

Seat No.	192
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M.Sc. (Part - I) (Semester - II) Examination, March - 2023

CHEMISTRY (NEP-2020)

Analytical Chemistry-II

(Paper-VIII-CH-2.4, APCH 2.4, IND 2.4) (CBCS)

Sub. Code : 90166/90076

Day and Date : Tuesday, 20 - 06 - 2023

Total Marks: 80

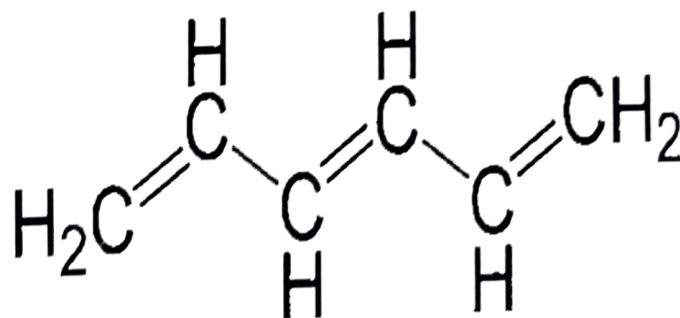
Time : 10.30 a.m. to 01.30 p.m.

- Instructions:
- 1) Attempt in all the five questions.
 - 2) Question No.1 is compulsory.
 - 3) Attempt any Two questions from Section-I and any two from Section-II.
 - 4) Answers to all questions from should be writtem in one answer book.
 - 5) All questions carry equal marks.
 - 6) Figures to the right indicate full marks.

Q1) Answer the following questions:

[16]

- a) List the factors affecting chemical shift.
- b) Differentiate between protonated ion and adduct ion.
- c) How will you differentiate between organochlorine and organobromine compound using MS spectra.
- d) Calculate the wavelength (λ_{max}) of given examples 1,3,5-hexatriene



- e) How many signals does the aldehyde $(CH_3)_3CCH_2CHO$ have in 1H NMR and ^{13}C NMR spectra?
- f) Define Beer's Lambert Law.

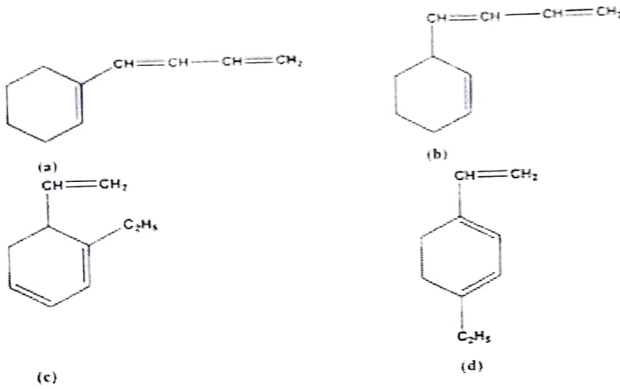
P.T.O.

- g) How will you differentiate trans-stilbene and cis-stilbene using UV-Vis spectroscopy?
- h) State the unique advantage of AAS in analysis of metals.
- i) What is thermogravimetric analysis?
- j) What is carrier gas in connection with thermal analysis and state its significance?
- k) What are the criteria for selecting the sample holders used in TG analysis?
- l) Compare between DSC and DTA.
- m) Which technique is generally used to deal with solid samples in AAS?
- n) Which of the following molecules will show IR spectrum HCl, CH₄, CO₂, H₂ and N₂O.
- o) How is sample prepared for AAS/ICP-AES?
- p) ICP-OES means

SECTION - I

- Q2) a) What is spin-spin coupling? Explain with examples the types of spin-spin couplings. [8]
- b) Deduce the structure from the given data: [8]
 M.F. : C₈H₁₁N ; IR : 3350, 1596, 1020, 761, 703 cm⁻¹.
 PMR: δ 7.2 (s, 5H), 3.87 q, 1H), 1.83 (s, 2H), 1.2 (d, 3H).
¹³C-NMR: 148, 128, 126 125, 51, 26. Justify the spectral data.
- Q3) a) Explain the instrumentation, working and applications of mass spectrometry. [8]
- b) Explain the Woodward-Feiser rule for calculating absorption maxima with suitable examples. [4]
- c) State the applications of IR spectroscopy. How are primary, secondary and tertiary alcohols distinguished using IR spectroscopy? [4]

