Duration: 2½ Hour **Max Marks: 60**

N.B: 1. All question carry equal marks.
2. Figures to the right indicate full marks.
3. Use of non-programmable calculator is allowed.

Q.1 A. Attempt any TWO of the following: **08**

i) What is an abstract writing? Gives step by step writing process of abstract.
ii) What is the impact factor of the journal? How it calculated? Explain its importance.
iii) What is a search engine? Gives details about types of search engine.
iv) Describe the term consortium. Give any three examples

B. Attempt any ONE of the following: **04**

i) What are the types of web sources? Explain each with suitable example.
ii) What is an e-journal? Gives its advantages and disadvantages.

Q.2 A. Attempt any TWO of the following: **08**

i) What is SI system of measurement? Write down the SI base units used to describe weight, volume, temperature, pressure.
ii) Explain in brief the limitations of scientific methods.
iii) Explain, variance and standard deviation with mathematical expression.
iv) What is curve fitting? Write a note on two general approaches for curve fitting.

B. Attempt any ONE of the following: **04**

i) Define, Weighted least square regression. Explain its anyone advantage and disadvantage.
ii) Find the variance and standard deviation of the average temperatures recorded over a five-day period last winter: 18, 22, 19, 25, 12

Q.3 A. Attempt any TWO of the following: **08**

i) Give the general guidelines for reporting a practical and project work.
ii) Gives steps of peer Review process of journals after submission of research paper
iii) What is a scientific poster? Give its advantages and disadvantages.
iv) Why publishing a scientific work is essential? Explain the qualities of good research manuscript.

X51Y6C7F20X51Y6C7F20X51Y6C7F20X51Y6C7F20

B. Attempt any ONE of the following: **04**

i) What are Silent features of preparation and delivering talk of Presentation?

ii) Write in brief general structure of research paper.

Q.4 A. Attempt any TWO of the following: **08**

i) Describe any four general requirements of chemical protective clothing.

ii) Write a note on safe use of Flammable and Explosive chemicals.

iii) What is Chemical waste? Write a note on recycling of laboratory chemicals.

iv) Explain the general procedure for laboratory disposal of explosive.

B Attempt any ONE of the following: **04**

i) Explain the various acceptable and non-acceptable discharge to the sanitary sewer system.

ii) Discuss the incineration method for the treatment of hazardous waste.

Q.5 Attempt any FOUR of the following: **12**

a. Define primary sources. Gives four examples of primary sources.

b. Discuss the terms: a) Chem Industry b) ChemSpider.

c. Express the number 7237, 0.351 in scientific notation and round off the number 1090 to two significant figures.

d. The IQs of 13 Students were recorded as 89, 93, 97, 98, 102, 106, 109, 110, 115, 119, 128, 131, 140. Calculate the mean and median.

e. How to avoid authorship abuse in scientific writing?

f. Define word Research. State the rules for writing conclusion.

g. Define incompatible chemicals. Give examples of any two incompatible chemicals.

h. Write a note on safe use of corrosive chemicals.

X51Y6C7F20X51Y6C7F20X51Y6C7F20X51Y6C7F20

Duration: 2½ Hours **Max Marks: 60**

N.B. **i)** **All Questions are compulsory**
ii) **Figures to the right indicates full marks**

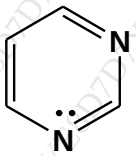
1. A. Attempt **any two** of the following: **8**
i) How will you synthesize androsterone from 16-DPA?
ii) Give the synthesis of Oestrone from 16-DPA.
iii) Discuss the occurrence, biological role and structural features of bile acids.
iv) How is cholesterol converted to 16-DPA?

B Attempt **any one** of the following: **4**
i) Write a note on corticosteroids.
ii) How is Cinerolone synthesized?

2. A Attempt **any two** of the following: **8**
i) Write the biological importance and synthesis of vitamin B_2.
ii) Briefly describe the sources, biological importance and synthesis of vitamin B_6 using ethoxy acetylacetone and cynoacetamide.
iii) Give classification of antibiotics on the basis of activity. Give synthesis of Pyrethrin-I.
iv Write the structure elucidation of Chloramphenicol.

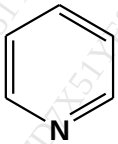
B Attempt **any one** of the following: **4**
i) Give an account of acid hydrolysis of Cephalosporin- C.
ii) Write structure elucidation of Zingiberene.

