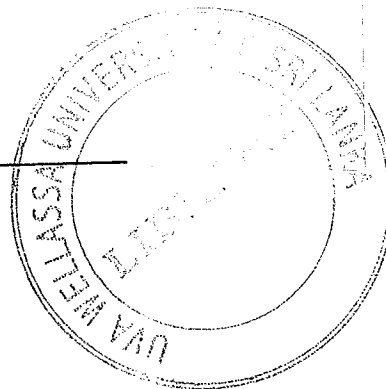


Uva Wellassa University of Sri Lanka  
Faculty of Science and Technology  
Department of Science and Technology  
100 Level 2<sup>nd</sup> Semester Examination December/January 2019  
SCT 132-2 Inorganic Chemistry



- i. Write the most stable electron configuration of copper atom.
- ii. What is the oxidation number of most stable copper ion?
- iii. Write the electron configuration of most stable copper ion.
- iv.  $\text{Cu}^{2+}$  forms stable octahedral metal complex with water molecules.
  - a. Write the chemical formula of copper-water complex.
  - b. Suggest the energy diagram of d orbitals of  $\text{Cu}^{2+}$  complex using crystal field theory.
  - c. Show the crystal field splitting energy ( $\Delta_{\text{Octahedral}}$ ) in the diagram very clearly.
  - d. Calculate the total spin number of  $\text{Cu}^{2+}$  complex.
  - e. Write the equation for the crystal field stabilizing energy of any octahedral complex and define all the terms in it.
  - f. Calculate the crystal field stabilizing energy of the  $\text{Cu}^{2+}$  complex in the term of crystal field splitting energy ( $\Delta_{\text{Octahedral}}$ ).
- v.  $\text{Cu}^{2+}$  ions absorb red-orange region of white light with the maximum with 800 nm. Prove that the crystal field splitting energy ( $\Delta_{\text{Octahedral}}$ ) of copper-water complex is equal to  $-2.48 \times 10^{-17}$  J. (Plank Constant =  $6.623 \times 10^{-34}$  J and velocity of light  $3 \times 10^8$   $\text{ms}^{-1}$ )
- vi. Prove that the crystal field stabilizing energy of the  $\text{Cu}^{2+}$  complex is equal to  $-1.5 \times 10^{-17}$  J under white light illumination.

vii. What is the major assumption that you made to calculate crystal field stabilizing energy of the  $\text{Cu}^{2+}$  complex under white light illumination.

viii. Write a reason for formation of tetrahedral  $[\text{Cu}(\text{Cl})_4]^{2-}$  from the reaction of octahedral  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$  with  $\text{Cl}^-$  ion.

ix. Explain why  $\text{Cu}^{2+}$  ion is stable than  $\text{Au}^{2+}$  ion in aqueous media using Jahn-Teller effect.

x. Explain why  $[\text{Co}(\text{NH}_3)_6]^{3+}$  ion undergoes  $d^2sp^3$  and  $[\text{Co}(\text{F})_6]^{3-}$  ion undergoes  $sp^3d^2$  hybridization.

(200 marks)

4.

i. Derive the following equation starting from total magnetic momentum of coordination compound metal ion,  $\mu_{\text{spin}} = \sqrt{n(n+2)}$ , where n is number of unpaired electrons.

ii. Nickel (II) complexes exhibit both tetrahedral and square planar geometries. Explain tetrahedral  $[\text{NiCl}_4]^{2-}$  is paramagnetic, and square planar  $[\text{Ni}(\text{CN})_4]^{2-}$  is diamagnetic.

(50 marks)

