

**Solutions to HWS-2
Home Worksheet-3**

Class-2-OCOC-II

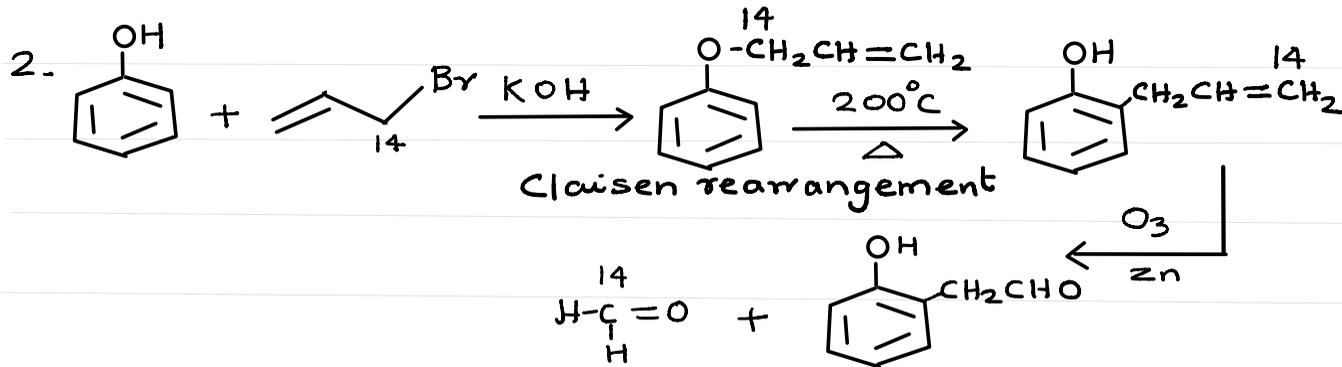
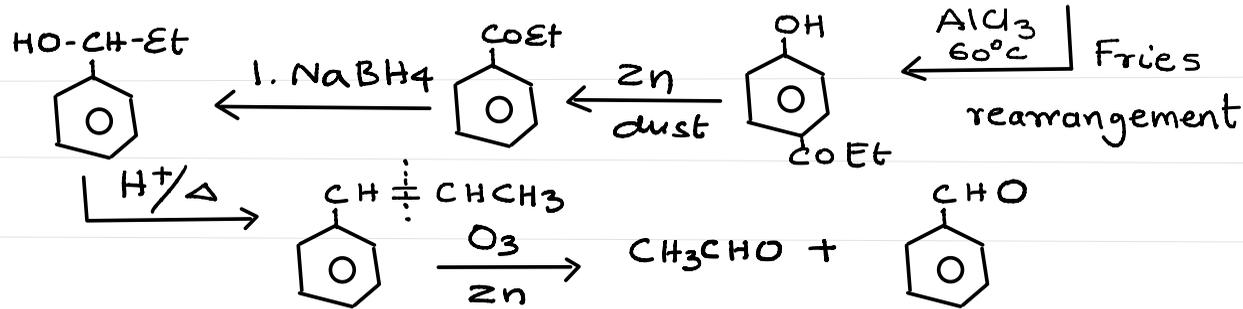
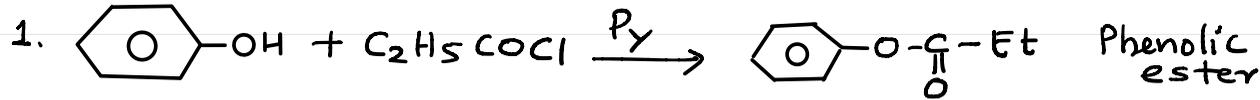
Reactions of Aldehydes & Ketones

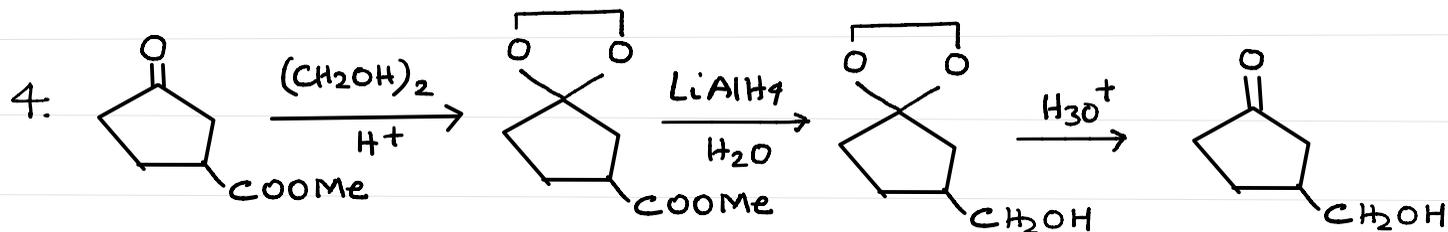
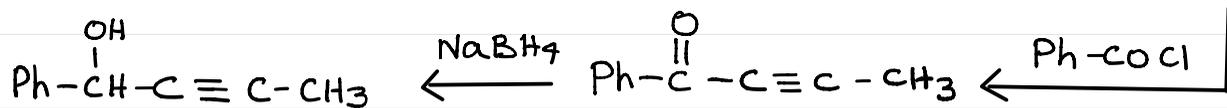
I. Typical (Direct) Nucleophilic Addition :

