PH 581.4   Reg. No. :

St Aloysius College (Autonomous)
Mangaluru
Semester IV – P.G. Examination – M.Sc. Chemistry
September - 2020

ORGANIC SYNTHETIC METHODS
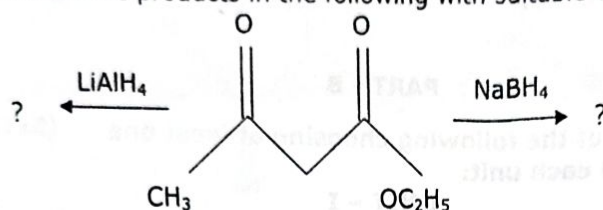
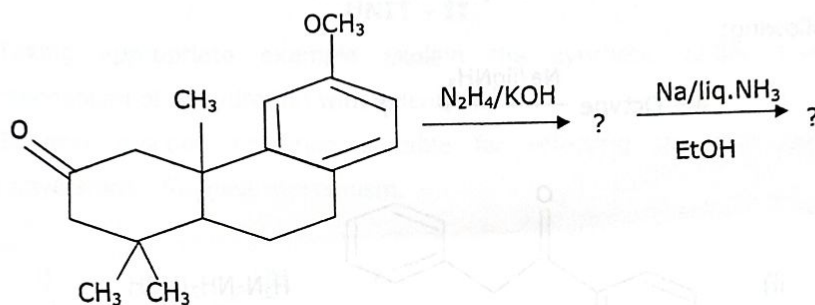Time: 3 Hours   Max. Marks: 70

PART - A

1. **Answer any FIVE sub divisions of the following:**   (5x2=10)
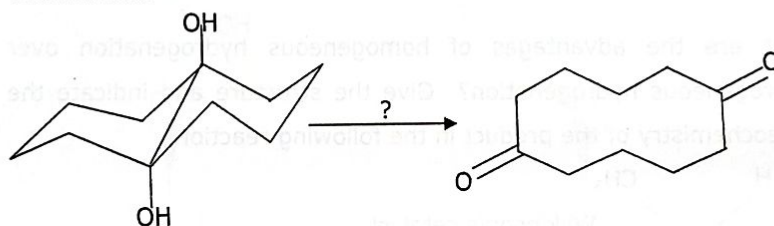
   a) Predict the products in the following with suitable explanation.
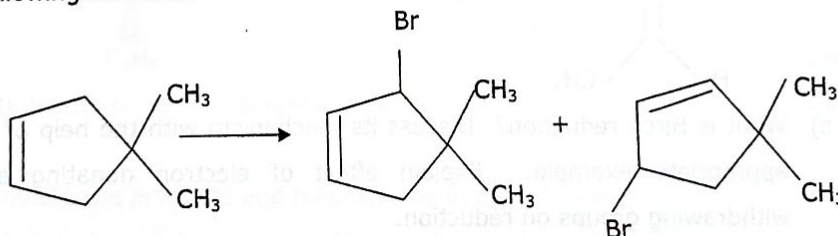

   b) Predict the products in the following reactions.
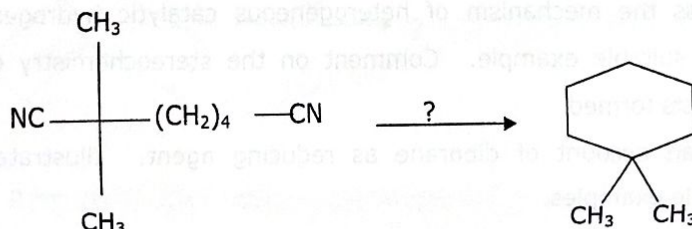

   c) Suggest a reagent to effect the following conversion and outline the mechanism.

   d) Suggest the reagents/reaction conditions and propose mechanism for the following reaction.

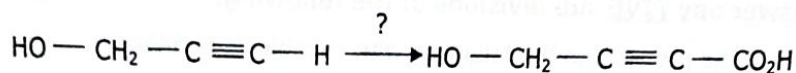   e) How is the following transformation achieved?

f) What is retro Diel's-Alder reaction? Illustrate with an example.

g) What are synthons ad synthetic equivalents? Give the synthetic equivalents for the following:

$$\overset{\oplus}{H}, \quad \overset{\ominus}{H}, \quad \overset{\oplus}{NO_2}, \quad \overset{\oplus}{NO}$$

h) How is the following transformation achieved?

