

B.Sc. CBCS Pattern Semester-VI  
**CHT14 - Chemistry Paper-II: Discipline Specific Elective Chemistry VI**  
**Physical Chemistry**

P. Pages : 2

Time : Three Hours



GUG/W/23/13342

Max. Marks : 50

- Notes : 1. All questions carry equal marks.  
2. Diagrams wherever necessary.

1. a) Draw Jablonski diagram and explain radiative and non- radiative transition. 5
- b) Explain polarization of polar molecule in an electric field. 5  
In a sodium chloride molecule, the bond length between Na & Cl atom is  $2.36 \times 10^{-10}$  m and its dipole moment is 8.0D. Calculate the percentage of ionic character of Na-Cl bond ( $q = 4.8 \times 10^{-10}$  esu).

**OR**

- c) Explain the reasons for high quantum yield. 2½
- d) State and explain second law of photochemistry. 2½
- e) Explain the term dipole moment. Discuss its application in determination of shape of molecules. 2½
- f) State Beer's law and derive its mathematical equation. 2½
2. a) The far infrared spectrum of HI consists of series of equally spaced lines  $12.4 \text{ cm}^{-1}$  apart. Calculate (i) Moment of inertia (ii) Bond length H-I bond Given 5  
 $M_H = 1.6739 \times 10^{-27} \text{ kg}$   
 $M_I = 2.1089 \times 10^{-25} \text{ kg}$   
 $h = 6.62 \times 10^{-34} \text{ Js}$   
 $c = 3 \times 10^8 \text{ m/s}$
- b) Explain vibrational energy level of a diatomic molecule as a simple harmonic oscillator using energy level diagram shows that only one absorption line obtained in vibrational spectra. 5

**OR**

- c) Explain the normal modes of vibration in  $\text{CO}_2$  molecule. 2½
- d) Show that each two spectral line in a rotational spectrum are separated by  $2B$ . 2½
- e) Calculate force constant of HCl bond if fundamental vibrational frequency is  $8.667 \times 10^{13} \text{ sec}^{-1}$ . Reduced mass of HCl is  $1.63 \times 10^{-27} \text{ kg}$ . 2½
- f) Explain different types of degrees of freedom possessed by linear & non linear molecule. 2½

