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M.Sc. (Previous) Examination, 2022

CHEMISTRY

Paper - I

(Symmetry & Spectroscopy)

Time : Three Hours] *[Maximum Marks : 100*

Note : Attempt **all** sections as per instruction.

Section-A

Note : Attempt **all** questions. Give answer of each question in about 50 words.

2×10=20

1. (a) What is zero point energy?
   (b) Which of the following atom do not exhibit NMR resonance 12_C, 14_N, 35_{Cl}, 31_P, 13_C ?
   (c) State and explain Koopman's theorem.
   (d) Describe stark effect.
   (e) Define electromagnetic radiations.

   (f) Write a note on spin-spin interactions.
   (g) What is difference between spectroscopy and spectrometry?
   (h) Explain internal conversion.
   (i) Define group and subgroup.
   (j) What is X-ray and its region?

Section-B

Note : Attempt **all five** questions. All question carry equal marks. The answer of each question should be in maximum 200 words. 10×5=50

2. Discuss chemical shift. Describe the mechanism and factors affecting the chemical shift.

OR

Describe the quantum theory of Raman effect. Discuss spectra of hydrogen atom.

3. Describe the principle of ESR spectroscopy and influencing factors that affect the hyperfine structure of ESR spectra of methyl radical.

OR

Describe the Debye-Scherrer X-ray method.

4. Describe point symmetry group, character tables and their use in spectroscopy.

OR

Describe the great orthogonality theorem and its importance.

5. Discuss the rules for predicting prominent peaks in electron impact spectra.

OR

State applications of ESR spectrum in determination of structure of molecules.

6. Distinguish between I.R. and Raman spectroscopy.

OR

Give the difference between X-ray diffraction and neutron diffraction.

Section-C

Note : Attempt any **two** questions. Give the answer in about 500 words.

15×2=30

7. Explain the principle and application of nuclear quadrupole resonance spectroscopy with suitable examples.

8. Write notes on any **two** of the following:

   (i) Magnetic Resonance Imaging (MRI)

   (ii) Selection rule in vibrational and rotational spectroscopy

   (iii) Coupling constant

   (iv) Shielding and Desheilding effect

9. Discuss the different possible application of electron spectroscopy for chemical analysis (ESCA).

10. Give one account of UPS (Ultraviolet Photoelectron Spectroscopy). Give block diagram of UPS spectrometer.