

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

QUESTION BANK

CLASS: III - B.Sc., CHEMISTRY (SHIFT-II), SEMESTER-VI

SUBJECT: ORGANIC CHEMISTRY -IV

SUBJECT CODE: CH614T

NAME OF THE STAFF: Mr. S. RICHARD RAJKUMAR & Dr. S. DAVID AMALRAJ

UNIT I

SECTION - A

- Which one is the base value of λ_{\max} (nm) of conjugated diene?
a. 214 nm b. 215 nm c. 217 nm d. 253 nm
- Which one of the following regions of IR is known as functional group region?
a. 650-900 cm^{-1} b. 900-1300 cm^{-1} c. 1300-4000 cm^{-1} d. 4000-12500 cm^{-1}
- The non bonding electrons are held more loosely than σ bonding electrons. So, $n \rightarrow \pi^*$ occur at
a. Shorter λ and lower E b) Longer λ and higher E c) Shorter λ only d) Comparatively very longer wave length
- The order of decreasing vibrational frequencies of the following bond is
a) C-Cl > C-Br > C-C > C-H b) C-Br > C-Cl > C-C > C-H
c) C-C > C-H > C-Br > C-Cl d) C-H > C-C > C-Cl > C-Br
- The functional groups are characterized by ----- spectroscopy.
a) IR b) NMR c) Mass d) UV-Visible
- The stretching frequency of C=O group is ----- cm^{-1} .
a) 3500 b) 1700 c) 1500 d) 2950
- The largest energy is required for transition between;
a) $\pi \rightarrow n$ b) $\pi \rightarrow \pi$ c) $\sigma \rightarrow \sigma$ d) $n \rightarrow \pi$
- The number of vibrational degrees of freedom for CO₂ is :
a) 2 b) 4 c) 6 d) 8
- The conjugated systems are studied by ----- spectroscopy.
a) IR b) NMR c) Mass d) UV-Visible
- The stretching frequency of 2900 cm^{-1} is characteristic of ----- stretching
a) O-H b) C-H c) N-H d) C=O
- For a linear triatomic molecule, the number of modes of vibration is
a) $3n-6$ b) $3n-5$ c) $2n-5$ d) $2n-6$

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

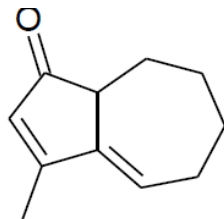
- The energy required for ____ transition is maximum
a) $\sigma\text{-}\sigma^*$ b) $n\text{-}\sigma^*$ c) $n\text{-}\pi^*$ d) $\pi\text{-}\pi^*$
- Theoretically the number of fundamental modes of vibration for CO_2 molecule _____.
- Calculating according to Woodward - Fieser rule, the basic value of α,β - Unsaturated carbonyl compound is taken as _____.
- The increment value for conjugated double bond is -----nm.
- In conjugated dienes, $\Pi\rightarrow\Pi^*$ transitions require _____ energy than the $\Pi\rightarrow\Pi^*$ transition is isolated diene.
- The increment value for λ_{max} for alkyl substituent is _____.

SECTION -B

- Define the the following terminologies:
i) Auxochrome ii) Bathochromic shift
- What is Finger print region?
- Define hypsochromic effect. Give an example.
- What are chromophores? Give examples.
- Give the vibrational modes of water molecule.
- What are the selection rules for IR spectroscopy?
- The largest energy transition takes place between $\bar{\nu}\rightarrow\bar{\nu}^*$ among all types of transition. Explain.
- Distinguish between primary and secondary amines using IR spectroscopy.
- How do you differentiate maleic acid from fumaric acid by IR spectroscopy?

SECTION –C

- Calculate the λ_{max} of :

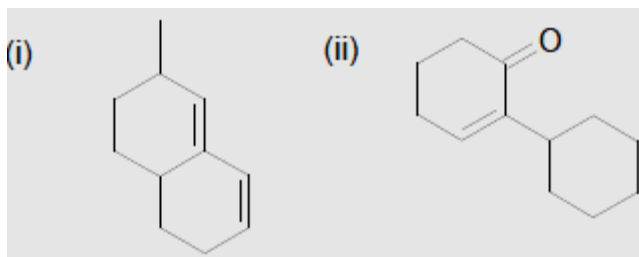


- Give the characteristic absorption of phenols and esters in IR.?

