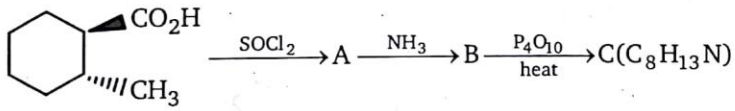
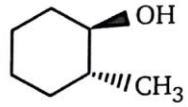
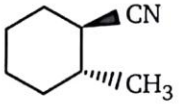
9 CARBOXYLIC ACID AND THEIR DERIVATIVES

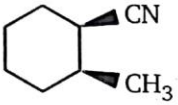
LEVEL-1

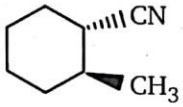
1. Identify C in the following sequence of reactions :



(a) 

(b) 

(c) 

(d) 

2. Saponification (basic hydrolysis) of $C_6H_5C(=O)CH_3$ will yield :

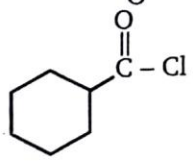
[◍ = mass – 18 isotope of oxygen]

(a) $C_6H_5-\overset{\overset{O}{\|}}{C}-◍^- + H◍CH_3$

(b) $C_6H_5-\overset{\overset{O}{\|}}{C}-O^- + H◍CH_3$

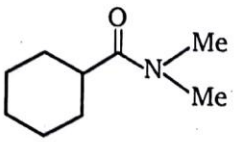
(c) $C_6H_5\overset{\overset{O}{\|}}{C}O^- + H◍^-$

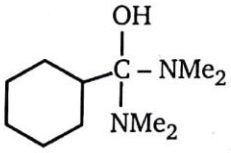
(d) $C_6H_5\overset{\overset{◍}{\|}}{C}O^- + HOCH_3$

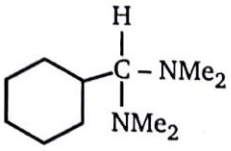
3. 

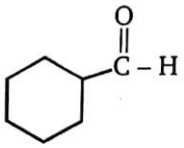
$\xrightarrow[0°C,\ 2h]{Me_2NH}$ (X) 86-89% (yield); (3 equivalent)

Product (X) of the reaction is :

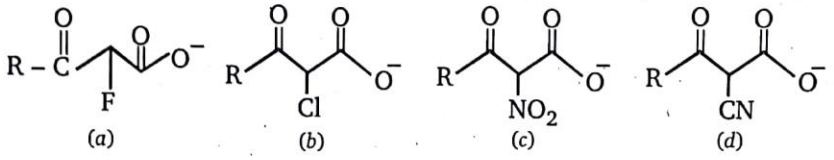
(a) 

(b) 

(c) 

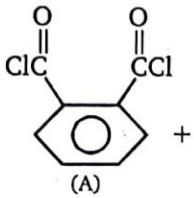
(d) 

4. Which of the following is the correct order of decarboxylation of β-keto carboxylate anion ?



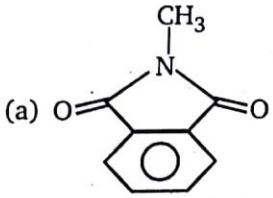
(a) (b) (c) (d)

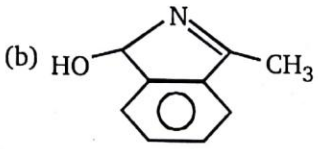
(a) $a > b > c > d$ (b) $c > d > a > b$ (c) $c > d > b > a$ (d) $d > c > a > b$

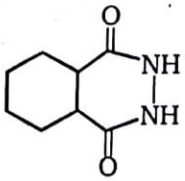
5. 

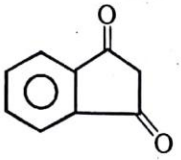
(A)

$+ CH_3 - NH_2 \longrightarrow$ Product of the reaction is :

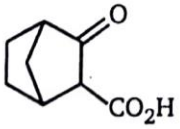
(a) 

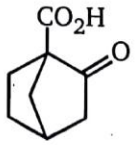
(b) 

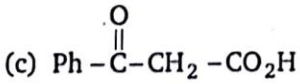
(c) 

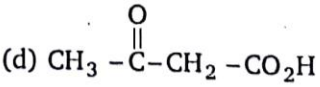
(d) 

6. Which β-keto acid shown will not undergo decarboxylation ?

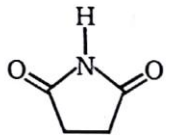
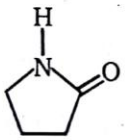
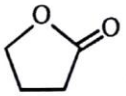
(a) 

(b) 

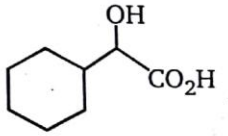
(c) 

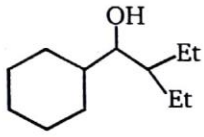
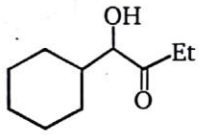
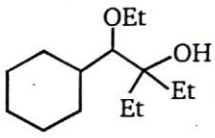
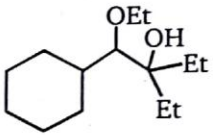
(d) 

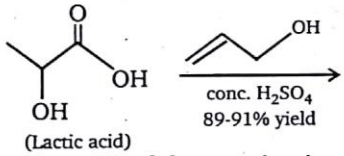
7. Choose the response that matches the correct functional group classification with the following group of structural formulas.

(a) Anhydride	Lactam	Lactone
(b) Lactam	Imide	Lactone
(c) Imide	Lactone	Anhydride
(d) Imide	Lactam	Lactone

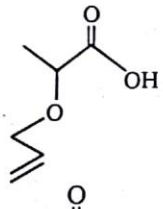
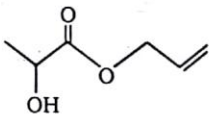
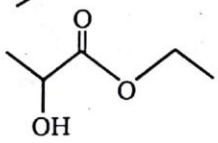
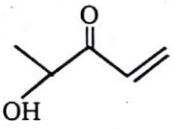
8.  ; Product (*P*) of the reaction is :

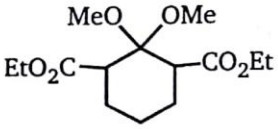
(a) 
(b) 
(c) 
(d) 

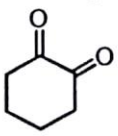
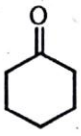
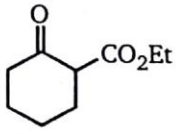
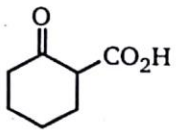
9. 