$$HO—CH_2—C\equiv C—H \xrightarrow{\quad ? \quad} HO—CH_2—C\equiv C—CO_2H$$

PART - B

Answer any FIVE of the following choosing at least one   **(5x12=60)**
full question from each unit:

UNIT – I

2.a) Predict the product and propose suitable mechanism for the following:

   i)   4 – Octyne $\xrightarrow{\text{Na/liqNH}_3}$?

   ii)

$$\xrightarrow[\text{HO-CH}_2\text{-CH}_2\text{-OH,} \ \triangle]{\text{H}_2\text{N-NH}_2|\text{KOH}} \ ? \quad \text{(4)}$$
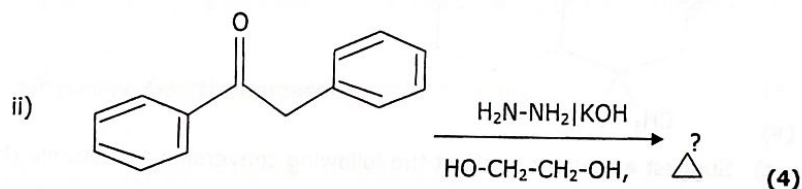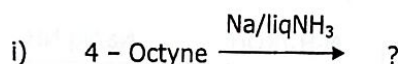
b) What are the advantages of homogeneous hydrogenation over heterogeneous hydrogenation? Give the structure and indicate the stereochemistry of the product in the following reaction.

$$\xrightarrow[\text{D}_2]{\text{Wilkinson's catalyst}} ?$$

                                                                   (4)
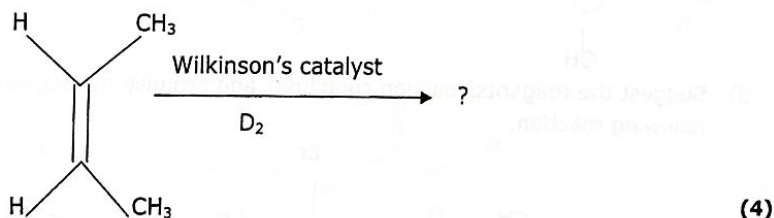
c) What is Birch reduction? Discuss its mechanism with the help of an appropriate example. Explain effect of electron donating and withdrawing groups on reduction.   **(4)**

3.a) Discuss the mechanism of heterogeneous catalytic hydrogenation using suitable example. Comment on the stereochemistry of the products formed.   **(4)**

b) Give an account of diborane as reducing agent. Illustrate with suitable examples.   **(4)**

c) Predict the product/s indicating the stereochemistry. Justify the answer.

i.

NaBH₄ → ?

ii.

LiAlH₄ / Ether → ?
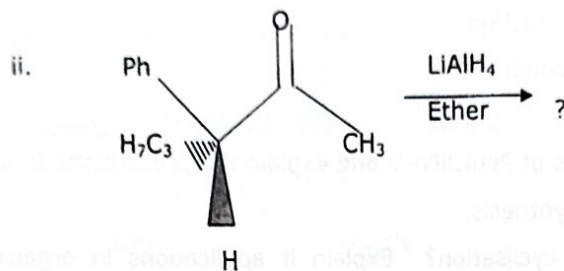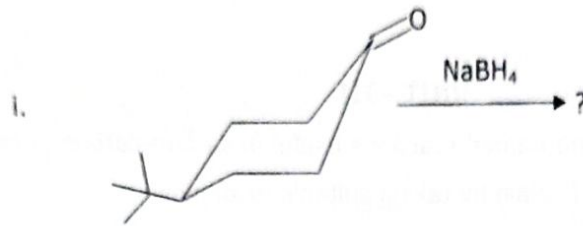
(4)

UNIT – II

4.a) Taking appropriate example explain the synthetic utility and mechanism of dehydration with selenium.

(4)

b) Suggest reaction condition suitable for effecting the following conversions. Suggest mechanism.

i)

? → $OHC-(CH_2)_3-CHO$

ii)

? →
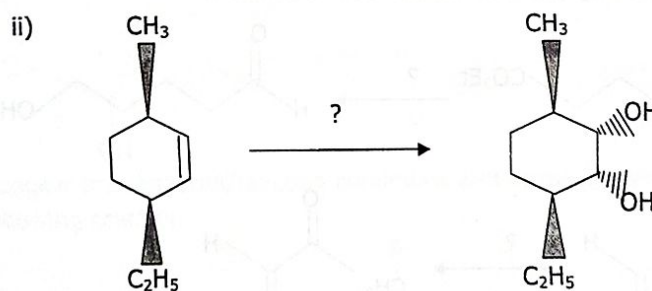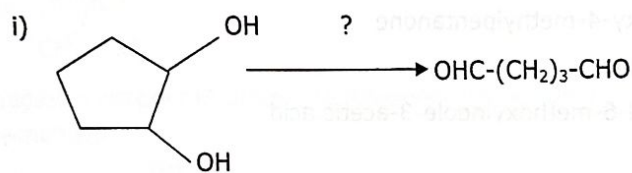
(4)

c) Write a note on allylic halogenations.