1. Of Hydride ion (H^-) : LiAlH_4 / ether or NaBH_4 / H_2O
2. Of Alkynide ion ($\text{R}-\text{C}\equiv\text{C}^--\text{Na}^+$)
3. Of $\text{H}_2\text{O}/\text{H}^+$ (Hydration)
4. (a) Of ROH/H^+ (b) Of Glycols (c) Of 1,3 Diols
5. Of HCN/KOH
6. Of NaHSO_3 (Bisulphate addition)
7. Of Grignard Reagent
8. Of Ylides (Wittig Reaction)
9. Of Ammonia & its derivatives
 - (a) of ammonia
 - (b) of Amines (RNH_2 & RNHR)
 - (c) of special derivatives (NH_2Y)
 - (d) Reductive amination

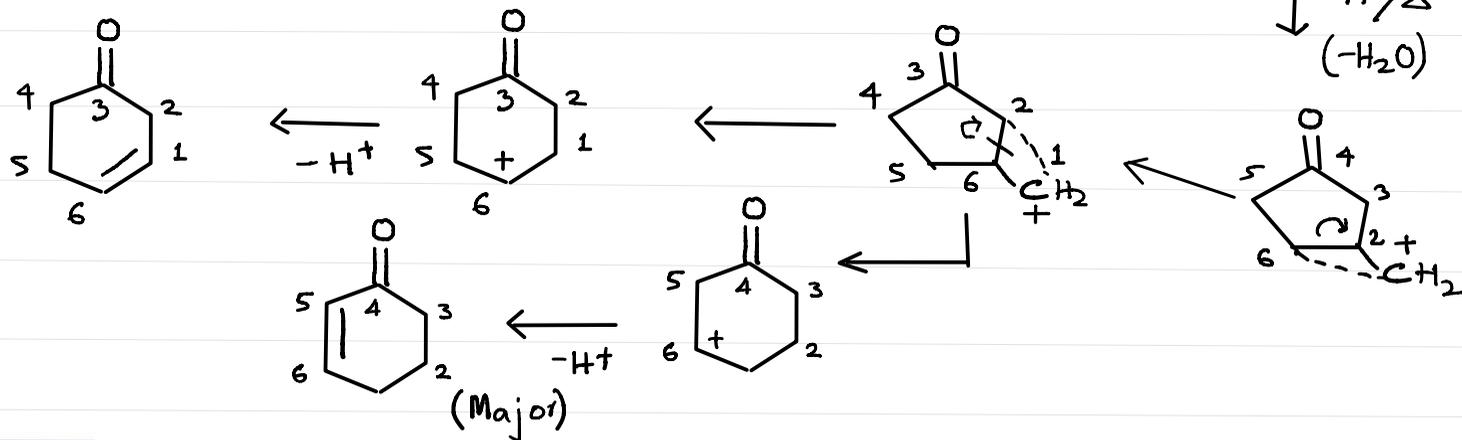
II. Special Reactions :

