

CHE 525

M.Sc. IVth SEMESTER EXAMINATION, 2024-25

5041

(CBCS MODE)

CHEMISTRY

(Spectroscopy-II)



Time : Three Hours]

[Maximum Marks : 75

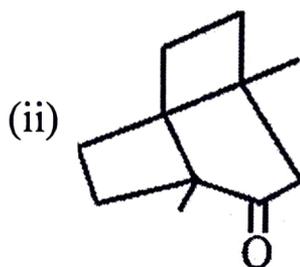
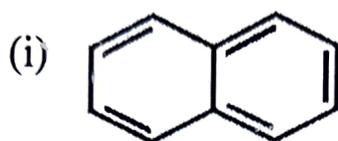
Note: There are **three** sections (A, B and C) and

Candidate has to attempt questions from all sections. Marks are indicated against each section

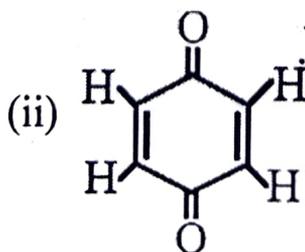
SECTION-A

1. Answer all questions. 5×3=15
- (a) Diethyl phthalate shows a peak at $m/z = 149$, explain the fragmentation of this peak.
- (b) Why tetra methyl silane (TMS) is most commonly used as internal standard in NMR spectroscopy ?

- (c) Predict the number of lines in ^{13}C NMR spectra in broadband decoupled spectrum of each of the following compounds :



- (d) Predict the number of lines and intensity for the ESR spectra of the following radicals :



- (e) Why Mossbauer spectrum of $Fe(CO)_{12}$ gives three signals ?

SECTION-B

Note : Answer all questions of the following : $5 \times 4 = 20$

2. (a) Explain the double bond equivalence with suitable examples.

Or

- (b) An organic compound shows molecular ion peak $m/z = 78$, with intensity of $[m + 1]$ and $[m + 2]$ peaks as 6.7 and 0.2 respectively. Find out the molecular composition.

3. (a) Explain chemical equivalence and magnetic equivalence with suitable example.

Or

(b) Explain any two of the following :

(i) ^{19}F NMR

(ii) Spin – spin coupling

(iii) NOE

4. (a) What is chemical shift ? What are the factors affecting chemical shifts in ^1H NMR spectra ?

Or

(b) Deduce ^1H NMR spectrum of p-methoxy pro-phenone in the following terms :

(i) Number of signals and chemical shift

(ii) Integration of peaks

(iii) Splitting pattern of peaks

(iv) Intensities of multiple peaks



5. (a) What is the principle of ESR spectroscopy ?
List the factors on which line width of ESR signal depends.

Or

- (b) Draw the ESR spectra of naphthalene radical and predict the number of lines.

SECTION-C

Note : Answer any two questions of the following. $2 \times 20 = 40$

6. (a) Explain the importance of Mossbauer spectroscopy.
- (b) Explain the following in context of Mossbauer spectroscopy :
- (i) Isomer shift
 - (ii) Quadrupole interaction
7. Explain the following with suitable examples :
- (a) Retro-Diels-Alder fragmentation
 - (b) McLafferty rearrangement

8. An organic compound showed the following spectral data :

Mass : M^+ ($m/z = 194$) $C_6H_{11}BrO_2$ other

peaks are at $m/z = 73, 121, 123, 149, 151$

uv : $\lambda_{max} = 206$

$\epsilon = 16250$

$\lambda_{max} = 262, \epsilon = 109$

IR : A prominent peak at 1738 cm^{-1}

$^1\text{H NMR}$: Peaks at $\delta 1.2$ ($q, 3H$)

$\delta 1.9$ ($q, 6H$)

$\delta 4.2$ ($q, 2H$)

$^{13}\text{C NMR}$: Peaks at $\delta 18, 29, 38, 51$ and 184 ppm.

Assign its structure and explain the data.

9. Explain the theory of ESR spectroscopy and give the significance of the following terms in structure determination with examples :

(a) g-factor

(b) Hyperfine splitting

••••