



Rayat Shikshan Sanstha's

Sadguru Gadge Maharaj College, Karad

(An Empowered Autonomous College)

7839



Information to be filled by Student
(विद्यार्थ्याने भरावयाचा रकाना)

Day and Date: 31/10/25 Friday

Language of Answer: English

Examination: OCT/NOV 2025

Question Paper Code No.: MT-MCT023-301

Subject: Organic reaction Mechanism

Paper No. -

Section: -

(Office)

Q. No.	Examiner Marks	Moderator Marks
1	16	
2	14	
3	7	
4	15	
5	7	
6	15	
7	16	
8		
9		
10		
11		
12		
Total	76/80	
Signature		

Q. C. - P. R.

IMPORTANT

As per Maharashtra Act No. XXXI of 1982 (7 & 8) whoever is found in or near an examination hall by the invigilator or any other person appointed to supervise the conduct of the examination, copying answers to the question paper set at the examination, from any book, notes or answer papers of other candidates, or appearing at the examination for any other candidates or using any other unfair means, shall, on conviction, be punished with imprisonment for a term which may extend to six months, or with fine which may extend to five hundred rupees or with both.

Whoever abets any offence punishable under this Act shall be punishable with the punishment provided for the offence.
बना - विद्यापीठ नियमानुसार जो कोणी परीक्षा हॉल जवळ किंवा हॉलमध्ये पर्यवेक्षकांना किंवा परीक्षेसाठी नेमलेल्या कर्मचाऱ्यांना उत्तरांची पुस्तक देऊ किंवा अन्य विद्यार्थ्यांच्या उत्तरपत्रिकेतून नकल करताना आढळून येईल किंवा जवळ परीक्षा गैरव्यवहारासाठी वापरता येईल असे अक्षेपाईल हित्य बाळगता असेल तर सदरची बाब परीक्षा प्रमाद मानून संबंधित व्यक्ति शिक्षेस पात्र राहील.

No.

महत्वाच्या सूचना

१. उत्तरपत्रिकेमध्ये अन्यत्र कोठेही बैठक क्रमांक (दिलेल्या जागेखेरीज) लिहू नये, तसेच अन्यत्र कोणत्याही प्रकारच्या खुणा करू अशा खुणा आढळल्यास तो ओळख पटविण्याचा प्रयत्न मानण्यात येईल व असा परीक्षा प्रमाद शिक्षेस पात्र राहील.
२. उत्तरास प्रश्न क्रमांक व उपप्रश्न क्रमांक लिहणे अनिवार्य आहे.
३. पूर्ण प्रश्नांचे उत्तर सलग व सुवाच्य अक्षरात लिहावे.
४. अवाचनीय अक्षरातील उत्तर शुन्य गुणासाठी ग्राह्य मानण्यात येईल.
५. आकृत्याखेरीज सर्व उत्तरासाठी फक्त निळ्या शाईचा वापर करावा.

IMPORTANT

1. Do not write seat number anywhere except at the space provided for it. If seat number or any marks, sy which indicates identity is/are found anywhere, it will be treated as malpractice and lapse. Such malpracti lapse will be punishable under Maharashtra University Act 1994.
2. It is necessary to write the Question No. and sub Question Number before answer.
3. Write the complete answer in sequential manner and then start the next question in readable handwriting.
4. Answer in an illegible & undecipherable handwriting are liable to be marked as zero.
5. Use of blue color ink (except diagrams) is permitted.

Q. No.	Verificaton Marks	Revaluation
1		
2		
3		
4		
5		
6		
7		
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10		
11		
12		
Total		
Signature		

Q. No.	1				TOTAL				TOTAL
Marks	16								

Q. No.

1

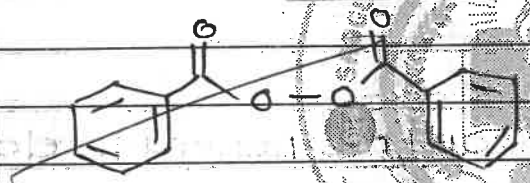
a

i] Node: If we go from one end to another end there is change in sign of wave function.

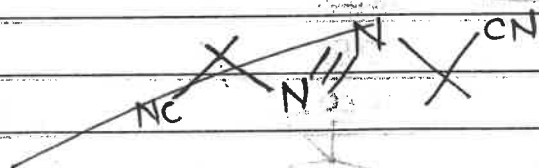
ii] Ylides: ylides are defined as positively charged heteroatom connected to negatively charged carbon atom.

iii] Free radical: A species that contains one or more unpaired electrons is called free radical.

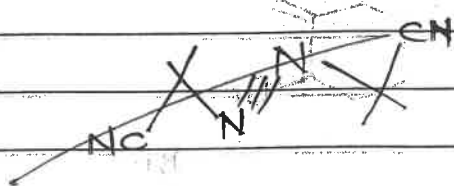
iv] Initiator: ① Benzoyl peroxide



② Aroboisisobutyronitrile

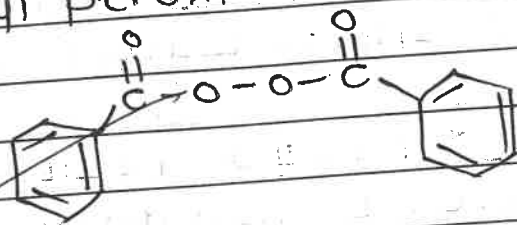


v] AIBN i- Aroboisisobutyronitrile



Q. No.				TOTAL				TOTAL
Marks								

vi Benzoyl peroxide:-

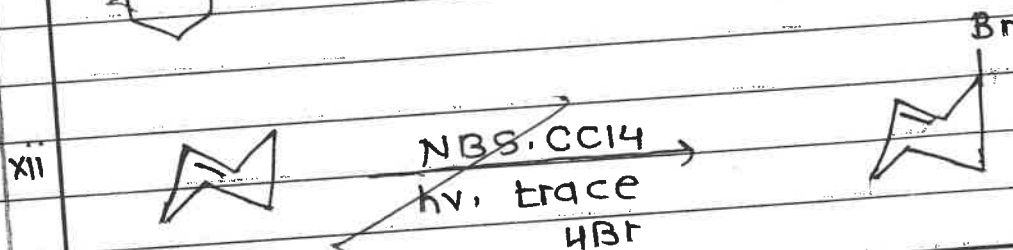
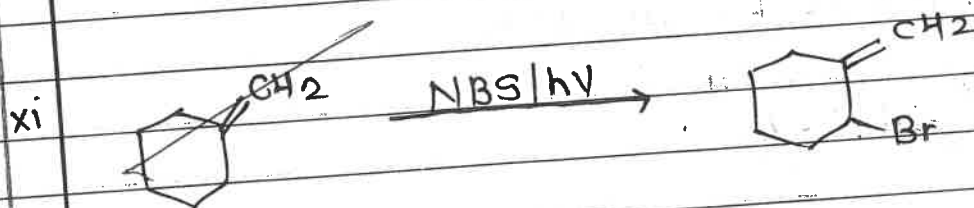
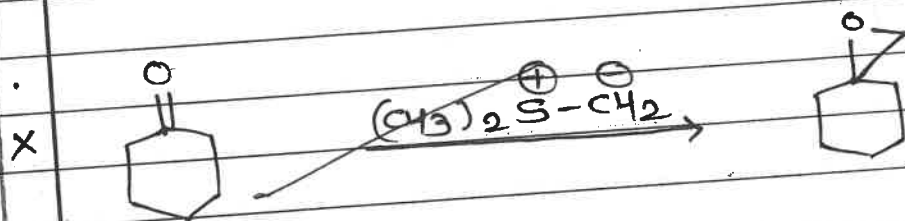


vii Triphenylphosphine used in Wittig reagent ($\text{P}(\text{Ph})_3$)

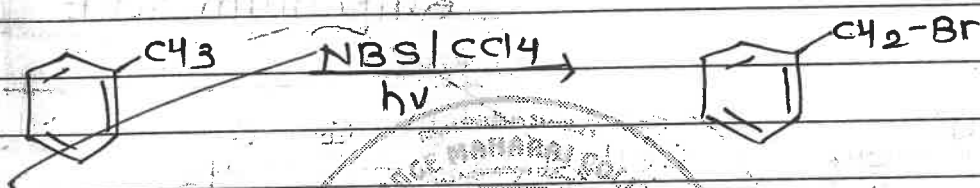
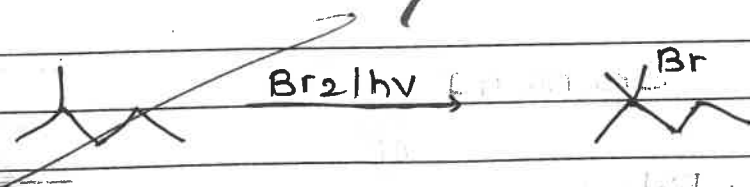


b) ix Taft equation is the linear free energy relationship used in physical organic chemistry

$$\log \left(\frac{k_S}{k_{CH_3}} \right) = \rho^* \sigma^* + \delta E_s$$



Q. No.				TOTAL				TOTAL
Marks								



vii) Molecularity of Reaction:- It is the number of molecules, atoms and ions that must collide simultaneously resulting in chemical reaction.

Order of Reaction:- It is the sum of number of power of concentration term on which rate of reaction depends.

Q. No.	4a+b	TOTAL				TOTAL
Marks	10+5=15					

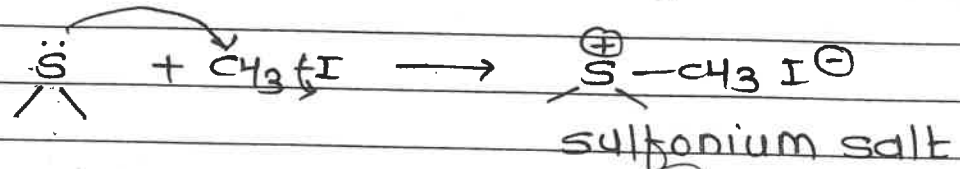
Q. No.

No.

