Carboxylic Acids and Its Derivatives

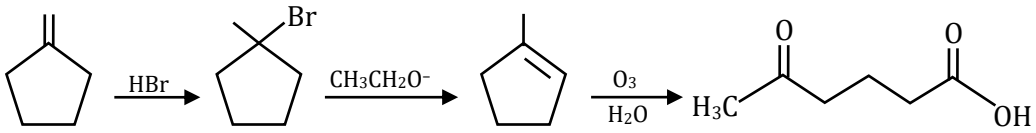
SOLUTIONS

EXERCISE - O

1. **Ans. (A)**

Formic acid found in red ants.

2. **Ans. (B)**



3. **Ans. (B)**

$$CH_3—C\equiv N \xrightarrow{H_2O/H^{\oplus}} \underset{(A)}{CH_3COOH} + \underset{(B)}{NH_3}$$

4. **Ans. (B)**

$$2CH_3—COOH \xrightarrow{\text{H–bonding}} \left(CH_3—\underset{\underset{O}{\|}}{C}—OH\right)_2$$

5. **Ans. (D)**

As Alkyl chain in carboxylic acid increase solubility decrease.

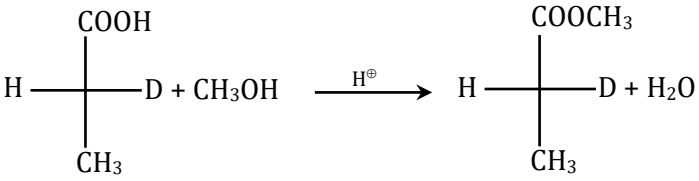
6. **Ans. (C)**

'Ka' small for weakest acid

7. **Ans. (C)**

$NaBH_4$ reduces reactant to $CH_3—\underset{\underset{OH}{|}}{CH}—CH_2—CH_2—CH_2—CO_2H$ which forms ester

8. **Ans. (A)**

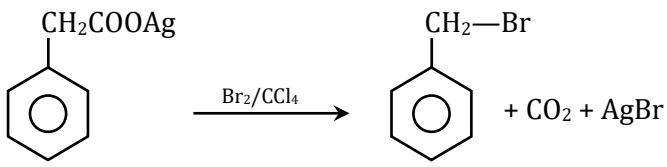


9. **Ans. (B)**

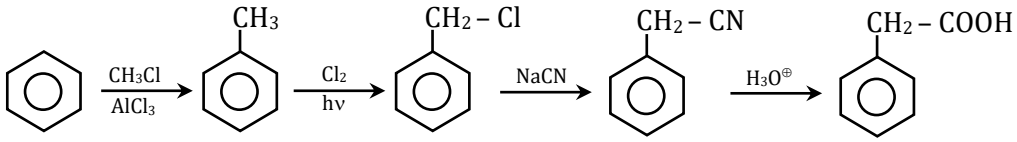
CO_2 at anode

H_2 at cathode

10. **Ans. (A)**



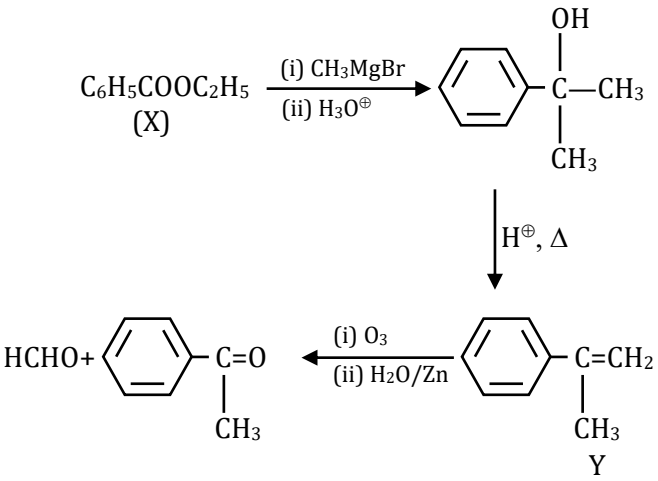
11. Ans. (B)



12. Ans. (C)

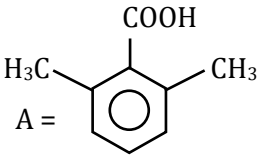
Hydrolysis of Glycidic ester (epoxy ester) gives aldehyde as one of the products.

13. Ans. (A)



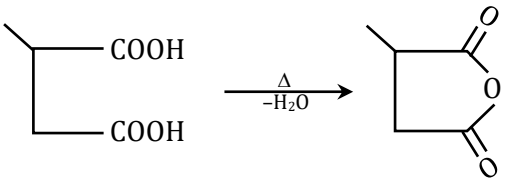
14. Ans. (C)

Ester on alkaline hydrolysis followed by acidification gives carboxylic acid which gives effervescence with $NaHCO_3$

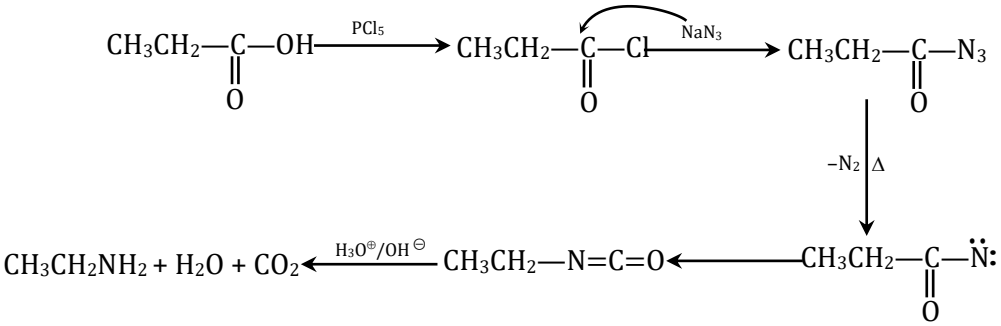


B = CH_3OH

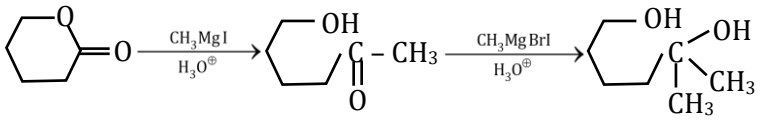
15. Ans. (B)



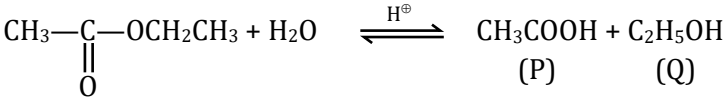
16. Ans. (A)



17. Ans. (B)



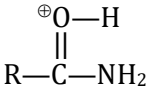
18. Ans. (B)



19. Ans. (C)

Nucleophilic addition elimination

20. Ans. (C)



21. Ans. (A)

Cl^- is a good leaving group

22. Ans. (A)

(i) Phthalic acid → Benzene-1, 2-dicarboxylic acid

(ii) Oxalic acid → Ethan-1, 2-dioic acid

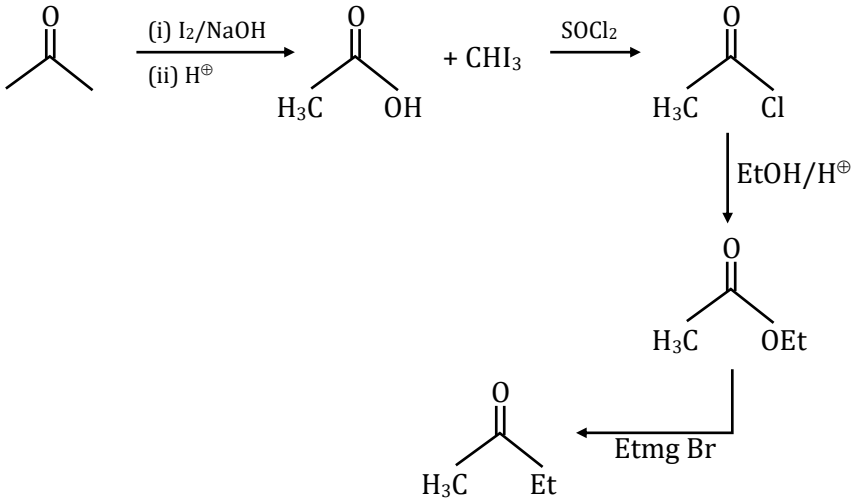
(iii) Succinic acid → Butane-1, 4-dioic acid

(iv) Adipic acid → Hexane-1, 6-dioic acid

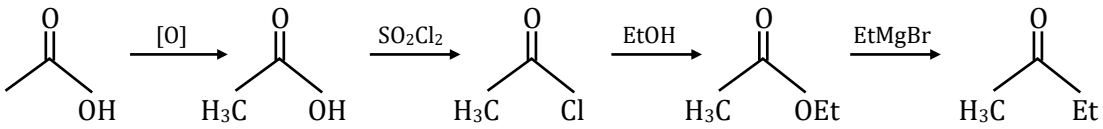
(v) Glutaric acid → Pentane-1, 5-dioic acid

23. Ans. (A)

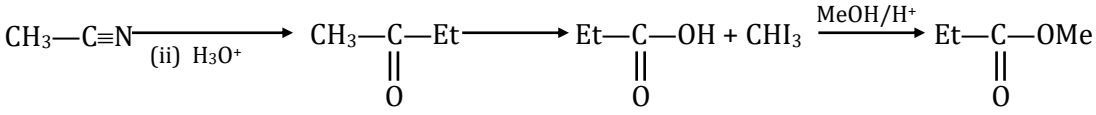
(I) Reaction sequence I



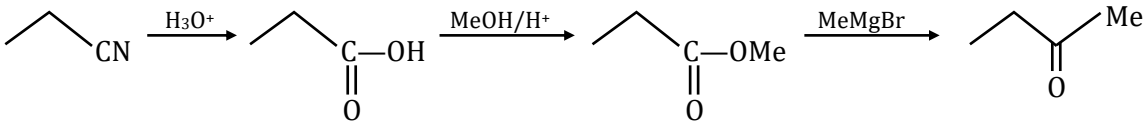
(II) Reaction sequence II



(III) Reaction sequence III

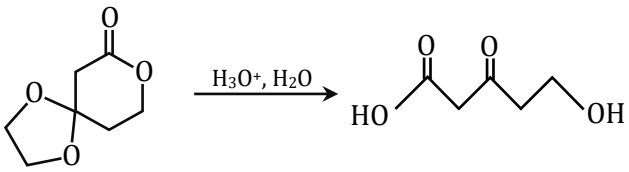


(IV) Reaction sequence IV

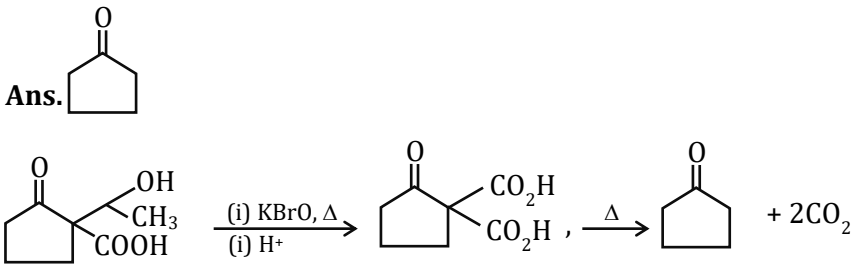


EXERCISE - S

1. **Ans. (4)**



2. **Ans.**



3. **Ans.** $(CH_3)_2CH-CH_2-\overset{\overset{O}{\|}}{C}-H$

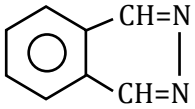
$(CH_3)_2CHCH_2C\equiv N \xrightarrow{HCl,H_2O} (CH_3)_2CH-CH_2-CO_2H \xrightarrow[2.\ H_2O]{1.\ LiAlH_4} (CH_3)_2CH-CH_2-CH_2-OH \xrightarrow[CH_2Cl_2]{PCC}$

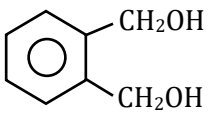
$(CH_3)_2CH-CH_2-\overset{\overset{O}{\|}}{C}-H$

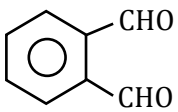
4. **Ans. (3)**

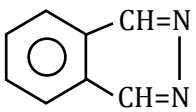
Cis form on heating gives only one product while trans form on heating give diastereomer as product.

