(C) Calculate the energy of one photon of light of wavelength 2450 A°. Will it be able to dissociate a bond in diatomic molecule which absorbs this photon and has a bond energy equal to 95 Kcal mol^{-1}. (h = 6.626×10^{-34} JS mol^{-1}, C = 3×10^8 ms^{-1}, N = $6.023 \times 10^{23} mol^{-1}$).

2½

(D) Explain photosensitized reactions by giving examples.

2½

(E) With the help of Jablonski diagram explain :

(i)   Internal conversion and

(ii)   Intersystem crossing.   2½

(F) Explain Rayleigh's line, Stokes' lines and anti-Stokes' line in Raman spectra.   2½

5.   Attempt any **TEN** questions of the following :

(i)   Define perfect blackbody

(ii)   State de-Broglie's hypothesis

(iii)   What are eigen values ?

(iv)   Write the expression for the energy for hydrogen like particles.

(v)   What is an orbital ?

(vi)   Draw potential energy curve for H_2^+ ion.

(vii)   A solution contains 5 g of A in 45 g of B. Calculate weight percent of A.

(viii) Define osmosis.

(ix)   Write the relation between magnetic moment and number of unpaired electrons.

(x)   Define the term spin multiplicity.

(xi)   State Grotthus-Draper law.

(xii)   What is selection rule for pure rotational Raman spectra ?   10×1=10

Bachelor of Science (B.Sc.) Semester—V (C.B.S.) Examination

CHEMISTRY

CH—502 (Physical Chemistry)

Paper—II

Time—Three Hours]   [Maximum Marks—50

Note :— (1)   All **FIVE** questions are compulsory and carry equal marks.

(2)   Draw diagrams wherever necessary.

1.   (A) Explain how classical mechanics fails when applied to :

(i)   Heat capacity of solids and

(ii)   Photoelectric effect.   5

(B) Starting from Schrodinger wave equation, show that for a particle in one dimensional box :

$$\psi = \sqrt{\frac{2}{a}} \, \sin \frac{n\pi}{a} x$$ where ψ, a, n and x have their usual meanings.   5

OR

(C) A particle having wavelength 6.6×10^{-6} m is moving with a velocity of 1×10^4 ms^{-1}. Find the mass of this particle. (h = 6.626×10^{-34} JS)   2½

(D) What are the main postulates of Bohr's model of an atom ? 2½

(E) State the postulates of quantum mechanics. 2½

(F) What is an operator ? When is it said to be commute and linear ? 2½

2. (A) What is radial probability ? Draw and discuss radial probability distribution curves for 2s and 3d orbitals. 5

(B) What are the conditions for the formation of molecular orbitals from atomic orbitals ? Discuss the physical picture of bonding and antibonding wave functions. 5

OR

(C) What are quantum numbers ? Discuss the significance of principle quantum number. 2½

(D) Write Schrodinger wave equation for hydrogen like particles in terms of polar co-ordinates. 2½

(E) Discuss graphically the variation of electron probability density for bonding molecular orbitals along the internuclear axis. 2½

(F) Explain molecular orbital theory for H_2 molecule. 2½

3. (A) How osmotic pressure is determined by Berkeley and Hartley's method ? A 10.0 g of a substance was dissolved in water and the solution was made up to 2.5×10^{-4} m^3. The osmotic pressure of the solution was found to be 8×10^5 Nm^{-2} at 288 K. Calculate the molar mass of the solute.

(R = 8.314 JK^{-1} mol^{-1}). 5

(B) Define :

(i) Magnetic permeability and

(ii) Molar magnetic susceptibility.

How magnetic susceptibility of a substance can be used to decide the structure of co-ordination compounds ? 5

OR

(C) A solution of 2.44 g of the solute dissolved in 75 g of water boils at 100.413° C. Calculate the molecular weight of solute (K_b = 0.52 K Kg mol^{-1}). 2½

(D) Find molarity and molality of a 15 % solution of H_2SO_4 (density of H_2SO_4= 1.10 g/ml and molecular mass of H_2SO_4 = 98). 2½

(E) Define Van't Hoff factor. How is it used in the determination of degree of association ? 2½

(F) Describe Gouy's method for the determination of magnetic susceptibility. 2½

4. (A) What is meant by quantum yield of a photochemical reaction ? How can it be experimentally determined ? Describe the function of an actinometer. 5

(B) What is Raman effect ? Give the experimental set up of Raman spectroscopy. What are the advantages of Raman spectroscopy over infrared spectroscopy ? 5

OR