Section I

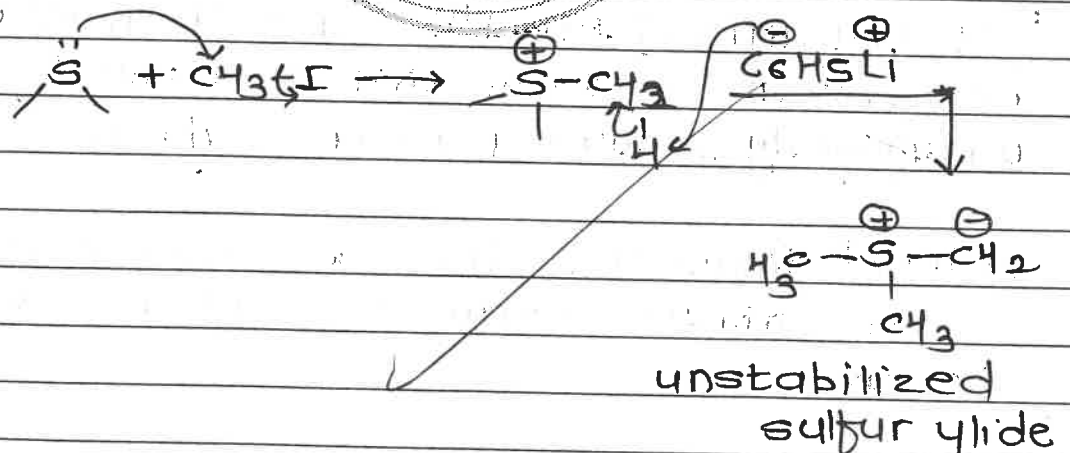
Q 4 a) Sulphur ylide:-

It is prepared from treatment of sulfonium salt with strong base (like $\text{C}_6\text{H}_5\text{Li}$)

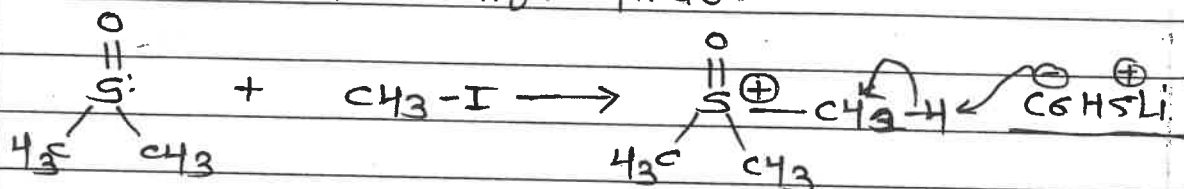


Types of sulfur ylide:

① Unstabilized sulfur ylide:
preparation:-

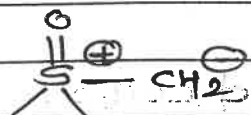


② stabilized sulfur ylide:

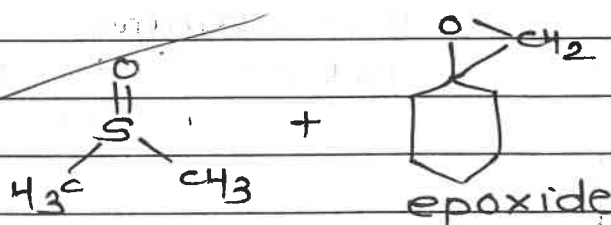
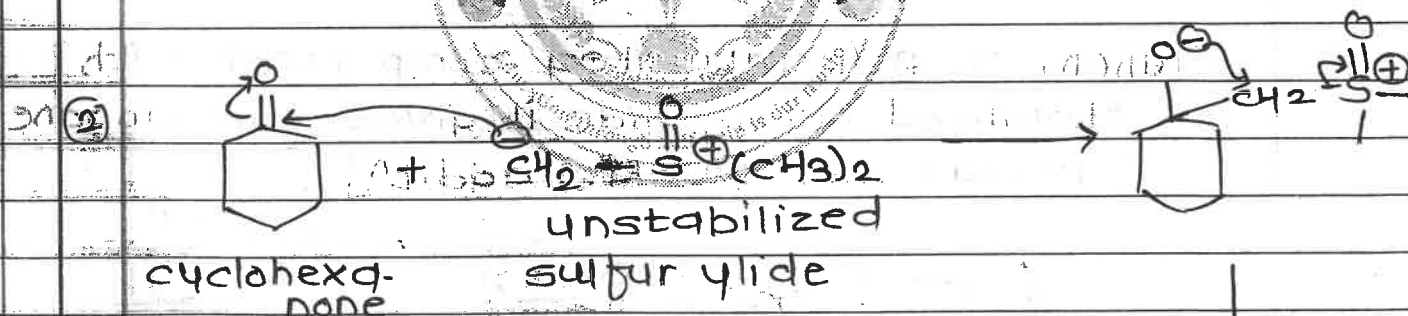
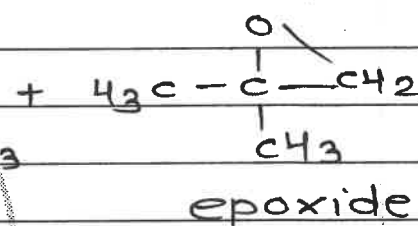
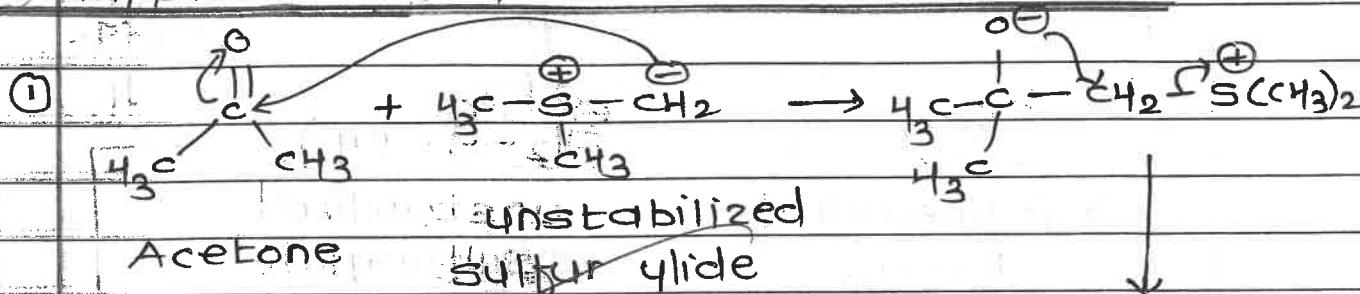


Q. No.				TOTAL				TOTAL
Marks								

I. No.



Application:- a) In carbonyl compound:-



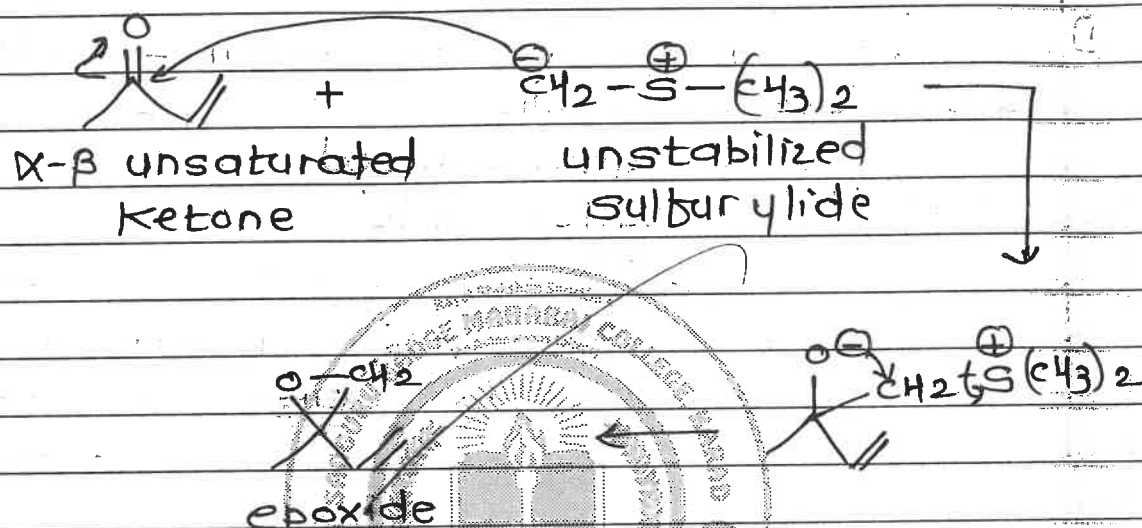
Thus, the in carbonyl compound when stabiliz-
ed comp sulfur ylide & unstabilized sulfur
ylide react then it gives epoxide.

Q. No.				TOTAL				TOTAL
Marks								

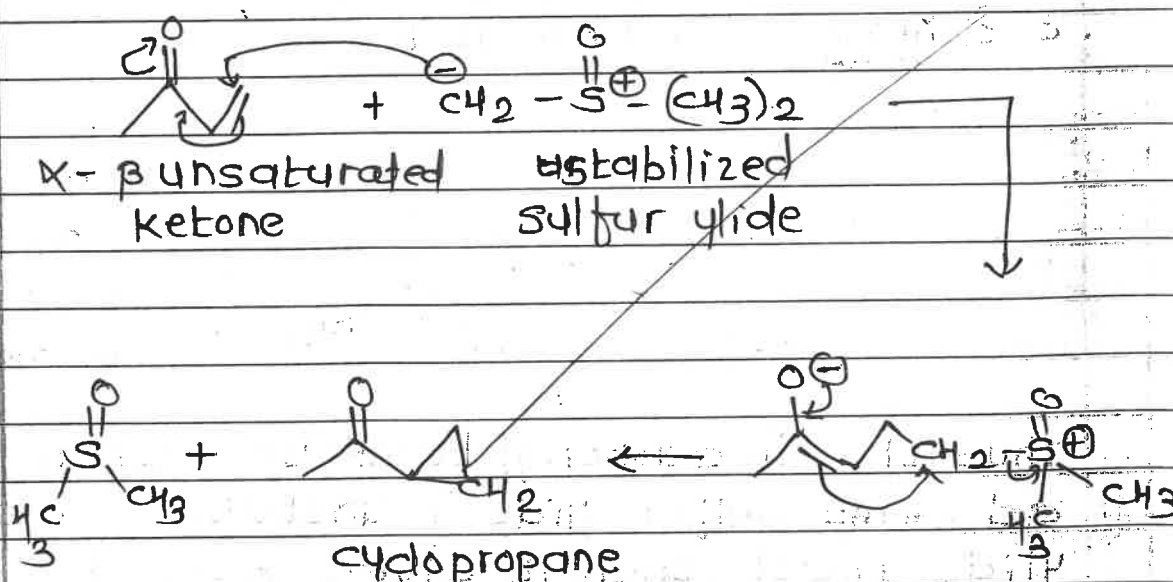
Q. No.

b) In α - β unsaturated comp:-

unstabilized sulfur ylide gives epoxide (1,2 addition)



When, α - β unsaturated comp. react with stabilized sulfur ylide it gives cyclopropane (1,4 addition, Michael addition)



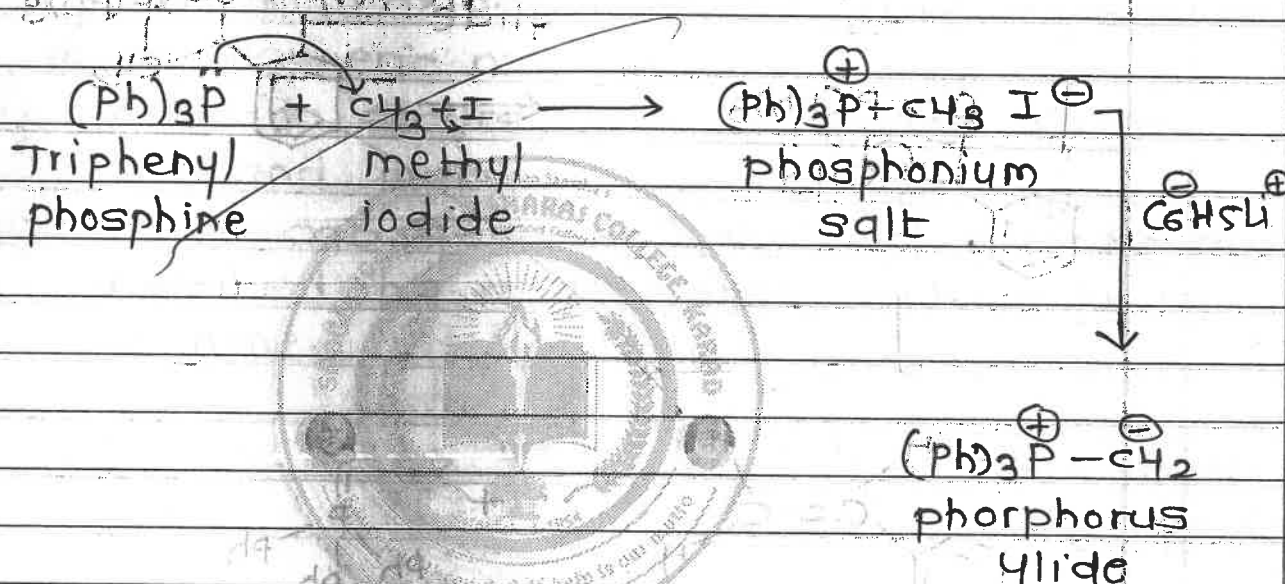
Q.No.				TOTAL				TOTAL
Marks								

Phosphorous ylide:-

Preparation:-

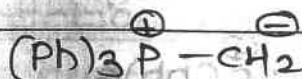
Triphenyl phosphine react with alkyl halide it gives phosphonium salt.

