THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Applied & Health Sciences

DEPARTMENT OF PURE & APPLIED SCIENCES

DIPLOMA IN ANALYTICAL CHEMISTRY

ACH 2305: CHEMISTRY OF TRANSITION ELEMENTS

SPECIAL/SUPPLEMENTARY EXAMINATION

SERIES: OCTOBER 2012

TIME ALLOWED: 2 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer Booklet*

This paper consists of **FIVE** questions
Answer question **ONE (COMPULSORY)** and any other **TWO** questions
This paper consists of **THREE** printed pages

Question One (COMPULSORY – 30 Marks)

a) (i) Write down the electronic configuration of the following elements W, X,Y and Z

W (13)
X (20)
Y (23)
Z (25) **(6 marks)**

(ii) With reason(s) state which of the elements above is:

i) P – block element
ii) Alkali metal
iii) Reactive metal
iv) D-block element **(6 marks)**

b) Give the names of the following complexes.

$[Al(H_2O)_6]^{3+}$ $[Ag(H_2O)_2]^{+}$

i)

$[Cu(H_2O)_4]^{2+}$

ii)

$[Fe(CN)_6]^{3-}$

iii) **(4 marks)**

c) Draw the structure of the following complexions:

$[Zn(NH_3)_4]^{2+}$

i)

$[Fe(H_2O)_6]^{3+}$

ii) **(4 marks)**

d) Determine the oxidation number of transition element in the following compounds or ions:

$KMn\ O_4^-$

i)

$Cu_2O_7^{-2}$

ii)

$[Fe(CN)_6]^{4-}$

iii) **(6 marks)**

e) Outline any **FOUR** general properties of transition elements **(4 marks)**

Question Two (20 Marks)

a) Define a transition element **(1 mark)**

b) State **FOUR** characteristic properties of a transition element. **(4 marks)**

c) Explain why:

i) Fe^{3+} ion is more stable than Fe^{2+} ion **(3 marks)**

ii) SC^{3+} and Zn^{2+} are not referred to as transition ions. **(3 marks)**

d) Define:

i) A ligand

ii) A chelate

iii) Paramagnetism **(3 marks)**

e) Draw the structure of $[Fe(CN)_6]^{3-}$ ion indicating its shape and co-ordinate bonds involved. **(3 marks)**

f) Outline **THREE** ways in which weak van dew waal forces of attraction formed. **(3 marks)**

Question Three (20 Marks)

a) Give the formula of a compound in which the oxidation of chromium is.

i) $+3$

ii) $+2$

iii) $+4$

iv) $+6$ **(6 marks)**

b) Outline any **FIVE** properties of chromium that influence their application. **(10 marks)**

c) Chromium is used in the extraction of other metal or shown below

$Cr_2O_3 + 2Al \rightarrow 2Cr + Al_2\ O_3$

$2Cr_2O_3 + 3Si \rightarrow 4Cr + 3SiO_2$

State the role of:

i) Cr_2O_3

ii) Al and silicon in the reaction above **(4 marks)**

Question Four (20 Marks)

a) Define the following:

i) Chelates

ii) Polydentate ligands **(3 marks)**

b) Give **TWO** examples in each category including their structures. **(2 marks)**

i) Momodentate ligands **(2 marks)**

ii) Didentate ligands **(2 marks)**

iii) Polydentate ligands **(2marks)**

c) Explain the following features of transition elements:
- **i)** Metallic properties
- **ii)** Complex ions
- **iii)** Variable oxidation states
- **iv)** Catalytic activity giving an example of each case **(4 marks)**

Question Five (20 Marks)

a) Define the term oxidation number **(2 marks)**

b) List any **THREE** factors that form complex ion formation **(3 marks)**

c) Give any **TWO** difference between zinc and other transition elements **(2 marks)**

d) Account for the relative stabilities of the +2 and +3 oxidation states of ion. **(3 marks)**

e) Explain the following general properties of the transition metals:
- **i)** Good conductors
- **ii)** Density
- iii) Ionization energies **(10 marks)**