Chapter 13

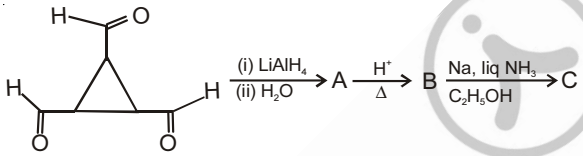
Aldehydes, Ketones and Carboxylic Acids

Solutions

SECTION - A

Objective Type Questions (One option is correct)

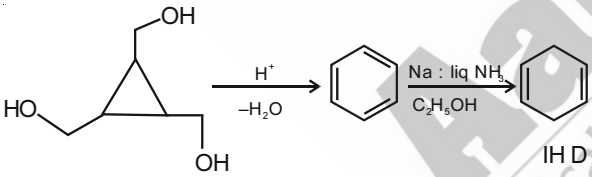
1. In the given reaction sequence



Index of Hydrogen deficiency of C is

(1) 1 (2) 2 (3) 3 (4) 4

Sol. Answer (3)



2. Acetone is converted into propane by

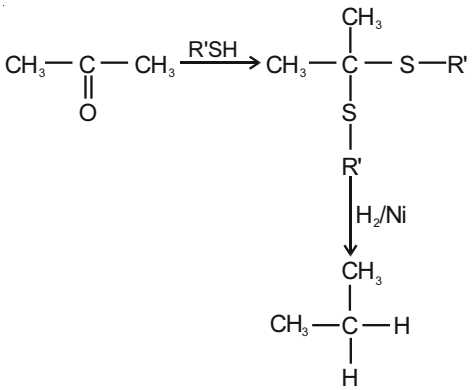
(1) Reduction with H_2/Ni followed by dehydration with H_2SO_4

(2) Reaction with thioalcohol (R'SH) followed by reduction with H_2/Ni

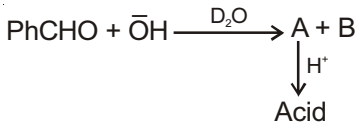
(3) Reaction with thioalcohol (R'SH) followed by hydrolysis with acidic water

(4) Reduction with H_2/Ni followed by oxidation with P.C.C/CH_2Cl_2

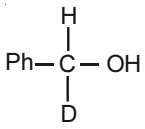
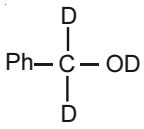
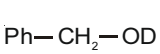
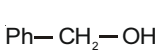
Sol. Answer (2)



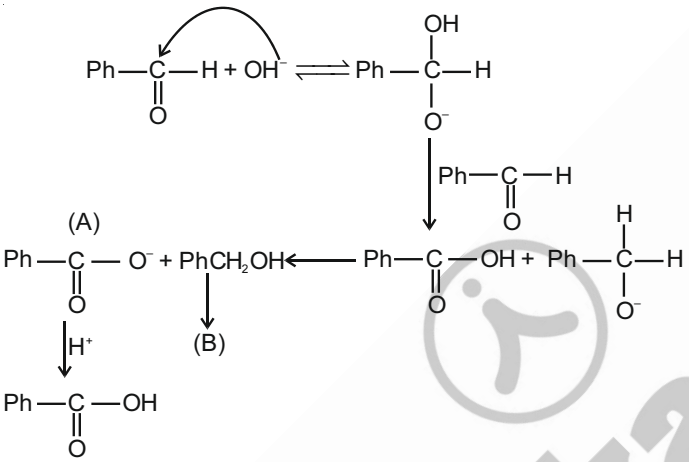
3. The aldehyde which have no α-hydrogen on reaction with NaOH or KOH show disproportionation reaction. Consider the reaction given below



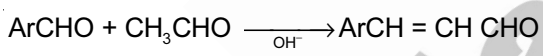
The structure of B is

(1) 
(2) 
(3) 
(4) 

Sol. Answer (4)



4. Consider the aldol condensation reaction



Select the correct statement.

(1) If the electron donating group ($-OCH_3$) attached with ArCHO at para position the rate of reaction increases

(2) If electron donating group ($-OCH_3$) attached with ArCHO at para position the rate of above reaction decrease

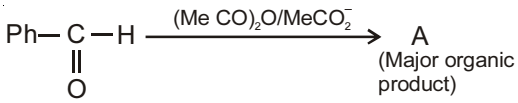
(3) If electron donating group ($-OCH_3$) attached with ArCHO, rate of above reaction never changed

(4) If electron withdrawing group is attached at para position then rate of above reaction never change

Sol. Answer (2)

E.D.G at para decrease the rate of reaction.

5. Consider the below reaction.



Select the incorrect statement

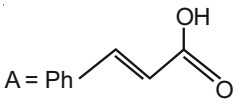
(1) One molecule of A contain nine sp^2 hybridised carbon

(2) During the formation of A, intermediate is formed that contain cyclic six membered ring.

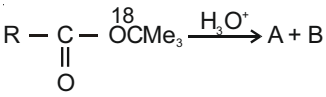
(3) The IUPAC name of A is 3-Phenylpropenoic acid

(4) One molecule of product contain ten carbon atom

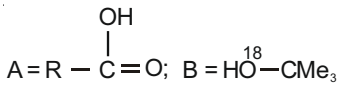
Sol. Answer (4)

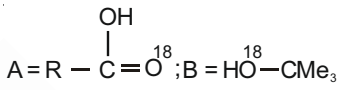


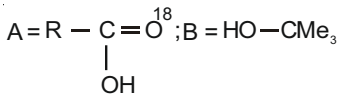
6. In the below reaction A and B are major product of reaction in which (B) is alcohol while (A) is acid

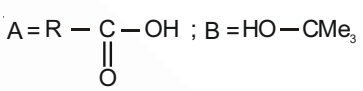


The correct structure of A and B are respectively

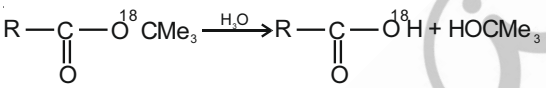
(1) 

(2) 

(3) 

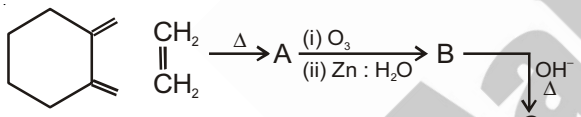
(4) 

Sol. Answer (3)

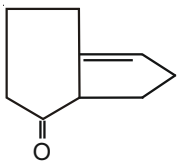


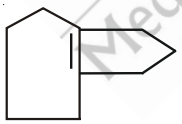
(A) (B)

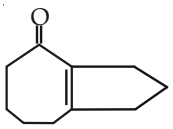
7. In the given reaction sequence

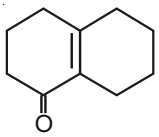


End product C is

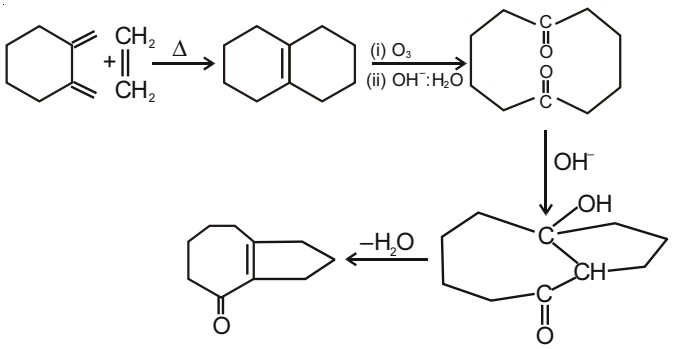
(1) 

(2) 

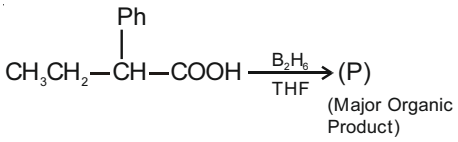
(3) 

(4) 

Sol. Answer (3)

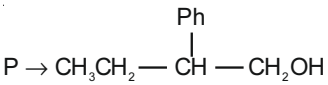


8. Which functional group is present in the product (P)?

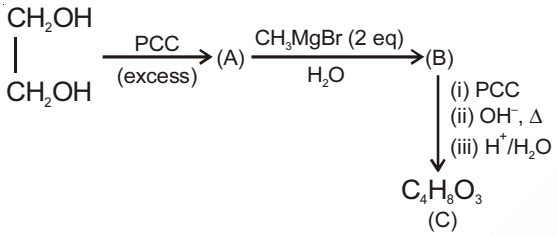


(1) Aldehyde (2) Ketone (3) Alcohol (4) Ester

Sol. Answer (3)



9. Consider the reaction sequence



Select the incorrect statement.

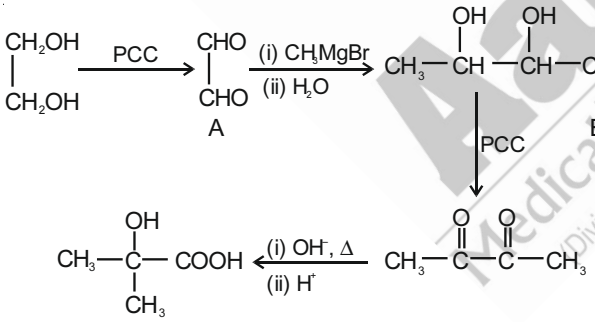
(1) A and B can undergo oxidation by Periodic Acid

(2) C on esterification can produce cyclic diester

(3) Compound C cannot show intermolecular H-Bonding

(4) Conversion of B to C involves migration of CH_3 group

Sol. Answer (3)



10. Consider the following statement

S1 : Hydrogen peroxide ion is stronger nucleophile than hydroxide ion

S2 : Peroxyacetic acid is weaker acid than acetic acid

S3 : H_2O_2 is weaker acid than water

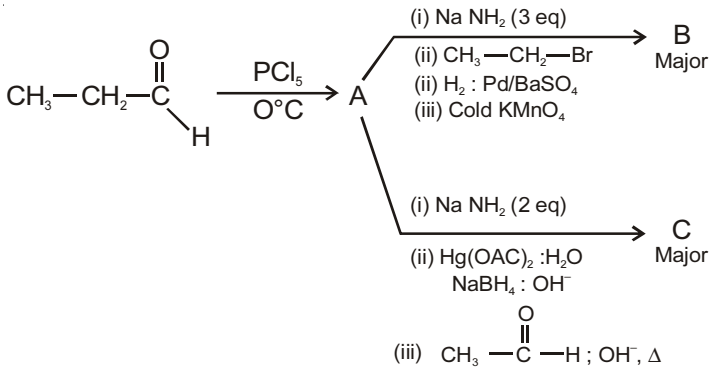
S4 : Peroxyacetic acid is stronger acid than acetic acid

The correct statement(s) is/are

(1) Only S1 and S2 (2) Only S1 and S4 (3) Only S2 and S4 (4) Only S2 and S3

Sol. Answer (1)

