Bachelor of Science (B.Sc.-III) Sixth Semester

B.Sc. 4511 - Chemistry Paper-II (Physical Chemistry)

P. Pages : 2 **GUG/W/18/1339**

Time : Three Hours * 1 0 5 2 * Max. Marks : 50

Notes : 1. All questions are compulsory and carry equal marks.
2. Draw diagrams and give equations wherever necessary.

1. a) What is radial Probability? Draw and discuss radial probability distribution curves for 25 and 2P orbitals. **5**

b) Discuss how LCAO-MO treatment of H_2^+ ion leads to the concept of bonding and antibonding molecular orbitals. Represent them diagrammatically. **5**

OR

c) Write Schrodinger's wave equations for hydrogen-like atom in three different forms containing one variables only. **2½**

d) What are quantum numbers? Give the physical significance of orbital quantum number and spin quantum number. **2½**

e) What are the main points of similarities and differences between VBT and MOT. **2½**

f) Define bonding and antibonding molecular orbitals. Write the expressions for normalized wave function for these orbitals. **2½**

2. a) What do you mean by quantum efficiency? Discuss experimental method for the determination of quantum efficiency. **5**

b) Explain the polarization of non-polar molecule in an electric field. **5**

The bond length of HF bond is 91.68pm. and dipole moment observed is 6.37×10^{-30} Cm . Calculate percentage ionic character of Hf molecule.

(charge on electron = 1.602×10^{-19} Coulomb).

OR

c) Distinguish between thermal and photochemical processes. **2½**

d) State and explain second Law of Photochemistry. **2½**

e) Define molar extinction co-efficient. On passing through 1cm long in a solution of concentration 10^{-4} molar, 20% of the incident radiation is absorbed. Find molar extinction co-efficient of the solution? **2½**

f) Explain graphical method for the determination of dipole moment. **2½**

3. a) Derive the expression for wave number of the rotational spectral lines in a pure rotational spectrum. Which type of molecule gives pure rotational spectrum. **5**

b) Define degrees of freedom of molecular motion. Explain the different types of degrees of freedom possessed by linear and non-linear molecule. **5**

OR

c) Define absorption spectra. Describe experimental set-up for absorption spectrometer. **2½**

d) What are the factors that affect intensity of spectral line. Explain relative intensities of rotational spectral lines. **2½**

e) 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**

f) Calculate the force constant for Nitrogen molecule if the fundamental vibration frequency is $2358\,cm^{-1}$. (mass of N = 14.00amu). **2½**

4. a) Discuss Langmuir theory of adsorption. Deduce an expression for Langmuir unimolecular adsorption isotherm. How can it be verified? **5**

b) Explain: **5**
i) Electro Osmosis and ii) Ultrafiltration
How arsenic Sulphide sol is formed by chemical reaction.

OR

c) What is adsorption? Explain the factors affecting adsorption of gases by solids. **2½**

d) Describe the application of adsorption chromatography. **2½**

e) What are lyophilic and lyophobic sols? How they are prepared. **2½**

f) Define ionic micelle? Explain the mechanism of micelle formation with suitable example. **2½**

5. Attempt **any ten.** **10**

i) Define Radial wave function.

ii) What is atomic orbital.

iii) Write the expression for energy of hydrogen atom.

iv) Define bond moment and group moment.

v) State any two limitations of Lambert's Beers Law.

vi) What type of transitions are involved in fluorescence and in phosphorescence.

vii) Why molecular spectra is called band spectra.

viii) Write Morse equation.

ix) What is frequency separation.

x) Why colloidal particles cannot pass through animal membrane.

xi) Define surfactant.

xii) Why powdered charcoal is a better adsorbent than a lamp of darcoal of the same mass.

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