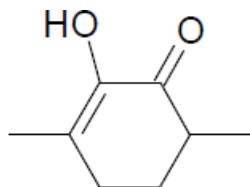
ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

- The syn conformation of ethylene glycol is more stable than its anti-conformation. Explain with the help of IR spectroscopy.
- What types of vibrations occur in a molecule?
- How will you differentiate the absorption bands of –OH and –NH in IR spectrum?
- Describe the Woodward-Fieser rules for calculating the λ_{\max} of a diene. Do these rules obey strictly in all dienes? Explain
- IR is a tool to identify the different types of H-bonding. Explain
- Calculate the λ_{\max} value for the following:



- Calculate the λ_{\max} of



- What is the finger print region? Give the characteristic absorption of phenols and esters.
- Calculate the λ_{\max} (nm) value for the following compounds.
 - 1,4-cyclohexadiene.
 - 1,3-pentadiene

UNIT II

SECTION - A

- Which one of the following compounds will give single NMR signal due to equivalent proton?
 - Dimethyl ether
 - Methoxy ethane
 - Methyl acetate
 - Vinyl bromide
- In a mass spectrometer an organic compound is bombarded with electrons of about _____ Energy.
 - 60eV
 - 70eV
 - 80eV
 - 90eV
- How many kinds of magnetically non-equivalent protons are present in $\text{CH}_3\text{CH}=\text{CH}_2$?
 - 02
 - 03
 - 04
 - 06

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

- How many signal will be obtained in the H¹-NMR of 1- nitropropane?
a) Four b) Three c) Two d) One
- The number of NMR signals for 2,2-dimethylbutane is
a) 3 b) 4 c) 2 d) 1
- The number of proton NMR signals for tertiary butyl bromide _____.
- A mass spectrum is the plot of relative abundance of ions against their _____ ratio.
- How many NMR signals are formed for 2-chloro-propane _____ .
- The base peak obtained for acyl ion is at ----- m/z
a) 78 b) 43 c) 91 d) 112
- Chemical Shift is expressed in -----units.
- The number of NMR signals for toluene is
a) 6 b) 1 c) 2 d) 5
- Among the following which is/ are isotopic peak?
a) Molecular ion peak b) M+1 peak c) (M+2) peak d) Both b & c
- The standard compound used for measuring chemical shift is _____.
- The nucleus which can give NMR spectra is:
a) ${}^8\text{O}^{16}$ b) ${}^5\text{B}^{10}$ c) ${}^6\text{C}^{12}$ d) ${}^2\text{He}^4$
- In the proton NMR spectrum of the compound ClCH₂CHCl₂, the multiplicities of the signals due to protons A and B respectively:
a) Doublet, singlet b) Singlet, doublet c) Doublet, triplet d) Triplet, doublet
- Greater is the degree of hydrogen bonding of a proton, _____ is the downfield shift in NMR spectroscopy.
- Tell the number of signals for 1,2 dichloropropane _____ .
- Tell the multiplicity of signals in CH₃CH₂OH in NMR spectroscopy _____.
- Which solvent cannot be used in NMR spectroscopy _____ .
- The signal for a compound like A-CH₂-CH₂-B will be _____ .
- The base peak obtained for tropylium ion is at ----- m/z
a) 78 b) 43 c) 91 d) 112

SECTION -B

- What is Nitrogen rule?
- What is a meta stable peak in Mass spectrometry?
- Write short notes on chemical shift.