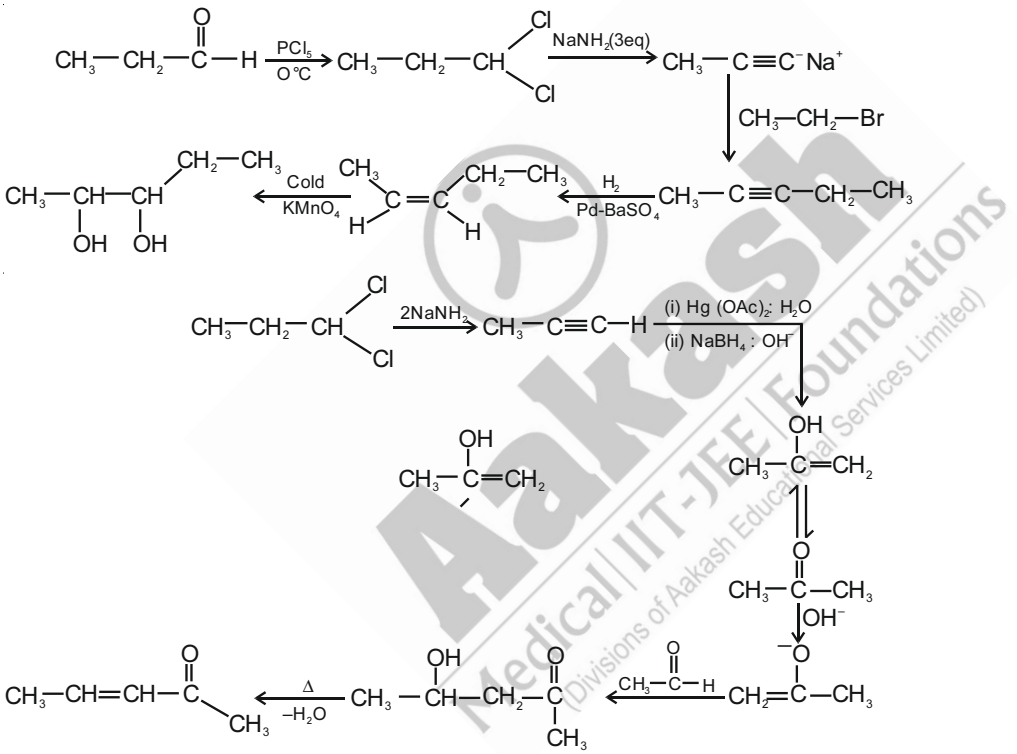
Acidic strength $H_2O_2 > H_2O$ $CH_3\overset{O}{\overset{\|}{C}}OOH < CH_3COOH$

11. 

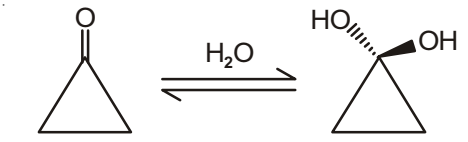
B and C are respectively

(1) Pentane–2, 3–diol and Pent –3–en–2–one
(2) Hexane –2, 3–diol and 3-Ethyl pent – en–2–one
(3) Pentane –2, 3–diol and 3–Methyl hex-4–en–1–al
(4) Hexane –2, 3–diol and 3–Methyl but –2–en–1–al

Sol. Answer (1)



12. Consider the reaction

Reaction 1 : 

(Cyclopropanone)

Reaction 2 : $CCl_3-C(=O)-H \underset{}{\overset{H_2O}{\rightleftharpoons}} Cl_3C-C(OH)_2-H$
(Chloral)

Both form isolable hydrate. The reason for formation of stable hydrate is

(1) In cyclopropanone, the driving force is relief in angle strain in product as compared to reactant

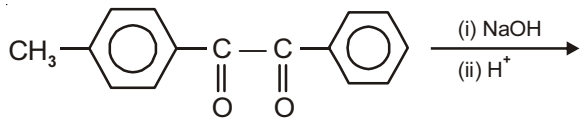
(2) In chloral, the driving force is bigger size of Cl group

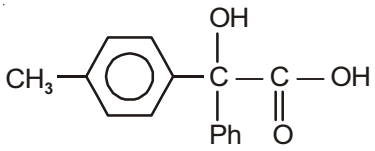
(3) In cyclopropanone, the driving force is cyclic structure that stabilize the –OH by banana bonds

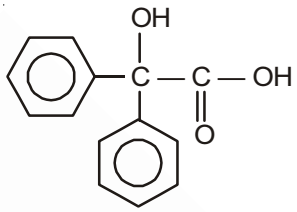
(4) In chloral, carbonyl carbon become sp^2 in product that is stabilized by two hydroxy group

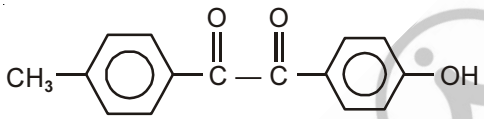
Sol. Answer (1)

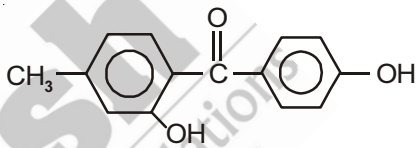
13. The major product of the reaction is



(1) 

(2) 

(3) 

(4) 

Sol. Answer (1)

14. Consider the following compound

(A) $CH_3–COOCH_3$

(B) $CH_3 – \overset{O}{\overset{\|}{C}} – Cl$

(C) $CH_3 – \overset{O}{\overset{\|}{C}} – O – \overset{O}{\overset{\|}{C}} – CH_3$

(D) $CH_3 – \overset{O}{\overset{\|}{C}} – S – \overset{O}{\overset{\|}{C}} – CH_3$

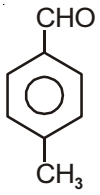
The correct order of rate of nucleophilic acyl substitution reaction is

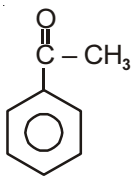
(1) B > A > C > D (2) B > C > D > A (3) B > D > C > A (4) D > B > C > A

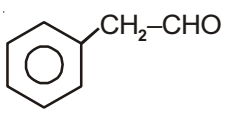
Sol. Answer (3)

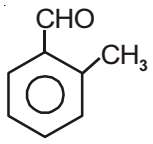
Rate of nucleophilic substitution reaction $\propto$ strength of leaving group.

15. Compound A(C_8H_8O) gives positive Fehling test but does not produces yellow solid on reaction with NaOH/I_2. Correct structure of A is

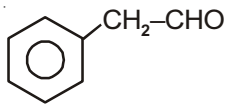
(1) 

(2) 

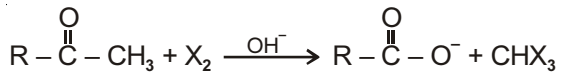
(3) 

(4) 

Sol. Answer (3)

A is 

16. Consider the reaction



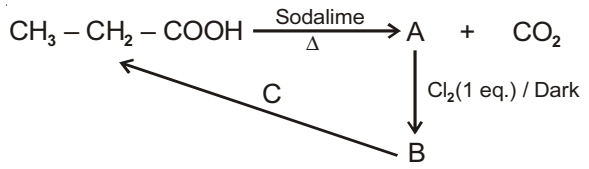
The correct order of rate of reaction w.r.t. X_2 is

(1) $I_2 > Br_2 > Cl_2$ (2) $Cl_2 > Br_2 > I_2$ (3) $I_2 = Br_2 = Cl_2$ (4) $Cl_2 > I_2 > Br_2$

Sol. Answer (3)

Rate of haloform reaction is same for halogens ($Cl_2 = Br_2 = I_2$)

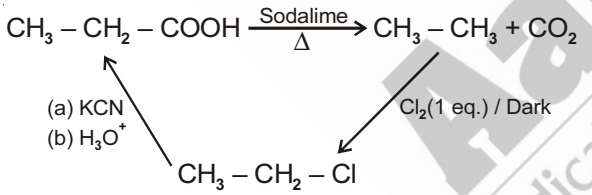
17. The sequence of reaction is given as



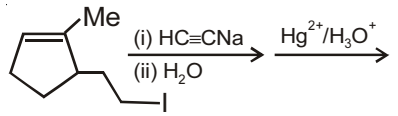
The correct combination of A, B and C is

	A	B	C
(1)	C_2H_6	C_2H_5Cl	$LiAlH_4$
(2)	C_2H_6	C_2H_5Cl	(a) KCN (b) H_3O^+ (excess)
(3)	C_3H_8	C_3H_7Cl	$LiAlH_4$
(4)	C_3H_8	C_3H_7Cl	(a) KCN (b) H_3O^+ (excess)

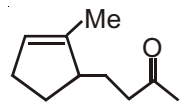
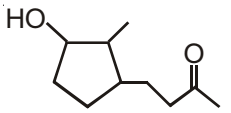
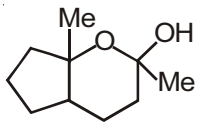
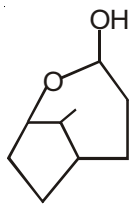
Sol. Answer (2)



18. Consider the following sequence of reactions



Major product would be

(1)  (2)  (3)  (4) 

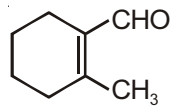
Sol. Answer (3)

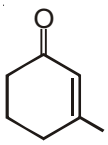
In the presence of Hg^{2+}/H_3O^+ hydration of alkene and alkyne both will take place.

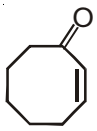
SECTION - B

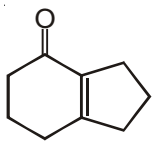
Objective Type Questions (More than one options are correct)

1. Which of the following compounds can be synthesized by intramolecular aldol condensation in very good yield (as a major product)?

(1) 

(2) 

(3) 

(4) 

Sol. Answer (2, 4)

In intramolecular aldol condensation, carbanion always attacks on aldehyde group. So, free aldehyde group is not present in product. And only five or six membered ring products are formed. So. (1) and (3) are not the major product.

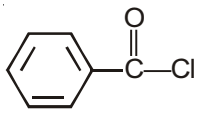
2. Which of the following reactions involve carbanion enolate as reactive intermediates?

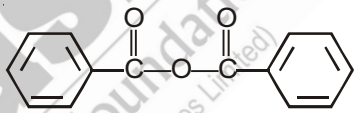
(1) Kolbe-Schmidt reaction
(2) Reimer-Tiemann reaction
(3) Claisen condensation
(4) Aldol condensation

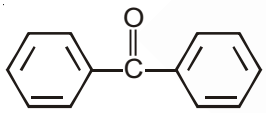
Sol. Answer (3, 4)

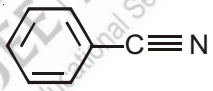
Fact

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

(1) 

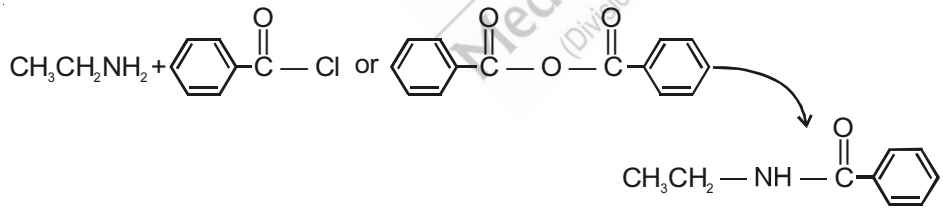
(2) 

(3) 

(4) 

Sol. Answer (1, 2)

Only benzoyl chloride and benzoic anhydride is used for the benzoylation of ethyl amine and it gives substitution product via addition/elimination mechanism.