(4)

5.a) Formulate the products and mechanisms in the following?

i)

O_3 → ?

ii) $R-CH=CH-CH_2-CH=CH-\overset{O}{\overset{\|}{C}}-R^{I}$ —Per acid→ ?   (4)
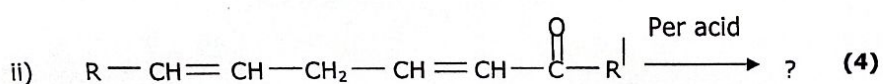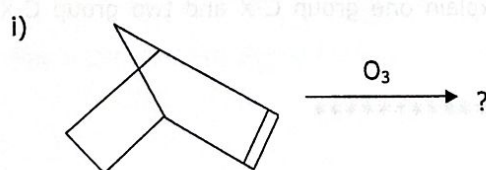
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b) Discuss the synthetic utility of lead tetraacetate. (4)

c) Explain the uses of various chromium and manganese salts in the oxidation of alcohols. (4)

UNIT - III

6. How are the following named reactions useful in carbon-carbon bond forming reactions? Explain by taking suitable examples.

    a) Carbene insertion reaction (4)

    b) Friedel-Craft's reaction (4)

    c) Robinson annulation (4)

7.a) Outline the synthesis of Penicillin-V and explain the precautions to be adopted during its synthesis. (4)

  b) What is Dickmann cyclisation? Explain it applications in organic synthesis using appropriate examples. (4)

  c) Outline the synthesis of 6-methoxy-tetralone. (4)

UNIT – IV

8. Propose retrosynthetic analysis for the following molecules and give their synthesis.

    a) 4-Hydroxy-4-methylpentanone (4)

    b) Benzocaine (4)

    c) 2-methyl-6-methoxyindole-3-acetic acid (4)

9.a) How the following transformations can be achieved?

i)

ii)

 (4)
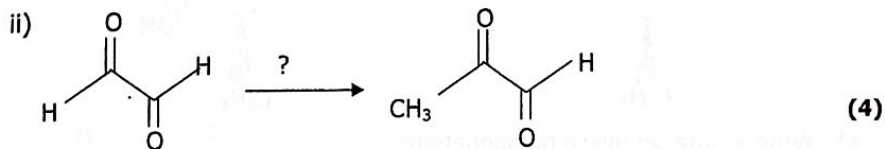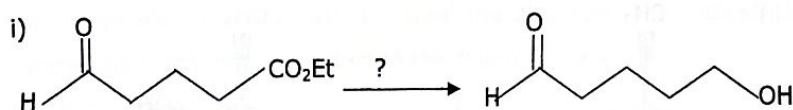
  b) Discuss the various techniques in the protection of amino group under different pH conditions. (4)

  c) With suitable examples, Explain one group C-X and two group C-X disconnections. (4)

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St Aloysius College (Autonomous)
Mangaluru
Semester IV – P.G. Examination – M.Sc. Chemistry
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RADIATION AND PHOTOCHEMISTRY

Time: 3 Hours   Max. Marks: 70

PART - A

1. **Answer any FIVE sub divisions of the following:**   (5x2=10)

   a) How is a nuclear reaction different from a chemical reaction?

   b) Complete the following nuclear reactions.

      i) $^{40}_{18}Ar + ^{1}_{1}H \rightarrow ? + ^{1}_{0}n$ ii) $^{235}_{92}U + ^{1}_{0}n \rightarrow ^{141}_{56}Ba + ? + 3^{1}_{0}n$

   c) The amount of carbon-14 in a piece of wood is found to be one sixth of its amount in a fresh piece of wood. Calculate the age of the old piece of wood. Given half life of carbon-14 is 5730 years.

   d) What is dosimeter? Give the composition of Fricke and Ceric sulphate dosimeter.

   e) Calculate the number of moles of $HCl_{(g)}$ produced by the absorption of one joule of radiant energy of wavelength 480nm in the photochemical reaction $H_{2(g)} + Cl_{2(g)} \rightarrow 2HCl_{(g)}$ if the quantum yield of the reaction is 1.00×10^6.

   f) State and explain Frank-Condon principle.

   g) Write the stern-volmer equation and explain the terms involved.

   h) State any two applications of photochemistry in atmospheric chemistry.

