CHEMISTRY

AAKASH INSTITUTE ENGLISH

ALDEHYDES, KETONES AND CARBOXYLIC ACIDS

Examples

1. How can you perform the following conversions?

Butyne to Butan-2-one

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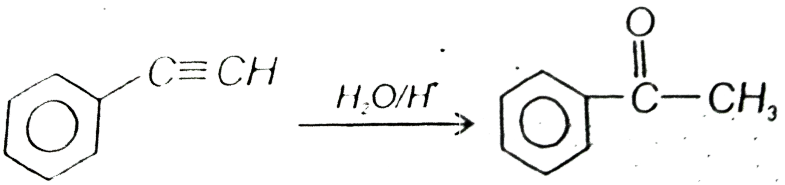
2. Write the mechanism for following conversion:



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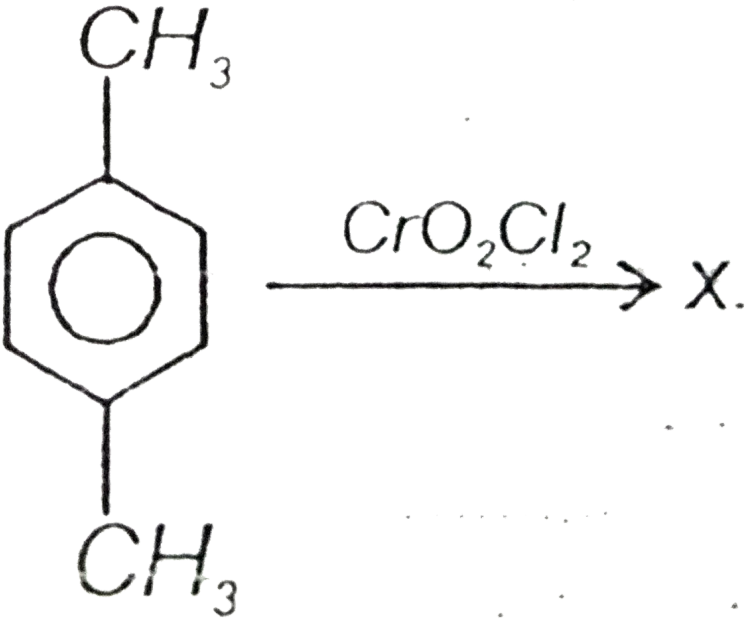
3. Complete the following reactions:

(i) $CH_3 - \underset{\underset{Cl}{|}}{\overset{\overset{CH_3}{|}}{C}} - CH_2CH_3 \xrightarrow[\Delta]{\text{alc}KOH} A \xrightarrow[Zn\,/\,H_2O]{O_3} (B + C)$

(ii) $\overset{I}{C}H_3CH - CH_3 \xrightarrow{\text{alc}KCN} A \xrightarrow[(ii)\,H_2O\,.\,OH\,.\,H_2O_2]{(i)\,SnCl_2\,/\,HCl} B$

(iii) $HCN \xrightarrow{HCl\,/\,AlCl_3} A \xrightarrow[(ii)\,(H_2O)\,/\,H^-]{(i)\,C_6H_6\,\Delta} B$

(iv)



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4. How would you do the following conversions in not more than two steps?

(i) Propanone to Propene

(ii) Propanal to Butaonone

(iii) Ethanol to 3-Hydroxybutanol

(iv) Benzaldehyde to Benzophenone

(v) Benzaldehyde to α-Hydroxyphenylacetic acid

(vi) Benzaldehyde to 3-Phenylpropan -1-ol

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5. An aromatic compound 'A' (molecular formula C_8H_8O) gives positive 2, 4-DNP test. It gives a yellow precipitate of compound 'B' on treatment with iodine and sodium hydroxide solution. Compound 'A' does not give Tollen's or Fehling's test. On drastic oxidation with potassium permaganate it forms a carboxylic acid 'C' (molecular formula $C_7H_6O_2$), which is also formed alongwith the yellow compound in the above reaction. Identify A, B and C and write all the reactions involved.

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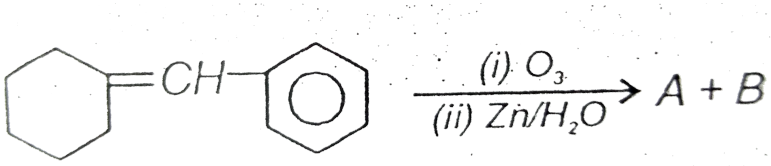
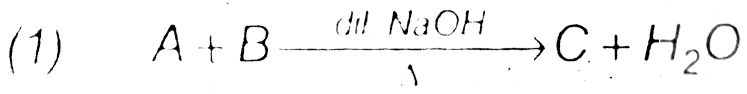
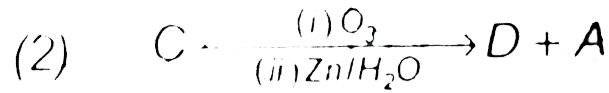
6. Identify A-D in the following reactions .

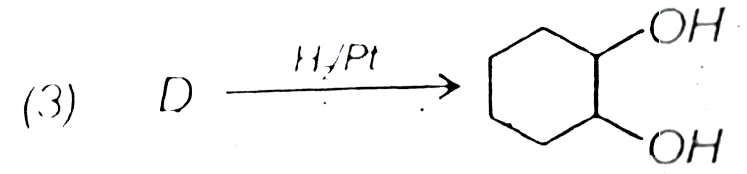


(1) $A + B \xrightarrow[\Delta]{\text{dil}NaOH} C + H_2O$

(2) $C \xrightarrow[(ii)\, Zn\,/\,H_2O]{\text{dil}NaOH} D + A$







(3)

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7. Molality of 20% (w/w) aq. glucose solution is

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8. Calculate the molarity of 40 % (w/w) NaOH solution, if the density of the solution is 1.5ml

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9. A 200 ml aq. Solution of NaCl contains 20 gm of NaCl. Find (w/v)%

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10. What volume of water must be added to 500 ml,6M NaOH to make 2% (w/v) NaOH

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11. 500 gm aq. NaOH solution contains 100 gm NaOH. Find (w/v)%

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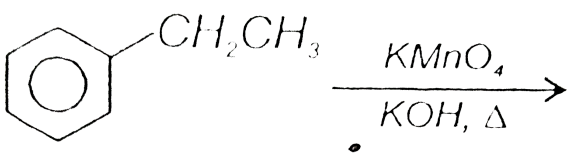
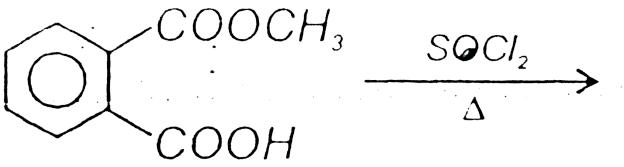
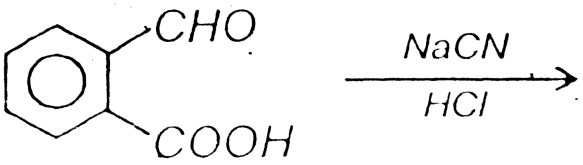
12. Complete the following reactions and form the products.

(a) 

(b) 

(c) 

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13. An organic compound A, C_8H_6 on reacting with dil. H_2SO_4 and $HgSO_4$ gives a compound 'B'-which can also be obtained from reaction of benzene with acid chloride in the presents of anh. $AlCl_3$ Compound B when reacted with iodine and aq. NaOH yields C and a yellow compound D. Identify A to D with proper justification.

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14. What is the molality of a solution containing 200 mg of urea (molar mass = 60 g mol^{-1}) in 40g of water ?

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15. Dissolving 180 g of glucose (mol.w.t. 180) in 1000g of water gave a solution of density 1.15 g/mL. The molarity of the solution is

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16. Give the reasons for the following:

(i) Iodoform is prepared by reacting acetone with hypoiodite and not with idodine. Explain.

(ii) Halogen acids readily combine with alkene to form addition products but fail to react with carbonyl compounds. Discuss.

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17. How can you perform the following conversions?

But-2-ene to Ethanol.

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18. $(CH_3)_2C = CHCOCH_3$ can be oxidised to $(CH_3)_2C = CHCOOH$ by

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19. An ester 'A' $(C_4H_8O_2)$ on treatment with excess methyl magnesium chloride followed on acidification gives an alcohol 'B' as the sole organic product. Alochol 'B' as the organic product. Alcohol 'B' on oxidation with NaOCl followed by acidification gives acetic acid. Deduce structure of A and B. Show the reactions involved.

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20. Write mechanism for decarboxylation of β-ketoacids.

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21. Acid-catalyzed mechanism of given aldol reaction.

$$2CH_3 - \overset{\overset{O}{||}}{C} - CH_3 \xrightarrow{HCl} CH_3 - \overset{\overset{O}{|}}{C} - CH = \overset{\overset{CH_3}{|}}{C} - CH_3 + H_2O$$

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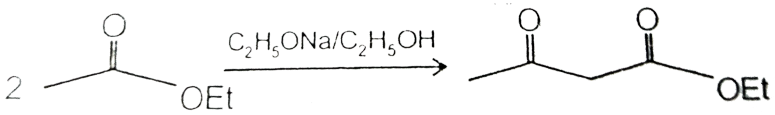
22. Propose mechanism of given reaction.



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23. What is the activation energy for the reverse of this reaction?

$N_2O_4(g) \rightarrow 2NO_2(g)$

Data for the given reaction is :$\Delta H = +54kJ$and $E_a = +57.2kJ$:

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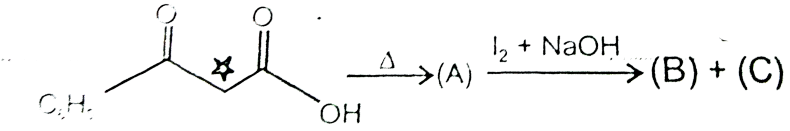
24. In the following reaction sequence the correct structures of A, B and C are



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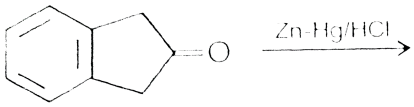
Illustrations

1. Predict the major products of the following reactions:



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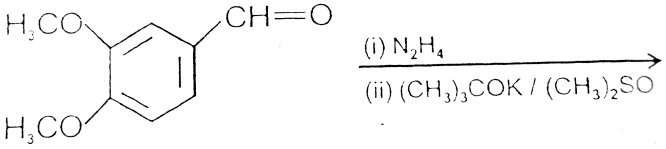

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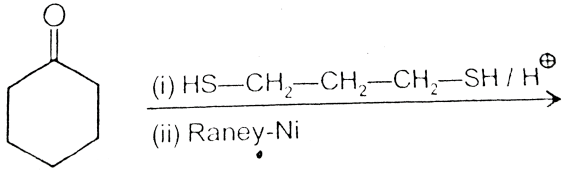

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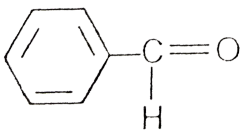
2. Write the structure of all possible products of reaction of $LiAID_4$.

Followed by H_3O^+ with



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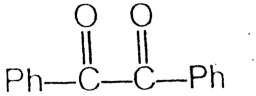

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3. How is aniline obtained from benzoic acid ?

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Assignment (Section A Competition Level Questions)

1. The general formula of both aldehyde & ketone is

A. $C_nH_{2n+2}O$

B. $C_nH_{2n}O$

C. $C_nH_{2n-2}O$

D. $C_nH_{2n+4}O$

Answer: B

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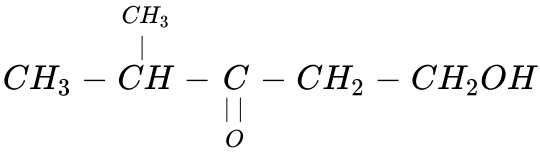
2. The IUPAC name of following structure is



A. 1-Hydroxy-4-methylpentan-3-one

B. 2-Methyl-5-hydroxy-3-pentanone

C. 4-Methyl-3-oxo-1-pentanol

D. Hexanol-1-one-3

Answer: A

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3. IUPAC name of $(C)Cl_3CHO$ is

A. Chloral

B. Trichloro acetaldehyde

C. 1,1,1- Trichloroethanol

D. 2,2,2- trichloroethanol

Answer: D

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4. Which of the following is mixed ketone?

A. Pentanone

B. Acetophenone

C. Benzaphenone

D. Butanone

Answer: B

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5. The reaction of acetaldehyde with HCN followed by hydrolysis gives a product which exhibits

A. Optical isomerism

B. Geometrical isomerism

C. Metamerism

D. Tautomerism

Answer: A

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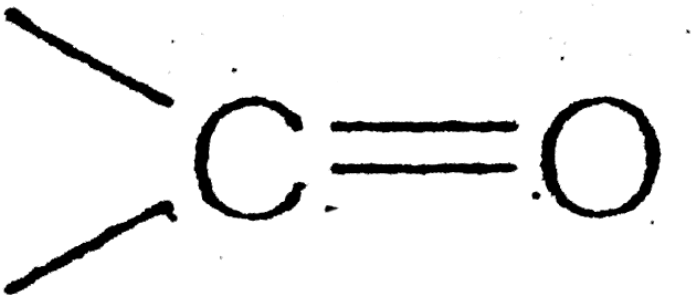
6. Which factors will increase the reactivity of



group?

(i) Presence of a group with positive inductive effect.

(ii) Presence of a group with (-ve) inductive effect

(iii) Presence of large alkyl group.