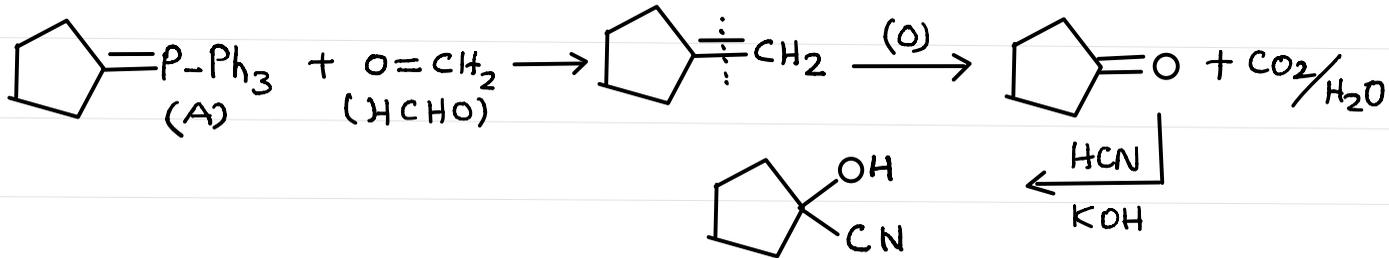
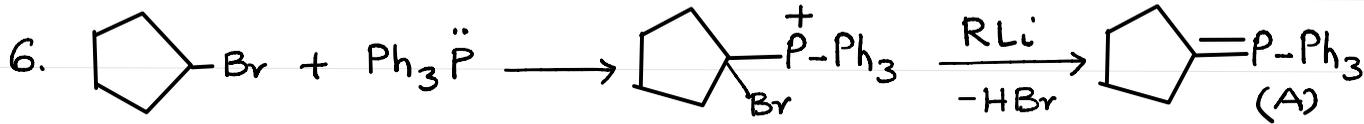
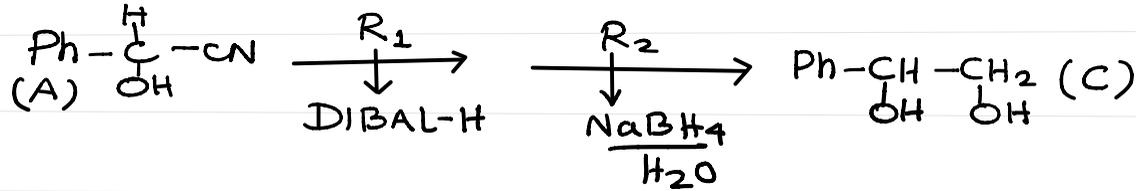
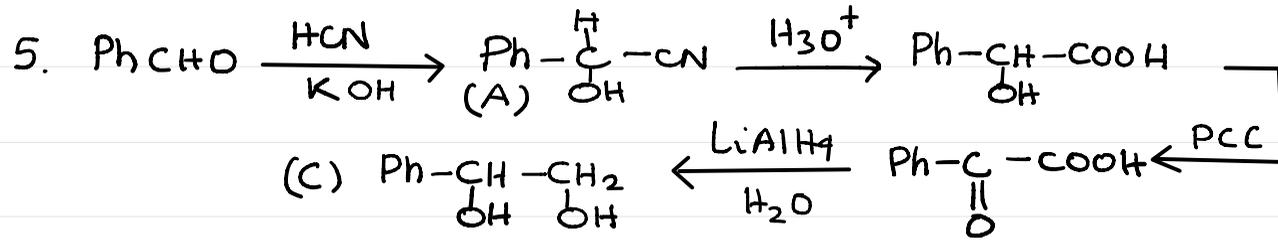
1. Beckmann Rearrangement
2. Cannizzaro Reaction
3. Tischenko Reaction
4. Reformatsky Reaction
5. Benzoin Condensation

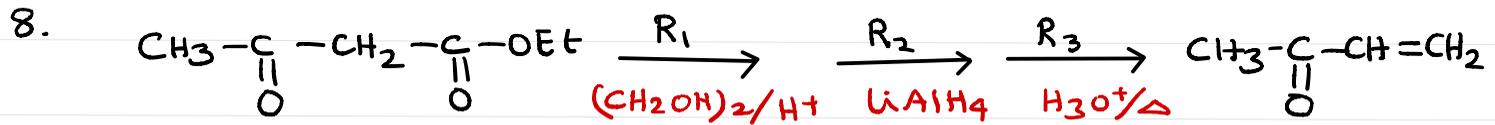
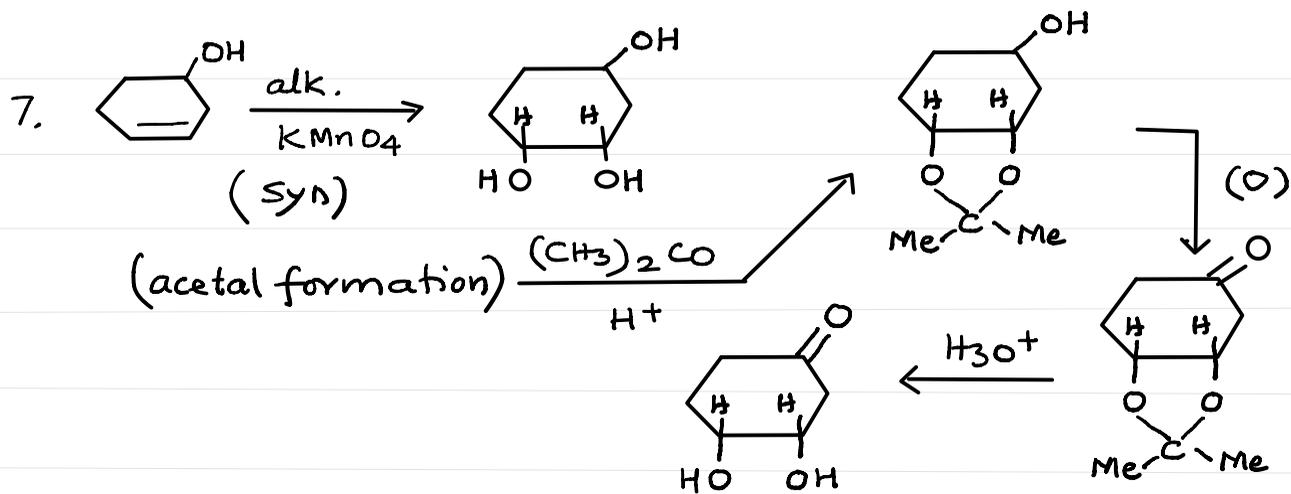