- Q4) a) What is McLafferty rearrangement? Explain with suitable examples. [8]
 b) Explain how the ultraviolet spectrum can be used to decide between the following isomeric systems. [4]



- c) Compare between EI and CI mass spectrometry. [4]

SECTION -II

- Q5) a) Write note on thermogravimetric analysis. State the factors affecting TGA thermogram. [8]
 b) How is TG useful in characterizing the food materials and state its significance? [4]
 c) Compare between TGA and DSC [4]
- Q6) a) Elaborate the significance of AAS, its instrumentation and applications in detail. [8]
 b) Explain the reasons of spectral interferences in AAS and measures to reduce the same. [4]
 c) Construction and working of Hollow Cathode Lamp in AAS. [4]

Q7. Write short note on **any four** of the following.

- State the advantages and disadvantages of AAS.
- Explain the shielding and deshielding effects.
- Compare between base peak and molecular ion peak
- Industrial Applications of DSC
- Different modes or types of thermogravimetric analysis.

Spectroscopic Data

Table: I Some characteristic IR frequencies (Only approximate values)

$\equiv\text{CH}$, 3300; $=\text{CH}$, 3050; $\text{O}=\text{C}-\text{H}$, 2800; NH , 3300; $\text{O}-\text{H}$, 3600; $\text{C}\equiv\text{N}$, 2200; $\text{C}=\text{C}$, 1620 to 1680; Aromatic, 1600-1500; $\text{C}=\text{N}$, 1660; Ketone, 1720; Ester, 1740; Saturated acids, 1720; Saturated aldehydes, 1730; Saturated amides, 1650; $\text{CH}=\text{CH}_2$, H (CIS), 690; $\text{C}=\text{H}$, 790-840; NO_2 , 1530 and 1350; Monosubstituted aromatics 690-710 and 730 to 770; Disubstituted 735-770; Trisubstituted 750-810; Tetra substituted, 770, 800-860; $-\text{CO}-\text{CH}_2-\text{Cl}$, 1745-1725 all values are in cm^{-1}

Table:II Approximate chemical shifts of $-\text{CH}_3$, $-\text{CH}_2$ and $-\text{CH}$ protons in δ (ppm)

$\text{C}-\text{CH}_3$, 0.9; $\text{O}-\text{CH}_3$, 1.6; $\text{Ar}-\text{CH}_3$, 2.2; $\text{O}=\text{C}-\text{CH}_3$, 2.3; $\text{N}-\text{CH}_3$, 2.3; $\text{O}-\text{CH}_2$, 3.3; $\text{C}=\text{CH}_2$, 4.6; to 5.3; $\text{C}=\text{CH}$; $\text{Ar}-\text{H}$, 7 to 9; $-\text{CO}-\text{C}=\text{CH}$, 6.2; $\text{C}-\text{CH}-\text{CO}$, 5.7.

Table:III Approximate ^{13}C chemical shifts

$\text{R}-\text{CH}_3$, 530; $\text{R}-\text{CH}_2-\text{R}$, 25-55; R_3-CH , 35 to 70; R_4C , 30-50; $\text{R}_3\text{C}-\text{O}$, 57-80; $\text{R}_3\text{C}-\text{N}$, 60 to 75; $\text{C}\equiv\text{C}$, 75 to 105; $\text{C}\equiv\text{N}$, 110 to 125; $\text{C}=\text{C}$, 100 to 140; Aromatics 115 to 145; $\text{R}-\text{COOR}$ / $\text{R}-\text{CONH}_2$, 155-180; $\text{R}-\text{COOH}$, 165-185; $\text{R}-\text{CHO}$, 185-205; RCOR , 190-225

