d) How do you reduce the symmetry of a perfect octahedral complex $[MA_6]$ by partial substitution of ligand A with a different kind of ligand, B, to C_{3v} and C_{4v} point group ?

2

Ex/FCH/I/XIII/34/2018(S)

FINAL B. SC. EXAMINATION, 2018

(1st Semester, Special Supplementary)

CHEMISTRY (HONOURS)

PAPER - XIII

INORGANIC CHEMISTRY

Time : Two hours Full Marks : 50

1. a) Write a short note on *trans*-effect. $3\frac{1}{2}$

   b) Write name and formula of a copper containing ore. Discuss briefly about the extraction of the metal from its ore. Write the relevant reactions. $3\frac{1}{2}$

2. a) Comment on the following :

      i) Copper (II) acetate shows subnormal magnetic moment at room temperature. 2

      ii) Temperature Independent Para-magnetism. 1

   b) For isoelectronic series $[V(CO)_6]^-$, $[Cr(CO)_6]$, and $[Mn(CO)_6]^+$, would you expect the energy of metal to ligand charge-transfer bands to increase or decrease with increasing charge on the complex ? Justify your answer. 3

   c) Determine the atomic term symbol, degeneracy and ground term arising out from the s^1p^1 configuration. 1

3. a) What are the major reasons why the mechanism of alpha decay cannot be explained by classical mechanics ? $1\frac{1}{2}$

   b) Describe an experiment that demonstrates the production of antineutrino during nuclear beta decay. $1\frac{1}{2}$

   c) Discuss the energy terms associated with the liquid drop model of the nucleus. Which of these terms change significantly when a nucleus undergoes fission ? $1\frac{1}{2}+1$

   d) What is fission parameter ? Discuss the significance of its lower and upper limits. $\frac{1}{2}+1$

4. a) What happens immediately when NO is passed through ammonical solution of FeS and $(NH_4)_2S_x$? What will happen, if NO passage continues for a longer period ? Write down the chemical reactions and structures of the products. $(1\frac{1}{2}+1\frac{1}{2})=3$

   b) How do you synthesize $Mn_2(CO)_{10}$ from MnI_2 ? Write down the reaction of $Mn_2(CO)_{10}$ upon addition of Na in THF medium followed by the addition of CH_3I. $2\frac{1}{2}$

   c) "Paramagnetic Co(III) complexes are a few." – Comment. $1\frac{1}{2}$

5. a) Write a short note on polyvandate. 3

   b) Aqueous solution of Ti(IV) develops an intense orange color with H_2O_2 and the color is discharged by F^- ion. Predict the structure of the orange species. 1

   c) How pure vandium can be extracted from its important ore ? Write appropriate reaction involved in each step. 3

6. a) Briefly discuss spinel and inverse spinel structure in inorganic solid oxides and hence determine the structure of the following metal oxides with justification.

   $CuFe_2O_4$ and $FeCr_2O_4$ 4

   b) Determine the nature of tetragonal distortion (if any) in the following octahedral complexes and justify your answer.

   $[Ti(H_2O)_6]^{3+}$, $[Cr(H_2O)_6]^{2+}$ and $[Mn(H_2O)_6]^{2+}$ 3

7. a) Determine the symmetry point group with justification ***(any two)*** :

   C_3H_4, *trans* $-C_2H_2Cl_2$, $[Cr(\eta^6-C_6H_6)_2]$, PPh_3 2

   b) Determine the symmetry of the valence d AOs of nickel in $[Ni(CN)_4]^{2-}$ 2

   c) Determine the product $\{C_2^1 \otimes i\}$ with the aid of matrix multiplication for C_{2h} point group. 2