



Reg. No. :

Name :

Third Semester M.Sc. Degree Examination, February 2015
Branch : Chemistry
CH/CL/CA 232 : ORGANIC CHEMISTRY - III
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION - A

Answer any two among (a), (b) and (c) from each question. Each sub-question carries 2 marks.

1. a) Give the names of two commonly used solvents in IR spectroscopy. Water and ethanol are not used commonly in IR spectroscopy. Give reason.
b) λ_{max} values of the two geometrical isomers of stilbene ($\text{C}_6\text{H}_5\text{CH}=\text{CHC}_6\text{H}_5$) are 278 and 294. Correlate the isomers with the corresponding λ_{max} and give reasons.
c) Give the base peak or the most abundant peak in the mass spectrum of toluene.
2. a) Account the fact that the δ value of an aromatic H (6 – 8.5 ppm) is higher than a vinylic H (4.6 – 5.9) in PMR spectrum.
b) Illustrate the statement "Chemically equivalent but magnetically non-equivalent protons" with suitable example.
c) Give one reason why ^{13}C NMR is less sensitive than ^1H NMR.
3. a) Discuss the term "hydrophobic interactions" with respect to protein structures.
b) What are molecular tweezers? Give any two applications.
c) Explain supramolecular liquid crystals.



4. a) Illustrate retrosynthesis with an example.
b) Differentiate in-silico and in-vitro analysis of drugs.
c) Predict the sign of the constant ρ in the Hammett equation for the reaction,
$$\text{Ar} - \text{H} + \text{NO}_2^+ \rightarrow \text{Ar} - \text{NO}_2 + \text{H}^+$$
5. a) Write any four basic principles of green chemistry.
b) What types of vessels are used in microwave synthesis and give reasons ?
c) What are ionic liquids ? (2×10=20 Marks)

SECTION – B

Answer either (a) or (b) of each question. Each question carries 5 marks.

6. a) Explain how a polar solvent shifts the wavelengths of
i) $\pi \rightarrow \pi^*$ and
ii) $n \rightarrow \pi^*$ transitions.
b) Write the fragmentation pattern to account the major peaks of each of the following compounds.
i) $\text{CH}_3\text{CH}_2\text{COOCH}_3$; $m/z = 57, 59$ and 88
ii) $\text{CH}_3\text{CH}_2\text{NHCH}_2\text{CH}_2\text{CH}_3$; $m/z = 30, 44, 58, 72$ and 87
7. a) Account the following :
i) In PMR spectra, δ value of the olefinic protons of cis-stilbene is at 6.55 ppm, whereas the δ value of the olefinic protons of trans-stilbene is at 7.10 ppm.
ii) 1, 2 dibromoethane and cyclohexane have single sharp signals in PMR although they have conformationally different Hydrogens.
b) Deduce the structure of a compound $\text{C}_8\text{H}_8\text{O}$ which gives ^1H NMR data as δ 7.28 (5H, multiplet), 2.8 (2H, doublet), 9.78 (1H, triplet) ppm.
- a) Discuss briefly the importance of molecular recognition in DNA and protein structure.
b) Write short notes on the following types of interactions in molecular recognition
i) π -stacking
ii) hydrogen bonding



9. a) Explain briefly on "combinatorial organic synthesis".
b) "Natural products have played a key role as a source of novel drugs or lead compounds for the development of drugs". Justify this statement briefly with suitable examples.
10. a) What is sonochemical synthesis ? Explain any two applications.
b) Write short notes on :
i) Green solvents
ii) Scavenger resins

(5×5=25 Marks)

SECTION – C

Answer **any three** questions. **Each** question carries **10** marks.

11. Describe briefly the major ion production techniques in mass spectrometry.
12. Predict the number of signal, relative chemical shifts and multiplicities in the PMR spectrum of the following compounds.
i) $(\text{CH}_3)_2\text{CHCOCH}_3$
ii) $\text{BrCH}_2\text{CH}_2\text{CH}_2\text{Br}$
iii) $p\text{-CH}_3\text{CH}_2\text{OC}_6\text{H}_4\text{NH}_2$
iv) $\text{C}_6\text{H}_5\text{CH}_2\text{CH}_2\text{CH}_2\text{Br}$
13. Write short notes on the following synthetic molecular receptors.
i) Cryptands
ii) Calixarenes
iii) Cyclophanes
iv) Cyclodextrins
14. Write the synthesis of
Chloramphenicol and phenobarbital
15. Explain in detail with examples of microwave synthesis as a green technology.

