



EMBU UNIVERSITY COLLEGE
(A CONSTITUENT COLLEGE OF THE UNIVERSITY OF NAIROBI)

FIRST SEMESTER EXAMINATIONS 2014/2015

THIRD YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SCH 301: COORDINATION CHEMISTRY

DATE: DECEMBER 16, 2014

TIME: 10:30AM – 12:30PM

INSTRUCTIONS:

Answer question ONE and ANY Other TWO Questions

QUESTION ONE

- a) Give the meaning of the following terms applied in coordination chemistry.
- i) Lanthanide contraction
 - ii) Polarizing power
- (4 marks)
- b) State the systematic names the following Coordination compounds
- i) $\text{Ni}(\text{CO})_4$
 - ii) $[\text{Mn}(\text{NH}_3)_6]\text{Cl}_2$
- (4 marks)
- c) Identify the five arrangements through which coordination compounds are formed. (5 marks)
- d) Draw and name a coordination compound of iron where the iron atom is a sandwich. (4 marks)
- e) Explain one of the biological importances of coordination complexes of Fe. (5 marks)
- f) Predict the no. of unpaired electrons, the spin-only magnetic moments at 25° C for each of the following.
- i) $[\text{Fe}(\text{CN})_6]^{4-}$

ii) $[\text{Ru}(\text{NH}_3)_6]^{3+}$ (4 marks)

g) What is the coordination number of the Fe and Au atoms in;

i) $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$

ii) $\text{K}[\text{Au}(\text{CN})_2(\text{SCN})_2]$ (4 marks)

QUESTION TWO

a) Calculate the oxidation state of the metal and the number of d electrons in the following coordination complexes:

i) $[\text{CoCl}_4]^{2-}$

ii) $[\text{Fe}(\text{bpy})_3]^{3+}$

iii) $[\text{Cu}(\text{ox})_2]^{2-}$

iv) iv) $[\text{Cr}(\text{CO})_6]$ (12 marks)

b) Draw the structure of the following complexes:

i) *trans*-diaquadichloroplatinum (II)

ii) ii) diamminetetra(isothiocyanato)chromate (III) (4 marks)

c) Explain any two factors that affect the stability of co-ordination complexes. (4 marks)

QUESTION THREE

a) Using chemical equations explain how the preparations below are carried out;

i) $\text{K}_3[\text{Rh}(\text{ox})_3]$ from kinetically inert $\text{K}_3[\text{RhCl}_6]$

ii) Inert $[\text{Cr}(\text{en})_3]\text{Cl}_3$ from inert $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ (8 marks)

b) Explain using an example what is meant by macrocyclic effect (4 marks)

c) Predict the number of unpaired d electrons and the magnetic moments at 25°C for each of the following

i) $[\text{Ni}(\text{CN})_6]^{4-}$

- ii) $[\text{Ru}(\text{H}_2\text{O})_6]^{3+}$
iii) $[\text{Cr}(\text{NH}_3)_6]^{2+}$
iv) $[\text{EuCl}_6]^{4-}$ (8 marks)

QUESTION FOUR

- a) Name and draw structures of the following complexes:
- i) $[\text{Ni}(\text{CO})_4]$
ii) $[\text{Ni}(\text{CN})_4]^{2-}$
iii) $[\text{CoCl}_4]^{2-}$
iv) $[\text{Ni}(\text{NH}_3)_6]^{2+}$. (12 marks)
- b) Draw the possible stereoisomers of octahedral $[\text{Mn}(\text{H}_2\text{O})_2(\text{ox})_2]^{2-}$ (5 marks)
- c) Explain what you understand by the phrase “organometallic” complex and give an example (3 marks)

QUESTION FIVE

- a) A certain macro coordination molecule is responsible for the green color of plants.
- i) Name the macro molecule (1 mark)
ii) Draw the structure of the molecule (6 marks)
iii) Explain the importance of the molecule (3 marks)
- b) Use the complex $[\text{FeCl}_6]^{4-}$ to answer the questions below
- i) Draw the energy level diagram to show how the d orbital split (4 marks)
ii) Determine the number of unpaired d electrons (2 marks)
iii) Distribute the electrons in the energy level diagram above (2 marks)
iv) Comment on the magnetic properties of the complex (2 marks)

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