B and C. Three acids give a product 'A', two acids give a product 'B' and one acid gives a product 'C'. The melting point of product 'C' is

- a.  $63^\circ\text{C}$
- b.  $90^\circ\text{C}$
- c.  $104^\circ\text{C}$
- d.  $142^\circ\text{C}$

18. The reagent, from the following, which converts benzoic acid to (+4, -1)

benzaldehyde in one step is



- a.  $\text{LiAlH}_4$
- b.  $\text{KMnO}_4$
- c.  $\text{MnO}$
- d.  $\text{NaBH}_4$

19. Oxidation of toluene to benzaldehyde can be easily carried out with which of the following reagents? (+4, -1)

- a.  $\text{CrO}_3$  / acetic acid,  $\text{H}_3\text{O}^+$
- b.  $\text{CrO}_3$  / acetic anhydride,  $\text{H}_3\text{O}^+$
- c.  $\text{KMnO}_4$  /  $\text{HCl}$ ,  $\text{H}_3\text{O}^+$
- d.  $\text{CO}/\text{HCl}$ , anhydrous  $\text{AlCl}_3$

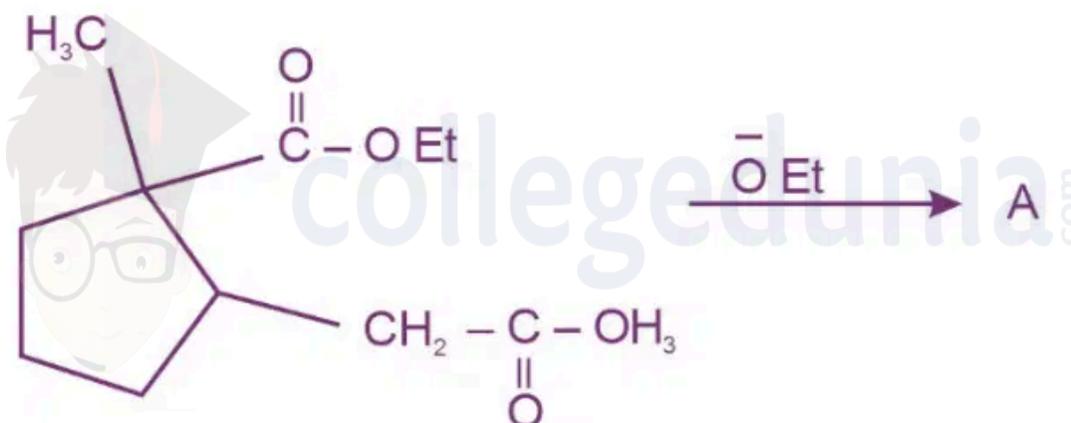
20. The conversion of *propan - 1 - ol* to *n - butylamine* involves the sequential addition of reagents. The correct sequential order of reagents is (+4, -1)

- a. (i)  $\text{SOCl}_2$  (ii)  $\text{KCN}$  (iii)  $\text{H}_2/\text{Ni}$ ,  $\text{Na}(\text{Hg})/\text{C}_2\text{H}_5\text{OH}$
- b. (i)  $\text{HCl}$  (ii)  $\text{H}_2/\text{Ni}$ ,  $\text{Na}(\text{Hg})/\text{C}_2\text{H}_5\text{OH}$
- c. (i)  $\text{SOCl}_2$  (ii)  $\text{KCN}$  (iii)  $\text{CH}_3\text{NH}_2$
- d. (i)  $\text{HCl}$  (ii)  $\text{CH}_3\text{NH}_2$

21. Hex-4-ene-2-ol on treatment with PCC gives 'A' on reaction with sodium hypiodite gives 'B', which on further heating with soda lime gives 'C'. The compound 'C' is (+4, -1)

- a. 2-pentene
- b. Proponaldehyde
- c. 2-butene
- d. 4-methylpent-2-ene

22. In the given reaction, (+4, -1)



(where Et is  $-\text{C}_2\text{H}_5$ )

The number of chiral carbon(s) in product A is \_\_\_\_\_.

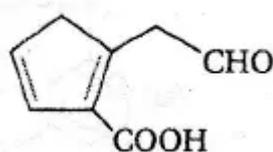
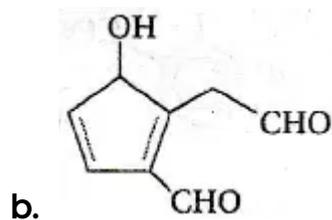
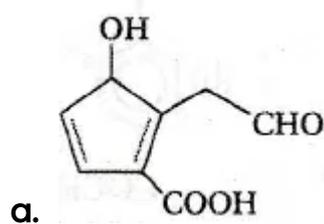
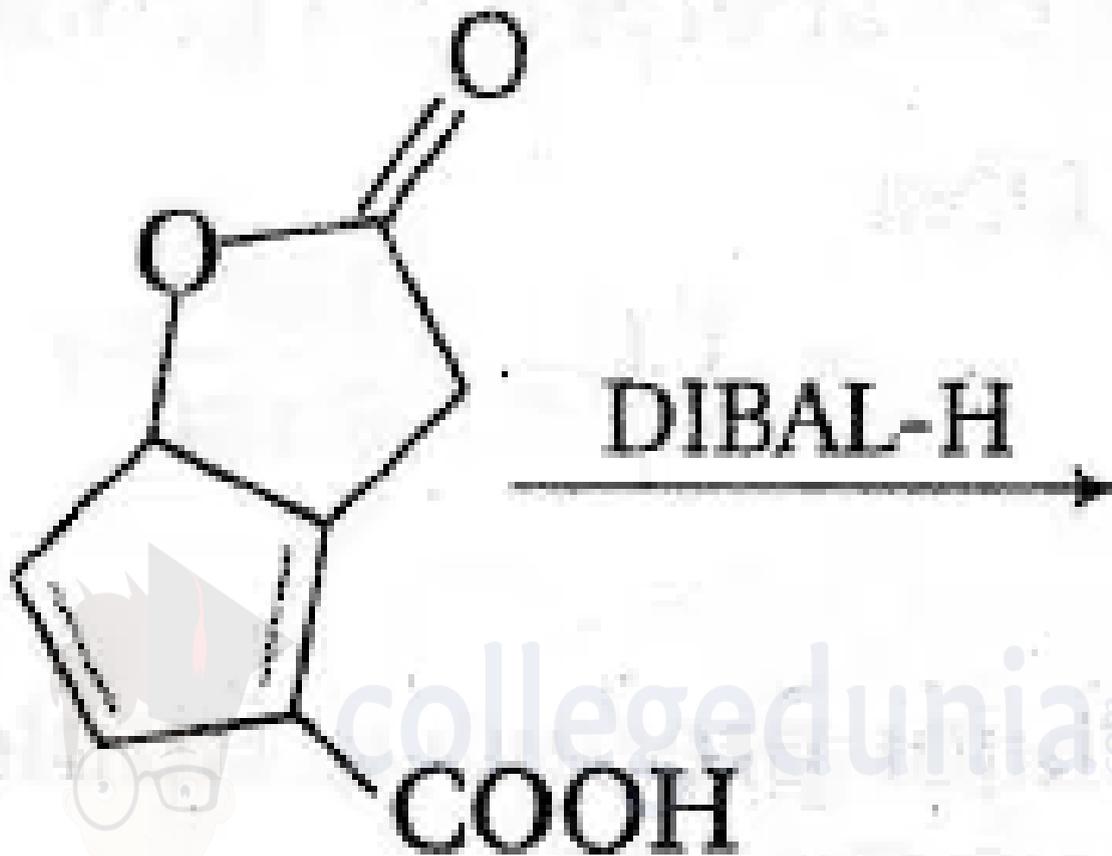
23. Given below are two statements : Statement I : On heating with  $\text{KHSO}_4$ , glycerol is dehydrated and acrolein is formed (+4, -1)  
 Statement II : Acrolein has fruity odour and can be used to test glycerol's presence Choose the correct option

- a. Both Statement I and Statement II are correct.
- b. Both Statement I and Statement II are incorrect
- c. Statement I is correct but Statement II is incorrect.

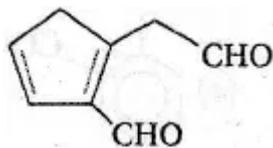
d. Statement I is incorrect but Statement II is correct.

24. The major product obtained in the following reaction is

(+4, -1)



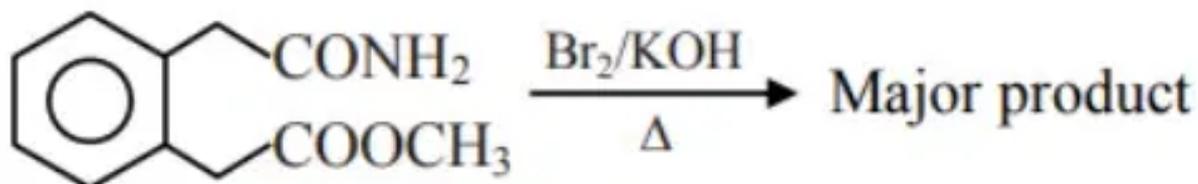
c.



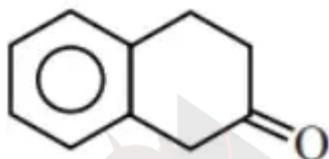
d.

25. Choose the correct option.

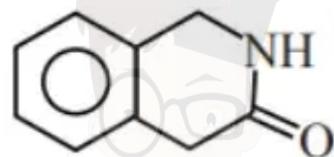
(+4, -1)



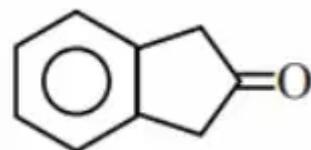
a.



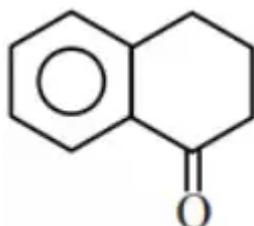
b.



c.



d.



## Answers

### 1. Answer: b

#### Explanation:

**Solution:** When *m*-chlorobenzaldehyde is treated with 50% KOH solution, it undergoes a reaction known as the Cannizzaro reaction, which occurs in aldehydes that do not have alpha hydrogens.

**Cannizzaro Reaction:** In the Cannizzaro reaction, an aldehyde is converted into a carboxylic acid and an alcohol in the presence of a strong base, like KOH. The reaction mechanism involves the disproportionation of the aldehyde, leading to the formation of the corresponding carboxylate and alcohol.

**Reaction Process:** For *m*-chlorobenzaldehyde, the reaction can be summarized as follows:



**Final Products:** The final products of the reaction are *m*-chlorobenzoate ion and *m*-chlorobenzyl alcohol.

Thus, the correct product obtained from the reaction is: chlorobenzoate and *m*-chlorobenzyl alcohol.

