LOYOLA COLLEGE (AUTONOMOUS), CHENNAI – 600 034

M.Sc. DEGREE EXAMINATION - **PHYSICS**

FOURTH SEMESTER – **APRIL 2013**

PH 4807 - SPECTROSCOPY

Date : 27/04/2013 Dept. No. Max. : 100 Marks

Time : 1:00 - 4:00

Part – A

Answer **ALL** Questions. (10x2=20)

1. State the rule of mutual exclusion.
2. The rotational constant for HCl ^{35} is 10.5909 cm^{-1}. What is the value of B for HCl ^{37}?
3. Sketch the fundamental vibrational modes of H_2O.
4. The first rotational Raman line of H_2 appears at 346 cm^{-1} from the exciting line. Calculate the bond length of H_2 molecule?
5. What is double resonance?
6. Distinguish between sequence and prog ression
7. An NMR signal for a compound is found to be 250 Hz downward from TMS operating at 500 MHz. Calculate shift in ppm.
8. Write a note on C^{13} spectroscopy.
9. Distinguish between photoluminescence and fluorescence spectroscopy
10. What is the difference between inelastic scattering and elastic scattering

Part – B

Answer any **FOUR** Questions. (4x7.5=30)

11. Explain with example, the effect of isotopic substitution, on the pure rotational spectra of a diatomic molecule. The first rotational line of $^{12}C^{16}O$ is observed at 3.84235 cm^{-1} and that of $^{13}C^{16}O$ at 3.67337 cm^{-1}. Calculate the atomic weight of ^{13}C, assuming the mass of ^{16}O to be 15.9949
12. Outline the theory of Raman effect on the basis of classical and quantum theory
13. What is Fortrat Parabola?. Explain how this is used to calculate the position of band head
14. What is indirect spin-spin interaction? Explain why many spectral lines are seen in the CH_3 and CHO protons of acetaldehyde?
15. Explain the functioning of XPES

Part – C

Answer any **FOUR** Questions. (4x12.5=50)

16. Explain with theory, the spectrum of a linear diatomic molecule of rigid rotor type. Outline the correction for non-rigid type.
17. Explain the vibrational spectrum of a diatomic molecule. Deduce the effect of anharmonicity. The fundamental and first overtone transition of NO molecule is centered at 1876.06 cm^{-1} and 3724.2 cm^{-1} respectively. Evaluate the equilibrium vibrational frequency, the anharmonicity constant and zero point energy.
18. Give the selection rules associated with the study of rotational fine structure of vibration spectra. Explain the origin of P,Q and R bands and derive the energy expressions associated with the spectrum observed.
19. With a block diagram explain the working of Mössbauer spectrometer. Explain how Doppler effect and uncertainty principle is useful to observe the spectrum
20. Explain the electron spectroscopy for chemical analysis in detail.

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