(3×10=30 Marks)



Reg. No. :

(Pages : 3)

9481

Name :

Third Semester M.Sc. Degree Examination, January 2016

Branch : Chemistry

CH/CL/CA 232 : ORGANIC CHEMISTRY – III
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION – A

Answer **any two** among (a), (b) and (c) from **each** question. **Each** sub-question carries **2** marks.

1. a) How IR spectroscopy is used to distinguish concentrated solutions of C_2H_5OH and CH_2OHCH_2OH since both give O-H stretching band at 3350 cm^{-1} ?
- b) Aniline absorbs at λ_{max} 280 nm, but on acidification, it is shifted to 203 nm – explain.
- c) How will you identify the mass spectrum of a compound containing one bromine atom ?
2. a) Account for the fact that [18] annulene has two signals (8.9 ppm and -1.8 ppm) in PMR.
- b) What is Nuclear Overhauser Effect (NOE) ?
- c) Predict the number of signals in the proton spin decoupled ^{13}C spectrum of allyl bromide $CH_2 = CHCH_2Br$.
3. a) What are cyclophanes ?
- b) Explain the term " π -stacking".
- c) Give two examples of clathrate hydrates of gases and mention their uses.
4. a) Give an example for solid supported automated organic synthesis.
- b) Differentiate in-vitro and in-vivo analysis of drugs.
- c) State the Hammett equation and explain the constants σ and ρ .



9481

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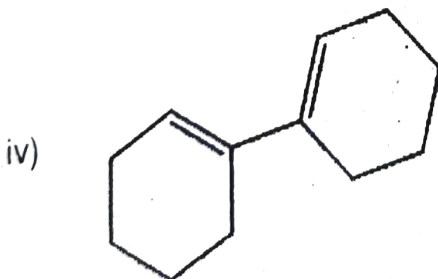
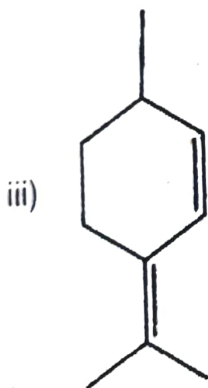
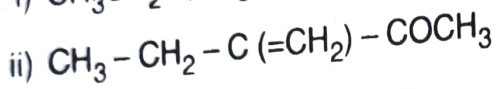
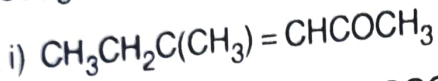
5. a) Define "biocatalysts" and "atom economy".
b) CO_2 is an excellent 'green' solvent as well as a greenhouse gas. Give reason.
c) What are scavenger resins? Give one example.

(2x10= 20 Marks)

SECTION - B

Answer either (a) or (b) of each question. Each question carries 5 marks.

6. a) Using Woodward-Fieser rule, calculate the λ_{max} of the following compounds.



- b) i) Explain McLafferty rearrangement with examples.
ii) Show the typical fragmentation pattern in benzyl methyl ether.



7. a) What is DEPT in NMR spectroscopy ? Explain its applications.
 b) Deduce the structure of a compound $C_8H_{10}O$ which gives 1H NMR data as $\delta 3.4$ (3H, singlet), 4.5 (2H, singlet), 7.2 (5H, singlet) (ppm).
8. a) What are cryptands ? Discuss its structure, properties and uses.
 b) Explain the "guest-host relationship" in molecular recognition.
9. a) Explain the following terms in drug developments by giving suitable illustrations
 i) Lead compound
 ii) Molecular receptors.
 b) Write the steps involved in the synthesis of phenobarbital.
10. a) Illustrate "ultra-sonication and microwave as better tools for organic synthesis" using suitable example.
 b) What is supercritical CO_2 ? Discuss its advantages. **(5x5= 25 Marks)**

SECTION – C

Answer **any three** questions. **Each** question carries **10** marks.