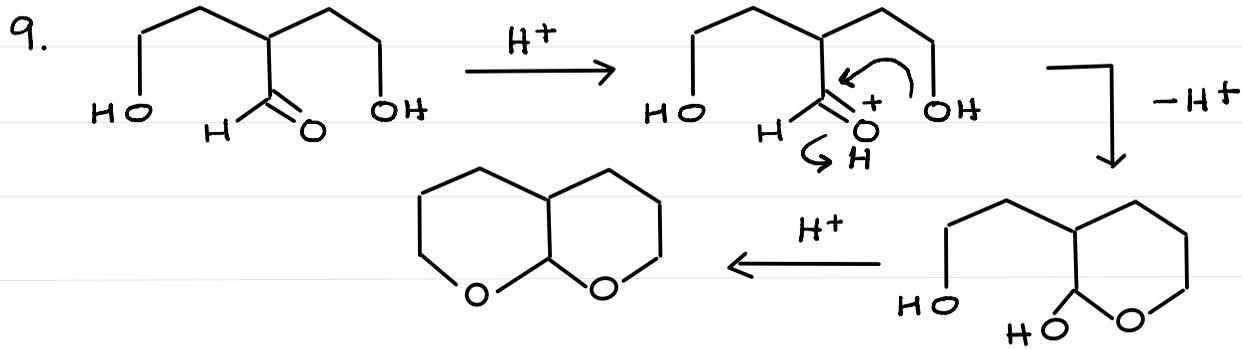
protecting $\text{C}=\text{O}$ group





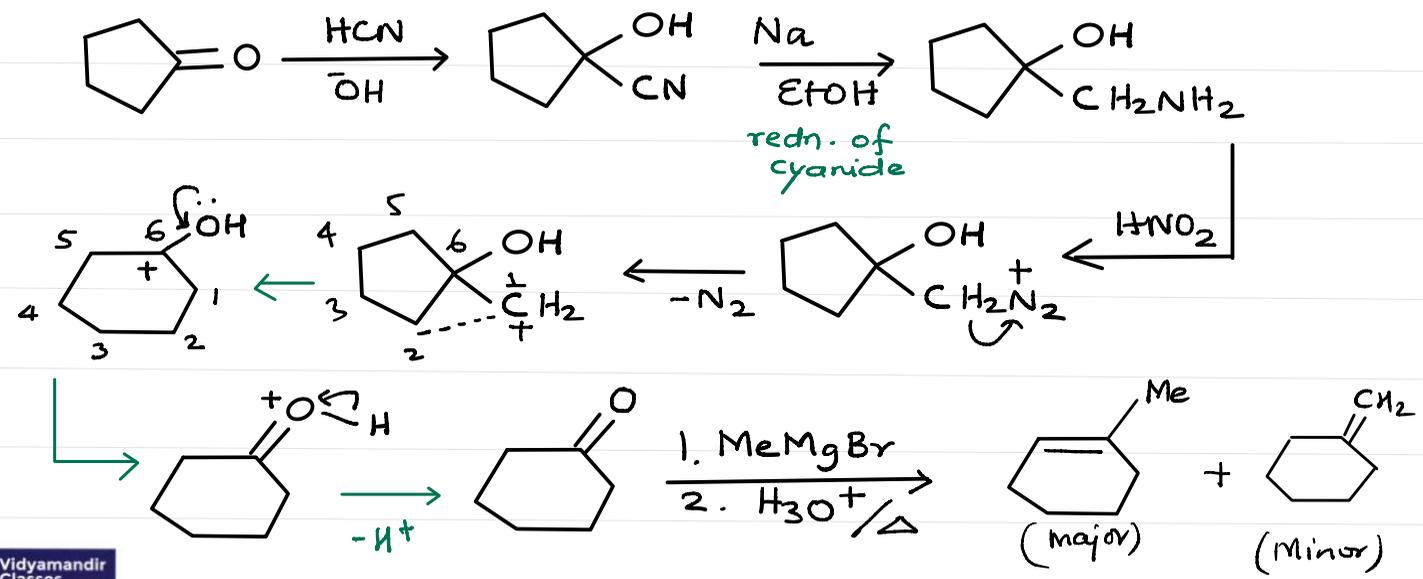


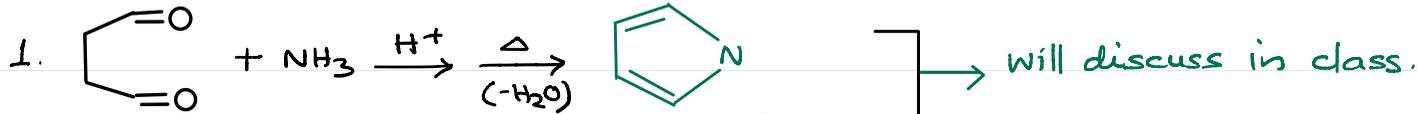
• Protect carbonyl group with $(\text{CH}_2\text{OH})_2/\text{H}^+$; use LiAlH_4 to reduce ester to alcohol; dehydrate alcohol using H^+/Δ & then hydrolyse acetal to get final product.



