THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

SEPTEMBER –DECEMBER 2021

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

REGULAR PROGRAMME

CHEM 301: COORDINATION CHEMISTRY

Date: DECEMBER 2021	Duration: 2 Hours
INSTRUCTIONS: Answer Question ONE and any TWO Questions	

Q1.

(a).Differentiate between counter and complex ions.   **(4 marks)**

(b).What is a polydentate ligand?   **(2 marks)**

(c). There is valency failure when it comes to explaining the formation of complex

ions. Explain.   **(3 marks)**

(d). What are the two possible geometries/shapes of an ML_5 coordination

compound?   **(4 marks)**

(e).Differentiate between spectrochemical and nephelauxetic series.

          (4 marks)

(f).Explain why the metal-ligand interaction is said to be an acid-base reaction.

          (3 marks)

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(g). Why is crystal field splitting generally greater in octahedral than in tetrahedral complexes? **(4 marks)**

(h). In stepwise mechanisms, the first stepwise stability constant is the largest. Explain. **(3 marks)**

(i). What are transition metals? **(2 marks)**

(j). Given an atomic number of a transition metal, explain how one calculates the value of n in d^n **(3 marks)**

Q2.

(a). Using suitable examples, differentiate between homoleptic and heteroleptic complexes. **(4 marks)**

(b). What is coordination isomerism? **(4 marks)**

(c). Determine the correct hybridization in each of the following:

(i). Tetrahedral geometry

(ii). Square planar geometry

(6 marks)

(d). Explain the meaning of the following special symbols μ, η and K as used in coordination chemistry. **(6 marks)**

Q3.

(a). Using suitable examples, explain the Kepert Model as applied to the determination of shapes of complexes.   **(6 marks)**

(b). Draw a well-labeled б (sigma) only octahedral molecular orbital diagram.

(14 marks)

Q4.

(a). Calculate the number of microstates associated with a d^2 system.   **(3 marks)**

(b). Determine and arrange the free ion terms of a p2 system starting with the least energetic.   **(8 marks)**

(c). Differentiate between allowed and forbidden electronic transitions.   **(4 marks)**

(d). Explain how distortion of molecular geometry or shape affects the arrangement of its molecular orbitals.   **(6 marks)**

Q5.

(a). Explain the derivation of a square planar geometry from an octahedral geometry.   **(6 marks)**

(b).Draw the molecular orbital diagram when the field changes from octahedral to square planar. Start with an octahedral field.   **(8 marks)**

(c). What do you understand by the following terms as applied to coordination Chemistry?

(i). Strong field

(ii). Weak field

(6 marks)

END