

M.SC. CHEMISTRY
SECOND SEMESTER
MOLECULAR SPECTROSCOPY-II
MSC – 205 [REPEAT]
[USE OMR FOR OBJECTIVE PART]

**SET
A**

Duration: 1:30 hrs.

Full Marks: 35

Time: 15mins.

(Objective)

Marks: 10

Choose the correct answer from the following:

1×10=10

- MnO₄⁻ shows colour because of -
 - LMCT
 - MLCT
 - MMCT
 - d-d transition
- Number of ¹H-NMR signal in TMS is -
 - 4
 - 6
 - 12
 - None of the above
- During electronic transition, average nuclear distance between atoms remains -
 - Same
 - Changes
 - Depends upon molecule
 - None of the above
- Number of ¹H-NMR signal in acetone is?
 - 3
 - 6
 - 2
 - 1
- [Mn(H₂O)₆] shows mild colour due to -
 - MLCT
 - MMCT
 - Vibronic coupling
 - None of the above
- The isomer shift in Mössbauer spectroscopy refers to
 - Shift in energy due to recoilless emission or absorption
 - Shift in energy due to change in nuclear spin state
 - Shift in energy due to magnetic field strength
 - Shift in energy due to temperature changes
- Which of the following is not a Mössbauer parameter
 - Isomer shift
 - Quadrupole splitting
 - Spin-lattice relaxation time
 - G-factor
- ESR spectroscopy is used to study
 - Electronic structure of atoms
 - Vibrational modes of molecules
 - Magnetic properties of materials
 - Optical properties of solids

9. Mössbauer spectroscopy is based on the interaction between gamma rays and
- a. Nuclei
 - b. Electrons
 - c. Protons
 - d. Neutrons
10. What type of spectra does ESR spectroscopy typically produce?
- a. Absorption spectra
 - b. Emission spectra
 - c. Continuous spectra
 - d. Line spectra

(Descriptive)

Time : 1 hr. 15 mins.

Marks : 25

[Answer question no.1 & any two (2) from the rest]

1. a. State Frank-Condon Principle. 2+3=5
b. Write the principles of ESR and Mossbauer Spectroscopy.

2. a. How ^{13}C -NMR is different from ^1H -NMR? Explain with an example. 3+2+3+
2=10
b. Explain the effect of polar solvent in electronic transitions of organic molecules.
c. For a radical species, an ESR spectrum was observed at 3810 gauss magnetic field and 9600 MHz microwave frequency. What will be the g-value for unpaired electron? ($1\text{T} = 10^4$ gauss).
d. Draw the overall spike diagram showing all the intensity ratios and write the total intensity ratio for $\bullet\text{CHD}_2$.

3. a. What do you mean by Chemical shift? Explain the factors influencing Chemical shift. 4+2+4
=10
b. Explain metal to metal charge transfer process with an example.
c. How many hyperfine lines will you observe for HD^{\bullet} and $\text{C}_6\text{H}_4\text{O}_2^{\bullet}$ and also write their intensity ratio.

4. a. Find if quadruple splitting is present or not in $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ complex? 3+1+1+
2+3=10
b. The number of ESR signals observed for octahedral Ni (II) complex is?
c. Arrange in increasing order of isomer shift for the following: SnF_4 , SnCl_4 , SnBr_4 , SnI_4
d. What is double bond equivalent?
e. Explain spin-spin splitting by taking the example of propanal.

5. a. Arrange in the decreasing order of isomer shift and give an explanation for the following series Sn, Sn⁺, Sn²⁺, Sn³⁺, Sn⁴⁺
- b. Explain what do you mean quadruple splitting? Arrange the following in increasing order of isomer shift for Fe, Fe⁺, Fe²⁺, Fe³⁺.
- c. What are chromophores and auxochromes?
- d. What is the advantage of MRI over other imaging methods?

3+3+2+
2=10

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