5. **Ans.**



(A) 

(B) 

(C) 

6. Ans. (6)

Approach : Compound A : DU = 1

↓ Ozonolysis

Ketone + Aldehyde $\xrightarrow{\text{Oxidation}}$ Carboxylic acid

B having

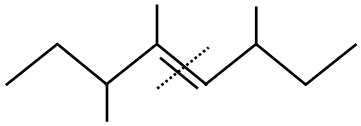
3α H

[B] [C] [D]

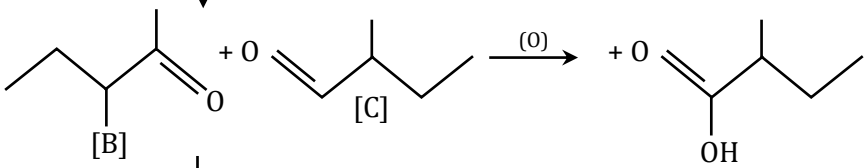
↓ Haloform

$CHCl_3$ + Sodium salt of carboxylic acid i.e. D

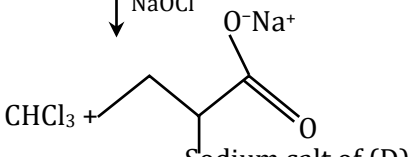
A :



$\xrightarrow{Zn/H_2O}$ $\xrightarrow{O_3}$

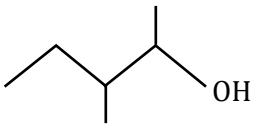


↓ NaOCl



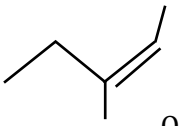
Sodium salt of (D)

E :

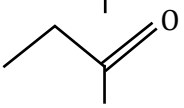


G :O

F :



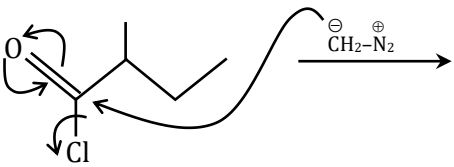
H :



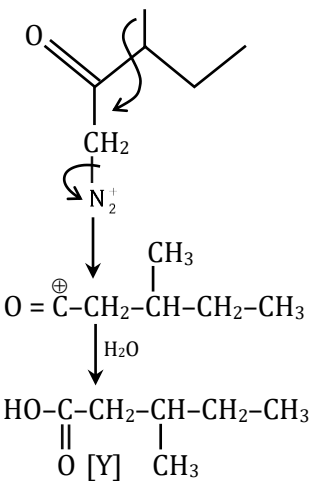
↓ Haloform

+ ve Test

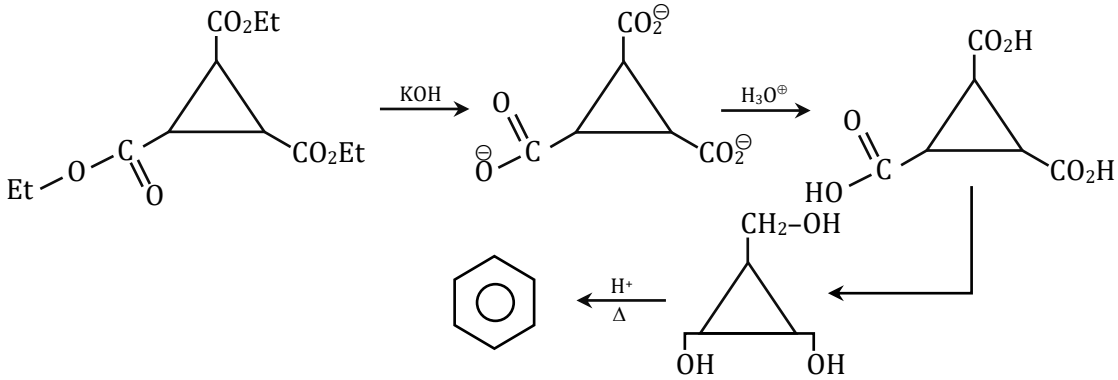
X :

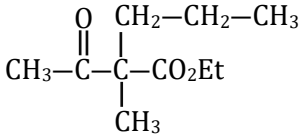


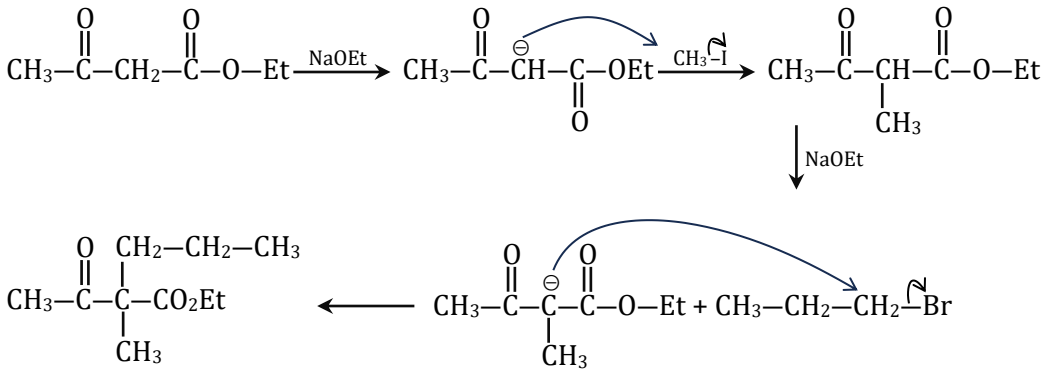
(X)



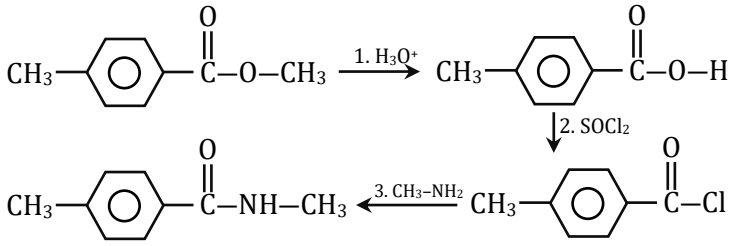
7. **Ans.** 



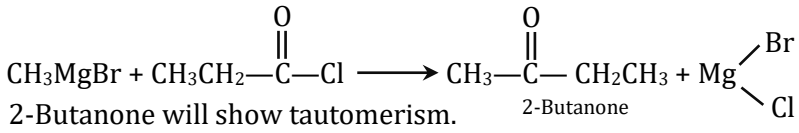
8. **Ans.** 



9. **Ans.** 1. H_3O^+ 2. $SOCl_2$ 3. $CH_3–NH_2$

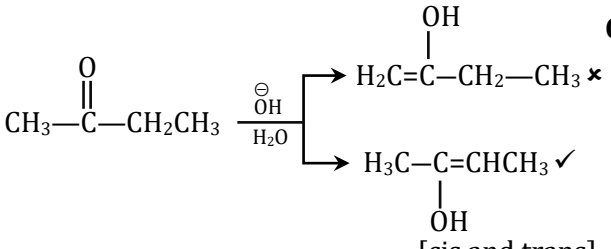


10. **Ans. (3)**



2-Butanone will show tautomerism.

G.I.



[cis and trans]

EXERCISE - JEE (Main) PYQ

1. Ans. (4)

Adipic acid $CO_2H-(CH_2)_4-CO_2H \xrightarrow[\text{agent}]{\text{dehydrating}}$ 7 membered cyclic anhydride (Very unstable)

2. Ans. (2)

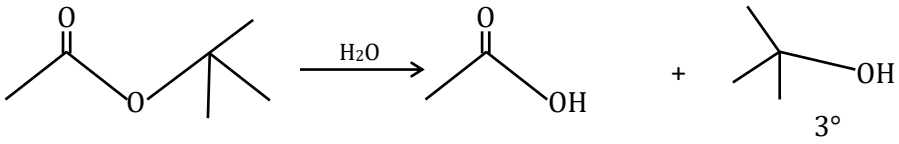
More is the electrophilic character of carbonyl group of ester faster is the alkaline hydrolysis.

3. Ans. (2,3,4)

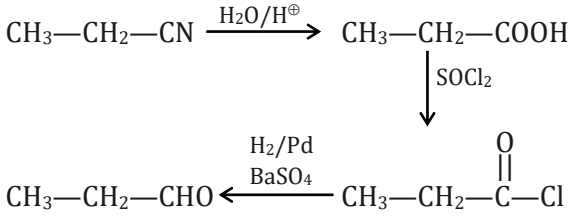
due to inter molecular hydrogen bonding (B) has more B.P., more soluble in water and more likely to be crystalline than A

4. Ans. (1)

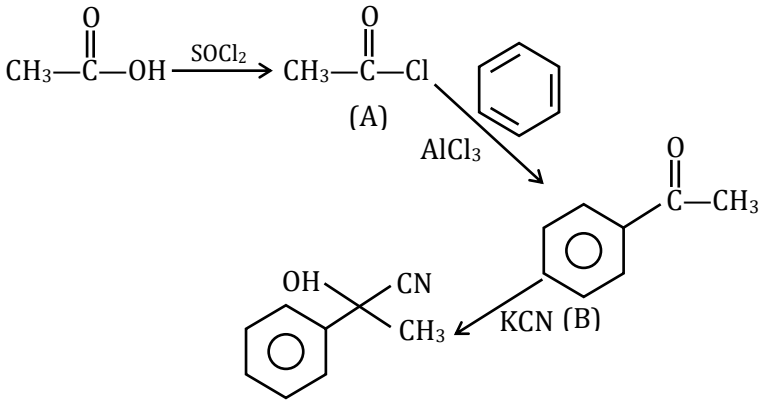
$\therefore$ alcohol gives white turbidity immediately so alcohol must be 3° and only 1st option give 3° alcohol by hydrolysis



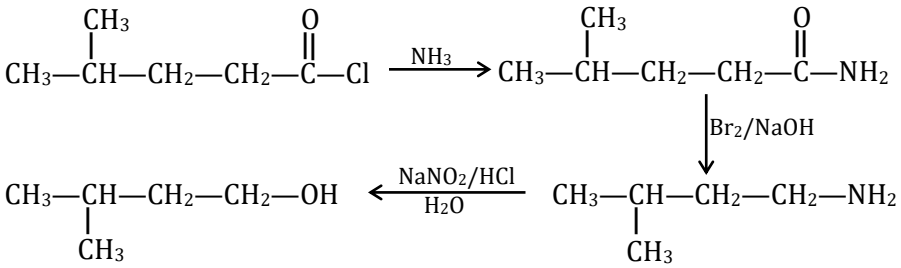
5. Ans. (4)



