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THIRD SEMESTER M.Sc. DEGREE (REGULAR/SUPPLEMENTARY) EXAMINATION, NOVEMBER 2022

(CBCSS)

Chemistry

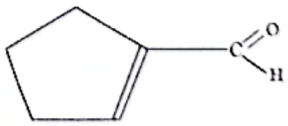
CHE 3C 09—MOLECULAR SPECTROSCOPY

(2019 Admission onwards)

Time : Three Hours Maximum : 30 weightage

Section A

Answer any **eight** *questions.*
Each question carries a weightage of 1.

1. The rotation constant B and distortion constant D of a diatomic molecule are 10 and 4×10^{-3} cm^{-1} respectively. Find the frequency corresponding to J = 9 to J = 10 transition.
2. Explain with example overtones and combinations bands.
3. NO shows a Q branch in vibration-rotation spectrum. Why ?
4. Stokes lines are more intense than anti stokes lines in vibrational Raman spectrum. Why ?
5. Chemical shifts (δ) are field dependent but coupling constants J are field independent. Why ?
6. How many lines do you expect in the ESR spectrum of NH_3 radical ? Justify.
7. Predict λ_{max} for (a) 3-methyl pent–3–en–2–one ; (b) 
8. A set of protons absorb 180 Hz higher frequency w.r.t. TMS in a 100 MHz NMR spectrum. Calculate δ(delta) value.
9. Explain with example double resonance.
10. Explain FAB with reference to MS.

(8 × 1 = 8 weightage)

Turn over

Section B

Answer any **six** *questions.*
Each question carries a weightage of 2.

11. Discuss rotation spectra symmetric top molecules.
12. The fundamental and first overtone of HCl are observed at 2886 and 5668 cm^{-1} respectively the fundamental vibrational frequency and anharmonicity constant.
13. Briefly discuss a 2-dimensional NMR experiment.
14. Discuss isomershift in Mössbauer spectroscopy.
15. How would you establish configuration and conformation of cis and trans-decalones?
16. Distinguish chemical, magnetic and stereochemical equivalence in NMR.
17. What is DEPT with reference to NMR ? Discuss.
18. Draw mass spectrum of butanons. Discuss.

$(6 \times 2 = 12$ we

Section C

Answer any **two** *questions.*
Each question carries a weightage of 5.

19. State Franck Condon principle. Discuss its applications in understanding electronic s diatomic molecules.
20. How do you achieve resonance condition in ESR spectroscopy ? Discuss.
21. The spectral data of a compound is given :

    IR 1740 cm^{-1} (s), 1160 cm^{-1} (s)
    NMR 3.6δ(3H singlet), 1.2δ (9H singlet)
    uv- no absorption
    MS $\frac{m}{zt}$ 116, 85, 59, 31

    Deduce the structure and assign the peaks.
22. Discuss the theory, applications and instrumentation in Raman spectroscopy.

$(2 \times 5 = 10$ w