Phosphonium salt treated with strong base it gives phosphorous ylide.

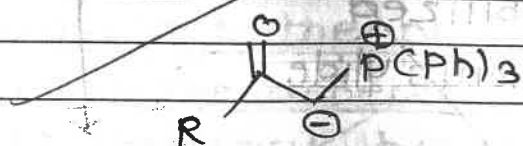


Types i-

① Unstabilized phosphorous ylide:



② Stabilized phosphorous ylide:

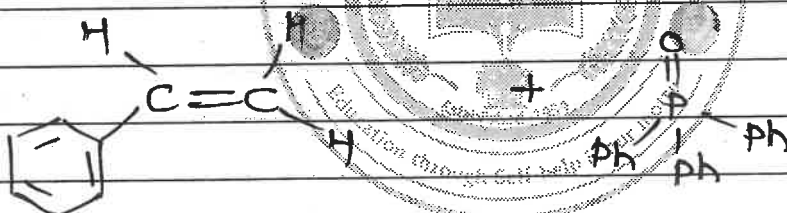
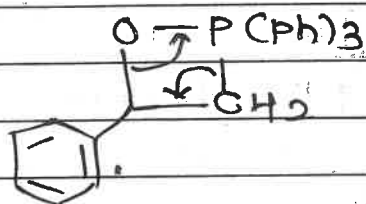
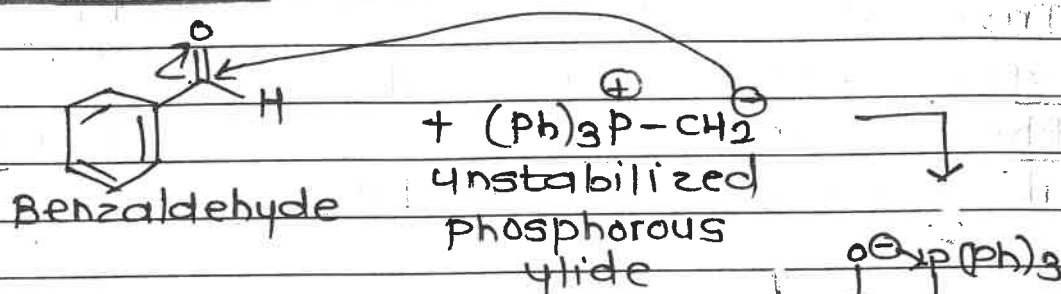


Q. No.				TOTAL				TOTAL
Marks								

Q. No.

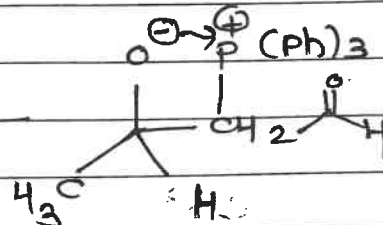
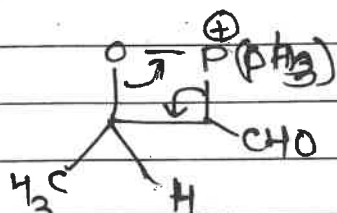
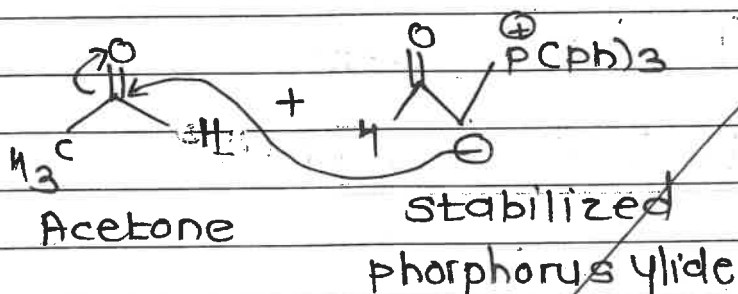
Application:-

①

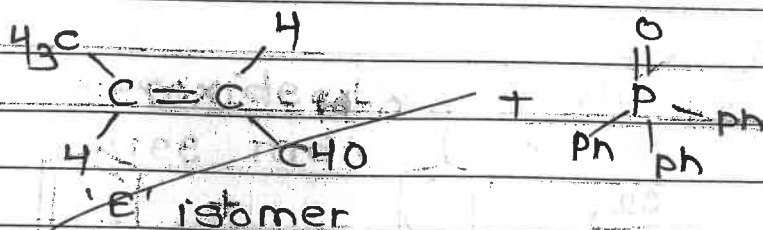


z isomer

②



Q. No.	4b			TOTAL				TOTAL
Marks	5							



b) Auto oxidation: -

i) It is a slow oxidation of a organic substance in atmospheric oxygen.

ii) Reaction occurs when compound allowed to stand in air.

iii) It is catalysed by light and initiator and inhibited by antioxidant such as hydroquinone.



iv) In this reaction, oxygen is not enough itself is unreactive. It reacts with free radical ($\text{R}^\cdot$) which is produced from some initiation steps.

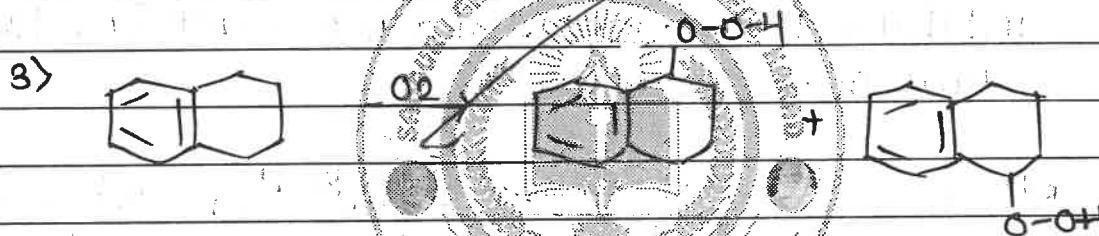
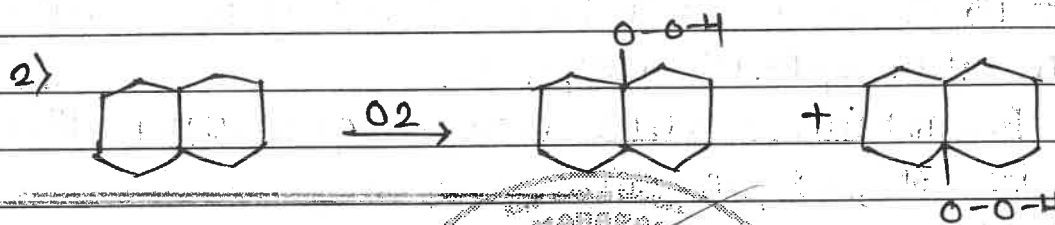
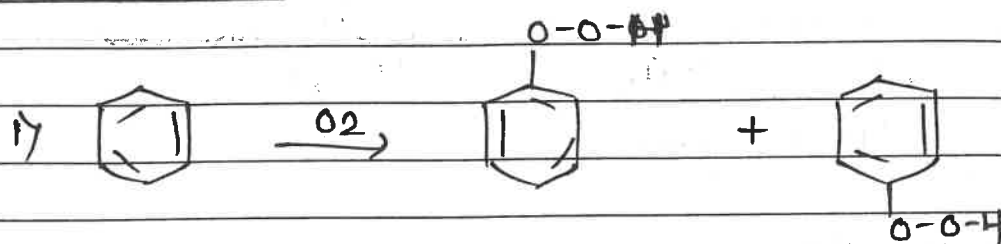
React with oxygen gives $\text{R-O-O}^\cdot$ which abstract the proton.

v) With the other free radical stabilization is tertiary, benzylic and allylic free radical, abstraction of hydrogen is more favourable.

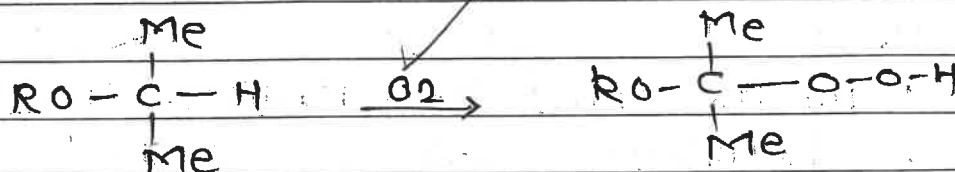
Q. No.				TOTAL				TOTAL
Marks								

Q. No.

Example:

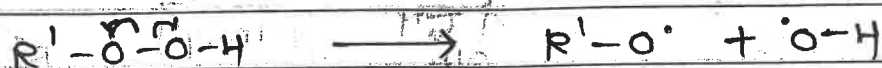


vi) α -position of the ether can also be attacked by oxygen. This reaction is responsible for hazardous due to in the storage of ether. Because solution of this hydroperoxide & its rearranged product in ether is potential spontaneous hazardous.



Q. No.				TOTAL				TOTAL
Marks								

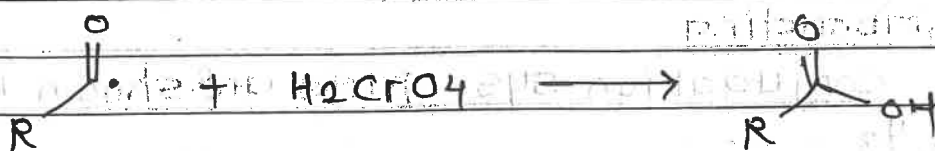
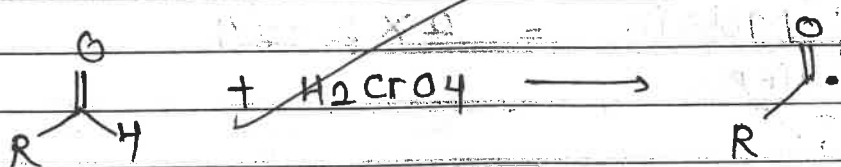
vii) Hydroperoxide then further decompose to give free radical and start a new chain



Oxidation of aldehydes to carboxylic acid i-

- i) oxidation of aldehydes to carboxylic acid has been carried out by different reagents such as acidic or neutral solution of permanganate, chromic acid, Silver oxide, Benedict's solution and Fehling solution.
- ii) Oxidation of aldehyde this mechanism is may free radical or ionic.
- iii) Both mechanisms are takes place together.
- iv) In free radical mechanism, aldehydic hydrogen is abstracted to give acyl radical which gives (OH) from oxidising agent.