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### 2. Answer: a

#### Explanation:

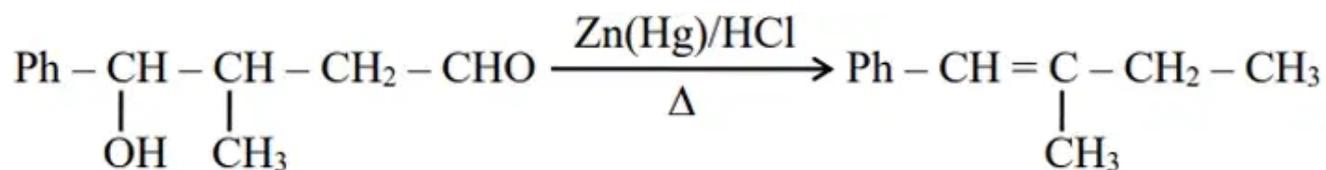
The Correct answer is option is (A) :  $N_2O_3$

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### 3. Answer: d

#### Explanation:

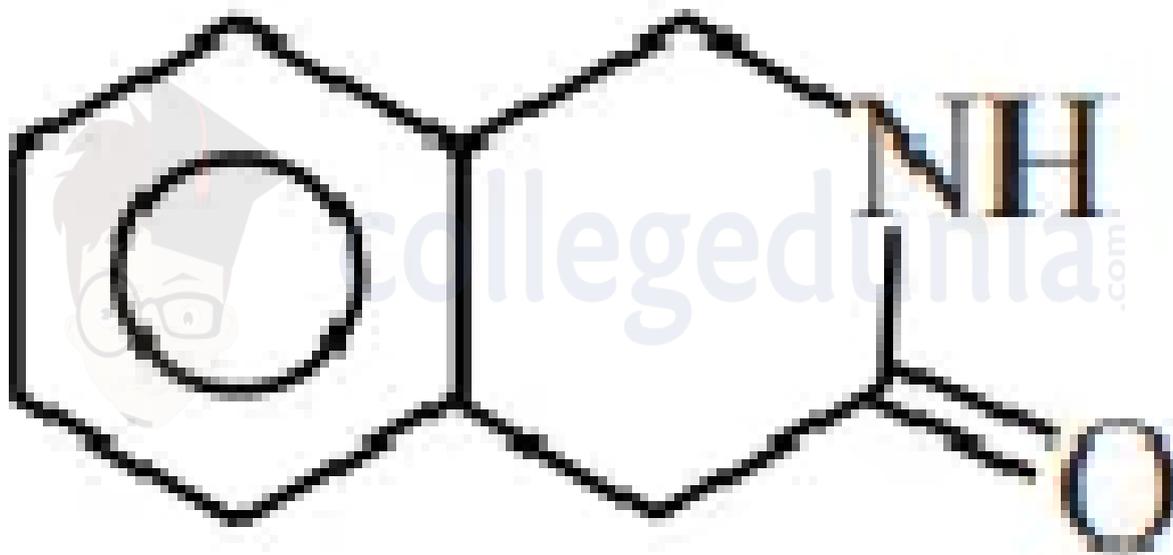
The correct option is (D): B only



#### 4. Answer: b

#### Explanation:

The correct answer is (B) :



#### Concepts:

##### 1. Aldehydes, Ketones, and Carboxylic Acids:

[Aldehydes, Ketones, and Carboxylic Acids](#) are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

#### Aldehydes:

Aldehydes are organic compounds that have the functional group  $\text{-CHO}$ .

### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

### Ketones:

Ketones are organic compounds that have the functional group  $\text{C=O}$  and the structure  $\text{R-(C=O)-R'}$ .

### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

### Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $\text{(C=O)OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

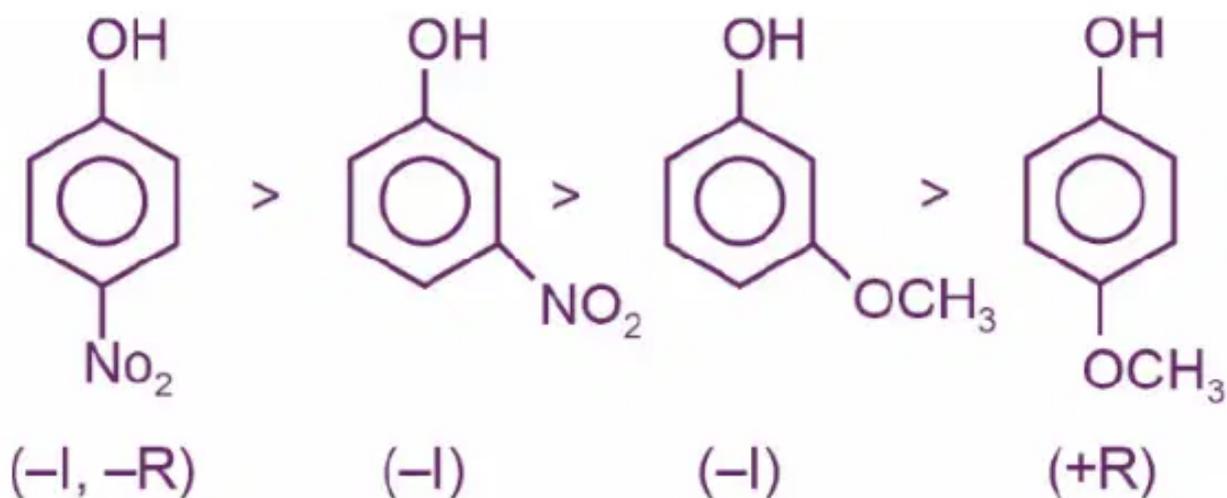
Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

---

### 5. Answer: a

#### Explanation:

The correct option is (A) :



## Concepts:

### 1. Aldehydes, Ketones, and Carboxylic Acids:

Aldehydes, Ketones, and Carboxylic Acids are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

### Aldehydes:

Aldehydes are organic compounds that have the functional group -CHO.

#### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with [hydrogen](#) in the presence of palladium catalyst spread on barium sulfate.

### Ketones:

Ketones are organic compounds that have the functional group C=O and the structure R-(C=O)-R'.

#### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

## Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $(C=O)OH$  group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

## 6. Answer: a

### Explanation:

To solve this question, we need to match chemical reactions in List-I with their corresponding names in List-II. Let's analyze each reaction one by one:

1. Reaction (A): Benzoyl chloride ( $C_6H_5COCl$ ) is being reduced to benzaldehyde ( $C_6H_5CHO$ ) using  $H_2$  over palladium-barium sulfate ( $Pd-BaSO_4$ ). This is known as the **Rosenmund reaction**. This matches with List-II (IV).
2. Reaction (B): The conversion of a nitrile to an aldehyde using  $SnCl_2$  and  $HCl$  followed by hydrolysis is the characteristic of the **Stephen reaction**. This matches with List-II (III).
3. Reaction (C): Oxidation of a methyl group to an aldehyde using  $CrO_2Cl_2$  (chromyl chloride) is known as the **Etard reaction**. This matches with List-II (II).
4. Reaction (D): Formation of benzaldehyde ( $C_6H_5CHO$ ) from benzene in the presence of  $CO$ ,  $HCl$ , and anhydrous  $AlCl_3$  is an example of the **Gattermann Koch reaction**. This matches with List-II (I).

Thus, the correct match is:

- A (IV): Rosenmund reaction
- B (III): Stephen reaction
- C (II): Etard reaction
- D (I): Gattermann Koch reaction

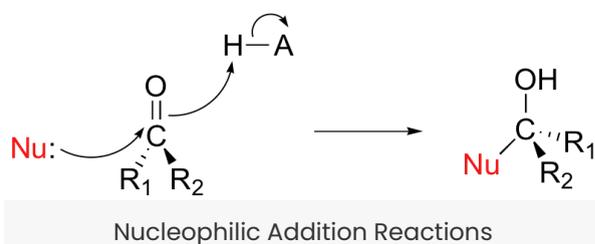
Therefore, the correct answer is: **A(IV), B(III), C(II), D(I)**

## Concepts:

### 1. Aldehydes, Ketones and Carboxylic Acids – Chemical Reactions:

#### Chemical Reactions of Aldehydes and Ketones:

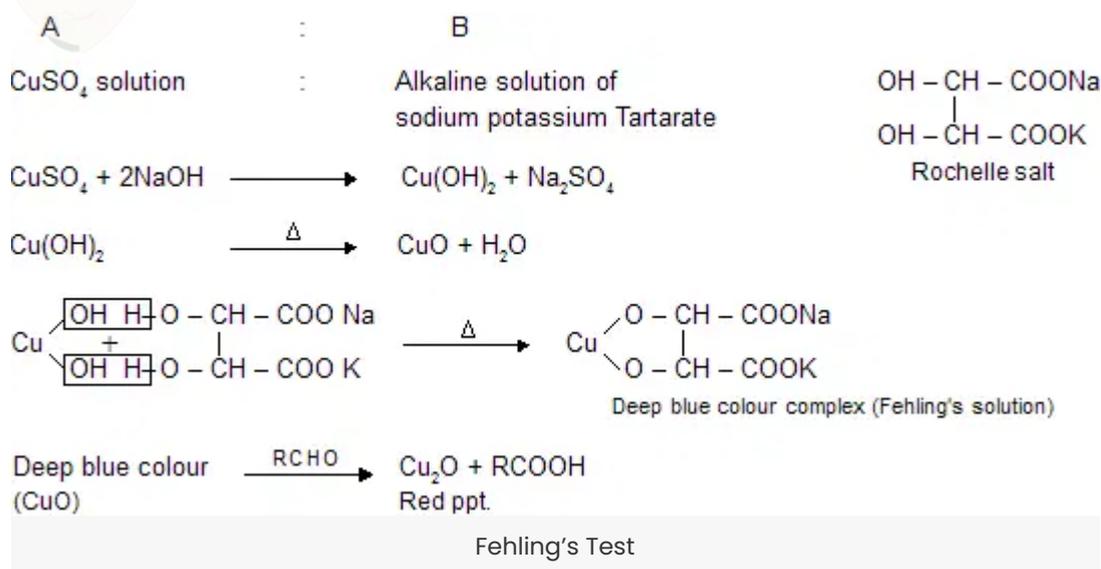
- Nucleophilic addition reactions



- Tollens' test



- Fehling's test



- Aldol condensation



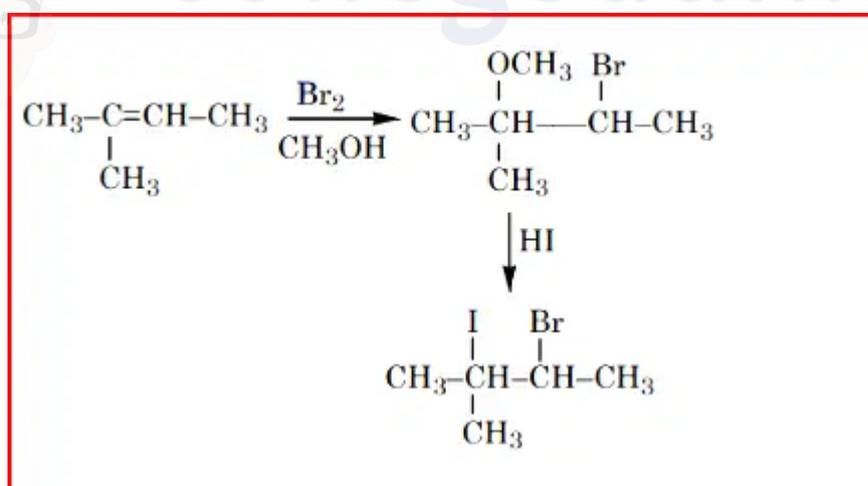


1. The initial compound is an alkene, which is treated with  $Br_2$  in methanol ( $CH_3OH$ ). This is a halogenation reaction in which the alkene reacts with bromine to form a vicinal dihalide.
2. Methanol acts as a nucleophile here and attacks the more substituted carbon, leading to the formation of a bromomethoxy compound.
3. The second step involves the treatment of this bromomethoxy compound with hydrogen iodide ( $HI$ ).
4.  $HI$  is a strong acid and also provides the iodide nucleophile. It reacts with the bromomethoxy compound to replace the methoxy group with an iodide, primarily through an  $S_N2$  mechanism.
5. Thus, the major product 'B' formed will have iodine attached in place of the methoxy group.