PART – B

Answer any FIVE of the following choosing at least one   (5x12=60)
full question from each unit:

UNIT – I

2.a) Explain the detection and measurement of radiation by using a Geiger-Muller counter.   (4)

   b) Calculate the half life of radium-226 if 1 gram of it emits 3.7×10^{10} alpha particles per second.   (4)

   c) Describe the important differences between nuclear fission and nuclear fusion.   (4)

3.a) Write a comparative note on the characteristics of α, β and γ rays.   (4)

   b) What are the postulates of liquid drop model of a nucleus? Explain the stability of the nucleus by using this model.   (4)

   c) Briefly explain the principle and working of a Breeder reactor.   (4)

UNIT – II

4. a) Explain the separation of radioisotopes by ion exchange method. (4)

   b) Outline the study of neutron absorptionmetry and its applications. (4)

   c) Discuss the radiation chemistry of water. (4)

5. a) Describe the applications of radioactive isotopes in agricultural and industrial applications. (4)

   b) Outline the pulse radiolysis technique for the study of transient species. (4)

   c) Write a note on radioactive waste management. (4)

UNIT – III

6. a) Explain the effect of solute-solvent interactions on electronic spectra. (4)

   b) Differentiate photochemical and thermochemical reactions. (4)

   c) Comment on the acidity constant of electronically excited molecules by taking suitable examples. (4)

7. a) Outline the study of excited states by flash photolysis. (4)

   b) By taking a suitable example, explain the determination of quantum yield by an actionometer. (4)

   c) Explain (i) Grother-Draper law

   (ii) Stark-Einstein law of photochemical equivalence (4)

UNIT - IV

8. a) Define photo dissociation and photo isomerization. Give examples for each. (4)

   b) Schematically explain the various photochemical fate of an excited state molecule. (4)

   c) Explain quenching of fluorescence. (4)

9. a) Discuss the kinetics of unimolecular photochemical reaction. (6)

   b) Explain the differences in the measurement of fluorescence and phosphorescence intensities. (3)

   c) Describe photochemical rearrangement reactions by taking suitable examples. (3)

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PH 583.4   Reg. No. : ⊔⊔⊔⊔⊔⊔⊔

St Aloysius College (Autonomous)
Mangaluru
Semester IV – P.G. Examination – M.Sc. Chemistry
September - 2020
CHEMISTRY OF POLYMERS AND NATURAL PRODUCTS

Time: 3 Hours   Max. Marks: 70

PART - A
1. **Answer any FIVE sub divisions of the following:**   (5x2=10)

a) Using polystyrene as an example, write the configuration of isotactic and syndiotactic polystyrenes.

b) Write the structure of the repeating units of the following polymers:
    i)   Polydimethylsiloxane
    ii)   Polyachrylonitrile
    iii)   Teflon
    iv)   Nylon 6

c) Among polyethylene and polystyrene, which polymer exhibits a higher Tg? Why?

d) Sketch the characteristic DSC curve of a semicrystalline polymer sample and mention the various features.

e) How codeine is converted to morphine and Thebaine.

f) Give the evidence for the presence of phenolic-OH group in adrenaline.

g) State special isoprene rule. Mark the isoprene units in α- pinene and zingiberene.

h) Predict the products in the following:

    i)   Abietic acid $\xrightarrow[\Delta]{Se}$?

    ii)   Menthol $\xrightarrow{CrO_3}$?

PART - B

Answer any FIVE of the following choosing at least one full question from each unit: (5x12=60)

UNIT – I

2.a) Differentiate between step growth and chain growth polymerization.   (4)

  b) Explain the viscometric method of determination of moleculas weight of a polymer.   (4)

  c) A polydisperse sample of polymers has 10% of molecules of molecular weight 10,000, 80% of 20,000 and 10% of 40,000. Calculate the number average and weight average molecular weights.   (4)

3.a) Explain the use of gel permeation chromatography technique in isolation and purification of polymers.   (4)

b) Discuss the Flory-Huggins theory of polymer dissolution.   **(4)**

c) Solution viscosity measurements give an idea about the size and shape of polymer molecules in solution. Justify.   **(4)**

UNIT – II

4.a) Discuss the factors affecting the Tg of polymers.   **(4)**

b) Elucidate the use of DSC technique in polymer characterisation.   **(4)**

c) Explain the method of vapour phase osmometry in the determination of polymer molecular weight.   **(4)**