(Lactic acid)

Product (X) of the reaction is :

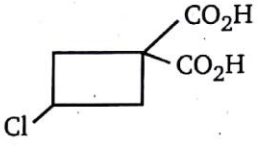
(a) 
(b) 
(c) 
(d) 

10.  , Product (*A*) obtained is :

(a) 
(b) 
(c) 
(d) 

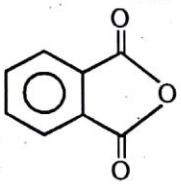
11. Which of the following acid on heating gives geometrical isomers as a product ?

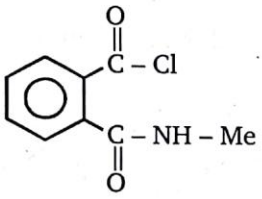
(a) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CO_2H$

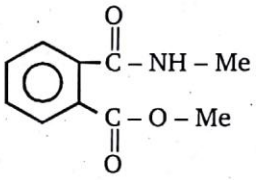
(b) 

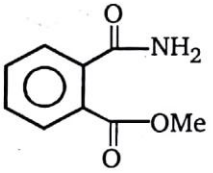
(c) $CH_3-\underset{\displaystyle OH}{\underset{|}{CH}}-CH_2-CO_2H$

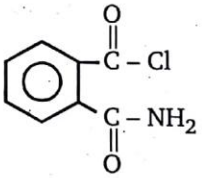
(d) All of these

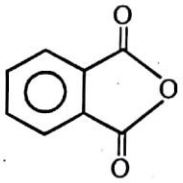
12.  $\xrightarrow{MeOH} A \xrightarrow{PCl_3} B \xrightarrow{MeNH_2} C$; Product (C) of the reaction is :

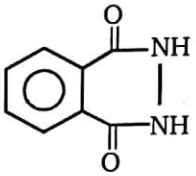
(a) 

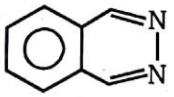
(b) 

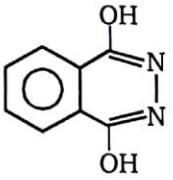
(c) 

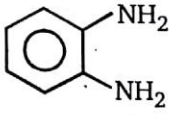
(d) 

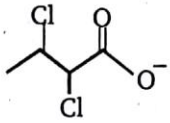
13.  $\xrightarrow{LiAlH_4} A \xrightarrow{PCC} B \xrightarrow{NH_2-NH_2} C$, Product (C) is :

(a) 

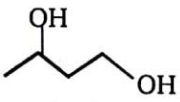
(b) 

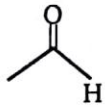
(c) 

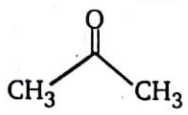
(d) 

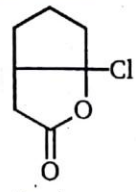
14.  $\xrightarrow{-CO_2} A \xrightarrow{HCl} B \xrightarrow{\text{aq KOH}} C$. Product ($C$) is :

(a) $CH_3-CH_2-\overset{\displaystyle O}{\overset{\|}{C}}-H$

(b) 

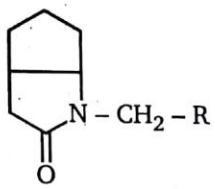
(c) 

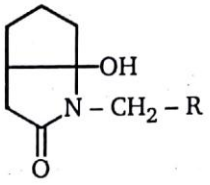
(d) 

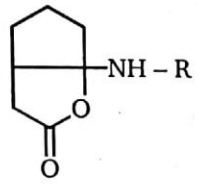
15. 

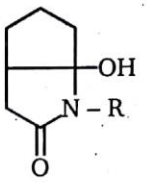
$+R-CH_2-NH_2 \xrightarrow[THF]{K_2CO_3} (A)$ (71%)

In above reaction identify major product (*A*) of the reaction:

(a) 

(b) 

(c) 

(d) 

16. An optically active compound '*X*' has molecular formula $C_4H_8O_3$. It evolves CO_2 with $NaHCO_3$. '*X*' reacts with $LiAlH_4$ to give an achiral compound. '*X*' is :

(a) $CH_3CH_2\underset{\underset{OH}{|}}{C}HCOOH$

(b) $CH_3\underset{\underset{Me}{|}}{C}HCOOH$

(c) $CH_3\underset{\underset{CH_2OH}{|}}{C}HCOOH$

(d) $CH_3CH\underset{\underset{OH}{|}}{C}H_2COOH$

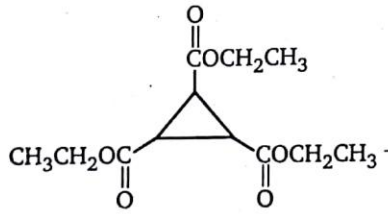
17. $CH_3-\overset{\overset{O}{\|}}{C}-O-CH_2-CH_3 + H-\bullet^- \longrightarrow$ ($\bullet = O^{18}$) One of the product of the reaction is :

(a) $CH_3-\overset{\overset{O}{\|}}{C}-O-H$

(b) $CH_3-CH_2-\bullet-H$

(c) $CH_3-\overset{\overset{O}{\|}}{C}-\bullet^-$

(d) $CH_3-CH_2-\bullet^-$

18. 