3. A Attempt **any two** of the following: **8**
i Name the following compounds according to the system of nomenclature mentioned alongside the structure

i  **Common name**

ii  **Hantzsch-Widman system**

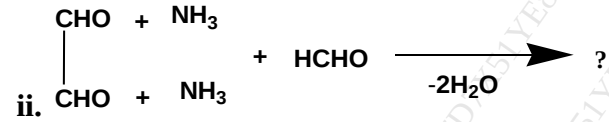
iii  **Hantzsch-Widman system**

iv  **Replacement**

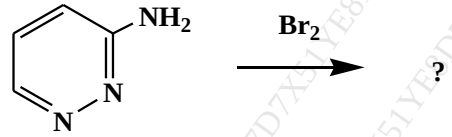
ii Explain:
a) Why pka value of Imidazole is more than other five membered azoles?
b) Complete the following reactions.

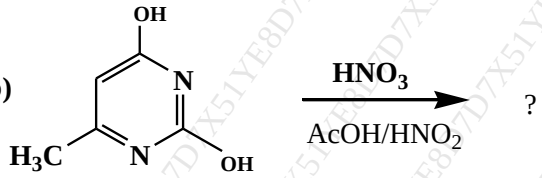
i. $CH_3COCH_2COCH_3$ (Acetyl Acetone) $\xrightarrow[-H_2O]{NH_2NH_2}$?

X51YE8D7D7X51YE8D7D7X51YE8D7D7X51YE8D7D7

ii. 

iii Complete the following reactions.

a) 

b) 

iv a) Explain: electrophilic substitution in Imidazole at 2-position is unfavorable attack at C-5.
b) Explain with suitable examples the reactivity of oxazoles towards electrophiles.

B Attempt **any one** of the following: **4**

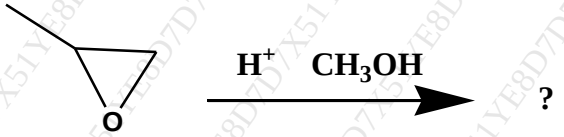
i Give any two methods of preparation of pyrazole.

ii a) Draw resonance structures of pyridazine.
b) Why pyridazine is weaker base than Pyrazine.

4. A Attempt **any two** of the following: **8**

i Draw the structures of the following:
a) Pyrazino[2,3-d] pyridazine b) Phenoxathiine
c) 10-azaanthracene d) 1,3-diazabenzene

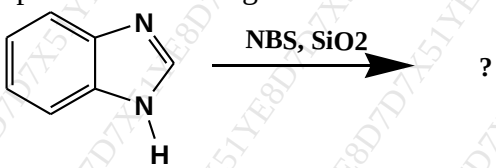
ii a) Complete the following reactions.

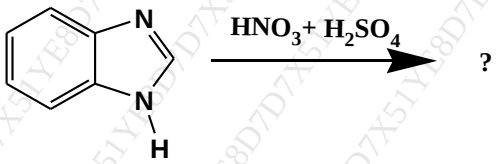
I 

II 

b) Give one synthetic method of Benzothiazoles.

iii Complete the following reactions

a) 

b) 

iv Give the synthesis of indole by (I) Fischer-Indole synthesis (II) Bischler synthesis.

B Attempt **any one** of the following: **4**

i Gives any two synthetic methods of benzimidazoles.

ii Gives two methods of synthesis of acridines.

X51YE8D7D7X51YE8D7D7X51YE8D7D7X51YE8D7D7

5 Attempt **any four** of the following: **12**

a) Give the synthesis of progesterone from 16-DPA.
b) Give the synthesis of muscone.
c) Give classification of Vitamins. Give synthesis of vit-E.
d) State the biological importance and give the synthesis of vit-K_1.
e) Explain: Electrophilic attack in 1, 2-diazoles takes place at position-4.
f) Give two examples of nucleophilic substitution in iso-thiazoles.
g) Draw the structure of Coumarin. Give anyone synthetic method of Coumarin.
h) Draw structure of 1, 2-dihydro Azete. What is action of HCl on Azetidine?

X51YE8D7D7X51YE8D7D7X51YE8D7D7X51YE8D7D7

Duration: 2 hours 30 minutes **Max. Marks: 60**

N.B. i) All questions are compulsory.
ii) Figures to the right indicate full marks.

