DL-107

December-2013

M.Sc., Sem.-I

CHE-401 : Chemistry

(Inorganic Chemistry)

Time : 3 Hours]　　　　　　　　　　　　　　　　　　[Max. Marks : 70

1.　Answer the following questions :　　　　　　　　　　　　　　14
　　(a)　Explain the step up and step down operators of angular momentum. Prove that $L_+ L_- = L^2 - Lz^2 + hLz$.

　　(b)　For first order perturbation, find out the values for correction to the energy and wave function.

OR

　　(a)　For Hydrogen atom, by applying variation principle, prove that $E = -\frac{1}{2}$ au.

　　(b)　Prove that $[L^2, Lx] = 0$.

2.　Answer the following questions :　　　　　　　　　　　　　　14
　　(a)　Explain the Great Orthogonality Theorem.

　　(b)　Taking wave function as the basis for irreducible representation for C_3V point group, considering 2px and 2py orbitals as the nitrogen atom in ammonia as the basis. Calculate the values for $\chi(E)$, $\chi(C_3)$ and $\chi(\sigma v)$.

　　(c)　Explain, by taking suitable example, stochastic matrix and Hermitian matrix.

OR

　　(a)　Explain the five important rules about irreducible representation and their characters by taking a suitable example.

　　(b)　Explain, by taking suitable example, scalar matrix and orthogonal matrix.

　　(c)　Find out the direct product for

　　　　(i)　$T_2 \times T_1$ and

　　　　(ii)　$E \times T_1$ in Td.

3.　Answer the following questions :　　　　　　　　　　　　　　14
　　(a)　Derive the basic equation for diamagnetic susceptibility.

　　(b)　Explain the use of Pascal's constants with example.

　　(c)　Explain Neel temperature.

OR

(a) Write differences between Ferromagnetism and Anti-Ferromagnetism.

(b) Discuss Curie and Curie Weiss Law.

(c) Derive an equation for spin magnetic Moment.

4. Answer the following questions : 14

(a) Explain the use of essential trace elements in biological systems.

(b) Discuss the specific functions of Na and K in human life.

(c) Discuss the use of coordination compounds in medicine.

OR

(a) Explain Nitrogen Fixation.

(b) Explain the role of chelation therapy and chelating agents.

(c) Write a note on toxic metals and their toxicity.

5. Answer the following questions in short : 14

(a) Define : Character.

(b) Describe the implied symmetry of the irreducible representation Ag in point group C_2H on the basis of Mulliken symbol.

(c) Explain the meaning of the term $2z^2 - x^2 - y^2$.

(d) The energy integral $\int \Psi i \, H \, \Psi j \, dT$ is zero. What are the circumstances which lead to the above requirements for the molecular point group ?

(e) Define : Linear Operator.

(f) What is the kinetic energy of operator $\hat{K}$?

(g) Calculate if $5x^3$ is the eigen function of d^2/dx^2 operator or not.

(h) Give equation for 'Molar magnetic susceptibility'.

(i) Define : Magnetic Induction.

(j) Give example of intermolecular Antiferromagnetism.

(k) Which metal ions are used in MRI ?

(l) Define : Metalloporphyrins.

(m) Which compounds are used in rheumatoid arthritis ?

(n) Give full name of vitamin B_{12}.