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

4. Define Spin- spin coupling.
5. What is meant by (n+1) in spin-spin coupling?
6. What is a base peak? Give an example.
7. Give the splitting pattern in 2-butanol.
8. Why molecular ion peak is not always observed in mass spectrum?
9. Define coupling constant.
10. The mass spectrum of isobutene shows a peak at $m/e=29$ while that of methane has a small peak at $m/e=17$. Explain these observations.
11. What is molecular ion peak?
12. What do you know about M^+ and $M+1$ ions?
13. Mention some important characteristic of solvents used in NMR
14. Deshielding is due to which hydrogens
15. Why TMS is used as a standard electrode

SECTION - C

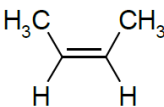
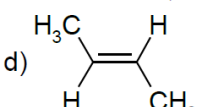
1. Mass spectrometry is the best tool to establish the structure of a new compound-Justify.
2. What is McLafferty rearrangement reaction? Explain.
3. Discuss the relaxation processes in NMR spectroscopy.
4. How will you distinguish 1-Butyne and 2-butyne using NMR spectroscopy?
5. Illustrate the fragmentation pattern for 2-butanone.
6. How will you distinguish 2-pentanone and 3-pentanone by NMR spectroscopy?
7. Discuss the relaxation processes in NMR spectroscopy
8. A compound with molecular formula $C_7H_5OCl_3$ shows 3 proton signals at 83.9 and two one proton doublets ($J=8$ Hz) at 86.76 and 7.3 identify the compound.
9. NMR has quantitative significance as well. Explain.
10. Explain why NMR spectrum of benzene is observed at lower field whereas that of acetylene is observed at higher field strength
11. What is meant by deshielding in NMR spectroscopy?
12. What do you mean by shielding and deshielding of a nucleus
13. An organic compound with molecular formula $C_3H_3Cl_5$ gave the following H^1 NMR data:
 - a) Atriplet 5.48 ($4.5\alpha\delta$)
 - b) A doublet 3.93 (6.07δ) $2H$Assign the structure of the molecule based on this data.

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

UNIT III

SECTION - A

- Birch reduction of benzene to 1,4-cyclohexadiene is governed by _____ mechanism
a. Free radical b. Ionic c. Both a and b d. Not by both
- Woff-Kishner reduction of carbonyl compounds to hydrocarbons involves the treatment of the carbonyl compound with the base____.
a. Semicarbazide b. Hydroxylamine c. 2,4-Dinitrophenyl hydrazine d. Hydrazine
- _____ is the structure of DIBAL.
- What is the product? But-2-yne ? 3 /NaliqNH
a) $\text{CH}_3\text{CH}_2\text{CH}=\text{CH}_2$ b) $\text{CH}_3\text{CH}_2\text{CH}_2\text{CH}_3$
c)  d) 
- The reducing ion is NaBH_4 is _____.
- The reaction of alkenes with $\text{H}_2\text{O}/\text{H}^+$ gives
a) Alcohols b) Diols c) Acids d) Esters
- Cyclohexene can be obtained from cyclohexane using
a. Hydroboration b) Birch reduction c) Clemmensen d) Dehydrogenation
- The oxidation number Manganese in KMnO_4 is -----.
- Cis-2-butene $\xrightarrow{M-CPBA}$ $\xrightarrow{H_3\bar{O}^+/\Delta}$ product is
a. Trans-1,2-diol only b) Cis-1,2-diol only c) Racemic mixture of trans-1,2-diol d) Meso-2,3-butanediol
- The reducing moiety is lithium aluminium-hydride is _____.
- LAH is used to reduce _____.
- Cyclohexene can be obtained from cyclohexane using
a) Hydroboration b) Birch reduction c) Clemmensen d) Dehydrogenation
- The substance NOT having active methylene group is
a) Acetoacetic ester b) Oxalic acid c) Malonic acid d) Cyanoacetic ester
- The DIBAL is used to convert nitriles to -----.

SECTION - B

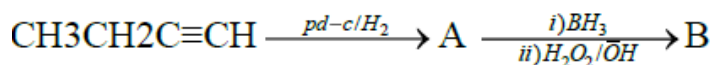
- Give an example for Birch Reduction.
- Assign the reagents to effect the following conversions.