11. a) How will you distinguish primary, secondary and tertiary amines using IR spectrum ?
 b) Discuss the important features of the mass spectrum of amines by giving suitable examples.
12. Write short notes on :
 a) Proton decoupled ^{13}C NMR.
 b) Anisotropic effect and chemical shift.
 c) Shift reagents.
 d) Attached proton test (APT) spectrum.
13. Describe the preparation, properties and applications of any four synthetic receptors in molecular recognition.
14. Write short notes on :
 i) Synthesis of chloramphenicol.
 ii) Retrosynthetic analysis and disconnection approach.
15. Discuss the designing of a green synthesis with suitable examples. **(3x10 = 30 Marks)**



(Pages : 3)

B - 4318

Reg. No. :

Name :

Third Semester M.Sc. Degree Examination, January 2017

Branch : Chemistry

CL/CA/CH 232 : ORGANIC CHEMISTRY - III
(2013 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION - A

Answer **any two** among (a), (b) and (c) from each question. Each sub-question carries 2 marks.

1. a) How will you distinguish CH_3OCH_3 and $\text{C}_2\text{H}_5\text{OH}$ using IR spectroscopy ?
b) Compare the stretching frequencies of $\text{C}-\text{C}$, $\text{C}=\text{C}$ and $\text{C}\equiv\text{C}$ by giving reasons.
c) What is McLafferty rearrangement in mass spectroscopy ?
2. a) Acetylenic H's are at a higher field than vinylic H's in PMR spectra - give reason.
b) What is DEPT in NMR spectroscopy ?
c) Give the number of signals in the proton spin decoupled ^{13}C spectrum of 3-hexanone, $\text{CH}_3\text{CH}_2\text{COCH}_2\text{CH}_2\text{CH}_3$.
3. a) What are cryptands ? Write an example.
b) Explain supramolecular organic nanotubes (ONTs). Give an application.
c) What are methane clathrates ? Write two applications.
4. a) Give the structure of benzyl penicillin.
b) What is Taft equation ? How it is superior to Hammett equation for structure reactivity relationship ?
c) Write the steps involved in the synthesis of paracetamol.

P.T.O.



5. a) What are the characteristics of ionic liquids ?
b) What is meant by "reaction mass balance" ?
c) What is sonication ? Give an example for sonication assisted organic synthesis.
(2×10= 20 Marks)

SECTION - B

Answer either (a) or (b) of each question. Each question carries 5 marks.

6. a) The dehydration of 1,2-dimethyl cyclohexanol gives three probable alkenes. Explain how IR spectroscopy is used to differentiate the alkenes.
b) Write the fragmentation pattern to account the major peaks of each of the following compounds
i) $\text{CH}_3\text{CH}_2\text{COOCH}_3$; $m/z = 57, 59$ and 88
ii) $\text{CH}_3\text{OCH}_2\text{CH}_2\text{CH}_3$; $m/z = 31, 45, 59$ and 74 .
7. a) i) Give reasons why TMS is used as a reference compound in NMR.
ii) What are the important characteristics of a solvent used in NMR ?
b) Deduce the structure of a compound $\text{C}_7\text{H}_7\text{NO}_3$ which gives ^1H NMR data as δ 3.9 (3H, singlet), 6.9 (2H, doublet), 8.1 (2H, doublet) (ppm)
8. a) Describe briefly "molecular receptors".
b) Write short notes on :
i) Organic zeolite and
ii) Calixarenes.
9. a) Explain briefly on retrosynthesis by giving suitable examples.
b) Write the steps involved in the synthesis of chloramphenicol.
10. a) Write notes on :
i) biocatalysts.
ii) sustainability in green chemistry.
b) Give the synthesis of any two organic compounds using microwave heating as green technology.
(5×5= 25 Marks)



SECTION - C

Answer any three questions. Each question carries 10 marks.