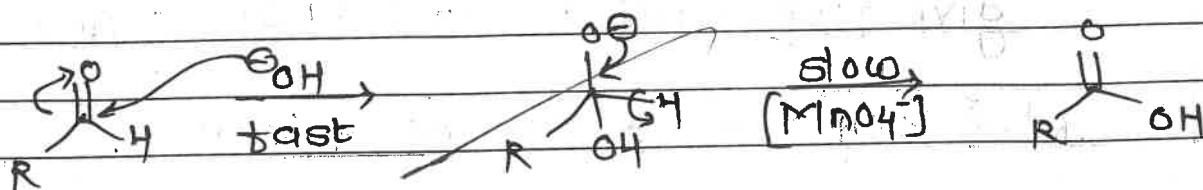
Free radical mechanism:-



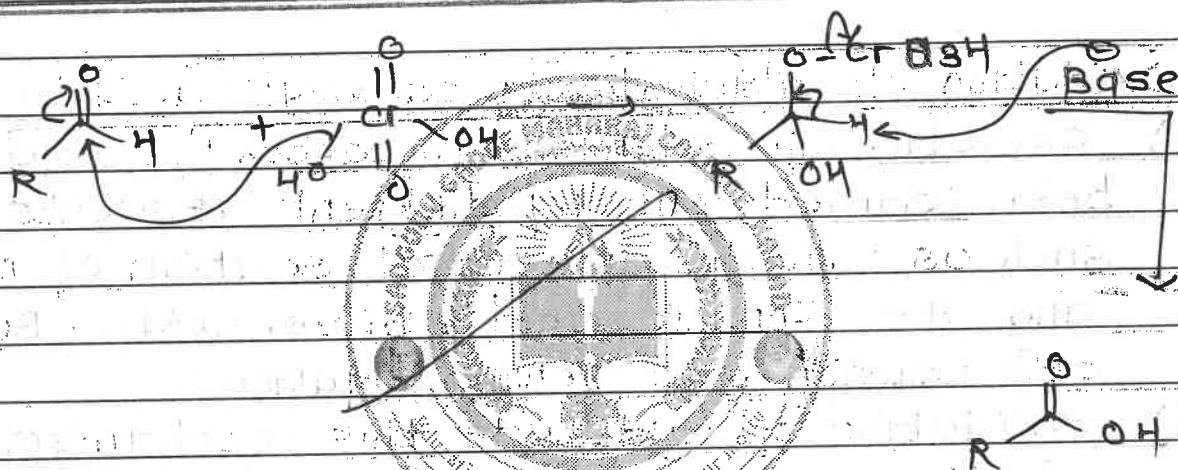
Q. No.	29th	TOTAL				TOTAL
Marks	7+1=8					

Q. No.

alkaline permanganate ionic mechanism:-



For CrH_2O_4 ionic mechanism:-



Q 2 First we study the molecular orbitals of cyclobutadiene and 1,3-butadiene

In No. of MO's = No. of $\pi e^- \times 2$
 In butadiene there are $2\pi e^-$
 $\therefore$ No. of MO's in 1,3 butadiene = $2 \times 2 = 4$

Out of these 4 MO's two are bonding and two are antibonding.

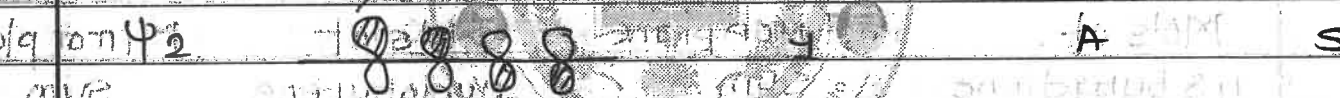
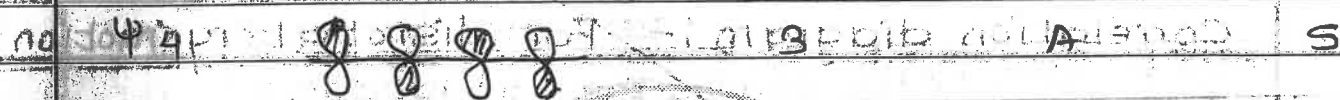
In open conjugation sys. MO's are shown by $\psi_1, \psi_2, \psi_3, \dots$

Q. No.				TOTAL				TOTAL
Marks								

15

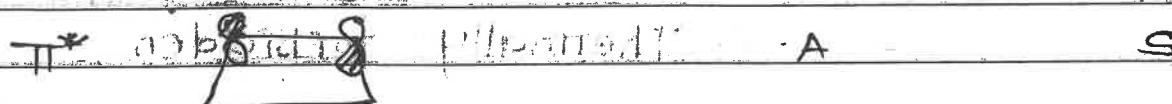
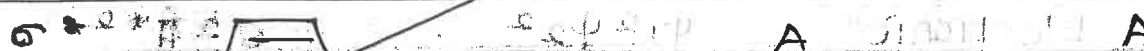
In butadiene there are 4 Mo's so, ψ_1 & ψ_2 are bonding and ψ_3 & ψ_4 are Antibonding.

Mo's of 1, 3-butadiene	Node	Mirror plane symmetry	C ₂ axis Sym.
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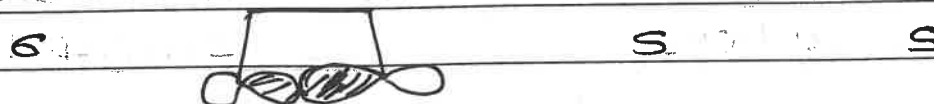
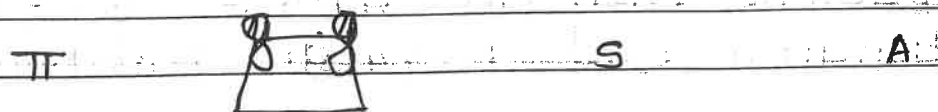
[A = Asymmetric & S = symmetric]

Mo's of cyclobutene	Mirror plane symmetry	C ₂ axis Sym.
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Q. No.				TOTAL				TOTAL
Marks								

Q. No.



Correlation diagram:- For disrotatory motion

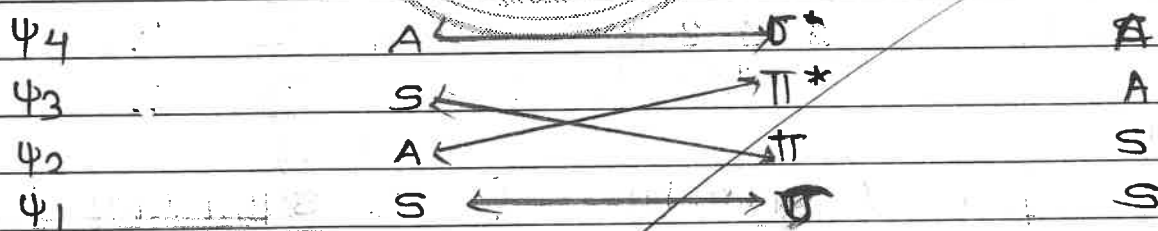


Mols of
1,3 butadiene

Mirror plane
sym.

Mols of
cyclobutene

Mirror plane
sym.



Ring closure Reactⁿ:-

a) Thermal process:-



Electronic $\psi_1^2 \psi_2^2$
configuratⁿ Ground
G.S state

$\sigma^2 \pi^{*2}$
upper excited
state

$\therefore$ Thermally forbidden

Q. No.				TOTAL				TOTAL
Marks								

No.

b) Photochemical process

E.G. 1,3 Butadiene $\longrightarrow$ Cyclobutene $\psi_1^2 \psi_2^1 \psi_3^1$ 1st excited state $\psi_1^2 \psi_2^1 \psi_3^1$ 1st excited state

photochemically allowed

Ring opening reaction

a) Thermal process

Cyclobutene $\longrightarrow$ 1,3 butadieneE.C. $6\pi^2$

Ground state

Upper excited state

Thermally forbidden

b) Photochemical process

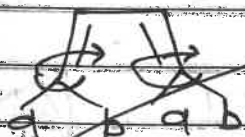
Cyclobutene $\longrightarrow$ Butadiene $6\pi^1 \pi^{*1}$ $\psi_1^2 \psi_2^1 \psi_3^1 \psi_4^1$

Upper excited state

Upper excited state

photochemically allowed

Correlation diagram for CONrotatory motion:-



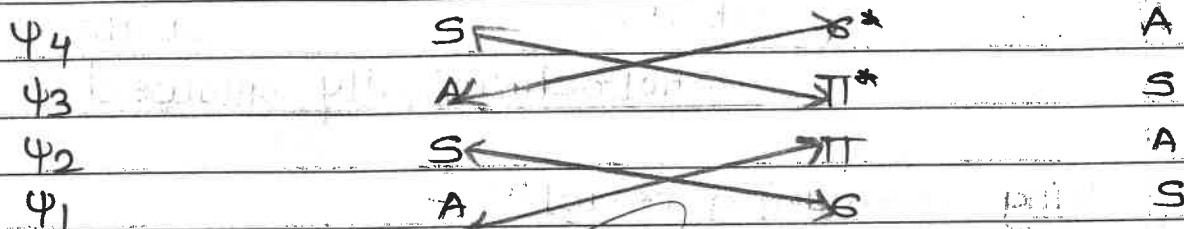
1,3 Butadiene

Cyclobutene

Q. No.				TOTAL				TOTAL
Marks								

Q. No.

Mo's of 1,3 butadiene C_2 axis Sym. Mo's of cyclobutene C_2 axis Sym.



