40

(University of Choice)

MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY (MMUST)

MAIN CAMPUS

UNIVERSITY EXAMINATIONS

SUPPLEMENTARY/SPECIAL EXAMINATION

2021/2022 ACADEMIC YEAR

THIRD YEAR SECOND SEMESTER EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF SCIENCE (CHEMISTRY) AND BACHELOR OF INDUSTRIAL CHEMISTRY

COURSE CODE: SCH 318

COURSE TITLE: INORGANIC REACTION MECHANISMS OF COMPLEX COMPOUNDS

DATE: 04/08/2022 **TIME:** 8.00-10.00 AM

INSTRUCTIONS TO CANDIDATES

Total Marks: 70

Answer all the Questions

TIME: 2 Hours

QUESTION ONE (18 Marks)

(a) Name the following complex ions/coordination complexes:

(i) $[Ag(NH_3)_2][Ag(CN)_2]$ **(2 marks)**

(ii) $[CoCl_2(en)_2]^+$ **(2 marks)**

(iii) $K_3[Al(C_2O_4)_3]$ **(2 marks)**

(b) (i) Define *trans*-influence **(2 marks)**

(ii) Differentiate between associative and dissociative mechanisms and derive their respective rate laws under steady state approximation **(6 marks)**

(c) Draw the structures of the following compounds:

(i) Optical isomers of *cis*-$[Co(en)_2Cl_2]^+$ **(2 marks)**

(ii) Geometric isomers of $[ML_4X_2]$ **(2 marks)**

QUESTION TWO (18 Marks)

(a) A chelate effect is an entropy factor discuss **(6 marks)**

(b) State any four differences between SN^1reaction and SN^2 reaction **(4 marks)**

(c) With an example of each explain:

(i) Complementary reaction **(2 marks)**

(ii) Non-complementary reaction **(2 marks)**

(d) Explain how polarization theory has a *trans* effect in square planar substitution reactions **(4 marks)**

QUESTION THREE (16 Marks)

(a) Given the complex PtL_3X reacts with nucleophile Y, show the two pathway mechanisms where one is solvent mediated [Y] not in rate determining step and second pathway [Y] involved in rate determining step **(4 marks)**

(b) Explain why octahedral complexes $[Cr(H_2O)_6]^{2+}$ readily undergoes substitution while $[Cr(CN)_6]^{4-}$ is inert to substitution. **(4marks)**

(c) Transition metal complexes undergo ligand substitution reactions by either associative (A) or dissociative (D) mechanisms. Show the reaction mechanism for each of the following reactions

(i) $[PtCl_4]^{2-} + NH_3 \rightarrow [PtCl_3(NH_3)]^- + Cl^-$ (A mechanism) **(2 marks)**

(ii) $[Co(NH_3)_5Cl]^{2+} + H_2O \rightarrow [Co(NH_3)_5H_2O]^{3+} + Cl^-$ (D mechanism) **(2 marks)**

(iii) Using activation parameters like ΔH, ΔS and ΔV show how you will differentiate associative from dissociative mechanism **(4 marks)**

QUESTION FOUR (18 Marks)

(a) Explain how you will distinguish the inner sphere electron transfer reaction from outer sphere electron transfer reaction **(4 marks)**

(b) State two factors that favours dissociative mechanism in octahedral complexes **(2 marks)**

(c) Explain why the electron transfer reaction of $[Fe(CN)_6]^{4-}/[Fe(CN)_6]^{3-}$ is faster than $[Co(NH_3)_6]^{2+}/[Co(NH_3)_6]^{3+}$ **(3 marks)**

(d) State any there applications of coordination complexes **(3 marks)**

(e) Draw the following coordination complexes:

(i) Bis(en)Co(III)-μ-amido-μ-hydroxobis(en)Co(III) **(2 marks)**

(ii) Diaquadiiododinitritopalladium(IV) **(2 marks)**

(iii) Enantiomers of $[Pt(en)_2Cl_2]^{2+}$ **(2 marks)**