



THE CATHOLIC UNIVERSITY OF EASTERN AFRICA

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MAIN EXAMINATION

MAY – JULY 2016 TRIMESTER

FACULTY OF SCIENCE

DEPARTMENT OF CHEMISTRY

SCHOOL FOCUSED PROGRAMME

CHEM 400: DESCRIPTIVE CHEMISTRY OF TRANSITION ELEMENTS

Date: JULY 2016

Duration: 2 Hours

INSTRUCTIONS: Answer Question ONE and ANY OTHER TWO Questions

- Q1. a) Given the following configuration of the following
- i Cr (Cr = 24)
 - ii Zr (Zr = 40)
 - iii Ag^+ (Ag = 47) **(3 marks)**
- b) i Sketch the structure of ferrocene. **(1 mark)**
- ii Write equations for the reactions of ferrocene in
 - I Friedal craft alkylation **(2 marks)**
 - II Addition reaction with $\text{CF}_2 = \text{CF}_2$ **(2 marks)**
 - iii State THREE uses of ferrocene **(3 marks)**
- c) i Define the lanthanide contraction **(2 marks)**
- ii State THREE effects of the lanthanide contraction on the lanthanides. **(3 marks)**
 - iii What contributes to the lanthanide contractions. **(2 marks)**

- d) Write an account on the following regarding 1st, 2nd and 3rd transition series.
- i Atomic volumes and densities. **(5 marks)**
 - ii Ionic radius. **(5 marks)**
- e) Why do transition elements exhibit a variety of oxidation states. **(2 marks)**
- Q2. a) Titanium is extracted by the Kroll process.
- i Name TWO ores from which titanium can be extracted. **(2 marks)**
 - ii Titanium is a metal and yet it cannot be extracted from Titanium (IV) chloride by electrolysis nor reduction using carbon. **(2 marks)**
 - iii Use a flow diagram to show the extraction of titanium. **(6 marks)**
- b) Titanium and its compounds have several applications. Give FIVE applications citing the property that each application depends on. **(10 marks)**
- Q3. a) Explain the following observations MnO_4^- is purple, TcO_4^- is dark red and ReO_4^- 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 not unlike that of alkali metals. Why then are the chemical properties of these elements different. **(10 marks)**
- Q4. a) The F-block is composed of TWO groups of elements. What is the name given to each group in the F-block. **(2 marks)**
- b) The TWO groups exhibit similarities and differences.
- i Give FIVE similarities. **(5 marks)**
 - ii State THREE uses for each group of the F-block elements. **(6 marks)**
- c) The extraction of F-block elements may impact negatively on the environment. Explain. **(4 marks)**
- d) A solution of Iron (III) Sulphate has a PH less than 7. Explain. **(3 marks)**
- Q5. a) i Define a metallic carbonyl. **(2 marks)**

- ii The stability of a metallic carbonyl depends on the oxidation state of the metal explain. **(4 marks)**
 - iii State the TWO classifications of metallic carbonyls. **(2 marks)**
 - iv By use of suitable examples, describe each classification. **(10 marks)**
- b) State the role of metal chelates in living systems. **(2 marks)**

END