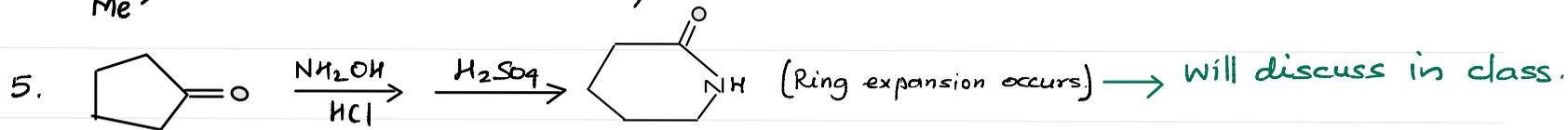
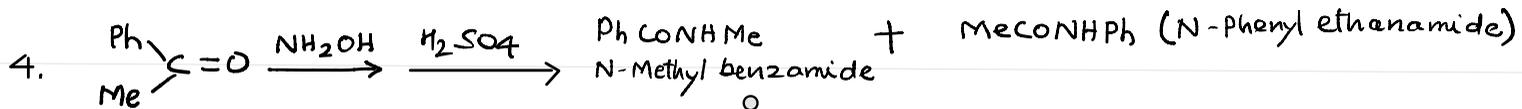
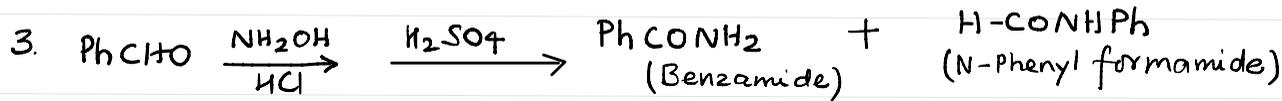
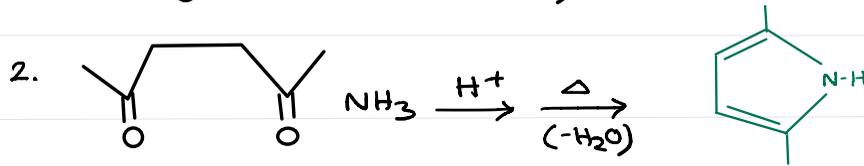
(S_N²) diols forms cyclic ethers

10.

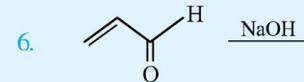
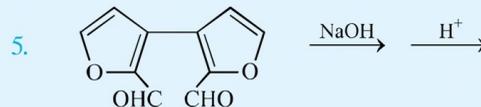
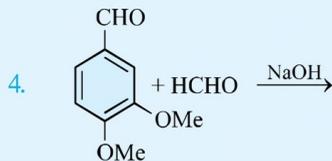
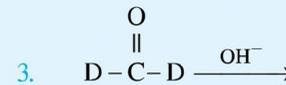
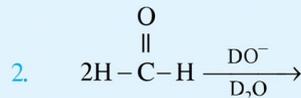
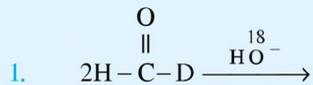




will discuss in class.



6. Give the products. (Cannizzaro Reaction)



7. **Illustration - 7** Do the following transformations (in not more than four - five steps)

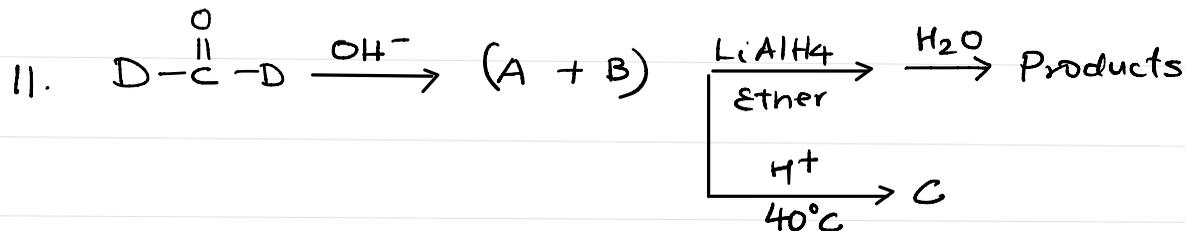
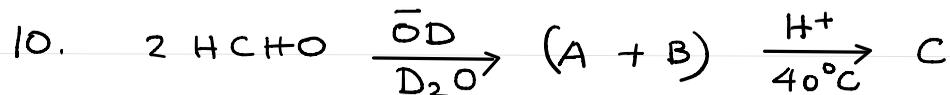
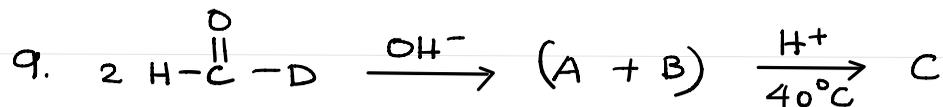
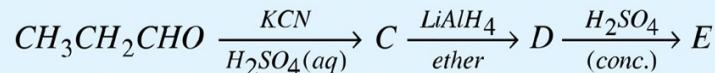
(a) Benzoic acid to cinnamaldehyde