1. a) Attempt **any two** of the following: **8**

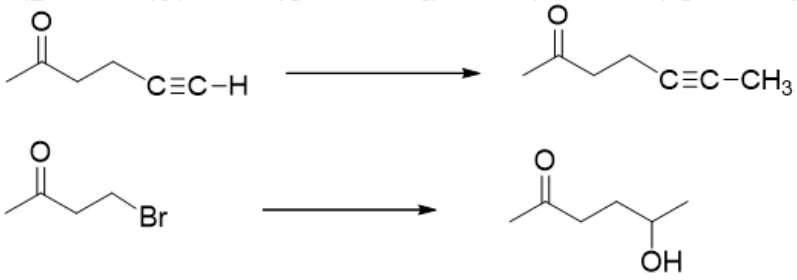
i) Give the equations involved in the protection and deprotection of following functional groups. I) Amino II) carboxylic acid

ii) What is acyl anion equivalent ? discuss with examples their generation via nitro compound.

iii) Describe the term Synthons and Synthetic equivalents. What are the synthetic equivalents for the following.



iv) Suggest the synthesis of the following using protection deprotection protocol.



b) Attempt **any one** of the following: **4**

i) Provide a retro-synthesis of the following compounds.

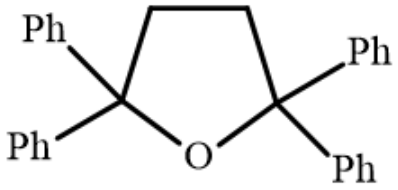


ii) Explain the term Functional Group Interconversions (FGI) and Functional Group Additions (FGA) with suitable examples.

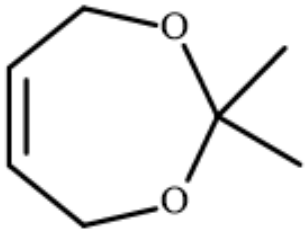
X51YA0A7D6X51YA0A7D6X51YA0A7D6X51YA0A7D6

2. a) Attempt **any two** of the following: **8**

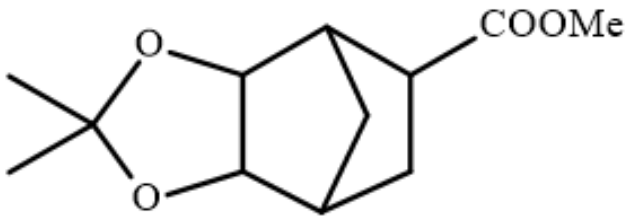
i) An important guideline in retrosynthetic analysis is to use the symmetry of the target molecule. On the basis of this guideline identify the best points of disconnection in the following molecule. Show the complete retrosynthetic pathway and the synthetic sequence.



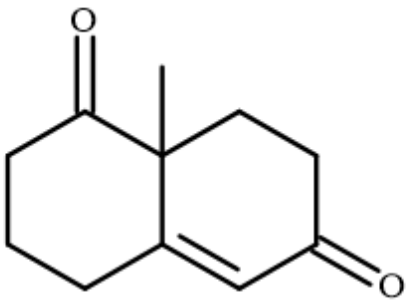
ii) For the following molecule, suggest a retrosynthetic pathway. Also write its synthesis, as per the pathway suggested by you.



iii) Propose a retrosynthetic analysis for the following molecule such that cyclopentadiene is one of the starting materials. Using this, write its synthesis from cyclopentadiene.



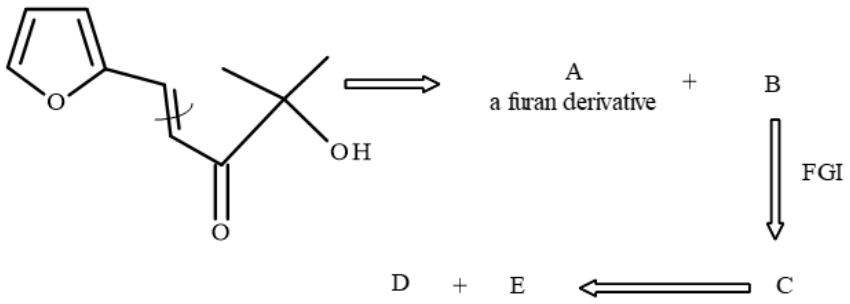
iv) The synthesis of the following molecule involves a Robinson annulation reaction. With this information, write a suitable retrosynthetic analysis and the corresponding synthesis.