Ring closure Reaction:

a) Thermal process:

1,3 Butadiene $\rightarrow$ cyclobutene

E.C. $\psi_1^2 \psi_2^2$

$\sigma^2 \pi^2$

Ground state

ground state

$\therefore$ Thermally allowed

b) Photochemical process

1,3 Butadiene $\rightarrow$ cyclobutene

E.C. $\psi_1^2 \psi_2^1 \psi_3^1$

$\pi^2 \sigma^1 \sigma^{*1}$

1st excited state

upper excited state

$\therefore$ photochemically forbidden

Ring opening:

a) Thermal process:

1,3 cyclobutene $\rightarrow$ 1,3 butadiene

E.C. $\sigma^2 \pi^2$

$\psi_2^2 \psi_1^2$

ground state

Ground state

$\therefore$ Thermally allowed

Q. No.	26			TOTAL				TOTAL
Marks	7							

b) Photochemical process:

E.C Cyclobutene $\rightarrow$ 1,3 butadiene

$\sigma 2\pi^1 \pi^*1$

$\psi_2^2 \psi_1^1 \psi_4^1$

15^{th} excited state

upper excited state

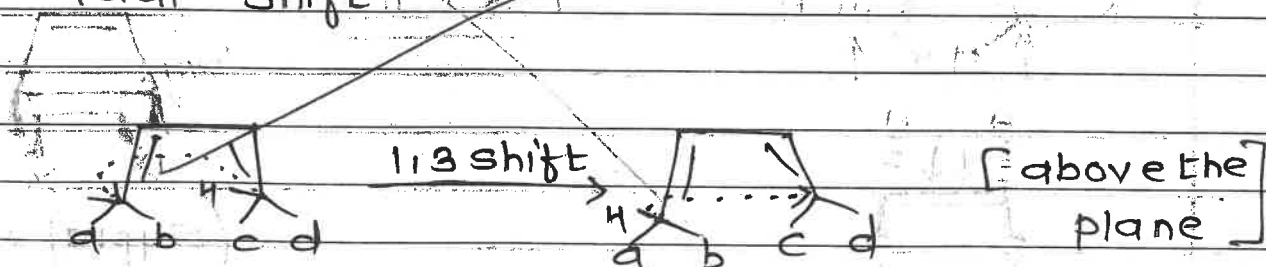
photochemically forbidden.

b) Suprafacial Migration:-

Bond breaking and formation takes place on the same face of molecular plane is called as suprafacial.



It is a stereochemistry causes in which migration of one atom or group takes place on same face of the π system is called suprafacial shift.



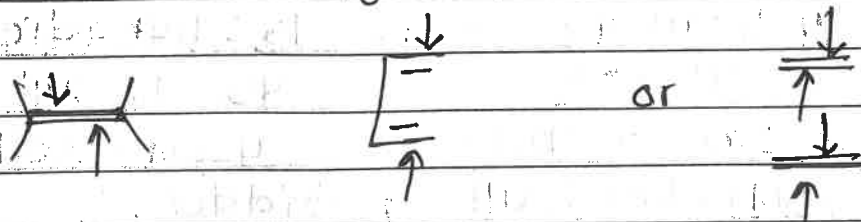
Antarafacial Migration:-

Bond breaking and bond formation takes place on opposite face of molecular plane is

Q. No.				TOTAL				TOTAL
Marks								

Q. No.

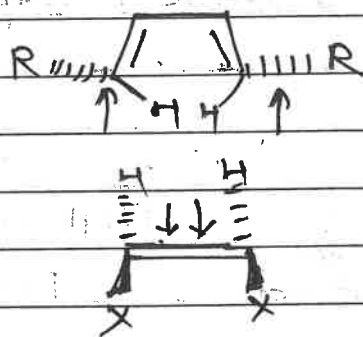
called antarafacial:



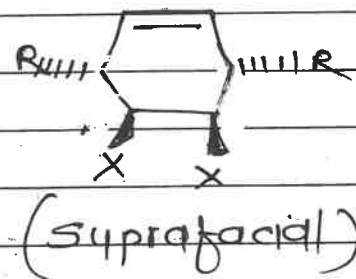
It is a stereochemistry caused by migration of one atom takes place on top face of the carbon atom terminate to bottom face of the atom called antarafacial shift.



For examples:-

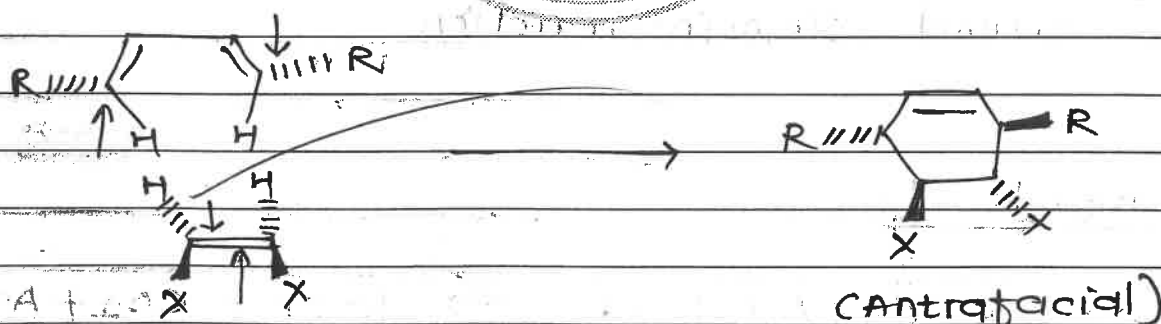
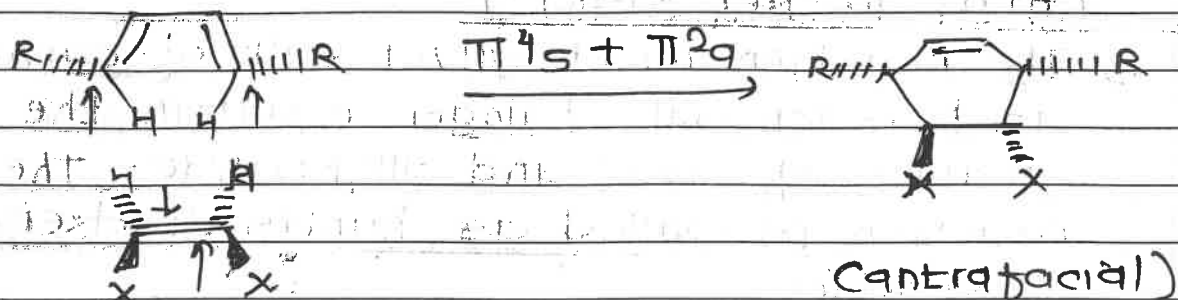


$\pi 4_s + \pi 2_s$



Q. No.				TOTAL				TOTAL
Marks								

No.



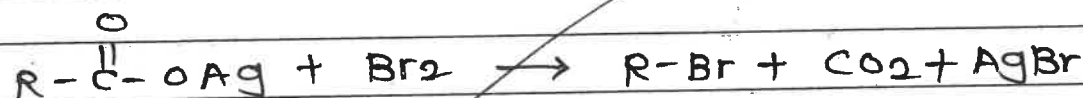
Q. No.	6a + b	TOTAL				TOTAL
Marks	7 + 8 = 15					

Q. No.

Q 6 Hund's diecker Reactⁿ:-

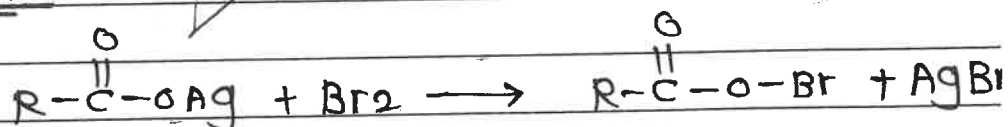
- a) i) The reaction which silver salt of carboxylic acid react with halogen result in the formation of aryl and allyl halide. These reaction is called as hund's diecker Reaction.
- ii) It is the way of degrading carbon chain by one unit.
- iii) Bromine is most used halogen but chlorine and iodine is also used.
- iv) When iodine is used the ratio between reactant are very important because it determines the product.
- v) 1:1 ratio of salt to iodine gives aryl halide and allyl halide as above.
- vi) 1:2 ratio gives ester. and this reaction is called simonini reaction.

Reaction:-



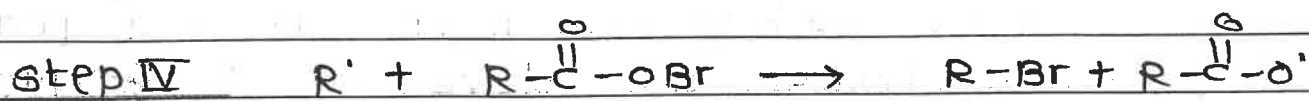
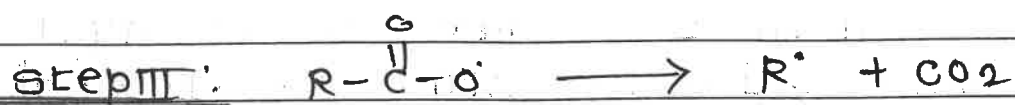
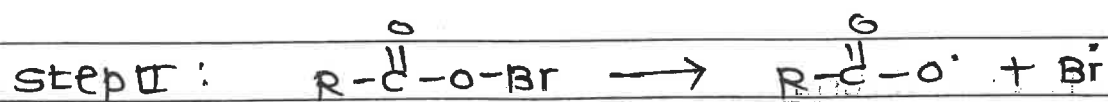
Mechanism:-

Step I:

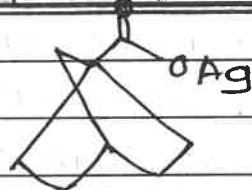


Q. No.				TOTAL				TOTAL
Marks								

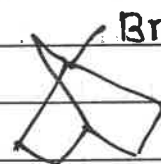
Q. No.



Application:-



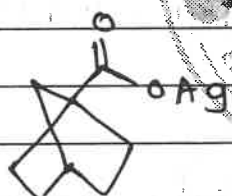
+ Br₂



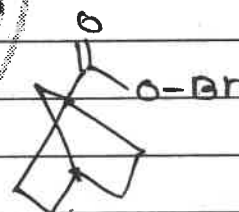
+ AgBr + CO₂

Mechanism:-

Step I

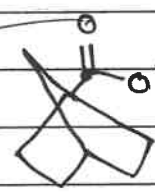
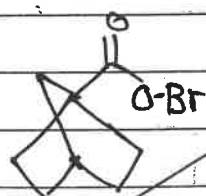


+ Br₂



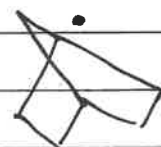
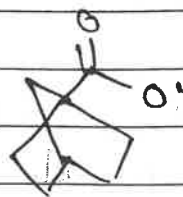
+ AgBr

Step II



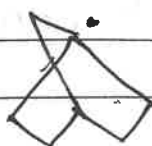
+ Br[·]

Step III

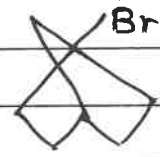
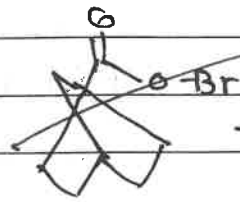


+ CO₂

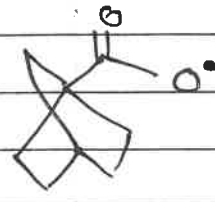
Step IV



+



+



Q. No.				TOTAL			TOTAL
Marks							

Q. No.

b) Taft equation:-

Taft equation is a linear free energy relationship used in the study of physical organic chemistry in the study of reaction mechanism and development of quantitative structure - activity relationship (QSAR).

Taft equation is derived from Robert W. Taft in 1952 as modification to Hammett equation. Hammett equation is account for how field, inductive and resonance affect the rate of reaction.

Taft equation also describe the steric effect and substituent. Taft equation can be written as:-

$$\log \left(\frac{k_s}{k_{CH_3}} \right) = \rho^* \sigma^* + \delta E_s$$

Where,

$\log \left(\frac{k_s}{k_{CH_3}} \right)$:- Ratio of rate of substituent reaction compared to reference reaction.