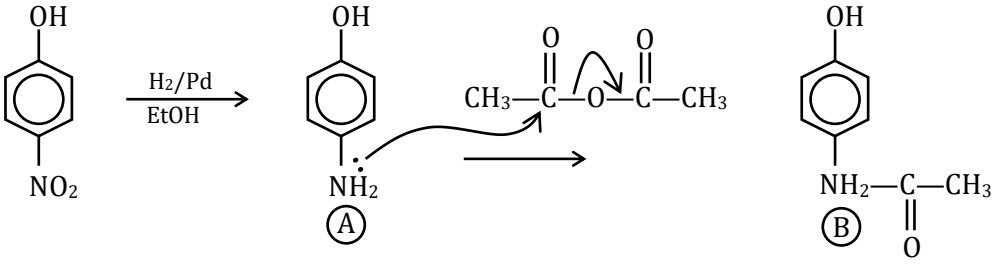
6. Ans. (1)



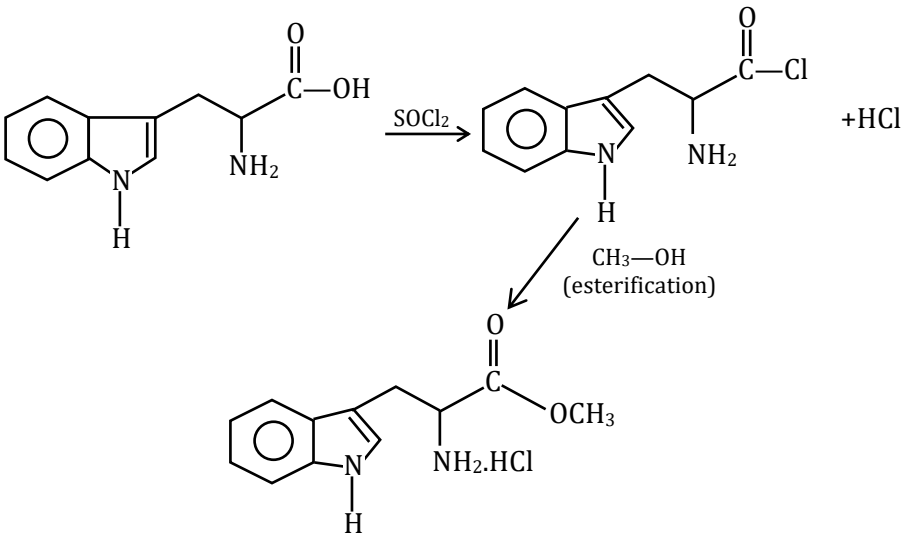
7. Ans. (3)



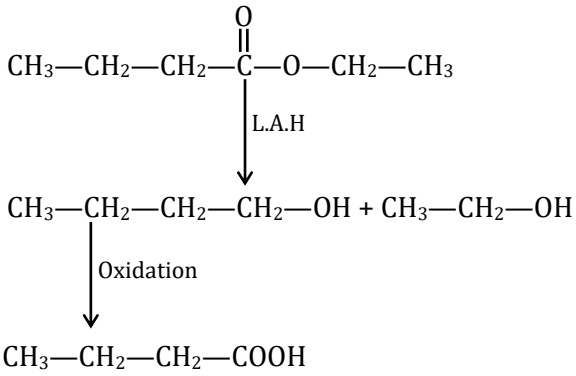
8. **Ans. (4)**



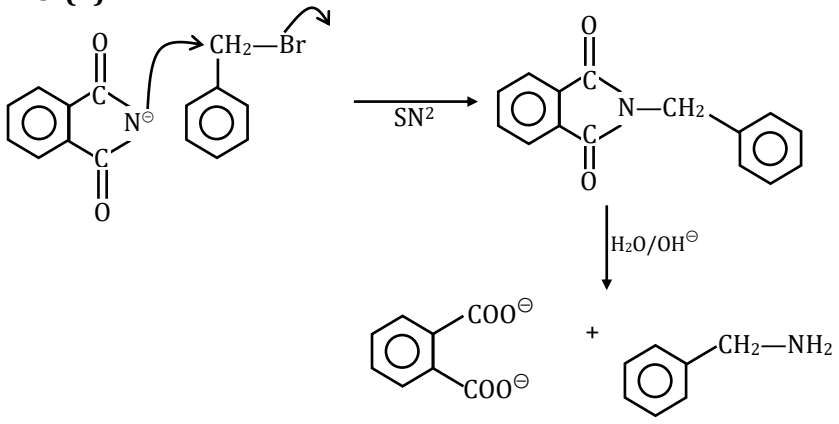
9. **Ans. (3)**



10. **Ans. (3)**



11. **Ans. (4)**

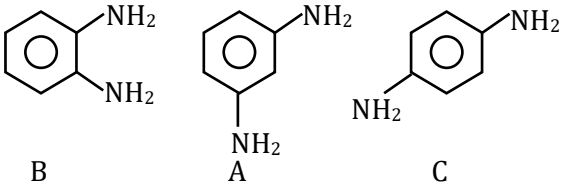


12. **Ans. (1)**

I. Better packing efficiency of monocarboxylic acids with even number of carbon atoms results in higher M.P

II. As molar mass increases hydrophobic part size increase hence solubility decreases.

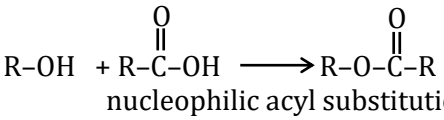
13. **Ans. (4)**



B A C

Melting point of compound C is 142°C

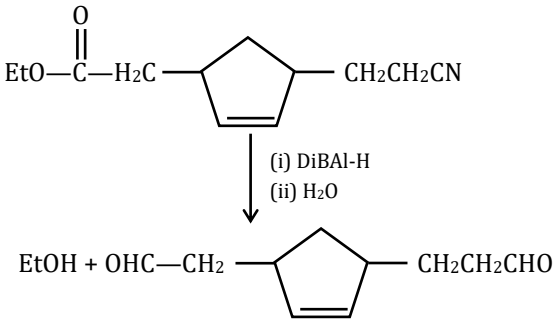
14. **Ans. (1)**



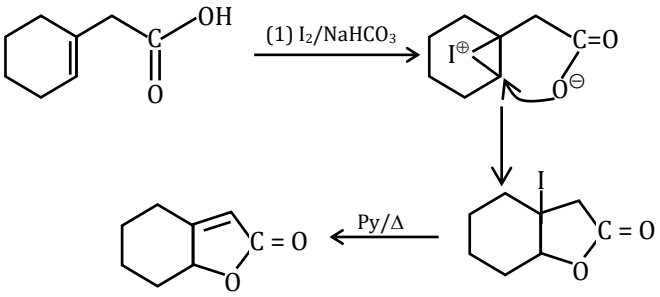
nucleophilic acyl substitution

electron with drawing group on carboxylic acid will increase the rate of esterification

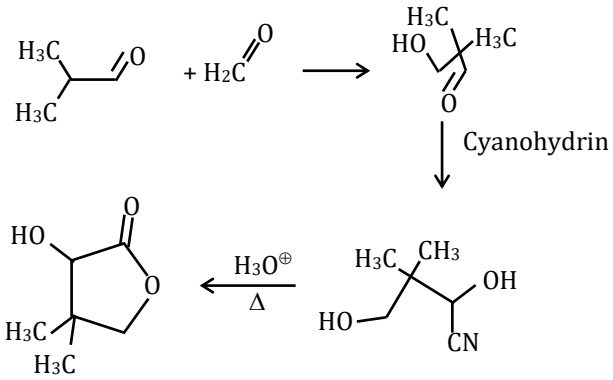
15. **Ans. (4)**



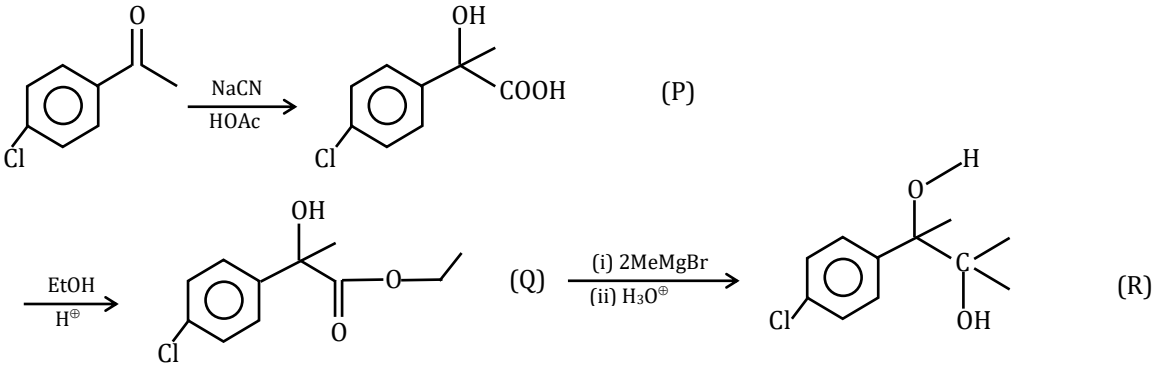
16. **Ans. (3)**



17. **Ans. (1)**



18. **Ans. (2)**



19. **Ans. (4)**

HVZ reactions = Br_2 / red P

Iodoform reaction = NaOH + I_2

Etard reaction = (i) CrO_2Cl_2, CS_2(ii) H_2O

Gatterman-Koch Reaction = CO, HCl, Anhydrous, $AlCl_3$

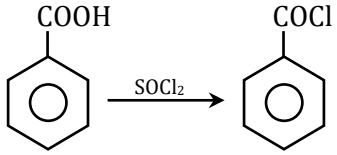
20. **Ans. (2)**

(1) $\underset{\text{Glycine}}{H_2N-CH_2-COOH} \xrightarrow[(HVZ)]{\text{Red P}, Cl_2} \underset{\text{Optically active}}{H_2N-\underset{Cl}{\underset{|}{CH}}-COOH}$

(2) Meso compound are optically inactive.

EXERCISE - JEE (Advanced) PYQ

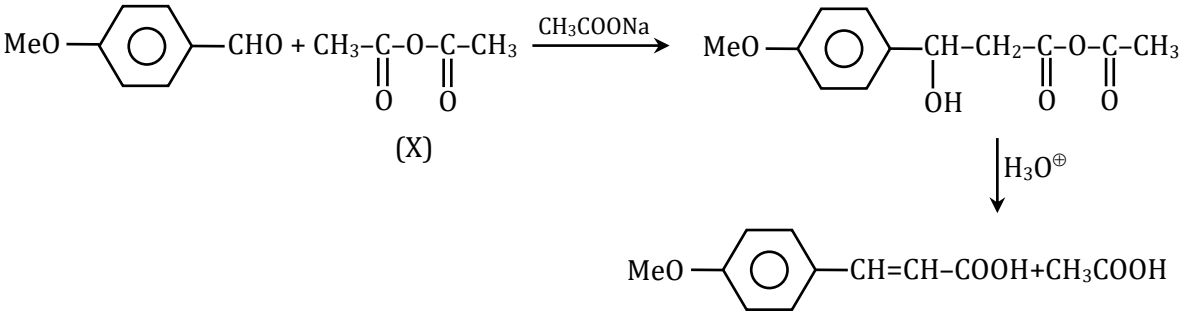
1. **Ans. (C)**



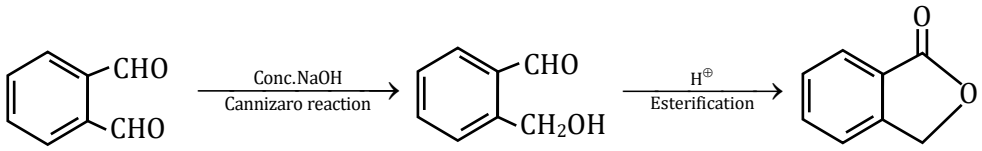
2. **Ans. (C)**

Less acidic nature of the compound, smaller will be the dissociation constant of the compound.

