

Seat No. : 1720 330

N24-104

December-2014

M.Sc., (Sem.-I)

401 : Chemistry, Paper – I

(Inorganic Chemistry)

Time : 3 Hours]

[Max. Marks : 70

1. Answer the following questions :

(a) For  $\psi = e^{-ax}$ , find out the amount of energy for Hydrogen atom by applying variation principle.

OR

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

(b) Explain step up and step down operators of angular momentum. Prove that  $[L_+, L_-] = 2\hbar L_z$ .

OR

For simple Harmonic Oscillator, prove that  $E = \frac{1}{2} ka^2$ .

2. Answer the following questions :

(a) Explain the Great Orthogonality theorem. Discuss its five important rules about irreducible representations and their characters.

OR

Explain what character table is. Explain its different compartments.

(b) Taking wave function as the basis for irreducible representation for  $C_{3v}$  point group, considering  $2p_x$  and  $2p_y$  orbitals as the nitrogen atom in ammonia as the basis, calculate the values for  $\chi(E)$ ,  $\chi(C_3)$  and  $\chi(\sigma_v)$ .

OR

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 :

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(a) Write differences between Curie's Temperature & Neel Temperature.

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OR

Write the statement of 'Lenz's law and derive the equation for Orbital Magnetic Moment :  $\mu = \sqrt{l(l+1)}$  B.M.

(b) Discuss the importance of 'Pascal Constant' and its utility and calculate the value of  $\chi_{dia}$  for (i)  $PPh_3$  and (ii) Bipy.

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OR

What are magnetically dilute substance ? Explain : Super exchange interaction and intermolecular antiferromagnetism.

4. Answer the following questions :

(a) Discuss the classification of elements in bioinorganic chemistry and discuss Fe-Cycle.

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OR

Discuss 'In Vitro' nitrogen fixation.

(b) Write a note on Cytochrome.

7

OR

Discuss the role of metals as :

- (i) Radio - Diagnostic Agents and
- (ii) Antimicrobial Agents

5. Answer the following questions in short :

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(1) By applying commutator relationship, how one can prove Heisenberg uncertainty principle ?

(2) What is the value of angular momentum operator  $\hat{L}_x$  ?

(3) Write the Perturbation equation and explain each terms involve in it.

(4) Which quantum number is obtained by solving  $\theta$  equation ?

(5) Describe the implied symmetry of the irreducible representation  $A_g$  in point group  $C_{2h}$  on the basis of Mulliken symbol.

(6) What will be the character of a doubly degenerate irreducible representation under identity operation ?

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- (7) 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 ?
- (8) Give example of intramolecular Antiferromagnetism.
- (9) Give the equation for velocity of 'Torque' produces during magnetic induction.
- (10) Define Magnetic induction.
- (11) What is 'Menkes disease' ?
- (12) Excess amount of Mn causes \_\_\_\_\_.
- (13) The heaviest element in biological system is tungsten found in some bacteria, which one is the second heaviest element in biological system ?
- (14) What is the structure of ATP ?  
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