EASTERN UNIVERSITY, SRI LANKA.

SECOND EXAMINATION IN SCIENCE 2005/2006 - PROPER
FIRST SEMESTER (AUG/SEPT 2007)
CH 201 COORDINATION CHEMISTRY AND MAIN GROUP CHEMISTRY

Time allowed: **ONE Hour**

Answer all the questions

The use of a non-programmable calculator is permitted

You may find the following data useful.

(Atomic no – Cr – 24, Mn – 25, Fe – 26, Co – 27, Ni – 28, Cs – 55)

1) a) Write down the systematic name of each of the following complexes and indicate the coordination number, oxidation state, electronic configuration and magnetic moment of the central ion.

i) $[Cr(NH_3)_3(H_2O)_3]Cl_3$
ii) $[Co(H_2O)_6]^{3+}$
iii) $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$
iv) $Cs[FeCl_4]$

(40 marks)

b) A pink solid has the molecular formula $CoCl_3.5NH_3.H_2O$. A solution of this salt is also pink and rapidly gives 3 moles of AgCl on titration with $AgNO_3$. When the pink solid is heated, it loses one mole H_2O and give a purple solid with the same ratio of NH_3: Cl: Co as in the pink solid. Deduce the structures of pink and purple solids

(15 marks)

c) i) Draw the crystal field splitting of 'd' orbitals for $[Co(NH_3)_6]^{3+}$.

ii) What happens to the 'd' orbital splitting pattern when the two ligands along the z-axis are removed.

iii) What is the crystal field stabilization energy (CFSE) for the following systems?

a) d^1 octahedral
b) d^5 low spin octahedral
c) d^5 high spin octahedral

(45 marks)

Turn over

2) a) The complex ion $[Ni(CN)_4]^{2-}$ was found to be diamagnetic while the complex ion $[NiCl_4]^{2-}$ was found to be paramagnetic with a magnetic moment of 2.9 BM. Deduce the structure of each of the complexes using Valence Bond Theory.

(20 marks)

b) Explain, giving examples, the following terms as used in coordination chemistry.

i) Jahn-Teller effect
ii) Linkage isomerism

(30 marks)

c) I) Write down the general properties of group VII^A elements

(20 marks)

ii) Outline five important similarities between F and O.

(15 marks)

iii) Outline five properties in which H resembles halogens.

(15 marks)

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