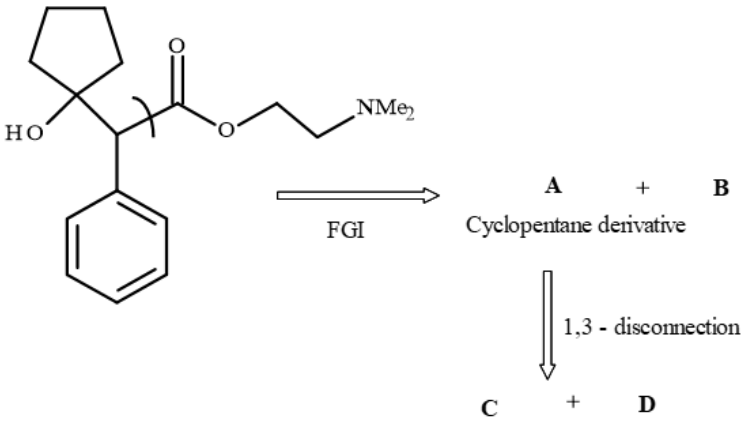
X51YA0A7D6X51YA0A7D6X51YA0A7D6X51YA0A7D6

b) Attempt **any one** of the following: **4**

i) Complete the following retrosynthetic analysis by drawing structures for A, B, C and D.

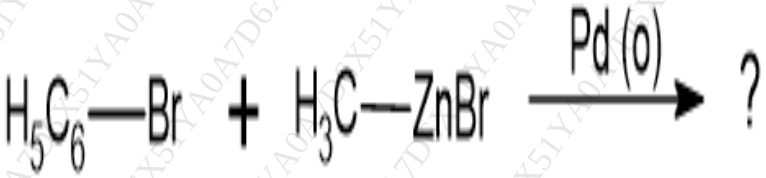


ii) Complete the following retrosynthetic pathway by drawing structures for **A, B, C and D**.

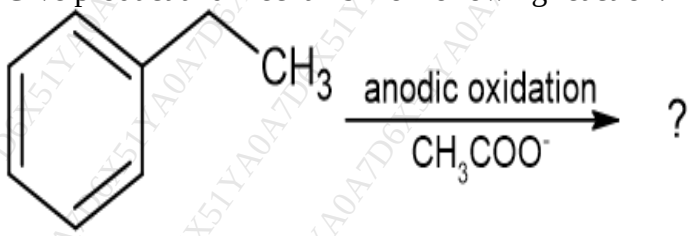


3. a) Attempt **any two** of the following: **8**

i) Give product, name and mechanism of following reaction.



ii) Give product and mechanism of following reaction.



iii) What are cryptands? Give a brief account of applications of cryptands in organic synthesis.

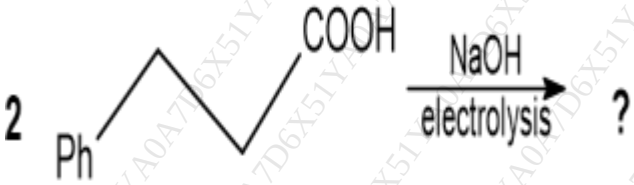
iv) What are the organocatalysts? Explain the use of imidazolidinone in organic synthesis.

X51YA0A7D6X51YA0A7D6X51YA0A7D6X51YA0A7D6

b) Attempt **any one** of the following: **4**

i) What are cyclodextrins? Discuss the structure and applications of cyclodextrins.

ii) Give product, name and mechanism of following reaction

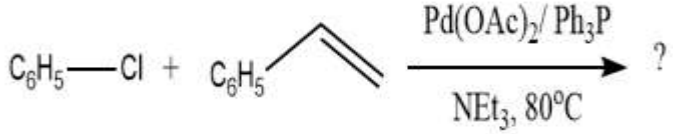


4. a) Attempt **any two** of the following: **8**

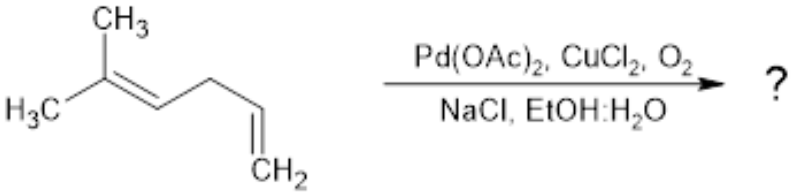
i) Explain reductive elimination and migratory insertion with suitable examples.

ii) What is the 18-electron rule? Apply this rule to determine the value of 'n' for $[MnBr(CO)_n]$ and $Na_2[Fe(CO)_n]$. (Given: At. No. of Mn = 25 and At. No. of Fe=26)

iii) Identify and complete the following reaction, and also suggest a suitable mechanism for the same.



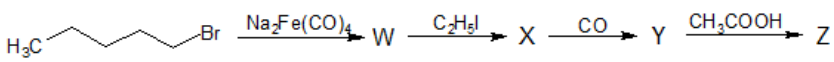
iv) Give the product, name and mechanism of the following reaction.



b) Attempt **any one** of the following: **4**

i) Explain Suzuki coupling with mechanism.

ii) Complete the following reaction sequence by identifying W, X, Y and Z.



