RAMAKRISHNA MISSION VIDYAMANDIRA

(A Residential Autonomous College under University of Calcutta)

First Year

First-Semester Examination, December 2010

Date : 16-12-2010 **CHEMISTRY (Honours)** Full Marks : 25

Time : 2pm – 3.30pm **Paper - I**

Group C (Inorganic Chemistry)

Answer <u>any three</u> questions from the following : [5×3 = 15]

1. a) Explain Packing fraction and mass defect. [2]
   b) How is mass defect is related to nuclear binding energy. [1]
   c) State how does radioactive equilibrium differs from chemical equilibrium. [2]
2. a) State the Radioactive Decay Law and give the physical significance of decay constant. [2]
   b) An old piece of a wooden sample has a disintegration rate, which is 30% of the disintegrations shown by an equal weight of a new piece of wood; Find the age of the wooden sample, given that $t_{1/2}$ for ^{14}C = 5740 y_r. [2]
   c) What do you mean by magic numbers? [1]
3. a) What is radial distribution function? Show diagrammatically the variation of radial distribution function with 'r' for the orbitals, 3s and 3p, in a hydrogen atom. [3]
   b) Explain why only 's' orbitals are spherical. [1]
   c) Why is 4s orbital is lower in energy than 3d orbital? [1]
4. a) Calculate the energy of an electron in the second Bohr orbit of a Hydrogen atom. [2]
   b) Calculate the radius of the first allowed Bohr orbit for Hydrogen atom. [1½]
   c) Find out ground state term symbols for Co^{+2} ion. [1½]
5. a) State Hund's rule of maximum multiplicity. Calculate the exchange energy for d^6 system. [2]
   b) One of the most stable nuclei is ^{55}Mn. Its nuclidic mass is 54·938 u. Determine its total binding energy and average binding energy per nucleon.
   [Mass of proton : 1·00783 u; Mass of neutron : 1·00867 u] [2]
   c) Explain why nuclear fission reactions are different from nuclear spallation. [1]

Answer <u>any two</u> questions from the following : [5×2 = 10]

6. a) What is lanthanide contraction? Write down its consequences. [1½+1½]
   b) Write notes on (<u>any one</u>)
      i) Catenation
      ii) Pauling's Univalent radii [2]
7. a) Distinguish between electron affinity and electronegativity. [2]
   b) Write down Slater's rules and its limitations. The F–F distance is 1·43 Å, using Slater's rule, calculate the electronegativity of fluorine. [1½+1½]
8. a) What is inert pair effect? Explain with an example. [2]
   b) Explain the following : (<u>any two</u>)
      i) Amongst Cu, Ag and Au whose first Ionisation energy will be higher and why?
      ii) The bond angles of OF_2 is 103° while that of Cl_2O is 110°. —Explain
      iii) The drop in ionisation energy from N to O is larger than that from P to S. [1½+1½]