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94143

B. Sc. (Hons.) Chemistry 6th Semester Examination – May, 2024

PHYSICAL CHEMISTRY-I

Paper : CH(H)-603

Time : Three hours] *[Maximum Marks : 40*

Before answering the questions, candidates should ensure that they have been supplied the correct and complete question paper. No complaint in this regard, will be entertained after examination.

Note : Attempt *five* questions in all, selecting ***one*** question from each Section. Question No. 1 is ***compulsory***. All questions carry equal marks.

1. (a) H_2, N_2 and O_2 do not show vibrational spectra, why ? $8 \times 1 = 8$

(b) What is Raman effect ?

(c) Define selection rule for vibrational spectroscopy.

(d) Why Stoke's line are more intense than anti stokes line in the Raman spectrum of molecules ?

(e) What is Born-Oppenheimer approximation ?

(f) How will you get intense Raman line for molecular having covalent bond ?

(g) What do you understand by well behaved function ?

(h) What is zero point energy ?

SECTION – A

2. (a) Write an expression for the vibrational energy of a diatomic molecular taking it as simple harmonic oscillator. Show diagrammatically the vibrational energy level of such a molecule. 4

(b) The reduced mass of a diatomic molecule is 2.5×10^{-26} kg and its vibrational frequency is 2900 cm^{-1}. Calculate its force constant. 4

3. (a) Explain with suitable derivation, the type of rotation-vibration spectrum obtained for a diatomic molecule taking it as anharmonic oscillator. 4

(b) The vibrational spectrum of *HCl* show a very Intense absorption at 2886 cm^{-1}, a weaker one at 5668 cm^{-1} and very weak one at 8347 cm^{-1}. Calculate equilibrium vibrational frequency and anharmonicity constant. 4

SECTION – B

4. (a) Explain Raman spectra on the basis of polarizability of molecule. 4

(b) Explain the following terms : 4

(i) Coupling constant

(ii) Chemical shift

5. (a) Briefly explain elementary idea of nuclear magnetic resonance. 4

(b) Write a short note on the application of Raman effect. 4

SECTION – C

6. (a) Briefly explain Franck-Condon principle. 4

(b) Explain the intensity of electronic bands on the basis of electronic transition. 4

7. (a) Briefly explain elementary idea of electron spin resonance spectroscopy. 4

(b) What are selection rule for electronic transition in Electronic spectroscopy ? 4

SECTION – D

8. Explain the following : 4, 4

(a) Photoelectric effect

(b) De-Broglie equation

9. (a) Write the postulates of Quantum Mechanics. 4

(b) Apply Schrodinger equation to a particle in one dimensional box and obtain the expression for the eigen function and eigen value of energy. 4