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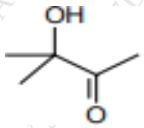
5. Answer **any four** of the following: **12**

(a) Explain the terms chemoselectivity and enantioselectivity with examples.

(b) What are acyl anion equivalent? Discuss with the conversion of formaldehyde to acetaldehyde.

(c) Using functional group addition as one of the steps, write the retro analysis of phenyl cyclohexane

(d) How will you synthesize the following molecule from acetylene?



(e) Discuss with examples cathodic reduction of carbonyl compounds.

(f) Give applications of $Yb(OTf)_3$ as a water tolerant Lewis acid catalyst in the following reactions:
Diels Alder reaction
Michael reaction
Friedel Crafts reaction

(g) Explain the olefin metathesis of cyclopentene.

(h) Give the applications of Ce(IV) in i) synthesis of quinoxaline ii) as a deprotection agent.

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X51YA0A7D6X51YA0A7D6X51YA0A7D6X51YA0A7D6

Duration: 2 ½ hrs. **Total Marks: 60**

Instructions:
(1) All questions are compulsory.
(2) Figures to the right indicate full marks.

Q. 1 (a) Attempt any **two** of the following: 08
(i) Explain quantitative structure activity relationship for *p*-substituted 2-aryl-2-chloropropanes with electron donating groups during their solvolysis in water.
(ii) "The shifts in rate limiting step within the same overall reaction pathway can be explained by using Hammett's equation." Justify with suitable example.
(iii) How are E_s and σ^* parameters are determined? Discuss their physical significance.
(iv) Give an account of Grunwald-Winstein equation.

(b) Attempt any **one** of the following: 04
(i) "The change in the reaction mechanism can be explained by the Hammett's equation". Explain with suitable example.
(ii) Explain Swain-Scott equation used for determination of nucleophilicity scale.

Q. 2 (a) Attempt any **two** of the following: 08
(i) Discuss any one example of a receptor with multiple hydrogen bonding sites?
(ii) What are rotaxanes? Discuss their structure.
(iii) What are Cryptands? Discuss their structural features and give any one method of synthesis of Cryptands?
(iv) What is molecular self-assembly? Explain with a suitable example.

(b) Attempt any **one** of the following: 04
(i) What are molecular tweezers? Write detailed notes on tweezers?
(ii) Discuss the structural features of molecular cleft derived from Kemp's triacid for their applications as synthetic receptors?

Q. 3 (a) Attempt any **two** of the following: 08
(i) What is absolute and relative configuration? How to determine a configuration of an enantiomer based on a comparison of Optical Rotation.
(ii) What is resolution of enantiomers? Explain the following chemical methods of resolution of enantiomers:
a. esterification
b. by forming diastereomeric Salt
(iii) The specific rotation of (*S*)-2-iodobutane is +15.90°. Determine the % composition of a mixture of (*R*)- and (*S*)-2-iodobutane if the specific rotation of the mixture is -3.18°.
(iv) What is optical rotatory dispersion & how is it useful in the characterization of substances?

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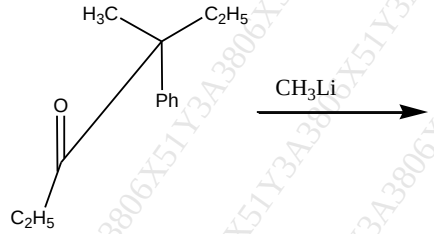
(b) Attempt any **one** of the following: 04

(i) What do you mean by Racemization? Explain the mechanism of racemization involving:
   a. stable Symmetrical intermediate
   b. Racemization through rotation around bonds

(ii) Explain the use of Lanthanide Shift Reagents in chiral discrimination.

Q. 4 (a) Attempt any **two** of the following: 08

(i) State Cram's rule. Illustrate the same for the following reaction.



(ii) Discuss the asymmetric aminohydoxylation.

(iii) Explain 'Asymmetric amplification' with example.

(iv) How will you achieve stereoselectivity in Diel's Alder reaction? Illustrate with the examples.

(b) Attempt any **one** of the following: 04

(i) How will you achieve distereoselectivity in aldol reaction.

(ii) Discuss chiral pool strategy in asymmetric synthesis.

Q. 5 Attempt any **four** of the following: 12

(a) Explain Dimmorth's E_T parameter.

(b) Explain Edward-Ritchie equation.

(c) What are Calixarenes? Give any one method of their synthesis?

(d) What are crown ethers? Give method of preparation of crown ethers.

(e) Give the applications of alpha-haloketone rule.

(f) Differentiate between ORD and CD curves.