Considering these steps, the major product 'B' is an iodo-alkane. Below is the correct option representing the major product:

This represents the structure of 'B' correctly as the iodo-alkane formed after the reaction steps described above.

The correct answer is (B)

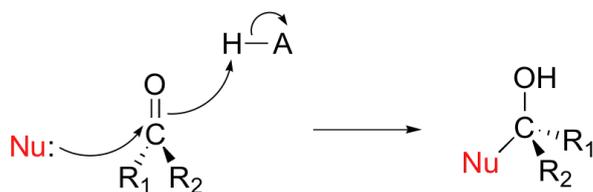


## Concepts:

### 1. Aldehydes, Ketones and Carboxylic Acids – Chemical Reactions:

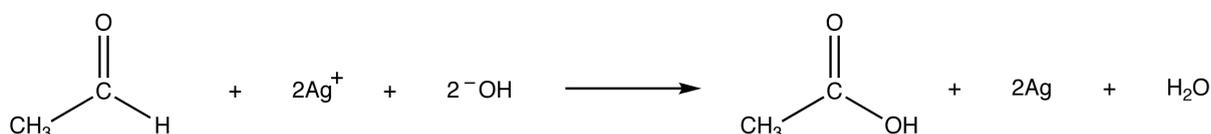
#### Chemical Reactions of Aldehydes and Ketones:

- [Nucleophilic addition reactions](#)



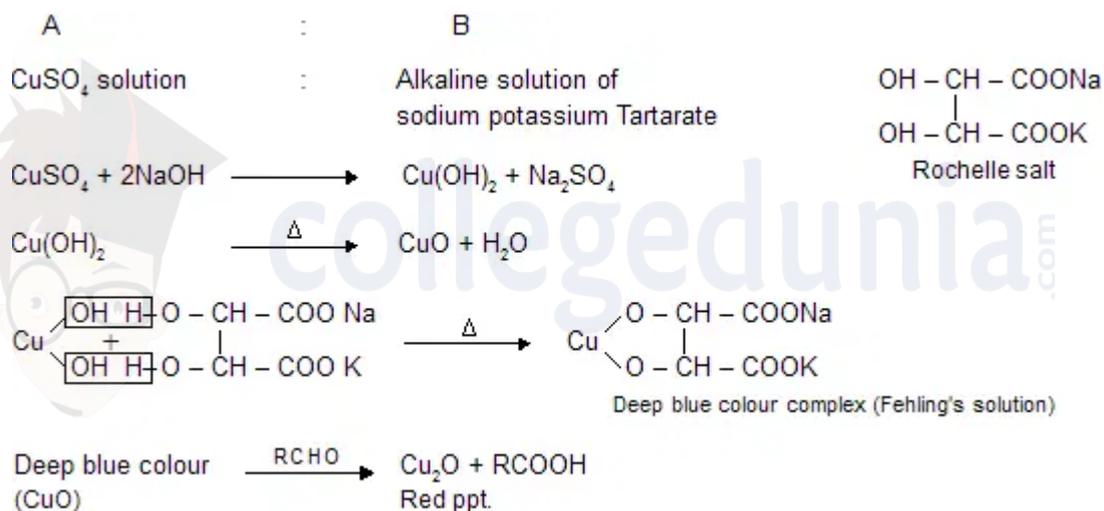
Nucleophilic Addition Reactions

- Tollens' test**



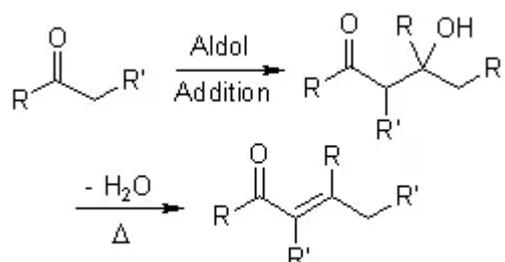
Tollens' Test

- Fehling's test**



Fehling's Test

- Aldol condensation**

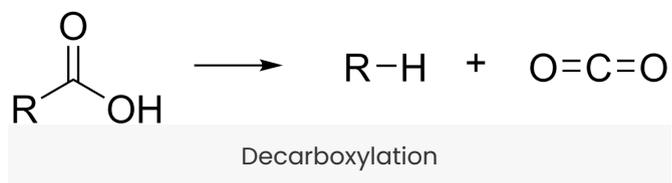


Aldol Condensation

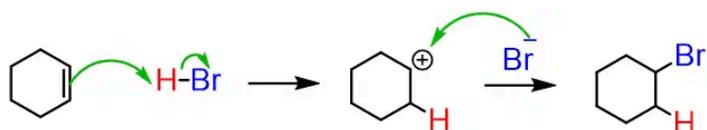
- Cross aldol condensation**



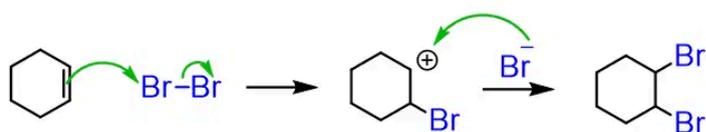
- [Decarboxylation](#)



- [Halogenation](#)



The mechanism of alkene hydrohalogenation



A possible mechanism of alkene halogenation

Halogenation

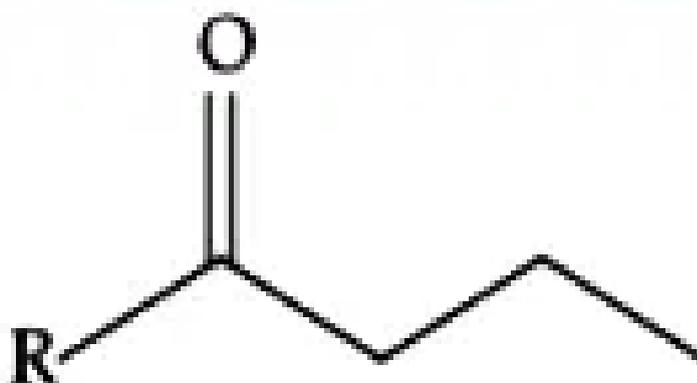
Read More: [Chemistry Named Reactions](#)

8. Answer: c

Explanation:

The correct answer is (C):

(C)









## 1. Aldehydes, Ketones, and Carboxylic Acids:

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### Aldehydes:

Aldehydes are organic compounds that have the functional group  $\text{-CHO}$ .

#### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

### Ketones:

Ketones are organic compounds that have the functional group  $\text{C=O}$  and the structure  $\text{R-(C=O)-R'}$ .

#### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

### Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $\text{(C=O)OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

#### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

---

10. Answer: b

Explanation:

The correct option is (B) :  $\text{CHCl}_3$ ,  $\text{NaOH}$

## Concepts:

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#### Aldehydes:

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##### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

#### Ketones:

Ketones are organic compounds that have the functional group  $\text{C}=\text{O}$  and the structure  $\text{R}-(\text{C}=\text{O})-\text{R}'$ .

##### Preparation of Ketones

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#### Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $(\text{C}=\text{O})\text{OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

##### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

---

## 11. Answer: c

### Explanation:

To determine which sugar does not give a reddish-brown precipitate with Fehling's reagent, we need to understand the chemistry behind Fehling's test.

Fehling's solution is used to test for reducing sugars. It is an alkaline solution containing copper(II) sulfate. When a reducing sugar is present, it reduces the copper(II) ions to copper(I) oxide, which precipitates as a reddish-brown solid. Here's the reaction:



Now, let's consider each option:

1. **Lactose** - It is a reducing sugar because it has a free anomeric carbon, allowing it to reduce Fehling's solution, producing a reddish-brown precipitate.
2. **Maltose** - Similarly, maltose is also a reducing sugar due to its free anomeric carbon, and it gives a reddish-brown precipitate with Fehling's reagent.
3. **Glucose** - Glucose is a reducing sugar known for its ability to give a positive Fehling's test.
4. **Sucrose** - This is a non-reducing sugar because the glycosidic bond in sucrose involves the anomeric carbon of both glucose and fructose, leaving no free anomeric carbon to act as a reducing agent. Therefore, sucrose does not reduce Fehling's solution and does not produce a reddish-brown precipitate.

Hence, the sugar which does not give a reddish-brown precipitate with Fehling's reagent is: **Sucrose**

### Concepts:

#### 1. Aldehydes, Ketones, and Carboxylic Acids:

**Aldehydes, Ketones, and Carboxylic Acids** are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

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### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

## Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $\text{(C=O)OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

---

## 12. Answer: c

### Explanation:

The correct answer is (C) :

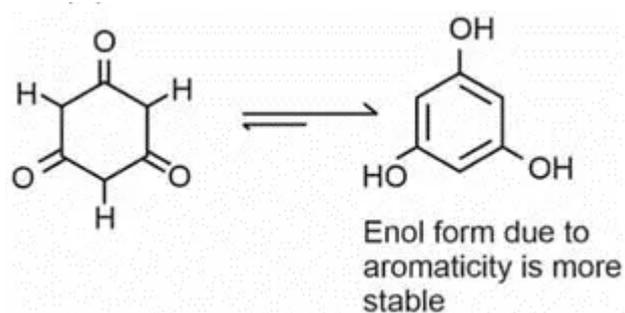
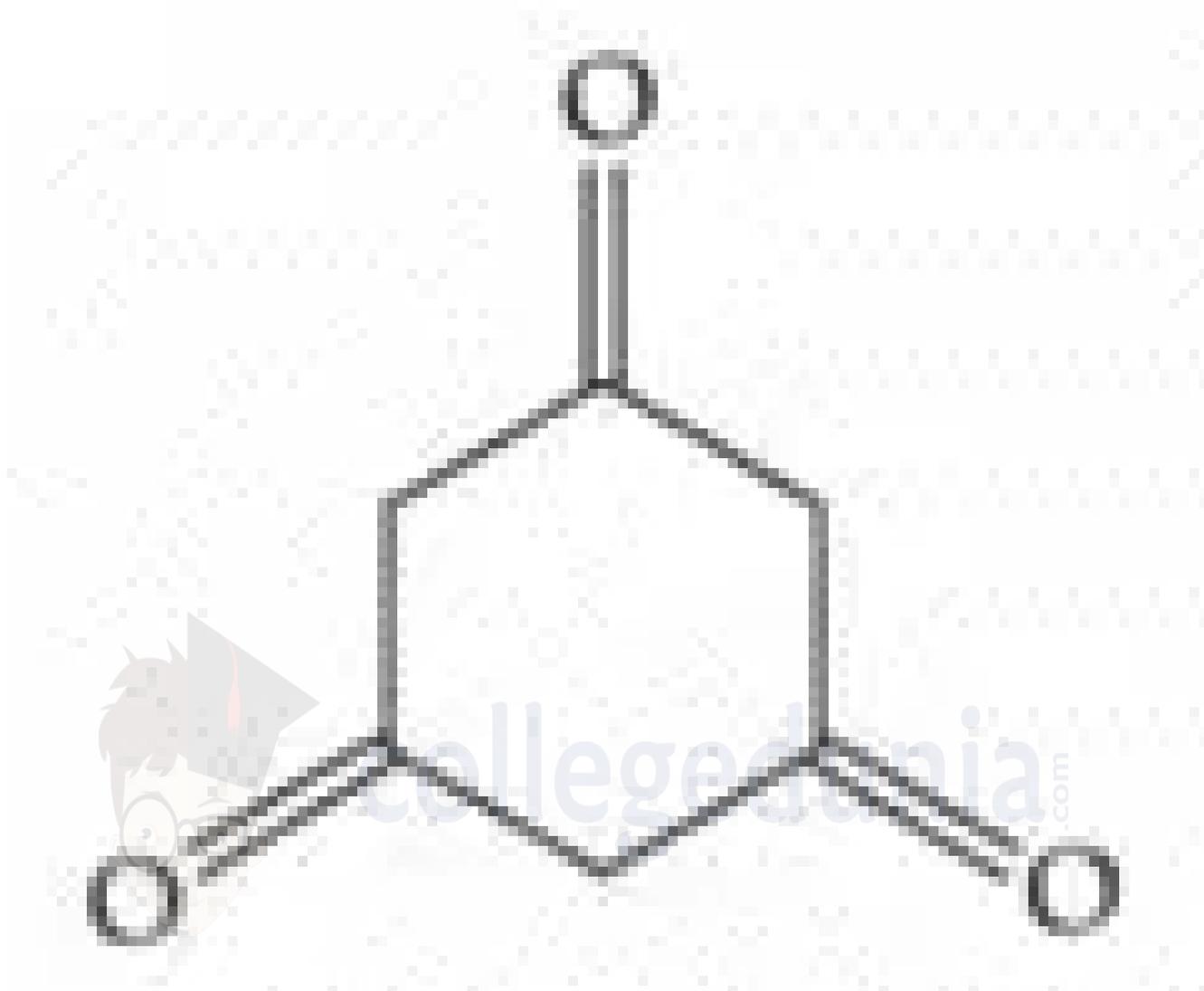