11. Discuss the different types of electronic transitions and transition probabilities. Explain the effect of polarity of solvent on each transition.
 12. Write short notes on :
 - i) Nuclear Overhauser Effect (NOE).
 - ii) Factors which affect the magnitude of chemical shift.
 - iii) Proton exchange reaction.
 - iv) Coupling constant.
 13. Describe the different types of driving forces involved in the formation of supramolecular structures with suitable examples.
 14. Write notes on :
 - i) Modeling studies in drug design
 - ii) Combinatorial organic synthesis.
 15. What are the twelve basic principles of green chemistry ? Explain any four with suitable examples. **(3×10 = 30 Marks)**
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(Pages : 3)

D - 3831

Reg. No. :

Name :

Third Semester M.Sc. Degree Examination, January 2018
Branch : Chemistry
CH/CL/CA/CM 232 : ORGANIC CHEMISTRY - III
(2016 Admission)

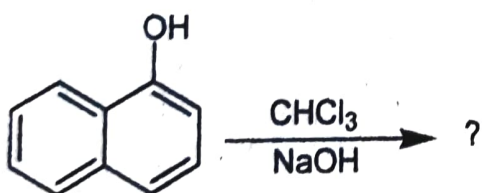
Time : 3 Hours

Max. Marks : 75

SECTION - A

Answer **any two** among (a), (b) and (c) from **each** question. **Each** sub-question carries 2 marks.

- What is the advantage of chemical ionization technique in MS ?
 - Why - OH absorption for alcohols in IR is very broad ?
 - Why red shift occurs in enones and compare to ketone in UV-V is spectrum ?
- Define chemical shift.
 - Name three shift reagents.
 - Explain the term polarization transfer in NMRI.
- Give an example for chichibabin reaction.
 - Complete the following reaction.



- What are the reagents for Oppeneaur oxidation ? Give an example.
- Give an example for Globe reaction.
 - What is meant by chiral auxiliary ?
 - How do you protect an amino group ?
 - Differentiate between adsorption and partition chromatography.
 - What is centrifugal TLC ?
 - List out the column used in GC.

(10x2=20 Marks)

P.T.O.

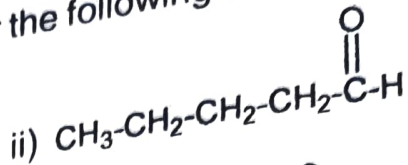
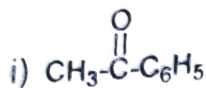
D - 3831

SECTION - B

Answer either (a) or (b) from each question. Each question carries 5 marks.

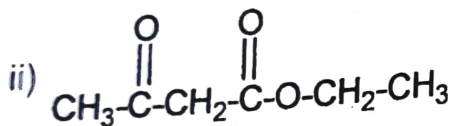
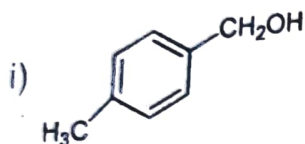
6. a) Illustrate Time of flight and quadrupole mass analyzers used in mass spectrometry.

b) Write the important mass fragments for the following molecules.

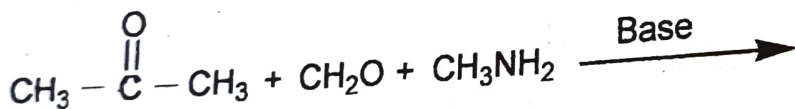


7. a) What are the factors which influencing ¹³C NMR spectra ?

b) Write the number of signals and splitting pattern for the following compounds :



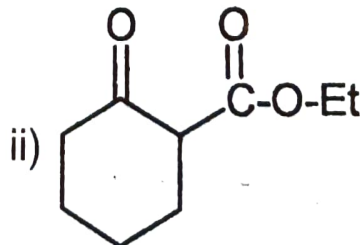
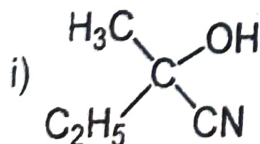
8. a) Complete and propose suitable mechanism for the following reaction.



b) Discuss Peterson's olefination with suitable example.

9. a) What is meant by stereoselective synthesis ? Discuss with an example.

b) Disconnect the following molecule and suggest suitable method of synthesis of target molecule.



10. a) Explain the Craig's technique of liquid-liquid extraction.

b) Discuss the application of capillary electrophoresis.

(5x5=25 Marks)



SECTION - C

Answer **any three** questions. **Each** question carries **10** marks.