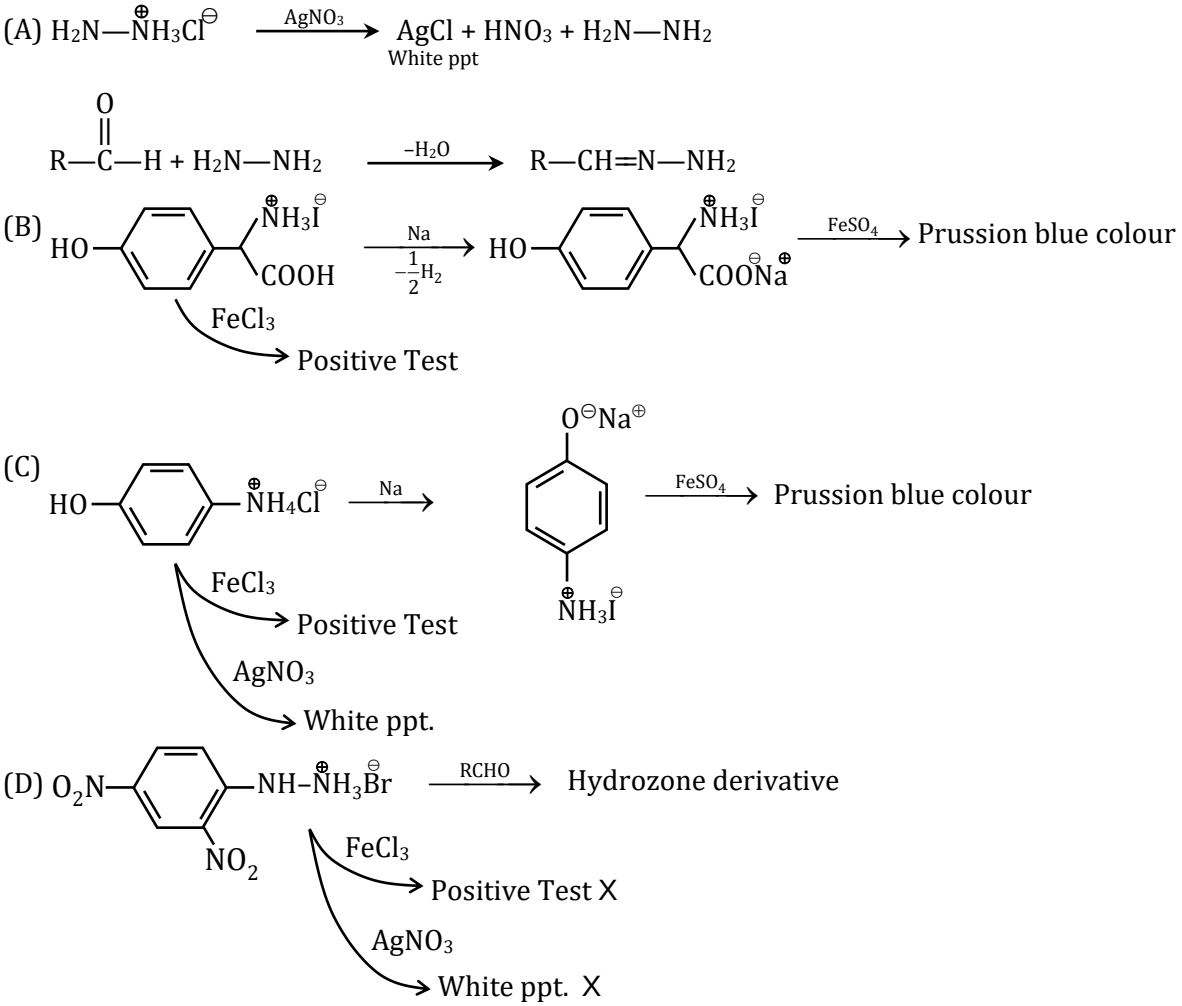
3. **Ans. (A)**



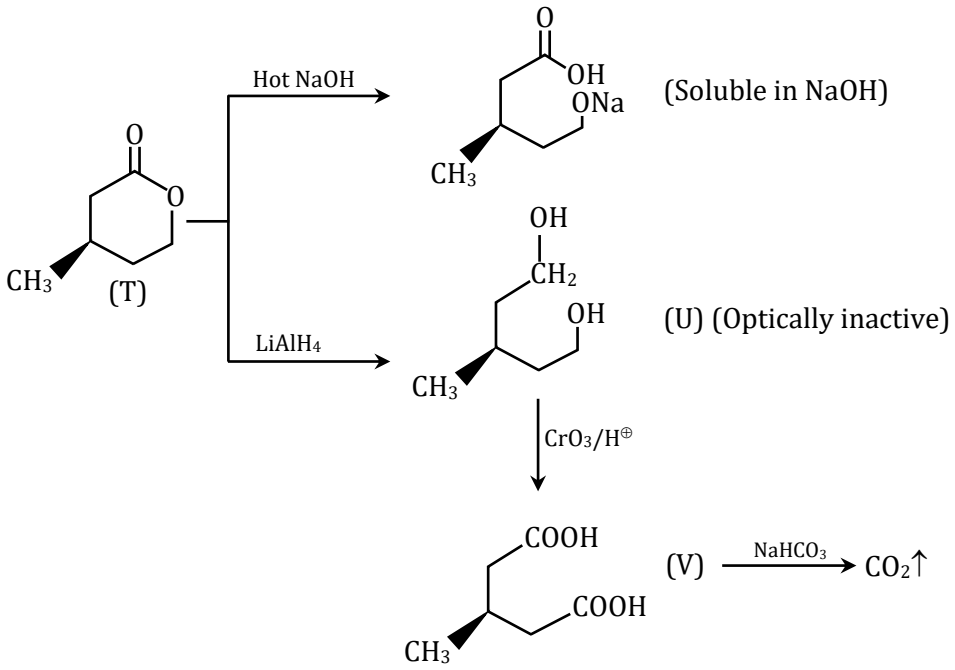
4. **Ans. (C)**



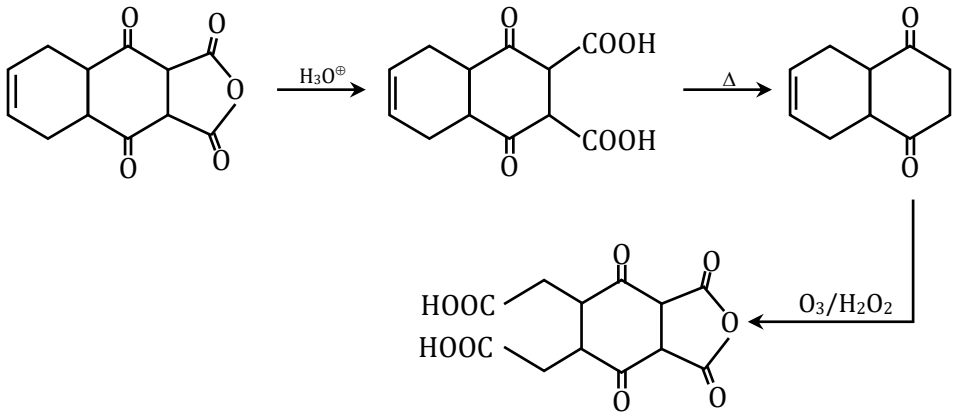
5. Ans. (A)



6. Ans. (A,C,D)

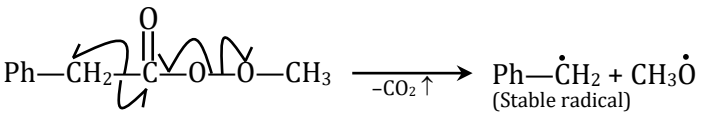


7. Ans. (2)



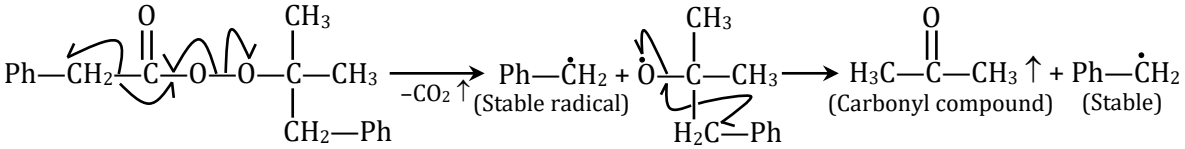
8. Ans. (A)

From Pathway (P)



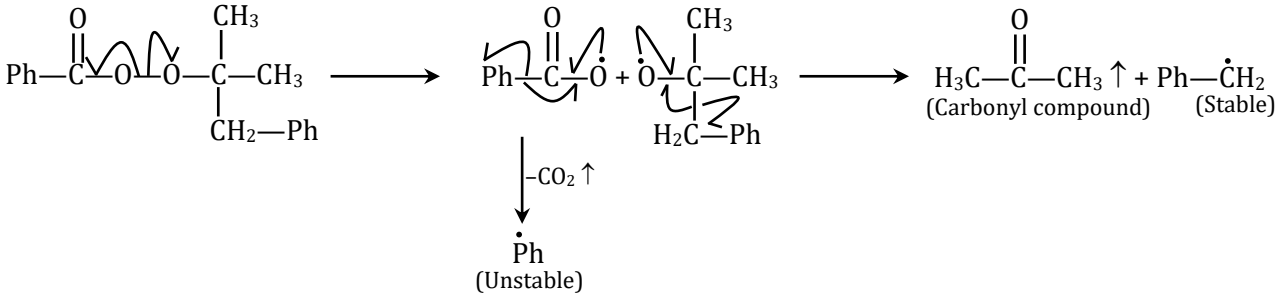
Here loss of CO_2 occur in 1st step due to formation of stable radical.

From Pathway (Q)



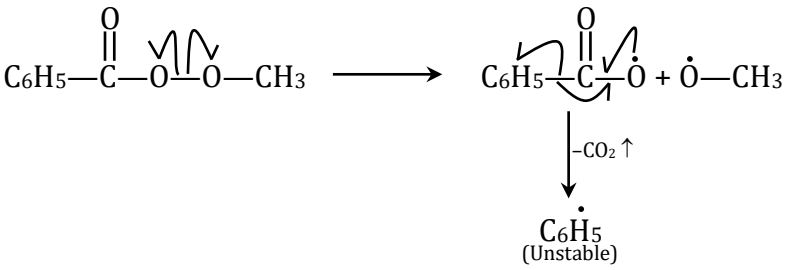
Here loss of CO_2 occur in 1st step due to formation of stable radical.

