

PGS-253008
Autonomous Examination DEC-2025
SEMESTER-III
M.Sc. Chemistry
Paper – V (Heterocyclic Chemistry)

Time : 3 Hours

M.M. : 70

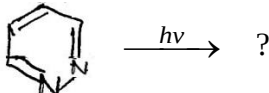
Note: Attempt all questions. Scheme of questions and marks are indicated against the questions.

Section-A

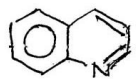
01.Objective type questions Attempt any 10 questions out of 12 given below.
(01 x 10 = 10)



Above reaction is known as

- | | |
|--|------------------------------|
| (a) Chichibabin reaction | (b) Skraup synthesis |
| (c) Indole synthesis | (d) Vilsmeier Haack reaction |
| (ii) Which element is present in Azepins ? | |
| (a) Nitrogen | (b) Oxygen |
| (c) Sulphur | (d) Phosphorus |
| (iii) IUPAC name of furan is - | |
| (a) Cyclopenta Oxa 2,4-diene | (b) Oxadiene cyclopentane |
| (c) Oxacyclopenta 2,4-diene | (d) None of these |
| (iv) O-diazine is known as - | |
| (a) Pyridazine | (b) Pyrazine |
| (c) Pyrimidine | (d) None of these |
| (v) Von Pechmann method is used for preparation of - | |
| (a) α -pyrone | (b) γ -pyrone |
| (c) Benzopyrylium salt | (d) None of these |
| (vi) Nitrogen is denoted byin heterocyclic compounds. | |
| (vii) Pyramidal inversion converts isomer into isomer and vice versa. | |
| (viii)  | |

(02)

- (ix)  is named as which is based on replacement system of nomenclature.
- (x) Pyrazine is oxidised to by trifluoro per acid.
- (xi) Distortion in three membered ring is greater than natural bond angle. (True/False)
- (xii) Pyrones are six membered heterocyclic compound with one oxygen atom in the ring and five sp^2 hybridised carbon. (True/False)

Section-B

02.Very Short answer type questions (word limit – 70-100 words) Attempt any Three questions out of Five given below.

(3 x 3 = 09)

- Explain trivial nomenclature of heterocyclic.
- Discuss nomenclature for bridge heterocycles.
- What are heterocyclic compounds ? Write their applications.
- Write Gabriel method for preparation of Aziridines.
- What are dioxocenes ?

Section-C

03.Short answer type questions (word limit – 200-250 words) Attempt any Three questions out of Five given below. Question for annotation is compulsory.

(6 x 3 = 18)

- Explain anomeric effect in heterocyclic compounds.
- Describe hetero Diels Alder reaction.
- What is delocalisation energy ?
- Describe medical applications of benzofused five membered heterocycles.
- Write a notes on oxirane.

(03)

Section-D

04. Long answer type questions (word limit – 500–600 words) Attempt any three questions out of five given below.

(3 x 11 = 33)

- (i) Discuss bond length in five and six membered hetrocycles.
- (ii) What is Empirical resonance energy ? Discuss the methods used for determination of empirical resonance energy.
- (iii) Describe the methods for preparation and properties of pyrilium salts.
- (iv) Write notes on -
 - (a) Nomenclature of fused ring system.
 - (b) Tautomerism in heterocyclic compounds.
- (v) Discuss Hantzsch Wildman nomenclature of monocyclic compounds.

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PGS-253006
Autonomous Examination -2025
Semester-III
M.Sc. - Chemistry

Paper-II (Application of Spectroscopy: Organic Chemistry)

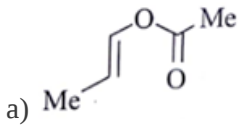
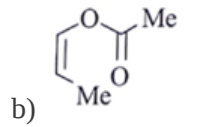
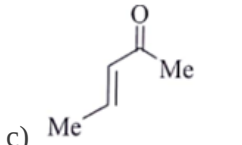
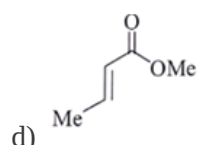
Time : 3 Hours

Maximum Marks : 70

Note : Attempt all questions. Scheme of questions and marks are indicated against the questions.