11. Illustrate instrumentation and application of mass spectrometry.
12. i) Discuss HSQC with suitable example.
- ii) An organic molecule of molecular formula $C_7H_6O_2$ having the following spectral features.
- IR (KBr) : 3025 (Br), 1690, 1235 cm^{-1}
- Mass (m/z): 122 (30%), 105 (100%), 77(80%),
- 1H NMR : 7.4 – 8.1(5H, m), 11.8 (1H, s)
- ^{13}C NMR : 128.4, 130.2, 133.83, 172.7 ppm.
- Assign the structure of the compound.
13. Discuss the following reactions with mechanism :
- i) Clemmenson reduction
- ii) Stork enamine reaction.
14. i) Discuss the electrochemical reduction of Nitro and Carbonyl groups.
- ii) What is metathesis ? Explain with suitable example.
15. Illustrate the instrumentation and working of HPLC.

(3×10=30 Marks)

Reg. No. :

Name :

Third Semester M.Sc. Degree Examination, January 2018

Branch : Chemistry

CH/CL/CA 232 - ORGANIC CHEMISTRY - III
(2013 Admission)

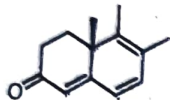
Time : 3 Hours

Max. Marks : 75

SECTION - A

Answer any two sub-questions among (a - c) from each question. Each sub-question carries 2 marks.

1. a) Predict the λ_{\max} for the following compound using Woodward Fieser rules :



- b) Suggest a suitable spectroscopic technique to differentiate between methyl 2-hydroxybenzoate and methyl 4-hydroxybenzoate. Justify.
- c) What is Mc Lafferty rearrangement in MS ? Give an example.
2. a) How will you define a first-order spectrum in NMR ?
- b) Comment on the nature of signals obtained for CH_3 , CH_2 and CH in APT experiments.
- c) Draw a stick spectrum for ethylbenzene indicating approximate chemical shifts of all protons and splitting patterns for $-\text{CH}_2$ and $-\text{CH}_3$ protons.
3. a) List out the important intermolecular forces involved in molecular recognition.
- b) What are crown ethers ? Explain the nature of non-covalent forces involved in cation binding by crown ethers.
- c) Explain the term self-assembly in supramolecular chemistry.

P.T.O.

- c) What are enamines ? Write one synthetic application of enamine.

P.T.O.

4. a) State and explain the terms involved in Hammett equation.
b) What are analgesics and antipyretics? Give examples with structures.
c) How is the synthesis of the β -lactam ring achieved in penicillin synthesis?
5. a) What is the importance of ionic liquids in organic synthesis?
b) Differentiate between yield and atom economy of a reaction.
c) Give a schematic diagram of a single mode microwave cavity.

(2×10=20 Marks)

SECTION - B

Answer either (a) or (b) of each question. Each question carries 5 marks.

6. a) Give a comparative account of EI and CI modes of ionization in mass spectroscopy.
b) Draw a schematic diagram of the instrumentation for FTIR and identify the major components and their functions.
7. a) Using appropriate examples illustrate AB and AX spin systems in NMR.
b) How will you differentiate between n-decane and 4-methylnonane on the basis of IR, UV and MS data?
8. a) Discuss the role of complementary multiple hydrogen-bonding sites in DNA base pairs with appropriate examples.
b) Write short notes on a) molecular tweezers b) liquid crystals.
9. a) What are the major factors to be considered while choosing a disconnection in retrosynthetic approach? Discuss.
b) Give a short account of the structure activity relationship of drugs.
10. a) Write a note on application of sonication in organic synthesis.
b) Briefly discuss the concept of a) green solvents b) biocatalysis.

(5×5=25 Marks)



SECTION - C

Answer any three questions. Each question carries 10 marks.

11. a) Write a detailed account on factors affecting carbonyl stretching frequency in ketones.
b) Explain the following : i) red shift, ii) TOF mass analyser.
 12. Briefly discuss the applications of NOE, APT, DEPT and INEPT techniques in NMR spectroscopy.
 13. Write brief notes on a) molecular receptors, b) self-association in nature, c) industrial applications of supramolecular chemistry.
 14. Give a detailed account of combinatorial organic synthesis.
 15. Highlight the significance of green reaction media and green processes.
(3x10=30 Marks)
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... enamines ? Write one synthetic application of enamine.