(g) Give synthesis of L-DOPA by Knowles's Mosanto method.

(h) Explain three methods of asymmetric induction.

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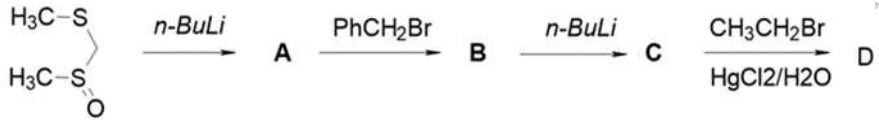
Duration: 2.5 hours **Max. Marks.60**

N.B. i) All questions are compulsory.
ii) Figures to the right indicate full marks.

1. A. Attempt **any two** of the following: **8**

i) Give the equations involved in the protection and deprotection of following functional groups. I) -NH2 II) -COOH

ii) Complete the following reaction sequence by identifying A-D.



iii) Describe the term Synthons and Synthetic equivalents. What are the synthetic equivalents for the following.

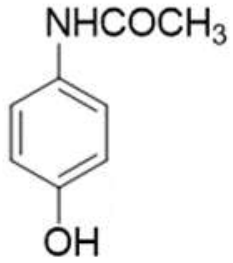


iv) Suggest the synthesis of the following using protection deprotection protocol.



B Attempt **any one** of the following: **4**

i) Provide a retro-synthesis of the following compound.

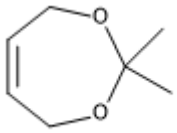


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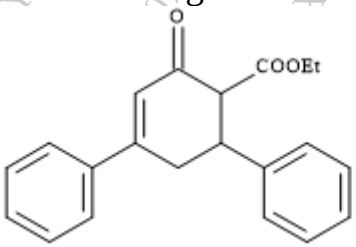
ii) Explain the terms Linear synthesis and Convergent synthesis using one example each and its Significance.

2. A Attempt **any two** of the following: **8**

i) For the following molecule, suggest a retrosynthetic pathway. Also write its synthesis, as per the pathway suggested by you.

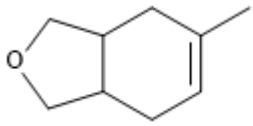


ii) The following molecule can be synthesised by a reaction sequence involving Michael reaction followed by cyclisation.



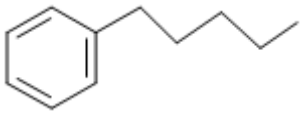
Using this sequence, write the synthesis. What is this reaction called?

iii) Write the retrosynthetic analysis of the following molecule and name the diene from which it can be synthesised.



Write the complete synthesis of this molecule.

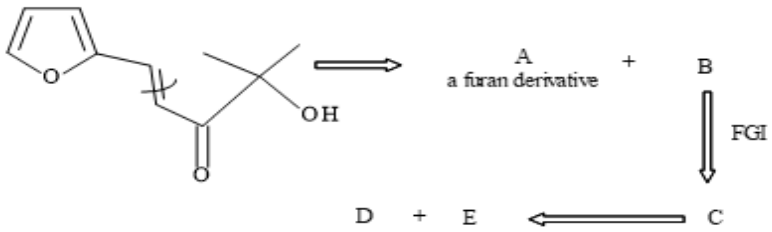
iv For the following molecule, show a retrosynthetic analysis using a Wittig reaction. Write the corresponding synthesis. **4**



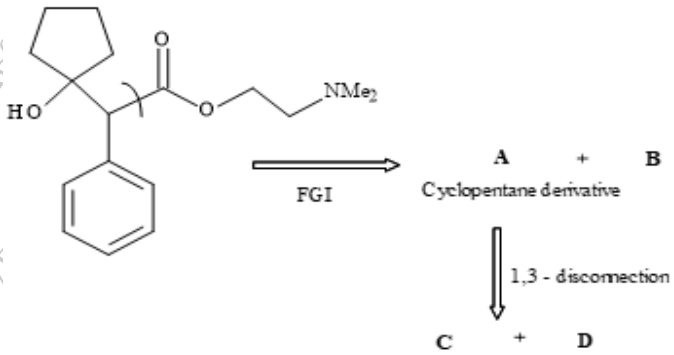
X51YA6077DX51YA6077DX51YA6077DX51YA6077D

B Attempt **any one** of the following:

i) Complete the following retrosynthetic analysis by drawing structures for A, B, C and D.

