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THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2025

(CBCSS)

Chemistry

CHE 3C 09—MOLECULAR SPECTROSCOPY

(2019 Admission onwards)

Time : Three Hours　　　　　　　　　　　　　　　　　　　Maximum : 30 Weightage

Section A

Answer **all** *questions.*

Each question carries a weightage of 1.

1. State selection rules for microwave spectroscopy.

2. What is anharmonicity constant ?

3. Distinguish between prolate and oblate type of molecules with examples.

4. Stoke's lines are more intense than anti stokes lines in the vibrational Raman spectrum, why ?

5. Chemical shift difference is field dependent but coupling constants are field independent.

6. Explain the term lande splitting factor.

7. Predict $\lambda_{-\max}$ for absorption in UV spectrum of :
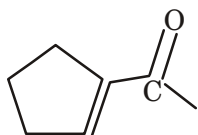
8. NMR spectrum of 18-annulene shows two peaks with relative intensity of 1 : 2 why ?

Turn over

9. δ – value (delta) for $\overset{13}{C}$ in much higher than that of protons. Why ?

10. State and explain even electron rule.

<div align="right">(8 × 1 = 8 weightage)</div>

Section B

Answer any **six** *questions.*

Each question carries a weightage of 2.

11. Microwave spectrum of Hcl shows a series of lines with a spacing of 21.2 cm^{-1}. Calculate the bond length of Hcl.

12. Using 435.8 nm source, Raman lines were observed at 439.9, 444.6 and 450.7 nm, calculate Raman frequencies.

13. Briefly explain Nuclear Overhausser effect.

14. What is zero field splitting ? Explain.

15. Explain Cotton Effect.

16. What are the factors affecting chemical shift ? Explain.

17. Briefly explain 'double resonance'in NMR.

18. What are the advantages of FAB in mass spectrometry ? Discuss.

<div align="right">(6 × 2 = 12 weightage)</div>

Section C

Answer any **two** *questions.*

Each question carries a weightage of 5.

19. (a) Define 'band width'. What are the contributing factors to non-zero band width ? Discuss.

(b) How would you determine C-O and C-S bond lengths in COS using microwave spectroscopy ? Explain.

20. Briefly discuss theory and applications of Mössbauer spectroscopy.

21. Discuss theory and applications of 2D-NMR.

22. A compound with molecular formula $C_6H_{12}O_2$ gave the following spectral data. Deduce the structure :

    IR 1740 cm^{-1}, 1160 cm^{-1}

    ^{1}H NMR δ 3.6 (3H, singlet) δ 1.2 (9 H singlet)

    Mass m/z 116, 85, 59, 31.

    $(2 \times 5 = 10$ weightage$)$