Reg. No. :

Name :

Third Semester M.Sc. Degree Examination, January 2020

Chemistry/Polymer Chemistry

CH/CL/CM/CA/ PC 232 : ORGANIC CHEMISTRY-III

(Common for Chemistry (2016 Admission Onwards) and Polymer Chemistry
(2018 Admission))

Time : 3 Hours

Max. Marks : 75

SECTION - A

(Answer **any two** among (a), (b) and (c) from each question. Each sub question carries 2 marks)

1. (a) Compare the relative red shifts of p-nitroaniline and p-diaminobenzene.
(b) Predict the relative IR absorption values (approximate) due to C=O stretch in an aldehyde, ketone and amide.
(c) Give any two major peaks and the mode of their formation in the mass spectrum of ethyl benzoate.
2. (a) The NMR spectrum of dimethyl formamide at room temperature shows two peaks for its methyl groups. Why?
(b) Write the advantages of the 2D NMR technique, COSY.
(c) Why are acetylenic hydrogens more up-field than vinylic hydrogens?

P.T.O.



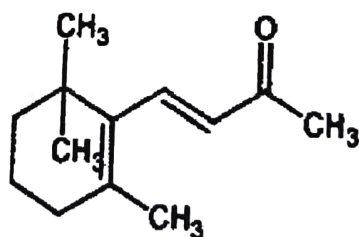
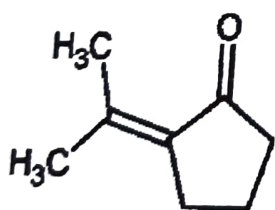
3. (a) Give the reagent and conditions for the selective conversion of an α, β -unsaturated ketone to the respective alcohol.
- (b) Write the mechanism of carbon-carbon bond formation between an alkene and an alkyl halide using palladium catalyst.
- (c) Explain an application of HI/O_4 in organic synthesis.
4. (a) Write the method of conversion of acetaldehyde to acetone using *umpolung*.
- (b) Explain the term combinatorial synthesis.
- (c) What is Mitsunobu reaction?
5. (a) Differentiate between "Gradient Elution" and "Isothermal Elution" in chromatography.
- (b) What is the principle of capillary zone electrophoresis?
- (c) Why liquid chromatography is a viable technique for the separation of proteins, nucleosides etc., as compared to gas chromatography?

(2 × 10 = 20 Marks)

SECTION – B

(Answer either (a) or (b) from each question. Each sub question carries 5 marks)

6. (a) (i) By using Woodward Fieser rules calculate the λ_{max} values for the following compounds.



- (ii) Which has a lower characteristic stretching frequency, the C-H or C-D bond? explain briefly.



- (b) (i) What are the predicted m/z values (masses) and relative heights of all the molecular ions of 1-bromoethane that would appear on a mass spectrum (excluding peaks produced by ^{13}C and ^2H)?
- (ii) Write short notes on metastable ions
7. (a) What is anisotropic effect? Explain the paramagnetic anisotropy of alkene, aldehydic and aromatic protons.
- (b) Predict the number of signals and their chemical shift and spin-spin coupling in each of the following compounds in ^1H NMR spectra.
- (i) $\text{CH}_3\text{-CH}_2\text{-Cl}$
- (ii) $\text{CH}_3\text{-CH}(\text{Cl})\text{-CH}_3$
- (iii) $\text{Br-CH}_2\text{-CH}_2\text{-CH}_2\text{-Br}$
8. (a) What is an enamine? How it is prepared? Give two synthetic applications.
- (b) With suitable examples (two), illustrate the application of Peterson olefination in stereoselective synthesis of alkenes.
9. (a) Explain the details of Sharpless asymmetric epoxidation of allylic alcohols.
- (b) Write short note on
- (i) Electrochemical Kolbe oxidation
- (ii) Olefin metathesis.
10. (a) Explain the development of TLC plates. How do you choose the solvents for the development of TLC plates?
- (b) Discuss the affinity and chiral separations using HPLC.

