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) (a) Define an Isotope (1 mark)

(b) Explain why isotope of some elements have got:

i) Same chemical properties (1 mark)
ii) Different physical properties (1 mark)

(c) Write an equation for the thermal decomposition of $NaNO_3$ (1 mark)

2) Write equations to the effect of water on the following:

i) O^{2-} (1 ½ marks)
ii) $O2^{2-}$ (1 ½ marks)
iii) $[Al(H_2O)_5(OH^-]^{2+}$ (1 marks)

3) (a) Write down the electronic configuration of elements X atomic number 11 and element Y atomic number 17 (2 marks)

(b) With reason(s), state the nature of the chemical bond that is likely to be formed between X and Y (2 marks)

4) (a) Define Fajan's Rule (2 marks)

(b) The relative molecular mass of solid Aluminium Chloride ($AlCl_3$) is found to be twice that in the gaseous state. Explain (2 marks)

5) Name **FOUR** quantum numbers which are needed to completely define the state of an electron in an atom (4 marks)

6) (a) State **FOUR** evidences that support the statement "All atoms in matter contain electrons" (2 marks)

(b) Explain any **TWO** properties of cathode rays (2 marks)

7) (a) State **TWO** factors which favour the formation of a Dative bond (2 marks)

(b) List **TWO** factors which influence solubility of an ionic compound (2 marks)

8) Explain the following:

(i) Water has abnormally high boiling point (2 marks)
(ii) Ice floats on liquid water (2 marks)

9) Outline **FOUR** factors which influence ionization energy (4 marks)

10) (a) Write equations to show diagonal similarities between Be and Aluminium (2 marks)
(b) Explain why CO_2 is a gas at room temperature while SiO_2 is a high melting point solid. (2 marks)

SECTION B (60 MARKS)

11) (a) Explain how diagonal relationships arise in the periodic table (2 marks)

(b) Relate Fajan's Rule and Covalency to diagonal relationship (2 marks)

(c) Outline the diagonal relationship between Boron and Silicon (10 marks)

(d) Explain the following:

(i) The 1st ionization energy and Beryllium is greater than that of Boron (2 marks)
(ii) Name one great differences between first and second ionization energies of elements (2 marks)

(e) State **TWO** factors that contribute to the formation of complex ions (2 marks)

(ΔH_f)

12) (a) Calculate the heat of formation (of potassium fluoride (KF) from the elements by use of Born-haber cycle. Write equations to show appropriate steps for each reaction (10 marks)

Use the following Data

Subimation energy of K(s) = 87.8KJ/mol

Dissociation Energy of F2 (D) = 158KJ/mol
Ionization Energy at F_2 (I)= 44.2KJ/mol
Electron Affinity for F(g) (E) = -334.7KJ/mol
Lattive Energy of KF (s) M = -807.5KJ/mol (4 marks)

(b) The table below applies to XCl_y and YCl_y

	MPt (°C)	BPt (°C)	Solution by H_2O	Solubility Non-Polar Solvent
XCly	801	1443	37	0.06
YCly	-22.6	76.3	0.08	Miscible in all Proportion

(i) What type of bonds are present in the two chlorides (2 marks)
(ii) Explain clearly how the bonding in each chloride leads to great differences in volatility shown in the table (4 marks)

13) (a) Three kinds of Particles occur in Neutral atoms. To which kind of particle(s) do the following the characteristics apply. Explain your answer

(i) They are present in all atomic nuclei
(ii) Their mass is almost the same as the mass of a hydrogen atom
(iii) They can pass through a thin sheet of metal foil
(iv) A stream of particles is not affected when passed between oppositely charged plates.
(v) They are given off as particles when radium disintegrates (10 marks)

(b) Describe:

(i) Faraday's experiments on electrolysis (5 marks)
(ii) The discharge tube experiment (5 marks)

14) Outline the main features of:

(i) Covalent bond (5 marks)
(ii) Ionic bond (5 marks)
(iii) Dative bond (5 marks)
(iv) Hydrogen bond (5 marks)

15) (a) Explain the following statements:

(i) Aluminium Chloride is essentially covalent while Aluminium Fluoride is ionic (3 marks)
(ii) Aqueous solution of Aluminium compounds are acidic (3 marks)

(b) Draw a flow diagram to illustrate the extraction of Aluminium (10 marks)

(c) Give reasons why Aluminium oxide is amphotenic white Buric oxide is acidic (4 marks)