



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

A. M. E. C. E. A

MAIN EXAMINATION

AUGUST - DECEMBER 2016 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

REGULAR PROGRAMME

**CHEM 400: DESCRIPTIVE INORGANIC CHEMISTRY OF TRANSITION
ELEMENTS**

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Date: DECEMBER 2016

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

- Q1. a) i) How would you locate the transition metals in the periodic table?
(4 marks)
- ii) Explain why the transition metals are harder, with melting and boiling points higher than those of Group 1 and 2 metals?
(4 marks)
- iii) Describe the structural similarity that determines the metallic character of transition elements.
(4 marks)
- b) i) Copper (ii) sulfate crystals are blue. To what colour does the light energy absorbed by crystals correspond?
(4 marks)
- ii) Distinguish between a polyatomic ion and complex ion.
(4 marks)
- c) Explain three differences between transition metals and main group elements.
(6 marks)

d) Predict the electron configuration of

(i) CO^{2+} and CO^{3+} ($\text{CO}=27$)

(ii) Fe^{2+} and Fe^{3+} ($\text{Fe} = 26$)

(4 marks)

Q2. a) There are two isomers for the $\text{Co}(\text{NH}_3)_4\text{Cl}_2^{4+}$ complex ion. Sketch and label them.

b) State four factors that determine the magnitude of energy ΔE **(4 marks)**

c) Briefly discuss the following with regard to the first transition series

i) Density **(4 marks)**

ii) Melting point and Boiling point **(4 marks)**

d) List five points of similarity among copper, silver and gold.

(4 marks)

Q3. a) Write an account of the lanthanides and actinides for each series

a) Indicate the position on the periodic table, range of elements and the sublevel being filled with electrons

b) Four properties of each series

c) Two uses of each series

d) Impact on the environment. **(20 marks)**

Q4. a) Describe the extraction of titanium from the Kroll process. **(10 marks)**

b) State five uses of titanium. In each case state the physical property for each use indicated.

Q5. a) Copper ii ions are blue MnO_4^- is purple. TCO^- is dark red and REO_T is white. Explain why these colours vary in the manner observed.

(10 marks)

b) Copper, silver and Gold sub-group have an electronic configuration of $(n-1)d^{10} ns^1$. This is unlike that of alkali metals. Why then the chemical properties of these elements different? **(10 marks)**

END