PB **5241**

Roll No. _____ Total No. of Pages: 04

M.Sc. (Semester - III) Examination - Dec. - 2025
CHEMISTRY
PAPER - 3.2 CHEM
Spectroscopy
(Common for all Specialization)

Time Allowed: Three Hours **Maximum Marks: 70**
Minimum Marks : 28

This question paper contains two sections as under

Section - A **(खण्ड - अ)** **Max. Marks-20**

This section will have 10 questions, having 02 questions from each unit with no internal choice. Answer in about 20 words. All questions will have equal marks. (02×10=20)

Section - B **(खण्ड - ब)** **Max. Marks-50**

This section will have 10 questions, having 02 questions from each unit, one question to be attempted from each unit. Words limit approximately 400-500 words. Questions may have sub divisions. All questions will have equal marks. (10×05=50)

Section - A

Q.1 i) What is Molar extinction coefficient?

ii) What is the basic requirements for vibration to be IR active.

iii) Which compound is used as Internals standard (reference material).

iv) What is the unit of coupling constant 'J' ?

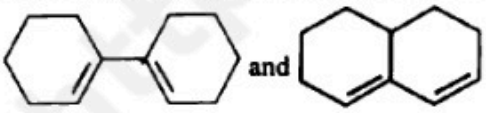
v) Which among C^{13} and C^{12} are NMR active. Why ?

vi) What type of radiation are used in EPR spectroscopy ?

vii) What is the Magnitude of Energy (in ev) of accelerated electron in Mass spectroscopy?

viii) What is the base peak in Mass spectra?

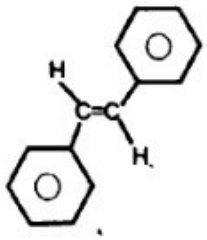
ix) Evaluate λ max of the following compounds.

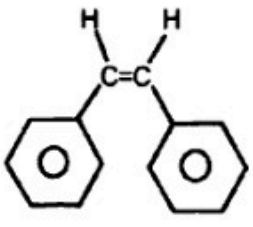


x) The mass spectra of toluene given base peak at m/z = 91. due to which fragment ?

Section-B (Unit-I)

Q.2 (i) Which among the stilbene have λ max = 294 nm. and λ max = 274 nm. Give reason for your answer. 4

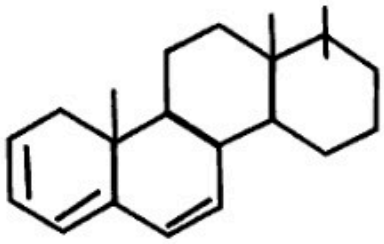




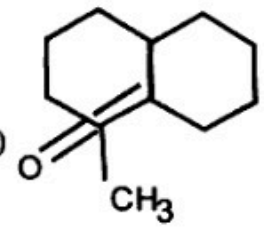
(ii) Explain bathochromic and Hypsochromic shift. 2

(iii) Calculate λ max of the following compound. 4

(a)



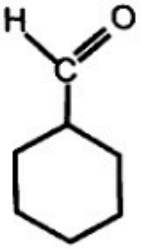
(b)



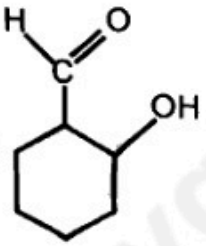
OR

(i) Predict the frequency shift of carbonyl absorption of the following aldehydes and give explaination for it. 3

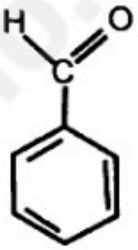
(a)



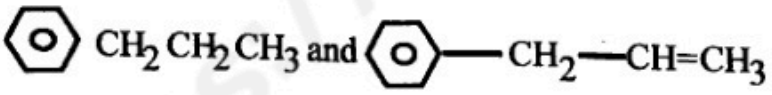
(b)



(c)



(ii) How will you distinguish the following compound on basis of IR frequencies. 3

(a)  and

(b) $CH_3-C\equiv CH$ and $CH_3C\equiv N$

(c) $(CH_3)_3N$ and $CH_3CH_2CH_2NH_2$

(iii) Explain fermi resonance and fundamental bonds. 4

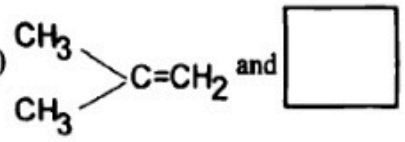
Unit- II

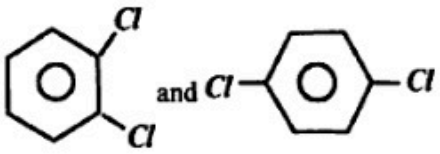
Q.2 (i) How many Hertz does δ =1 corresponds for PMR spectrometer operating at 4 radiofrequency

(a) 60MHz (b) 100MHz.

(ii) Which Member of each of the following pair of the structure Isomer would be expected to exhibit single peak in PMR. 4

(a) CH_3Cd_3 and $Cl\,CH_2CH_2Cl$

(b)  and

(c) 

(d) $ClCH_2CH_2Cl$ and CH_3CHCl_2

(e) $CH_2{=}C{=}CH_2$ and $CH_3C{\equiv}CH$

(iii) Define coupling constant. 2

OR

(i) Write short note on :

(a) Shift reagent 4

(b) Spin decoupling 3

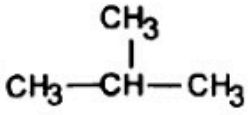
(c) Nuclear overhauser effect (NOE). 3

Unit - III

Q4 (i) Write a short note on C^{13}–$_1H^1$ decoupled spectra. 5

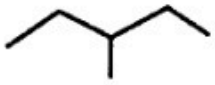
(ii) Give No. of C^{13} NMR signal in the following. 5

(a) $CH_3CH_2CH_2CH_3$

(b) 

(c) 

(d) 

(e) 

OR

(i) Write a short note on :

(a) Kramer's degeneracy 3

(b) Mc. Connell relationship 3

(c) Hyperfine splitting 4

Unit-IV

Q.5 (i) Mass spectra of Benzophenone exhibits strong peak at m/z=105 and other peaks at m/z = 77 and m/z =51. Discuss fragmentation pattern of the compound and discuss these peaks. 4

(ii) Mass spectra of phenol shows sharp peak at m/z = 65. Explain the fragmentation pattern. 4

(iii) What is the difference between base peak and molecular ion peak. 2

OR

(i) Give instrumentation of mass spectroscopy and derive equation $\frac{B^2r^2}{2V} = \frac{m}{z}$ 5.

(ii) How will you distinguish three isomeric alcohols like 1- Butanol, 2- Butanol and 2- Methyl -2 Propanol by Mass spectroscopy. 5

Unit – V

Q.6 A compound with emperical formula $C_9H_{10}O_2$ give the following spectral data.

IR = 1745 cm^{-1}, 1225 cm^{-1}, 749gcm^{-1}, 697 cm^{-1}

UY= λ max = 268, 264, 262, 257

$$_1H^1 - NMR = \delta = 1.96(3H,S)$$

$$\delta = 5.0\,(2H,S)$$

$$\delta = 7.22\,(5H,S)$$

Deduce the structure of the compound.

OR

An organic compound with emperical formula $C_6H_{12}O_2$ show the following $_1H^1$–NMR and IR spectra data. Assign the structure to the compound.

IR = 2950 cm^{-1}, 2850 cm^{-1}, 1730 cm^{-1}.

1480 cm^{-1}, 1460 cm^{-1}, 1400 cm^{-1}

$_1H^1$–NMR = δ =1.20 (9H,S)

δ =3.70 (3H,S)