Ethyl benzamide

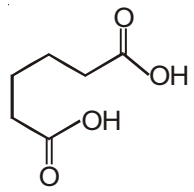
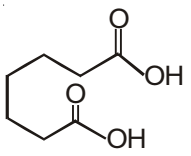
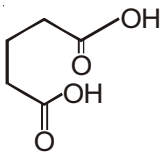
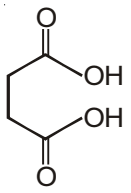
4. Which of the following reagents can be used to distinguish Benzaldehyde from acetophenone?

(1) Tollen's reagent
(2) Sodium hypoiodite
(3) 2, 4-Dinitrophenyl hydrazone
(4) Benedicts solution

Sol. Answer (1, 2)

Benzaldehyde reduces Tollen's reagent while acetophenone is not while acetophenone reacts with sodium hypoiodite and give iodoform reaction while benzaldehdye is not.

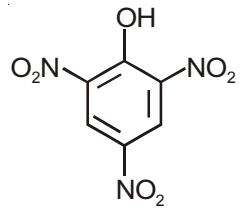
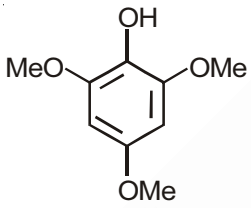
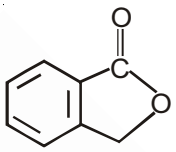
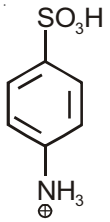
5. Which of the following dicarboxylic acid will give cyclo alkanone on heating?

(1) 
(2) 
(3) 
(4) 

Sol. Answer (1, 2)

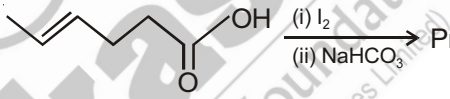
In (1) and (2) cyclopentanone is formed. While in (3) and (4) cyclobutanone and propanone is formed which is less stable due to ring strain and almost no yield is observed.

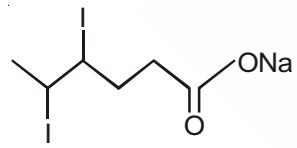
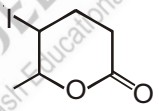
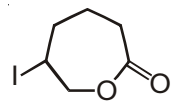
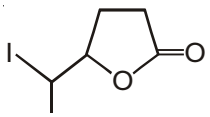
6. Which of the following compounds could liberate CO_2 with aqueous $NaHCO_3$?

(1) 
(2) 
(3) 
(4) 

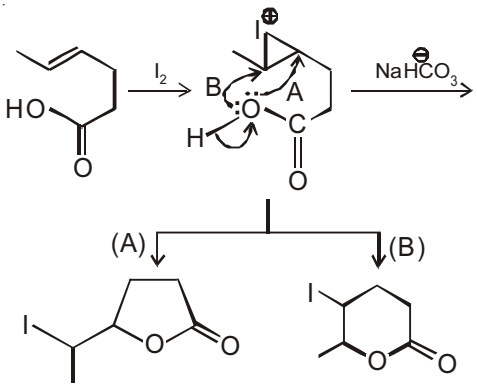
Sol. Answer (1, 4)

Only those compound which has equal or more acidic hydrogen than carboxylic acid liberates CO_2 with aqueous $NaHCO_3$.

7. Consider the following sequence of reactions  Products. Products of the given reaction would be

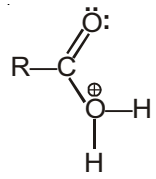
(1) 
(2) 
(3) 
(4) 

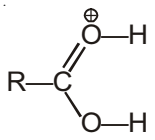
Sol. Answer (2, 4)

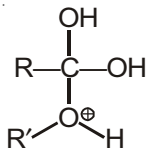


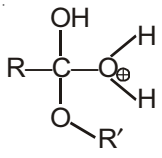
Now $\ddot{\overline{O}}$ attacks on that position where the good leaving group i.e. I atom is attached and it gives two cyclic product.

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

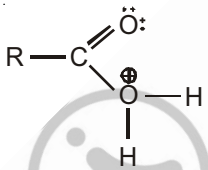
(1) 

(2) 

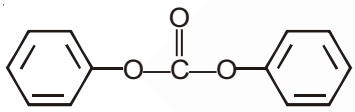
(3) 

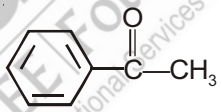
(4) 

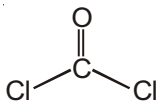
Sol. Answer (2, 3, 4)

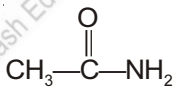
In acid catalyzed esterification of carboxylic acid H^+ attack on double bonded oxygen atom not on single bonded oxygen atom. So,  is not formed.

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

(1) 

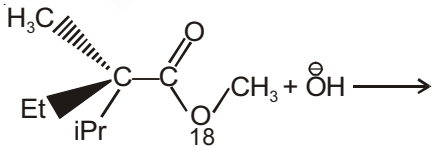
(2) 

(3) 

(4) 

Sol. Answer (1, 3)

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



[where iPr = CH_3—CH(—CH_3)— group, O^{18} = represents labelled oxygen]

(1) The given reaction primarily follows S_N2 mechanism

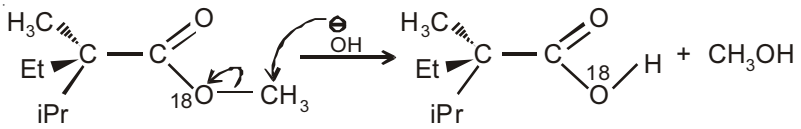
(2) In the given reaction condition inversion occurs at the chiral carbon

(3) Labelled ^{18}O is present in formed carboxylic acid

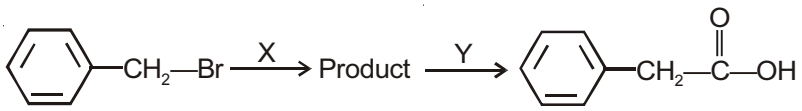
(4) The given reaction primarily follows addition / elimination mechanism

Sol. Answer (1, 3)

In this reaction, $\overset{\ominus}{O}H$ does not attack on $>C=O$ due to steric hinderance and it attacks on the back side of O^{18} and abstracts CH_3. This is the S_N2 mechanism



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



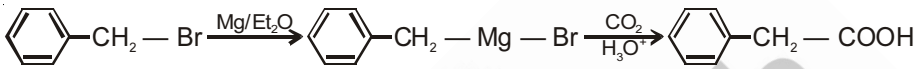
(1) X = Mg / Et_2O, Y = CO_2, followed by H_3O^+

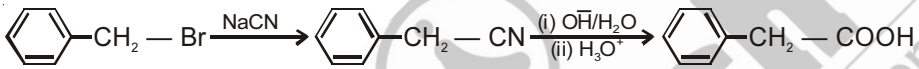
(2) X = AgCN, Y = (i) $\overline{O}H$ / H_2O (ii) H_3O^+

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

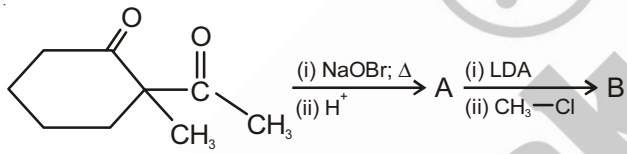
(4) X = alcoholic KOH, Y = (i) HCN (ii) H_3O^+

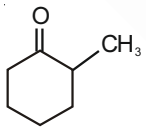
Sol. Answer (1, 3)

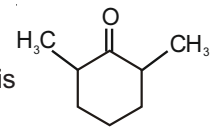
(1) 

(2) 

12. In the given reaction sequence



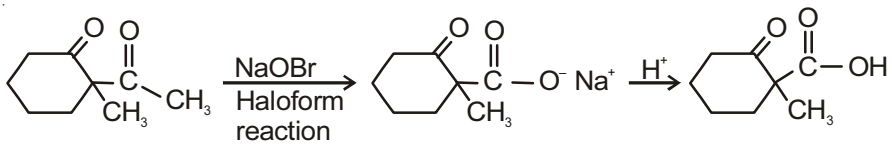
(1) A is 

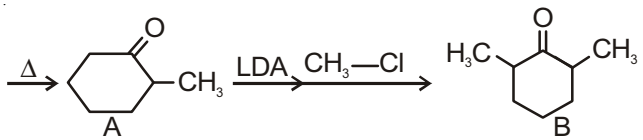
(2) B is 

(3) Conversion of A to B is Kinetically controlled reaction

(4) Conversion of A to B is Thermodynamically controlled reaction

Sol. Answer (1, 2, 3)





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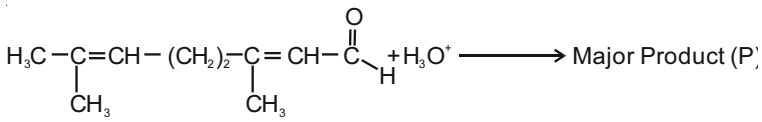
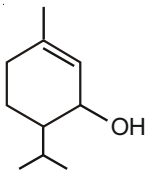
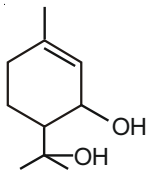
13. Which of the following is correct about following reaction?



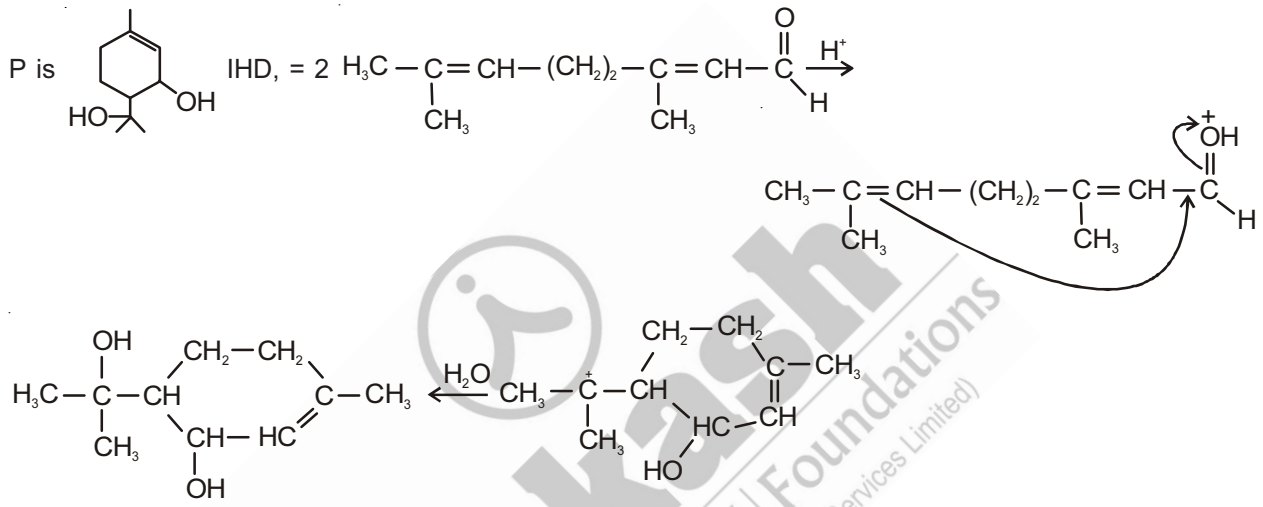
(1) Product P is 

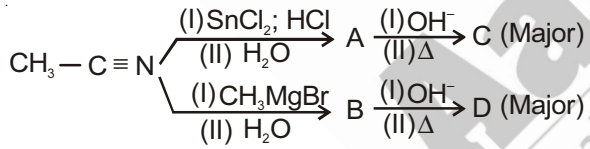
(2) Product P is 

(3) Index of Hydrogen deficiency of product P is 2

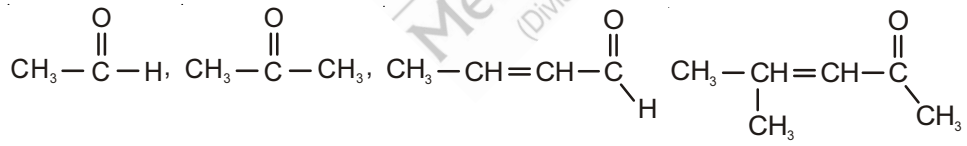
(4) Index of Hydrogen deficiency of product P is 3

