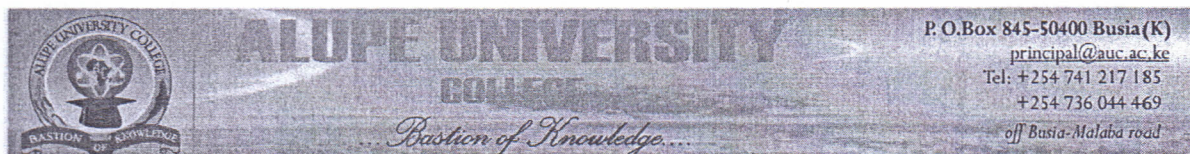


CHE 318



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

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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) $[\text{Fe}(\text{CN})_6]^{4-}$
 - ii) $[\text{CuCl}_2(\text{CH}_3\text{NH}_2)_2]$
- 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) $[\text{Ag}(\text{NH}_3)_2]^+$ (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) $\text{Pt}(\text{NH}_3)_2\text{Cl}_2$ (2 Marks)
 - ii) $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ (2 Marks)

Question Two

- a) The complex ion $[\text{Ni}(\text{NH}_3)_6]^{2+}$ 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 $[\text{Cr}(\text{en})_3]^{3+}$, $[\text{MnCl}_4]^{2-}$ and $[\text{Cu}(\text{H}_2\text{O})]^{2+}$; [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)

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- 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)