From Pathway (R)



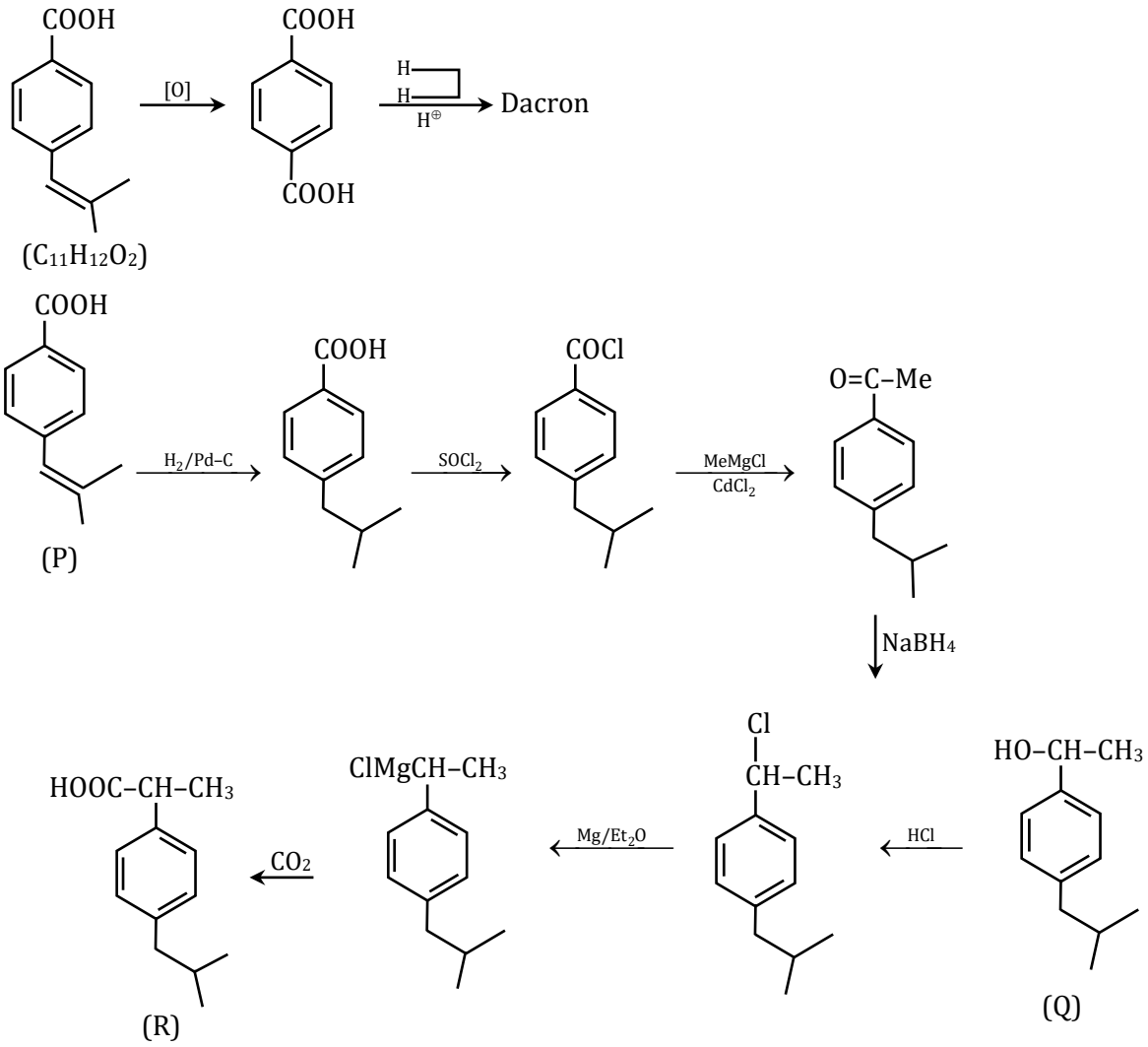
Here loss of CO_2 occur in 2st step due to formation of stable radical.

From Pathway (S)

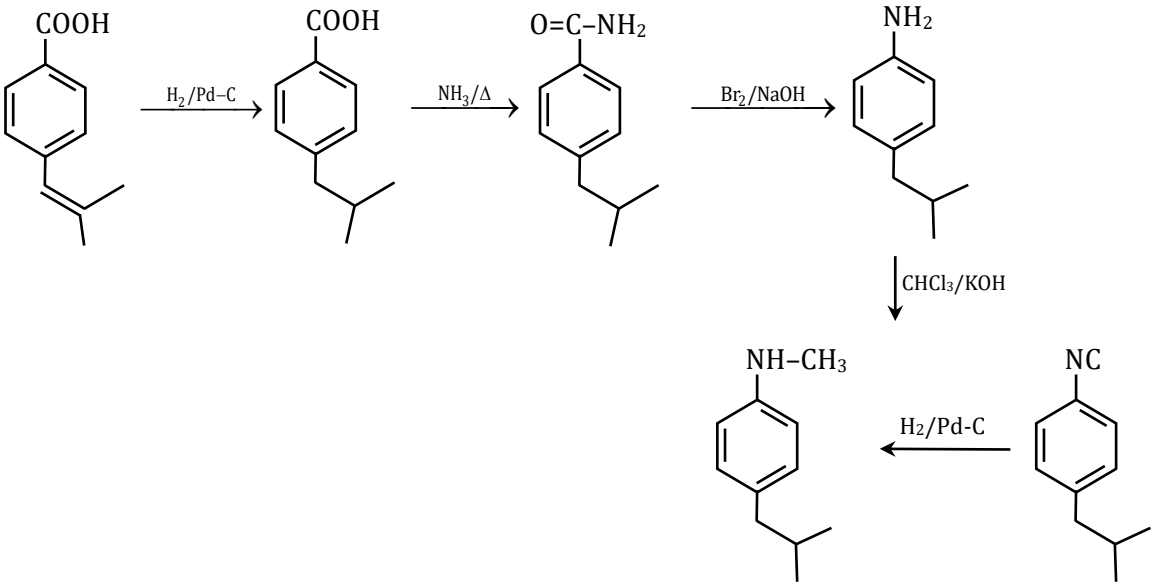


Here loss of CO_2 occur in 2st step due to formation of unstable radical.

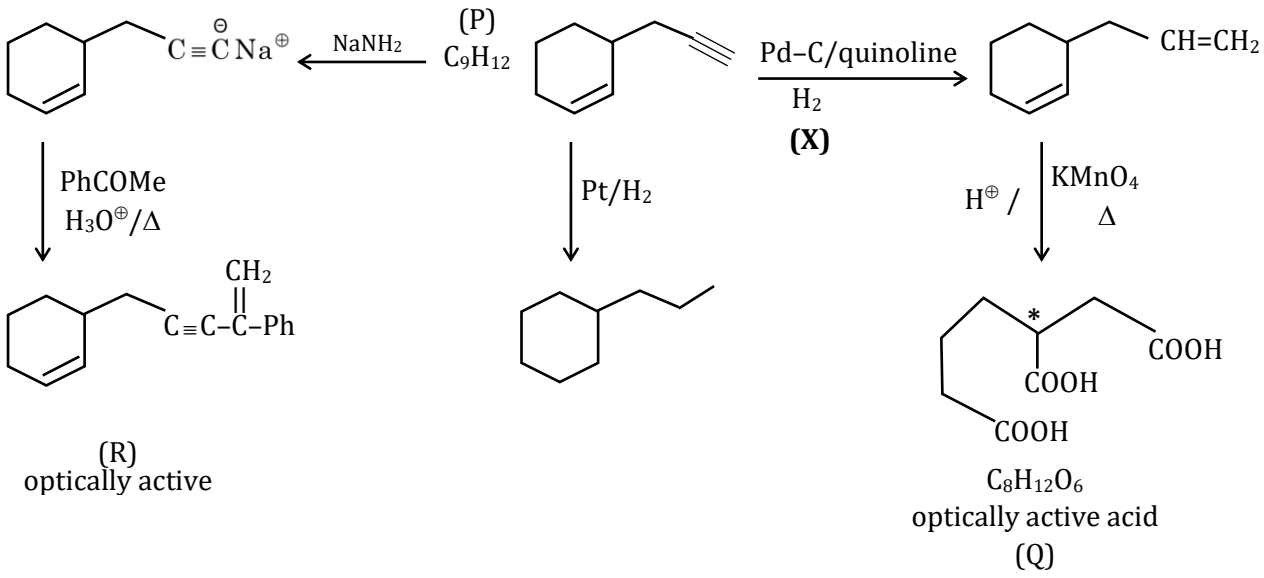
9. Ans. (A)



10. Ans. (B)



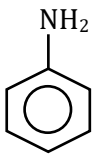
11. Ans. (B,C)



(R)
optically active

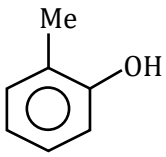
$C_8H_{12}O_6$
optically active acid
(Q)

12. Ans. (D)



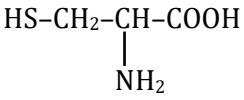
: Blue colour in Lassign test due to presence of N

Aniline



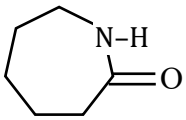
:Violet colour with $FeCl_3$ due to presence of phenolic OH