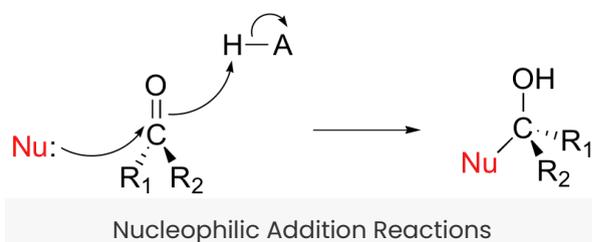
Fig.

## Concepts:

### 1. Aldehydes, Ketones and Carboxylic Acids – Chemical Reactions:

#### Chemical Reactions of Aldehydes and Ketones:

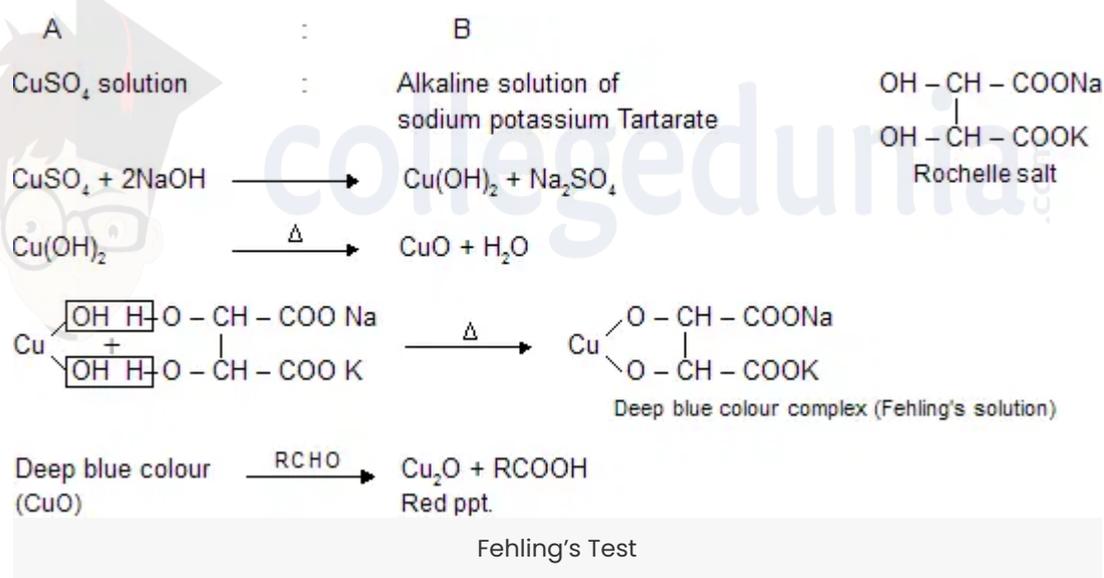
- Nucleophilic addition reactions



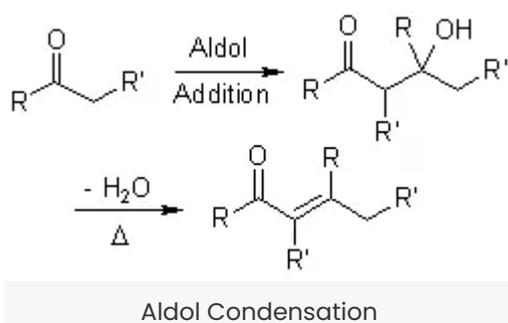
- Tollens' test



- Fehling's test



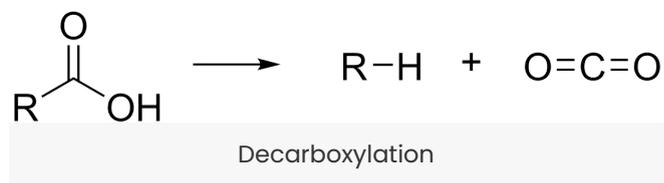
- Aldol condensation



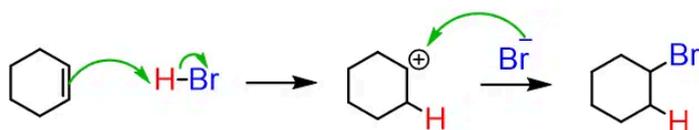
- Cross aldol condensation



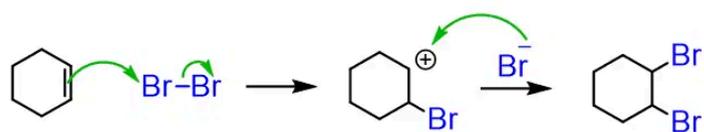
- [Decarboxylation](#)



- [Halogenation](#)



The mechanism of alkene hydrohalogenation



A possible mechanism of alkene halogenation

Halogenation

Read More: [Chemistry Named Reactions](#)

13. Answer: a

Explanation:

The correct answer is (A) :

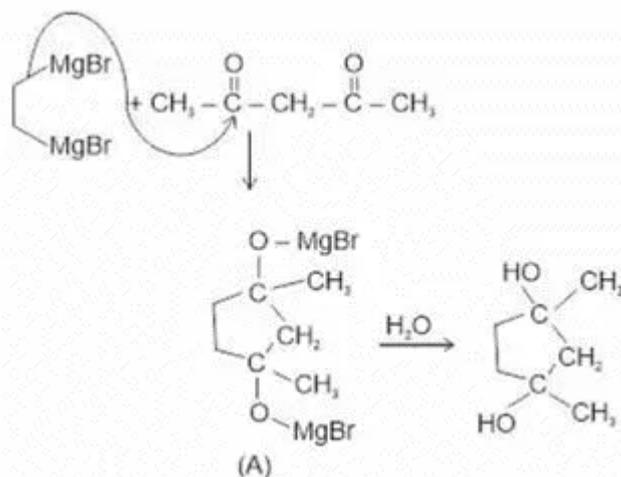
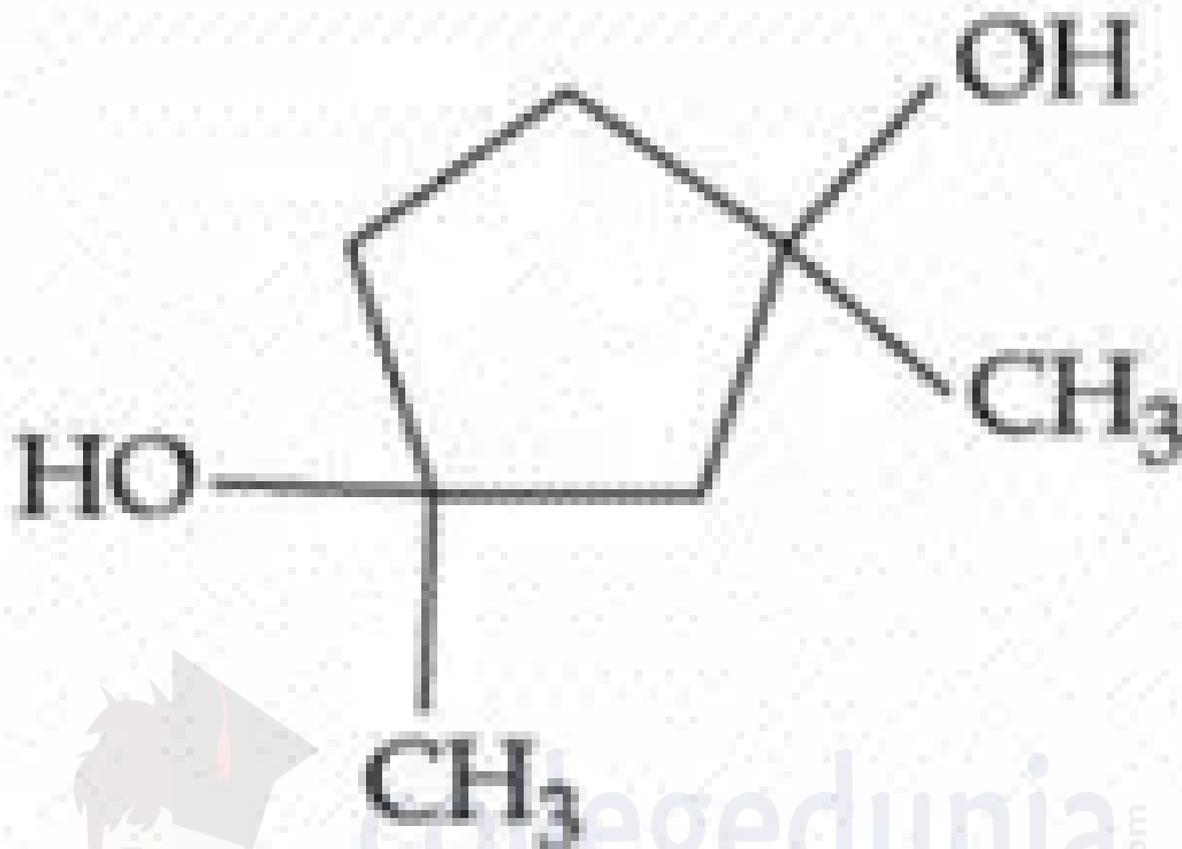


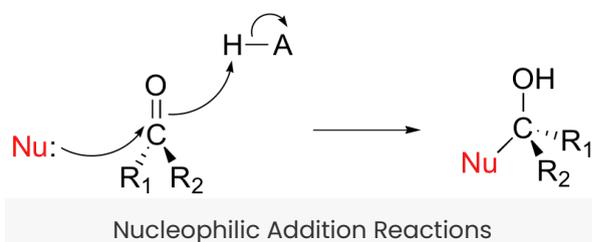
Fig.