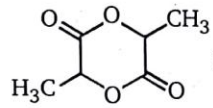
$\xrightarrow{KOH} \xrightarrow{H_3O^+} \xrightarrow{PCl_5} \xrightarrow{LiAlH_4} \xrightarrow{H^+/\Delta} (X)$

Product (X) is :

(a)  (b)  (c)  (d) 

19. Identify final product in the following reaction;

$$CH_3CHCOOH \xrightarrow{\Delta} \text{Product}$$
$$\quad\;\; OH$$

(a)  (b) $CH_2 = CHCO_2H$ (c) $CH_3-\overset{O}{\overset{\|}{C}}CO_2H$ (d) CH_3CH_2OH

20. Select the final product from this sequence of reactions.

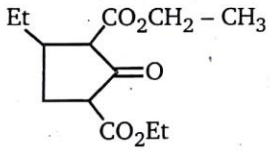
Acetoacetic ester $\xrightarrow{NaOEt}$ $\xrightarrow{CH_3I}$ $\xrightarrow{NaOEt}$ $\xrightarrow{CH_3CH_2CH_2Br}$

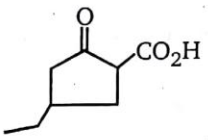
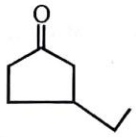
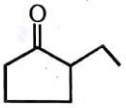
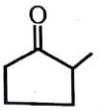
(a) $H_3C-\overset{O}{\overset{\|}{C}}-\overset{CH_3}{\overset{|}{C}}-COOC_2H_5$ with $CH_2CH_2CH_3$ on the central C

(b) $H_3C-\overset{CH_3}{\overset{|}{C}}-CH_2COOC_2H_5$ with $CH_2CH_2CH_3$ on the central C

(c) $H_3C-\overset{H}{\overset{|}{C}}-CH_2COOC_2H_5$ with $CH_2CH_2CH_3$ on the central C

(d) $CH_3CO-\overset{CH_3}{\overset{|}{C}}-CH_2COOC_2H_5$ with CH_3 on the central C

21.  $\xrightarrow[\text{heat}]{H_2O,\ H_2SO_4}$ (*A*) ; Product (*A*) will be :

(a)  (b)  (c)  (d) 

22. $CH_2(CO_2Me)_2 + ? \xrightarrow[\text{(ii) AcOH}]{\text{(i) Na}} CH(CO_2Me)_3$

Which of the following reactants will complete the above reaction ?

(a) $CH_2(CO_2Me)_2$ (b) $(CO_2Me)_2$

(c) $Cl-CO_2Me$ (d) $COCl_2$

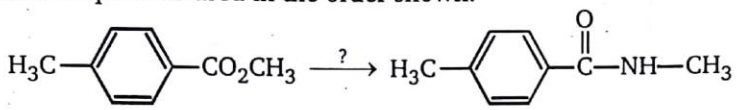
23. Arrange the following in order of increasing reactivity (least ⟶ most) towards nucleophile

$CH_3\overset{O}{\overset{\|}{C}}OCHCH_3$ (1) $\quad$ $CH_3\overset{O}{\overset{\|}{C}}Cl$ (2) $\quad$ $CH_3\overset{O}{\overset{\|}{C}}NHCH_3$ (3)

(a) 1 < 2 < 3 (b) 3 < 1 < 2

(c) 1 < 3 < 2 (d) 2 < 1 < 3

24. Choose the best sequence of reactions for transformation given. Semicolons indicate separate reaction steps to be used in the order shown.



(a) H_3O^+; $SOCl_2$; CH_3NH_2

(b) HO^-/H_2O; PBr_3; Mg; CO_2; H_3O^-; $SOCl_2$; CH_3NH_2

(c) $LiAlH_4$; H_2O; HBr; Mg; CO_2; H_3O^+; $SOCl_2$; CH_3NH_2

(d) None of these would yield the desired product

25. A key step in the hydrolysis of acetamide in aqueous acid proceeds by nucleophilic addition of :

(a) H_3O^+ to $CH_3\overset{\overset{O}{\|}}{C}NH_2$

(b) H_2O to $CH_3\overset{\overset{+OH}{\|}}{C}NH_2$

(c) H_3O^+ to $CH_3\overset{\overset{+OH}{\|}}{C}NH_2$

(d) HO^- to $CH_3\overset{\overset{+OH}{\|}}{C}NH_2$

26. Which reaction is not possible for acetic anhydride ?

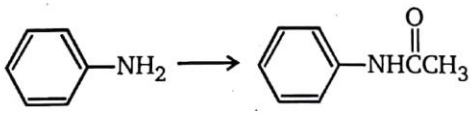
(a) $(CH_3\overset{\overset{O}{\|}}{C})_2O + 2HN(CH_3)_2 \longrightarrow CH_3\overset{\overset{O}{\|}}{C}N(CH_3)_2 + CH_3CO_2^- + H_2\overset{+}{N}(CH_3)_2$

(b) $(CH_3\overset{\overset{O}{\|}}{C})_2O + CH_3CH_2OH \longrightarrow CH_3\overset{\overset{O}{\|}}{C}OCH_2CH_3 + CH_3CO_2H$

(c) $(CH_3\overset{\overset{O}{\|}}{C})_2O + C_6H_6 \xrightarrow{AlCl_3} CH_3\overset{\overset{O}{\|}}{C}C_6H_5 + CH_3CO_2H$

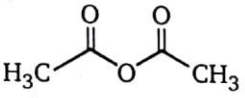
(d) $(CH_3\overset{\overset{O}{\|}}{C})_2O + NaCl \longrightarrow CH_3\overset{\overset{O}{\|}}{C}Cl + CH_3CO_2^-Na^+$

27. All but one of the following compounds react with aniline to give acetanilide. Which one does not?

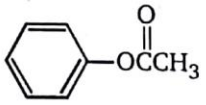


Aniline Acetanilide

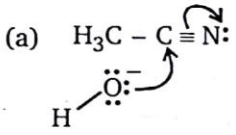
(a) $CH_3\overset{\overset{O}{\|}}{C}—Cl$

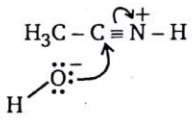
(b) 

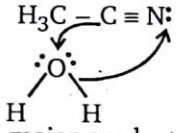
(c) $CH_3\overset{\overset{O}{\|}}{C}—H$

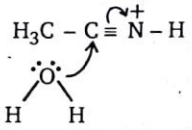
(d) 

28. Which of the following best describes the nucleophilic addition step in the acid-catalyzed hydrolysis of acetonitrile (CH_3CN) ?

