KABARAK UNIVERSITY

EXAMINATIONS

2008/2009 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **CHEM 321**

COURSE TITLE: **CO-ORDINATION CHEMISTRY**

STREAM: **SESSION VI**

DAY: **FRIDAY**

TIME: **2.00-4.00 P.M.**

DATE: **28/11/2008**

INSTRUCTIONS:

Answer ALL questions in sections

PLEASE TURN OVER

1. (a) Write the electron configuration of the following atoms;

(i) Sc (ii) Co (iii) Cu (iv) Zn

[Atomic numbers; Sc = 21, Co = 27, Cu = 29 and Zn = 30] [4 marks]

(b) Briefly explain why Zn is not considered as transition elements. [1 mark]

(c) Draw diagram of the five *d*-orbitals indicating clearly the distribution of their electron densities with respect to x, y and z – axes. [2.5 marks]

2. (a) Explain the main postulates of Werner's theory of co-ordination compounds.[4 marks]

(b) Study the table below showing properties of Cobalt ammonate chlorides and answer the questions that follow;

Compound	Number of Particles determined by cryscopic measurements	Molar conductance Λ_m $Ohm^{-1}cm^2$
$CoCl_3.6NH_3$	4	390
$CoCl_3.5NH_3$	3	262
$CoCl_3.4NH_3$	2	102
$CoCl_3.3NH_3$	1	0

(i) Account for the above experimental observation using Werner's theory of co-ordination compounds [4 marks]

(ii) Calculate the E.A.N of cobalt in the compound above

[Atomic number of Co = 27] [1 mark]

3. (a) Write short notes on the following terms as applied in co-ordination chemistry;

(i) Hard acids (ii) Spectrochemical series (iii) Back-bonding [6 marks]

(b) Give the I.U.P.A.C names of the following compounds:

(i) $[Co(en)_2Cl(NO_2)Cl$ (ii) $[Cu(NH_3)_4][PtBr_4]$ (iii) $K[PtNH_3Cl_5]$

(iv) $[Zn(NH_3)_4)SO_4$ (v) $[(NH_3)_4Co(NH_3)_4]NO_3$ [5 marks]

(c) Draw the structures of the following ligands and indicate clearly the donor atoms;

(i) Trien (ii)EDTA (iii) peroxo (iv) thiocynato [4 marks]

(d) Distinguish between;

(i) chelating and bridging ligands (ii) ambidentate and polydentate ligands.

[4 marks]

4. a) Using examples, discuss the following types of isomerism in co-ordination compounds;

(i) co-ordination position isomerism (ii) geometric isomerism (iii) ligand Isomerism

[6 marks]

(b) **State** and **explain** three factors that determine the magnitude of crystal field splitting in co-ordination compounds. [6 marks]

5. (a) The complex $[Fe(CN)_6]^{3-}$ is paramagnetic with one unpaired electron. Account for the bonding in this complex using the following bonds theories.

[Atomic number of Fe = 26]

(i) Valence bond theory

(ii) Crystal field theory

(iii) Molecular orbital theory [10 marks]

(b) State two advantages and two disadvantages of the molecular orbital theory over crystal field theory . [4 marks]

(c) Account for the following observations;

(i) $[Ti(H_2O)_6]^{3+}$ is coloured but $[Sc(H_2O)_6]^{3+}$ is not.

(ii) $[MnF_6]^{4-}$ has a perfect octahedral geometry while $[CoF_6]^{4-}$ is tetragonal

(iii) Transition elements form complexes

[Atomic number; Sc = 21, Ti = 22, Co = 27 and Mn = 25] [9 marks]