



MACHAKOS UNIVERSITY

University Examinations 2018/2019

SCHOOL OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATIONS 2018/2019

SECOND YEAR SECOND SEMESTER EXAMINATION FOR

BACHELOR OF EDUCATION SCIENCE

SCH 301: COORDINATION AND ORGANOMETALLIC CHEMISTRY

DATE: 24/7/2019

TIME: 11:00 – 1:00 PM

INSTRUCTIONS:

ANSWER YOUR QUESTIONS IN ANSWER BOOKLET PROVIDED.

ANSWER QUESTION ONE [COMPULSORY] AND ANY OTHER TWO QUESTIONS.

QUESTION ONE (THIRTY MARKS)

- a. Define the following terms 4 marks
- i. Ligand
 - ii. Coordination sphere
 - iii. Organometallic compound
 - iv. Chelate
- b. Give TWO differences between organometallic and coordination compounds 2 marks
- c. Distinguish between bidentate and polydentate ligands. Give an example of each of these. 4 marks
- d. State THREE factors that favour tetrahedral over octahedral complexes 3 marks
- e. State FOUR factors that affect the stability of coordination complexes 4 marks
- f. Chelated complexes are more stable than non-chelated complexes. Explain 2 marks
- g. Describe how a high-spin complex is formed 4 marks
- h. Give any 3 limitations of valence bond theory (VBT) 3 marks

- i. State the successes and limitations of crystal field theory (CFT) 4 marks

QUESTION TWO (TWENTY MARKS)

- a) Give FOUR examples of Organometallic Compounds of transition metals, their structures and functions 10 marks
- b) With relevant examples, describe any FOUR methods of synthesizing organometallic compounds 10 marks

QUESTION THREE (TWENTY MARKS)

- a. Using the valence bond theory, describe the formation of tetrahedral and octahedral complexes. Clearly show that d^2sp^3 and sp^3d^2 complexes are octahedral. 10 marks
- b. Describe Octahedral Ligand field splitting and discuss THREE factors that affect determines the degree of splitting of the d orbitals 10 marks

QUESTION FOUR (TWENTY MARKS)

- a. Provide the correct names or formulae of the following complexes 8 marks
- i. $K_3[Fe(CN)_6]$
 - ii. $[Co(NH_3)_4SO_4]NO_2$
 - iii. Decammine- μ -amidodicobalt(III) nitrate
 - iv. Pentaquathiocyanatoiron(III) sulfate
- b. Discuss each of the following types of isomerism about coordination complexes. Give relevant examples 12 marks
- i. Geometric or stereoisomerism
 - ii. Linkage isomerism
 - iii. Coordination isomerism
 - iv. Ionization isomerism
 - v. Solvate isomerism

QUESTION FIVE (TWENTY MARKS)

- a. Draw the seven Tanabe-Sugano diagrams corresponding to the configurations $d^2 - d^8$. Give the applications of this kind of diagrams. 12 marks
- b. Describe Crystal Field Splitting in Tetrahedral and Square Planar Complexes 8 marks