A. Only (i)

B. Only (ii)

C. Both (i) and (iii)

D. Both (ii) and (iii)

Answer: B

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7. Which of the following is optically active?

A. Ethylene glycol

B. Oxalic acid

C. Glycerol

D. Tartaric acid

Answer: D

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8. identify the wrong statement from the following:

A. Salicylic acid is a monobasic acid

B. Methyl salicylate is an ester

C. Salicylic acid gives violte colour with neutral ferric chloride as well as brisk effervescence with sodium bicarbonate

D. Methyl salicylate does not occur in natural oils.

Answer: D

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9. The general formula of $C_nH_{2n}O_2$ could be for open chain

A. Diketones

B. Carboxylic acid

C. Diols

D. Dialdehyde

Answer: B

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10. The IUPAC name of the phthalic acid-

A. Benzene-1,2-dicarboxylic acid

B. Benzene-1,4-dioic acid

C. Cyclo-1,3,5-trien-1,2-diolic acid

D. Benzene-1,3-dicarboxylic acid

Answer: A

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

$$R-\overset{\overset{O}{\|}}{C}-Cl \xrightarrow[Pd/BaSO_4]{H_2} P$$

A. RCH_2OH

B. RCOOH

C. RCHO

D. RCH_3

Answer: C

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12. Dry distillation of calcium acetate gives :

A. Acetaldehyde

B. Ethane

C. Acetic acid

D. Acetone

Answer: D

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13. $CH_3 - CH_2 - C \equiv CH \xrightarrow[H_3O^{\oplus}]{R}$ Butanone, R is

A. Hg^{+2}

B. $KMnO_4$

C. $KClO_3$

D. $K_2Cr_2O_7$

Answer: A

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14. Which of the following pathways produces 2-hexanone?

(i) 1-Hexyne is treated with $Hg^{2\oplus}$ / dil H_2SO_4

(ii) 3-methylhept-2-ene is treated with O_3 followed by hydrolysis.

(iii) n-butyl magnesium bromide reacts with acetaldehyde followed by hydrolysis and then oxidation with chromic acid.

(iv) Hydroboratioin-oxidation of 1-hexyne.

A. (i), (ii) and (iii)

B. (i) and (ii) only

C. (i), (ii) and (iv)

D. (i) amd (iii) only

Answer: A

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15. An alkene of molecular formula C_9H_{18} on ozonolysis gives 2.2 dimethyl propanal and 2- butanone, then the alkene is

A. 2,2,4-trimethylhex-3-ene

B. 2,2,6-trimethylhex-3-ene

C. 2,3,4-trimethylhex-2-ene

D. 2,2,4-trimethylhex-2-ene

Answer: A

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16. $(CH_3)_2CO \xrightarrow[HCI]{NaCN} (A) \xrightarrow[\Delta]{H_3^+O} (B)$

In the above sequence of reactions, (A) and (B) are :

A. $(CH_3)_2C(OH)CN.\ (CH_3)_2C(OH)COOH$

B. $(CH_3)_2C(OH)CNH_2.\ (CH_3)_2C(OH)_2$

C. $(CH_3)_2C(OH)CN.\ (CH_3)_2CHCOOH$

D. $(CH_3)_2C(OH)CNH_2.\ (CH_3)_2C=0$

Answer: A

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17. A liquid was mixed with ethanol and a drop of concentrated H_2SO_4 was added. A compound with a fruity smell was formed. The liquid was

A. CH_3OH

B. HCHO

C. CH_3COCH_3

D. CH_3COOH

Answer: D

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18. The major product obtained on interaction of phenol with sodium hydroxide and carbon dioxide is

A. Benzoic acid

B. Salicyladehyde

C. Salicylic acid gives violte colour with neutral ferric chloride as well as brisk effervescence with sodium bicarbonate

D. Phthalic acid

Answer: C

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19. Which of the following does not give benzoic acid on hydrolysis?

A. Phenyl cyanide

B. Benzoyl chloride

C. Benzyl chloride

D. Methyl benzoate

Answer: C

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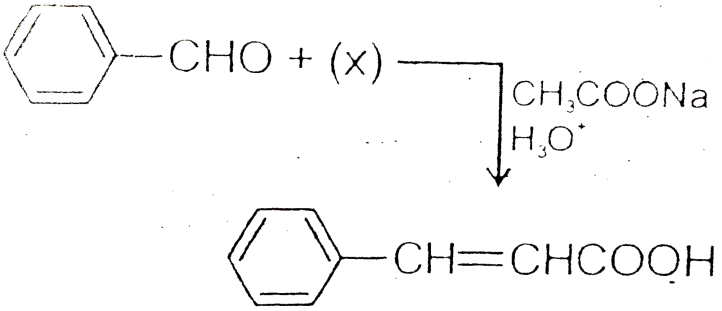

20.

The compound x is

A. CH_3COOH

B. $BrCH_2 - COOH$

C. $(CH_3CO)_2O$

D. $CHO - COOH$

Answer: C

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21. Acetic acid is obtained when

A. Methyl alcohol is oxidised with potassium permanganate

B. Calcium acetate is distilled in the presence of calcium formate

C. Acetaldehyde is oxidised with potassium dichromate and sulphuric acid

D. Glycerol is heated with sulphiric acid

Answer: C

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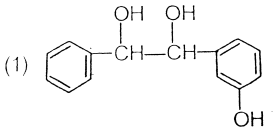
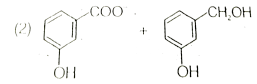
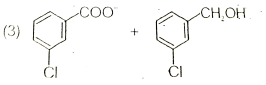
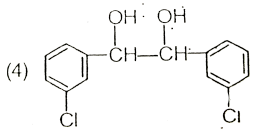
22. When m-chlorobenzaldehyde is treated with $50\,\%\,KOH$ solution, the product (s) obtained is (are)

A. 

B. 

C. 

D. (4) 

Answer: C

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23. Aldol condensation will not be observed in

A. Chloral

B. Phenyl acetaldehyde

C. Hexanal

D. Ethanal

Answer: A

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24. Whch of the following gives aldol condensation reaction?

A. C_6H_5OH

B. $C_6H_5\overset{\overset{O}{||}}{C} - C_6H_5$

C. $CH_3CH_2 - \underset{\underset{O}{||}}{O} - CH_3$

D. $(CH_3)_3C - \underset{\underset{O}{||}}{C} - C(CH_3)_3$

Answer: C

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25. Which of the following organic compound exhibits positive Fehling test as well as iodoform test?

A. Methanal

B. Ethanol

C. Propanone

D. Ethanal

Answer: D

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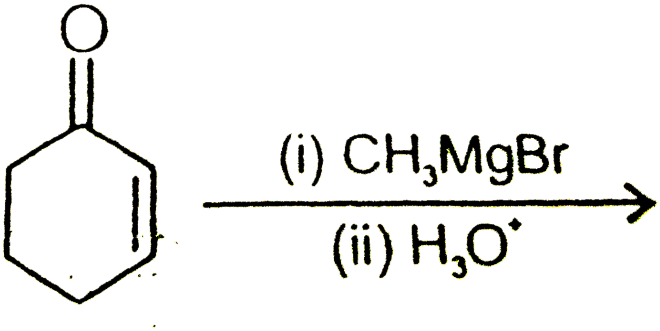
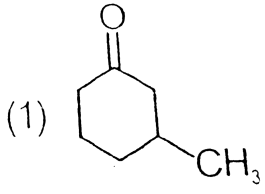
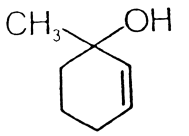
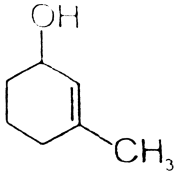
26. Predict the product

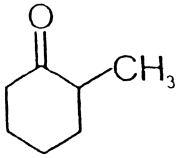


A.



B. (2) 

C. (3) 

D. (4) 

Answer: B

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27. Which of the following will not undergo aldol condensation-

A. Acetaldehyde

B. Propanaldehyde

C. Benzaldehyde

D. Trideuteroacetaldehyde

Answer: C

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28. Benzyl alcohol and sodium benzoate is obtained by the action of sodium hydroxide on benzaldehyde. This reaction is known as

A. Perkin reaction

B. Cannizzaro reaction

C. Sandmeyer reaction

D. Claisen condensation

Answer: B

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29. Dimethyl ketones are usually characterised through

A. Tollens reagent

B. Iodoform test

C. Schiff's test

D. Benedict's reagent

Answer: B

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30. In the Cannizzaro reaction given below:

$2Ph - CHO \xrightarrow{\overset{\Theta}{OH}} Ph - CH_2OH + PhCO_2^-$ 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 from the carboxylic group

D. The deprotonation of $PhCH_2OH$

Answer: B

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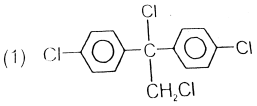
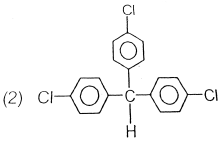
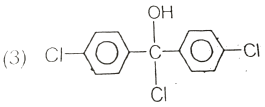
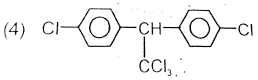
31. Trichloroacetaldehyde, CCl_3CHO reacts with chlorobenzene in presence of sulphuric acid and produces.

A. 

B. 

C. 

D. 

Answer: D

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32. The order of reactivity of $CH_3CHO, CH_3COC_2H_5$ and CH_3COCH_3 is

A. $CH_3CHO > CH_3COCH_3 > CH_3COC_2H_5$

B. $C_2H_5COCH_3 > CH_3COCH_3 > CH_3CHO$

C. $CH_3COCH_3 > CH_3CHO > C_2H_5COCH_3$

D. $CH_3COCH_3 > C_2H_5COCH_3 > CH_3CHO$

Answer: A

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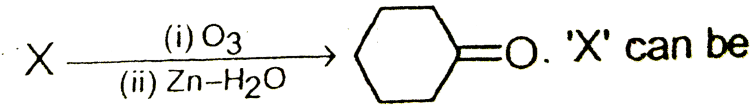
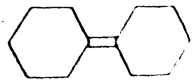
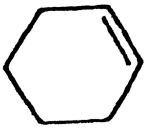
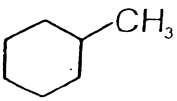
33. 

'X' can be

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: A

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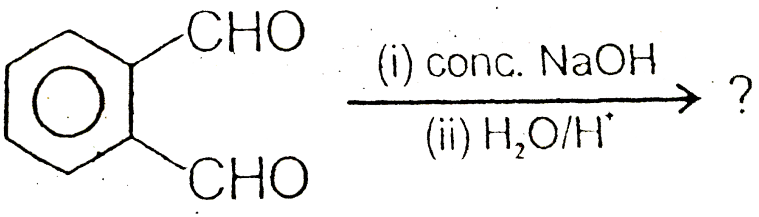
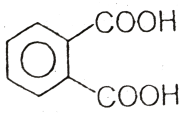
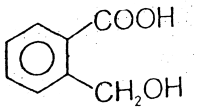
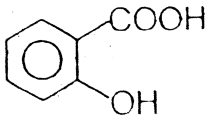
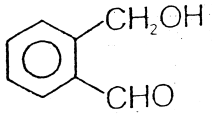
34. 

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: B

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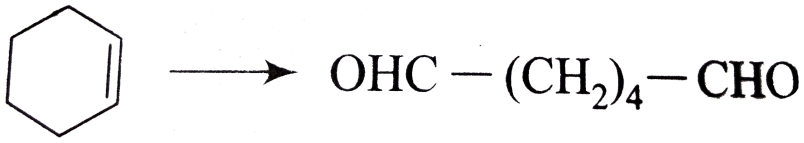
35. Select the reagent for the following reaction:



A. SeO_2

B. O_3, Zn / H_2O

C. O_3, $H_2O_2 - (CH_3COOH)$

D. PCC

Answer: B

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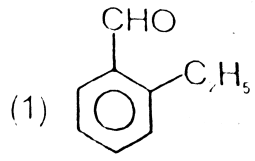
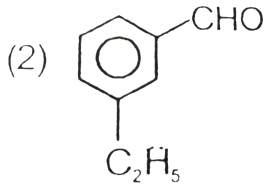
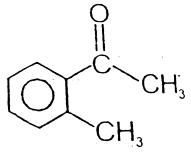
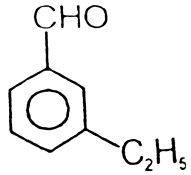
36. An organic compound (X) with molecular formula $C_9H_{10}O$ gives positive 2, 4-DNP and Tollens'tests. It undergoes Cannizzaro reaction and on vigorous oxidation it gives 1, 4-benzenedicarboxylic acid. Compound (X) is

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: A

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37. The increasing order of the rate of HCN addition to compound A-D is

(A) HCHO

(B) CH_3COOH_3

(C) $PhCOCH_3$

(D) $PhCOPh$

A. $A < B < C < D$

B. $D < B < C < A$

C. $D < C < B < A$

D. $C < D < B < A$

Answer: C

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38. The correct order of reactivity of PhMgBr with

$$Ph - \underset{\underset{(I)}{C}}{\overset{\overset{O}{||}}{C}} - Ph \qquad CH_3 - \underset{(II)}{\overset{\overset{O}{||}}{C}} - H \qquad CH_3 - \underset{(III)}{\overset{\overset{O}{||}}{C}} - CH_3$$ is

A. $(i) > (ii) > (iii)$

B. $(iii) > (ii) < (i)$

C. $(ii) < (iii) < (i)$

D. $(i) < (iii) < (ii)$

Answer: C

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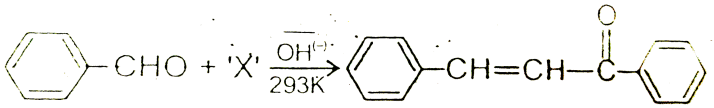
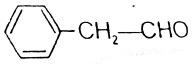
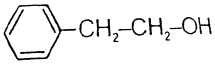


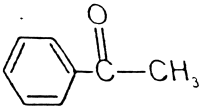
Identify 'X'

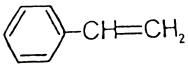
39.