o-Cresol



: It gives blod red colour with NaSCN

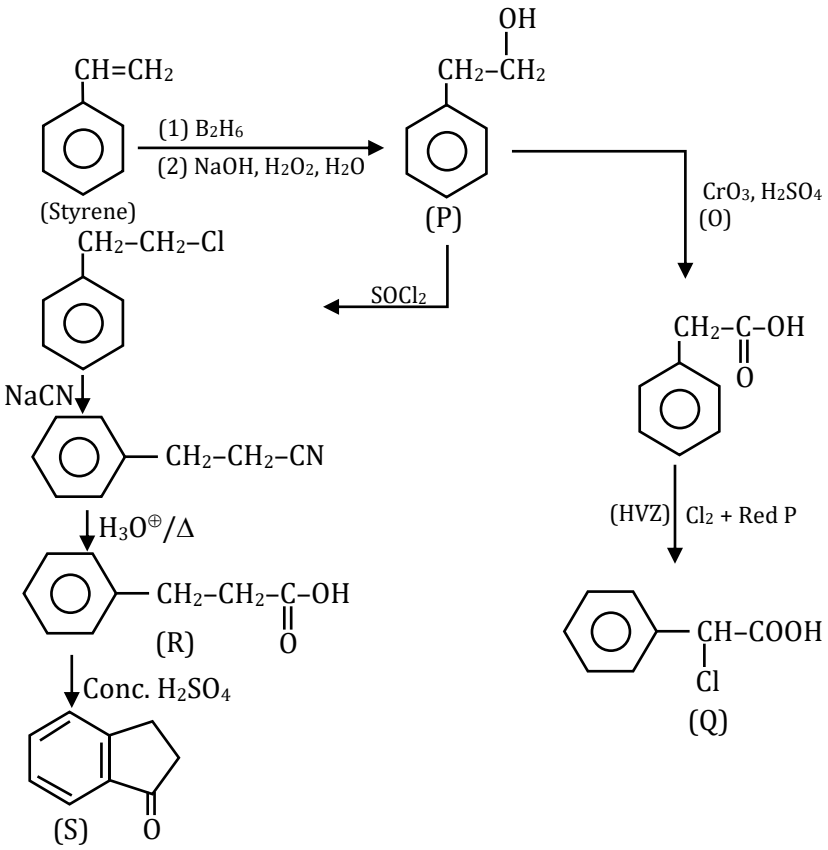
Cysteine



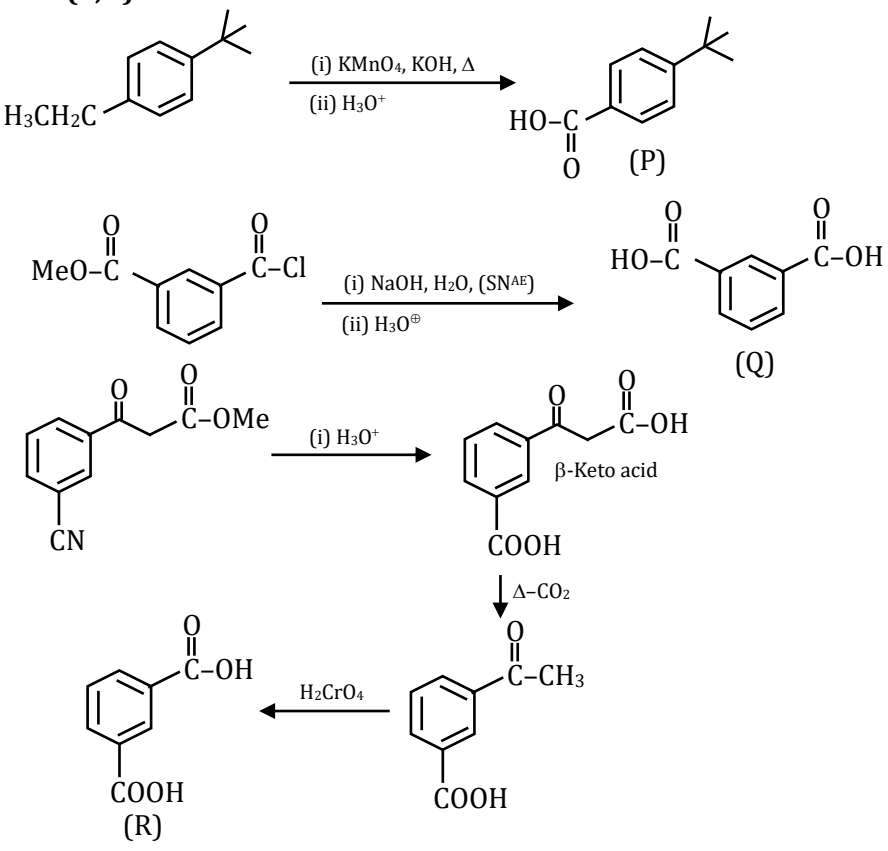
: Blue colour in Lassign test due to presence of N

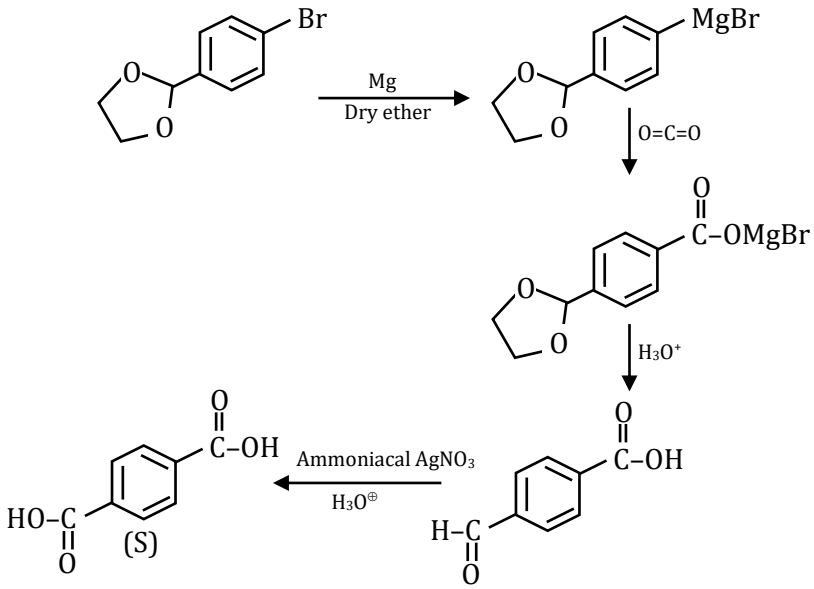
Caprolactam

13. Ans. (B)



14. Ans. (C,D)

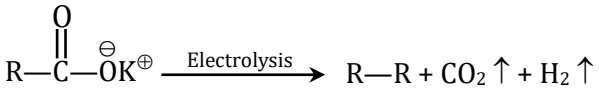




JEE (Main) Practice Paper

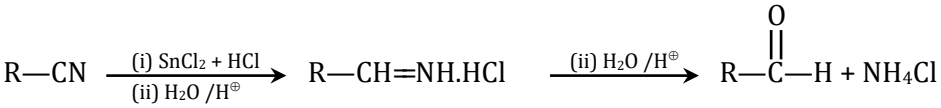
SECTION–A

1. Ans. (1)

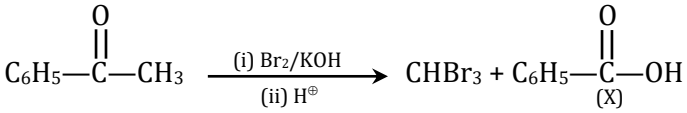


2. Ans. (2)

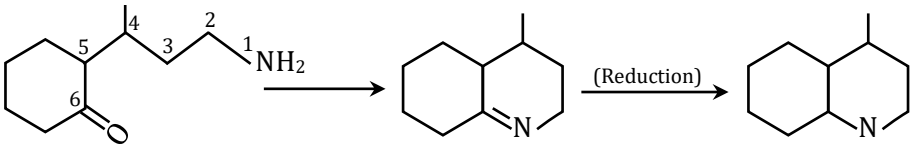
Stephen's reduction



3. Ans. (2)

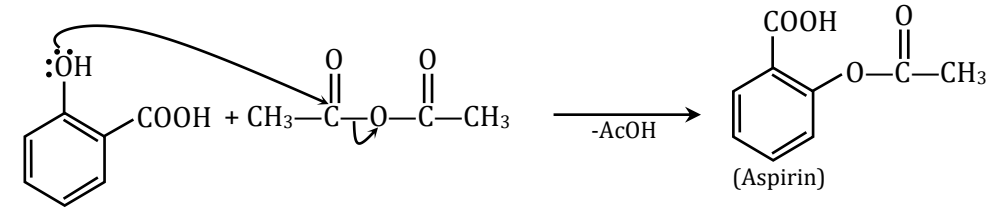


4. Ans. (3)



Product

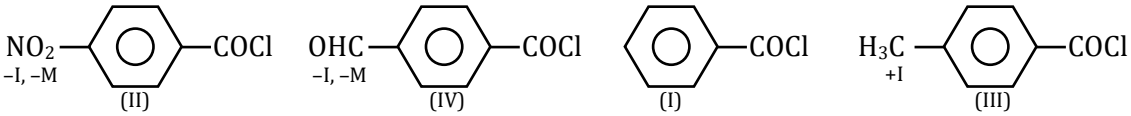
5. Ans. (3)



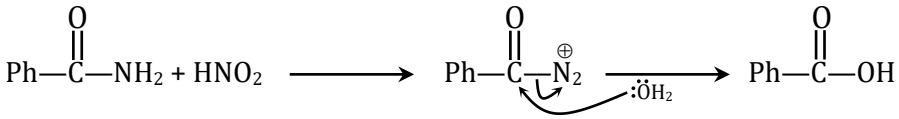
(o–hydroxybenzoic acid)

6. Ans. (1)

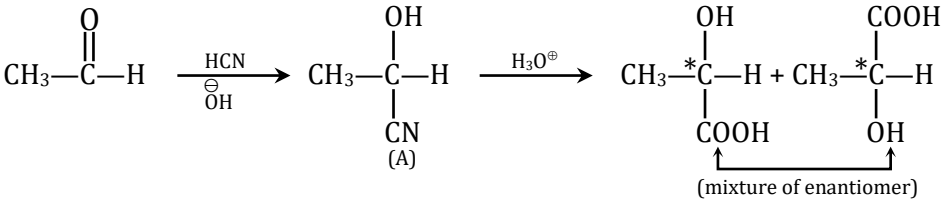
Higher the electron deficiency at acid halide group's carbon centre ⟶ faster will be rate of hydrolysis reaction.



7. Ans. (2)

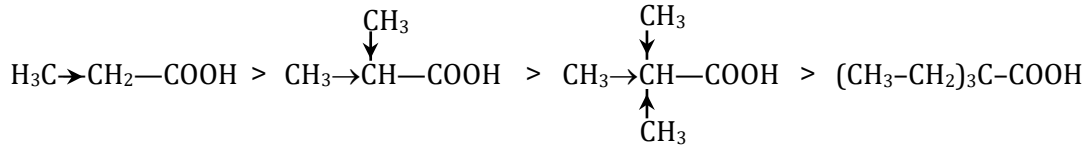


8. Ans. (3)

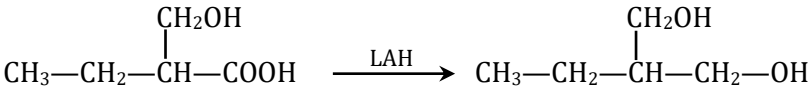


9. Ans. (1)

Ease of esterification ∝ electron deficiency at carbon centre of acid group.



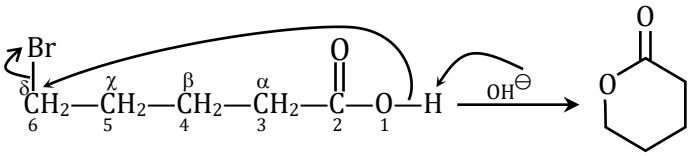
10. Ans. (3)



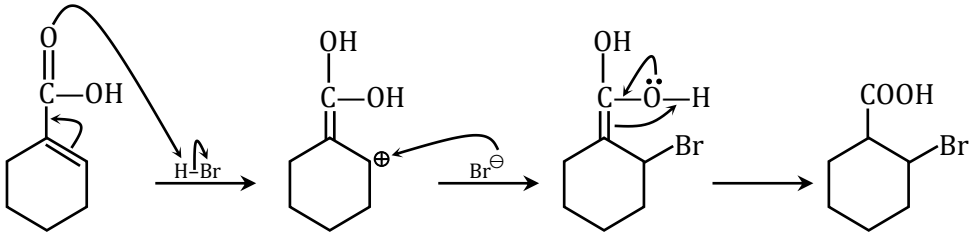
Optically inactive due to all 4 substituents are not same

11. Ans. (4)

δ-Bromo acid in basic medium give lactone.

