NO-111

December-2015

M.Sc., Sem.-I

401- Chemistry

(Inorganic Chemistry)

Time : 3 Hours] [Max. Marks : 70

1. Answer the following questions :

   (a) For simple harmonic oscillator prove that $E = \frac{1}{2} ka^2$. 7

      OR

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

   (b) State Perturbation principle. Give its application to the Helium atom. 7

      OR

      For $\psi = e^{-ar}$, find out the amount of energy for Hydrogen atom by applying

      variation principle. $\left(\text{(Given: } \int e^{-kr} r^n dr = \frac{n!}{(k)^{n+1}} \right)$.

2. Answer the following questions :

   (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}: Alu × Alu. 7

      OR

      For a point with a coordinate x, y, z obtain the matrix for symmetry operation E and Cn.

   (b) State and explain five important rules about irreducible representations and their characters. 7

      OR

      Label and explain all the components of character table. With the help of reduction formula reduce the following representation into its irreducible components.

C_{3V}	E	$2C_3$	$3_{\sigma V}$
$\Gamma 1$	7	–2	1

3. Answer the following questions :
   (a) Explain the terms Ferromagnetism and Antiferromagnetism. Distinguish between the properties of the compounds exhibiting such phenomenon. **7**

   OR

   Discuss Curie-Weiss Law.

   (b) Explain the "Pascal's constants" with example. **7**

   OR

   Explain Antiferromagnetism in (i) $Cu_2(OOCH_3)_4.2H_2O$ and
   (ii) bis (diazoamino-benzenato) copper(II)

4. Answer the following questions :
   (a) (i) Write a note on vitamin B12. **4**
       (ii) Discuss magnetic resonance imaging. **3**

   OR

       (i) Discuss in detail cytochromes. **4**
       (ii) Discuss the role of gold complexes in rheumatoid arthritis. **3**

   (b) (i) Write a note on hemoglobin and myoglobin. **4**
       (ii) Write a note on metallocenes. **3**

   OR

       (i) Discuss the antibacterial agents. **4**
       (ii) Discuss zinc metalloenzymes. **3**

5. Answer the following questions in short. **14**
   (1) Write the equation of energy of the HMO.
   (2) What is the application of step up and step down operators ?
   (3) What is the application of commutator relationship ?
   (4) In the harmonic oscillator, the equation : force = − proportionality constant × displacement, is based on which law ?
   (5) Give an example of orthogonal matrix.
   (6) How do we designate all one dimensional representation in character table ?
   (7) When is kronecker delta equals zero ?
   (8) An electric dipole transition will be allowed with x, y or z polarization if ....
   (9) Give examples of molecules for intermolecular Antiferromagnetism.
   (10) Write the definition of "Neel Temperature".
   (11) Define "Hysteresis".
   (12) What is the biological function of manganese ?
   (13) What is the bond energy of N_2 ?
   (14) Complete the following reaction :

$$R-\overset{\overset{O}{\|}}{C}-NHCH-\overset{\overset{O}{\|}}{C}-O^{\ominus} + H_2O \xrightarrow{\text{Carboxypeptidase A}}$$
$$\underset{CH_2Ph}{|}$$

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