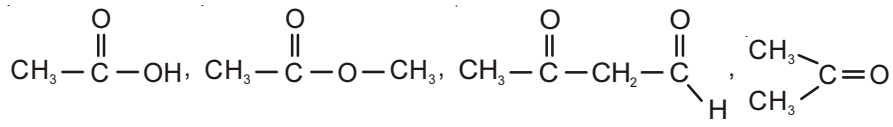
Sol. Answer (2, 3)

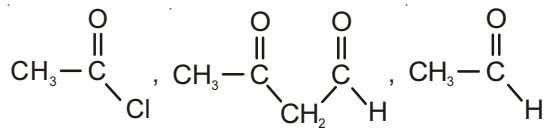


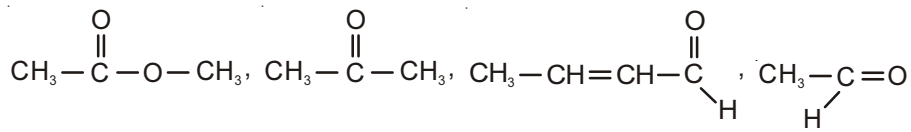
14. 

Product A, B, C, D are respectively

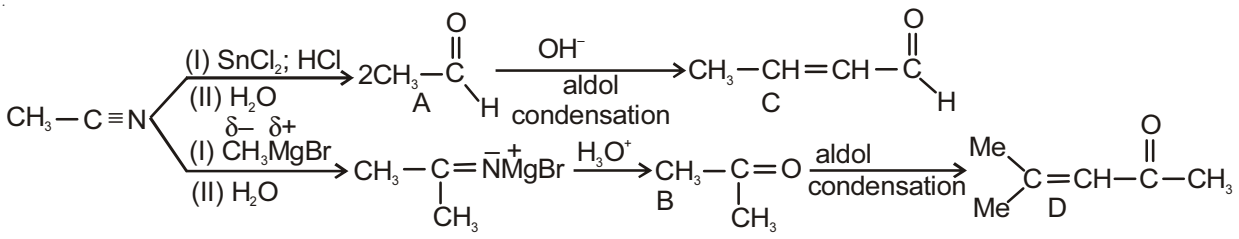
(1) 

(2) 

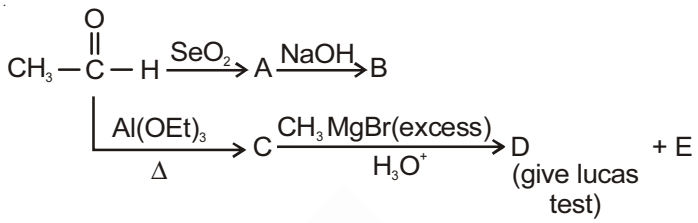
(3) 

(4) 

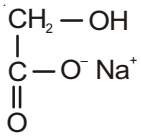
Sol. Answer (1)

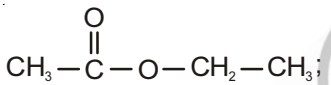
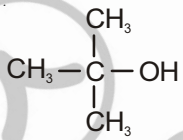


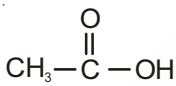
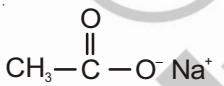
15. In the given reaction sequence

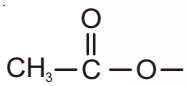
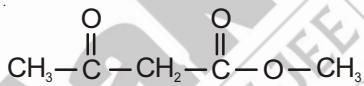


Which of the following is correct?

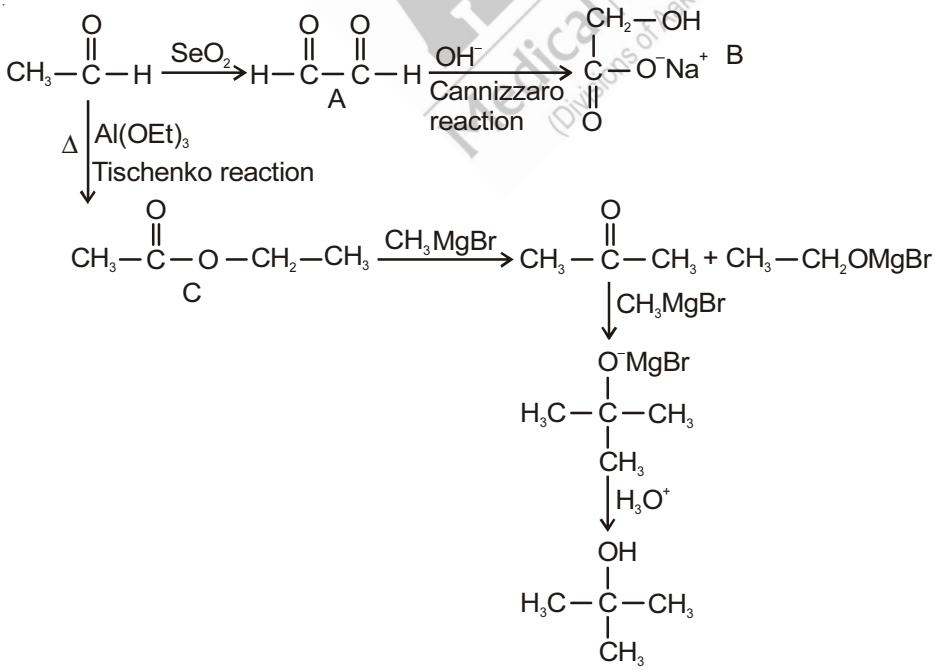
(1) A is  ; B is 

(2) C is  ; D is 

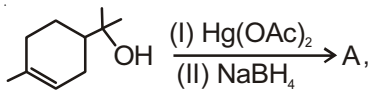
(3) A is  , B is 

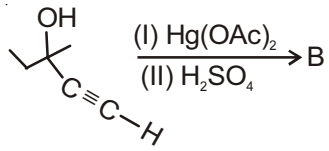
(4) A is  , C is 

Sol. Answer (1, 2)

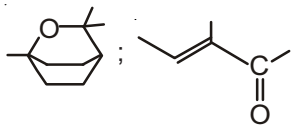


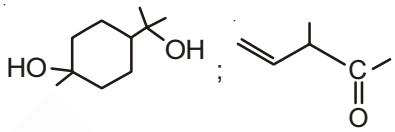
16. In the given reaction

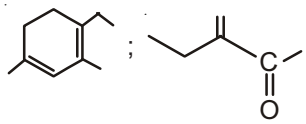
Reaction - I : 

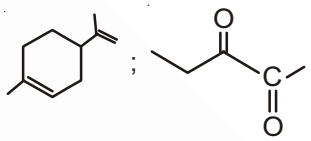
Reaction - II : 

A and B are respectively

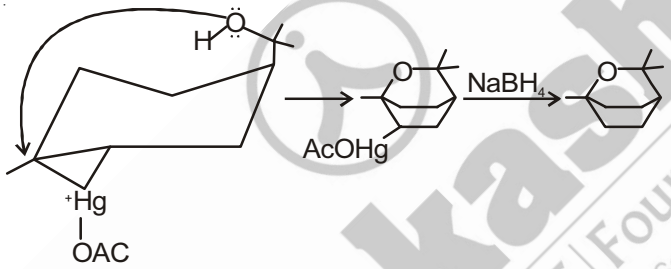
(1) 

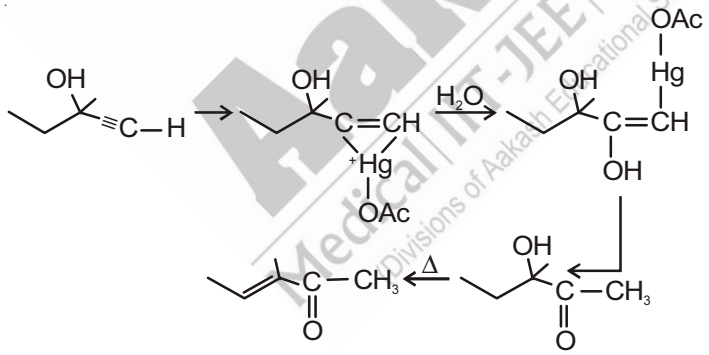
(2) 

(3) 

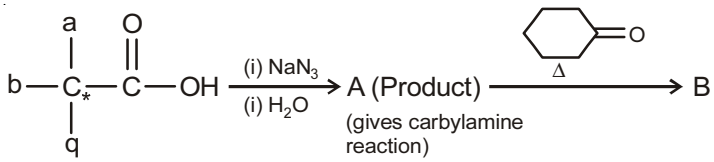
(4) 

Sol. Answer (1)

Reaction-I : 

Reaction-II : 

17. In the given reaction sequence



Which of the following is correct?