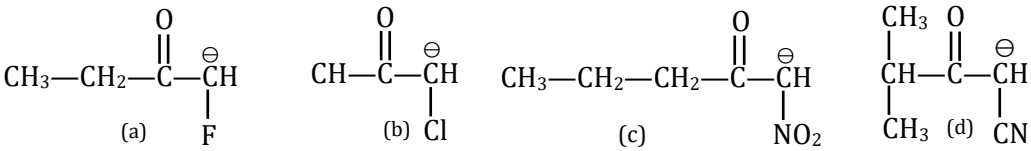


12. Ans. (2)



13. Ans. (3)

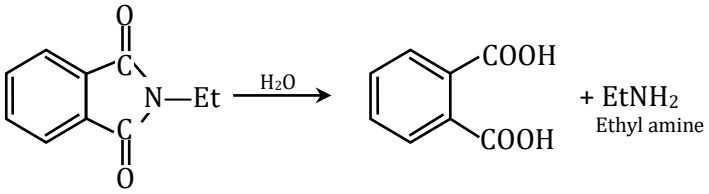
More stable the carbanion after loss of CO_2 ⟶ higher rate of decarboxylation



Stability of anion, c > d > a > b

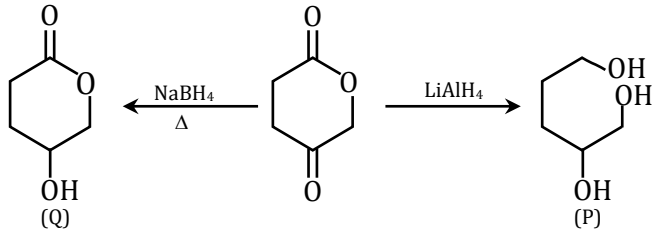
Rate of decarboxylation, c > d > a > b

14. Ans. (2)

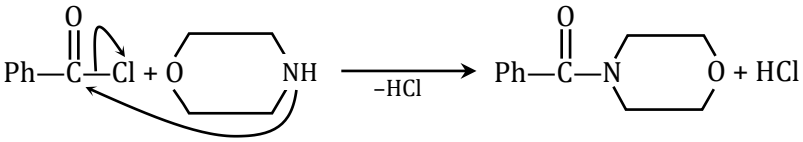


N-ethyl phthalimide

15. Ans. (1)

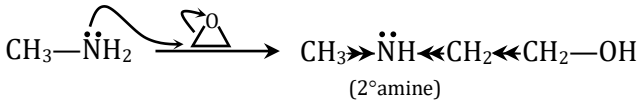


16. Ans. (3)



17. Ans. (2)

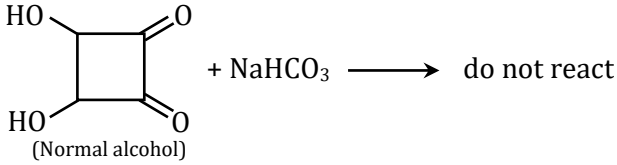
A is less basic than CH_3NH_2 due to –I of –OH group.



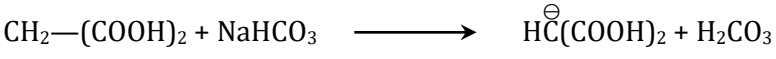
(2°amine)

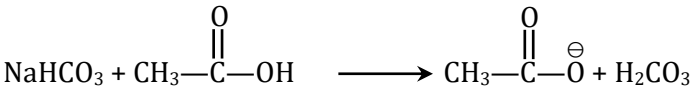
18. Ans. (3)

(ii) & (iii) react with $NaHCO_3$ to give CO_2.

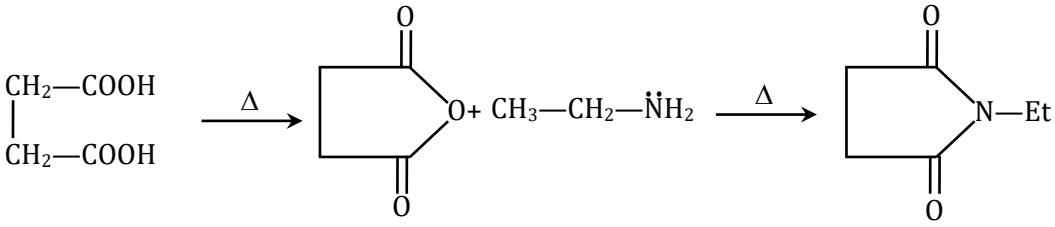


(Normal alcohol)

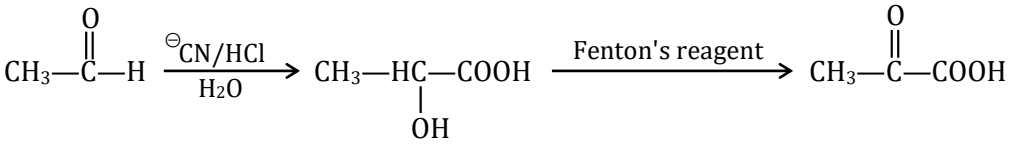




19. Ans. (2)



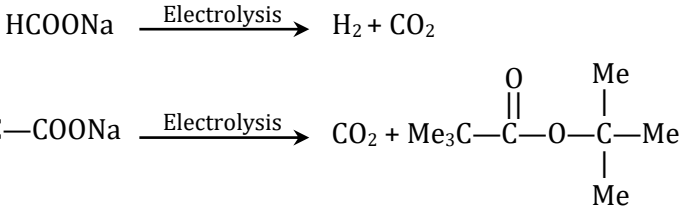
20. Ans. (3)



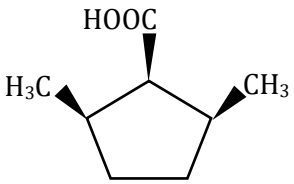
Pyruvic acid

SECTION-B

1. Ans. (2)

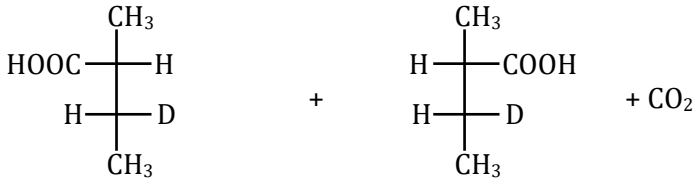


2. Ans. (1)



only one product obtained.

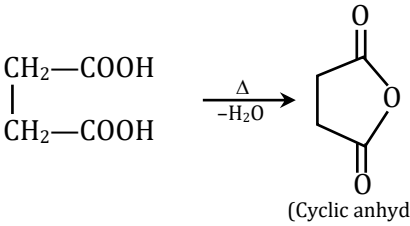
3. Ans. (3)



Total 3 product obtained

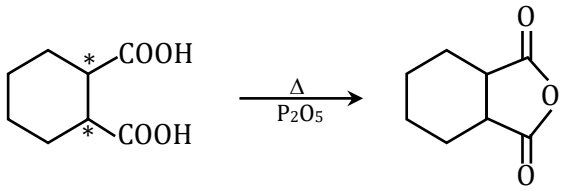
4. Ans. (2)

n = 2



(Cyclic anhydride)

5. **Ans. (3)**



n(chiral carbon) = 2

POS present, so total stereoisomers = $2^{n-1} + 2^{\frac{n}{2}-1}$

$= 2^{2-1} + 2^{\frac{2}{2}-1} = 3$

6. **Ans. (6)**

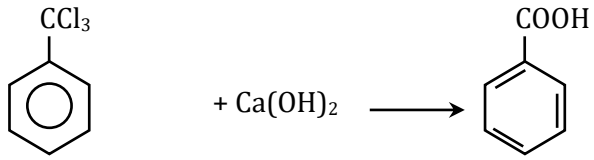
Compounds more acidic than water are soluble in hot NaOH a soluble solution

7. **Ans. (3)**

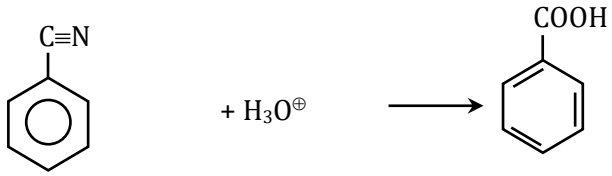
Acetaldehyde give silver mirror test so statement (iii) incorrect and (i), (ii), (iv) are correct.

8. **Ans. (3)**

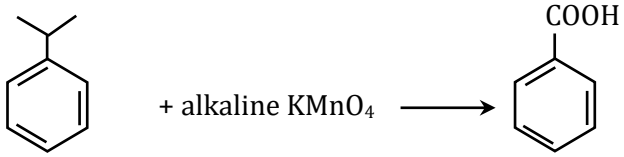
$H_2C = CH_2 + HCl \longrightarrow H_3C - CH_2 - Cl$



(benzotrichloride)



(benzonitrite)



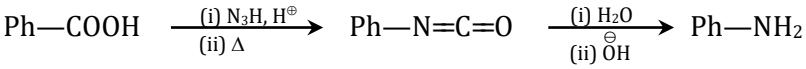
9. **Ans. (3)**

Reagent	Phenol	Benzoic acid	Conclusion
Aqueous NaOH	Salt formation	Salt formation	No specific colour change
Tollen's reagent	No effect	No effect	
Molisch reagent	No effect	No effect	
Neutral $FeCl_3$	Violet colour	Buff–coloured Precipitate	Thus, $FeCl_3$ can be used to make distinguish

Hence A, B, C cannot used to distinguish them and from D it can be distinguished.

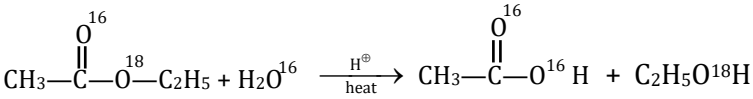
10. **Ans. (2)**

Schmidt reaction

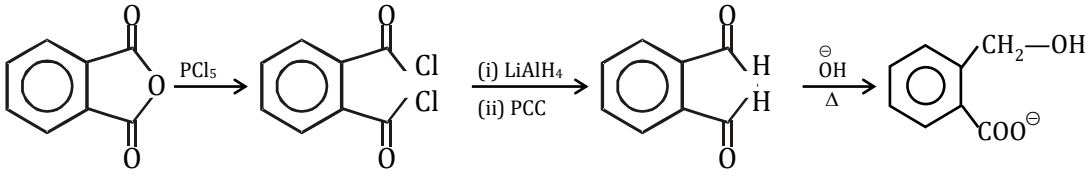


JEE (Advanced) Practice Paper

1. Ans. (A)

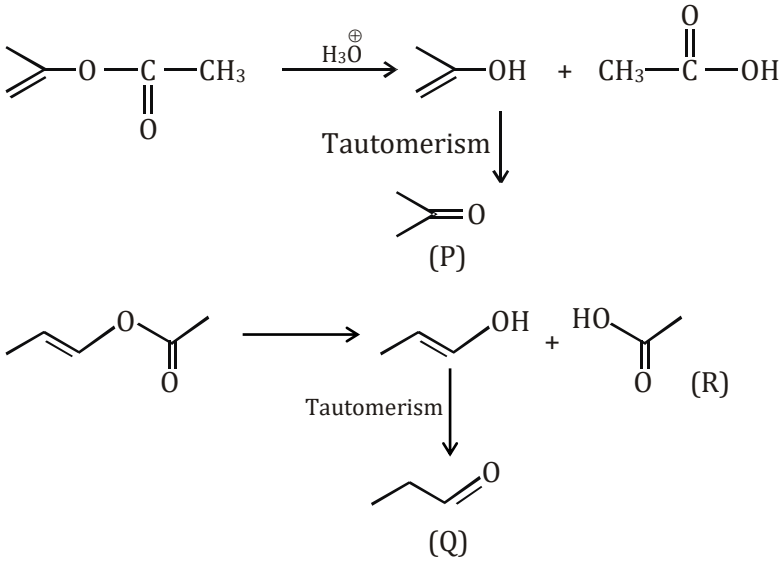


2. Ans. (A)



annizeroo reaction

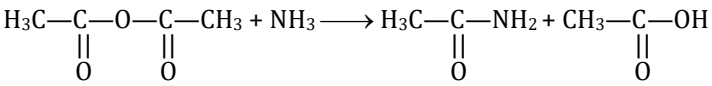
3. Ans. (C)



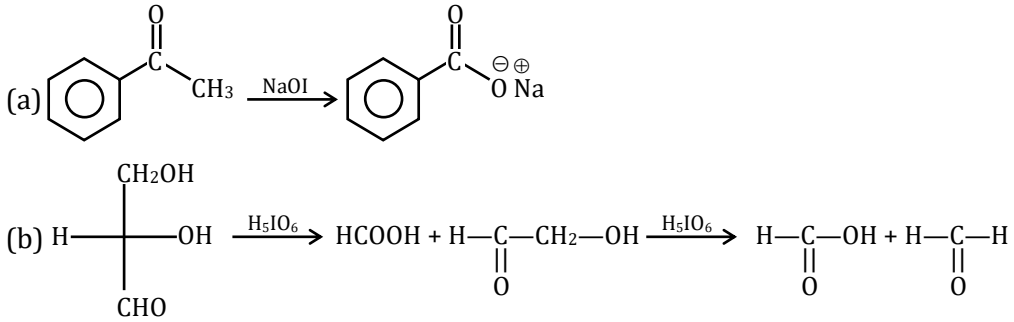
4. Ans. (C)

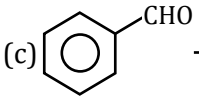
Higher the electron deficiency at acid halide group's carbon centre ⟶ faster will be rate of hydrolysis reaction.