Identify 'X'

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: C

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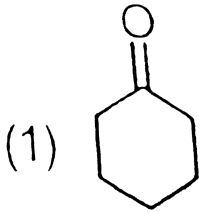
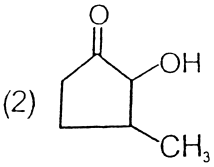
40. The diketone $CH_3 - \overset{O}{\overset{||}{C}} - (CH_2)_2 - \overset{O}{\overset{||}{C}} - CH_3$ on intermolecular aldol condensation gives the final product

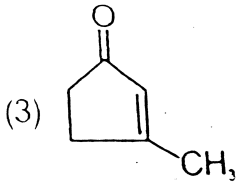
A. (1)



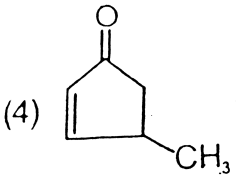
B. (2)



C. (3)



D. (4)



Answer: C

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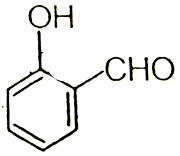
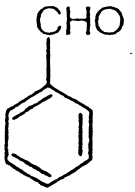
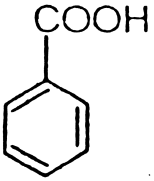
41. What will be the product , when carboxy phenol, obtained by Reimer Tiemann's process, is deoxidised with Zn powder ?

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: D

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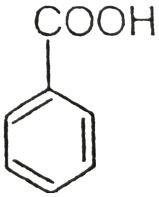
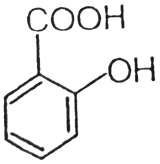
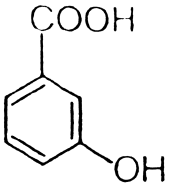
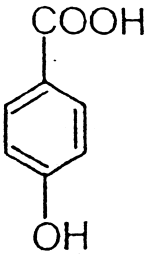
42. Which of the following aromatic acids is most acidic?

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: B

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43. $CH_3COOH \xrightarrow[P_2O_5]{\Delta} X$. Identify X

A. CH_3COCH_3

B. CH_3CHO

C. $(CH_3CO)_2O$

D. CH_4

Answer: C

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44. Which one of the following orders of acidic strength is correct?

A. $RCOOH > HC \equiv CH > HOH > ROH$

B. $RCOOH > ROH > HOH > HC \equiv CH$

C. $RCOOH > HOH > HC \equiv CH > ROH$

D. $RCOOH > HC \equiv CH > HOH > ROH$

Answer: C

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45. Which of the following represents the correct order of acidity in the given compounds ?

A.

$$CH_3COOH < BrCH_2COOH < ClCH_2COOH < FCH_3COOH$$

B.

$$FCH_2COOH > CH_3COOH > BrCH_2COOH > ClCH_2COOH$$

C.

$$BrCH_2COOH > ClCH_3COOH > FCH_2COOH > CH_3COOH$$

D.

$$FCH_3COOH > ClCH_2COOH > BrCH_2COOH > CH_3COOH$$

Answer: D

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46. The correct order of acidic strength is

A. Formic acid $<$ Benzoic acid $<$ Acetic acid

B. Formic acid $<$ Acetic Acid $<$ Benzoic acid

C. Acetic acid $<$ Formic acid $<$ Benzoic acid

D. Acetic acid $<$ Benzoic acid $<$ Formic acid

Answer: D

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47. Treatment of benzoic acid with $Cl_2 / FeCl_3$ will give

A. p-chlorobenzoic acid

B. o-chlorobenzoic acid

C. 2-4-dichlorobenzoic acid

D. m-chlorobenzoic acid

Answer: D

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48. In esterfication

A. OH^- of acid is replaced by C_6H_5OH

B. H^+ of acid is replaced by sodium metal

C. OH^- of alcohol is replaced by chlorine

D. OH^- of acid is replaced by RO^- group

Answer: D

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49. Acetyl chloride is reduced with $LiAlH_4$, the product formed is

A. Methyl alcohol

B. Ethyl alcohol

C. Acetaldehyde

D. Acetone

Answer: B

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50. The reaction

$CH_3COOH + Cl_2 \xrightarrow{redP} CICH_2COOH + HCl$ is called

A. Hell-Volhard-Zelinsky reaction

B. Birch reaction

C. Rosenmund reaction

D. Hunsdiecker reaction

Answer: A

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51. Saponification of ethyl benzoate with caustic soda as alkali gives

A. Benzyl alochol and ethanoic acid

B. Sodium benzoate and ethanol

C. Benzoic acid and sodium ethoxide

D. Phenol and ethanoic acid

Answer: B

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52. Which of the following acids has the smallest dissociation constant?

A. $CH_3CHFCOOH$

B. FCH_2CH_2COOH

C. $BrCH_2CH_2COOH$

D. $CH_3CHBrCOOH$

Answer: C

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53. Which of the following compounds will show the maximum 'enol' content?

A. Acetone

B. Acetophenone

C. Acetic acid

D. Acetyl acetone

Answer: D

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54. Aliphatic aldehyde can be oxidised by

A. Tollen's reagent

B. Fehling solution

C. Benedict solution

D. All of these

Answer: D

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55. Formaldehyde when treated with KOH (caustic potash) gives methanol and potassium formate, the reaction is known as

A. Perkin reaction

B. Claisen reaction

C. Cannizzaro reaction

D. Knoevengael reaction

Answer: C

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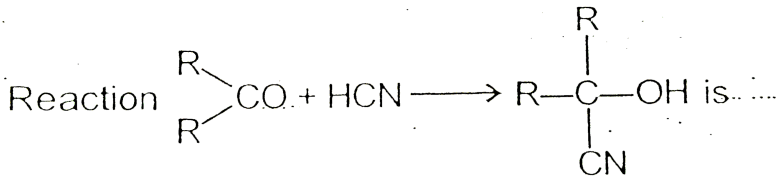
56. Reactions 

A. Electrophilic substitution

B. Nucleophilic substiution

C. Nucleophilic addition

D. Electrophilic addition

Answer: B

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57. Bakelite is prepared by the reaction between

A. HCHO + Phenol

B. HCHO + acetaldehyde

C. Phenol + H_2SO_4

D. HCHO + acetone

Answer: A

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58. Fehling test is positive for

A. Acetaldehyde

B. Benzaldehyde

C. Ether

D. Alcohol

Answer: A

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59. $2C_6H_5CHO \xrightarrow{NaOH} C_6H_5CH_2OH + C_6H_5COONa$

The similar reaction can take place with which of the following aldehyde?

A. CH_3CHO

B. CH_3CH_2CHO

C. $(CH_3)_3(C)CHO$

D. $CH_3CH_2CH_2CHO$

Answer: C

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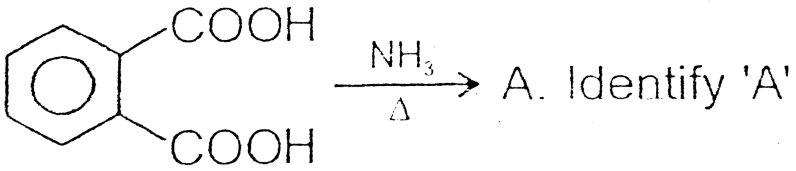
60. 

A. Benzene

B. Phthalimide

C. Benzamide

D. Acetaldehyde

Answer: B

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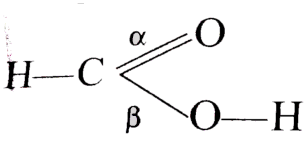
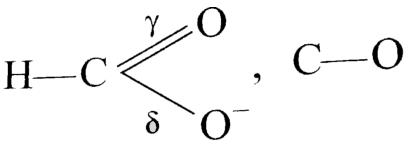
Assignment (SECTION -B OBJECTIVE TYPES QUESTIONS (ONE OPTION IS CORRECT)

1.   designated

by α, β, γ and δ are in order:

A. $\alpha = \gamma < \beta = \delta$

B. $\alpha < \beta < \gamma = \delta$

C. $\alpha < \gamma = \delta < \beta$

D. $\alpha = \beta = \gamma = \delta$

Answer: C

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2. $CH_3CH_2 - \overset{O}{\overset{||}{C}} - O - C_2H_2 \xrightarrow[(ii)\, H_3O^+]{(i)\, DIBAL.H\,(1eq)} A + B$ A and B are

respectively.

A. $CH_3CH_2CH_2OH + C_2H_5OH$

B. $CH_3CH_2CHO + C_2H_5OH$

C. $CH_3CH_2CHO + CH_3CHO$

D. $CH_3CH_2CH_2OH^- + CH_3CHO$

Answer: B

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3. $CH_3CHO + LiAlH_4 \rightarrow CH_3CH_2OH$ Nucleophile added in this reaction is

A. AlH_4^-

B. Li^+

C. H_-^+

D. H^-

Answer: D

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4. Complete the reaction

$$Ph - CH = CH - CHO \xrightarrow[H_3O^+]{PhMgBr} \text{Product}$$

A. $Ph - \underset{\underset{Ph}{|}}{CH} - \underset{\underset{OH}{|}}{CH} - CHO$

B. $Ph - \underset{\underset{Ph}{|}}{CH} = CH_2 - CHO$

C. $Ph - \underset{\underset{Ph}{|}}{CH} - \underset{\underset{Ph}{|}}{CH} - CHO$

D. $Ph - \underset{\underset{Ph}{|}}{CH} - CH_2 - CH_2 - OH$

Answer: B

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5. Consider the following sequence of reactions:

The final product [B] in the reaction would be:

A. Meso

B. Racemic

C. Inversion

D. All of these

Answer: B

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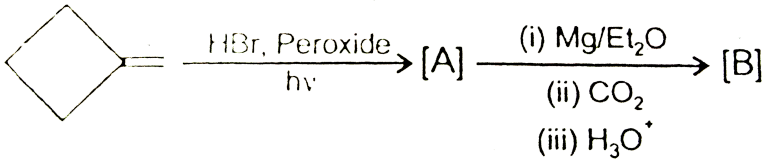
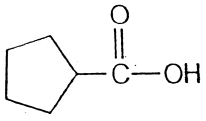
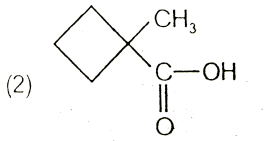
6. Consider the following sequence of reaction

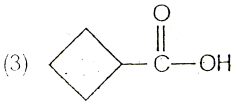


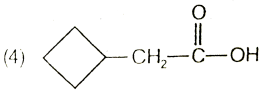
The final product [B] in th reaction would be:

A. (1)



B. (2) 

C. (3) 

D. (4) 

Answer: D

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7. $CH_3 - \overset{O}{\overset{||}{C}} - CH_3 \xrightarrow[HNO_3]{\text{Conc}}$ Product

The product is

A. CH_3COOH

B. $CH_3CH_2COOH + HCOOH$

C. $CH_3CH_2CH_2COOH$

D. No reaction

Answer: A

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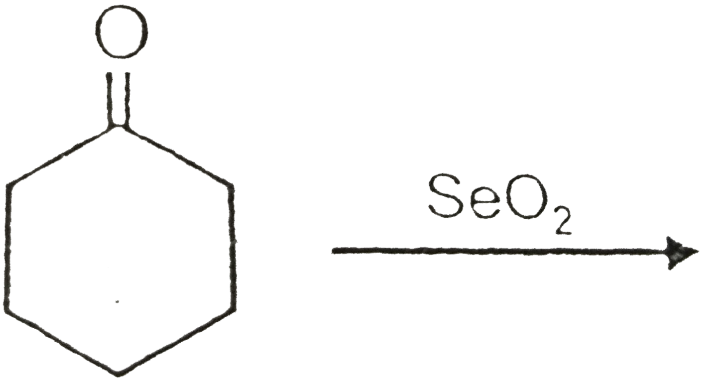
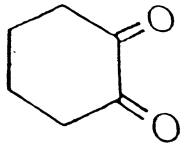


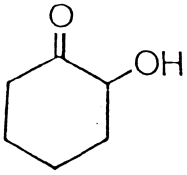
8.

(1)

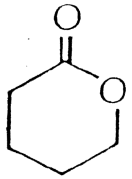


A.

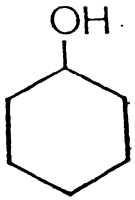
(2)



B.

(3) 

C.

(4) 

D.