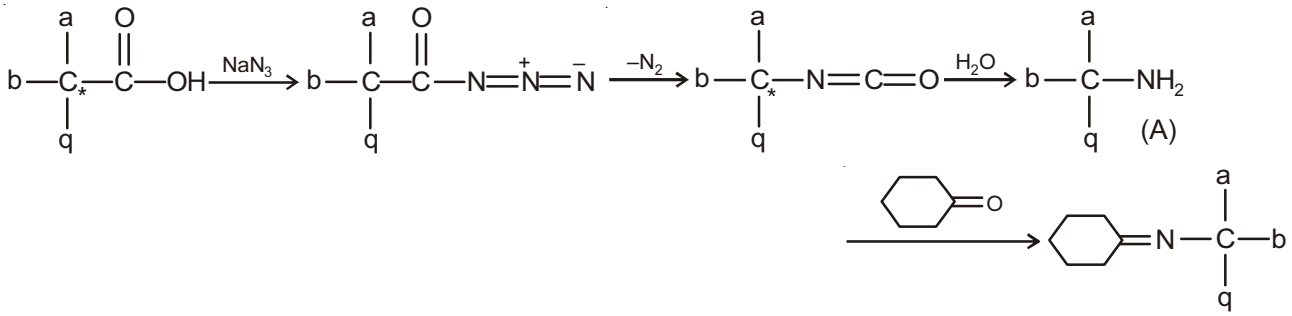
(1) Stereochemistry of C* retained in Product A

(2) Intermediate formed in formation of A is Isocyanate

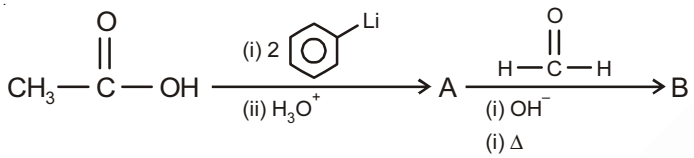
(3) Compund A does not react with Hinsberg Reagent

(4) Compound A react with Hinsberg Reaction

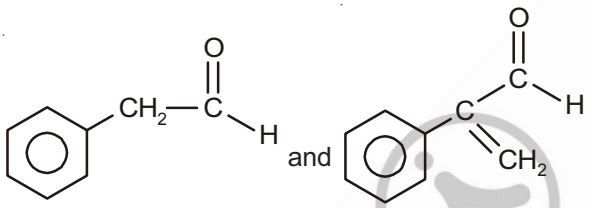
Sol. Answer (1, 2, 4)

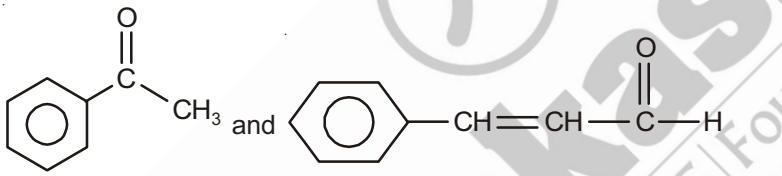


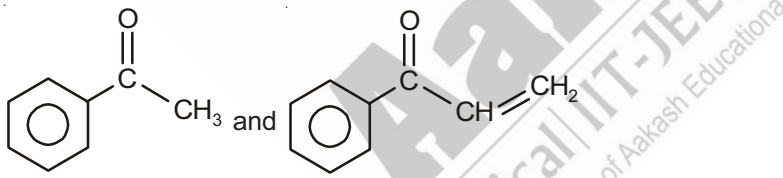
18. In a given reaction Sequence

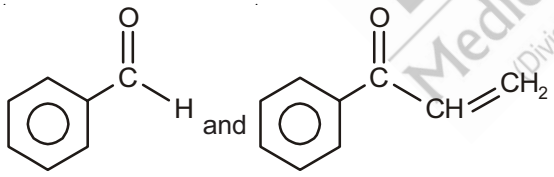


A and B are respectively

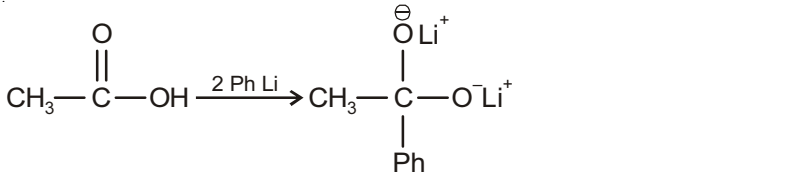
(1) 

(2) 

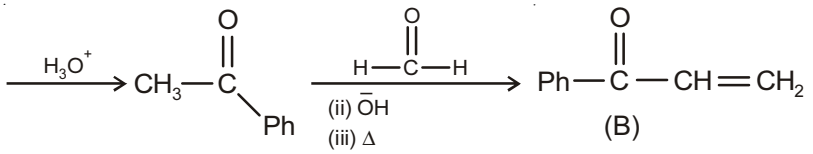
(3) 

(4) 

Sol. Answer (3)



(A)



(B)

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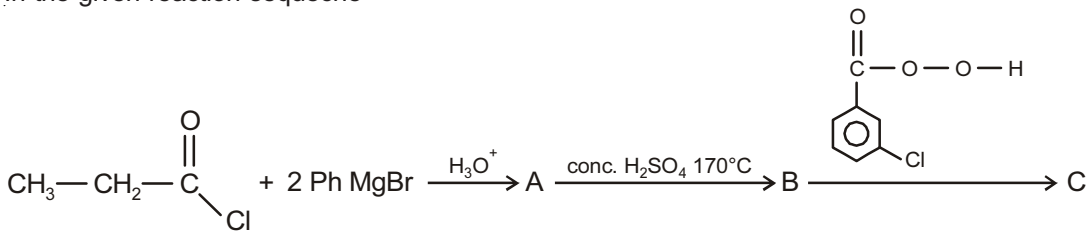
19. In the given reaction sequecne



Which of following is correct?

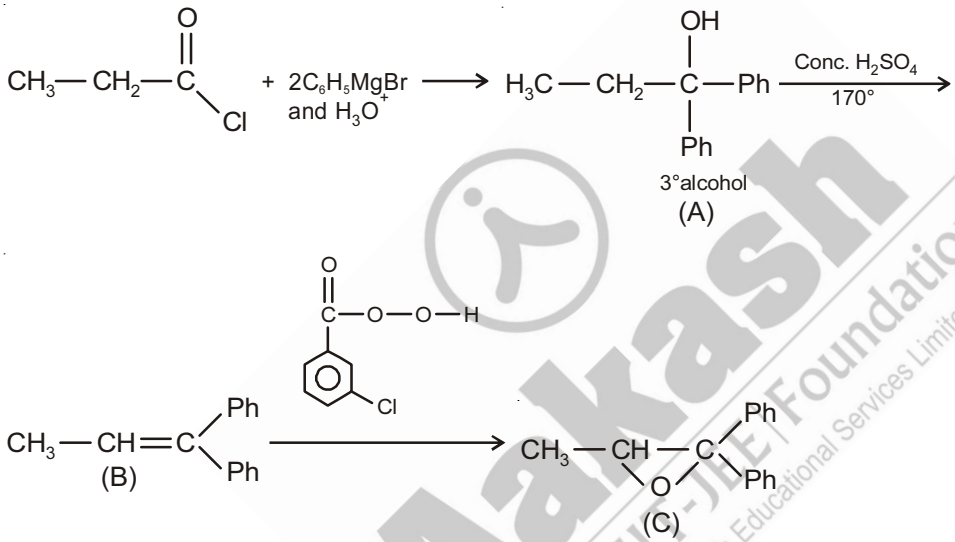
(1) Compound A is 3° alcohol

(2) Compound B gives test of unsaturation with Br_2/CCl_4

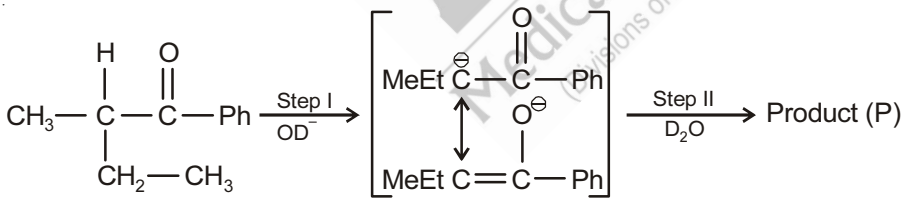
(3) Compound C is 3° alcohol

(4) Compound C React with Na to give hydrogen

Sol. Answer (1, 2)



20. Which of following is correct about following reaction?



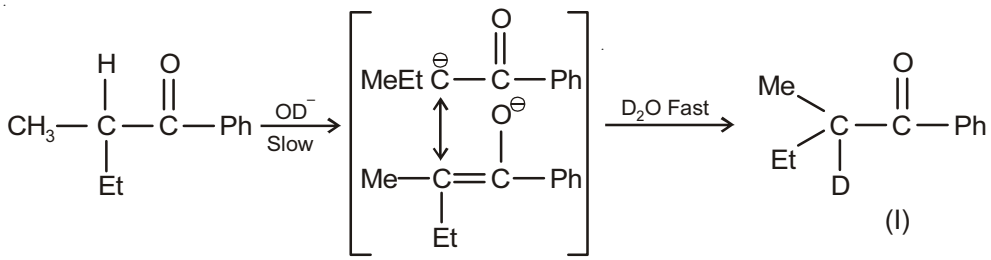
(1) Step-I is rate limiting step

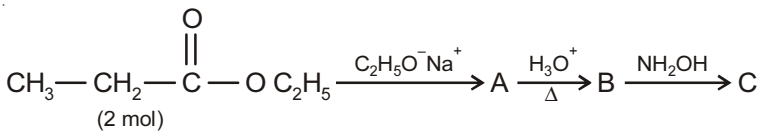
(2) Product P is racemic mixture

(3) Step-II is rate limiting step

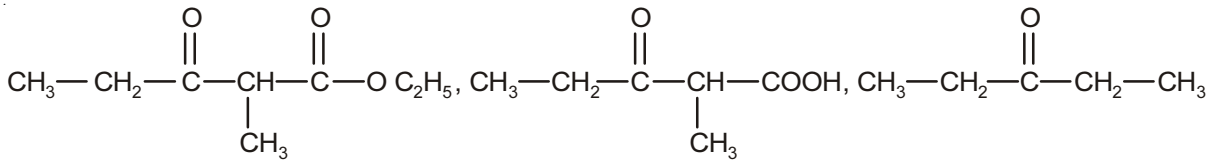
(4) P contain one chiral carbon atom

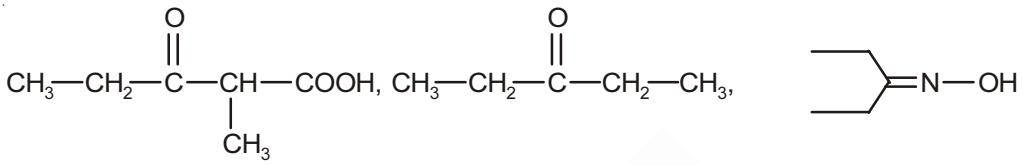
Sol. Answer (1, 2, 4)

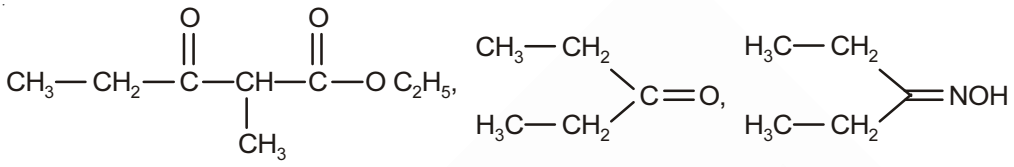


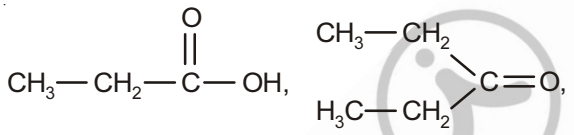
21. 

