(6 pages)

5555/MC5 **MAY 2006**

INORGANIC CHEMISTRY — II

Time : Three hours Maximum : 100 marks

Answer ALL questions.

UNIT I

1. (a) Calculate the spin-only magnetic moment for $[V(H_2O)_6]^{3+}$. Is there any orbital contribution. Explain. (2)

(b) Bring out the significance of spectrochemical series. (2)

2. (a) What are spinels? Classify Fe_3O_4 and Mn_3O_4 into normal or inverted spinel? Give reason. (6)

Or

(b) What do you mean by 'stabilization of unusual oxidation states by complex formation'? Illustrate by giving Cu, Co, and Cv complexes. (6)

15. (a) (i) Describe the concept of electron

3. (a) Give the MO energy level diagram for $[Co(CN)_6]^{3-}$ and $[CoF_6]^{3-}$ and discuss. (10)

Or

(b) (i) Describe the electronic configuration of FeF_6^{3-} and $[Fe(CN)_6]^{3-}$ in terms of VBT and CFT. (5)

(ii) Cu^{2+} is stable in tetragonal field, whereas Au^{2+} disproportionate into Au (I) and Au (III) — Explain. (5)

UNIT II

4. (a) Illustrate template effect with an example. (2)

(b) The formation of $[Cu(en)_3]^{2+}$ is not observed in solution. (2)

5. (a) Distinguish between S_N2 and S_N1CB mechanisms for the acid hydrolysis of Co (III) complexes. (6)

Or

(b) Give the structure of carboxypeptidase A. Describe how it is involved in the mechanism for the hydrolysis of a peptide. (6)

6. (a) Obtain a relationship between overall and stepwise formation constant of a complex. Describe Job's method for the determination of the formation constant for $[Cu(NH_3)_4]^{2+}$. (10)

Or

(b) Compare inner and outer sphere electron transfer reaction mechanisms. (10)

UNIT III

7. (a) Comment on the structure of $[HFe_3(CO)_{11}]^-$. (2)

(b) Arrange cobaltocene, ferrocene and nickelocene in the decreasing order of their stabilities. Justify your answer. (2)

8. (a) Explain the catalytic mechanism of Ziegler-Natta catalyst for the polymerisation of propylene. (6)

Or

(b) Write a brief note on bipyridyl and dithiolene complexes. (6)

9. (a) (i) What is fluxional behaviour? How will you study it? (5)

(ii) Comment on the structure of Zeiese's salt. (5)

Or

(b) (i) Illustrate the application of In spectroscopy in the study of Metal carbonyls and nitrosyls. (5)

(ii) Discuss the catalyst cycle of hydroformylation using Co metal catalyst. (5)

UNIT IV

10. (a) Comment on the XPS of O_2 molecule. (2)

(b) Compare the colour of Mn (II) complexes with that of $[MnO_4]^{-1}$ and explain. (2)

11. (a) Arrange $K_4[Fe(CN)_6]$, $K_3[Fe(CN)_6]$, $K_3[Fe(CN)_5(NH_3)]$ and $Na_2[Fe(CN)_5(NO)]$ in the increasing order of their isomer shifts. Justify your answer. (6)

Or

(b) What are micro states? Deduce all the micro states for nd^2 system. (6)

12. (a) What are Orgel and TS diagrams? Describe the electronic spectrum of octahedral Ni (II) complexes. The electronic spectrum of $[Ni(NH_3)_6]^{2+}$ shows bands at 10750 cm^{-1} and 17500 cm^{-1}. Calculate the values of B', β and 10 Dq. Also, calculate the frequency of the third transition. Given that B for free Ni (II) is 104500 cm^{-1}. (10)

Or

(b) Write notes on :

(i) Auger emission spectroscopy.

(ii) MB spectra of high and low spin Fe (II) and Fe (III) octahedral complexes. (10)

UNIT V

13. (a) Distinguish between pyroxenes and amphiboles. (2)

(b) Illustrate hetero catenation with an example. (2)

14. (a) Discuss the bonding in $N_3P_3Cl_6$. Mention two applications of phosphazenes. (6)

Or

(b) Discuss the structure of 12-phosphomolybdic acid. (6)

15. (a) (i) Describe the concept of electron deficiency by citing B_4H_{10} as an example. (5)

(ii) How is S_4N_4 prepared? Describe its properties and structure. (5)

Or

(b) Write notes on :

(i) Zeolites and molecular sieves.

(ii) Carborates. (10)