Answer: A

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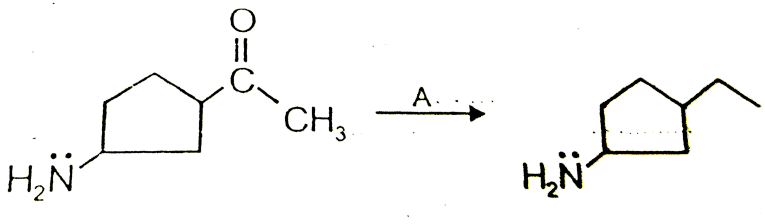
9. The appropriate reagent for the transformation :



A. $Zn - Hg / HCl$

B. $NH_2 - NH_2 / OH^-$

C. Both (1) and (2)

D. $NaBH_4$

Answer: B

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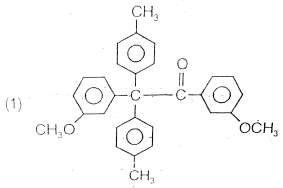
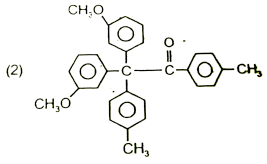
10.

	Column I		Column II
(A)	$2\sin\theta\cos\theta = \frac{1}{\sqrt{2}}$	(p)	$\theta = 3\pi/8$
(B)	$2\cos 2\theta\cos 4\theta + 2\cos^2 2\theta - 1 = 0$	(q)	$\theta = 7\pi/8$
(C)	$8\cos^2\theta\sin\theta - 4\cos^2\theta - 2\sin\theta + 1 = 0$	(r)	$\theta = 2\pi/3$
(D)	$\sin 4\theta = \pm 1$	(s)	$\theta = \pi/6$

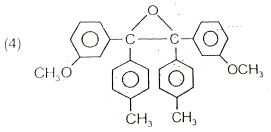
A.



B.



C. Both (1) and (2)

D. 

Answer: A

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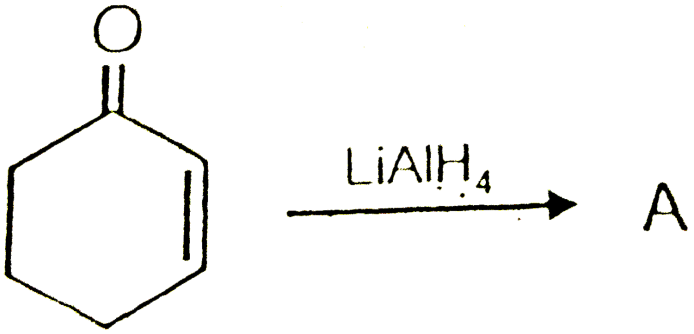
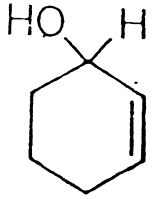
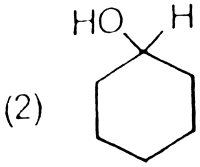
11. 

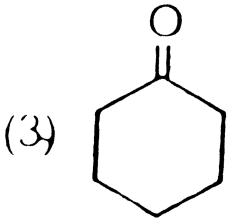
The product predominates is

A. (1) 

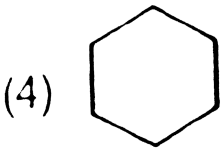
B.



C.



D.



Answer: A

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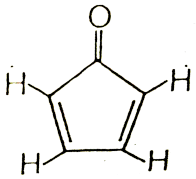
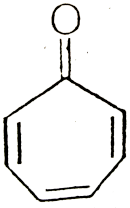
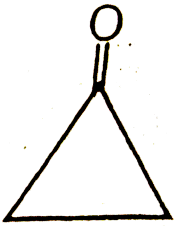
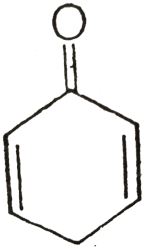
12. Which of the following carbonyl oxygen will form strongest hydrogen bond with H_2O molecule?

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: B

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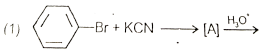
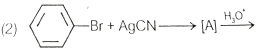
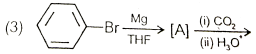
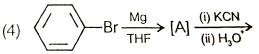
13. Which of the following would be the best synthesis of benzoic acid from bromobenzene?

A. 

B. 

C. 

D. 

Answer: C

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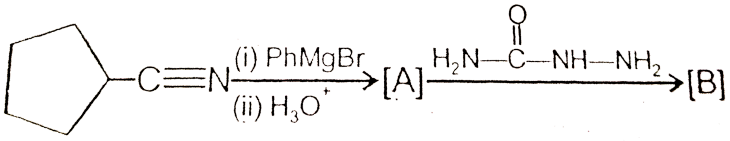
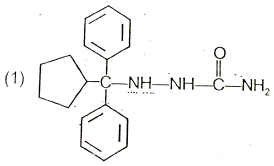
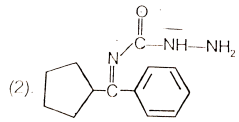
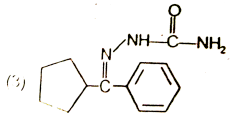
14. Consider the following sequence of reactions:

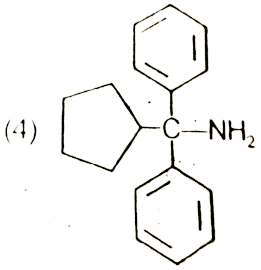


Major product [B] of the given reaction would be

A. 

B. 

C. 

D. 

Answer: C

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15. The compound which is not reduced by $LiAIH_4$ is

A. Cyclohexanone

B. 2-Methyl-1-butanol

C. Ethyl benzoate

D. ω-caprolactam

Answer: B

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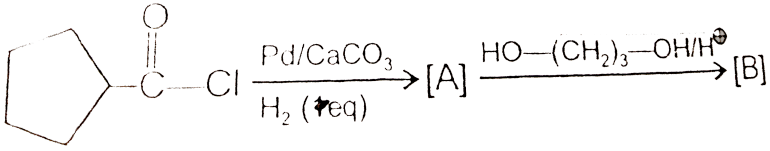
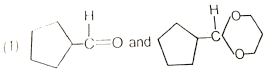
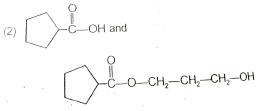
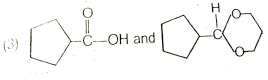
16. Consider the following sequence of reactions.

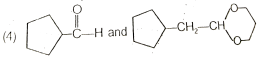


The product [A] and [B] are respectively

A. 

B. 

C. 

D. 

Answer: A

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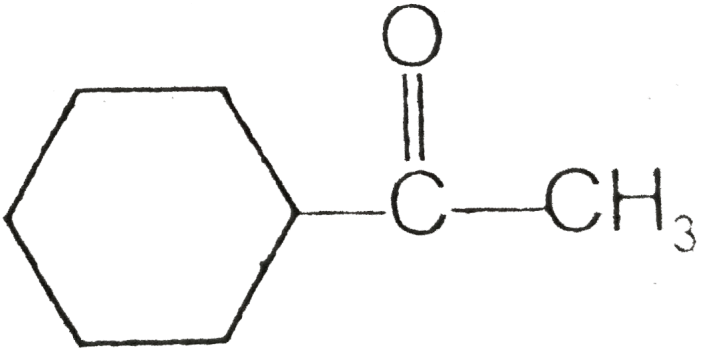
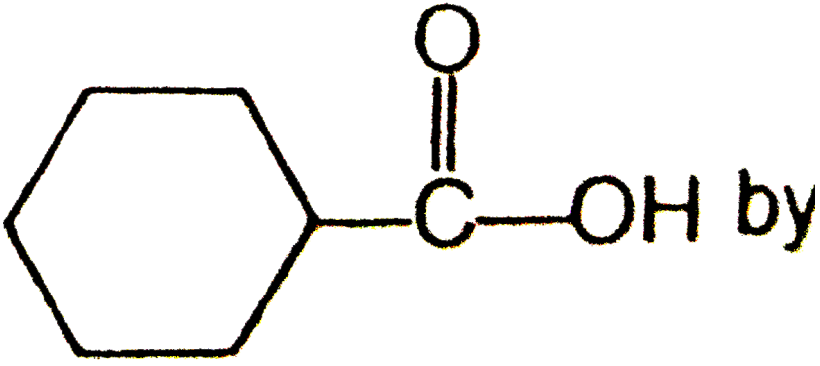
17. The compound  can be compounded oxidized into  by

A. NaCN followed by hydrolysis

B. NaOI followed by H_3O^+

C. $KMnO_4$ hot followed by hydrolysis

D. $K_2Cr_2O_7$ followed H_3O^+

Answer: B

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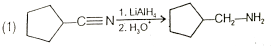
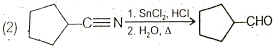
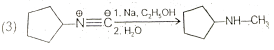
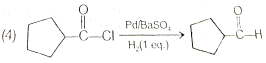
18. Which of the following conversion is known as Stefen's reduction?

A. 

B. 

C. 

D. 

Answer: B

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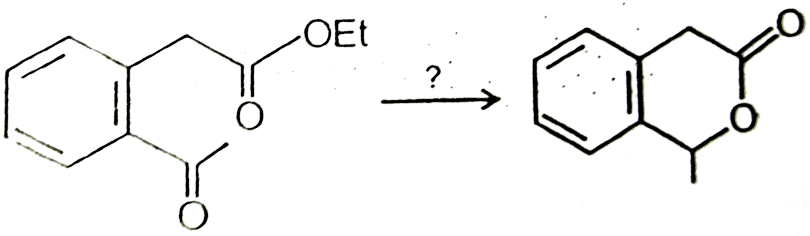
19. Which reagent or sequence of reagents would best accomplish the following synthesis?



A. (i) $LiAlH_4$ (ii) H^+, Δ

B. $NaBH_4$

C. (i) Na/NH_3 (ii) $NaBH_4/H^+.\Delta$

D. (i) Mg/Et_2O (ii) $LiAlH_6$, (iii) H^+, Δ

Answer: B

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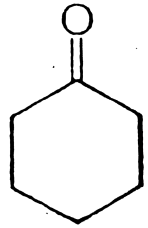
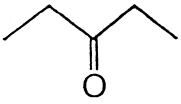
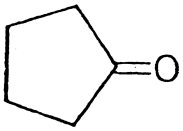
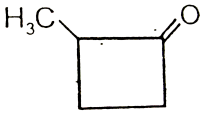
20. An organic compound [X]. C_5H_8O reacts with hydroxylamine to form [Y]. In the presence of conc. H_2SO_4 gives δ-lactam. [X] neither give Benedicts test nor it respond positively towards haloform test. The compound [X] is

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: C

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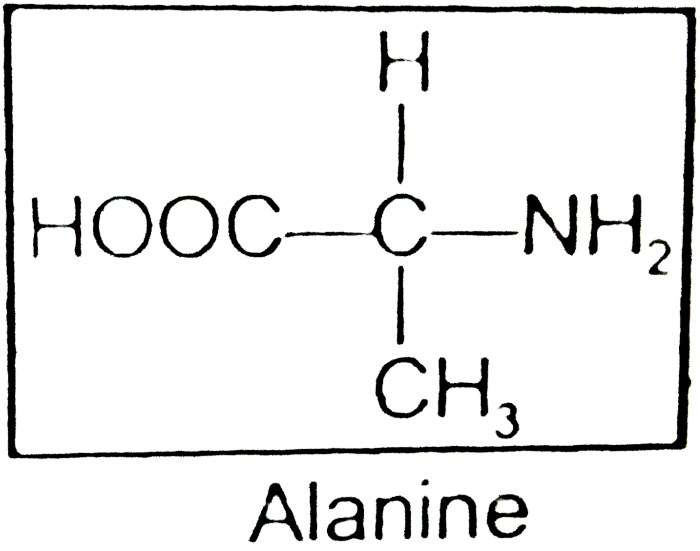
21. Alanine can be obtained from acetaldehyde by the following sequence of reactions.

Alanine

$$HOOC - \underset{\displaystyle CH_3}{\overset{\displaystyle H}{\overset{|}{\underset{|}{C}}}} - NH_2$$



Alanine

A. Reactions with HCN, followed by NH_3 and finally acidic hydrolysis

B. Reactions with HCN, acidic hydrolysis and finally reaction with NH_3

C. Reaction with NH_3, followed by HCN and finally acidic hydrolysis

D. Reaction with $NaHSO_3$, followed by NH_3 and finally acidic hydrolysis.

Answer: A

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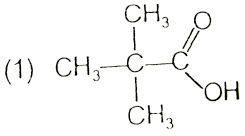
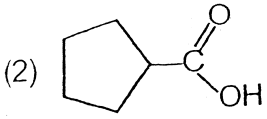
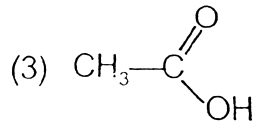
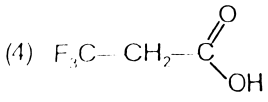
22. Which of the following carboxylic acid ismost reluctant to form ester with a given alcohol in the presence of a catalytic amount of concentrated H_2SO_4 ?

A. 

B. 