A, B and C are respectively

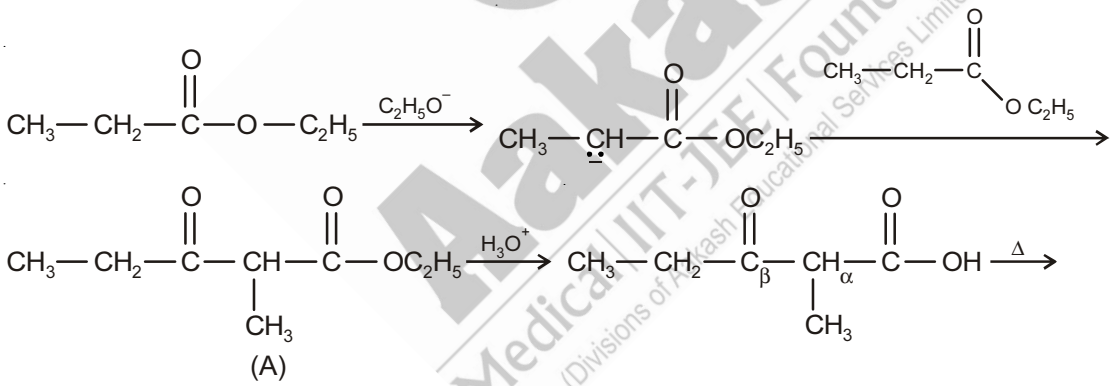
(1) 

(2) 

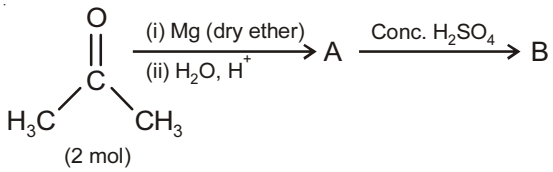
(3) 

(4) 

Sol. Answer (3)



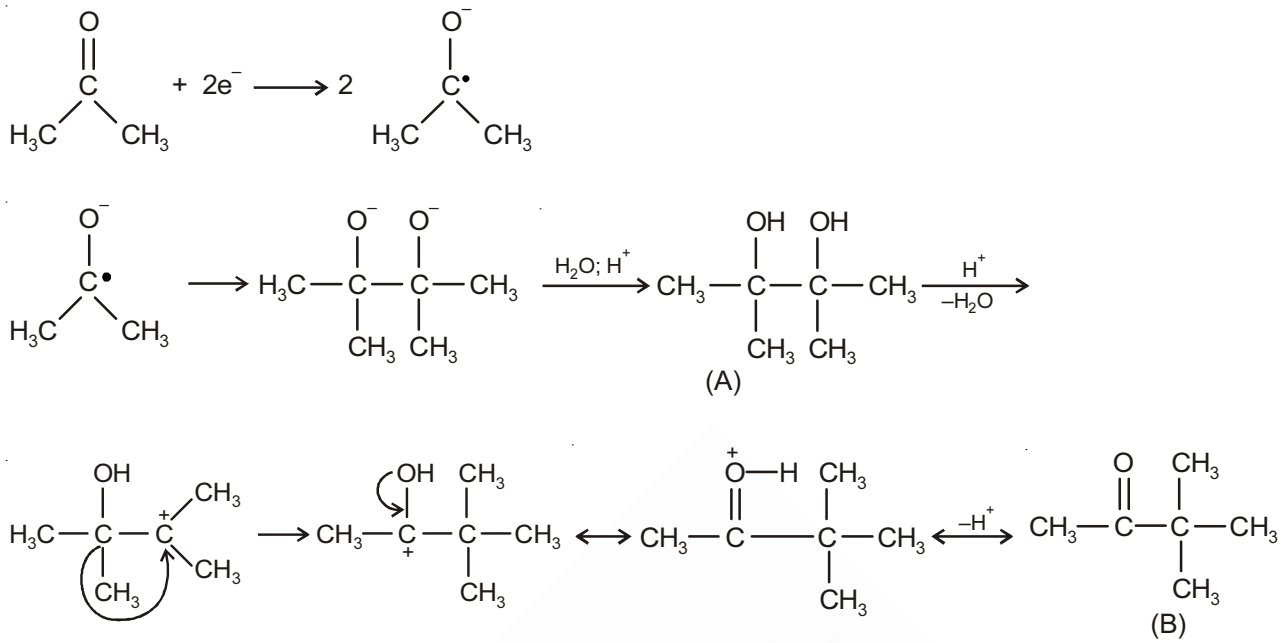
22. Consider the sequence of reaction



Which of following is correct?

(1) A gives Tollen's reagent test
(2) A gives lucas test at room temperature
(3) B gives Iodoform test
(4) B gives 2, 4-DNP test

Sol. Answer (2, 3, 4)

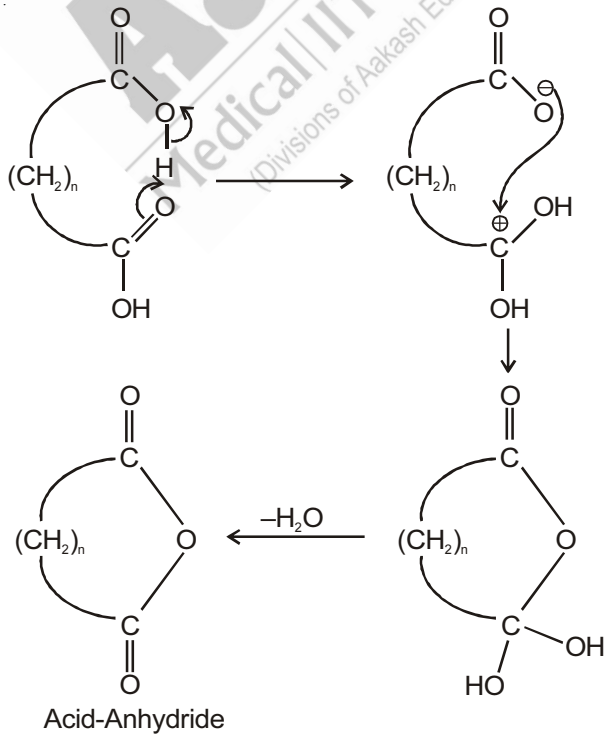


SECTION - C

Linked Comprehension Type Questions

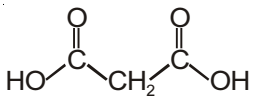
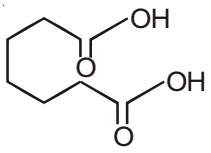
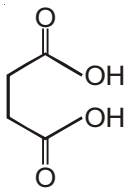
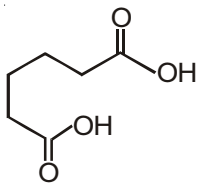
Comprehension-I

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

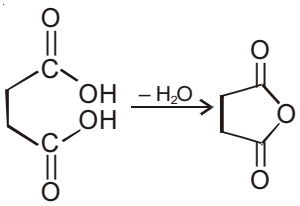


Acid-Anhydride

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

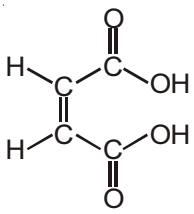
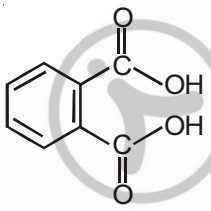
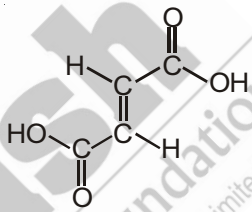
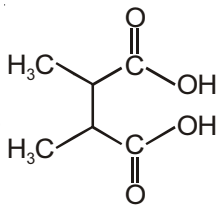
(1) 
(2) 
(3) 
(4) 

Sol. Answer (3)



Only it forms stable five membered ring compound other forms 4 membered or seven membered ring compound which is least stable.

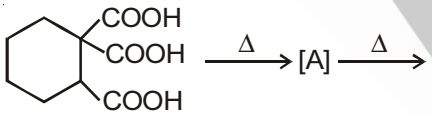
2. Which of the following dicarboxylic acid will not form cyclic anhydride?

(1) 
(2) 
(3) 
(4) 

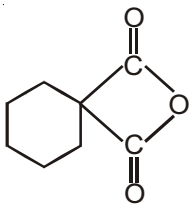
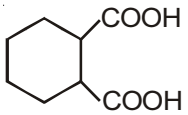
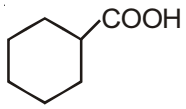
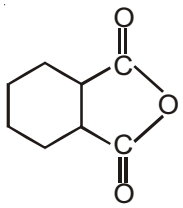
Sol. Answer (3)

Those dicarboxylic acid will not form cyclic anhydride in which both —COOH groups are present on trans position.

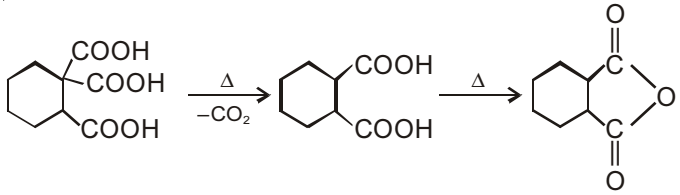
3. Consider the following sequence of reaction.



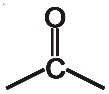
The final product of the reaction would be

(1) 
(2) 
(3) 
(4) 

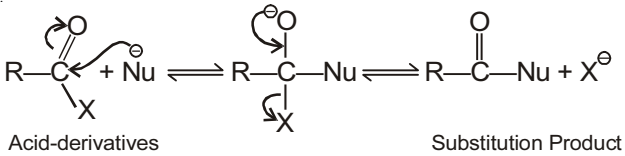
Sol. Answer (4)



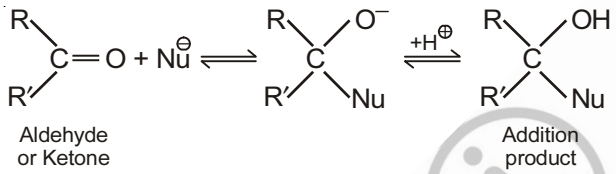
Comprehension-II

Both carbonyl compounds and acid derivatives though they contain  grouping yet the reactions given by them are entirely different.

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



where X— = —Cl, —O—C—R, —OR′, –NRR′ etc.



1. Why aldehydes and Ketones give nucleophilic addition reaction while acid derivatives prefer nucleophilic acyl substitution reaction?

   (1) Carbonyl carbon of aldehydes and Ketones are more electron deficient than acid derivatives

   (2) Carbonyl carbon of acid derivatives are more electron deficient

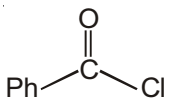
   (3) Acid derivatives also give addition reaction

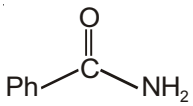
   (4) In acid derivatives, acyl carbon is connected with a good leaving group

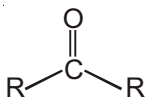
Sol. Answer (4)

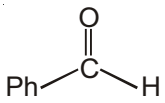
In acid derivatives, acyl carbon is connected with good leaving group. So, it gives nucleophilic acyl substitution reaction.

2. Which of the following is most reactive towards a nucleophile?

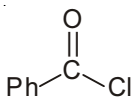
(1) 

(2) 

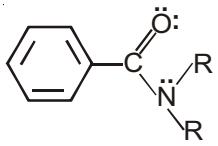
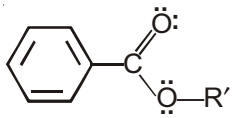
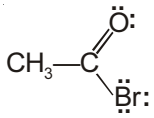
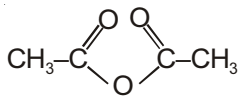
(3) 

(4) 

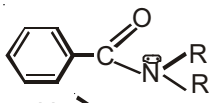
Sol. Answer (1)

 is most reactive because —Cl is the good leaving group.

