NKT/KS/17/5204

Bachelor of Science (B.Sc.) Semester—VI (CBS) Examination
CH—601 : INORGANIC CHEMISTRY
Paper—1
(Chemistry)

Time : Three Hours] [Maximum Marks : 50

N.B. :— (1) All **FIVE** questions are compulsory and carry equal marks.

(2) Write equations and draw diagrams wherever necessary.

1. (A) Define crystal field splitting energy and explain the crystal field splitting of 'd' orbitals in :

(i) $[Co(NH_3)_6]^{3+}$ and

(ii) $[Co\ F_6]^{3-}$ ion. 5

(B) (i) What is Jahn-Teller effect ? Explain it with respect to distortion in Cu(11) Octahedral complexes.

(ii) Explain spin allowed and spin-forbidden selection rule with examples. 5

OR

(C) Calculate CFSE value in terms of Δ_o value in the following :—

(i) d^5 low spin octahedral and

(ii) d^6 high spin octahedral. 2½

(D) Explain why Δ_t value is less than Δ_o and give the relationship between the two. 2½

(E) Discuss the electronic spectra of $[Ti(H_2O_6)]^{3+}$ ion with respect to :—

(i) Position of the band and

(ii) Intensity of the band. 2½

(F) Explain Hole formalism principle considering $d^1 - d^9$ configuration system. 2½

2. (A) (i) Define :—

(a) Magnetic susceptibility

(b) Gram magnetic susceptibility

(c) Molar magnetic susceptibility and

explain the significance of molar magnetic susceptibility.

(ii) Calculate spin only magnetic moment of d^7 system in weak octahedral field. 5

(B) (i) What is thermodynamic and kinetic stability of complexes ? How are they correlated ?

(ii) How do the following factors affect the stability of complexes :—

(a) Chelate effect and

(b) Concentration of Ligand ? 5

OR

(C) What is orbital magnetic moment ? Give the conditions required to contribute to the orbital magnetic moment. 2½

(D) On basis of CFT determine the number of unpaired electrons and calculate the spin only magnetic moment of $[Mn(CN)_6]^{4-}$ complex ion. 2½

(E) Derive the relationship between stepwise stability constant and overall stability constant. 2½

(F) Discuss the Job's method of determination of composition of Fe(III)–5 SSA complex. 2½

3. (A) (i) State Beer Lambert's law and derive a mathematical expression for it.

(ii) A solution of compound having concentration of 1.5×10^{-3} M when placed in a cell with path length of 2 cms, show % T of 65. Calculate the molar absorptivity of the compound. 5

(B) (i) What are ion exchange resins ? Discuss the different types.

(ii) Explain the technique of ascending paper chromatography. 5

OR

(C) Draw a well labelled schematic diagram of double beam colorimeter. 2½

(D) Discuss the different causes for deviation from Beer's law. 2½

(E) What is ion exchange capacity ? How is it determined for cation exchange resin ? 2½

(F) Discuss the principle of solvent exctraction and give any two applications of it. 2½

4. (A) (i) What are Organosilicones ? How are cross-linked silicones prepared ?

(ii) What are Silicon oils ? Give any three uses of it.

(B) (i) What are phosphonitrilic halides ? Discuss the structure of $(NPCl_2)_4$. 5

(ii) Give any one method of preparation of $(NPCl_2)_3$. What is the action of following on $(NPCl_2)_3$?

(a) Excess of ammonia and

(b) Potassium alkoxide. 5

OR

(C) What is Silicone rubber ? Give any three uses of Silicone rubber. 2½

(D) What are Linear Silicones ? Give a method of preparation of Linear Silicones. 2½

(E) What is the action of following on $(NPCl_2)_3$?

(i) Benzene in presence of $AlCl_3$ and

(ii) Boiling water. 2½

(F) Draw the structure of $(NPCl_2)_3$ and give any three uses of phosphonitric halides. 2½

5. Solve any **TEN** of the following :—

(i) Define crystal field stabilization energy.

(ii) Draw crystal field splitting diagram of d^2 system in tetrahedral field.

(iii) State Laporte's selection rule.

(iv) Which of the following CFT configuration will show orbital contribution to magnetic moment ?

(a) $t_{2g}^{\ 2}\, eg^o$

(b) $e^2\ t_2^{\ o}$.

(v) What are inert complexes ?

(vi) What are Penetration complexes ?

(vii) Define molar extinction coefficient and give its units.

(viii) Calculate the % T for 0.5 absorbance.

(ix) Define :—

(a) Rf value and

(b) Elution.

(x) Give any two uses of Silicones.

(xi) What is the action of heat on $(NPCl_2)_3$?

(xii) Give one reaction to prove that phosphonitrilic halides are Lewis bases. 1×10=10