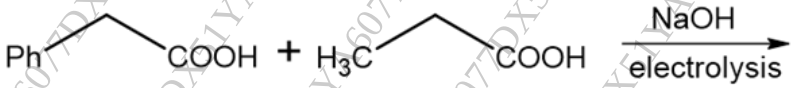


ii) Complete the following retrosynthetic pathway by drawing structures for **A, B, C and D**.



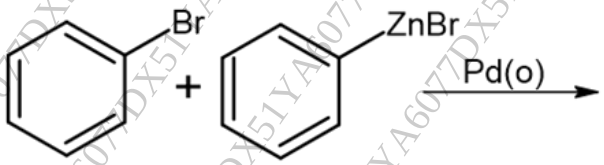
3. A Attempt **any two** of the following: **8**

i) Give the product, name and mechanism of the following reaction.



ii) What are cyclodextrins? Give structure of α-cyclodextrin. How does it help in selective chlorination of anisole using HOCl?

iii) Give the product, name and mechanism of the following reaction.



X51YA6077DX51YA6077DX51YA6077DX51YA6077D

iv) Give applications of $Yb(OTf)_3$ as a water tolerant Lewis acid catalyst in the following reactions:
Diels Alder reaction
Michael reaction
Aldol condensation
Friedel Crafts reaction

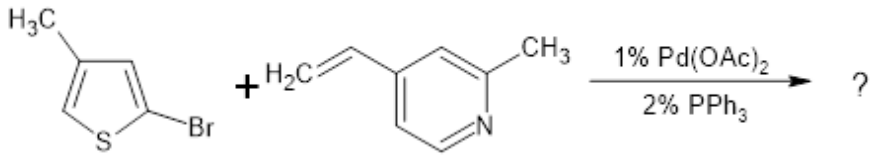
B Attempt **any one** of the following: **4**

i) What are crown ethers? Explain the selectivity of crown ethers towards alkali metal ions and give their applications in organic synthesis.

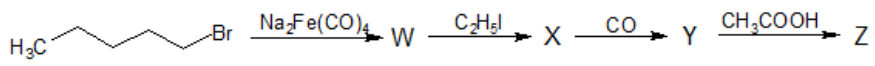
ii) What are organocatalysts? Explain the use of imidazolidinone in organic synthesis with suitable examples.

4. A Attempt **any two** of the following: **8**

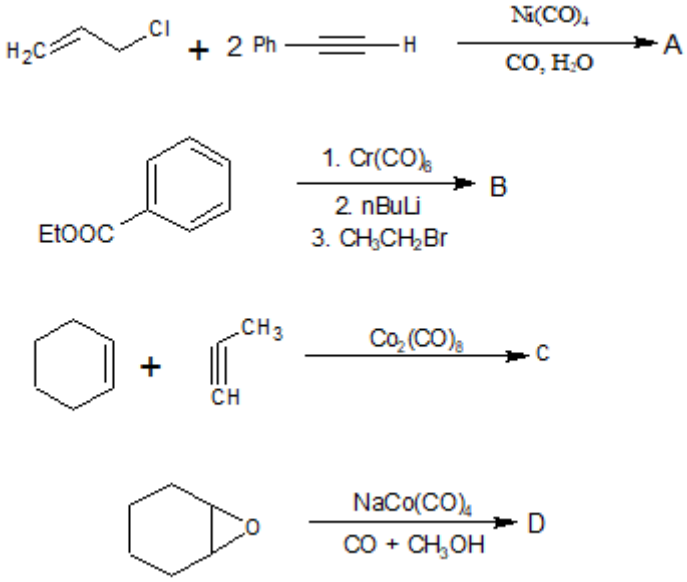
i) Give name, product and mechanism of the following reaction.



ii) Complete the following reaction and identify W, X, Y and Z.



iii) Complete the following reactions by identifying A, B, C and D.

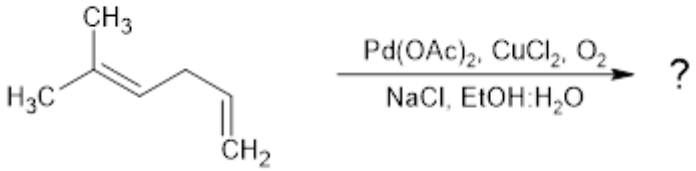


X51YA6077DX51YA6077DX51YA6077DX51YA6077D

iv) What is the action of SmI_2 on the following compounds - aldehydes, nitro compounds, alkyl halides and α-functionalized carbonyls?

B Attempt **any one** of the following: **4**

i) Give the product, name and mechanism of the following reaction.



