KABARAK UNIVERSITY

UNIVERSITY EXAMINATIONS

2010/2011 ACADEMIC YEAR

FOR THE DEGREE OF BACHELOR OF EDUCATION SCIENCE

COURSE CODE: CHEM 421

COURSE TITLE: COMPARATIVE STUDY OF *d* AND *f* BLOCK ELEMENTS

STREAM: Y4 S2

DAY: MONDAY

TIME: 2.00 – 4.00 P.M

DATE: 29/11/2010

INSTRUCTIONS:

- Attempt **ALL** questions
- Periodic Table provided

PLEASE TURN OVER

QUESTION ONE (20MARKS)

a) Define the term transition element?
(2marks)

b) Explain why d-block elements have the ability to form complex compounds.
(2marks)

c) Explain the origin of the deep colours in oxysalts of transition element. **(2marks)**

d) Explain why the solution formed when a concentrated solution of NH_3 is added to a solution containing $Zn(NO_3)_2$ is colourless. **(4marks)**

e) Account for the following observations using valence bond theory: $[Cu(NH_3)_4]^{2+}$ is paramagnetic while $[Co(NH_3)_6]^{3+}$ diamagnetic [Atomic numbers; Co =27, and Cu =29]
(4marks)

f) Define and give an explanation for Lanthanide contraction. **(4marks)**

QUEATION TWO (2OMARKS)

a) Outline any two general properties of d-block elements? **(2marks)**

b) State any two similarities between the d and f-block elements. **(4marks)**

c) Explain the following observations.

i. The sizes of lanthanides decrease as one moves across the period. **(2marks)**

ii. The ionic radius of Fe^{3+} is 0.64A while that of Fe^{2+} is 0.76A **(2marks)**

iii. Transition metals have very high boiling and melting points. **(2marks)**

iv. d-block elements have a marked ability to form alloy compounds. **(2marks)**

v. d-block elements have a marked ability to form interstitial compounds**.(2marks)**

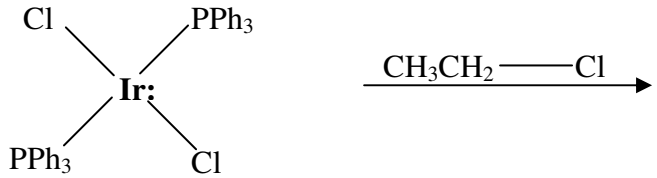
vi. The covalent character of the M^{3+} ions of the lanthanides increases across the period. **(2marks)**

QUESTION THREE (15MARKS)

a) Explain, what are metal carbonyls? **(2marks)**

b) Outline the hybridization in the formation of $Ni(CO)_4$ molecule. **(8marks)**

c) Outline the mechanism involved in the following reaction. **(5marks)**



QUESTION FOUR (15MARKS)

a) Explain ,using any two equations how organometallic compounds are formed **(4marks)**

b) Explain how vibration frequency and bond length of a C=C is affected when it bonds to a metal centre? **(3marks)**

c) With reference to the 18-electron rule, comment on the stability of the following complexes: **(8marks)**

i. $Ni(CO)_4$
ii. $Fe(CO)_5$
iii. $Mn(CO)_5$
iv. $Mn_2(CO)_{10}$