



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

Faculty of Applied & Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

DIPLOMA IN ANALYTICAL CHEMISTRY (DAC 10J)

ACH 2216: INORGANIC CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2011

TIME: 3 HOURS

Instructions to Candidates:

You should have the following for this examination

- *Answer booklet*

This paper consists of **TWO** sections **A & B**

Answer **ALL** questions in section A and **THREE** questions in section B.

Each question in section **A** carries **4** marks while those in section **B** carry **20** marks each

This paper consist of **FOUR** printed pages

SECTION A (Answer all questions)

1) Explain the trend in the first ionization energies of the elements given below

Carbon	1090KJ/mol	
Silicon	786KJ/mol	
Germanium	762KJ/mol	(4 marks)

2) Consider the elements chromium; manganese and iron with atomic number 24, 25 and 26 respectively.

- (a) Write the electronic configuration of the Cu^{2+} , Mn^{2+} and Fe^{3+} ions (3 marks)
(b) Explain the stability of Cr^{2+} , Mn^{2+} and Fe^{3+} ions (1 mark)

3) Determine the oxidation number of the following elements in the compounds below.

- a) $\text{KM}_n\text{O}_4(\text{Mn})$
b) $\text{K}_2\text{Cr}_2\text{O}_7(\text{Cr})$
c) $\text{CO}_2(\text{C})$
d) $\text{H}_2\text{SO}_4(\text{S})$ (4 marks)

- 4) (a) Define the term Lewis acids (2 marks)
(b) Explain why orthoboric acid (H_3BO_3) acts as a Lewis acid (2 marks)

5) The table below shows first ionization energies for some elements in period Two.

Element	N	O	F	Ne
Ionization Energy(KJ/mol)	1400	1310	1680	2080

- a) Explain why the value for oxygen is lower than that of Nitrogen (2 marks)
b) Explain why Neon has the highest value for the first ionization energy (2 marks)
- 6) (a) The atomic number of elements X and Y are 38 and 51 respectively. Write the electronic configuration of X and Y (2 marks)
(b) State with reason(s) the element in (a) above that has a higher value of the first of ionization energy (2 marks)
- 7) Explain the Trivalency and Monovalency of group III elements (4 marks)
- 8) (a) Define Catenation (1 mark)
(b) Give reasons why catenated compounds of Si-Si do not exist unlike those of carbon (3 marks)
- 9) Calcium Fluoride and Calcium Chloride are typical ionic compounds. Explain why calcium Fluoride has a melting point of 1423°C . While calcium chloride has a melting point of 772°C (4 marks)
- 10) (a) Define the term electron affinity (1 mark)
(b) Study the table below to answer the questions that follow

Element	Li	B	C	N	O	F	Ne
First Electron Affinity (KJ/mol)	-60	-28	-122	7	-142	-328	29

Explain the difference in the values for Carbon and Nitrogen (3 marks)

SECTION B (60 MARKS)

11) (a) Name **ONE** ore of Aluminium and give its formula (2 marks)

(b) Aluminium is purified by the process of electrolysis.

(i) Explain why Cryolite is added during this process (2 marks)

(ii) Explain why Aluminum and oxygen are discharged at their respective electrodes (3 marks)

(iii) Explain why the anode is replaced from time to time during the process of electrolysis (2 marks)

(iv) Give **TWO** alloys of Aluminium (2 marks)

(c) Explain the following observations:

(i) Aluminium Chloride is essentially covalent whereas aluminum fluoride is predominantly ionic (2 marks)

(ii) Write a balanced equation for the reaction of water and a dimer of Aluminium Chloride (3 marks)

(iii) Suggest a suitable PH value of the resultant aqueous solution in (c) (ii) above (2 marks)

(d) Give **TWO** uses of Aluminium (2 marks)

12) (a) Define the term REDOX reaction (2 marks)

(b) Determine the oxidation number of the element in brackets in each of the following compounds/ions

(i) Cl in ClO_4^-

(ii) S in SO_4^{2-}

(iii) S in $\text{Na}_2\text{S}_4\text{O}_6$ (3 marks)

(c) Consider the following redox reaction



State with reason(s) the:

(i) Oxidizing agent (2 marks)

(ii) Reducing agent (2 marks)

(d) With the aid of a well labeled diagram, describe the extraction of phosphorous (7 marks)

(e) Give the formula of a compound in which the oxidation state of sulfur is:

- (i) -2
- (ii) +2
- (iii) +4
- (iv) +6

(4 marks)

13) (a) Draw a well labeled diagram of the Nitrogen cycle

(7 marks)

(b) Outline Nitrogen fixation by lightning

(3 marks)

(c) Explain any **FOUR** features of Nitrogen that distinguish it from the rest of group V B.

(6 marks)

(d) Give reasons for the following:

(i) Diamond is very hard while Graphite is soft

(2 marks)

(ii) Graphite is a conductor while Diamond is a non-conductor

(2 marks)

14)(a) Briefly explain the following behavior.

(i) CO₂ has low Mpt and Bpt while Si O₂ is a high boiling point solid

(3 marks)

(ii) Al F₃ is ionic while Al Br₃ is covalent

(2 marks)

(iii) Na Cl dissolved in water forms a neutral solution (PH = 7) while Al₂Cl₆ dissolved in water forms acidic solution (PH = 3)

(3 marks)

(iv) BF₃ is non-polar while NF₃ is polar

(2 marks)

(b) The shapes of covalent molecules are mainly determined by the number of electron pairs.

(i) Which are the three possible ways of interaction between the electron pairs (3 marks)

(ii) Draw the shapes of the following molecules or ions and indicate the position of the lone pairs of electrons



(7 marks)

15) Outline the distinguishing features between covalent and ionic compounds

(20marks)