

KABARAK



UNIVERSITY

UNIVERSITY EXAMINATIONS

2009/2010 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHEM 421

**COURSE TITLE: COMPARATIVE STUDY OF THE D AND F-
BLOCK ELEMENTS**

STREAM: SESSION VIII & IX

DAY: WEDNESDAY

TIME: 2.00 – 4.00 P.M.

DATE: 07/04/2010

INSTRUCTIONS:

- *Attempt all questions*

PLEASE TURN OVER

QUESTION ONE (20 MARKS)

- a. Write two general properties of d-block elements? **(2marks)**
- b. Give three differences between lanthanides and actinides. **(6marks)**
- c. Give the electronic configuration of the following elements;
(a) Sc (b) Cr (c) Fe (d) Cu [Atomic numbers; Sc = 21, Cr = 24, Fe = 26, and Cu = 29]. **(4marks)**
- d. Given that nickel metal can be written as $[\text{Ar}] 4s^2 3d^8$, which is the correct representation of the electronic configuration for Ni^{2+} ion. **(2marks)**
- e. Discuss the general characteristics of the elements of titanium group under the following features.
- i. Oxidation states.
 - ii. Melting and boiling points
 - iii. Formation of complexes. **(6marks)**

QUESTION TWO (20 MARKS)

- a. "Cobalt Yellow" is a pigment used in oil paints, and contains the coordination compound $\text{K}_3[\text{Co}(\text{NO}_2)_6]$. How many unpaired electrons are there on the cobalt atom in this compound? **(4marks)**
- b. Give an explanation for any two similarities between Ni and Cu. **(4marks)**
- c. When a concentrated solution of NH_3 is added to a solution containing $\text{Zn}(\text{NO}_3)_2$, a colorless solution containing the complex ion $\text{Zn}(\text{NH}_3)_4^{2+}$ results. Explain why this solution is colorless? **(4marks)**
- d. Account for the following observations using valence bond theory and crystal field theory: $[\text{Cu}(\text{NH}_3)_4]^{2+}$ is paramagnetic while $[\text{Co}(\text{NH}_3)_6]^{3+}$ diamagnetic [Atomic numbers; Co = 27, and Cu = 29] **(4marks)**
- e. Define and give an explanation for Lanthanide contraction. **(4marks)**

QUESTION THREE (20 MARKS)

- a. Give an explanation for the following observations:
- Most of the trivalent lanthanide elements are coloured in solids as well as in aqueous solutions while only a few are colourless.
 - The covalent character of the M^{3+} ions of the lanthanides increases across the period.
 - The tripositive lanthanide cations have a poor tendency to form complexes.
 - Actinides have a greater tendency to form complexes than the lanthanides. **(8marks)**
- b. Enumerate any two uses on lanthanides. **(2marks)**
- c. Based on the structure and the number of metallic atoms present, classify the carbonyls. **(6marks)**
- d. Give an equation in each case for the formation of carbonylate anion and cation respectively. **(4marks)**

QUESTION FOUR (10 MARKS)

- a. What are metal carbonyls? **(2marks)**
- b. Show the hybridization in the formation of $Ni(CO)_4$ molecule. **(4marks)**
- c. Give any two equations for the formation of organometallic compounds. **(4marks)**