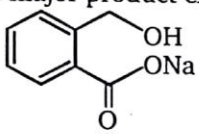
(a) 

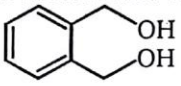
(b) 

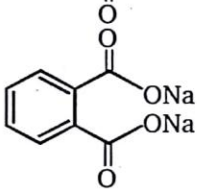
(c) 

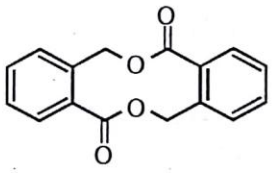
(d) 

29. The major product expected, when Phthalamide is treated with NaOH, is :

(a) 

(b) 

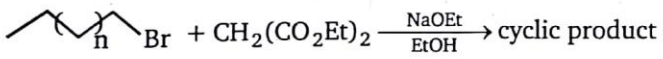
(c) 

(d) 

30. Which of following acid remains unaffected on heating ?

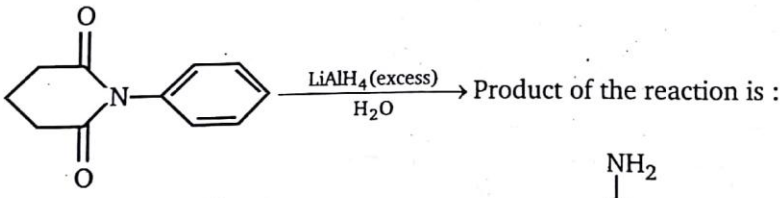
(a) malonic acid (b) maleic acid

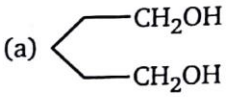
(c) Fumaric acid (d) Succinic acid

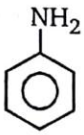
31. 

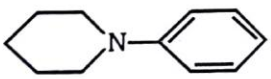
At which value of n the formation of six membered ring takes place ?

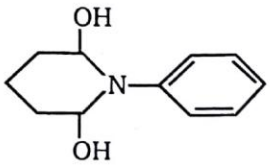
(a) $n = 2$ (b) $n = 3$ (c) $n = 5$ (d) $n = 6$

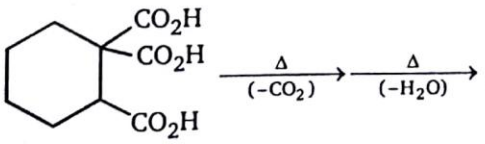
32. 

(a) 

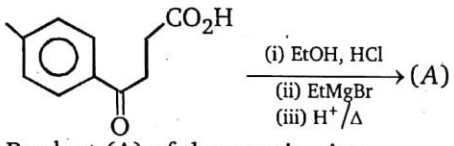
(b) 

(c) 

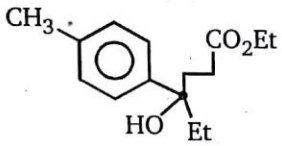
(d) 

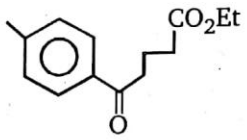
33. 

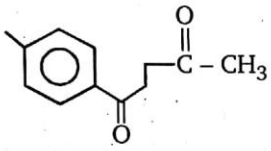
(a) *cis*-anhydride
(b) *trans*--anhydride
(c) both (a) & (b)
(d) mono-basic acid

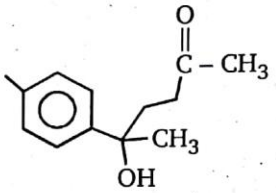
34. 

Product (A) of the reaction is :

(a) 

(b) 

(c) 

(d) 

35. $CH_2-O-COR$ / $CH-O-COR_2$ / $CH_2-O-COR_3$ $+ 3NaOH \longrightarrow (A)$ + Salt of fatty acid (soap)

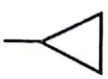
Product (*A*) of the reaction is :
(a) Ethylene glycol
(b) Glycerol
(c) Glyceryltrinitrate (explosive)
(d) Cumene hydrogen peroxide

36. $CH_3-\underset{\underset{(d)}{Et}}{CH}-OAc \xrightarrow{HO^-}$ Product of the reaction is :
(d=dextro rotatory)

(a) $CH_3-\underset{(d)}{\overset{Et}{\overset{|}{CH}}}-OH$ (b) $CH_3-\underset{\underset{(l)}{Et}}{\overset{|}{CH}}-OH$ (c) $CH_3-\underset{\underset{(d)\ \&\ (l)}{Et}}{\overset{|}{CH}}-OH$ (d) $CH_3-\underset{CH_3}{\overset{|}{C}}=CH_2$

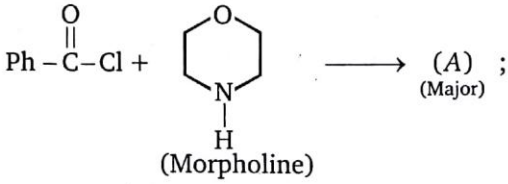
37. $Ph-CH=CH-\overset{O}{\overset{\|}{C}}-O-H \xrightarrow[(ii)\ NH_2]{(i)\ SOCl_2} (A)$; Product (*A*) of the reaction is :

(a) $Ph-CH=CH-\overset{O}{\overset{\|}{C}}-CH_2-NH$ 

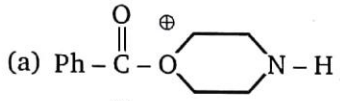
(b) $Ph-CH=CH-\overset{O}{\overset{\|}{C}}-NH$ 

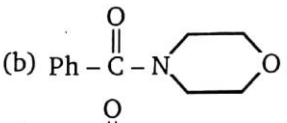
(c) $Ph-CH=CH-\overset{O}{\overset{\|}{C}}-H$

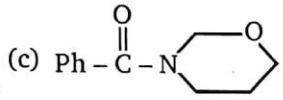
(d) $Ph-CH=CH-NH$ 

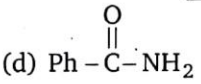
38.  ; Identify the product (*A*).

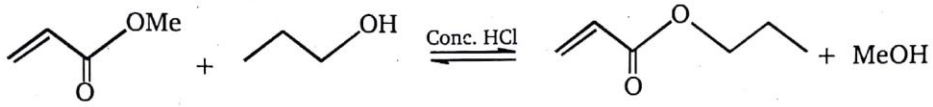
(Morpholine)

(a) 

(b) 

(c) 

(d) 

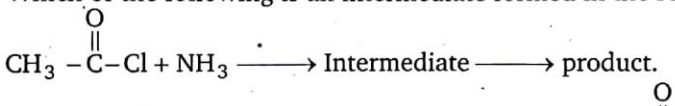
39. 

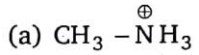
Above reaction is an example of :

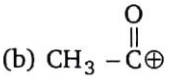
(a) Esterification (b) Saponification

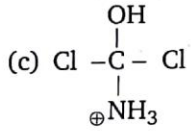
(c) Hydrolysis (d) Trans Esterification

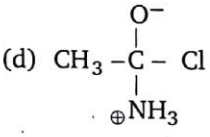
40. Which of the following is an intermediate formed in the reaction shown below ?