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

- a. $\text{CH}_3\text{CHO} \longrightarrow \text{CH}_3\text{CH}_2\text{OH}$
b. $\text{C}_6\text{H}_5\text{CN} \longrightarrow \text{C}_6\text{H}_5\text{CH}_2\text{NH}_2$

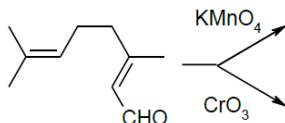
- Write any three uses of LDA.
- Discuss the hydroboration reaction of an alkene.
- What is Swern oxidation? Give example.
- Define Clemmenson reduction with example.
- Write the use of a hindered borane in the hydroboration-oxidation of an alkyne.
- What is Bayer's test?
- Find A and B in the following equation:



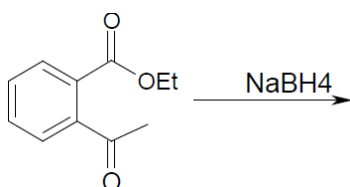
- Give any two synthetic uses of DIBAL
- Give the product of hydroboration of 2-butyne.
- Give any two reactions of LiAlH_4 .
- Discuss any two synthetic applications of NaBH_4 .
- Write the advantages of DIBAL over LiAlH_4 .
- What is swern oxidation? Give an example.

SECTION - C

- What is Jones reagent? Mention its synthetic applications.
- Write short notes on Clemmensen reduction.
- Compare the reduction of conjugated and non conjugated systems using LAH and NaBH_4
- Write the products.



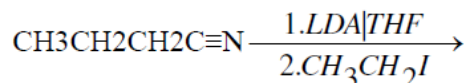
- What happens when glucose reacts with peracid? Give the reaction.
- Predict the products of the following reaction:



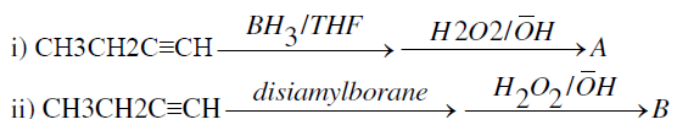
ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

- Discuss the catalytic hydrogenation with an example.
- Give the mechanism of Wolff-Kishner reduction.
- Explain hydroboration of alkynes
- Write the product of the following reaction:



- What happens when cyclohexene is treated with Trifluoroacetic acid?
- What are the products of oxidation of propanol by acidified $\text{K}_2\text{Cr}_2\text{O}_7$. Write the equation.
- Write the mechanism of Birch reduction.



UNIT IV

SECTION - A

- Active methylene compounds react with aldehydes in the presence of piperidine to give α,β -unsaturated acids, This reaction is known as
a. Claisen reaction b. Perkin reaction c. Knoevenagel reaction d. Reformsky reaction
- Which one of the following is not an alkaloid?
a. Nicotine b. Quinine c. Reserpine d. Adrenaline
- The molecular formula of Coniine is _____.
- Alkaloids are not found in :
a) Acetic acid b) Caro's acid c) Oxalic acid d) Citric acid
- The free bases obtained during the extraction of alkaloids are separated by _____.
- The alkaloids are usually purified by extraction with _____
- Which among the following is NOT a sigmatropic rearrangement?
a) [3,3] b) [2,3] c) [2,2] d) [1,3]
- The dienophile in Diels – Alder reaction is
a) Conjugated diene b) Isolated diene c) Alkene d) Cumulated diene
- Which of the following is an alkaloid?
a) Geraniol b) Isoprene c) Coniine d) α -pinene
- The free bases obtained during the extraction of alkaloids are separated by _____.

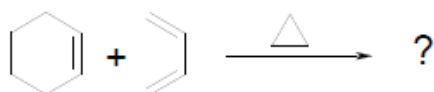
ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

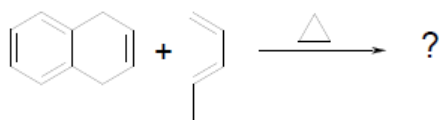
10. Thermodynamically controlled addition of hydrogen bromide to a conjugated diene is
a) 1,2-addition b) 1,3-addition c) 1,4-addition d) 1,1-addition
11. The adduct given by the reaction between 1,3-butadiene and fumaric acid will be _____
12. Electron withdrawing substituent in dienophile in Diels-Alder reaction _____
13. The source of piperine is
a) Hemlock b) Pepper c) Tobacco d) Eucalyptus