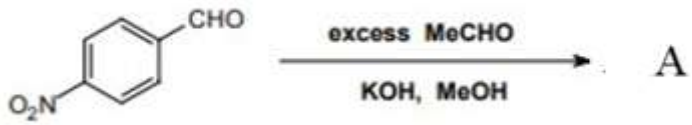
ii) Explain the terms oxidative addition and reductive elimination with suitable examples.

5. Answer **any four** of the following: **1 2**

(a) Explain the term Functional Group Interconversions (FGI) and Functional Group Additions (FGA) with suitable examples.

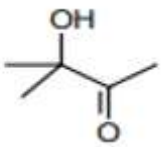
(b) Using the umpolung concept, write the conversion of Benzaldehyde to acetophenone.

(c)



Draw the structure of A and show its disconnection to the given starting material.

(d) How will you synthesise the following molecule from acetylene?



(e) What are micelles? Explain their role as phase transfer catalyst in organic synthesis giving suitable examples.

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(f) Discuss with examples cathodic reduction of carbonyl compounds.

(g) Explain the 18-electron rule. Using this rule, determine the value of n for $[Cl_2Cr(CO)_n]$ (At. no. of Cr = 24).

(h) Give the applications of Ce(IV) in i) synthesis of quinoxaline ii) as a deprotection agent.

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Time: 2 hours 30 minutes **Total Marks: 60**

Instructions:
(1) All questions are compulsory.
(2) Figures to the right indicate full marks.

Q. 1 (a) Attempt any **two** of the following: 08
(i) Explain quantitative structure activity relationship for *p*-substituted 2-aryl-2-chloropropanes with electron donating groups during their solvolysis in water.
(ii) "The shifts in rate limiting step within the same overall reaction pathway can be explained by using Hammett's equation." Justify with suitable example.
(iii) How are E_s and ɗ parameters are determined? Discuss their physical significance.
(iv) Give an account of Grunwald-Winstein equation.

(b) Attempt any **one** of the following: 04
(i) "The change in the reaction mechanism can be explained by the Hammett's equation". Explain with suitable example.
(ii) Explain Swain-Scott equation used for determination of nucleophilicity scale.

Q. 2 (a) Attempt any **two** of the following: 08
(i) What are molecular tweezers? Write a detailed notes on tweezers?
(ii) What are Cyclophanes? Discuss their structural features?
(iii) Give any one method of synthesis of crown ethers. Discuss their structural features.
(iv) Discuss the structural features of molecular cleft derived from Kemp's triacid for their applications as synthetic receptors?

(b) Attempt any **one** of the following: 04
(i) Discuss any one example of a receptor with multiple hydrogen bonding sites?
(ii) What are Cryptands? Discuss their structural features and give any one method of synthesis of Cryptands?

Q. 3 (a) Attempt any **two** of the following: 08
(i) What is racemisation? Discuss the mechanism of racemisation involving:
a. Stable symmetrical intermediate
b. Configurational change in substitution reactions
(ii) Define resolution and explain the method of resolution through inclusion compounds.
(iii) How NMR spectroscopy (use of Shift reagents) and enzymatic methods are useful in determining optical purity and enantiomeric excess in racemates?
(iv) Explain the correlation method applied for a configurational assignment using chemical transformation involving the chiral centre.

(b) Attempt any **one** of the following: 04
(i) Explain Correlative method for configurational assignment based on NMR spectroscopy.
(ii) Give an informative note on Linearly and circularly polarized light.

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Q. 4 (a) Attempt any **two** of the following: 08

(i) Explain asymmetric synthesis of an aldol involving achiral aldehyde and chiral enolate.

(ii) Discuss substrate and catalyst controlled asymmetric induction with suitable examples.

(iii) Give synthesis of L-DOPA by Knowles's method.

(iv) Explain Cram's rule and Felkin-Anh model using one example each.

(b) Attempt any **one** of the following: 04

(i) Explain mechanism and stereochemistry of Sharpless enantioselective epoxidation.

(ii) Write a note on asymmetric Diels-Alder reaction.

Q. 5 Attempt any **four** of the following: 12

(a) Explain Dimmorth's E_T parameter.

(b) Explain Edward-Ritchie equation.

(c) What are rotaxanes? Discuss their structure.

(d) Discuss any one example of a receptor with multiple hydrogen bonding sites?

(e) Explain the application of ORD and CD curves with the cotton effect used in the determination of the structure of polypeptides and proteins.

(f) Explain octant rule with one example.

(g) Explain enantioselective alkylation through chiral oxazolines with suitable reactions.

(h) Give the chiral pool synthesis of D-alanine from L-lactic acid.

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X51YDBCE15X51YDBCE15X51YDBCE15X51YDBCE15