ρ^* : sensitivity factor for the reaction to polar effect.

σ^* : polar substituent constant.

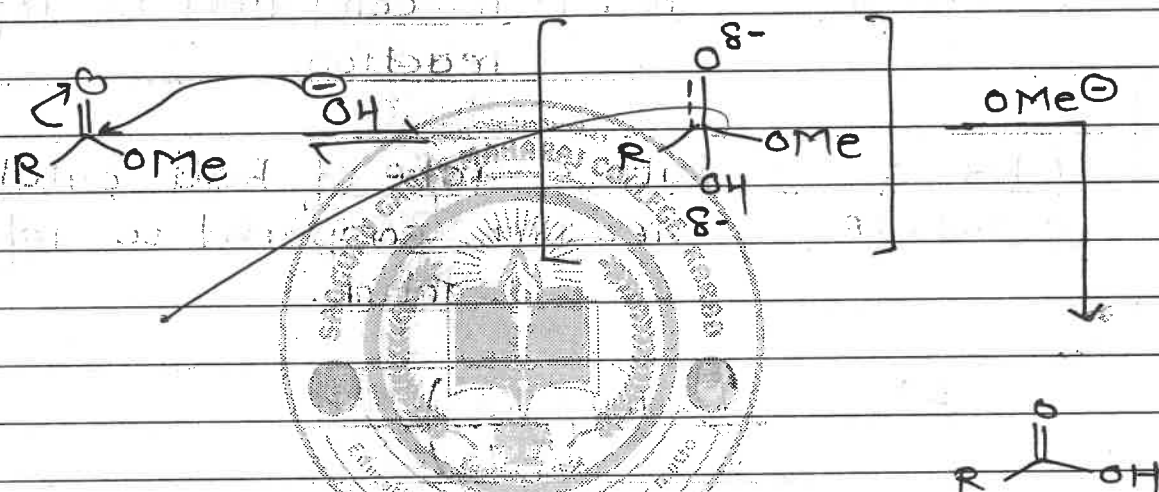
Q. No.				TOTAL				TOTAL
Marks								

2. No.

ρ : Sensitivity factor for the reaction to steric effect.

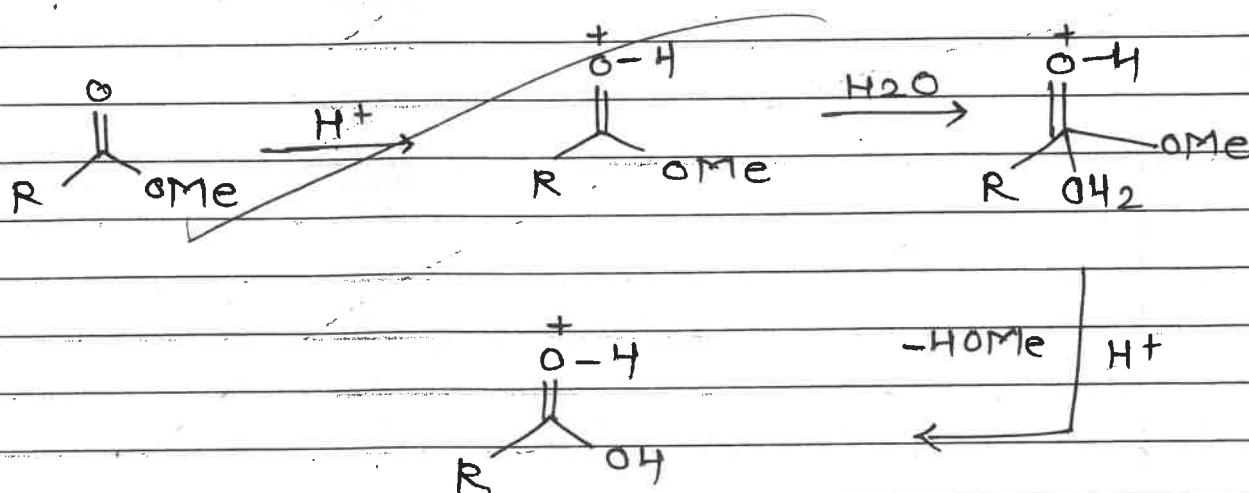
E_s : steric substituent constant.

For determining the polar substituent constant study the hydrolysis of ester reaction



This is the Base catalysed reaction of ester Hydrolysis.

Now, Acid catalysed reaction of ester Hydrolysis



Q. No.				TOTAL				TOTAL
Marks								

Q. No.

From above

$$\rho^* = \frac{1}{2.48 \rho^*} \left[\log \left(\frac{K_S}{K_{CH_3}} \right)_B + \log \left(\frac{K_S}{K_{CH_3}} \right)_A \right]$$

Where,

$\left(\frac{K_S}{K_{CH_3}} \right)_B$ = Ratio of rate of base catalysed reaction compared to reference reaction.

$\left(\frac{K_S}{K_{CH_3}} \right)_A$ = Ratio of rate of Acid catalysed reaction compared to reference reaction.

$$\rho^* = \frac{1}{\delta} \log \left(\frac{K_S}{K_{CH_3}} \right)$$

δ = substituent constant.

K_S = substituent reaction

K_{CH_3} = The reference reaction (where $R=CH_3$)

Q. No.	7				TOTAL				TOTAL
Marks	4+4+4+4+3				16				

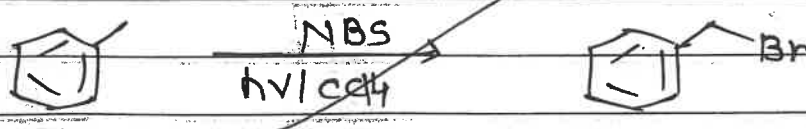
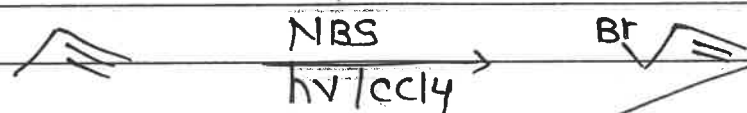
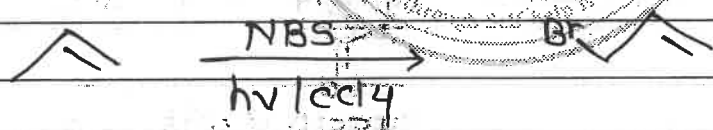
I. No.

7

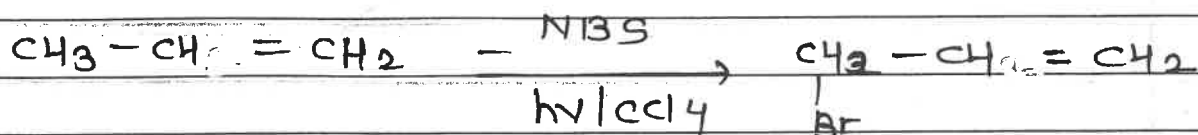
b) Allylic Halogenation:-

- Alkenes can be halogenated by no. of reagents such as N-bromosuccinimide (NBS), N-chlorosuccinimide (NCS) and tertiary butyl hypochlorite.
- The NBS is a highly regioselective reagent that takes place at allylic position.
- The NBS is a highly regioselective brominating agent at position α to the aromatic ring (benzyl position), to a carbonyl group, to a triple bond.
- When double bond and triple bond present in same molecule then preferred position is α to the triple bond.

For example



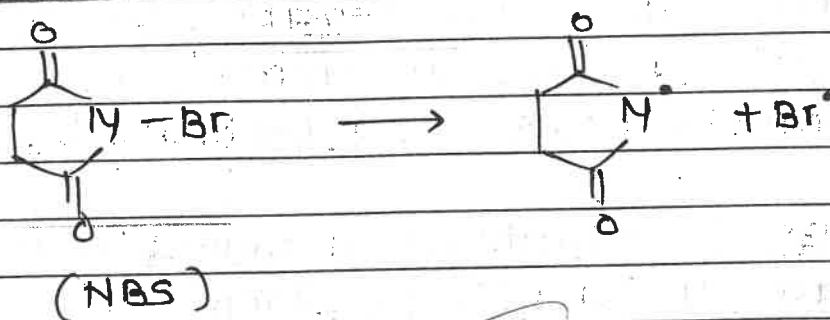
Reaction i:-



Q. No.				TOTAL				TOTAL
Marks								

Q. No.

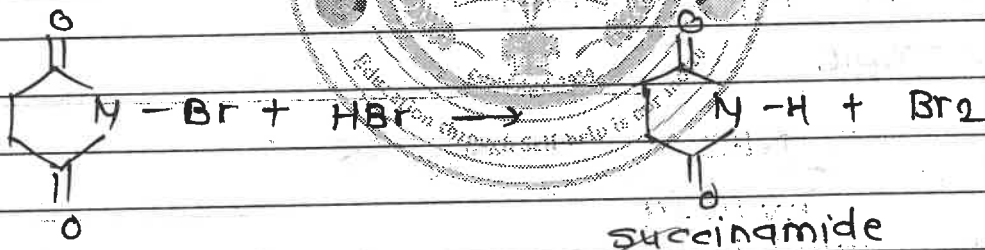
Mechanism:- Step I



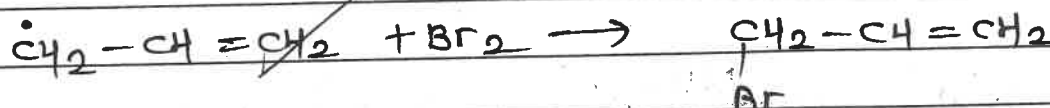
Step II



Step III



Step IV



Q. No.				TOTAL				TOTAL
Marks								

No.

c) Sandmayer Reaction:-

Treatment of diazonium salt with cuprous chloride or cuprous bromide it gives aryl bromide and aryl chloride. This reaction is called as sandmayer reaction.

When the reaction carried out by copper & Hydrogen chloride or hydrogen bromide in this case it is called as gattermen reaction.

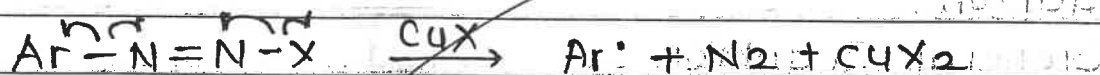
Sandmayer reaction is not useful for preparation of chlorine. But it is useful for introducing chloride and bromide into aromatic ring.

Reaction:-



Mechanism:-

Step I:- Reduction of a diazonium salt with cuprous ion to produce aryl radical.



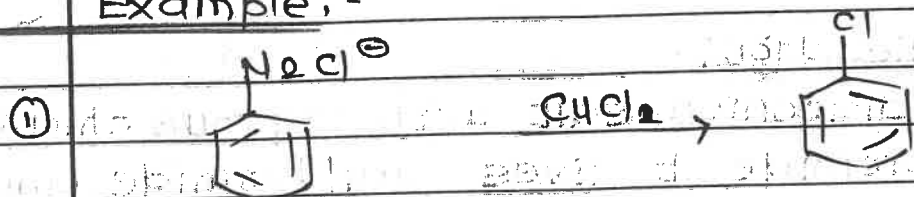
Step II:- Abstraction of halogen by aryl radical and CuX is regenerated it is a true catalyst.