Section -A

1. Objective type questions Attempt any 10 questions out of 12 given below.

- (i) An organic compound Q exhibited the following spectral data obtained by mass spectroscopy.
IR: 1760 cm^{-1}
 ^1H NMR: chemical reference (ppm): 7.2 (1H, d, 16.0 Hz), 5.1 (1H, m), 2.1 (3H, s), 1.8 (3H, d, $J = 7.0$ Hz)
 ^{13}C NMR chemical reference (ppm): 170 (carbonyl carbon). What is compound Q?
- a)  b) 
- c)  d) 
- (ii) Which type of ionic species are allowed to pass through the slit and reach the collecting plate?
- a) Negative ions of all masses
b) positive ions of the specific mass
c) Negative ions of the specific mass
d) Positive ions of all masses
- (iii) Which species of the following is used to bombard with the sample for which mass spectroscopy has been performed?
- a) Alpha particles b) Neutrons
c) Electrons d) Protons
- (iv) An unknown organic compound shows a strong, sharp absorption band around 1715 cm^{-1} and another medium, broad absorption band in the $3000\text{--}2500\text{ cm}^{-1}$ region. Which of the following functional groups is most likely present?
- a) Alcohol (R-OH) b) Aldehyde (R-CHO)
c) Carboxylic Acid (R-COOH) d) Alkene (C=C)

(02)

- (v) For $\text{HCl} = 1.63 \times 10^{-27}\text{ kg}$, the observed frequency = 2890 or $\nu = 8.67 \times 10^{13}\text{ Hz}$. What is the force constant K ?
- a) 4.83 $\text{m dyn \AA}^{-1}$ b) 8.43 dynes cm^{-1}
c) 483 μm^{-1} d) 4.83 $\text{dyn \AA}^{-1}$
- (vi) In a 2D ^1H - ^1H COSY spectrum, what information is provided by a cross-peak appearing at the intersection of the ^1H NMR chemical shift for a proton at 3.5 ppm and the ^1H NMR chemical shift for a proton at 1.2 ppm?
- a) The two protons have the same chemical shift.
b) The two protons are *not* coupled to each other.
c) The two protons are coupled to each other, likely through two or three bonds.
d) The two protons are separated by a distance greater than 5 $\text{\AA}$ in space.
- (vii)organic compound with molecular formula $\text{C}_3\text{H}_6\text{Cl}_2$ exhibits only one signal in the ^1H NMR spectrum?
- (viii)peaks are expected in low-resolution NMR spectrum of vinyl chloride and ethyl cyclopropane?
- (ix) When a proton decoupled spectrum is obtained, the intensity of the carbon resonance are enhance it is called as.....
- (x) ^{13}C has gyrometric ratio
- (xi) The mass spectroscopy technique can be used on all state of matter. (True/False)
- (xii) ^{13}C NMR requires large samples for the analysis. (True/False)

Section-B

02. Note: Very Short Answer type questions. Attempt any three questions out of five given below (Word limit 70-100 words) (03x03=09)

- (i) Write Octane rule for Ketone.
(ii) What is Nitrogen rule?
(iii) Write McLafferty rearrangement.
(iv) Explain Overtones?
(v) What is Overhauser effect.

Section-C

03. Note: Short Answer type questions. Attempt any three questions out of five given below. (Word limit 200-250 words) (03x06=18)

- (i) Give ultraviolet spectral bands for carbonyl compounds and dienes.
(ii) Describe Optical Rotatory Dispersion and Circular Dichroism.
(iii) Explain Fourier Transform Technique.
(iv) Describe ^{13}C NMR with chemical shift of aliphatic and aromatic compounds .
(v) What is contact shift reagent and solvent effect?

(03)

Section-D

04. Note: Long Answer type questions. Attempt any three questions out of five questions given below.(Word limit 500-600 words) (03x11=33)

- (i) Discuss Mass spectral fragmentation of organic compounds, common functional groups, molecular ion peak and metastable peak.
- (ii) What is Infrared spectroscopy? Explain its instrumentation sample handling and vibrational frequencies of Aldehydes , Esters, Amides and Acids.
- (iii) Describe Nuclear Magnetic Resonance , mechanism of measurement and Chemical shift of Alcohols, Phenols Amines and Carboxylic acids.
- (iv) Explain spin-spin interaction between two, three, four and five nuclei, virtual coupling and hindered rotation.
- (v) Write short note on:
 - (a) COSY and NOESY
 - (b) INADEQUATE and INEPT

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