

2023
M.Sc.
Fourth Semester
CORE – 12
CHEMISTRY
Course Code: MCHC 4.21
(Organic Chemistry - IV)

Total Mark: 70
Time: 3 hours

Pass Mark: 28

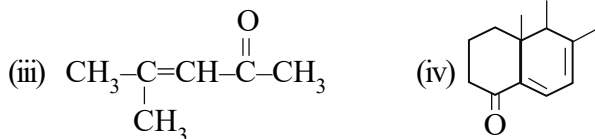
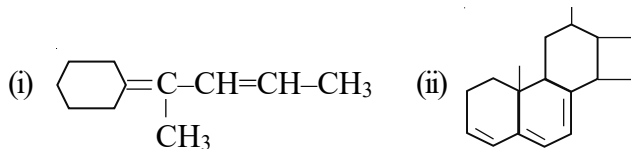
Answer five questions, taking one from each unit.

UNIT-I

1. (a) Following characteristic absorption peaks have been observed in the IR spectrum of an organic compound having formula C_2H_6O .
A strong band at 3300 cm^{-1} , band at 2965 cm^{-1} , band at 2920 cm^{-1} and band at 1050 cm^{-1} . Identify the compound and give its name. 5
- (b) Calculate the wave number and frequency of stretching vibration of carbon-carbon double bond where force constant is $10 \times 10^5\text{ dynes cm}^{-1}$. 7
- (c) The O–H stretching frequency is observed at higher frequency than the C–H stretching frequency. Why? 2
2. (a) The force constant for carbon monoxide molecule is 1840 Nm^{-1} .
Calculate the vibrational frequency and wave number. Given atomic masses are $^{12}\text{C} = 19.9 \times 10^{-27}\text{ Kg}$, $^{16}\text{O} = 26.6 \times 10^{-27}\text{ Kg}$. 6
- (b) An organic compound A with molecular formula C_3H_9N shows the following peaks in IR spectrum.
(i) 3000 cm^{-1} (ii) 3423 cm^{-1}
(iii) 3236 cm^{-1} (iv) 1615 cm^{-1}
Identify the compound and give its name. 6
- (c) Why is water not used as a solvent in IR spectroscopy? 2

UNIT-II

3. (a) Calculate the λ_{\max} of the following compounds: 2×4 =8

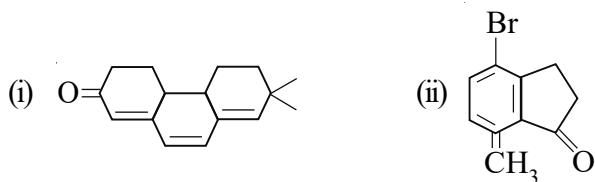


(b) How will you distinguish between cis and trans 1, 3, 5-hexatriene by U.V. spectrum? 2

(c) Explain the following terms: 2×2=4

- (i) Chromophores
- (ii) Auxochromes

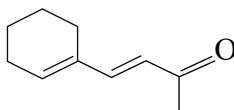
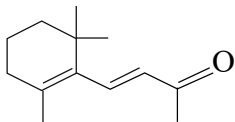
4. (a) Calculate the λ_{\max} of the following compounds: 2×4 =8



(b) Explain the following terms: 2×2=4

- (i) Hyperchromic shift
- (ii) Hypochromic shift

- (c) How will you identify the following compounds from the given spectral data λ_{\max} 296 nm, ϵ_{\max} 10700 and λ_{\max} 281 nm ϵ_{\max} 20800? 2



UNIT-III

5. (a) What do you understand by the term “Splitting of the signals”. Explain with examples. 4
- (b) An organic compound with a molecular formula C_3H_8O has the following NMR data 6
- (i) Three proton triplet (9.1 τ) (ii) Two proton sextet (8.45 τ)
 (iii) Two proton triplet (6.4 τ) (iv) One proton singlet (7.7 τ)
 Assign suitable structure to this compound with reason and plot the graph.
- (c) Distinguish between the following: 2×2= 4
- (i) Inter and intra molecular hydrogen bonding.
 (ii) Primary, secondary, and tertiary alcohol on the basis of PMR spectroscopy.
6. (a) Explain the following terms: 2×3=6
- (i) Spin-spin relaxation
 (ii) Spin lattice relaxation
 (iii) Spin-spin coupling
- (b) An organic compound with molecular formula C_7H_8O has the following NMR data: 5
- (i) Three proton triplet (7.75 τ)
 (ii) One proton singlet (4.32 τ)
 (iii) Four proton unsymmetrical pattern (2.75-3.5 τ)
 Assign the suitable structure of the compound with reason.
- (c) Predict the number of signals and their multiplicity for the PRM spectrum of *p*-nitrotoluene. 3

UNIT-IV

7. (a) How will you differentiate between the following from ^{13}C NMR spectroscopy? 2+4+2=8
- (i) Cis and trans 2-butene
 - (ii) Butanone, butanal and 2-methyl propanol
 - (iii) Butanol and 2-butanol
- (b) Write the characteristic features of chemical shift of ^{13}C nuclei. 3
- (c) How many signals are expected in ^{13}C NMR spectrum of o-, m-, and para xylenes? 3
8. (a) Explain the application of NMR spectroscopy. 5
- (b) Explain the factors affecting chemical shift in ^{13}C NMR spectroscopy. 6
- (c) Explain the terms INEPT and DEPT. 3

UNIT-V

9. (a) Explain the fragmentation of n-butane and 2-pentene in mass spectroscopy and indicate the m/e value. 4+4=8
- (b) Describe the importance of meta-stable peaks. 3
- (c) Write the basic principles of mass spectroscopy. 3
10. (a) Suggest the structure of the compound which exhibits ion peaks at m/z 88, 70, 55, 41, 31 (base peak) and 29 in the mass spectrum. 4
- (b) Predict the structure of the compound $\text{C}_{10}\text{H}_{12}\text{O}$ which shows ion peaks at m/e 15, 43, 57, 91, 105 and 148. 4
- (c) How would you distinguish three isomeric butanols, 1-butanol, 2-butanol and 2-methyl-2-propanol on the basis of mass structural analysis? 6