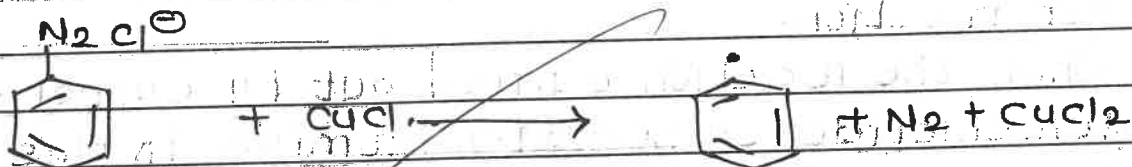
Q. No.				TOTAL				TOTAL
Marks								

Q. No.

Example:-



Mechanism:- Step I



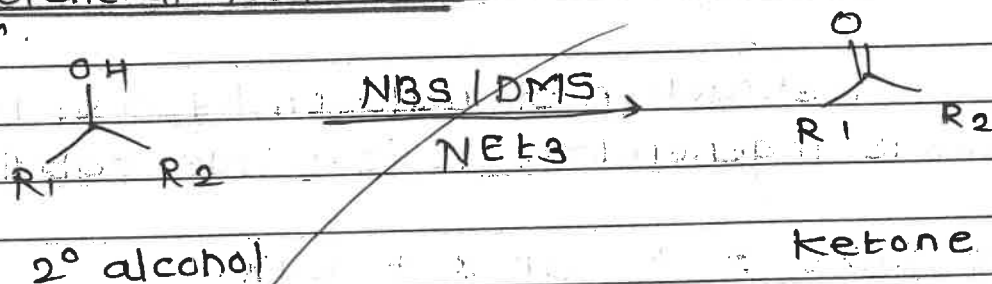
Step II



d) Corey-Kim oxidation

Oxidation of alcohol into corresponding aldehyde or ketone by using N-bromosuccinimide and dimethylsulphide (DMS) in the presence of a base (usually NEt_3) is called as Corey Kim oxidation.

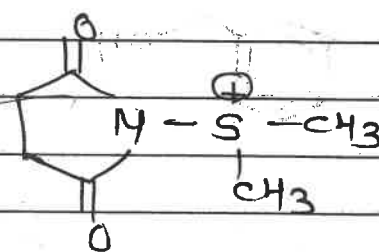
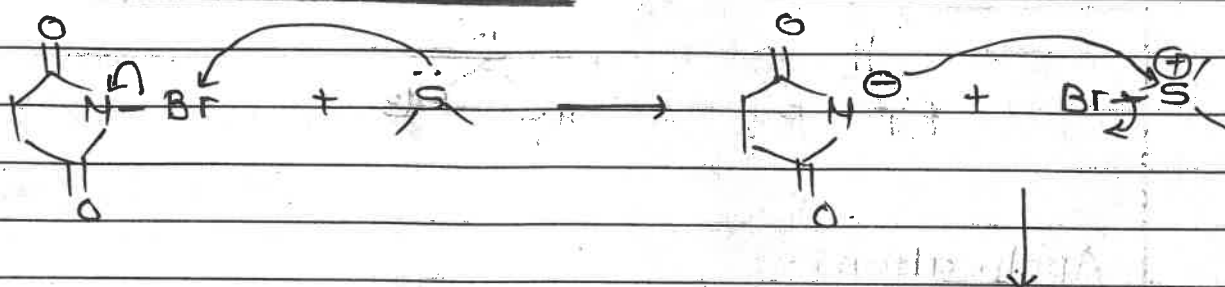
General Reaction



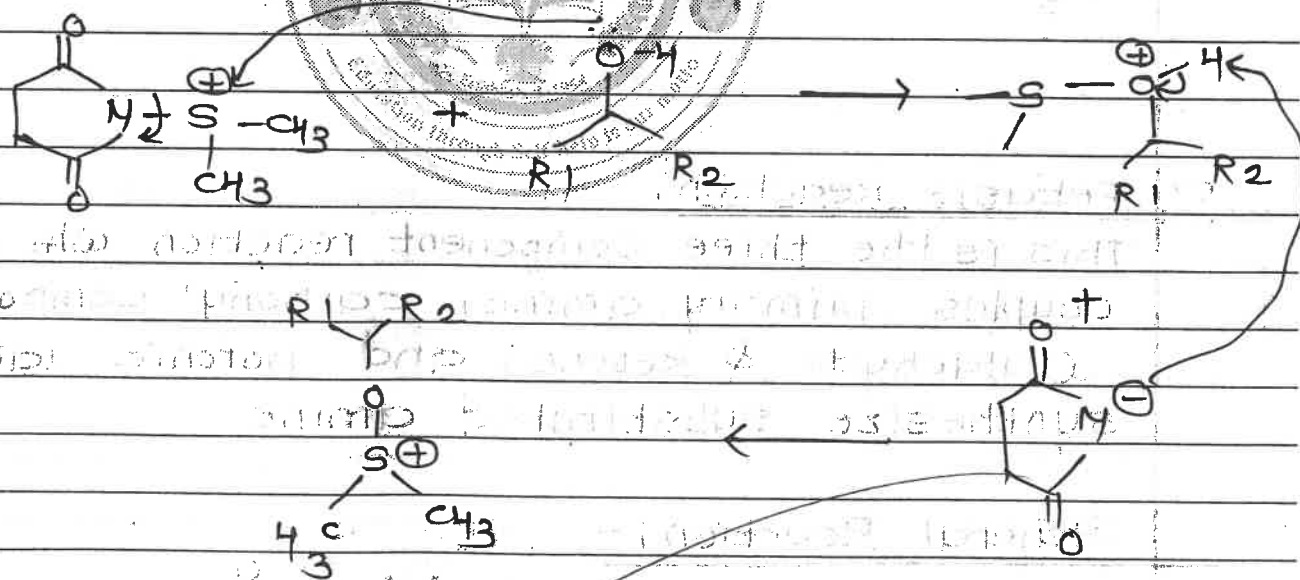
Q. No.				TOTAL				TOTAL
Marks								

2. No.

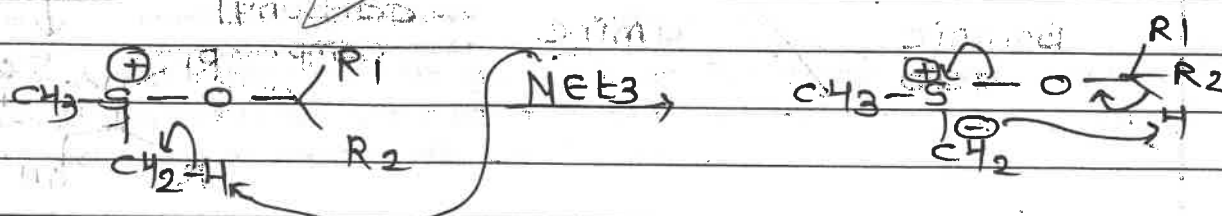
Mechanism:- step I:



Step II:

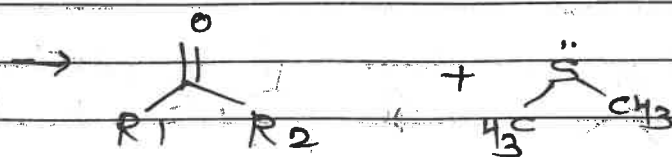
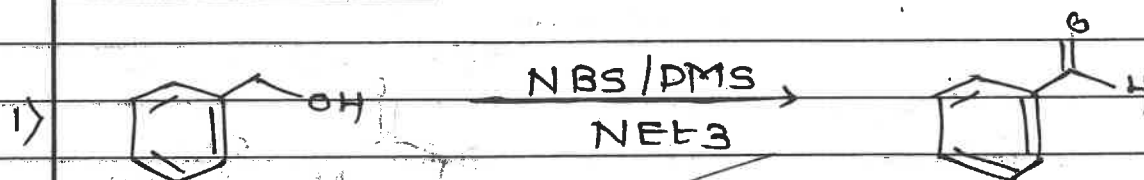


Step III:

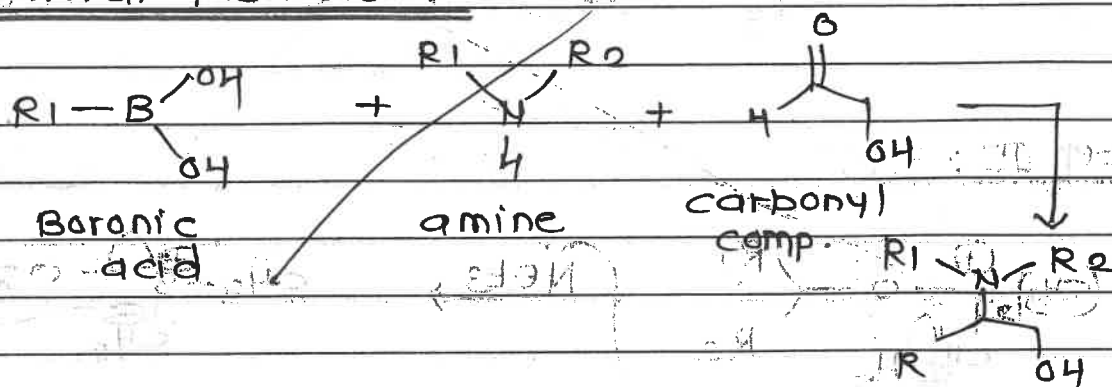


Q. No.				TOTAL				TOTAL
Marks								

Q. No.

Application:-e) Petasis Reaction:-

This is the three component reaction in which couples primary amine, carbonyl compound (aldehyde & ketone) and boronic acid to synthesize substituted amine.

General Reaction:-



14136

SGMCK
(An Autonomous College)

Rayat Shikshan Sanstha's

**Sadguru Gadge Maharaj
College, Karad**
(An Autonomous College)**Information to be filled by Student**
(विद्यार्थ्याने भरावयाचा रकाना)

Day and Date : 31/10/25 Friday

Language of Answer : English

Examination : Oct/Nov-2025

Question Paper Code No. : MJ-MCT023-301

Subject : Organic Reaction mechanism

Register No. : 10

Signature : - 0/1

(Office Use)

Q. No.	Examiner Marks	Moderator Marks
1	22	19
2		
3		
4		
5		
6		
7		
8		
9		
10		
11		
12		
Total	41	7
Signature		

Q. C. - O. K.

IMPORTANT

As per Maharashtra Act No. XXXI of 1982 (7 & 8) whoever is found in or near an examination hall by the invigilator or any person appointed to supervise the conduct of the examination, copying answers to the question paper set at the examination, from any book, notes or answer papers of other candidates, or appearing at the examination for any other candidates or using any other unfair means, shall, on conviction, be punished with imprisonment for a term which may extend to six months, or with fine which may extend to five hundred rupees or with both.

