UNIVERSITY OF NORTH BENGAL

B.Sc. Honours 4th Semester Examination, 2021

CC8-CHEMISTRY

INORGANIC

Full Marks: 40

ASSIGNMENT

The figures in the margin indicate full marks.
All symbols are of usual significance.

Answer any *four* questions of the following 10×4 = 40

1. (a) A bidentate ligand forms a more stable complex than a monodentate ligand of similar nature. Explain. $2\frac{1}{2}$

   (b) $[CoF_6]^{3-}$ is paramagnetic whereas $[Co(CN)_6]^{3-}$ is diamagnetic. Explain the data using valence bond approach. $2\frac{1}{2}$

   (c) The complex compounds $Co(en)_2(NO_2)_2Cl$ has been prepared in a number of isomeric forms. One form undergoes no reaction with $AgNO_3$ or en. The second form reacts with $AgNO_3$ but not with en. The third form reacts both with $AgNO_3$ and en. Identify each form with proper arguments and write their IUPAC names. 3

   (d) What are flexidentate ligands? Give example. 2

2. (a) Discuss the splitting of *d* orbitals in an octahedral field with proper diagram. 4

   (b) Predict which of the following pair will have greater splitting energy. Give reason: 3

   (i) $[Co(NH_3)_6]^{3+}$ and $[Co(NH_3)_6]^{2+}$

   (ii) $[V(H_2O)_6]^{2+}$ and $[Cr(H_2O)_6]^{3+}$

   (c) Calculate CFSE (in Δ_0) for d^4 system in tetrahedral field. 2

   (d) Calculate the magnetic moment of $K_3[Fe(CN)_6]$ in Bohr Magneton unit. 1

3. (a) State the criteria for essential elements. 2

   (b) The metal ion present in oxyhaemoglobin and deoxyhaemoglobin is different magnetically. Explain. 3

   (c) What is Bohr effect? 2

   (d) Discuss the role of metal chelates in medicine. Give three examples. 3

4. (a) Why do transition elements exhibit variable oxidation states? 2

   (b) Discuss the catalytic properties of transition elements. 3

   (c) Why do lanthanides exhibit common oxidation state of +3? 2

   (d) The electronic absorption spectra of tripositive lanthanide ions give rise to multiple sharp peaks. Explain. 3

5. (a) Square planar complexes do not show optical isomerism. Explain. 3

   (b) What is Jahn-Teller distortion? Which of the following ions will suffer Jahn-Teller distortion and Why: High-spin Co(III) in octahedral ligand field and low-spin Fe(II) in octahedral ligand field. 1+2

   (c) Usually the first series transition metals are found in different metalloproteins and metalloenzymes. Which factor is mainly responsible for this natural selection? 2

   (d) Name two metalloenzymes which contain zinc. 2

6. (a) Discuss lanthanide contraction giving causes and its consequences. 3

   (b) Explain why magnetic properties of lanthanides are different from those of transition metals. 3

   (c) Write down the formula of the following compounds: 2

      (i) ammonium bis(oxalato) oxoanadate (IV)

      (ii) potassium ammine dicyano dioxo peroxo chromate (VI)

   (d) What is a spectrochemical series? 2

7. (a) Discuss the aqueous chemistry of manganese in different oxidation states. 4

   (b) Write down the differences between lanthanides and actinides. 3

   (c) Mention the role of Ca^{2+} and Mg^{2+} in biological systems. 3

8. (a) CFT is not applicable to main group metals. Explain why? 2

   (b) $K_2[NiCl_4]$ is paramagnetic whereas $K_2[PtCl_4]$ is diamagnetic although both Ni(II) and Pt(II) are d^8 ions. Explain using CFT approach. 3

   (c) Compounds of transition metals are generally coloured. Explain. 3

   (d) What is tetragonal distortion? Give an example of tetragonally distorted octahedral complex. 1+1

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