

DL-107**December-2013****M.Sc., Sem.-I****CHE-401 : Chemistry****(Inorganic Chemistry)****Time : 3 Hours]****[Max. Marks : 70**

1. Answer the following questions :

- (a) Explain the step up and step down operators of angular momentum. Prove that $L_+ L_- = L^2 - L_z^2 + \hbar L_z$. 14/17
- (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 $[L^2, L_x] = 0$.

2. Answer the following questions :

- (a) Explain the Great Orthogonality Theorem. 14/10
- (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 T_d .

3. Answer the following questions :

- (a) Derive the basic equation for diamagnetic susceptibility. 14/2
- (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 :

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- (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 :

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- (a) Define : Character.
- (b) Describe the implied symmetry of the irreducible representation A_g 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 $\int \Psi_i H \Psi_j d\tau$ is zero. What are the circumstances which lead to the above requirements for the molecular point group ?
- (e) Define : Linear Operator. GujaratStudy.com
- (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} .

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