C. (3) 

D. (4) 

Answer: A

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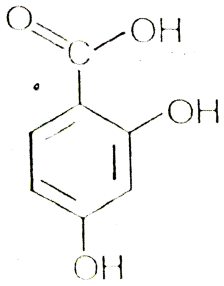
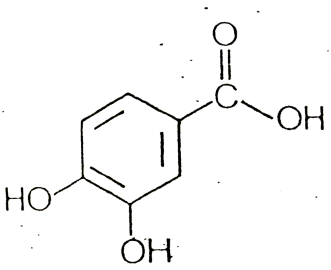
23. Among the given compounds



(I)



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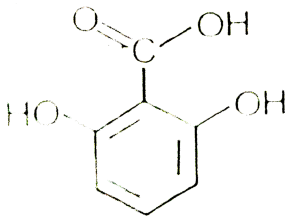

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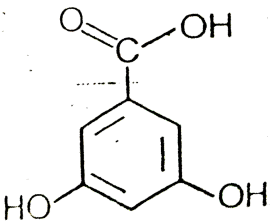

(IV)

A. $III > IV > I > II$

B. $I > IV > II > III$

C. $III > I > IV > II$

D. $III > I > II > IV$

Answer: C

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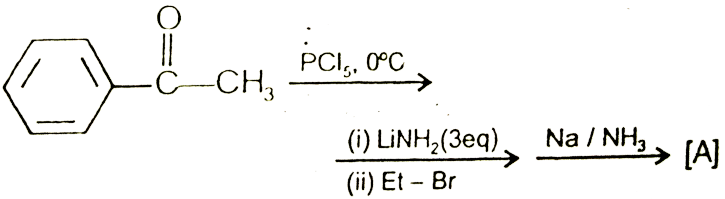
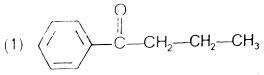
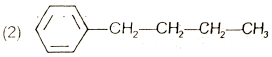
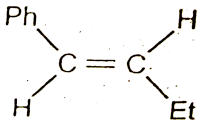


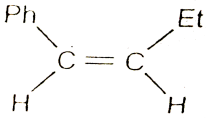
24. A is

A is

A. 

B. 

C. (3) 

D. (4) 

Answer: C

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Assignment (SECTION -C Objective type questions more than one options are correct)

1. Which of the following reactions involve carbanion enolalte as reactive intermediate?

A. Kolbe-Schmidt reaction

B. Reimer-Tiemann reaction

C. Claisen condensation

D. Aldol condensation

Answer: C::D

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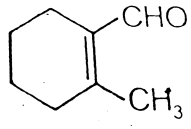
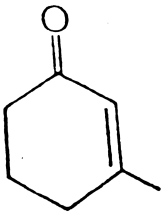
2. Which of the following compounds can be synthesized by intramolecular aldol condensation in very good yield ?

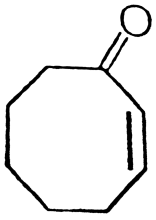
A. (1)

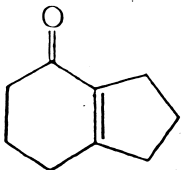


B. (2)



C. (3)



D. (4) 

Answer: B::D

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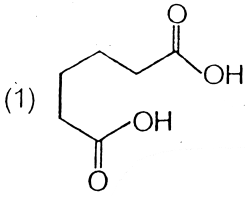
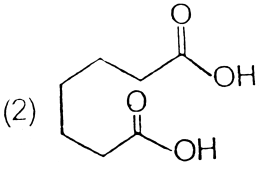
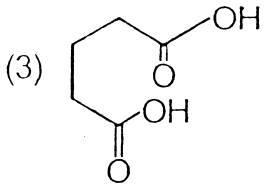
3. Which of the following dicarboxylic acid will give cycle alkanone on heating?

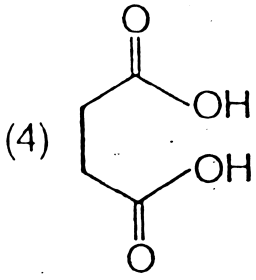
A. (1) 

B. (2) 

C.



D.



Answer: A::B

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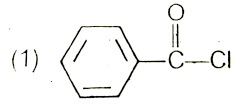
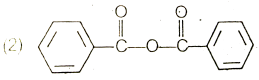
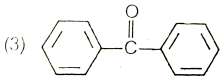
4. Which of the following compounds will give over all substitution product via. Addition/elimination mechanism with Ethylamine?

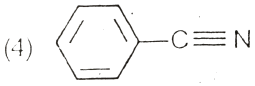
A.



B.



C. 

D. 

Answer: A::B

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5. Which of the following reagents can be used to distinguish Benzaldehdyde from acetophenone?

A. Tollen's reagent

B. Sodium hypoiodite

C. 2,4-Dintrophenyl hydrazine

D. Benedicts solution

Answer: A::B

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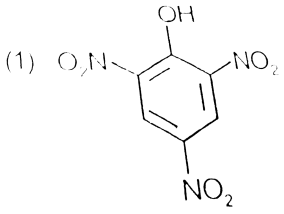
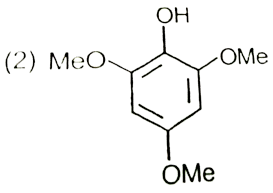
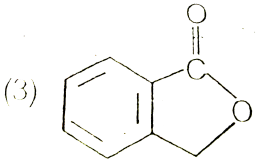
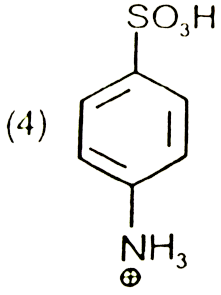
6. Which of the following compounds could liberate CO_2 with aqueous $NaHCO_3$?

A. 

B. 

C. 

D. 

Answer: A::D

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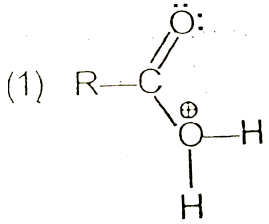
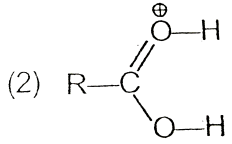
7. Which of the following intermediates are involved in the acid catalyzed esterification of carboxylic acid?

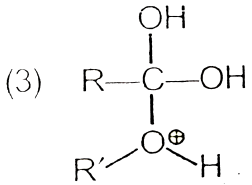
A.



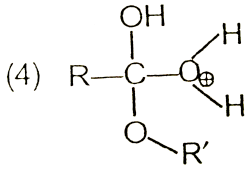
B.



C.



D.



Answer: B::C::D

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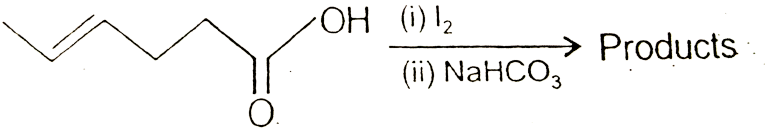
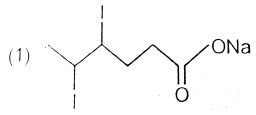
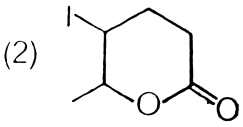
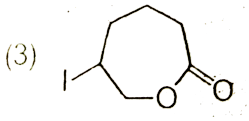
8. Consider the following sequence of reactions

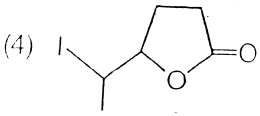


Products of the given reaction would be

A. 

B. 

C. 

D. 

Answer: B::D

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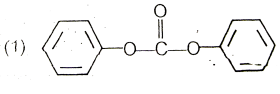
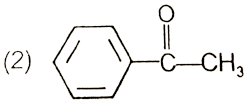
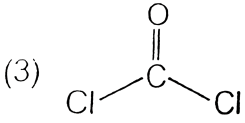
9. Which of the following compounds will give tertiary butanol as the major product when treated with excess of MeMgBr?

A. 

B. 

C. 

D. $CH_3 - \overset{O}{\overset{||}{C}} - NH_2$

Answer: A::C

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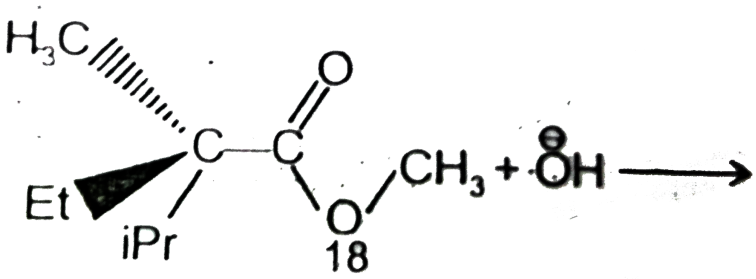
10. Which of the following statements are correct regarding given reaction?



Labled oxygen]

A. The given reaction primarily follows $S-(N)^2$- mechanism

B. In the given reaction condition inversion occurs at the chiral carbon

C. Labelled $.^{18}O$ is present is formed carboxylic acid.

D. The given reaction primarily follows addition/elimination mechanism

Answer: A::C

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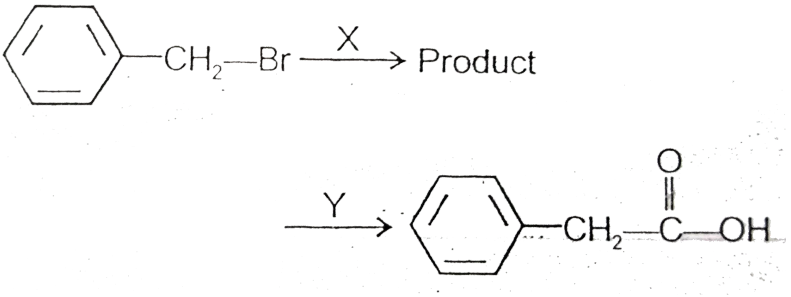
11. Identify the set of reagents/ reaction conditions X and Y in the following of transformations



A. $X = \mathrm{Mg}/Et_2O.\ Y = CO_2$, followed by H_3O^+

B. X=AgCN. Y=(i) $\overrightarrow{O}H/H_2$ (ii)H_3O^+

C. $X = NaCN, Y$=(i) $\overrightarrow{O}H/H_2O$ (ii) H_3O^+

D. X=alcoholic KOH, Y= (i) HCN, (ii) H_3O^+

Answer: A::C

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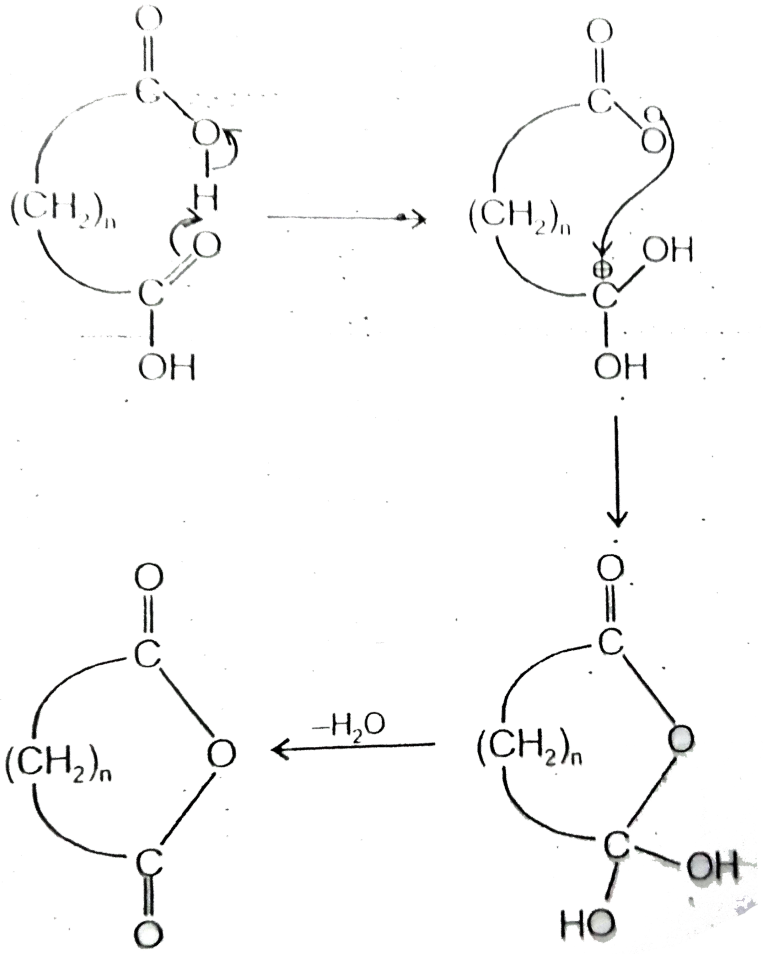
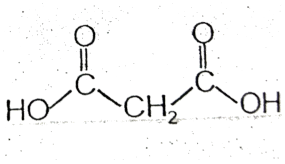
Assignment (SECTION -D Linked Comprehension type Questions)

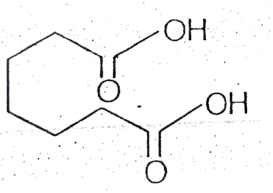
1. Certain dicarboxylic acids spontaneously eliminate water when heated forming cycioc anhydirides. But for the reaction to be successfully. The cyclic anhydrides product must normally have a ring size of fivee or six members. There are two important reasons, first, the second carboxyl group can serve as the acid catalyst (by intramolecular proton transfer), as well as the nucleophile. And second, the high temperature involved reduce the need for catalyst.



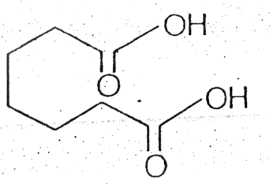
Which of the following dicarboxylic acid would you expect to form cyclic anhydride?

A. 

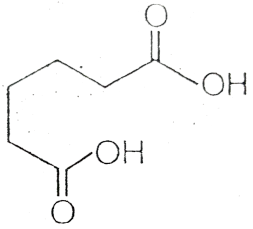
B.



C.



D.



