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Reg. No.....

Name.....

M.Sc. DEGREE (C.S.S.) EXAMINATION, JUNE 2018

Second Semester

Faculty of Science

AN2C08/AP2C08/CH2C08/PH2C08/POH2C08—MOLECULAR SPECTROSCOPY

(2012 Admission onwards)

[Common to all Branches of Chemistry]

Time : Three Hours Maximum Weight : 30

Section A

Answer any **ten** *questions, each question carries weight* 1.

1. Explain the principle of lamp dip spectrum.
2. Explain Pressure broadening. What are the factors which affects the Doppler line width ?
3. What is Fermi resonance ? How the Fermi resonance lines are identified in IR spectra ?
4. Give the spectroscopic term symbol for N_2 molecule.
5. State and explain Karplus relationships used in NMR spectra.
6. What is Nuclear Overhauser Effect (NOE) ? What is its use in NMR spectra ?
7. Explain Kramer's Theorem. What is its relevance in EPR spectra ?
8. Explain 'Mutual exclusion principle' used in Raman and IR spectrum.
9. Explain the use of microwave spectroscopy in chemical analysis.
10. What are overtones and hot bands in IR spectra ?
11. Explain Franck-Condon principle.
12. Draw the EPR spectra of Isopropyl radical.
13. What is fiber coupled Raman spectrometer ? What are its advantages over the classical one ?

(10 × 1 = 10)

Section B

Answer any **five** *questions by attempting not more than three questions from each bunch. Each question carries weight* 2.

BUNCH 1

14. What are the important factors in deciding the line width of a spectral line
15. Derive an expression for calculating J_{max} in microwave spectra.

Turn over

16. Draw Morse potential energy diagram and explain fundamental, overtone and hot bands.

17. What are lasers ? What are its characteristic properties ? List the important advantages in using lasers in spectroscopic measurements.

BUNCH 2

18. A molecule makes a transition between the ground state and an excited state having a life time 10^{-3} S. Calculate the uncertainty in the excited state energy level and the width of the associated spectral line

19. The first line in the rotation spectrum of carbon monoxide has a frequency of 3.8424 cm^{-1}. Calculate the rotational constant and hence C-O bond length in carbon monoxide.

    Avogadro number is 6.022×10^{23} per mole.

20. Consider a gas at temperature T = 300 K and pressure P = 100 Torr, and mass of each atom is 4.2×10^{-27} Kg. Some of the atoms in an excited state emit radiation of frequency v. Estimate the amount of Doppler broadening.

21. A particular NMR instrument operates at 30.256 MH_z What magnetic fields are required to bring a proton nucleus and C^{13} nucleus to resonate at this frequency ? Magnetic moment of proton nucleus = $2.7927\mu_N$ and a $C^{13} = 0.7022\mu_N$.

(5 × 2 = 10)

Section C

Answer any **two** *questions.*
Each question carries weight 5.

22. Write briefly on the applications of : (a) X-ray Photoelectron spectroscopy ; and (b) NQR spectroscopy.

23. Give a brief description of two dimensional NMR spectroscopy with special reference to COSY and HETCOR.

24. Write briefly on the following (a) The applications of Raman spectroscopy ; and (b) The Birge-Sponer method of dissociation energy calculation.

25. What chemical shift as given in NMR spectra ? Explain giving suitable examples the different factors which affect the value of chemical shifts of different protons.

(2 × 5 = 10)