



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

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

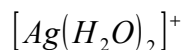
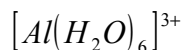
ii) Alkali metal

iii) Reactive metal

iv) D-block element

(6 marks)

b) Give the names of the following complexes.



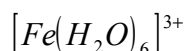
ii) $[Cu(H_2O)_4]^{2+}$

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



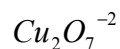
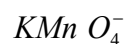
(4 marks)

c) Draw the structure of the following complexions:



(4 marks)

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



(6 marks)

e) Outline any **FOUR** general properties of transition elements

(4 marks)

Question Two (20 Marks)

a) Define a transition element

(1 mark)

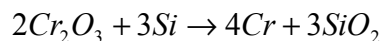
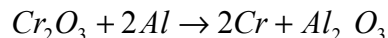
b) State **FOUR** characteristic properties of a transition element.

(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 der Waals forces of attraction are 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



State the role of:



- i)
- 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) Monodentate 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)