Answer: C

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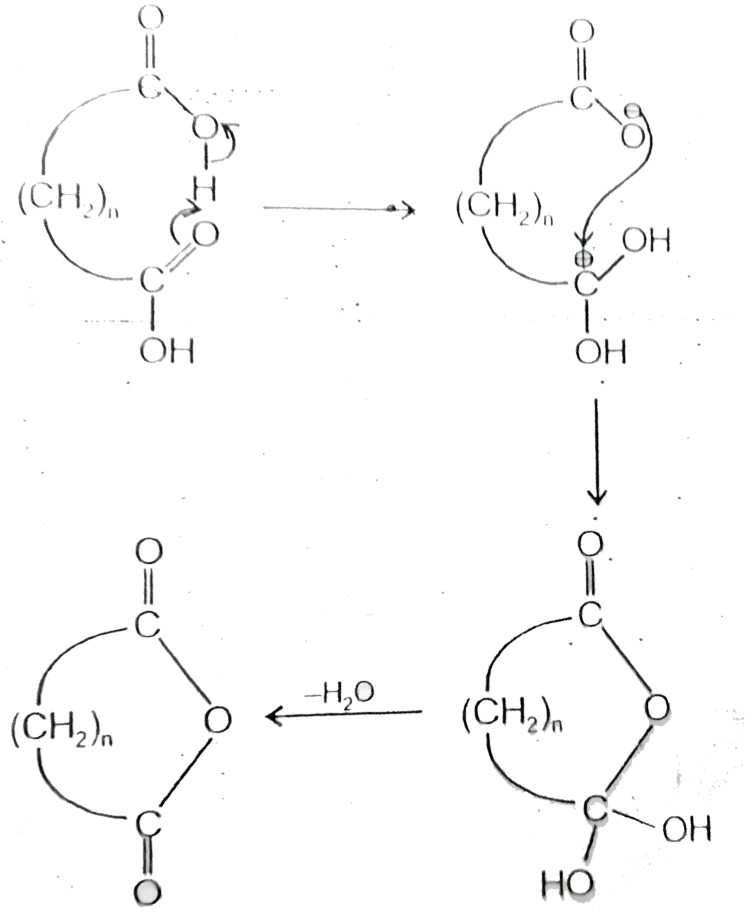
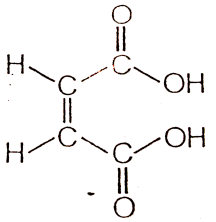
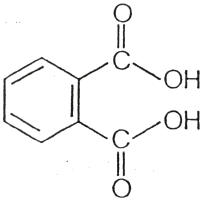
2. Certain dicarboxylic acids spontaneously eliminate water when heated forming cycioc anhydirides. But for the reaction to be successfully. The cyclic anhydrides product must normally have a ring size of fivee or six members. There are two important reasons, first, the

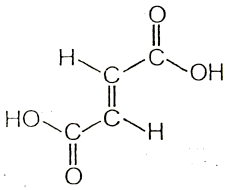
second carboxyl group can serve as the acid catalyst (by intramolecular proton transfer), as well as the nucleophile. And second, the high temperature involved reduce the need for catalyst.

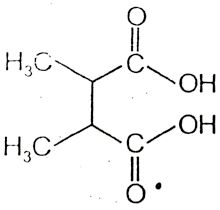


Which of the following dicarboxylic acid will not for cyclic anhydrides?

A. (1) 

B. (2) 

C. (3) 

D. (4) 

Answer: C

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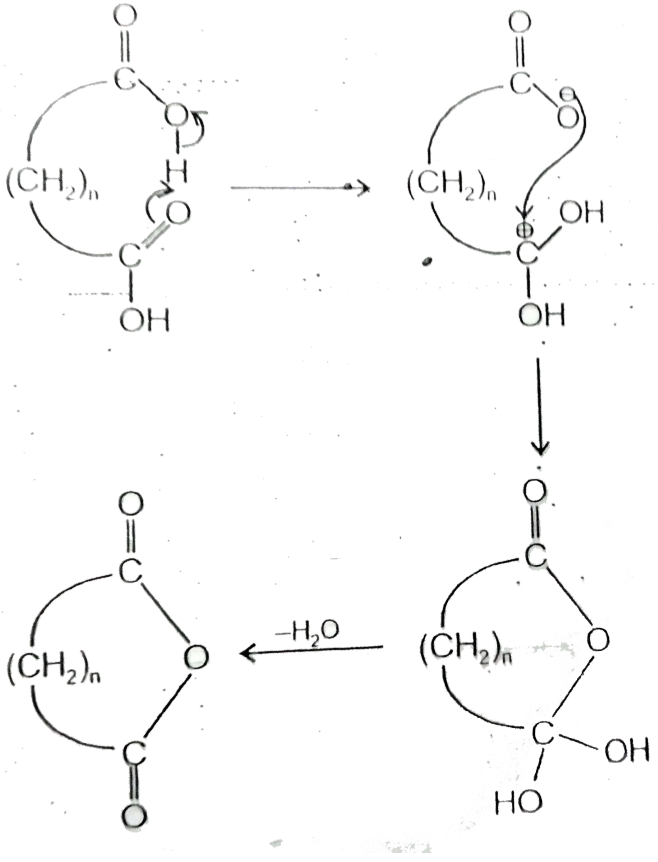
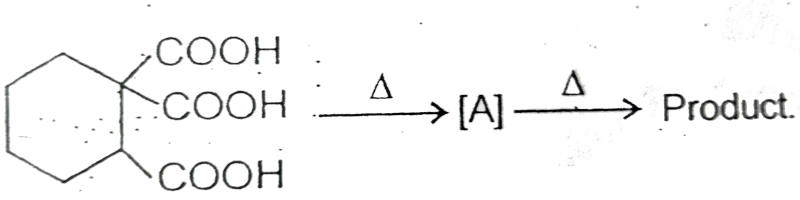
3. Certain dicarboxylic acids spontaneously eliminate water when heated forming cycioc anhydirides. But for the reaction to be successfully. The cyclic anhydrides product must normally have a ring size of fivee or six members. There are two important reasons, first, the second carboxyl group can serve as the acid catalyst (by intramolecular proton transfer), as well as the nucleophile. And second, the high temperature involved reduce the need for catalyst.

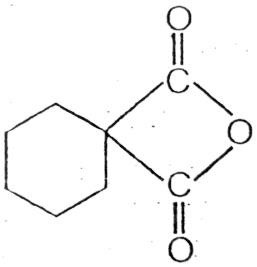


Consider the following sequence of reaction,

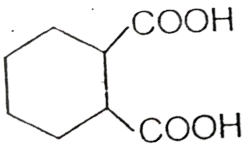


The final product of the reaction would be

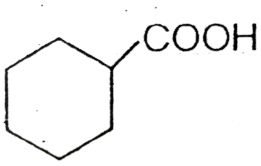
A.

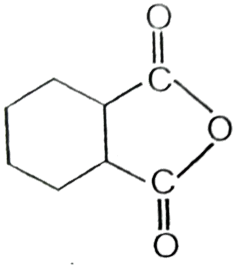


B.



C.





D.

Answer: D

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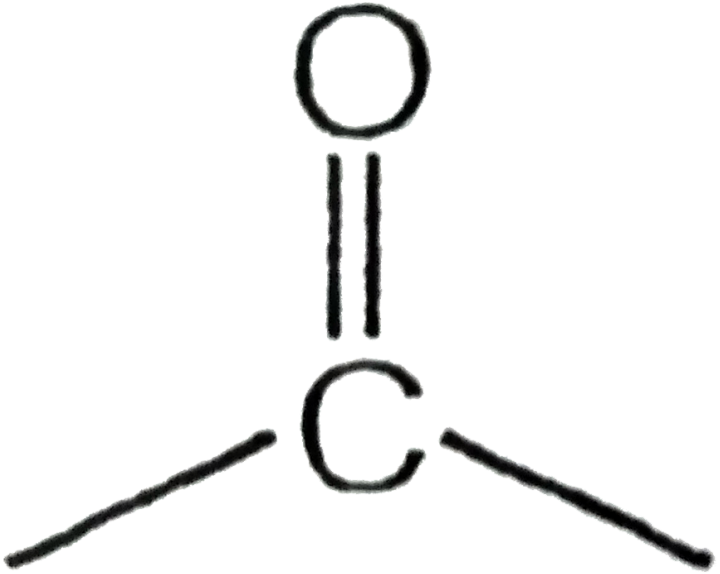
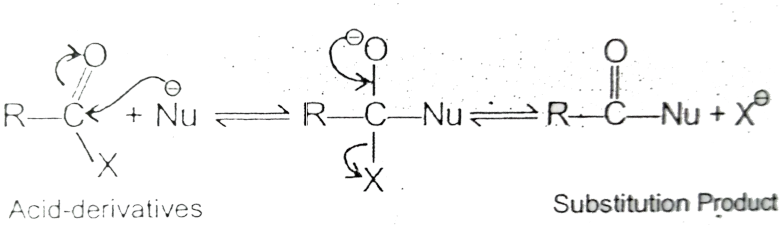
4. Both carbonyl compounds and acid derivatives though they contain



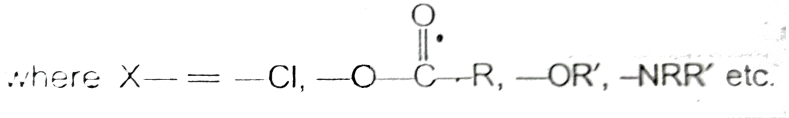
grouping yet

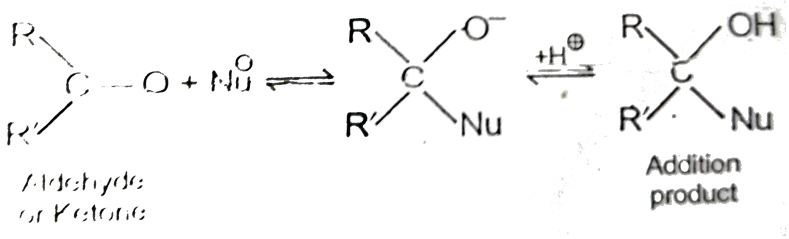
the reactions given by them are entirely different.

As Aldehydes and Ketones give addition product with a nucleophile, while carboxylic acid derivatives give nucleophilic acyl substitution through addition/elimination mechanism.



Where $X - = - Cl - O - \overset{O}{\overset{||}{C}} - R - OR, - NR(R)$ etc.





Why aldeydes and Ketones give nucleophilic addition reaction while acid derivatives prefer nucleophilic acyl substitititution reaction?

A. Carbonyl carbon of aldehyde and Ketones are more electron deficient than acid derivatives

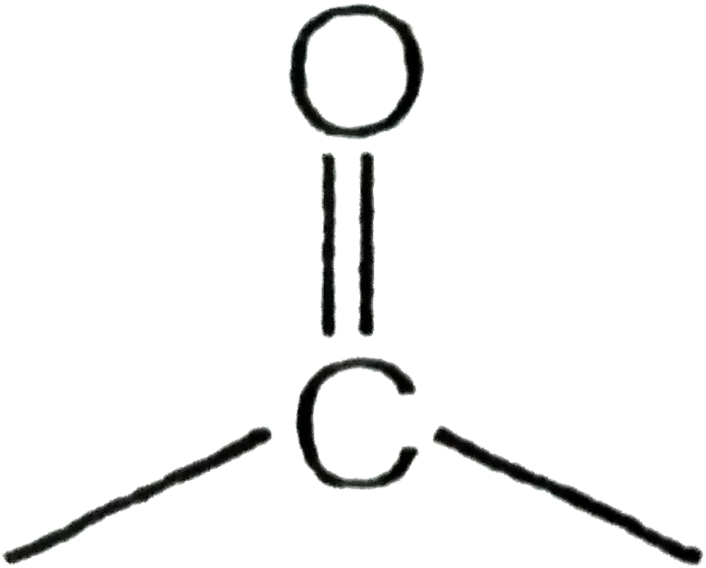
B. Carbonyl carbon of acid derivatives are more electron deficient.

C. Acid derivatives also give addition reaction

D. In acid derivatives, acyl carbon is connected with a good leaving group

Answer: D

5. Both carbonyl compounds and acid derivatives though they contain



grouping yet the reactions given by them are entirely different.

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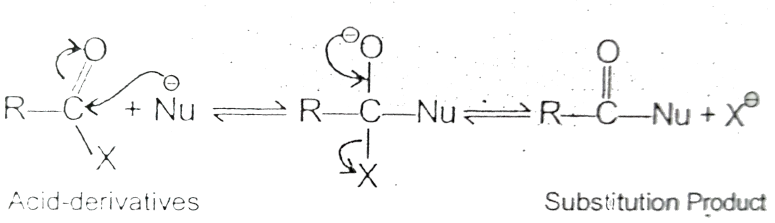
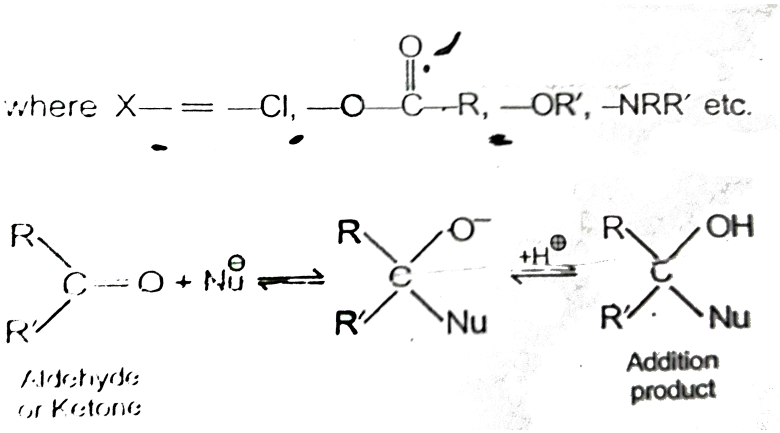
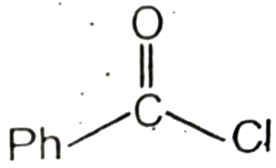


Where $X - = - Cl - O - \overset{\overset{O}{\|}}{C} - R - OR, - NR(R)$ etc.

