

B.Sc. (with Credits)-Regular-Semester 2012 Sem VI
B.Sc.4511 - Chemistry-II (Physical Chemistry) Paper-II

P. Pages : 2

Time : Three Hours



GUG/S/18/5628

Max. Marks : 50

- Notes : 1. All questions are compulsory.
2. All questions carry equal marks.

1. a) What is radial probability? Explain the probability distribution curves of 2s, 3p orbitals. **5**
b) What are the criteria for the formation of molecular orbitals from atomic orbitals. **5**
Give the physical significance of bonding and antibonding molecular orbitals.

OR

- c) Write Schrodinger's wave equation for hydrogen like atoms in spherical polar coordinates. **2½**
d) Explain principle and azimuthal quantum numbers. **2½**
e) Write any five postulates of Molecular orbital theory. **2½**
f) Discuss the application of valence bond theory to study the bond dissociation energy of H₂ molecule. **2½**
2. a) Draw Jablonski diagram and explain radiative and non radiative transitions. **5**
b) Explain the term dipole moment, discuss its application in determination of
i) Percentage of Ionic character. **5**
ii) Shape of molecule.

OR

- c) Distinguish between thermal and photochemical process. **2½**
d) Explain the reasons of low quantum yield. **2½**
e) A certain system absorbs 3×10^{18} quanta of Light per second. On irradiation for 20 minutes 0.003 Mole of the reactant was found to have reacted calculate the quantum yield of the process ($N_A = 6.023 \times 10^{23}$) **2½**
f) Explain the polarisation of polar molecules in electric field. **2½**
3. a) Derive expression for the frequency of rotational lines in a pure rotational spectrum. **5**
What are the conditions to show pure rotational spectra?
b) Explain the vibrational energy levels of a diatomic molecule as a simple harmonic oscillator and anharmonic oscillator **5**

OR

- c) The rotational constant of NO molecule is 166m^{-1} . Calculate the bond length if its reduced mass is $1.24 \times 10^{-26}\text{kg}$ ($h = 6.626 \times 10^{-34}\text{J.S}$, $C = 3 \times 10^8\text{ m/s}$). 2½
- d) Explain why molecules behave as non rigid rotors. Write expression for the wave numbers of rotational levels of a non-rigid rotor. 2½
- e) Explain normal modes of Vibrations in CO_2 molecule. 2½
- f) Calculate the force constant of H-Br bond if it gives absorption maximum at $3.77 \times 10^{-6}\text{m}$. (Reduced Mass = $1.6528 \times 10^{-27}\text{kg}$). 2½
4. a) Define adsorption isotherm. Explain Freundlich adsorption isotherm and obtain the values of k and n graphically. 5
- b) Give the method of preparation of colloidal solution using condensation method. 5

OR

- c) Describe Langmuir theory of adsorption. 2½
- d) Write a note on adsorption chromatography. 2½
- e) Define CMC. Explain the effect of temperature on it. 2½
- f) What do you understand by electrophoresis and electroosmosis. 2½
5. Attempt **any ten**. 10
- i) What is atomic orbital.
 - ii) Write the equation of energy of hydrogen like atom.
 - iii) Write normalized wavefunction for bonding and antibonding molecular orbitals.
 - iv) Define molar extinction coefficient.
 - v) Obtain the value of one Einstein of wavelength 400Å
 $(h = 6.626 \times 10^{-34}\text{J.S}$, $C = 3 \times 10^8\text{m/s}$ $N = 6.02 \times 10^{23})$.
 - vi) Write Clausius – Mossotti equation.
 - vii) What do you mean by allowed transition.
 - viii) Write Morse equation.
 - ix) Define zero point energy.
 - x) What is R_f value.
 - xi) Define lyophobic sol with example.
 - xii) What is gold number.