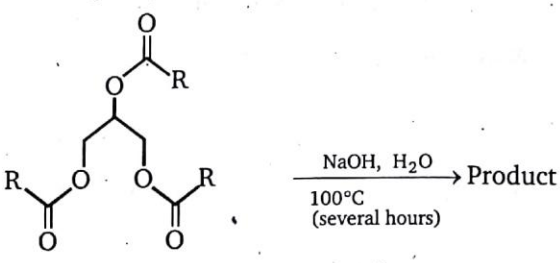


(a) 

(b) 

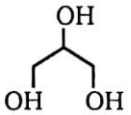
(c) 

(d) 

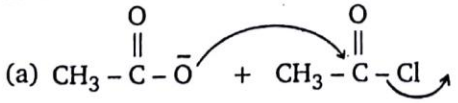
41. 

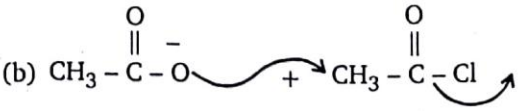
(Principal component of coconut oil.)

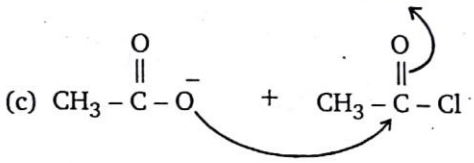
Product is obtained in the above reaction is :

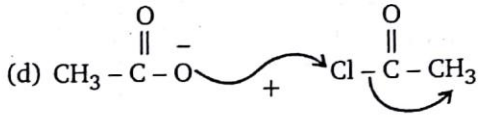
(a) $R-CO_2Na$ (b)  (c) Both (a) and (b) (d) None of these

42. The reaction of sodium acetate with acetyl chloride proceeds through which of the following mechanisms ?

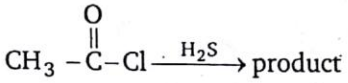
(a) 

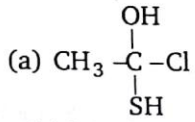
(b) 

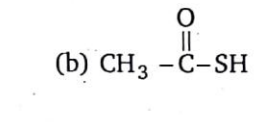
(c) 

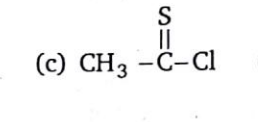
(d) 

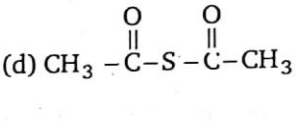
43. Which is the major product of the following reaction ?



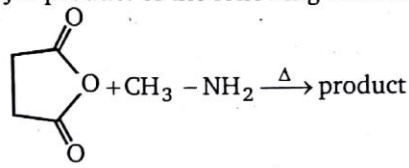
(a) 

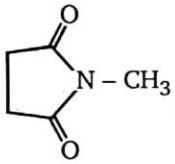
(b) 

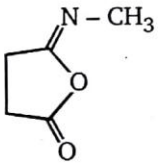
(c) 

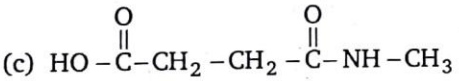
(d) 

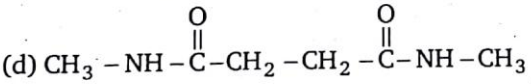
44. Which is the major product of the following reaction ?



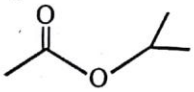
(a) 

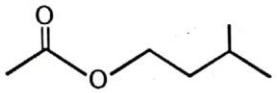
(b) 

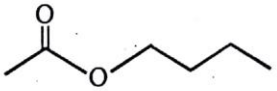
(c) 

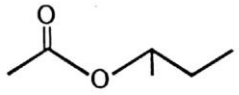
(d) 

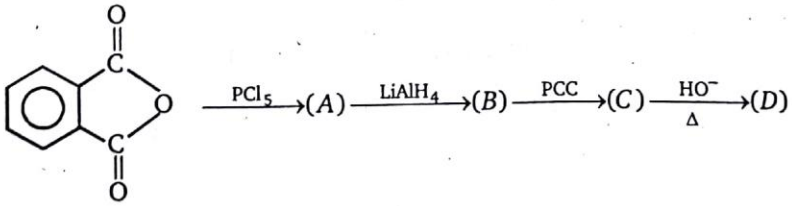
45. Ethanoic acid + 3-methyl-1-butanol  (*A*); Compound (*A*) is :

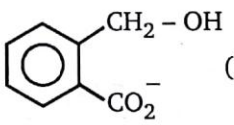
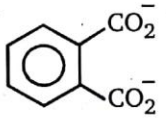
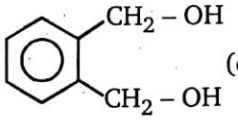
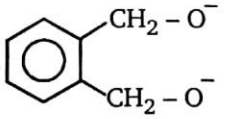
(a) 

(b) 

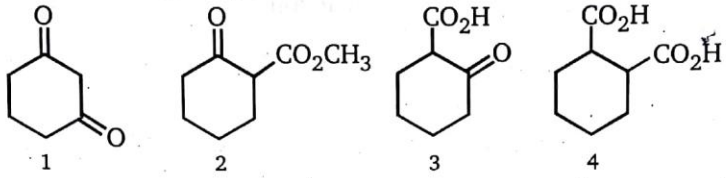
(c) 

(d) 

46. 

(a)  (b)  (c)  (d) 

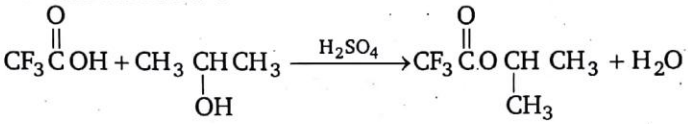
47. Which of the following compounds will undergo decarboxylation on heating ?

