



EASERN UNIVERSITY, SRI LANKA

SECOND EXAMINATION IN SCIENCE – PROPER

EXTERNAL DEGREE

FIRST SEMESTER 2002-2003 (OCTOBER 2006)

EXTCH 201 COORDINATION CHEMISTRY AND GROUP CHEMISTRY

Time allowed: **ONE Hour**

Candidate must NOT start writing their answers until told to do so

You may find the following data useful

Avagadro constant (N_A): $6.023 \times 10^{23} \text{ mol}^{-1}$

Electron charge (e): $1.602 \times 10^{-19} \text{ C}$

Faraday constant (F): $9.648 \times 10^4 \text{ Cmol}^{-1}$

Gas constant (R): $8.314 \text{ JK}^{-1}\text{mol}^{-1}$

Planck's constant (h): $6.626 \times 10^{-34} \text{ Js}$

Rest mass of electron (m_e): $9.1 \times 10^{-31} \text{ kg}$

Velocity of light (c): $3 \times 10^8 \text{ ms}^{-1}$

Atomic number of Chlorine-17, Florine-9, Iodine-53

The use of a non-programmable calculator is permitted

1) a) Give IUPAC names for the following compounds.

- i) $[\text{Al}(\text{OH})(\text{H}_2\text{O})_5]^{2+}$
- ii) $[\text{Co}(\text{ONO})(\text{NH}_3)_5] \text{SO}_4$
- iii) $\text{K} [\text{PtCl}_3(\text{C}_2\text{H}_4)]$
- iv) $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$
- v) $[(\text{NH}_3)_5\text{-Cr-OH-Cr}(\text{NH}_3)_5]\text{Cl}_2$

(35 marks)

b) Draw the geometrical isomers of the following

- i) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
- ii) $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^+$

Which of the above isomers are optically active? Draw the mirror images for each optically active isomer.

(20 marks)

c) i) What are the main assumptions made in crystal field theory?

(05 marks)

ii) Discuss the crystal field splitting of d-orbitals that arise from a square planar arrangement of ligands.

(15 marks)

iii) Deduce the crystal field splitting of d-orbitals for a linear ML_2 complex (Assume that the ligands in the linear complex are along the Z-axis).

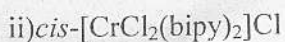
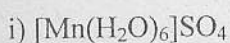
(25 marks)

2) a) A metal with d^4 configuration has an electron pairing energy of 62.3 kJ mol^{-1} . It forms octahedral complexes MA_6 and MB_6 with 2 different ligands A and B. The Crystal Field Splitting Energies of these two compounds obtained from spectral data are 126.0 and 42.3 kJ mol^{-1} respectively.

- i. Deduce the spin configuration of each complex (MA_6 and MB_6)
- ii. Calculate the crystal field stabilization energies of MA_6 and MB_6 complexes.

(20 marks)

b) Give the oxidation state, d-orbital occupation, coordination number and expected magnetic moment (spin only) of the central metal ion in the following complexes.



(16 marks)

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c) i) Most of the ionic and covalent compounds of transition elements are strongly coloured but compounds of S and P block elements are white or not strongly coloured. Explain this.

(20 marks)

ii) Briefly describe the structures of IF_6 and ClF_3 .

(24 marks)

iii) Give the properties in which lithium resembles to magnesium (at least five).

(20 marks)

End