Seat No. : 198

# KJ-382

December-2012

## 401-Chemistry Paper-I

## (Inorganic Chemistry)

Time : 3 Hours] [Max. Marks : 70

**Instruction:** (1) Provide character table.

1. (a) Discuss the second postulate of quantum mechanics. 3

(b) Show that $[L_x, L_y] = iL_z$ 4

(c) Discuss the solutions of $\theta$ and $\varphi$ equations and correlate with quantum numbers. 4

(d) Explain the inner quantum number, j. 3

**OR**

(a) State and prove variation method. 3

(b) Apply perturbation theory to calculate ground state energy of Helium atom. 4

(c) What is the significance of spherical harmonics ? 3

(d) Explain step-up and step-down angular momentum operators. 4

2. (a) Show that px and py orbitals of nitrogen atom in ammonia, described by the eigen function $px = R\sin\theta\cos\varphi$ ; $py = R\sin\theta\sin\varphi$ ; provide a basis of the irreducible representation E. 5

(b) State five important rules about irreducible representations and their characters. 5

(c) Illustrate with an example about the condition of conformability for multiplication of two matrices. 4

**OR**

(a) Write the characters of the representation of the following direct products and determine the irreducible representation which comprise them for the point group $D_6h$: $A_1g \times B_1g$. 3

(b) In area III of the character table, what do understand when function x and y are written as (Rx, Ry) and not as Rx, Ry belonging to one representation. 3

(c) Differentiate between Unit matrix and Unitary matrix. 4

(d) Explain the significance of every portion of character table. 4

3. (a) Deduce the basic equation of diamagnetic susceptibility. 5

(b) Explain Curie and Curie Weiss Law. 5

(c) Give a brief account on ferromagnetism and antiferromagnetism. 4

**OR**

(a) Give an account on the importance of Pascal constant and its utility. 5

(b) Differentiate orbital magnetic moment, magnetic induction and magnetic susceptibility. 5

(c) Explain the difference between intramolecular and intermolecular antiferromagnetism. 4

4. (a) Define various types of zinc enzymes and discuss the functions of zinc. 5

(b) Give an account on biochemical effect of arsenic and lead. 5

(c) What is chelation therapy ? Discuss the use of BAL, Aurin tricarboxylic acids and penicillinamine as a chelating agent. 4

**OR**

(a) Define various types of iron enzymes and explain the functions. 5

(b) With suitable illustration prove the importance of sodium and potassium ions in biological system. 5

(c) Write a note on the use of Gold complexes in Rheumatoid arthritis. 4

5. Answer the following questions : **(1 mark each)**

(a) The potential energy of Helium atom V= $\frac{2e^2}{r_1} - \frac{2e^2}{r_2} + \frac{e^2}{r_{12}}$

(b) The fundamental vibration frequency of a simple harmonic oscillator, $\nu_0$ = $2\alpha^2/\mu$

(c) $L_z$ ( in polar coordinate ) =

(d) How do we designate all three dimensional representation in character table ?

(e) What will be the character of the matrices of non degenerate or singly degenerate representation under identify operation ?

(f) An energy integral $\int \psi i H \psi i \, dt$, may be non zero only if .....

(g) What is kronecker delta ? $\delta_{ij}$ $i=j$

(h) A paramagnetic substance will have P<1; True or False.

(i) An anti ferromagnet has a characteristic Curie temperature.

(j) The function of heamoglobin is oxygen transport

(k) What is polycythemia ?

(l) In MRI, which metal ions are used for diagnosis of diseases ?

(m) How can we cure the deficiency of zinc ion in diabetes and leukemia ?

(n) The ideal curie paramagnates are Ar, Pt, Mg.