(b) Benzene to 4-Nitrobenzaldehyde

(c) 1-Butyne to 2-Pentanone

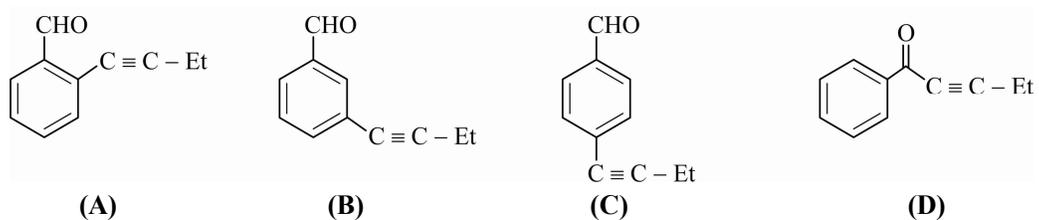
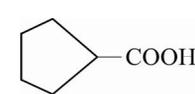
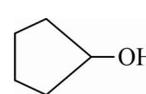
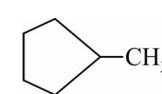
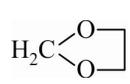
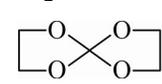
(d) Cyclohexanone to 2-methyl cyclohexanone

8. **Illustration - 8** Write the structure of the major organic products in each of the following reaction setups.



For each question choose the correct alternative Only One choice is correct. However, questions marked with '*' may have More than One correct option :

- Which of the following compounds does not react with sodium bisulphate ?
(A) Benzaldehyde (B) Acetone (C) Butanone (D) Acetaldehyde
- A mixture of Benzaldehyde and Formaldehyde on heating with aq NaOH solution gives :
(A) sodium benzoate and methyl alcohol (B) sodium benzoate and ethyl alcohol
(C) benzyl alcohol and methyl alcohol (D) benzyl alcohol and sodium formate
- Acetaldehyde forms a white crystalline compound on mixing with a..... solution of.... :
(A) Acidic Zn, Hg (B) Alcoholic Na_2SO_3
(C) Saturated, aqueous NaHSO_3 (D) Aqueous NaCl
- $\text{CH}_3\text{CHO} + \text{NH}_2\text{OH} \rightarrow \text{Y}$. The number of σ bonds, π -bonds and lone pairs of electrons in the compound 'Y' are respectively :
(A) 9, 1, 4 (B) 11, 1, 5 (C) 9, 2, 2 (D) 8, 1, 3
- *5. A carbonyl compound reacts with hydrogen cyanide to form cyanohydrin which on hydrolysis forms a racemic mixture of α -hydroxy acid. The carbonyl compound is :
(A) formaldehyde (B) acetaldehyde (C) acetone (D) benzaldehyde
- *6. Which of the following undergoes cannizaro reaction ?
(A) HCHO (B) $\text{C}_6\text{H}_5\text{CHO}$ (C) $\text{Cl}_3\text{C}-\text{CHO}$ (D) $(\text{CH}_3)_3\text{C}-\text{CHO}$
- A new C-C bond formation is possible in :
(A) Cannizaro reaction (B) Rosenmund's reduction
(C) Acetal formation (D) Wittig reaction
- $\text{C}_6\text{H}_5\text{CH}_3 \xrightarrow[\text{H}_3\text{O}^+]{(1) \text{CrO}_2\text{Cl}_2 / \text{CS}_2} (\text{A}) \xrightarrow{\text{OH}^-} (\text{B})$
The conversion of A to B is called as :
(A) Cannizaro reaction (B) Aldol Condensation
(C) Clemmenson reduction (D) Etard reaction
- A substance $\text{C}_4\text{H}_{10}\text{O}$ on oxidation yields compound $\text{C}_4\text{H}_8\text{O}$. Which gives an oxime and a positive iodoform test. The original substance on treatment with conc. H_2SO_4 gives C_4H_8 . The compound is :
(A) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_2\text{OH}$ (B) $\text{CH}_3\text{CHOHCH}_2\text{CH}_3$
(C) $(\text{CH}_3)_3\text{COH}$ (D) $\text{CH}_3\text{CH}_2-\text{O}-\text{CH}_2\text{CH}_3$

