D 51230 (Pages : 2) Name......................................

Reg. No.................................

THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2023

(CBCSS)

Chemistry

CHE 3C 09—MOLECULAR SPECTROSCOPY

(2019 Admission onwards)

Time : Three Hours   Maximum : 30 Weightage

Section A

Answer any **eight** *questions.*

Each question carries a weightage of 1.

1. Classify the following molecules as spherical, symmetric or asymmetric tops and state which will give pure rotational spectra : CS_2, BeH_2, NH_3, SO_2.

2. The rotational constant of $H^{35}Cl$ is 10.5909 cm^{-1}. Calculate the rotational constant of $H^{37}Cl$.

3. What is meant by normal modes of vibration? How many normal modes of vibration do the following molecule have : C_2H_2, NH_3.

4. What is coupling constant ? What are the factors affecting J values ?

5. Why water cannot be used as a solvent in IR spectroscopy ?

6. What is metastable peak ?

7. Explain the effect of solvents and extended conjugation on electronic transition.

8. Write notes on McLafferty rearrangement.

9. Write a short note on Karplus relationship.

10. What is nuclear overhauser effect ?

(8 × 1 = 8 weightage)

Turn over

Section B

Answer any **six** *questions.*

Each question carries a weightage of 2.

11. What is nitrogen rule and how it is useful to have an idea about the mass of the given organic molecule ?

12. Give an account of quantum theory in explaining Raman effect.

13. Illustrate dissociation and predissociation with diagrams.

14. With a brief explanation, draw the schematic high resolution ESR spectrum of methyl radical.

15. Write notes on ; (i) Shielding mechanism ; and (ii) spin-lattice relaxation.

16. Discuss the strategies to improve M+ intensity in mass spectra

17. Give an account of how Raman spectra of diatomic molecules give valuable information about their molecular structure and other properties.

18. Explain the isotope effect on the rotation spectrum.

$(6 \times 2 = 12 \text{ weightage})$

Section C

Answer any **two** *questions.*

Each question carries a weightage of 5.

19. (a) Outline the principle of Mossbauer spectroscopy.

    (b) Explain the applications of Mossbauer theory in the study of Fe (Il) and Fe (III) cyanides.

20. Explain in detail the applications of IR spectroscopy in elucidating the molecular structure.

21. Discuss the principle of NMR spectroscopy. Taking suitable examples explain the spin-spin coupling involved in the NMR spectra of AB type of molecules.

22. Explain the terms : (i) FAB spectra ; (ii) Cotton Effect ; (iii) Me Connell Relation ; and (iv) Woodward-Fieser rule.

$(2 \times 5 = 10 \text{ weightage})$