## Concepts:

### 1. Aldehydes, Ketones and Carboxylic Acids – Chemical Reactions:

#### Chemical Reactions of Aldehydes and Ketones:

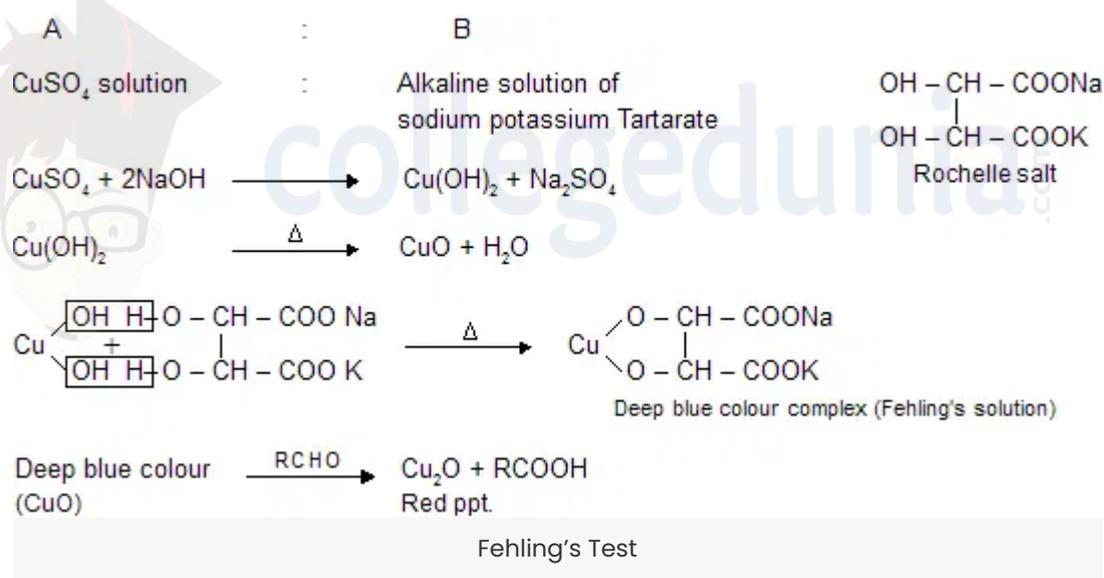
- Nucleophilic addition reactions



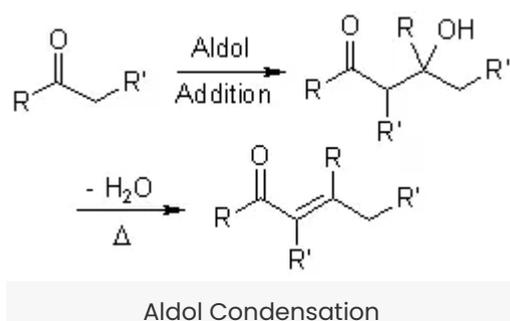
- Tollens' test



- Fehling's test



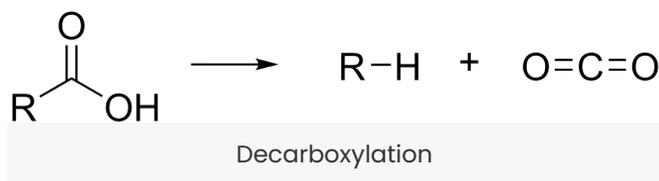
- Aldol condensation



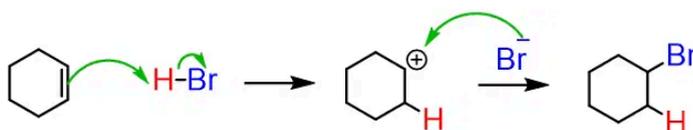
- Cross aldol condensation



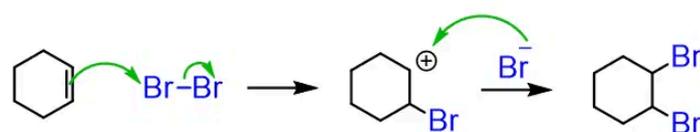
- [Decarboxylation](#)



- [Halogenation](#)



The mechanism of alkene hydrohalogenation



A possible mechanism of alkene halogenation

Halogenation

Read More: [Chemistry Named Reactions](#)

#### 14. Answer: a

#### Explanation:

To determine the second homologue in the homologous series of monocarboxylic acids, it's essential to understand the general formula for monocarboxylic acids. The general formula for a monocarboxylic acid is  $C_nH_{2n+1}COOH$  where  $n$  is a positive integer.

Monocarboxylic acids, also known as aliphatic carboxylic acids, consist of a carboxyl group ( $COOH$ ) attached to an alkyl chain. The series starts with formic acid ( $HCOOH$ ) where  $n = 0$ .

To find the second homologue:

1. Formic acid (first compound in this series):  $HCOOH$  (equivalently written as  $CH_2O_2$ ) corresponds to  $n = 0$ .

2. Acetic acid (second compound in the series), substituting  $n = 1$  in the formula:  
 $C_1H_{2(1)+1}COOH = C_2H_4O_2$ .

Thus, the correct molecular formula of the second homologue in the homologous series of monocarboxylic acids is  $C_2H_4O_2$ .

**Correction:** The initial provided correct answer seems to have been misunderstood as  $C_2H_2O_2$ . Upon re-evaluation, using the formula explained above,  $C_2H_4O_2$  is indeed the correct formula for acetic acid, the second homologue.

- **Option 1** ( $C_2H_2O_2$ ) does not fit the general formula for monocarboxylic acids.
- **Option 2** ( $CH_2O$ ) lacks the carboxyl group.
- **Option 3** ( $C_2H_4O_2$ ) is the correct molecular formula for acetic acid.
- **Option 4** ( $C_3H_6O_2$ ) corresponds to propionic acid, the third homologue.

## Concepts:

### 1. Preparation – Aldehydes, Ketones and Carboxylic Acids:

[Aldehydes, ketones, and carboxylic acids](#) are organic compounds that can be prepared by a variety of methods.

#### Preparation of Aldehydes:

[Aldehydes can be prepared](#) by the oxidation of primary alcohols using mild oxidizing agents such as pyridinium chlorochromate (PCC) or by the ozonolysis of alkenes followed by reductive workup. Another method involves the dehydrogenation of alcohols in the presence of a dehydrogenating agent like pyridinium chlorochromate (PCC).

#### Preparation of Ketones:

Ketones can be prepared by the oxidation of secondary alcohols using oxidizing agents such as potassium permanganate ( $KMnO_4$ ), chromium trioxide ( $CrO_3$ ), or by the ozonolysis of alkenes followed by oxidative workup. Another method involves the Friedel-Crafts acylation of aromatic compounds.

#### Preparation of Carboxylic Acids:

Carboxylic acids can be prepared by the oxidation of primary alcohols or aldehydes using strong oxidizing agents such as potassium permanganate ( $KMnO_4$ ) or chromic acid ( $H_2CrO_4$ ). Another method involves the hydrolysis of nitriles, which

produces carboxylic acids and ammonia. Additionally, carboxylic acids can be prepared from Grignard reagents by reacting with carbon dioxide followed by acidic hydrolysis.

In summary, aldehydes, ketones, and carboxylic acids can be prepared by various methods, including oxidation, ozonolysis, and hydrolysis. Understanding the preparation methods of these compounds is important for predicting their behavior and understanding their potential applications in various fields, including chemistry, biology, and industry.

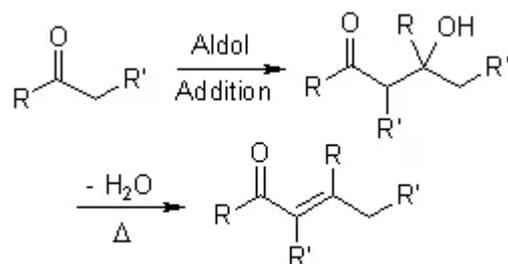
## 15. Answer: d

### Explanation:

To determine the acidity order of the  $-OH$  group in the given compounds, we need to understand the effect of substituents on the phenol ring.

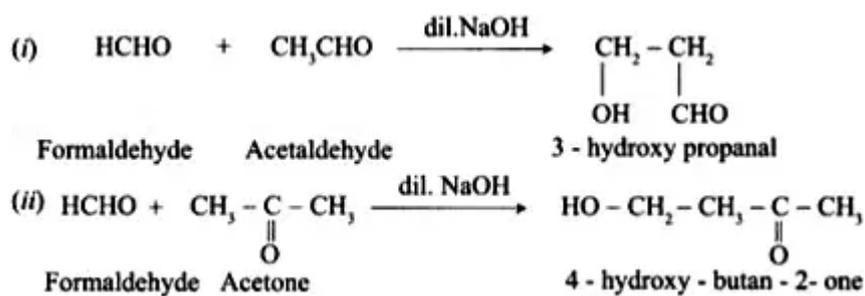
- 1. Phenol Acidity:** Phenols are acidic because they can donate a hydrogen ion (proton) from the hydroxyl group, resulting in a phenoxide ion. The stability of the phenoxide ion determines the acidity of phenols.
- 2. Effect of Substituents:**
  - *Electron-withdrawing groups* (EWG) like  $-NO_2$  increase acidity by stabilizing the negative charge on the phenoxide ion through resonance or induction.
  - *Electron-donating groups* (EDG) like  $-OCH_3$  decrease acidity by destabilizing the phenoxide ion.
- 3. Analysis of Each Compound:**
  - **(A) Bu - OH:** A simple butanol with no resonance stabilizing effects, therefore, least acidic.
  - **(B)  $p - NO_2 - C_6H_4 - OH$ :** Contains a strong electron-withdrawing  $-NO_2$  group, significantly increasing acidity.
  - **(C)  $p - OCH_3 - C_6H_4 - OH$ :** Contains an electron-donating  $-OCH_3$  group, decreasing acidity.
  - **(D) Phenol:** Standard reference for acidic strength in phenols.
  - **(E)  $2,4 - NO_2 - C_6H_3 - OH$ :** The presence of two  $-NO_2$  groups greatly enhances the acidity due to strong electron-withdrawing effects.
- 4. Conclusion:** Based on the effects explained above, the correct order of acidity is:





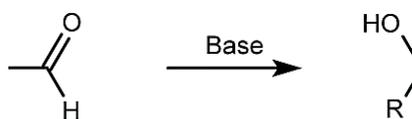
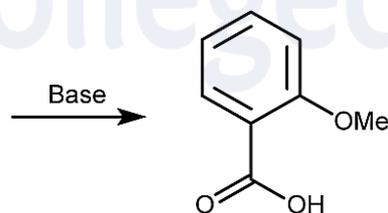
Aldol Condensation

- Cross aldol condensation



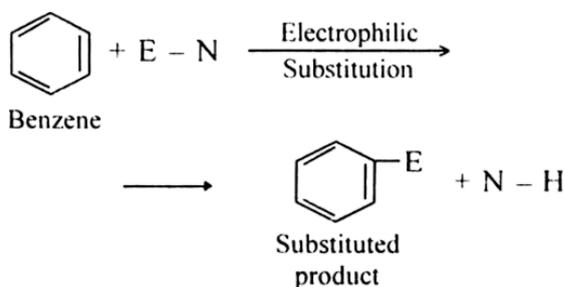
Cross Aldol Condensation

- [Cannizzaro Reaction](#)



