ALUPE UNIVERSITY COLLEGE
... Bastion of Knowledge...
P. O.Box 845-50400 Busia(K)
principal@auc.ac.ke
Tel: +254 741 217 185
+254 736 044 469
off Busia-Malaba road

OFFICE OF THE DEPUTY PRINCIPAL
ACADEMICS, STUDENT AFFAIRS AND RESEARCH

UNIVERSITY EXAMINATIONS

2020/2021 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER REGULAR EXAMINATION

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: **CHE 318**

COURSE TITLE: **COORDINATION CHEMISTRY**

DATE: 16TH JULY 2021 **TIME: 2 -5 PM**

INSTRUCTION TO CANDIDATES

- **SEE INSIDE**

THIS PAPER CONSISTS OF 4 PRINTED PAGES **PLEASE TURN OVER**

CHE 318

REGULAR - MAIN EXAM

CHE 318: COORDINATION CHEMISTRY

STREAM: BED (Science) **DURATION: 3 Hours**

INSTRUCTIONS TO CANDIDATES

*i. Answer **ALL** questions.*

ii. Diagrams may be used whenever they serve to illustrate the answer.

Question One

a) Give IUPAC names of the following coordination compounds (2 Marks)

i) $[Fe(CN)_6]^{4-}$

ii) $[CuCl_2(CH_3NH_2)_2]$

b) Give the formulae of the following coordination complexes (2 Marks)

i) Tetraamminedibromoplatinum (IV) bromide

ii) Cis-diamminedichloroplatinum (II)

c) Draw the structures of the following complexes and give their possible geometries

i) MnF_6^- (1 Mark)

ii) $[Ag(NH_3)_2]^+$ (1 Mark)

d) Draw the structures of the following ligands indicating clearly the donor atoms:

i) EDTA (1 Mark)

ii) Ethylenediamine (en) (1 Mark)

iii) Pyridine (1 Mark)

iv) CO_3^{2-} (1 Mark)

e) Indicate ALL possible types of isomerism exhibited by the following compounds and give the structures of the isomers

i) $Pt(NH_3)_2Cl_2$ (2 Marks)

ii) $CrCl_3.6H_2O$ (2 Marks)

Question Two

a) The complex ion $[Ni(NH_3)_6]^{2+}$ has two unpaired electrons. Describe the bonding in the complex ion using the following theories

i) Valence bond (3 Marks)

ii) Crystal field (3 Marks)

iii) Molecular orbital (σ-bond only) [Atomic no; Ni =28] (3 Marks)

b) For the complex ions $[Cr(en)_3]^{3+}$, $[MnCl_4]^{2-}$ and $[Cu(H_2O)]^{2+}$; [Atomic no; Cr = 23, Mn = 25, Cu = 29]. Determine,

i) The term spectroscopic symbols of the central metal ions (3 Marks)

ii) μ-spin-only values (3 Marks)

iii) CFSE (3 Marks)

iv) Which complex/complexes will experience Jahn-Teller distortion? Give a reason for your answer (2 Marks)

Question Three

a) Explain the bonding in coordination compounds in terms of Werner's postulates (4 Marks)

b) Explain briefly the meaning of the following terms giving an example in each case;

i) Dissociative reaction mechanism (2 Marks)

ii) Outer orbital complex (2 Marks)

iii) Jahn-Teller distortion (2 Marks)

iv) Charge transfer band (2 Marks)

c) Explain briefly the three rules of an electronic transition (3 Marks)

d) Discuss briefly giving an example in each case-the role of coordination compounds in

i) Biological systems (1 Mark)

ii) Analytical chemistry (1 Mark)

iii) Medicinal chemistry (1 Mark)

Question Four

a) Give the ground state electronic configurations of the following atoms or ions (Atomic no. Cr = 24, Fe = 26, Cu = 29, Ru = 44)

i) Cr (1 Mark)

ii) Fe^{3+} (1 Mark)

iii) Cu (1 Mark)

iv) Ru (1 Mark)

b) Illustrating with an example in each case, briefly describe the basic ideas in the following types of isomerisms in coordination compounds

i) Ionization isomerism (2 Marks)

ii) Coordination isomerism (2 Marks)

iii) Linkage isomerism (2 Marks)

iv) Geometric isomerism (2 Marks)

c) Show how the d orbitals are perturbed in the following fields;

i) Tetrahedral (2 Marks)

ii) Square planar (2 Marks)

iii) Octahedral (2 Marks)

****