10. What is the product of Cannizzaro reaction of glyoxal ?
 (A) $\begin{array}{c} \text{COOH} \\ | \\ \text{COOH} \end{array}$ (B) $\begin{array}{c} \text{CHO} \\ | \\ \text{COOH} \end{array}$ (C) $\begin{array}{c} \text{COO}^- \\ | \\ \text{CH}_2\text{OH} \end{array}$ (D) $\begin{array}{c} \text{CHO} \\ | \\ \text{CH}_2\text{OH} \end{array}$
11. In the cannizzaro reaction given : $2\text{PhCHO} \xrightarrow{\text{OH}^-} \text{PhCH}_2\text{OH} + \text{PhCO}_2^-$. The slowest step is :
 (A) The attack of OH^- at the carbonyl group
 (B) The transfer of hydride to the carbonyl group
 (C) The abstraction of proton form the carboxylic group
 (D) Deprotonation of phCH_2OH
12. $\text{Et}-\text{C}\equiv\text{CH} \xrightarrow{\text{NaNH}_2} \xrightarrow[\text{H}_2\text{O}]{\text{Ph}-\text{CHO}} \xrightarrow{\text{MnO}_2} \text{X} :$

 (A) (B) (C) (D)
13. The major product obtained in the reaction: $\text{Cyclopentanone} \xrightarrow{\text{HCN}} \text{X} \xrightarrow[2. \text{Red, HI}/\Delta]{1. \text{H}_3\text{O}^+} \text{Y}$ is :
 (A)  (B)  (C)  (D) 
14. $\text{C}_2\text{H}_4 \xrightarrow[\text{Zn}]{\text{O}_3} \text{A} \xrightarrow[\text{H}^+]{(\text{CH}_2\text{OH})_2} \text{B}$. The product B is :
 (A) $\text{H}_2\text{C}=\text{CH}(\text{OCH}_3)_2$ (B) 
 (C)  (D) HCHO
15. $(\text{CH}_3)_2\text{C}=\text{CHCOCH}_3$ can be oxidised to $(\text{CH}_3)_2\text{C}=\text{CHCOOH}$ by :
 (A) chromic acid (B) $\xrightarrow[2. \text{H}^+]{1. \text{NaOH}/\text{I}_2}$ (C) Cu at 300°C (D) KMnO_4
16. The smallest ketone and its next homologue are reacted with NH_2OH to form oxime :
 (A) two different oximes are formed (B) three different oximes are formed
 (C) two oximes are optically formed (D) all oximes are optically active
17. If 3-hexanone is reacted with NaBH_4 followed by hydrolysis with D_2O , the product will be :
 (A) $\text{CH}_3\text{CH}_2\text{CH}(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_3$ (B) $\text{CH}_3\text{CH}_2\text{CD}(\text{OH})\text{CH}_2\text{CH}_2\text{CH}_3$
 (C) $\text{CH}_3\text{CH}_2\text{CH}(\text{OD})\text{CH}_2\text{CH}_2\text{CH}_3$ (D) $\text{CH}_3\text{CH}_2\text{CD}(\text{OD})\text{CH}_2\text{CH}_2\text{CH}_3$
18. What will be the final product when cyclohex-2-enone is selectively reduced in MPV reaction ?
 (A) Cyclohexanol (B) Cyclohex-2-en-1-ol
 (C) Cyclohexanone (D) Cyclohex-3-en-1-ol

19. What is the product obtained in the reaction of Acetaldehyde with semicarbazide ?

- (A) $\text{H}_3\text{C}-\text{CH}=\text{N}-\text{NH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$ (B) $\text{H}_3\text{C}-\text{CH}=\text{N}-\text{NH}_2$
- (C) $\text{H}_3\text{C}-\text{CH}=\text{N}-\text{OH}$ (D) $\text{H}_3\text{C}-\underset{\text{CH}_3}{\text{C}}=\text{N}-\text{NH}-\overset{\text{O}}{\parallel}{\text{C}}-\text{NH}_2$

20. What are the products A, B, C in the following reactions ?

- I. $(\text{CH}_3\text{CO}_2)_2\text{Ca} \xrightarrow{\Delta} \text{A}$ II. $\text{CH}_3\text{CO}_2\text{H} \xrightarrow[\text{Red P}]{\text{HI}} \text{B}$
- III. $2\text{CH}_3\text{CO}_2\text{H} \xrightarrow[\Delta]{\text{P}_4\text{O}_{10}} \text{C}$
- | | | | |
|-----|------------------------------------|----------------------------|------------------------------------|
| | A | B | C |
| (A) | C_2H_6 | CH_3COCH_3 | $(\text{CH}_3\text{CO})_2\text{O}$ |
| (B) | $(\text{CH}_3\text{CO})_2\text{O}$ | C_2H_6 | CH_3COCH_3 |
| (C) | CH_3COCH_3 | C_2H_6 | $(\text{CH}_3\text{CO})_2\text{O}$ |
| (D) | CH_3COCH_3 | C_2H_6 | CH_3COOH |

21. $2\text{PhCHO} + \text{HC} \equiv \text{CH} \xrightarrow{\text{NaNH}_2} \xrightarrow{\text{H}^+}$ Product formed is :

