

D 70917

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Name.....

Reg. No.....

**THIRD SEMESTER M.Sc. DEGREE (REGULAR) EXAMINATION
NOVEMBER 2019**

Chemistry

CH3C09—MOLECULAR SPECTROSCOPY

Time : Three Hours

Maximum : 36 Weightage

Section A

Answer all questions.

Each questions carries 1 weightage.

1. Discuss the factors influencing bandwidth in vibrational spectrum.
2. Vibrational frequency in the excited state of a molecule is smaller than that in the ground state. Why ?
3. Explain Karplus relationship.
4. What is Larmor frequency in NMR ?
5. What is 'g' factor ? How are 'g' values determined ?
6. Explain Doppler broadening.
7. What is meant by rigid rotor ?
8. Give examples for spherical top molecules and give the symmetric criteria.
9. Why homonuclear diatomic molecule does not give any vibrational spectra ?
10. Explain McConnell equation ?
11. ^{13}C NMR is active while ^{12}C NMR does not. Why ?
12. Explain high resolution mass spectrometry (HRMS).

(12 × 1 = 12 weightage)

Section B

Answer any eight questions.

Each question carries 2 weightage.

13. Explain the factors responsible for the hyperfine structure in EPR spectra.
14. Give the principle of Optical Rotatory Dispersion and explain Circular Dichroism.
15. Write notes on : (i) Predissociation ; and (ii) Fermi resonance.
16. What is Nuclear Overhauser Effect (NOE) ?

Turn over

17. Write a note on cotton effect.
18. Detail Franck-Condon principle.
19. Determine the principal moment of inertia of methane if its bond length is 1.09 \AA ?
20. Draw a diagram showing the allowed rotational energies of a rigid diatomic molecule and explain ?
21. Explain the various factors influencing the width and intensity of spectral lines in microwave spectrum.
22. Discuss microwave spectroscopy.
23. The mass spectrum of 2-butenal shows a peak at m/z 69 that is 28.9 % as intense as the base peak. Propose at least one fragmentation route to account for this peak and explain why this fragment would be reasonably stable ?
24. Detail the factors affecting the position and intensity of electronic absorption bands?
(8 × 2 = 16 weightage)

Section C

*Answer any two questions.
Each question carries 4 weightage.*

25. (a) Write note on FT NMR.
(b) Explain the theory of spin-spin splitting in NMR spectroscopy.
26. (a) Explain the application of Mossbauer spectroscopic techniques in the study of Fe (II) and Fe (III) cyanides.
(b) What is isomer shift in Mossbauer Spectroscopy ?
27. (a) What vibrational frequency in wave number corresponds to a thermal energy of kT at 298K ?
(b) Why is that in the excited state of a molecule the vibrational frequency is smaller than in the ground state ?
28. (a) Explain Kramer's theorem in Electron Paramagnetic Resonance ?
(b) Write a note on McLafferty rearrangement.

(2 × 4 = 8 weightage)