3. Carbonyl character is most supressed in

(1)  (2)  (3)  (4) 

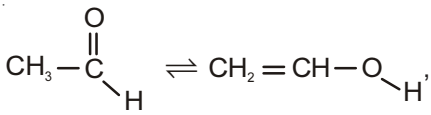
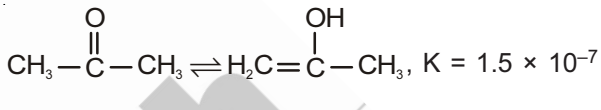
Sol. Answer (1)

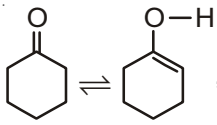
Carbonyl character is most suppressed in  because in this case the lone pair of $\bar{e}$ of N atom more strongly participate in resonance with $>C=O$ group.

Comprehension-III

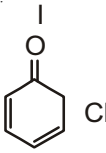
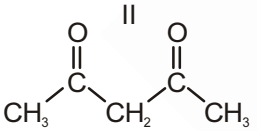
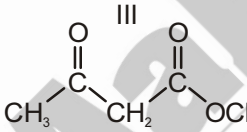
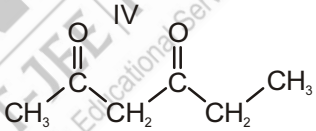
Aldehydes and ketones exist in solution as equilibrium mixtures of two isomeric forms, the ketone form and the enol form.

Keto $\rightleftharpoons$ Enol form, $K = \frac{[\text{Enol form}]}{[\text{Keto form}]}$, Value of K are given for some reactions

 $K = 2 \times 10^5$  $K = 1.5 \times 10^{-7}$

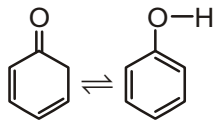
 $K = 5 \times 10^{-5}$

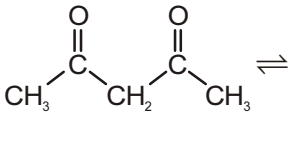
1. Arrange the order of % of enol content of following compound

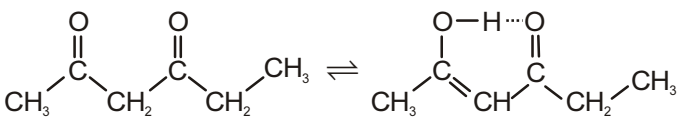
I  II  III  IV 

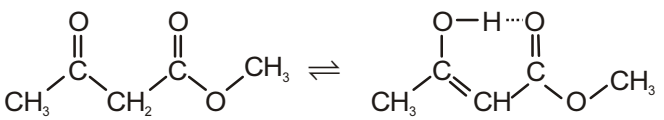
(1) I > II > IV > III (2) I > II > III > IV (3) II > III > I > IV (4) III > II > I > IV

Sol. Answer (1)

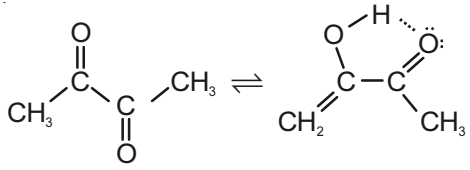


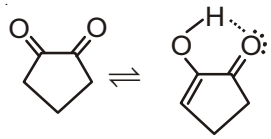


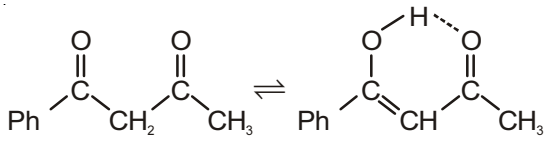




2. Consider the given reactions

(I) 

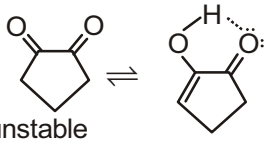
(II) 

(III) 

The percentage of enol content is highest for

(1) Reaction (I) (2) Reaction (II) (3) Reaction (III) (4) All have same enol %

Sol. Answer (2)



unstable due to dipole-dipole repulsion

≈ 100%

SECTION - D

Matrix-Match Type Questions

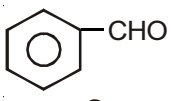
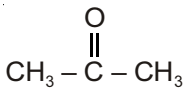
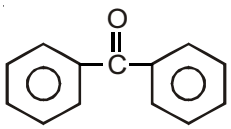
1. Match the following

Column-I	Column-II
(A) Fries rearrangement	(p) Acid-catalysed rearrangement
(B) Claisen rearrangement	(q) Concerned with ester
(C) Bayer Villiger's rearrangement	(r) Involves electrophilic substitution
(D) Pinacol-pincolone rearrangement	(s) Intramolecular rearrangement

Sol. Answer: A(p, q, r, s), B(r, s), C(p, q, s), D(p, s)

All reactions are fact.

2. Match the following.

Column-I	Column-II
(A) 	(p) Aldol condensation
(B) 	(q) Cannizzaro reaction
(C) HCHO	(r) Benzoin condensation
(D) 	(s) Claisen-Schmidt reaction

Sol. Answer: A(q, r, s), B(p, s), C(q, s), D(s)

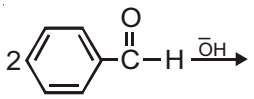
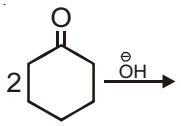
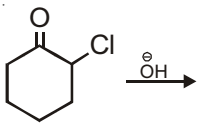
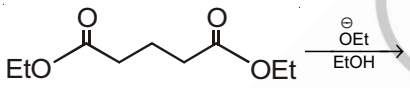
(A) Benzaldehyde can give Cannizzaro reaction, Benzoin condensation and Claisen Schmidt reaction.

(B) Acetone can give aldol condensation and Claisen Schmidt reaction.

(C) HCHO can give Cannizzaro reaction and Claisen Schmidt reaction.

(D) $C_6H_5-\overset{\overset{O}{\|}}{C}-C_6H_5$ can only give Claisen Schmidt reaction.

3. Match the following.

Column I	**Column II**
(A) 	(p) Involves carbanion enolate
(B) 	(q) Involves nucleophilic addition
(C) 	(r) Molecular wt. of product more than that of reactant
(D) 	(s) Five membered ring formation
	(t) Generates resonance stabilized carbanion

Sol. Answer: A(q, r), B(p, q, r, t), C(p, s, t), D(p, t)

Fact

4. Match the following.

Column-I (Reactions)	**Column-II (Reagents/Catalyst)**
(A) Cannizzaro's reaction	(p) $Al(OCHMe_2)_3$
(B) Clemmensen's reduction	(q) Conc. NaOH
(C) Wolff Kishner's reduction	(r) Zn-Hg/HCl
(D) Meerwein Ponndorf's Verleys reduction	(s) $N_2H_4/\overline{O}H$

Sol. Answer: A(q), B(r), C(s), D(p)

All are facts.

SECTION - E

Assertion-Reason Type Questions

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

and

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

Sol. Answer (3)

Only aromatic aldehyde doesn't give Benedict's test while aliphatic aldehyde gives positive Benedict's test.

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

and

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

Sol. Answer (4)

The $\bar{O}D$ of D_2O doesn't participate in Cannizzaro's reaction.

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

and

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

Sol. Answer (1)

Fact

4. STATEMENT-1 : Cyclohexanone on reaction with secondary amines yields Schiff's base.

and

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

Sol. Answer (4)

Only primary amine reacts with carbonyl compound to form Schiff's base.

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

and

STATEMENT-2 : Methanoic acid is stronger acid than ethanoic acid.

Sol. Answer (2)

Methanoic acid is stronger acid than ethanoic acid. Methanoic acid also acts as reducing agent while ethanoic acid doesn't acts as reducing agent.

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

and

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

Sol. Answer (3)

Acetic acid doesn't undergo haloform test but it contains α-hydrogen atom.

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

and

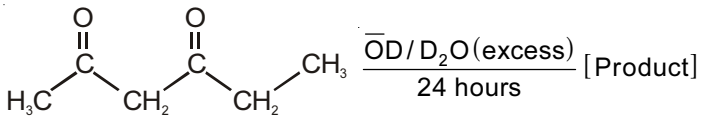
STATEMENT-2 : Decarboxylation takes place via a six membered cyclic transition state.

Sol. Answer (4)

β-Keto acid is easily decarboxylated because it forms most stable reactive intermediate on decarboxylation.

SECTION - F

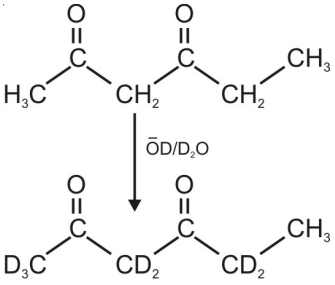
Integer Answer Type Questions

1. Consider the following reaction : 

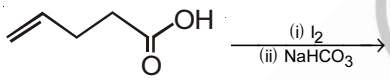
Molecular weight of the product would increase by :

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

Sol. Answer (7)

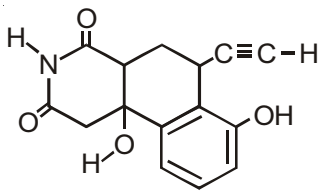


2. What would be the maximum number of atoms involved in the formation of newly constructed ring in the given reaction?



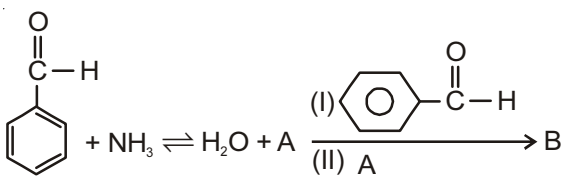
Sol. Answer (5)

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



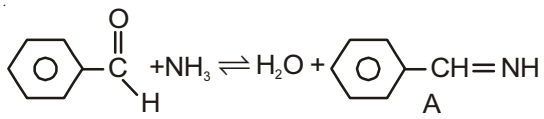
Sol. Answer (2)

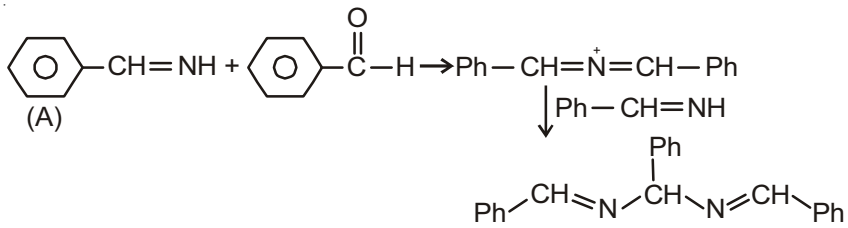
$\overline{OH}$ is not enough strong to deprotonate Alkyne and aliphatic alcohol.

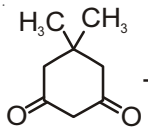
4. 