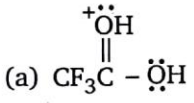
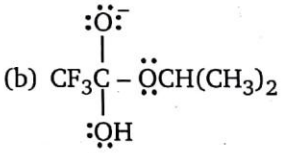


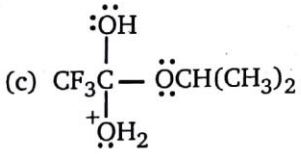
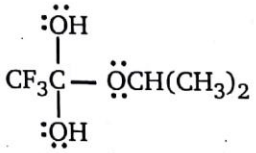
1 2 3 4

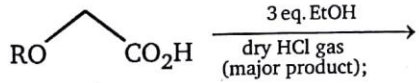
(a) 2 and 3 (b) 3 and 4 (c) 3 only (d) 1 and 4

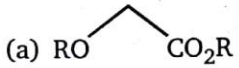
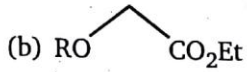
48. Which one of the following is not an intermediate in the generally accepted mechanism for the reaction shown below ?

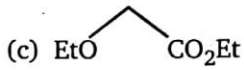
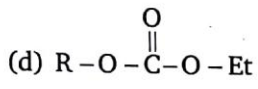


(a)  (b) 

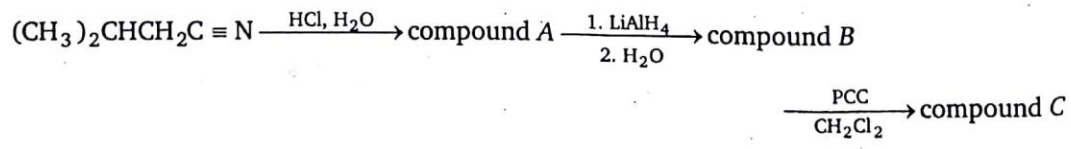
(c)  (d) 

49.  (*A*); Product *A* is :

(a)  (b) 

(c)  (d) 

50. Identify the compound *C* in the following sequence :



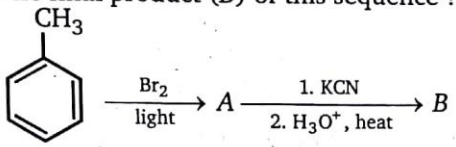
(a) $(CH_3)_2CHC(=O)CH_3$

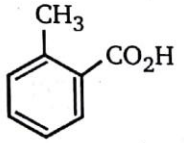
(b) $(CH_3)_2CHCH_2C(=O)OH$

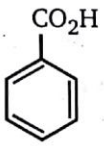
(c) $(CH_3)_2CHCH_2C(=O)H$

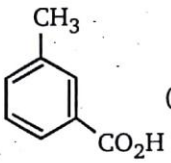
(d) $(CH_3)_2CHC(=O)CH_2OH$

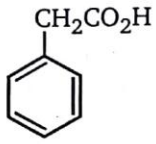
51. What is the final product (*B*) of this sequence ?



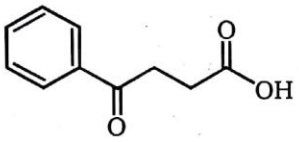
(a) 

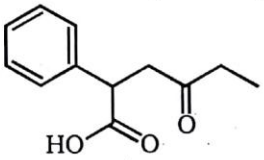
(b) 

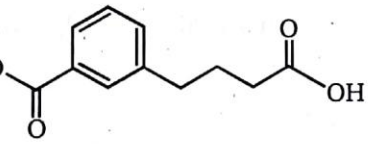
(c) 

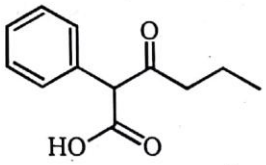
(d) 

52. Which of the following undergoes decarboxylation most readily on being heated ?

(a) 

(b) 

(c) 

(d) 

53. What is compound *Z* ?

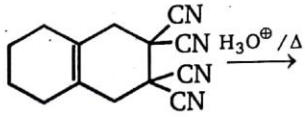
$$CH_3CH_2CH_2Br \xrightarrow{NaCN} X \xrightarrow[heat]{H_3O^+} Y \xrightarrow[H^+]{CH_3CH_2OH} Z$$

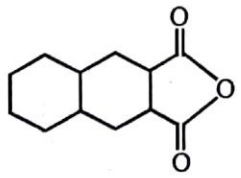
(a) $CH_3CH=CHC(=O)OH$

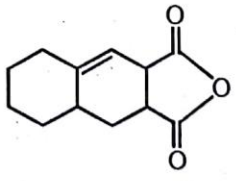
(b) $CH_3CH_2CH_2CH=NOCH_2CH_3$

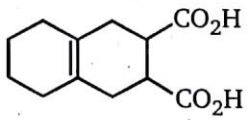
(c) $CH_3CH_2CH_2CH(OCH_2CH_3)_2$

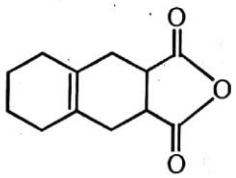
(d) $CH_3CH_2CH_2C(=O)OCH_2CH_3$

54.  $\xrightarrow{H_3O^{\oplus}/\Delta}$ (*A*); Product (*A*) of the reaction is :

(a) 

(b) 

(c) 

(d) 

55. $CH_3-CH=CH-CH_2-CO_2H \xrightarrow{\Delta} (X)$ (major); Product (X) is :

(a) $CH_3-CH=CH-CH_3$

(b) $CH_3-\underset{\displaystyle CH_3}{\overset{\displaystyle |}{C}}=CH_2$

(c) $CH_3-CH_2-CH=CH_2$

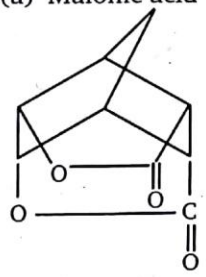
(d) $CH_3-CH=CH_2$

56. $H-O-\overset{\displaystyle O}{\overset{\displaystyle ||}{C}}-(CH_2)_n-\overset{\displaystyle O}{\overset{\displaystyle ||}{C}}-O-H \xrightarrow{\Delta}$ product , At what value of (n) given compound will not evolve CO_2 gas ?

