F521

Dual Degree B.Sc. (Hons.) Chemistry-M. Sc. Chemistry
EXAMINATION, 2020

(Sixth Semester)

(Main Only)

INORGANIC CHEMISTRY-VI

DCH302

Time : 3 *Hours*]   [*Maximum Marks :* 75

Before answering the question-paper candidates should ensure that they have been supplied to correct and complete question-paper. No complaint, in this regard, will be entertained after the examination.

Note : The question paper will consist of nine questions. The candidates will be required to attempt *Five* questions in all. Q. No. **1** will be compulsory and comprising short answer type questions spread over the whole syllabus. The candidates shall attempt *four* more questions selecting *one* question from each Unit. All questions carry equal marks.

1. (i)   Draw the structure of nickel dimethylglyoxime complex.   **2**

   (ii)   How do coordination compounds differ from double salts ?   **2**

   (iii) Cu(I) is diamagnetic whereas Cu(II) is paramagnetic. Why ?   **2**

   (iv)   Define crystal field stabilization energy.   **2**

   (v)   What is log β ? How is it related to stability of complexes ?   **2**

   (vi)   What are inert and labile complexes ?   **2**

   (vii) Derive states for d^2 configuration.   **2**

   (viii) Determine the term symbol for s^1p^1.   **1**

Unit I

2. (a) On the basis of valence bond theory how will you explain that $[CoF_6]^{3-}$ is paramagnetic whereas $[Co(NH_3)_6]^{3+}$ is diamagnetic. **8**

   (b) What are Isomers ? Give one example of each type of isomerism in coordination compounds. **7**

3. (a) List the basic postulates of Werner's theory of coordination. How does the theory account for the ionic behaviour of the compounds $CoCl_3.5(NH_3)$ and $CoCl_3.4(NH_3)$? **12**

   (b) Why $K_4[Fe(CN)_6]^{4-}$ is not toxic whereas KCN is highly toxic ? **3**

Unit II

4. (a) Describe salient features of crystal field theory and explain the crystal field splitting in octahedral complexes. **10**

   (b) Give the limitations of valence bond theory. **5**

5. (a) Explain the factors that affect the magnitude of crystal field splitting energy. **8**

   (b) Calculate the CFSE for the following cases : **4**
      (i) $[Cr(H_2O)_6]^{3+}$
      (ii) $[FeCl_4]^-$
      (iii) $[TiF_6]^{3-}$
      (iv) $[Co(NH_3)_6]^{3+}$

   (c) Why Δ_t is smaller value as compared to Δ_0 ? **3**

Unit III

6. (a) Derive relationship between stepwise stability constants and overall stability constants. **8**

   (b) $NiCl_4^{2-}$ is thermodynamically stable but kinetically labile. Discuss. **3**

   (c) Explain the stability of complexes with respect to nature of metal ion. **4**

7. (a) Write down the mechanism of nucleophilic substitution in square planar complexes. **7**

(b) Explain with examples, how stability of a complex is increased by chelation. **8**

Unit IV

8. (a) What are Orgel diagrams ? Draw and discuss the Orgel diagram for $[Cu(H_2O)_6]^{2+}$ ion. **9**

(b) Calcualte microstates for the following terms : **3**

(i) d^1

(ii) d^4

(iii) p^3

(b) The complex ion $[Ti(H_2O)_6]^{3+}$ absorbs at 5000 Å. Calculate Δ_o for this absorption. **3**

9. (a) State and explain selection rules of electronic spectra. **8**

(b) Describe vibronic coupling with examples. **4**

(c) Why tetrahedral complexes of Mn(II) are more intensely coloured than the octahedral complexes of Mn(II) ? Explain. **3**