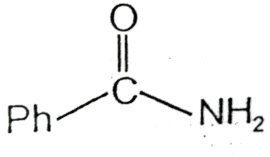


Which of the following is most reactive towards a nucleophile?

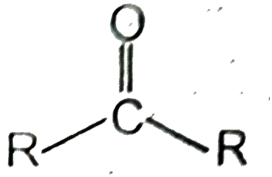
A.

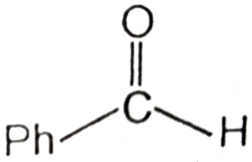


B.



C.





D.

Answer: A

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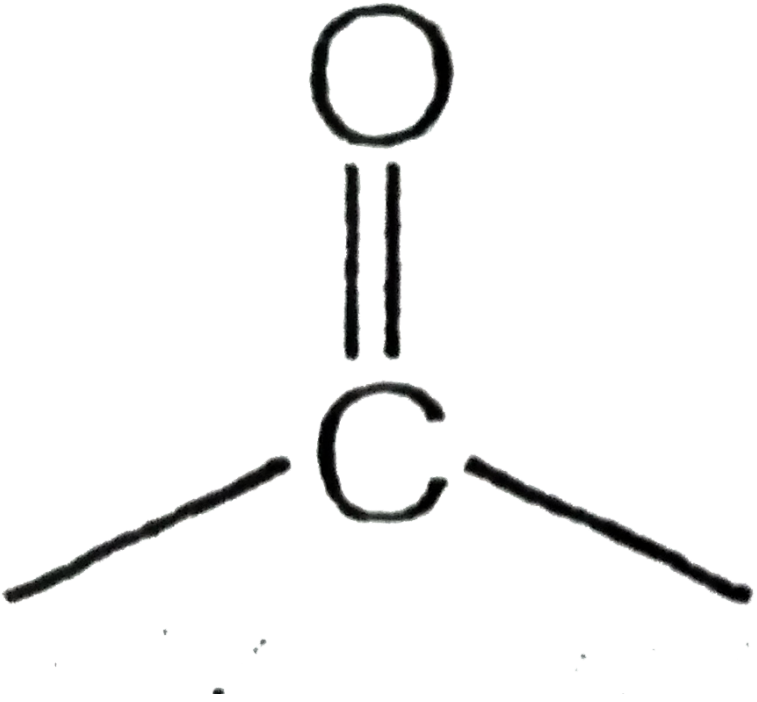
6. Both carbonyl compounds and acid derivatives though they contain



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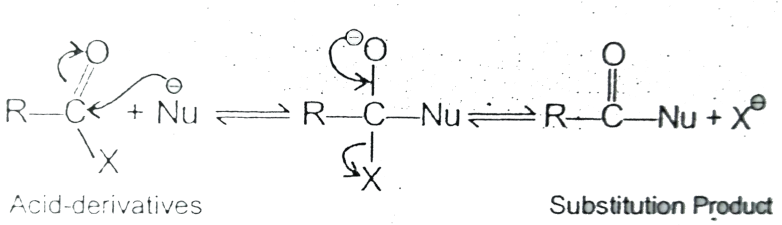
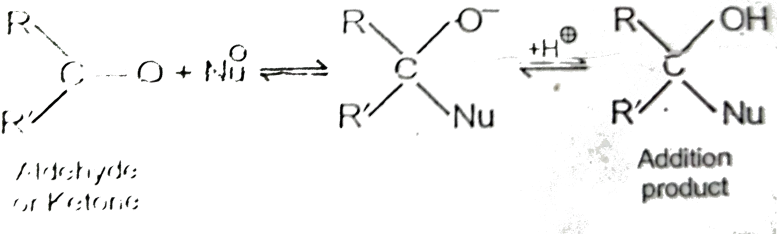
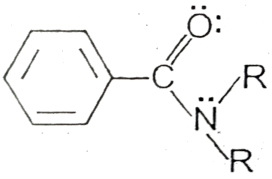


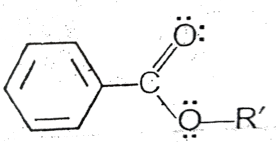
Where $X - = - Cl, - O - \overset{O}{\overset{||}{C}} - R, - OR, - N(R)R$ etc.

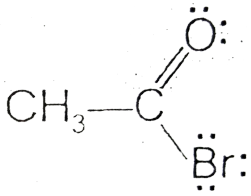


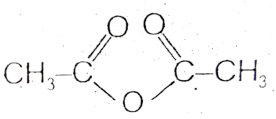
Carbonyl character is most supressed in



A.

B. 

C. 

D. 

Answer: A

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Assignment SECTION - E Assertion - Reason Type Questions)

1. Statement-1: Benzaldehyde gives negative Benedict's test

and

Statement-2: Aldehydes do not respond positively with Benedicts reagent.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-1

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: C

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2. Statement-1: When PhCHO is made to react in D_2O, deuterium in incorporated in product in Cannizzaro reaction.

and

Statement-2: In cannizzaro reaction transfer of hydride takes place from one molecule to other.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-2

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-2

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: D

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3. Statement-1: Ketones in presence of highly electropositive elements such as Na, Mg, Yield 1,2 diol or pinacol.

and

Satement-2: Electrons released by electropositive elements convert C=O group into radical anion.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-3

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-3

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: A

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4. Statement -1: Cyclohexanone on reaction with secondary amines yeilds Schiff's base.

and

Statement-2: The initial adduct lose water to generate product.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-4

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-4

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: D

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5. Statement-1: Methanoic acid reduces mercuric chloride to mercurous chloride on heating while ethanoic acid does not.

and

Statement-2: Methanoic acid is stronger acid then ethanoic acid.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-5

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-5

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: B

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6. Statement-1: Acetic acid does not undergo haloform test.

and

Statement-2: Acetic acid does not contain any α- hydrogen.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-6

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-6

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: C

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7. Statement-1: Decarboxylation of β- keto acid is very difficult

and

Statement-2: Decarboxylation takes place via a six membered cyclic transition state.

A. Statement-1 is True, Statement-2 is true, statement-2 is a correct explanation for statement-7

B. Statement -1 is true, Statement-2 is true, statement-2 is not a correct explanation for statement-7

C. Statement-1 is true, statement -2 is False

D. Statement-1 is False, Statement-2 is true

Answer: D

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Assignment (SECTION - F Matrix Match type Questions)

1. When B_2H_6 react withCl_2 it produce:

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2. When B_2H_6 react with O_2 and H_2O independently then product formed are:

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3. Molar conductance of 1M solution of weak acid HA is 20 $ohm^{-1}cm^2mol^{-1}$. Find % dissocation of HA:

$\left(\wedge_m^o\left(H^+\right)=350Scm^2mol^{-1}\right),\left(\wedge_m^o\left(A^-\right)=50Scm^2mol^{-1}\right)$

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4. The conductivity of 0.01 $molL^{-1}$KCl solution is 1.41×10^{-3} S cm^{-1}. What is the molar conductivity (Scm^2mol^{-1}) ?

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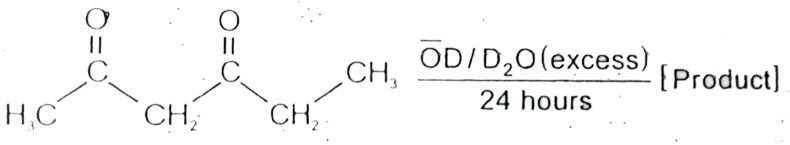
Assignment (SECTION -G Integer Answer Type Questions)

1. Consider the following reactions.



Molecular weight of the product would increase by

[Assuming that mol. Wt. of C=12, O=16, H=1 and D=2]

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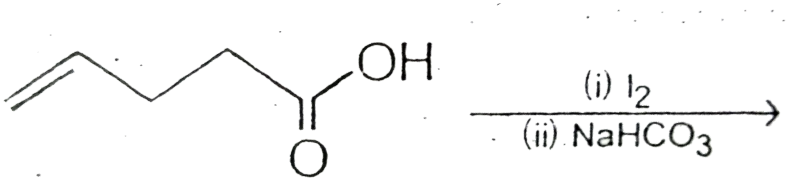
2. What would be the maximum number of atoms involved in the formation of newly constructed ring in the given reaction?



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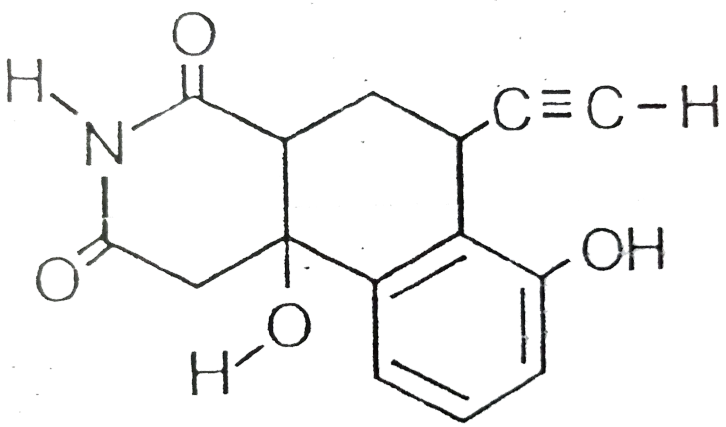
3. What is the net negative charge on the major product of the given species when it is treated with excess NaOH?



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Assignment (SECTION -H Multiple True-False Type Questions)

1. Statement -1: Acetophenone gives aldol condensation.

Statement-2: Benzaldehyde is more reactive than acetaldehyde towards nucleophilic addition.

Statement-3: Benzophenone has α-Hydrogens

A. TTT

B. FFF

C. TFF

D. TFT

Answer: C

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2. Statement-1: Formation of cyclic acetal is entropically favourable.

Statemen-2: PCC converts primary alcohol into aldehydes.

Statement-3: Aliphatic alcohols are practically insoluble in aqueous NaOH.

A. TTT

B. FFF

C. TFT

D. FTF

Answer: A

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Assignment (SECTION -I Subjective Type Questions)

1. Conductivity of 0.003 M sulphuric acid is $6.896 \times 10^{-5} \mathrm{S}\ cm^{-1}$. Calculate its molar conductivity and if $\wedge^{\circ} m$ for sulphuric acid is 490.5 Scm^2mol^{-1}, what is its dissociation constant?

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2. Calculate the degree of dissociation (alpha) of acetic acid if its molar conductivity is $39.05 Scm^2mol^{-1}$. Given $\lambda^{\circ}\left(H^{+}\right) = 349.6 S\ \ cm^2mol^{-1}$ and $\lambda^{\circ}\left(CH_3COO^{-}\right) = 40.9\ \mathrm{S}\ \ cm^2mol^{-1}$.

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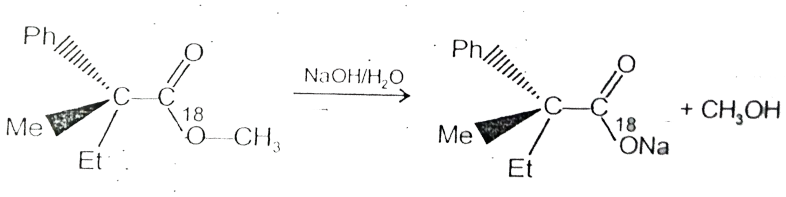
3. Propose mechanism for the given reaction:



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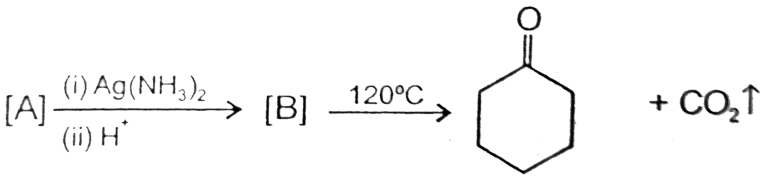
4. Supply the structures of A and B



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5. 10 g of glucose is dissolved in 150 g of water. The mass percentage of glucose is :

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6. The molar conductivity of acetic acid solution at infinite dilution is 390.7 $\Omega^{-1}cm^2mol^{-1}$. Calculate the molar conductivity of 0.01M acetic acid solution, given that the dissociation of acetic acid is 1.8×10^{-5}.

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7. The conductivity of a 0.01 M solution of acetic acid at 298 k is $1.65 \times 10^{-4} Scm^{-1}$. Calculate molar conductivity $(\wedge_m)$ of the solution.

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8. If 50ml of 0.2 M KOH is added to 40 ml of 0.05 M HCOOH, the pH of the resulting solution is ($K_a = 1.8 \times 10^{-4}$)

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9. Convert into moles:

22g of carbon dioxide.