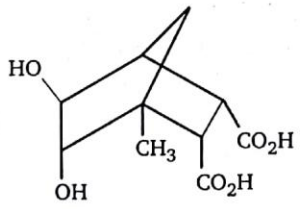
(a) $n = 5$ (b) $n = 4$ (c) $n = 2$ (d) $n = 1$

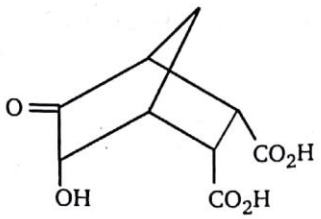
57. $\underset{\displaystyle CO_2H}{\overset{\displaystyle |}{(CH_2)_n}}$; If $(n = 4)$ then di-carboxylic acid would be known as :

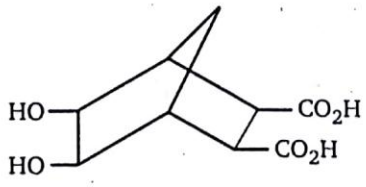
(a) Malonic acid (b) Succinic acid (c) Adipic acid (d) Oxalic acid

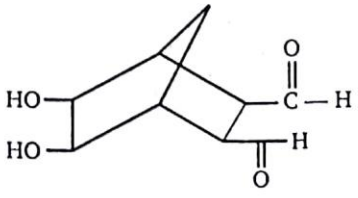
58.  $\xrightarrow{2H_2O}(A)$

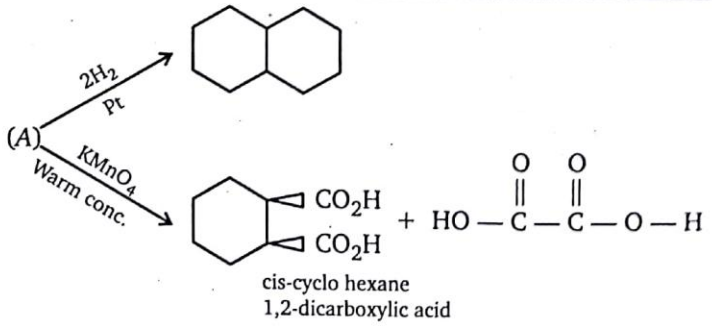
Product (A) of the above reaction is :

(a) 

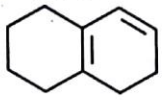
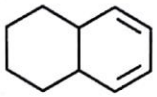
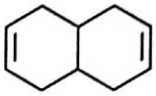
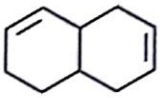
(b) 

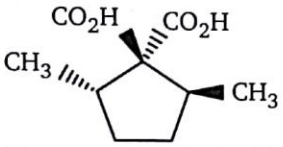
(c) 

(d) 

59. 

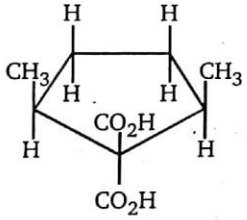
Identify (*A*).

(a)  (b)  (c)  (d) 

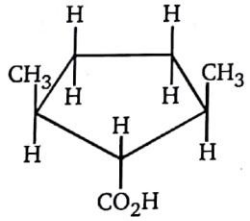
60. 

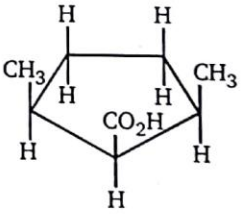
How many product will be formed when above compound undergo de-carboxylation?

(a) 0 (b) 1 (c) 2 (d) 3

61. 

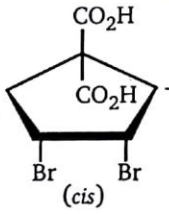
$\xrightarrow[(-CO_2)]{\Delta}$ Product of the reaction is :

(a) 

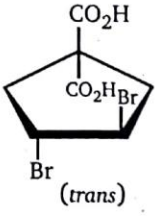
(b) 

(c) Both (a) and (b) (d) none of these

62. Products obtained in the given reactions are shown below.



$\xrightarrow{\Delta} CO_2 + x,$

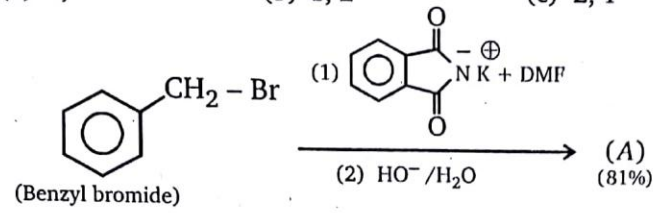


$\xrightarrow{\Delta} CO_2 + y$

The number of possible products for x and y are :

(a) 1, 1 (b) 1, 2 (c) 2, 1 (d) 2, 2

63.



(Benzyl bromide)

Product (A) of the above reaction is :

(a) $Ph-NH_2$ (b) $Ph-CH_2-NH_2$

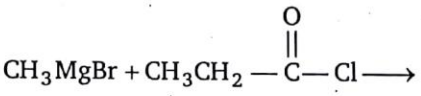
(c) $Ph-CH_2-NH-CO_2H$ (d) $Ph-CH_2-NH-CHO$

64. Which of the following pair is C_2-epimer ?

(a) *D*-Glucose, *D*-Maltose (b) *D*-Glucose, *D*-Mannose

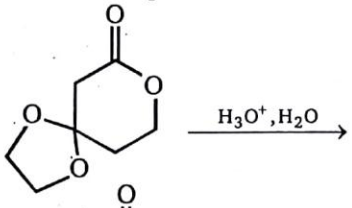
(c) *D*-Allose, *D*-Ribose (d) *D*-Glucose, *D*-Arabinose

65. Total number of enol possible for the compound formed during given reaction will be (including stereoisomer):

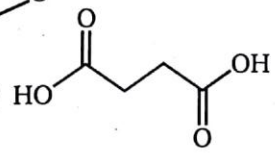


(a) 2 (b) 3 (c) 4 (d) 5

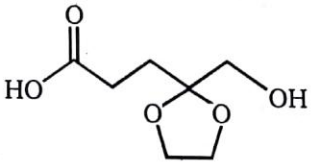
66. What is the product of the following reaction ?



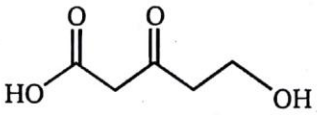
(a)



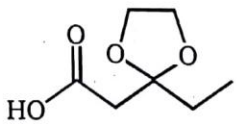
(b)



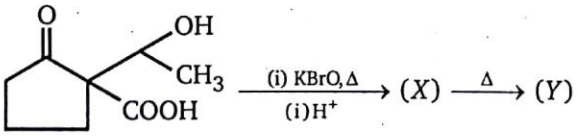
(c)



(d)

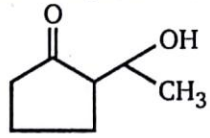


67.

