Uva Wellassa University of Sri Lanka
Faculty of Science and Technology
Department of Science and Technology
100 Level 2nd 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. $Cu^{2+}$ 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 $Cu^{2+}$ complex using crystal field theory.

c. Show the crystal field splitting energy ($\Delta_{Octahedral}$) in the diagram very clearly.

d. Calculate the total spin number of $Cu^{2+}$ 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 $Cu^{2+}$ complex in the term of crystal field splitting energy ($\Delta_{Octahedral}$).

v. $Cu^{2+}$ ions absorb red-orange region of white light with the maximum with 800 nm. Prove that the crystal field splitting energy ($\Delta_{Octahedral}$) 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 $3 \times 10^{8}$ $ms^{-1}$)

vi. Prove that the crystal field stabilizing energy of the $Cu^{2+}$ 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 $Cu^{2+}$ complex under white light illumination.

viii. Write a reason for formation of tetrahedral $[Cu(Cl)_4]^{2-}$ from the reaction of octahedral $[Cu(H_2O)_6]^{2+}$ with $Cl^-$ ion.

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

x. Explain why $[Co(NH_3)_6]^{3+}$ ion undergoes $d^2sp^3$ and $[Co(F)_6]^{3-}$ ion undergoes $sp^3d^2$ hybridization.

(200 marks)

4.

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

ii. Nickel (II) complexes exhibit both tetrahedral and square planar geometries. Explain tetrahedral $[NiCl_4]^{2-}$ is paramagnetic, and square planar $[Ni(CN)_4]^{2-}$ is diamagnetic.

(50 marks)