

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

P. Pages : 2

Time : Three Hours



**GUG/W/24/13342**

Max. Marks : 50

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1. a) Draw Jablonski diagram and explain radiative and non radiative transitions. 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  $1.36 \times 10^{-10}$  m and its dipole moment is 6.0D. Calculate the percentage of ionic character of Na-Cl bond.

**OR**

- c) Explain the reason 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  $12.4 \text{ cm}^{-1}$  apart. 5  
Calculate  
i) Moment of inertia ii) Bond length of H-I bond  
Given that  $m_{\text{H}} = 1.6739 \times 10^{-27}$  Kg,  $h = 6.63 \times 10^{-34}$  m,  $m_{\text{I}} = 2.1089 \times 10^{-25}$  Kg
- b) Explain the vibrational energy level of a diatomic molecule as a simple harmonic oscillator using energy level diagram. 5

**OR**

- c) Explain normal modes of vibration in CO<sub>2</sub> molecule. 2½
- d) Show that each two spectral line in rotational spectrum are separated by 2B. 2½
- e) Calculate force constant of HCl bond if fundamental vibrational frequency is  $13 \times 10^6 \text{ s}^{-1}$ . 2½  
Reduced mass of HCl is  $1.63 \times 10^{-27}$  kg.
- f) State the selection rule for vibrational spectrum in simple harmonic oscillator. Show that only one absorption line will be obtained in vibrational spectrum of simple harmonic oscillator. 2½
3. a) Discuss Langmuir theory of adsorption? Deduce an expression for Langmuir unimolecular adsorption isotherm. 5

- b) Explain method of preparation of colloidal solution using condensation method. 5

**OR**

- c) Distinguish between physical and chemical adsorption. 2½
- d) What is Freundlich adsorption isotherm? What are its limitation? 2½
- e) Explain term electrophoresis. 2½
- f) Define miscelle concentration. What is effect of temperature on CMC? 2½

4. a) Discuss nuclear stability on the basis of binding energy curve. 5
- b) Explain application of radioisotopes in – 5
- i) Reaction Mechanism ii) Medicinal application.

**OR**

- c) Write a short note on G. M. counter method for radioactivity measurement. 2½
- d) What are general characteristics of radioactive decay. 2½
- e) The isotopic mass of  $^{84}_{36}\text{Kr}$  is 83.9115. Calculate mass defect and binding energy if masses of electron, proton neutron are 0.00055 amu, 1.007277 amu & 1.008665 respectively. 2½
- f) Give classification of nuclides. 2½

5. Solve **any ten**. 1x10 =10
- i) What is quantum yield?
- ii) State Grotthus – Draper law.
- iii) Define Group moment.
- iv) Which of the following molecule show rotational spectra HCl, N<sub>2</sub>, CH<sub>4</sub> ?
- v) Give the selection rule for pure rotational spectrum.
- vi) Define fundamental vibrational frequency.
- vii) What is emulsion?
- viii) What is ultrafiltration?
- ix) Define gold number.
- x) Define : a) Isobar b) Isotopes
- xi) What is radioactive element?
- xii) What is Carbon Dating?

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