



THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A Constituent College of JKUAT)

(A Centre of Excellence)

Faculty of Applied & Health

Sciences

DEPARTMENT OF MATHEMATICS & PHYSICS

UNIVERSITY EXAMINATION FOR:
BACHELOR OF MATHEMATICS PHYSICS & COMPUTER

SCH 2110: CHEMISTRY

END OF SEMESTER EXAMINATION

SERIES: DECEMBER 2012

TIME: 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

Maximum marks for each part of a question are as shown

This paper consists of **THREE** printed pages

Question One (Compulsory)

a) (i) Discuss briefly types of bonds in terms of orbital theorem. (6 marks)

b) (ii) Draw the shapes of the following orbitals:

(a) $2P_z$ (b) d_{z^2} (c) $d_{x^2-y^2}$ (d) $2S$ (4 marks)

(iii) Write down electronic configuration for the following elements:

a) Ti ($Z = 22$)

b) Cr ($Z = 24$)

c) K ($Z = 19$)

d) W ($Z = 21$) (5 marks)

(iv) Define an acid in terms of the following:

- Bronsted-Lowry Theory
- Lewis Concept
- Arrhenius Theory

(3 marks)

(v) Calculate the pH of a 1.0×10^{-8} M solution of HCL.

(10 marks)

(vi) Define a buffer solution and give an example.

(2 marks)

Question Two

a) Define an acid-base indicator.

(1 mark)

b) For phenolphalein, $pK_{HIn} = 9.7A$. The indicator can be used from pH 8.2 to pH 10. Calculate the ratio of $[In^-]/[HIn]$ for the lower and upper units of the range.

(8 marks)

c) The solubility product of Agcl is 1.5×10^{-10} . What weight of Agcl will be dissolved:

(i) In 100ml of water?

(ii) In a solution containing 0.234g of Nacl in 100ml?

(iii) In solution containing 0.17g of $AgNO_3$ in 100ml?

RAM Na = 23 Cl = 35.5 Ag = 108.

(9 marks)

(iv) Calculate $[Sr^{2+}]$ required to start the precipitation of strontium flouride ($K_{sp} = 7.9 \times 10^{-11}$) from a solution that contains 0.01M F ions.

(2 marks)

Question Three

a) Describe Rutherford nuclear model of the atom.

(6 marks)

b) Define the following:

(i) Wave length

(ii) Wave number

(iii) Frequency

(iv) Amplitude

(4 marks)

c) The wavelength of blue light is 480nm. Calculate the frequency and wave number of this light ($C = 3 \times 10^8 \text{ ms}^{-1}$)

(5 marks)

d) Briefly discuss the formation of hydrogen banding and give a general example of compounds exhibiting abnormal strength as a result of hydrogen bonding.

(5 marks)

Question Four

a) State KOHLRAUSCH Law of independent migration of ions.

(2 marks)

b) The resistance of a 0.2N solution of an electrolyte in a conductivity cell is 100ohm at 25°C. What are its conductivity and equivalent conductance if the cell constant is 2.06cm^{-1} .

(5 marks)

c) The silver nitrate solution from the central compartment of a transference cell weighed 36.58g and was titrated with 32.7ml of NH_4CN solution, 1ml of which was equivalent to 0.0085g of $AgNO_3$. The solution from the cathode compartment, weighing 43.17g, 29.4ml of NH_4CNS solution. In the

coulometer, in series, the amount of copper deposited was 0.02g. Calculate the transport number of Ag^+ and OH^- ions. (13 marks)

Question Five

- a) Outline the main types of forces which contribute to van der waal's bonding. (3 marks)
- b) Discuss briefly the intra and inter molecular hydrogen bonding and the abnormal melting and boiling points exhibited by compound having them. (5 marks)
- c) Calculate the lattice energy of KCL from the following data (please show all the steps) (12 marks)

(i)	Enthalpy of sublimation of potassium	=	90.9KJ Mol ⁻¹
(ii)	Ionization energy of potassium	=	418.7KJ Mol ⁻¹
(iii)	Enthalpy of dissolution of chlorine	=	240KJ Mol ⁻¹
(iv)	Electron affinity of chlorine	=	-348.7KJ Mol ⁻¹
(v)	Enthalpy of formation of KCL	=	-440.3KJ Mol ⁻¹