M 27345

Reg. No. : .....

Name : .....

Second Semester M.A./M.Sc./M.Com. Degree (Regular/Supplementary/ Improvement) Examination, March 2015
Physics (2013 & Earlier Admn.)
PH 204 : ATOMIC AND MOLECULAR SPECTROSCOPY

Time : 3 Hours Max. Marks : 50

PART – A

Answer **any two** questions. **Each** question carries **10** marks.

1. Describe how atomic states are represented in L-S and j-fcoupling schemes.
2. Derive an expression for the frequency of the absorption line of the rotational spectra of rigid diatomic molecules. Give the effect of isotopic substitution on the rotational spectra of molecules.
3. What are the parameters that can be obtained from the study of vibration-rotation spectrum of a hetero nuclear diatomic molecule ? How are they estimated ?
4. Describe the band origin and band head in the rotational fine structure of electronic vibration spectra. Explain whether there will be a band at the band origin.

(2×10=20)

PART – B

Answer **any five** questions. **Each** question carries **3** marks.

1. Explain recoilless emission and absorption of r-rays.
2. Explain the principle of ESR.
3. How is magnetic resonance imaging done ?
4. What is Fortrat diagram ? Give its significance.
5. What is mutual exclusion principle ? Give an example.

P.T.O.

6. Give the advantages of FTIR spectroscopy.

7. What is V2 mode of ammonia molecule ? Account for the inversion vibration of ammonia.

8. What are singlet and triplet states ? Give examples. **(5×3=15)**

PART – C

Answer **any three** questions. **Each** question carries **5** marks.

1. Prove that the spin angular momentum vector S precesses around a magnetic field B twice as fast as the angular momentum vector L.

2. Calculate the average period of rotation of HCL molecule if it is in the J = I state, given the inter nuclear distance of HCL is 0.1274 nm. Mass of hydrogen atom = 1.673×10^{-27} kg and mass of chlorine atom = 58.06×10^{-27} kg.

3. Determine the minimum KE at which a neutron, in a collision with a molecule of gaseous oxygen, can lose energy by exciting molecular rotation. The bond length of the oxygen molecule = 1.2 A°.

4. If the bond length of H_2 is 0.07417 nm, what will be the positions of the first three rotational Raman lines in the spectrum ?

5. The spectroscopic bond dissociation energy of $^{35}Cl^{16}O$ radical is 1.9 ev. Calculate the equilibrium bond dissociation energy of ClO. The fundamental vibrational frequency is 780 cm^{-1}. **(3×5=15)**