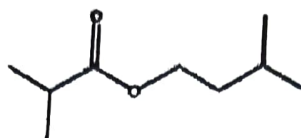
(5 × 5 = 25 Marks)



SECTION – C

(Answer **any three** questions. Each question carries **10** marks)

11. Describe briefly the major ion production techniques in mass spectrometry.
12. (a) Draw the proton decoupled ^{12}C -NMR, DEPT-45, 90 and 135 spectra of given compound. 4



- (b) Write notes on
- (i) Shift reagents
 - (ii) HMBC 2D NMR spectra. 6

13. Write notes on the following

- (a) Mannich reaction
 - (b) Wolf-Kishner reduction
 - (c) Shapiro reaction
 - (d) Suzuki coupling
14. Discuss the advantages and disadvantages of hydroxyl, thiol, carboxyl, and carbonyl protecting groups used in organic synthesis.
15. Explain the applications of Gas chromatography in separation, identification and quantitative analysis of organic compounds

(3 × 10 = 30 Marks)



Reg. No. :

Name :

Third Semester M.Sc. Degree Examination, February 2021

Chemistry/Polymer Chemistry

CH/CL/CA/CM/PC 232 - ORGANIC CHEMISTRY - III

Common for Chemistry (2016 Admission Onwards) and

Polymer Chemistry (2018 Admission Onwards)

Time : 3 Hours

Max. Marks : 75

SECTION - A

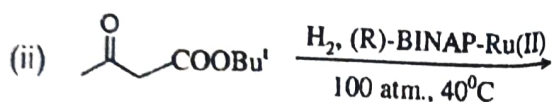
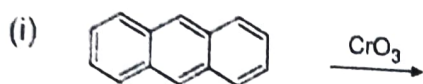
Answer any **two** among (a), (b) and (c) from each questions. Each sub question carries 2 marks.

1. (a) Determine the structure of the compound. Molecular formula C_3H_6O , $\lambda_{max} = 292 \text{ nm}$ and $\epsilon_{max} = 21$; IR (1) 2720 cm^{-1} (w) and (2) 1738 cm^{-1} (s).
- (b) A nitrogen containing aromatic compound shows bands at 1550 and 1350 cm^{-1} . Identify the functional group present in it.
- (c) Indicate which absorption bands in the IR spectrum can be used to distinguish between the following pairs of compounds :
 - (i) $(CH_2)_3N$ and $(CH_3)_2CHNH_2$,
 - (ii) CH_3CH_2OH and CH_3CO_2H

P.T.O.



2. (a) Explain the advantages of TOF mass analysers?
 (b) What do you mean by DEPT?
 (c) Give the splitting pattern in the ^1H NMR spectrum of $\text{CH}_2=\text{CHBr}$.
3. (a) What are the different factors affecting the rate of Chichibabin reaction.
 (b) Predict the products of the following reactions :



- (c) What are the advantages of osmium tetroxide compared to KMnO_4 in hydroxylation of alkenes? What are the disadvantages?
4. (a) What is chiral pool synthesis?
 (b) Describe Kolbe oxidation
 (c) What are synthons? How is it related with synthetic equivalents?
5. (a) What is the principle of column chromatography?
 (b) Describe the application of paper chromatography in identifying different α -amino acids.
 (c) What is capillary electrophoresis?

SECTION – B

Answer (a) or (b) of each question and each question carries 5 marks.

6. (a) Discuss briefly about Nuclear Overhauser Effect (NOE)?
(b) Explain nitrogen rule. Explain how it is useful in determining the molecular formula.
7. (a) What is olefin metathesis? Discuss the synthetic applications.
(b) Discuss the mechanism and applications of Mitsunobu reaction.
8. (a) Explain with examples :
 - (i) Shapiro reaction and
 - (ii) Ritter reaction.
(b) Discuss Wolf-Kishner reduction and Oppenauer oxidation.
9. (a) Explain the principle of gas chromatography. What type of substrates are analysed using GC?
(b) Discuss the principle and applications of solvent extraction.
10. (a) Discuss about Electrospray and MALDI ion sources in mass spectrometry.
(b) Identify the structure of the compound using following spectral details :

MF : $C_8H_{10}O_2$

IR Bands : 3000, 2951, 2936, 1509, 1464, 1233, 1060, 827 cm^{-1}

1H NMR : δ 3.75s, 6H, δ 6.83, s, 4 H

^{13}C NMR : (off resonance splitting in paranthesis) 56(q), 114(d) and 153 (s)
ppm

EIM MS : 138 (Base peak) 123, 95, 41