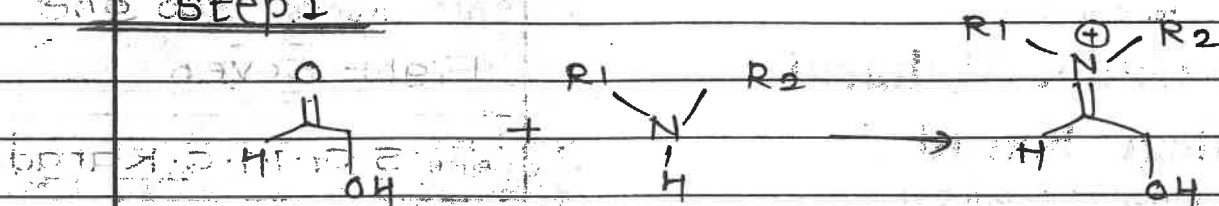
Whoever abets any offence punishable under this Act shall be punishable with the punishment provided for the offence.
II : विद्यापीठ नियमानुसार जो कोणी परीक्षा हॉलजवळ किंवा हॉलमध्ये पर्यवेक्षकांना किंवा परीक्षेसाठी नेमलेल्या कर्मचाऱ्यांना उत्तरांची पुस्तके किंवा अन्य विद्यार्थ्यांच्या उत्तरपत्रिकेतून नकल करताना आढळून येईल किंवा जवळ परीक्षा गैरव्यवहारासाठी वापरता येईल असे अक्षेपाईल त्या बाळगता असेल तर सदरची बाब परीक्षा प्रमाद मानून संबंधित व्यक्ति शिक्षेस पात्र राहील.

Q. No.				TOTAL				TOTAL
Marks								

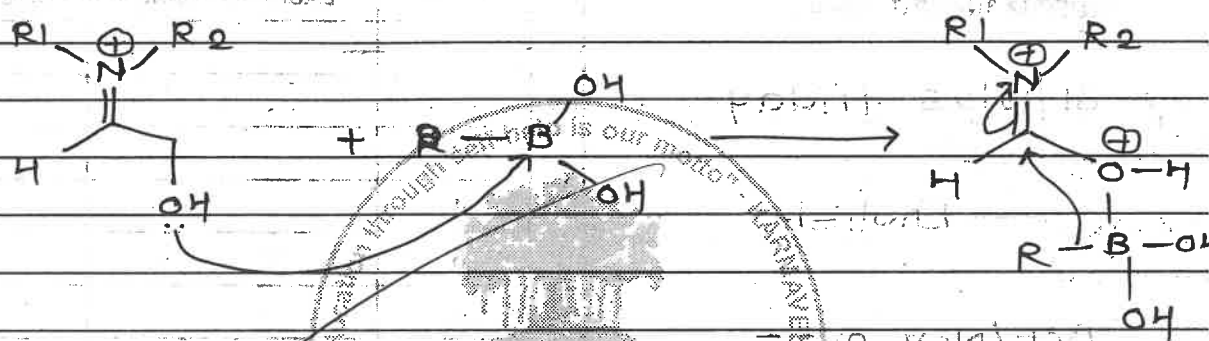
Q. No.

Mechanism:-

Step I

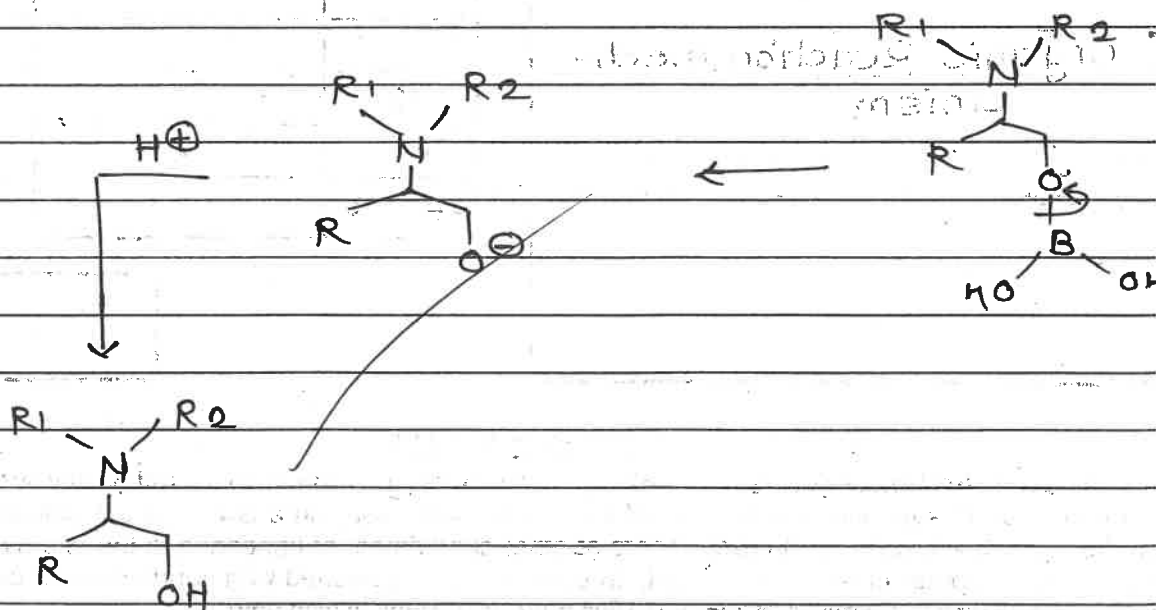


Step II



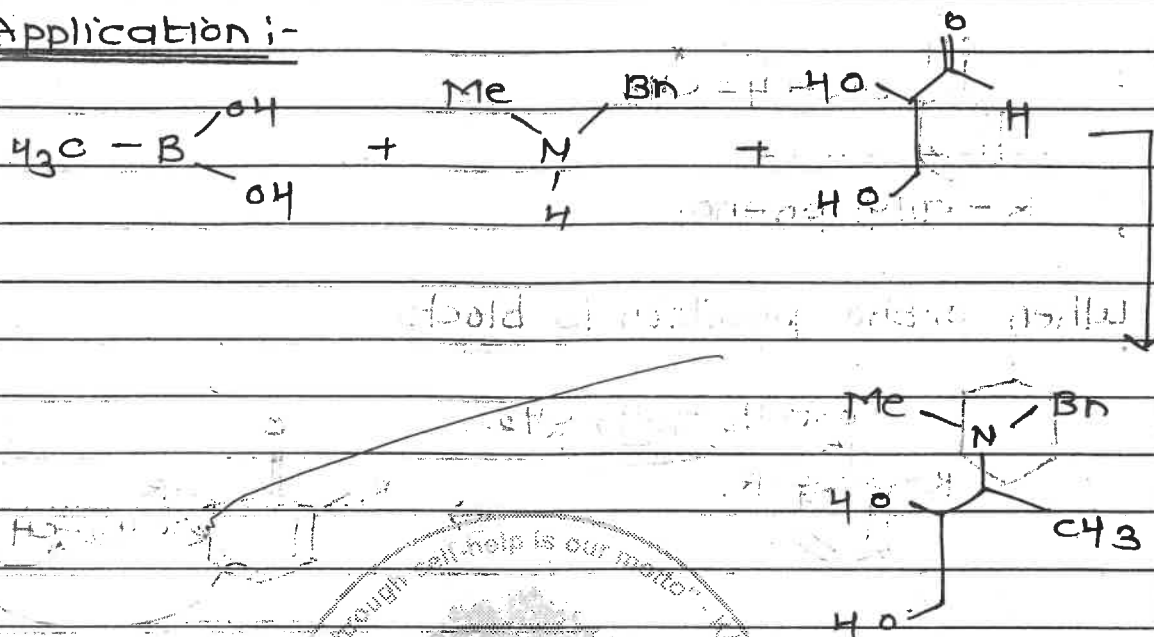
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Q. No.				TOTAL				TOTAL
Marks								

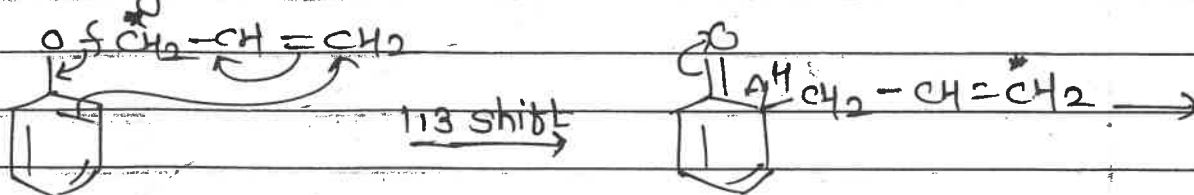
No.

Application:-(a) Claisen rearrangement:-

It is a 3,3 sigmatropic rearrangement. The 3,3 shift takes place in this rearrangement.

This rearrangement involves allyl phenols converted into allyl phenols through migration. Allyl group migrates on ortho position of the aromatic ring. If ortho position is block then this arrangement takes place at para position.

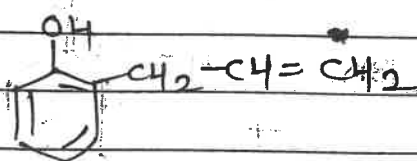
Claisen rearrangement is carried out by labeling the carbon atom by C^1 & we have labelled carbon atom which is not attached to ring.



allyl allyl ether

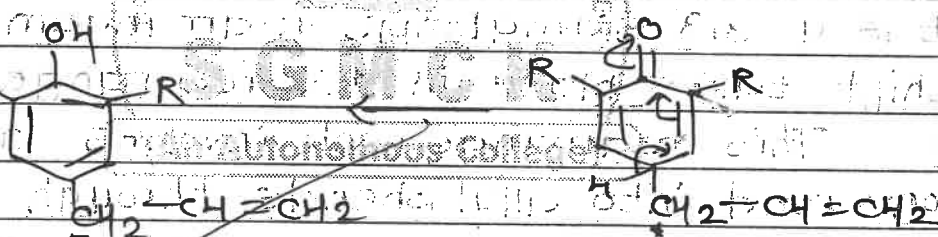
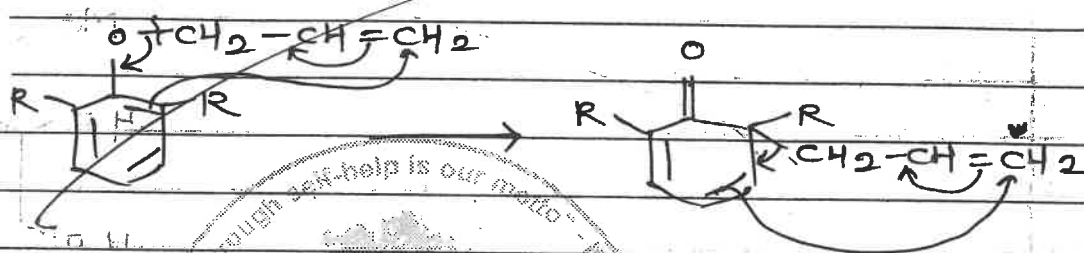
Q. No.				TOTAL				TOTAL
Marks								

Q. No.



o-allyl phenol

When ortho position is block.



In this reaction two Claisen rearrangement occurs and therefore labelled carbon is attached to aromatic ring.