- (A) $\text{PhCH}(\text{OH})-\text{C} \equiv \text{C}-\text{H}$ (B) $\text{PhCH}(\text{OH})-\text{C} \equiv \text{C}-\text{CH}(\text{OH})\text{Ph}$
- (C) $\text{PhCH}=\text{CH}-\text{C} \equiv \text{CH}$ (D) $\text{PhCH}(-\text{C} \equiv \text{CH})_2$

22. Iodoform can be prepared from all except :

- (A) Ethyl methyl ketone (B) Isopropyl alcohol
- (C) 3-Methyl-2-butanone (D) Isobutyl alcohol

23. Which of the following give most stable hydrate with $\text{H}_2\text{O}/\text{H}^+$?

- (A) CH_3CHO (B) HCHO (C) CCl_3CHO (D) PhCHO

24. $(\text{CH}_3)_2\text{CO} \xrightarrow[\text{(HCl)}]{\text{NaCN}} \text{A} \xrightarrow{\text{H}_3\text{O}^+} \text{B}$. In the given sequence of reactions A and B are :

- (A) $(\text{CH}_3)_2\text{C}(\text{OH})\text{CN}$, $(\text{CH}_3)_2\text{C}(\text{OH})\text{COOH}$
- (B) $(\text{CH}_3)_2\text{C}(\text{OH})\text{CN}$, $(\text{CH}_3)_2\text{C}(\text{OH}_2)$
- (C) $(\text{CH}_3)_2\text{C}(\text{OH})\text{CN}$, $(\text{CH}_3)_2\text{CHCOOH}$
- (D) $(\text{CH}_3)_2\text{C}(\text{OH})\text{CN}$, $(\text{CH}_3)_2\text{C}=\text{O}$

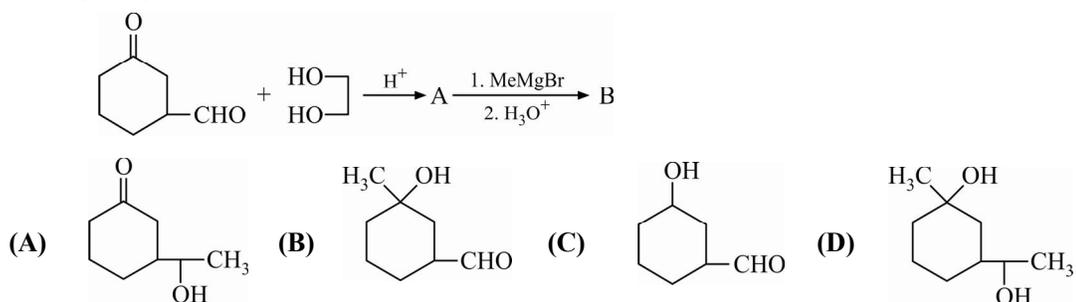
25. The most reactive compound towards formation of cyanohydrin on treatment with KCN followed by acidification is :

- (A) benzaldehyde (B) p-nitrobenzaldehyde
- (C) p-chlorobenzaldehyde (D) p-hydroxybenzaldehyde

26. Reaction of cyclohexanone with dimethylamine in the presence of catalytic amount of an acid forms a compound if water during the reaction is continuously removed. The compound formed is generally known as :

- (A) A Schiff's base (B) An enamine (C) An imine (D) An amine

27. m-chlorobenzaldehyde on reaction with conc. KOH at room temperature gives :
- (A) potassium m-chlorobenzaldehyde and m-hydroxy benzaldehyde
 (B) m-hydroxy benzaldehyde and m-chlorobenzaldehyde
 (C) m-chlorobenzyl alcohol and m-hydroxy benzyl alcohol
 (D) potassium m-chlorobenzoate and m-chloro benzyl alcohol
28. $\text{CH}_3\text{CHO} + \text{NH}_2\text{OH} \rightarrow \text{CH}_3\text{CH} = \text{N} - \text{OH}$. The above reaction is carried out at :
- (A) pH = 1 (B) pH = 4.5 (C) pH = 12 (D) pH = 14
- *29. Which of the following statements regarding aldehydes is(are) correct ?
- (A) The carbonyl functional group is planar
 (B) The boiling points of aldehydes is greater than those of alkanes of comparable molar masses
 (C) The boiling points of aldehydes is greater than those of alcohols of comparable molar masses
 (D) Formaldehyde is gas at room temperature
30. Identify the product (B) :



ANSWER KEY FOR PART TEST-2/Aldehydes & Ketones (Properties)

1	2	3	4	5	6	7	8	9	10
C	D	C	D	BD	ABD	D	A	B	C
11	12	13	14	15	16	17	18	19	20
B	D	C	B	B	B	C	B	A	C
21	22	23	24	25	26	27	28	29	30
B	D	C	A	B	B	D	B	ABD	B

A wooden clothespin is attached to a piece of light-colored paper with a red and blue striped border. The paper is pinned to a dark wooden surface. The words "THANK YOU" are written in a bold, black, sans-serif font across the center of the paper.

THANK YOU