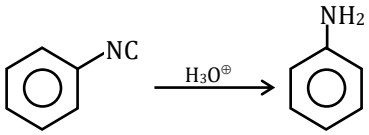
5. Ans. (A)



6. Ans. (C)



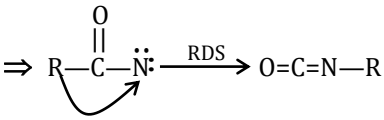
(c)  Fehling solution → Aromatic aldehyde do not respond to fehling's test

(d)  + HCOOH

7. Ans. (B)

Carboxylic acid having α–hydrogen will give HVZ reaction

8. Ans. (B)



⇒ Here migrating group should be e^- rich and must have better donor ability

9. Ans. (A,B,C)

Generally, β-keto carboxylic acids simply undergo decarboxylation on just heating.

10. Ans. (B,C)

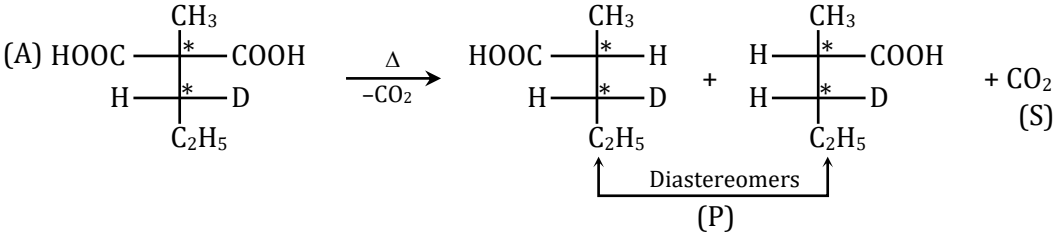
(A) Acetic acid on treatment with X_2 and NaOH undergo acid base reaction

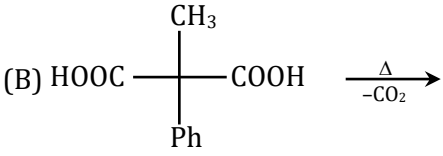
(B) Schiff's reagent and schiff's base has different structure

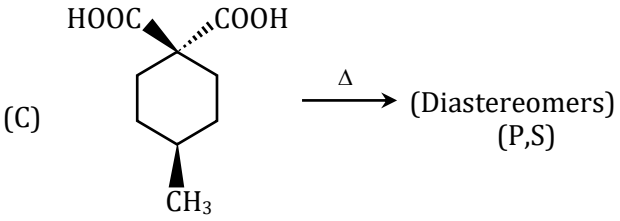
(C) Aromatic aldehyde do not respond to fehling's test

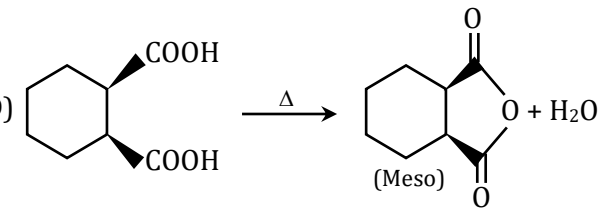
(D) Carbonyl compound give 2,4-DNP test.

11. Ans. (A)

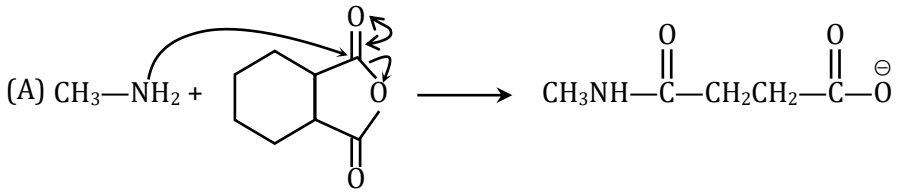


(B) 

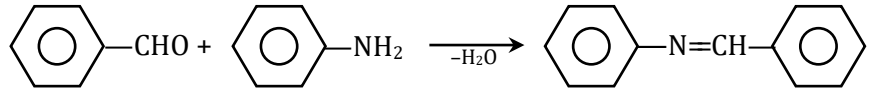
(C) 

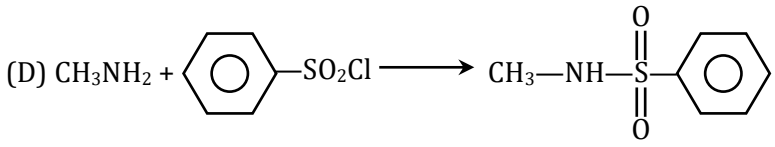
(D) 

12. **Ans. (A)**



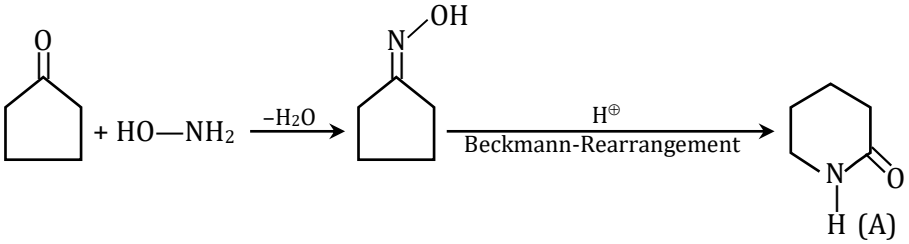
(B) Schotten baumann reaction $\longrightarrow$ $(CH_3)_2-C(=O)-$C$_6$H$_5$



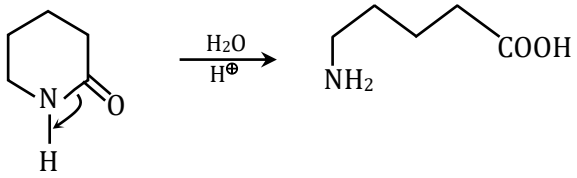


13. **Ans. (C)**

Lactam is cyclic amide.



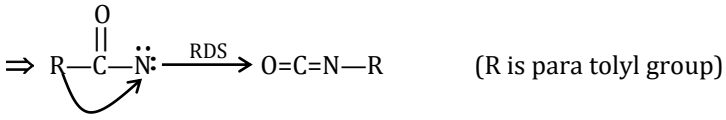
14. **Ans. (C)**



15. **Ans. (A)**

Alkaline hypohalite is the reagent in Hofmann's Bromamide reaction (HBR)

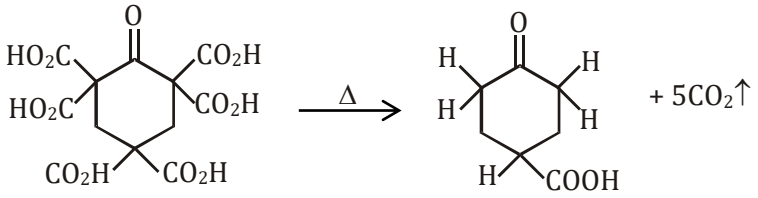
16. **Ans. (AB)**



Slowest step which is rate determining step in HBR is migration of para tolyl group.

Rate of reaction increases when the migrating group is electron donating.

17. **Ans. (5)**



number of CO_2 molecule released = 5

18. **Ans. (4)**

Since in the given compound 4 acidic hydrogen are available so 4 mole of NaOH is required for complete neutralization.

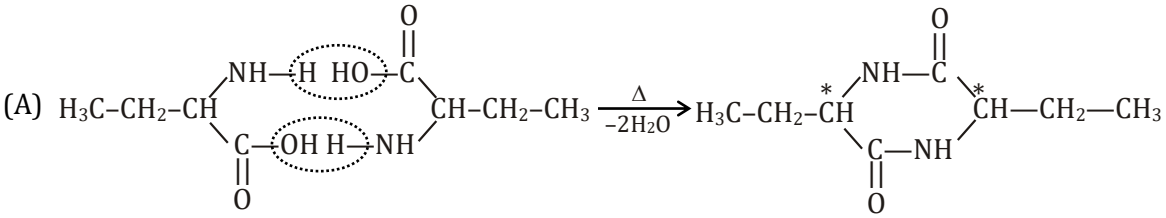
19. **Ans. (5)**

$\Rightarrow$ β-keto carboxylic acid undergo decarboxylation simply on heating.

$\Rightarrow$ Geminal dicarboxylic acid undergo decarboxylation simply on heating.

$\Rightarrow$ α,β-unsaturated carboxylic acid undergo decarboxylation simply on heating.

20. **Ans. (9)**

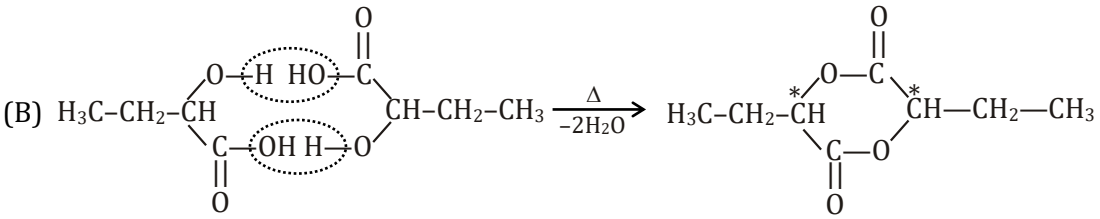
(A) 

n = 2, symmetrical product

So total products = $2^{n-1} + 2^{n/2-1}$

$= 2^{2-1} + 2^{2/2-1}$

$= 2 + 1 = 3$

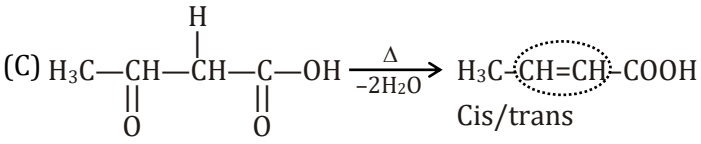
(B) 

n = 2, symmetrical product

So total products = $2^{n-1} + 2^{n/2-1}$

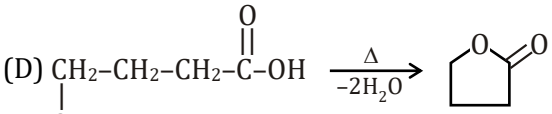
$= 2^{2-1} + 2^{2/2-1}$

$= 2 + 1 = 3$

(C) 

Cis/trans

Total products = 2

(D) 

1 product

So total product from all reaction is nine.