



**NATIONAL OPEN UNIVERSITY OF NIGERIA**  
**Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi, Abuja**

FACULTY OF SCIENCE

2016\_2 EXAMINATION

COURSE CODE: CHM 423

COURSE TITLE: COORDINATION CHEMISTRY

COURSE UNIT: 3 Units

TIME: 2 hours

INSTRUCTION: Answer any Five (5) questions

Q1.

- a) State Alfred Werner's findings and conclusions as regards coordination Chemistry (4 marks)
- b) State the primary and secondary valencies as well as the possible shape of these coordination complexes: (4 marks)
- i)  $K_4[Fe(CN)_6]$
  - ii)  $[Ag(NH_3)_2]Cl$
  - iii)  $[Co(NH_3)_4Cl_2]Cl$
  - iv)  $[Cu(H_2O)_6]^{2+}$
- c) Define the following terms: (3 marks)
- i) Ligands
  - ii) Homoleptic and heteroleptic complexes
- d) Describe three applications of coordination compounds (3 marks)

Q2

- a) Write the structure of these coordination compounds. (3 marks)
- i) trans- diaminedichloroplatinum (II)
  - ii) tetraammineplatinum(II) tetrachloroplatinate(II).
  - iii) dichlorobis(ethylenediamine)cobalt(III) ion.
- b) Write the IUPAC names of the following coordination compounds. (2 marks)
- i)  $[Cu(NH_3)_4(H_2O)_2]SO_4$
  - ii)  $[Co(H_2NCH_2CH_2NH_2)_2Cl_2]Cl$
- c) Discuss the following methods of metal complex preparation. (9 marks)
- i) Direct reaction

ii) Substitution reaction

iii) Redox reaction

Q3

a) Discuss the limitations of crystal field theory and the factors that affects crystal field splitting (2 ½ marks)

b) i) Differentiate between low spin complexes and high spin complexes according to Valency Bond Theory explanation of magnetic behaviour. (2 marks)

c) State two limitations of valency bond theory. (2 marks)

d) For each of the following complexes, give the hybrid orbital type, shape or structure and classification as inner d- complex or outer d-complex:

( 7 ½ marks)

i)  $[\text{Cu}(\text{CN})_5]^{3-}$  ii)  $[\text{Zn}(\text{Cl})_4]^{2-}$  iii)  $[\text{Ni}(\text{CN})_5]^{3-}$

iv)  $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$  v)  $[\text{Mn}(\text{NO}_2)_6]^{3-}$

Q4

a) State the Lenz's law of magnetism. (2 marks)

b) Describe the following types of magnetic behaviours: (12 marks)

i) Diamagnetism

ii) Paramagnetism

iii) Ferromagnetism

iv) Antiferromagnetism

Q5

a) i. List the 3 factors that affect absorption bands in coordination compounds (1 ½ marks)

ii) State the number of infrared active mode of vibration and their absorption bands of these

complexes:  $[\text{PdCl}_4]^{2-}$ ,  $[\text{MnO}_4]^-$ ,  $[\text{VCl}_6]^{2-}$  (4 ½ marks)

b) What is meant by linkage isomerism. Give an example of ion that exhibits this type of isomerism (3 marks)

c) Explain the different mode of molecular vibration in compounds. (5 marks)

Q6

a) Using the Valence Bond Theory as a guide, outline five ways in which coordination complexes can be formed. (6 marks).

b) Explain the reason that the metal d-orbital splitting pattern in a tetrahedral ligand field is an inversion of that in an octahedral ligand field. (4 marks)

- c) Why is the splitting parameter in the tetrahedral field much smaller than that in an octahedral field. (4 marks)

Q7

- a) Explain these terms and give examples where necessary. ( 10 marks: 2 ½ marks each)

i) Chlate effect

ii) Conjugate Base formation

iii) Ion-pair formation

iv) Geometric isomers

- b) State any four techniques that can be used to monitoring the progress of inorganic reactions. (4 marks)