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10. Convert 48g of oxygen gas into moles:

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Assignment (SECTION -J Akash challengers Questions)

1. Draw the Structure for 1-Chloro-2,4-dinitrobenzene

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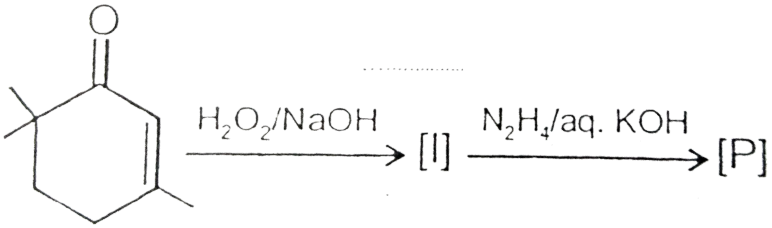
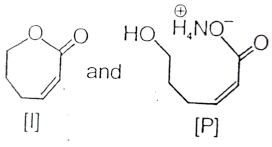
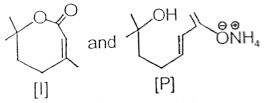
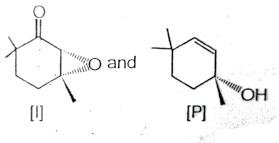
2. Consider the following sequence of reactions:

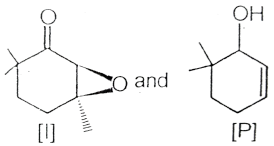


Intermediate [I] and corresponding major product [P] in the given reactions are

A. 

B. 

C. 

D. 

Answer: C

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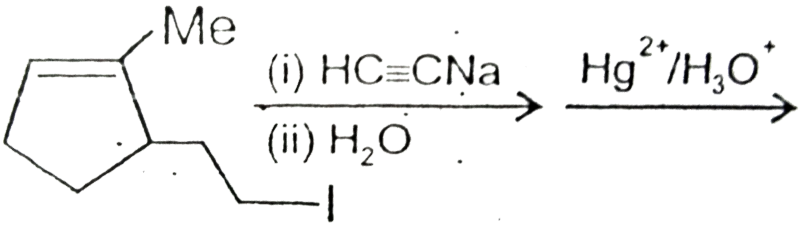
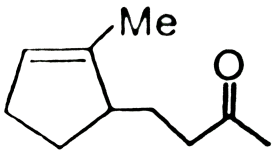
3. Consider the following sequences of reactions.

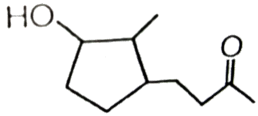


Major product would be

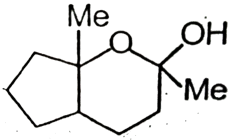
A.



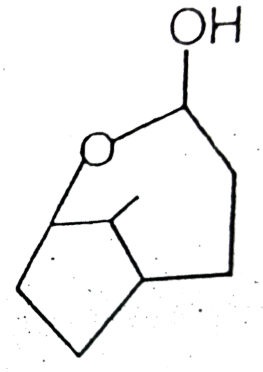
B.



C.



D.



Answer: C

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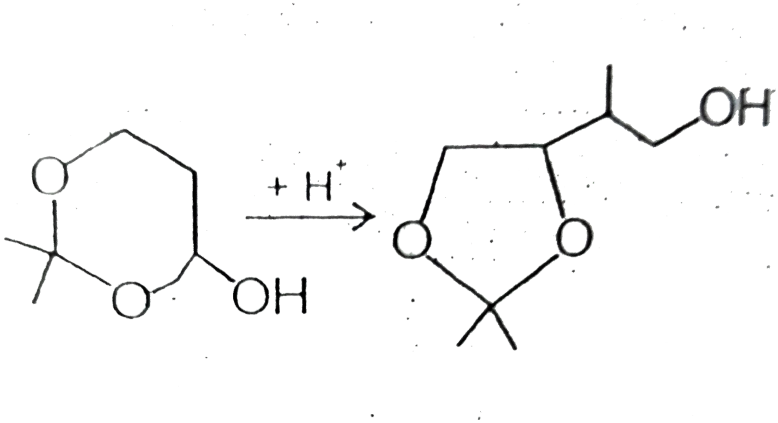
4. Draw a stepwise mechanism for the following reaction



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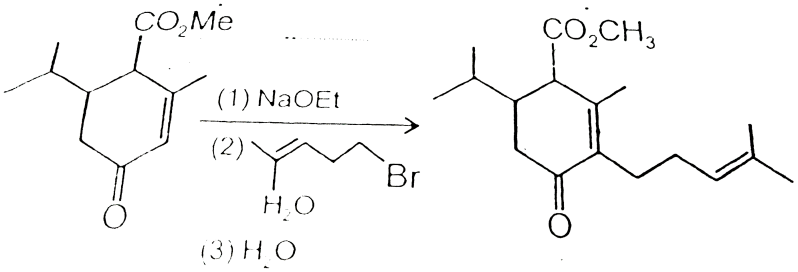
5. Draw a mechanism for the following reaction.



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6. The number of nitrogen atoms in 21 g of nitrogen are: (Molecular Weight of Nitrogen =14 g/mole)

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7. Calculate the number of molecules in 33 g of CO_2.

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8. Calculate the number of molecules in 44 g of CO_2.

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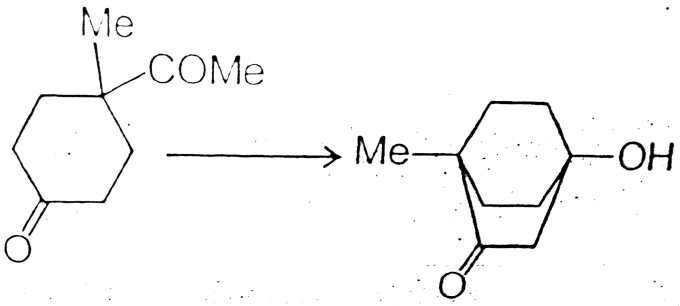
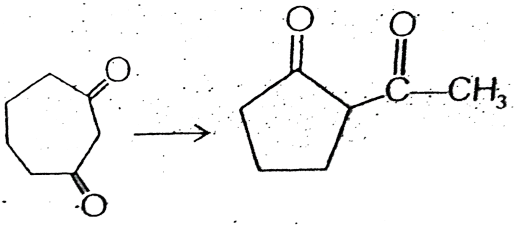
9. Suggest mechanisms for the following reactions which are catalyzed by strong base:

(i)



(ii)



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10. PhCOEt+Mg $\rightarrow$ Ether

The number of stereoisomers shown by the product of the following reaction would be:

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Try Yourself

1. The number of molecules in 16g of methane is:

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2. Write the structures of the following compounds

(i) 4-chloropentn-2-one

(ii) p-Nitropropiophenone

(iii) 3-Methylbutanal

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

(v) p-Methoxy benzaldehyde

(vi) o,o'-Dichlorobenzophenone

(vii) Penta-1,4-dien-3-one

(viii) 2-Methyyl-4-oxohexanal

(ix) Cyclohex-2-en-1-one

(x) Pentan-2,4-dione

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3. Give chemical equations and name the main product formed when

(i) Ethyl alcohol is mixed with air and passed over Ag catalyst at 520 K.

(ii) Benzoyl chloride is treated with lithium tri-tert-butoxy aluminium hydride.

(iii) Isoprophlidene chloride is treated with caustic potash.

(iv) Methylmagnesium iodide is treated with HCN and the resultant product is hydrolysed.

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4. What are the products formed by reductive ozonolysis of penta-1,3-diene?

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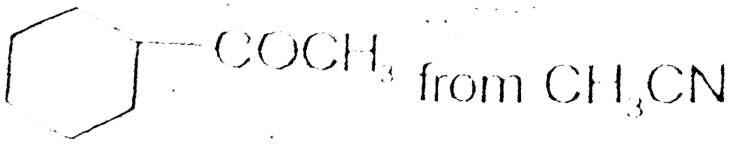
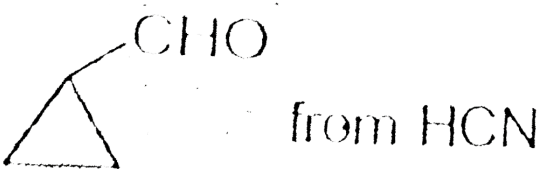
5. Give chemical equations for following conversions:

(i) Propanal from allyl alcohol





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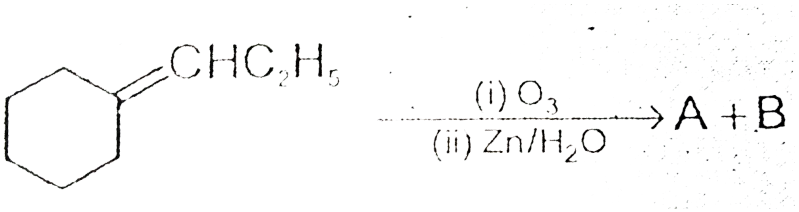
6. Identify unknown compounds A to E in the following series of chemical reactions.

(i)



(ii) $A + B \xrightarrow{\text{dil NaOH}} C + H_2O$

(iii) $C \xrightarrow[(ii)\ Zn/H_2O]{(i)\ O_3} A + D$

(iv) $D \xrightarrow[\Delta]{H_2/Ni} E$

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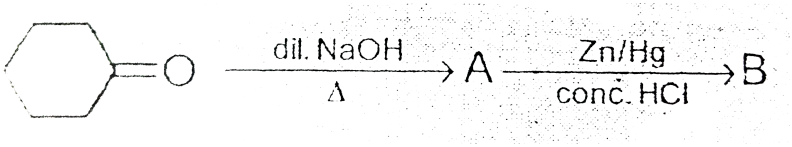
7. Complete the reaction



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8. Complete the following reactions and identify A, B and C,

(i) $A + H_2(g) \xrightarrow{Pd/BaSO_4} (CH_3)_2CH - CHO$

(ii) $CH_3 - \overset{\overset{H_3C}{|}}{\underset{\underset{CH_3}{|}}{C}} - \overset{\overset{O}{||}}{C} - CH_3 + NaOI \rightarrow B + C$

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9. An organic compound [A] with molecular formula $C_5H_8O_2$ is reduced to n-pentane on treatment with $Zn - Hg/HCl$. The compound [A] forms a dioxime with hydroxyl amine and give a positive

iodoform test and Tollen's test. Identify the compound [A] and deduce its structure?

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10. Write reactions and conditions to bring about the following conversions.

(i) Toluene to benzaldehyde

(ii) Calcium formate to urotropin

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11. How can we distinguish chemically the following pairs of compounds?

(i) CH_3CHO and CH_3COCH_3

(ii) CH_3CHO and C_6H_5CHO

(iii) $C_6H_5COCH_3$ and $C_6CH_5COC_6H_5$

(iv) CH_3CHO and CH_3CH_2CHO

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12. How can you perform the following conversions?

Cyclohexanol to Cyclohexanone

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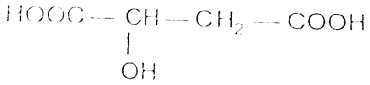
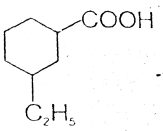
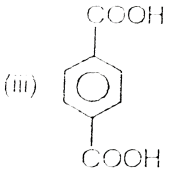
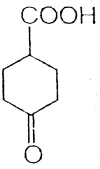
13. Give IUPAC names of the following compounds.

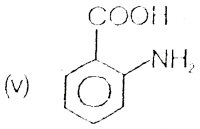
(i) $HOOC - \underset{\underset{OH}{|}}{CH} - CH_2$

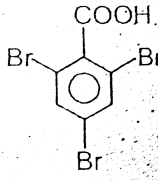
(i) 

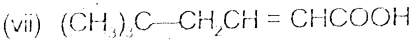
(ii) 

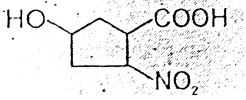
(iii) 

(iv) 

(v) 

(vi) 

(vii) 

(viii) 

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14. At STP 5.6 "litre" of a gas weigh 8 g. The vapour density of gas is:

A. 32

B. 40

C. 16

D. 8

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15. A compound [A] of molecular formula C_4H_9Br yields a compound [B] of molecular formula $C_4H_{10}O$ when reated with aqueous $NaOH$. On oxidation [B] gives a ketone [C]. The vigorous oxidation of ketone gives ethanoic acid. Deduce the structure of A, B and C.

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16. Calculate the frequency of a photon, having energy 41.25 eV. $\left(h = 6.6 \times 10^{-34} Js\right)$.

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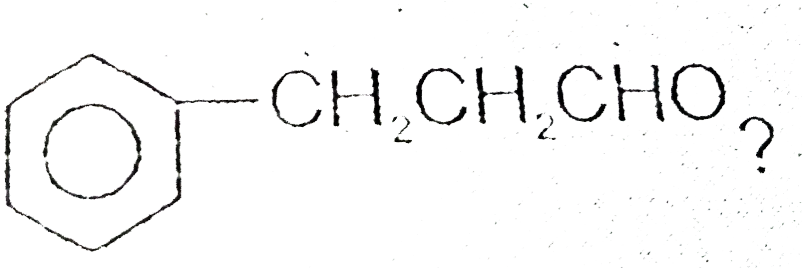
17. How will you convert benzene into



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18. Arrange the following in decreasing order of nucleophilic addition

$CH_3CHO, CH_3COCH_3, HCHO, C_2H_5COCH_3$

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19. The activation energies of the forward and backward reactions in the case of a chemical reaction are 30.5 and 45.4kJ/mol respectively. The reaction is:

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20. Ethyl alcohol is heated with conc. $H_2SO_4 at 170^\circ C$. The product formed is:

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