5.a) Explain how the structure of a polymer influences the following properties:

i) Tensile strength   ii) Flexural strength   **(4)**

b) How do you correlate the glass transition temperature, crystallinity and melting point of a polymer with the structure of that polymer? Explain with suitable example.   **(4)**

c) Discuss the uses of thermogravimeric analysis of polymers.   **(4)**

UNIT – III

6.a) Give the synthesis of piperine.   **(4)**

b) Explain the use of Emode's degradation in the determination of the structure of an alkaloid.   **(4)**

c) Outline the steps involved in the determination of structure of nicotine.   **(4)**

7.a) Outline conversion of ethyl quininate to (±)-quinine.   **(4)**

b) Write the steps involved in the synthesis of papaverine from dimethoxy benzene.   **(4)**

c) Outline the reactions that indicate the following:

i)   Presence of methylene group in papaverine.

ii)   Attachment of –CHOH group directly to the benzene ring in adrenaline.   **(4)**

UNIT - IV

8.a) How do you fix up the positions of three double bonds in zingiberene?   **(4)**

b) Discuss how the structure of geraniol was established.   **(4)**

c) Give the synthesis of farnesol.   **(4)**

9.a) Write the steps involved in the synthesis of dihydroabietic acid.   **(4)**

b) Explain the structure of santonin by its degradation studies.   **(4)**

c) Indicate the reagents that are used to bring about the following conversions.

Pinene glycol ⟶ pinonic acid ⟶ Pinic acid ⟶ cis-norpinic acid

Give the structures of all these compounds and write the synthesis of any one of them.   **(4)**

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Reg. No: ☐☐☐☐☐☐

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Mangaluru
Semester IV– P.G Examination – M.Sc. Chemistry
September - 2020
SOLID STATE AND NANO CHEMISTRY

Time: 3 Hours

Max. Marks: 70

PART - A

1. Answer any **SEVEN** sub-divisions of the following: (7x2=14)

   a) Define a unit cell. Give the types of crystal lattices.

   b) Define systematic absences.

   c) Write the Wierl equation. Give its significance.

   d) Differentiate between Schottky and Frenkel defects.

   e) Distinguish two types of nucleation processes.

   f) Classify the solids based on their electrical conductivity with suitable examples.

   g) Define the nano dimensions.

   h) What are chemical nano composites?

   i) What are Xerogels and Aerogels?

PART – B
Answer any FOUR of the following choosing at least one full question from each unit: (4x14=56)

UNIT- I

2. a) Discuss the application of electron diffraction technique in the determination of structure of surfaces.   **(4)**

   b) Explain the determination of structure of a single crystal by X-ray diffracrometric method.   **(4)**

   c) Write a short note on calculation of number of particles in a unit cell.   **(3)**

   d) Elaborate the Weissenberg method of structure determination of solids.   **(3)**

3. a) Describe the factors affecting the intensities of diffracted X-rays.   **(4)**

   b) Explain the Debye-Scherrer method of X-ray diffraction.   **(4)**

   c) Write the Laue equation and give the significance of Laue method of X-ray diffraction studies.   **(3)**

   d) Discuss the low energy electron diffraction technique for study of surfaces.   **(3)**

UNIT- II

4. a) Describe the formation of p-n junctions.   **(4)**

   b) Discuss the thermodynamics of Schottky defect in solids.   **(4)**

   c) What are colour centres? How are they formed? Explain with suitable example.   **(3)**

   d) Explain the chemical vapour deposition method of preparation of thin films.   **(3)**

5. a) Explain the pyroelectric and piezoelectric properties of solids and their applications.   **(4)**

   b) Discuss briefly about the Intrinsic and extrinsic semiconductor.   **(4)**

   c) Describe the pulling and zoning techniques of crystal growth.   **(3)**

d) Explain the structure of FeO.   (3)

UNIT- III

6. a) Discuss the application of nanomaterials in the field of medicine and   (4)
      electronics.

   b) Elaborate the sol-gel process of nanomaterial synthesis.   (4)

   c) Differentiate between bottom-up and top-down synthesis methods.   (3)

   d) Write a note on classification of nanomaterials with suitable examples.   (3)

7. a) Describe the redox and mechanical properties of nanomaterials.   (4)

   b) Explain the electrokinetic potential and peptization processes.   (4)

   c) Discuss the electrodepostion method of synthesis of nanoparticales.   (3)

   d) Write a note on smart materials.   (3)

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