



MASINDE MULIRO UNIVERSITY OF SCIENCE AND TECHNOLOGY

(MMUST)

Main CAMPUS

UNIVERSITY EXAMINATIONS

2022/2023 ACADEMIC YEAR

Semester II

THIRD YEAR MAIN EXAMINATION

(BSC Chemistry & Industrial Chemistry)

FOR THE DEGREE

OF

BACHELOR OF SCIENCE IN CHEMISTRY

COURSE CODE: SCH 313

COURSE TITLE: Inorganic Reaction Mechanisms of Complex Compounds

DATE: 27/4/2023

TIME: 3.00 - 5.00 PM

INSTRUCTIONS TO CANDIDATES

Answer all the Questions

Find the attached periodic table

TIME: 2 HOURS

MMUST observes ZERO tolerance to examination cheating

Question One (19 Marks)

1. (a) Differentiate between the following terms that are used to describe the types of Metal complex reactions
- Associative interchange mechanism and Dissociative interchange mechanism. (4 Marks)
 - Inert and Labile metal complex (2 Marks)
 - Trans effect and Polarization theory for ligand substitution in square planner (5 marks)
- (b) State and explain the types of reactions shown? (8 Marks)
- $[\text{Co}(\text{H}_2\text{O})_6]^{2+} + \text{Cl}^- \rightarrow [\text{CoCl}(\text{H}_2\text{O})_5] + \text{H}_2\text{O}$
 - $10\text{FeSO}_4 + 2\text{KMnO}_4 + 8\text{H}_2\text{SO}_4 \rightarrow \text{K}_2\text{SO}_4 + 2\text{MnSO}_4 + 5\text{Fe}_2(\text{SO}_4)_3 + 8\text{H}_2\text{O}$ (Hint, for Fe complex)
 - $[\text{Cu}(\text{H}_2\text{O})_4]^{2+} + 4\text{NH}_3 \rightarrow [\text{Cu}(\text{NH}_3)_4] + 4\text{H}_2\text{O}$
 - $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_2 + 6\text{NH}_3 \rightarrow [\text{Co}(\text{NH}_3)_6]\text{Cl}_2 + 6\text{H}_2\text{O}$
 - $\text{MnO}_2 + 4\text{HCl} \rightarrow \text{MnCl}_2 + \text{Cl}_2 + 2\text{H}_2\text{O}$
 - $2\text{MnO}_4^- + 10\text{Cl}^- + 16\text{H}^+ \rightarrow 2\text{Mn}^{2+} + 5\text{Cl}_2 + 8\text{H}_2\text{O}$
 - $[\text{Co}(\text{H}_2\text{O})_6]\text{Cl}_2 \rightarrow 6\text{H}_2\text{O} + \text{CoCl}_2$
 - $[\text{Fe}(\text{CN})_6]^{4-} + [\text{IrCl}_6]^{2-} \rightarrow [\text{Fe}(\text{CN})_6]^{3-} + [\text{IrCl}_6]^{3-}$

Question Two (17 Marks)

2. (a). Arrange the following octahedral complexes in order of their ligand exchange rates (8 Marks)
- $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Ir}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Rh}(\text{H}_2\text{O})_6]^{2+}$,
 - $[\text{AlF}_6]^{3-}$, $[\text{PF}_6]^-$, SF_6 , $[\text{Na}(\text{H}_2\text{O})_n]^+$, $[\text{Mg}(\text{H}_2\text{O})_n]^{2+}$, $[\text{Al}(\text{H}_2\text{O})_6]^{3+}$, $[\text{SiF}_6]^{2-}$
 - $[\text{Ca}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Sr}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Rn}(\text{H}_2\text{O})_6]^{2+}$, $[\text{Mg}(\text{H}_2\text{O})_6]^{2+}$,
 - Give reasons for your order of arrangement for i. and for ii, iii above (4 Marks)
 - $[\text{Ni}]^{2+} + 6 \text{NH}_3 \rightleftharpoons [\text{Ni}(\text{NH}_3)_6]^{2+}$ and $[\text{Ni}]^{2+} + 3 \text{en} \rightleftharpoons [\text{Ni}(\text{en})_3]^{2+}$ (2 Marks)
 - Give reasons for your choice for iv above (3 marks)

(b) Between Tetrahedral geometry and Square planar geometry complexes, which geometry can give rise to geometrical isomers? Give reason for your answer. (3 Marks)

(c). Pentaaminebromo cobalt (III) Sulphate and Pentaaminesulphato cobalt (III) bromide are each separately dissolved in water. (8 marks)

i. Explain how a student will differentiate these two isomers in the laboratory.

ii. Explain giving reasons for your choice experiment.

(d) Isomer which rotates the plane polarized light to the right is called dextro rotatory (d-form) and the isomer which rotates the plane polarized light to the left is called laevorotatory (l-form). You are given a (Mabcdef) type complex: $\text{PtpyNH}_3\text{NO}_2\text{ClBrI}$. Sketch or draw to differentiate the d-form and l-form for the complex

$\text{PtpyNH}_3\text{NO}_2\text{ClBrI}$. (4 Marks)

-----**Total 70 Marks**-----