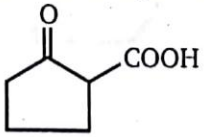


Hence the product (Y) in the above sequence of reactions, is :

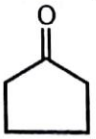
(a)



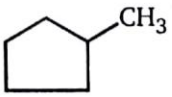
(b)

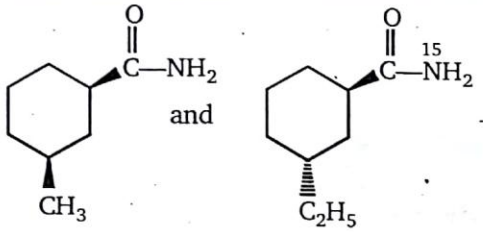


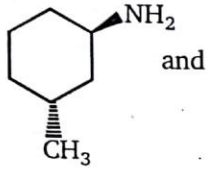
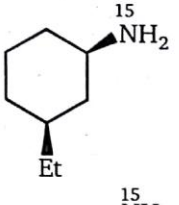
(c)

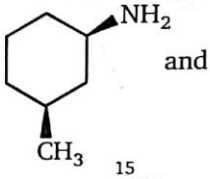
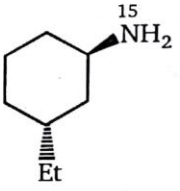


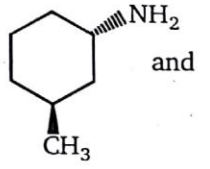
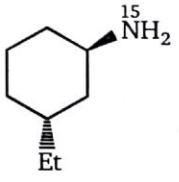
(d)

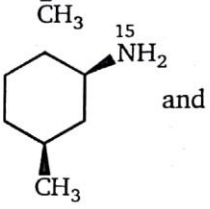
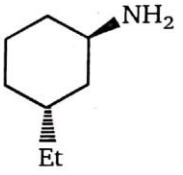


68.  and $\xrightarrow[\text{(Intramolecular migration)}]{\ominus\ OH/Br_2}$ Products are :

(a)  and 

(b)  and 

(c)  and 

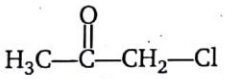
(d)  and 

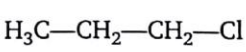
69. $CH_3CH_2CH(OH)CH(CH_3)_2 + CH_3COCl \xrightarrow{\text{base}} CH_3CH_2CH(OCOCH_3)CH(CH_3)_2 + HCl$

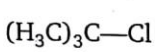
In the above reaction, if the reactant alcohol is a pure R-isomer the product would.

(a) have configuration inverted at the chiral atom
(b) be a racemic mixture
(c) have the same configuration at the chiral atom
(d) be optically inactive

70. The order of S_N1 reactivity in aqueous acetic acid solution for the compounds

 (1)

 (2)

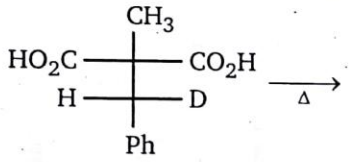
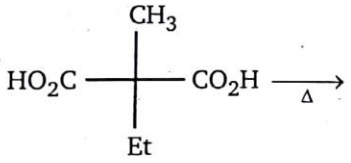
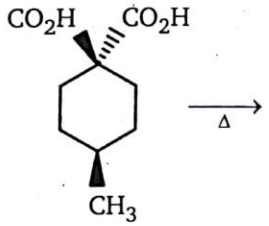
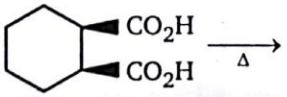
 (3)

(a) 1 > 2 > 3 (b) 1 > 3 > 2 (c) 3 > 2 > 1 (d) 3 > 1 > 2

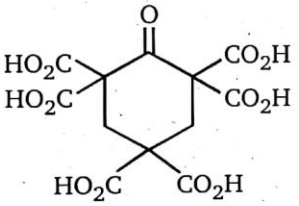
ANSWERS — LEVEL 1															
1.	(b)	**2.**	(b)	**3.**	(a)	**4.**	(c)	**5.**	(a)	**6.**	(b)	**7.**	(d)	**8.**	(b)
9.	(b)	**10.**	(b)	**11.**	(d)	**12.**	(b)	**13.**	(b)	**14.**	(a)	**15.**	(b)	**16.**	(c)
17.	(c)	**18.**	(b)	**19.**	(a)	**20.**	(a)	**21.**	(b)	**22.**	(c)	**23.**	(b)	**24.**	(a)
25.	(b)	**26.**	(d)	**27.**	(c)	**28.**	(d)	**29.**	(c)	**30.**	(c)	**31.**	(b)	**32.**	(c)
33.	(a)	**34.**	(a)	**35.**	(b)	**36.**	(a)	**37.**	(b)	**38.**	(b)	**39.**	(d)	**40.**	(d)
41.	(c)	**42.**	(c)	**43.**	(b)	**44.**	(c)	**45.**	(b)	**46.**	(a)	**47.**	(c)	**48.**	(b)
49.	(b)	**50.**	(c)	**51.**	(d)	**52.**	(d)	**53.**	(d)	**54.**	(d)	**55.**	(c)	**56.**	(c)
57.	(c)	**58.**	(c)	**59.**	(b)	**60.**	(b)	**61.**	(c)	**62.**	(c)	**63.**	(b)	**64.**	(b)
65.	(b)	**66.**	(c)	**67.**	(c)	**68.**	(b)	**69.**	(c)	**70.**	(c)				

LEVEL-2

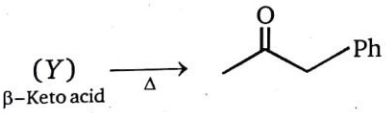
1. Match the Column (I) and (II). (Matrix)

Column (I)		Column (II)	
Reaction		Products formed	
(a)		(p)	Diastereomers
(b)		(q)	Racemic mixture
(c)		(r)	Meso compound
(d)		(s)	CO_2 gas will evolve

SUBJECTIVE PROBLEMS

1. 

$\xrightarrow{\Delta}$ (X) mole of $CO_2\uparrow$;



(Y) is including stereoisomers. Value of $(X+Y)$ will be

ANSWERS — LEVEL 2

1. a – p, s; b – q, s; c – p, s; d – r

Subjective Problems

1. 8