SH-V/CHEM-501/C-11/19

B.Sc. 5th Semester (Honours) Examination, 2019-20

CHEMISTRY

Course ID : 51411 **Course Code : UG/CHEM-501/C-11**

Course Title: Inorganic Chemistry (IV)

Time: 1 Hour 15 Minutes **Full Marks: 25**

The figures in the right hand side margin indicate marks.

Candidates are required to give their answers in their own words as far as practicable.

1. Answer *any five* questions: 1×5=5

(a) Give an example of each for MLCT and LMCT transition.

(b) Find out the Russel-Saunder's ground state term symbol for Mn(IV).

(c) What is the $\mu_{s.o.}$ of $[Cr(H_2O)_6]^{3+}$?

(d) Calculate the CFSE of a high spin octahedral d^5 system.

(e) What is the significance of Racah parameters?

(f) Which parameters are plotted in an orgel diagram?

(g) Mention two consequences of lanthanide contraction.

(h) Write down the outer electronic configuration of the *nf* elements.

2. Answer *any two* questions: 5×2=10

(a) (i) Compare the magnetic behaviour of $[Co F_6]^{3-}$ with that of $[Co(CN)_6]^{3-}$ on the basis of CFT.

(ii) Lanthanide elements show the common stable oxidation state of + 3 — comment. 3+2=5

(b) (i) CrF_2 and MnF_2 both have a central metal ion surrounded by Six F^- ligands. The $Mn - F$ bond lengths are equidistant, but four of the $Cr - F$ distances are long and two are short. Provide an explanation.

(ii) What do you mean by magnetic super exchange? 3+2=5

(c) (i) Discuss the spectral properties of lanthanoids and compare them with those of the d-block metals.

(ii) What are the factors that affect the magnitude of crystal field splitting? 3+2=5

(d) (i) Explain when Δ and CFSE are zero.

(ii) $MnSO_4$ is pale but $KMnO_4$ has a deep colour — explain.

(iii) Write down the electronic configuration of Gd^{3+}. 2+2+1=5

3. Answer *any one* question: 10×1=10

(a) (i) $[Zn(CN)_4]^{2-}$ is tetrahedral but $[Ni(CN)_4]^{2-}$ is square planar — why?

(ii) Tetrahedral low spin complexes are rare — explain.

(iii) Why OH^- ion is in lower position than H_2O in spectrochemical series.

(iv) A light pink aqueous Co(II) chloride solution becomes deep blue on addition of excess HCl. Account for the fact.

(v) Write down the selection rules for electronic transitions. 2+2+2+2+2=10

(b) (i) Explain the principle involved in the separation of individual lanthanides by ion-exchange technique.

(ii) State two limitations of Valence Bond Theory.

(iii) Why the d-orbital splitting diagram is reversed in tetrahedral and octahedral fields?

(iv) Magnetic moment of copper (II) acetate dihydrate is less than expected — why?

(v) 'Ni(II) forms tetrahedral and octahedral complexes respectively with ligands such as Cl^- and NH_3 but Pd(II) and Pt(II) form square planar complexes with both the ligands' — Explain.

2+2+2+2+2=10

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