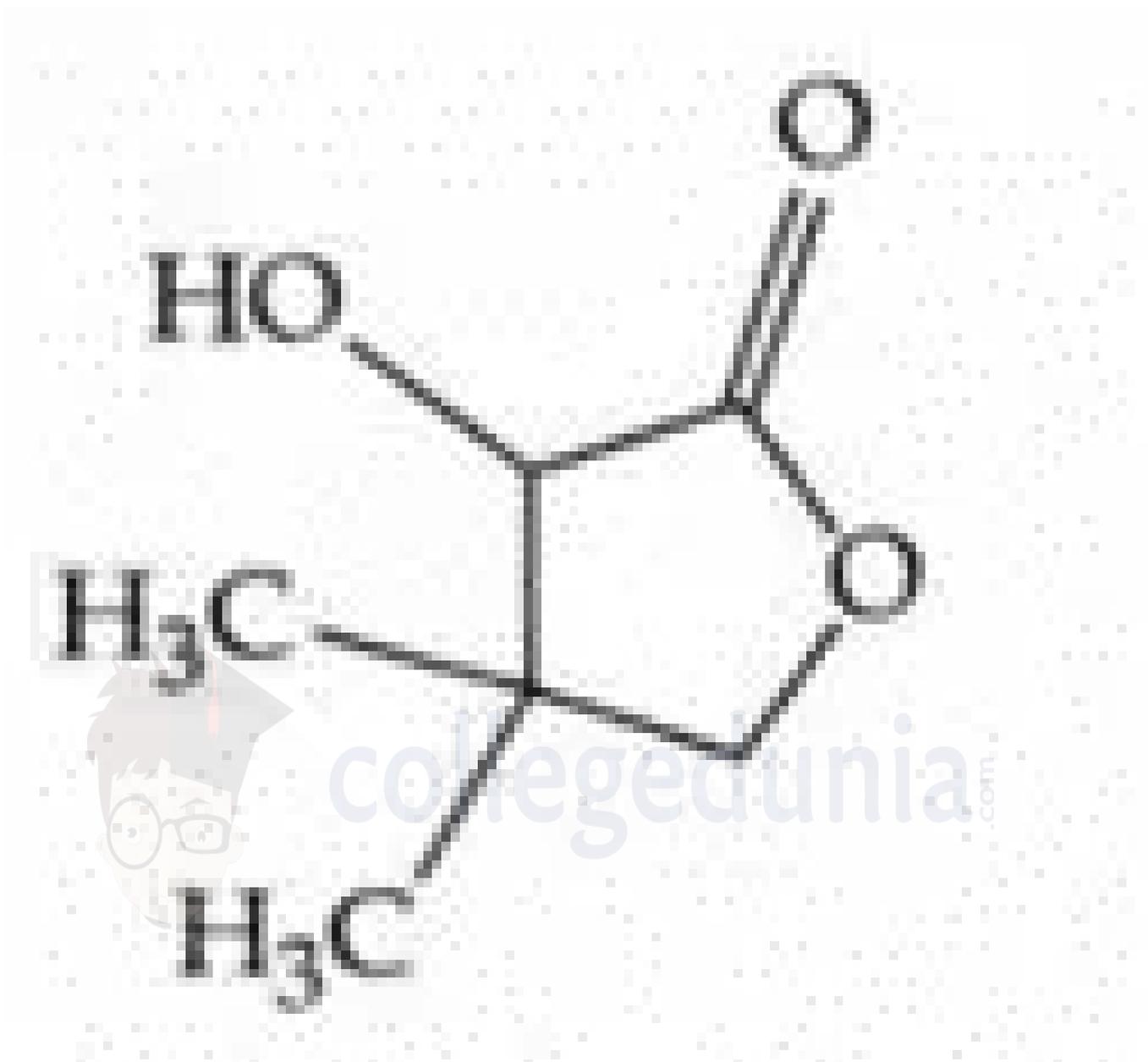
Cannizzaro Reaction

- [Electrophilic Substitution Reaction](#)



Electrophilic Substitution Reaction





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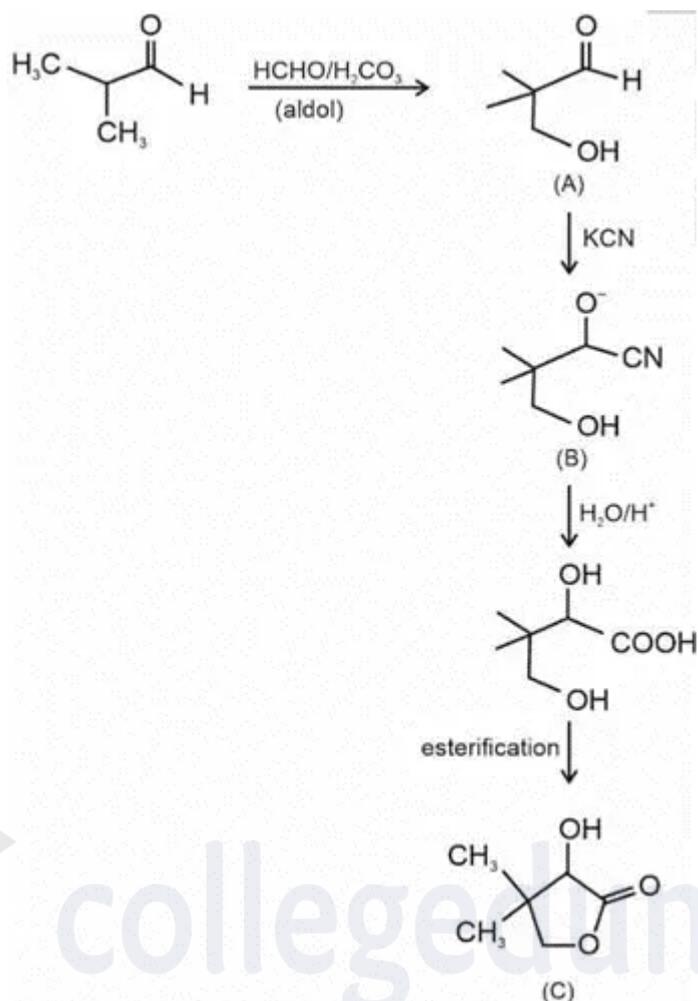


Fig.

## Concepts:

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Aldehydes, Ketones, and Carboxylic Acids are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

### Aldehydes:

Aldehydes are organic compounds that have the functional group -CHO.

#### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

## Ketones:

Ketones are organic compounds that have the functional group  $C=O$  and the structure  $R-(C=O)-R'$ .

### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

## Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $(C=O)OH$  group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

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## 17. Answer: d

### Explanation:

Melting point of product (C) =  $142^{\circ}C$

Hence, the correct option is (D):  $142^{\circ}C$

### Concepts:

#### 1. Uses of Carboxylic Acids:

**Carboxylic acid** makes up a series of fatty acids that is essential for human health. Some carboxylic acids such as omega-6 and omega-3 are not produced in the human body. This carboxylic acid helps in maintaining the cell membrane and control nutrient use along with metabolism. It is essential to consume those foods which have fatty acids.

- In food industries, organic acids are used to produce vinegar, sodium salts and other soft drinks and sodium benzoate is used to preserve foods.
- In chemical industries, Acetic is used to produce dye-stuff, perfumes and rayon's etc.
- In rubber making industry, Acetic acids are used to manufacture the rubber
- To manufacture the soaps and detergents carboxylic acids such as stearic acids are the most important acid
- Hexanedioic acid is used during manufacturing of nylon in nylon industries
- Esters of benzoic acids are used to make perfume, body mist, etc.
- In drug-making industries, acetylsalicylic acid is used to produce aspirin, phenacetin, etc.

Read More: [Uses of Carboxylic Acids](#)

18. Answer: c

Explanation:

The correct answer is (C) : MnO  
Benzoic acid can be converted to benzaldehyde in presence of MnO.

19. Answer: b

Explanation:

The correct answer is (B) :  $\text{CrO}_3$  / acetic anhydride,  $\text{H}_3\text{O}^+$

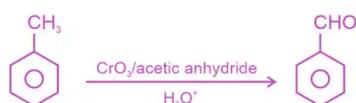


Fig. Chemical Reaction

Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids:

[Aldehydes, Ketones, and Carboxylic Acids](#) are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

## Aldehydes:

Aldehydes are organic compounds that have the functional group  $\text{-CHO}$ .

### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

## Ketones:

Ketones are organic compounds that have the functional group  $\text{C=O}$  and the structure  $\text{R-(C=O)-R'}$ .

### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

## Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $(\text{C=O})\text{OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

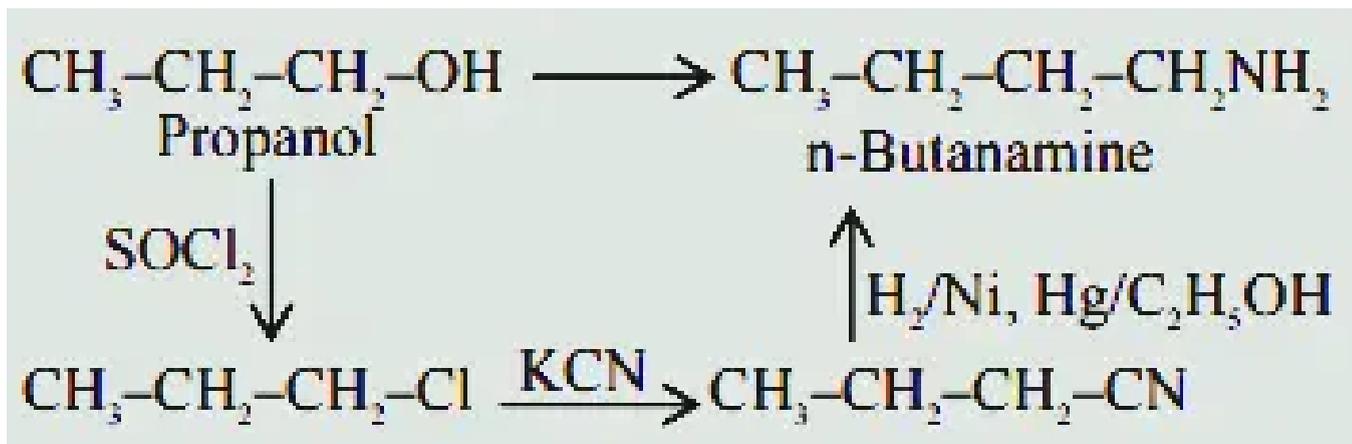
### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

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20. Answer: a

Explanation:



Hence, the correct option is (A): (i)  $\text{SOCl}_2$  (ii)  $\text{KCN}$  (iii)  $\text{H}_2/\text{Ni, Na(Hg)}/\text{C}_2\text{H}_5\text{OH}$

## Concepts:

### 1. Aldehydes, Ketones, and Carboxylic Acids:

**Aldehydes, Ketones, and Carboxylic Acids** are *carbonyl compounds that contain a carbon-oxygen double bond*. These organic compounds are very important in the field of organic chemistry and also have many industrial applications.

#### Aldehydes:

Aldehydes are organic compounds that have the functional group  $-\text{CHO}$ .

##### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

#### Ketones:

Ketones are organic compounds that have the functional group  $\text{C}=\text{O}$  and the structure  $\text{R}-(\text{C}=\text{O})-\text{R}'$ .

##### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

#### Carboxylic Acid:

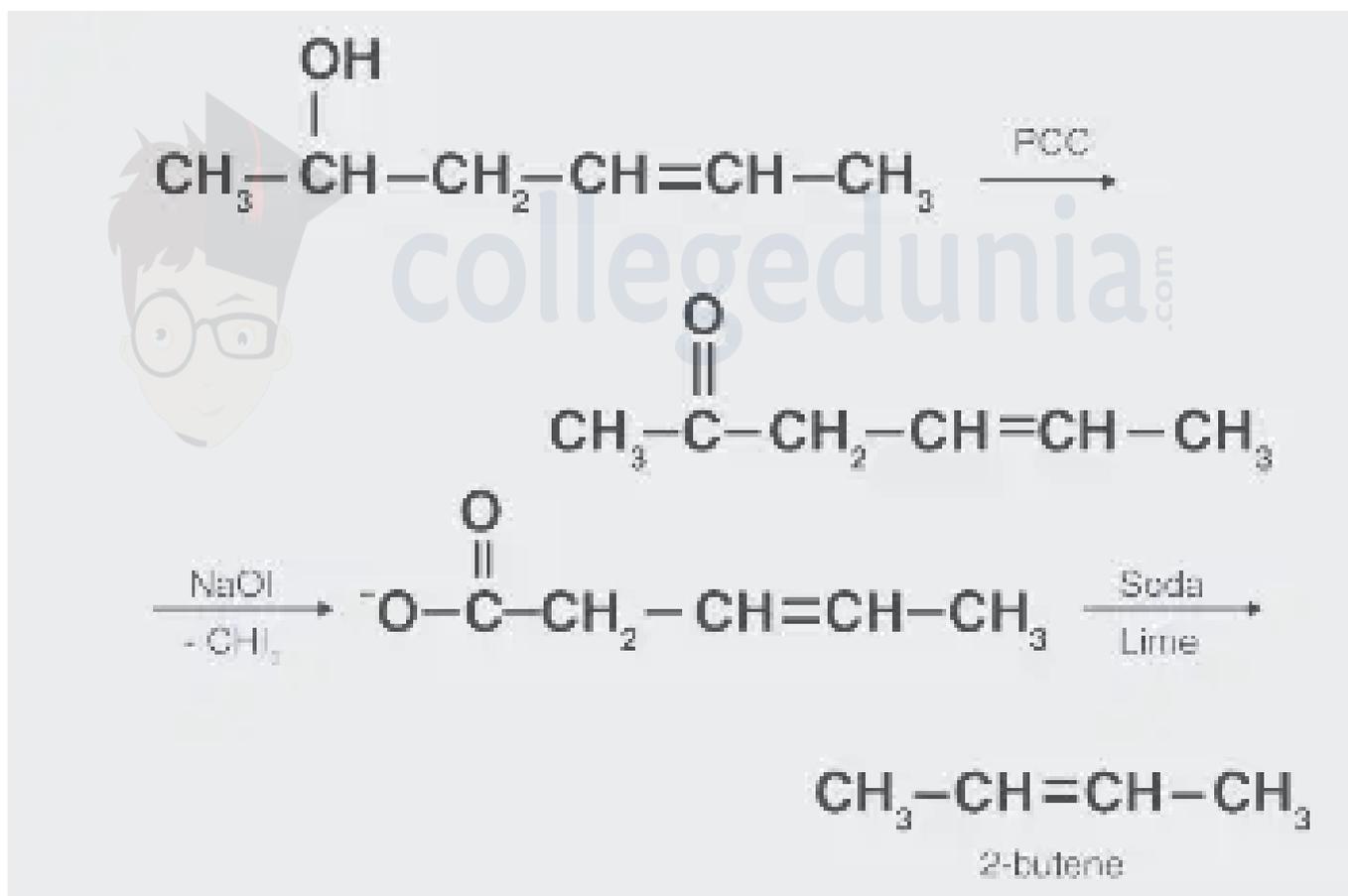
**Carboxylic acids** are organic compounds that contain a (C=O)OH group attached to an R group (where R refers to the remaining part of the molecule).

### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

21. Answer: c

Explanation:



Therefore, the correct option is (C): 2-butene

Concepts:

1. Aldehydes, Ketones, and Carboxylic Acids – Chemical Reaction:

A **Chemical reaction** is a process in which one or more substances, the reactants, are converted to one or more different substances, the products. Substances are either chemical **elements** or compounds. A chemical reaction rearranges the constituent atoms of the reactants to create different substances as products.

## Types of Chemical Reactions

### Nucleophilic Addition Reaction

A nucleophile forms a sigma bond with an electron of other species. These reactions help in the formation of several new organic chemicals.

**Nucleophilic Addition Reaction** is a type of Addition Reaction in which a nucleophile reacts with a  $\text{Pi}$ - bond of a compound and results in the formation of a new sigma bond. Nucleophilic Addition reactions are the most important reactions as it allows carbonyl compounds to form various new products with different functional groups.

### Reduction

The reaction used for the reduction of aldehydes or ketones to alkanes is known as **Clemmensen Reduction Reaction**. In a reduction reaction, there is a loss of oxygen atoms from the molecule or gain of electrons.

Clemmensen Reduction Reaction is immensely useful for aryl-alkyl ketones reduction, formed in Friedel Crafts acylation. Acyl Benzene is formed from acylation with the help of Friedel-Crafts acylation. Clemmensen reduction reaction is used for transformation of acyl benzene to alkylbenzene and likewise, reduction of other ketones or aldehydes.

### Oxidation

Aldehydes differ from ketones in their oxidation reactions. Aldehydes are easily oxidised to carboxylic acids on treatment with common oxidising agents like nitric acid, potassium permanganate, potassium dichromate, etc. Even mild oxidising agents, mainly Tollens' reagent and Fehlings' reagent also oxidise aldehydes.

### Reactions due to $\alpha$ -hydrogen

Acidity of  $\alpha$ -hydrogens of aldehydes and ketones: The aldehydes and ketones undergo a number of reactions due to the acidic nature of  $\alpha$ -hydrogen.

Aldehydes and ketones having at least one  $\alpha$ -hydrogen undergo a reaction in the presence of dilute alkali as catalyst to form  $\beta$ -hydroxy aldehydes (aldol) or  $\beta$ -hydroxy ketones (ketol), respectively. This is known as **Aldol reaction**. The aldol and ketol readily lose water to give  $\alpha,\beta$ -unsaturated carbonyl compounds which are aldol condensation products and the reaction is called Aldol condensation.

### Other reactions

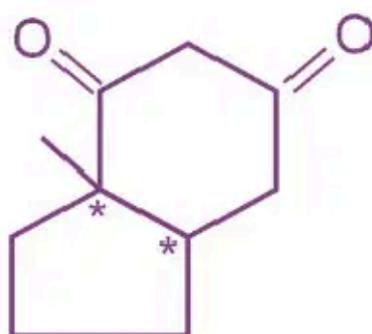
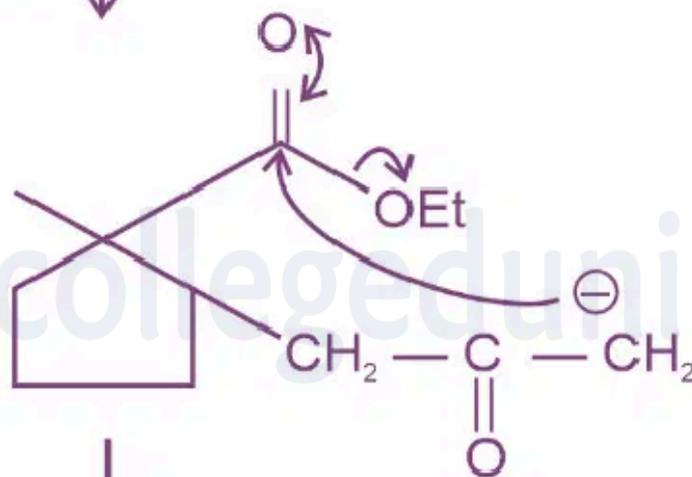
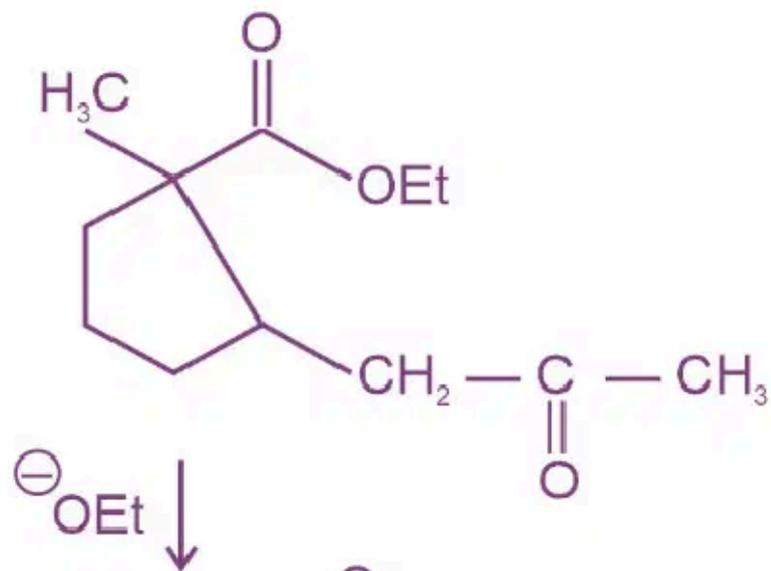
The **Cannizzaro reaction** can be referred to as a scientific process that requires a base-induced disproportionation of two molecules belonging to a non-enolizable aldehyde in order to produce a carboxyl group and a primary alcohol. The Cannizzaro reaction was named by an Italian chemist named Stanislao Cannizzaro

**Electrophilic substitution reaction:** Aromatic aldehydes and ketones undergo electrophilic substitution at the ring in which the carbonyl group acts as a deactivating and meta-directing group.

---

22. Answer: 2 – 2

Explanation:



(A)

Two chiral carbons are there in product A.

**Concepts:**

## 1. Aldehydes, Ketones, and Carboxylic Acids:

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### Aldehydes:

Aldehydes are organic compounds that have the functional group  $\text{-CHO}$ .

#### Preparation of Aldehydes

Acid chlorides are reduced to aldehydes with **hydrogen** in the presence of palladium catalyst spread on barium sulfate.

### Ketones:

Ketones are organic compounds that have the functional group  $\text{C=O}$  and the structure  $\text{R-(C=O)-R'}$ .

#### Preparation of Ketones

Acid chlorides on reaction with dialkyl cadmium produce ketones. Dialkyl cadmium themselves are prepared from Grignard reagents.

### Carboxylic Acid:

**Carboxylic acids** are organic compounds that contain a  $(\text{C=O})\text{OH}$  group attached to an R group (where R refers to the remaining part of the molecule).

#### Preparation of Carboxylic Acids

Primary alcohols are readily oxidized to carboxylic acids with common oxidizing agents such as potassium permanganate in neutral acidic or alkaline media or by potassium dichromate and chromium trioxide in acidic media.

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23. Answer: c

Explanation:

Therefore, the correct option is (C): Statement I is correct but Statement II is incorrect.