Number of sp^2 hybridised carbon atoms in B is

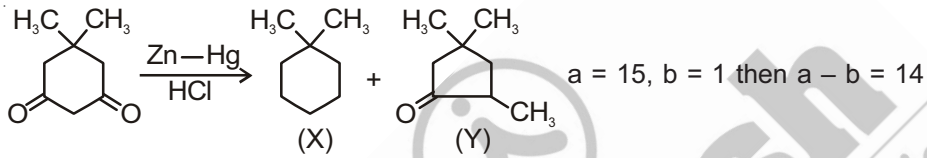
Sol. Answer (20)



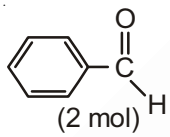
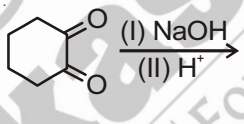


5.  (X) + (Y) . If number of sp^3 hybridised C – atom in X and Y is a; number of sp^2 hybridised C – atom in X and Y is b then a – b is

Sol. Answer (14)

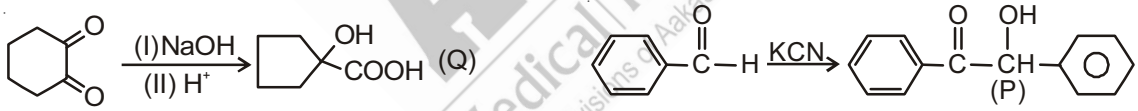


a = 15, b = 1 then a – b = 14

6. Reaction - I  P, Reaction- II 

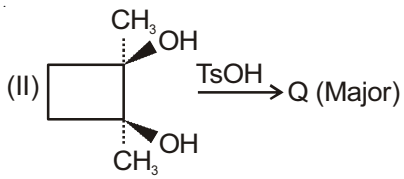
Number of sp^3 hybridised carbon atoms in P and Q is x and number of sp^2 hybridised carbon atom in P and Q is y then x + y is

Sol. Answer (20)



C(sp^3) in P and Q = x = 1 + 5 = 6
C(sp^2) in P and Q = y = 13 + 1 = 14
x + y = 6 + 14 = 20

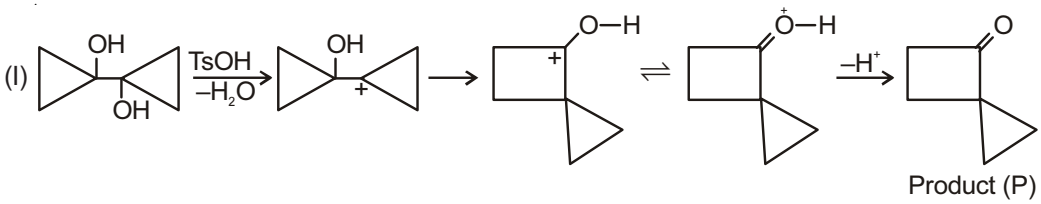
7. (I) 

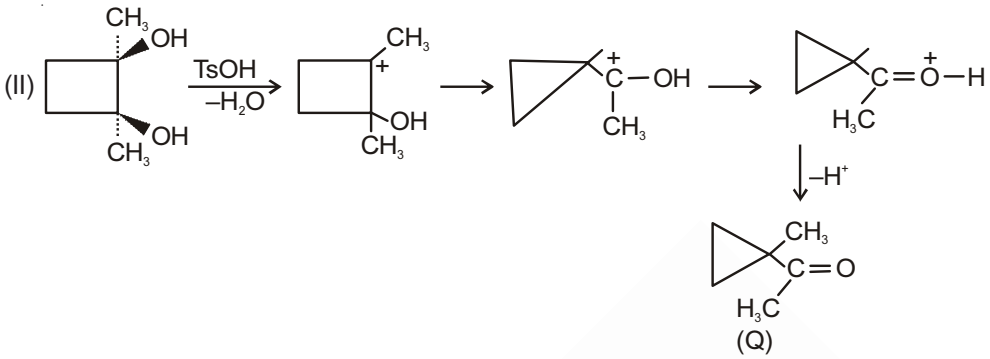


(Where TsOH is Toluenesulfonic acid)

Number of C – atom in cyclic compound P is x; Number of sp^3 hybridised C – atom in Q is y; number of lone pair in P is z then x + y + z is

Sol. Answer (13)

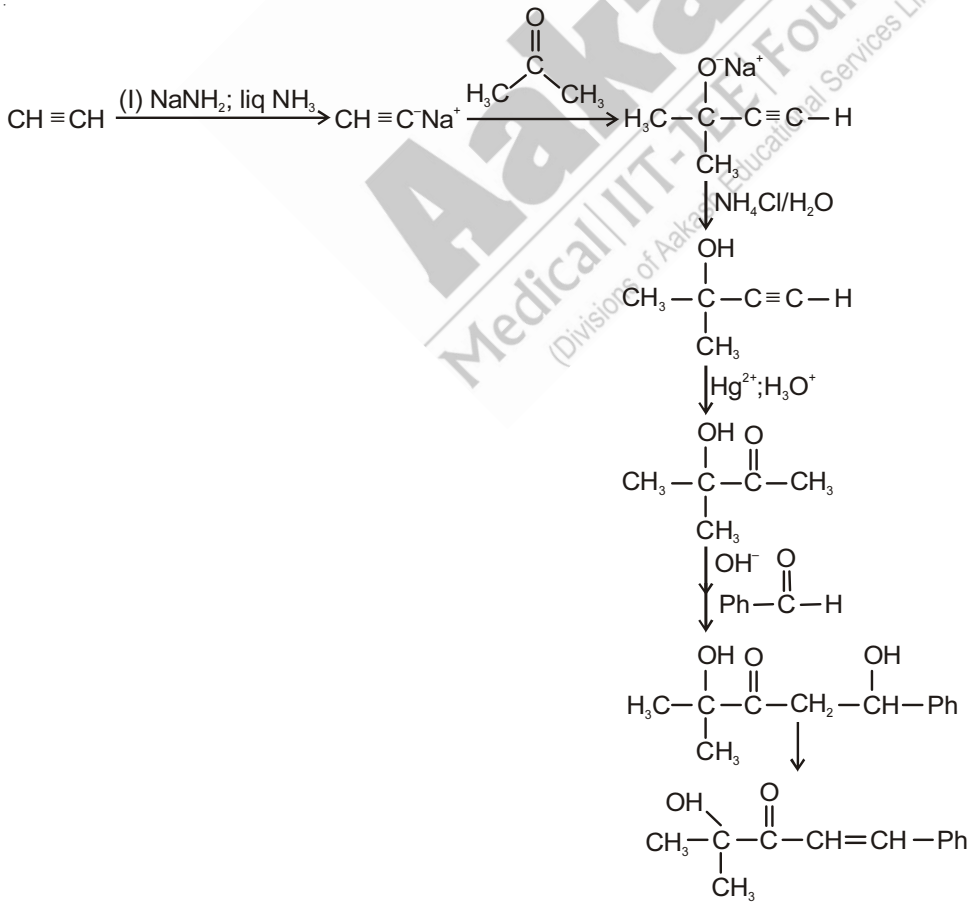




8. In a given reaction sequence $H-C\equiv C-H \xrightarrow[\text{(II) } CH_3-\overset{\overset{O}{\|}}{C}-CH_3 \text{ (III) } NH_4Cl/H_2O]{\text{(I) } NaNH_2;\ LiqNH_3} A \xrightarrow[\text{(II) } H_2O \text{ (III) } C_6H_5CHO;\ OH^-,\ \Delta]{\text{(I) } Hg^{2+};\ H_3O^+} B\ (C_{12}H_{14}O_2)$

Number of sp^2 hybridised C – atom in B is x then value 2x is

Sol. Answer (18)



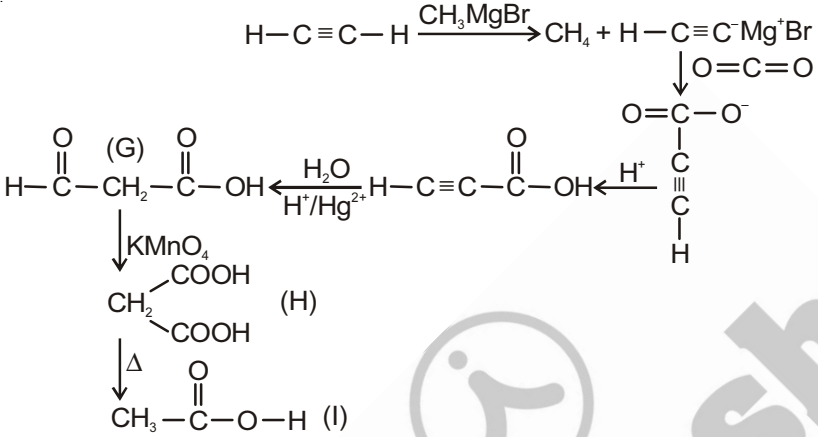
9. In a given reaction sequence $H-C\equiv C-H \xrightarrow{CH_3MgBr} G + CH_4$

$$G \xrightarrow[\substack{(II)\ H_2O;\ H^+/Hg^{2+}\\(III)\ KMnO_4}]{(I)\ CO_2;\ H^+} H \xrightarrow[\text{heat}]{\Delta} I$$

Let number of –COOH group in compound H is x and number of σ(sigma) bonds in compound I is y.

Then find the value of $(x^2 + y^2)$

Sol. Answer (53)

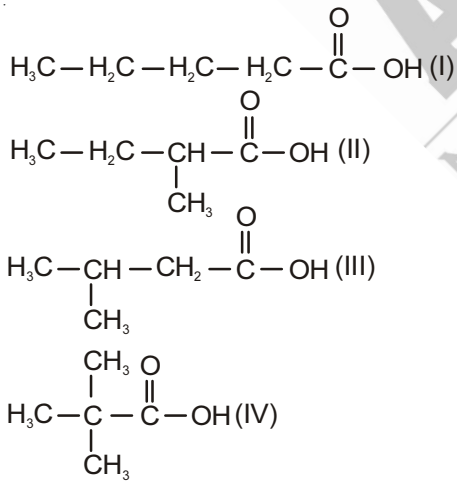


Number of –COOH is H is 2, number of σ bonds = 7, Then x = 2 and y = 7, $x^2 + y^2 = 4 + 49 = 53$

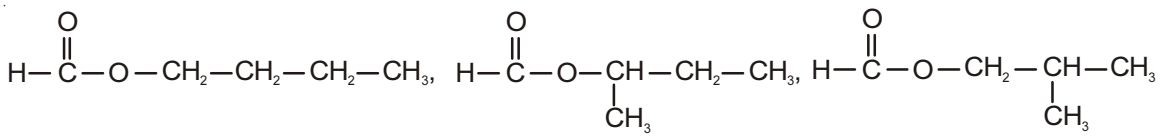
10. Number of carboxylic acid and ester isomers of molecular formula $C_5H_{10}O_2$ is

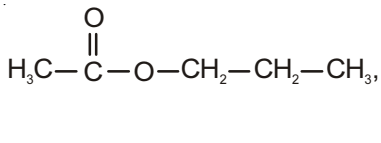
Sol. Answer (13)

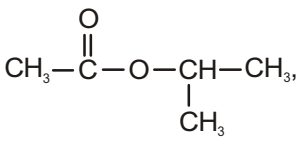
4 acid isomers

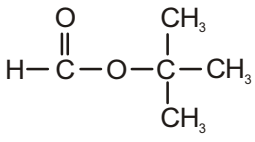


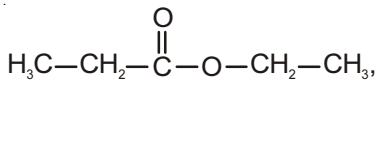
9 ester isomers

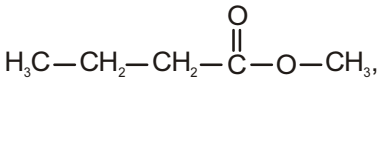


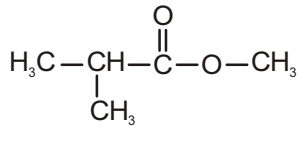












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