SECTION --B

1. Give an example for Diels –Alder reaction.
2. Predict the product of the following reaction:



3. Define alkaloids.
4. Explain Electrocyclic ring closure reaction.
5. Predict the product of the following reaction:



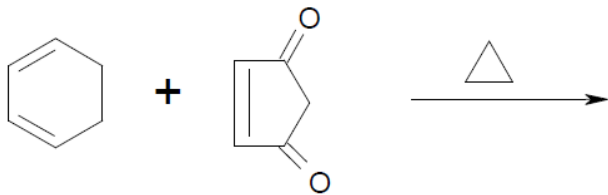
6. What are alkaloids?
7. $\text{CH}_2=\text{C}-\text{CH}=\text{CH}_2 + \text{CH}_2=\text{CH}-\text{C}-\text{CH}_3 \longrightarrow$ Products?
8. Deduce the structure of coniine?
9. what is piperidine? How are piperidine and coniine related to each other?
10. what is meant by a pericyclic reaction?
11. what is the cycloaddition reaction?
12. what is an electrocyclic reaction?

SECTION - C

1. Write the structural elucidation of piperine.
2. What is an alkaloid? Sketch the methods used to extract it from plants.
3. Elucidate the structure of coniine.
4. Discuss the preparation of coniine with the reaction.
5. Discuss the synthesis of piperine.
6. How are alkaloids isolated?
7. Give the product for the following reaction:

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001



8. Explain diels-alder reaction with mechanism?
9. Suggest suitable mechanism for the following reaction:



10. Starting from piperic acid how will you get piperine.
11. what is diels alder pericyclic?
12. what is a sigmatropic rearrangement?give an example?
13. write a note on general procedure followed for establishing the structure of an alkaloid.

UNIT V

SECTION - A

1. Nucleophilic substitution of isoquinoline will occur at position
a) 2 b) 1 c) 8 d) 5
2. Squaline is a
a) Alkaloid b) Terpenoid c) Carbohydrate d) Protein
3. An organic compound which on hydrolysis to give isoprene units is called _____
4. _____ is the hybridization of the oxygen in furan.
5. _____ is an example for bicyclic terpenoid
6. The number of isoprene units present in menthol is _____.
7. Which one of the following is most basic?
a. Pyrrole b. Pyridine c. Piperidine d. Furan
8. Which one of the following is a sesquiterpene?
a. Rubber b. Squalene c. Limonene d. Zingiberine
9. The hydrolysis of piperine gives piperic acid and piperidine. The piperic acid is then heated with HCl at 200°C and pressure to yield protocatechuic acid. The number of replaceable protons in this acid is:
a. 01 b. 02 c. 03 d. 04
10. ----- is an example of five-membered sulphur heterocycle

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

a) Pyridine b) Pyrrole c) Furan d) Thiophene

11. Which among the following terpenoid has the smell of lemon grass?

a) Citral b) Geraniol c) Menthol d) Camphor

12. The molecular formula of camphor is -----.

13. Pyrrole reacts with I₂ in aqueous KI to give mostly

SECTION - B

1. State the isoprene rule?

2. How will you synthesis pyridine from acrolein?

3. Draw the structures of (i). Geraniol (ii). Citral?

4. Give an example for the dehydrohalogenation of alkyl halide?

5. Write a method of preparing pyrrole?

6. What are terpenoids?

SECTION - C

1. Write the reaction of Reimer-Tieman formylation of pyrrole?

2. What is chloromethylation of thiophene?

3. Give mechanism for the conversion of butanoic acid from diethyl malonate?

4. Starting from pyrrole, how will you get pyridine?

5. Explain the Skraup synthesis?

6. Write the structural elucidation of menthol?

7. Write the Fischer-Indole synthesis?

8. Write the reaction of Reimer-Tieman formylation of pyrrole?

9. What is chloromethylation of thiophene?

10. Explain the Skraup Synthesis of isoquinoline?

11. Discuss the mechanism of Fischer Indole synthesis?

12. Give the preparation of thiophene?

ST. JOSEPH'S COLLEGE OF ARTS & SCIENCE (AUTONOMOUS)

ST. JOSEPH'S COLLEGE ROAD, CUDDALORE – 607001

13. Explain the structure of menthol?

14. Give the following synthesis of indole and quinoline

(i) Fischer Indole synthesis

(ii) Skraup synthesis