## Concepts:

### 1. Aldehydes, Ketones, and Carboxylic Acids – Physical Properties:

The following are the [Physical Properties of Aldehydes, Ketones, and Carboxylic Acids](#):

The physical properties of aldehydes and ketones are stated below:

#### Physical State:

While Ethanal is a volatile liquid, Methanal is a gas at room temperature. Similarly, other aldehydes and ketones are either gas or liquid at room temperature.

Boiling point: The boiling point of methanal is  $-19^{\circ}\text{C}$  and for ethanal it is  $+21^{\circ}\text{C}$ . From this we can say that the boiling point of ethanal is close to room temperature. Generally the boiling point of aldehydes and ketones increases with increase in molecular weight. Boiling point depends upon the strength of the intermolecular forces.

- **Vander Waals Dispersion Force:** The boiling point of aldehydes and ketones depend on the carbon atoms. When the molecules lengthen and the number of electrons increases, the bond increases and the boiling point increases.
- **Van Der Waals dipole-dipole attraction:** Due to the presence of the double bond between carbon and oxygen, aldehydes and ketones are polar to each other. This leads to an attraction between the permanent dipoles and other molecules near it. This is what makes the boiling point of these compounds high.

#### Solubility:

Aldehydes and ketones are soluble in water. The solubility decreases when the length of the alkyl chain increases. Aldehydes and ketones like methanol, ethanal and propanone are miscible in water of all quantities. These compounds cannot form hydrogen bonds on their own but are able to do so with water due to the dipole-dipole attraction.

#### Smell:

All lower aldehydes have a strong and unpleasant smell. Other aldehydes and ketones have a pleasant smell. When the molecule size of the compounds increases, the smell becomes less pungent. Naturally occurring aldehydes and ketones are used regularly in flavouring agents and perfumes like vanilla flavoring.

The physical properties of carboxylic acids are stated below:

**Physical state:**

Carboxylic acids, at room temperature, are colourless liquids. These acids have nine carbon atoms or less. Higher acids are more waxy and are solid.

**Boiling Point:**

Compared to aldehydes, ketones and other compounds of similar molecular masses, carboxylic acids have high boiling points. The reason behind such high boiling points is for the acid molecules ability to substantially associate with each other through intermolecular hydrogen bonding. The hydrogen bonds do not break up completely even in the vapour state as a result. Most carboxylic acids are present as dimers in the vapour state.

**Smell:**

At room temperature, carboxylic acids have shown to possess unpleasant odours.

**Solubility:**

The more simple aliphatic components of carboxylic acids have four carbon atoms and are miscible or soluble in water. This is due to its ability to form hydrogen bonds with water. When the number of atoms in the carboxylic acids is increased, the solubility nature decreases. For higher members of the same group, the immiscibility nature can be attributed to its hydrophobic communication of the hydrocarbon part of the acid. However, they are able to become soluble in organic solvents that are less polar like alcohol, benzene, ether etc.

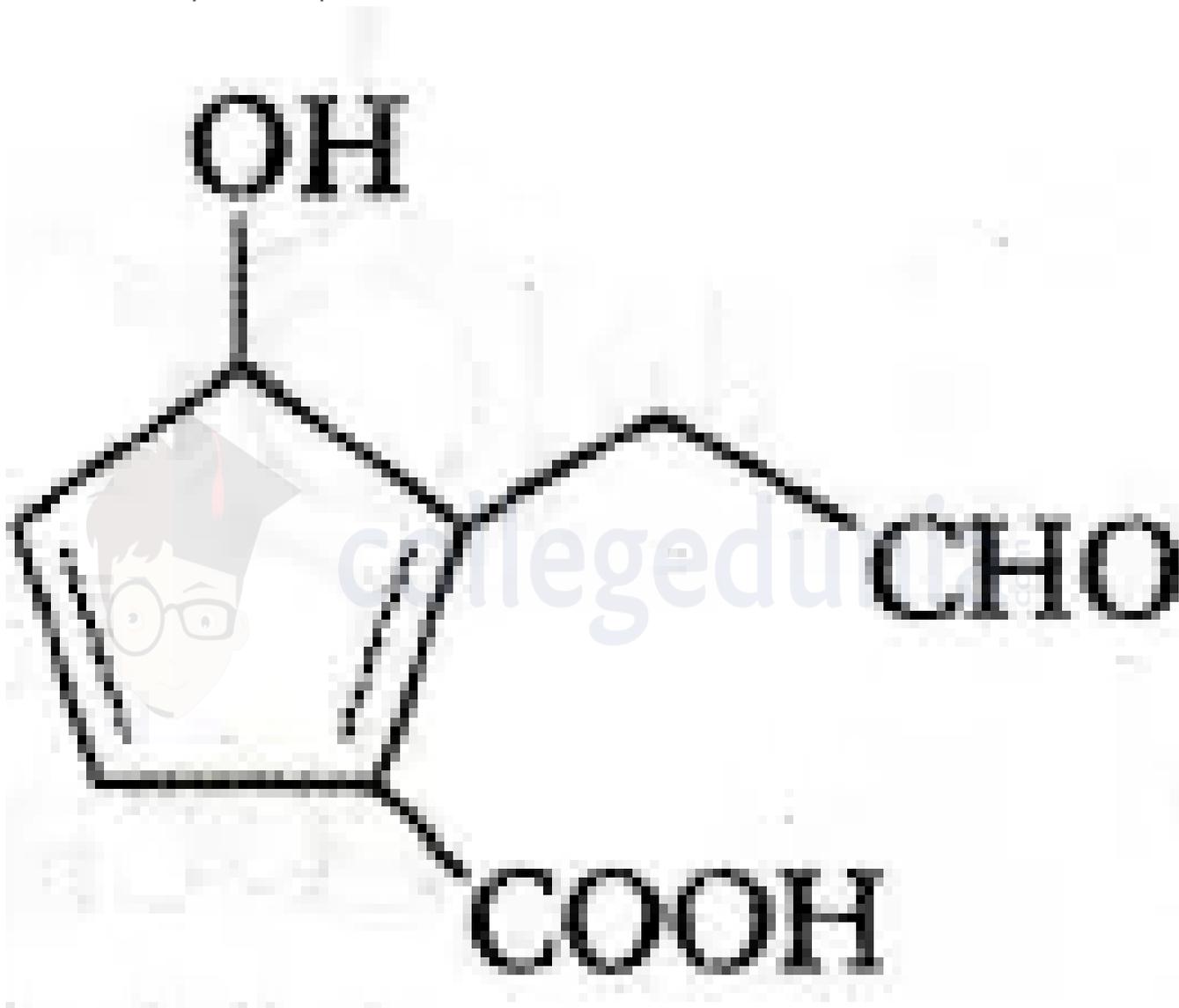
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**24. Answer: a**

**Explanation:**

In the given reaction, DIBAL-H will act as a strong reducing agent. It is used for the conversion of lactones into functional groups like aldehyde and alcohols. The reduction of lactones with DIBAL-H gives mainly aldehydes. For this the hydride ion from DIBAL-H is transferred to the function group of lactone.

The correct option is option (a):



## Concepts:

### 1. Preparation – Aldehydes, Ketones and Carboxylic Acids:

[Aldehydes, ketones, and carboxylic acids](#) are organic compounds that can be prepared by a variety of methods.

Preparation of Aldehydes:

[Aldehydes can be prepared](#) by the oxidation of primary alcohols using mild oxidizing agents such as pyridinium chlorochromate (PCC) or by the ozonolysis of alkenes followed by reductive workup. Another method involves the dehydrogenation of alcohols in the presence of a dehydrogenating agent like pyridinium chlorochromate (PCC).

#### **Preparation of Ketones:**

Ketones can be prepared by the oxidation of secondary alcohols using oxidizing agents such as potassium permanganate ( $\text{KMnO}_4$ ), chromium trioxide ( $\text{CrO}_3$ ), or by the ozonolysis of alkenes followed by oxidative workup. Another method involves the Friedel-Crafts acylation of aromatic compounds.

#### **Preparation of Carboxylic Acids:**

Carboxylic acids can be prepared by the oxidation of primary alcohols or aldehydes using strong oxidizing agents such as potassium permanganate ( $\text{KMnO}_4$ ) or chromic acid ( $\text{H}_2\text{CrO}_4$ ). Another method involves the hydrolysis of nitriles, which produces carboxylic acids and ammonia. Additionally, carboxylic acids can be prepared from Grignard reagents by reacting with carbon dioxide followed by acidic hydrolysis.

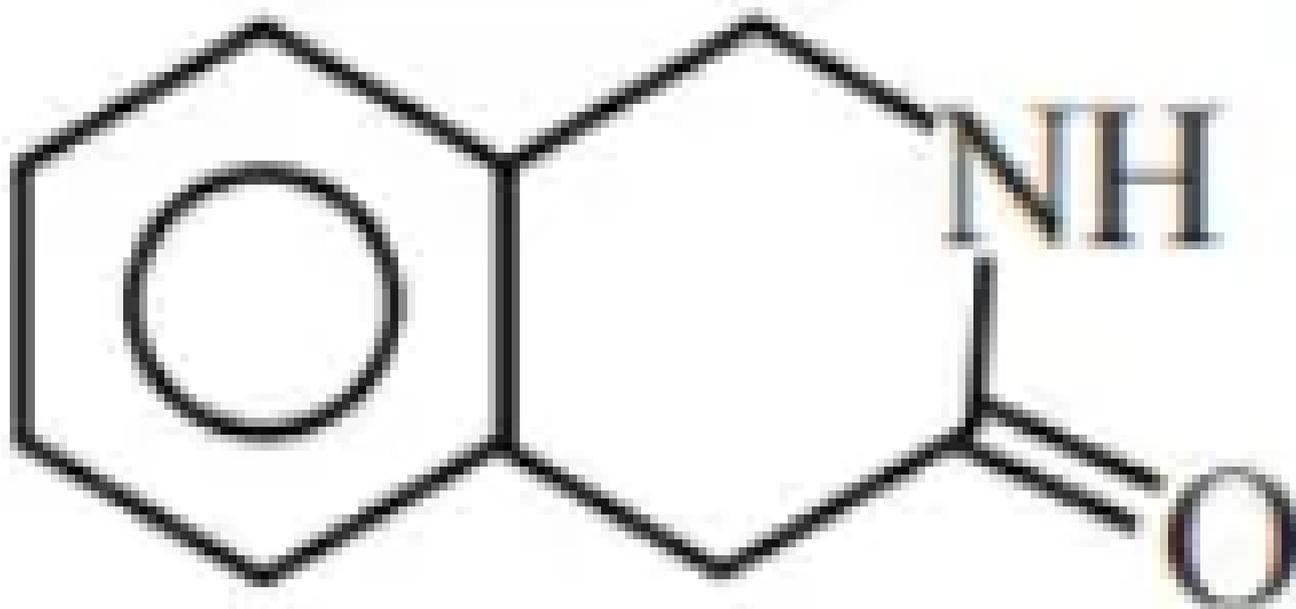
In summary, aldehydes, ketones, and carboxylic acids can be prepared by various methods, including oxidation, ozonolysis, and hydrolysis. Understanding the preparation methods of these compounds is important for predicting their behavior and understanding their potential applications in various fields, including chemistry, biology, and industry.

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#### **25. Answer: b**

#### **Explanation:**

The correct answer is option (B):



## Concepts:

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