



JARAMOGI OGINGA ODINGA UNIVERSITY OF SCIENCE AND TECHNOLOGY
SCHOOL OF BIOLOGICAL AND PHYSICAL SCIENCES
UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF EDUCATION
SCIENCE
1ST YEAR 1ST SEMESTER 2013/2014 ACADEMIC YEAR
MAIN

COURSE CODE: SCH 102

COURSE TITLE: BASIC INORGANIC CHEMISTRY

EXAM VENUE: LAB 3

STREAM: (SBPS)

DATE: 24/04/14

EXAM SESSION: 9.00 – 11.00 AM

TIME: 2.00 HOURS

Instructions:

- 1. Answer ALL Questions in Section A and ANY other 2 questions**
- 2. Candidates are advised not to write on the question paper.**
- 3. Candidates must hand in their answer booklets to the invigilator while in the examination room.**

Useful information:

Constant A	$= 2.18 \times 10^{-18} \text{ J}$
Planck's constant, h	$= 6.625 \times 10^{-34} \text{ Js}$
Mass of an electron, m	$= 9.11 \times 10^{-31} \text{ kg}$
Speed of light, C	$= 3.0 \times 10^8 \text{ ms}^{-1}$
Reydenerg's constant, R_H	$= 109678 \text{ cm}^{-1}$

Section A This section contains ONE COMPULSORY question**Question 1**

- a. Briefly explain each of the following terms: (6 marks)
- Dalton's theory of atomic structure
 - Wave number
 - n/p ratio
 - Energy quantization
 - Periodic law
 - Lanthanide contractions
 - electronegativity
- b. Outline the properties of cathode rays (8 marks)
- c. What is the wavelength of a grain of sand whose weight is 0.0011 g moving at a speed of 0.01 m/s? (4 marks)
- d. Briefly discuss the properties of ionic compounds (4 marks)
- e. Deduce the type of hybridization that occurs in phosphorus during formation of PCl_5 and hence predict the shape of the molecule. (4 marks)
- f. Carbon-14 is an example of an unstable isotope and for a period of time decomposes to form nitrogen-14.
- Identify the type of emission involved in this change (1 mark)
 - Write an equation to show this change (1 mark)

Section B:**Question 2 (20 marks)**

- a. Explain the term radioactivity (2 marks)
- b. Briefly discuss the main features of Rutherford – Geiger experiment (6 marks)
- c. Sketch the shapes of each of the following orbitals: (4 marks)
- p_y
 - d_{yz}
 - $d_{x^2-y^2}$
 - d_z^2
- d. Calculate spin only magnetic moments for a carbon atom, ${}^6\text{C}$. (4 marks)
- e. Briefly discuss the steps followed in determining the Lewis structure for a polyatomic molecular species (4 marks)

Question 3 (20 marks)

- Explain the term momentum (2 marks)
- Briefly discuss the different types of spectral emission series of the hydrogen atom (5 marks)
- The ionization energy of beryllium (atomic number 4) is greater than that of boron (atomic number 5) and that of nitrogen (atomic number 7) greater than that of oxygen (atomic number 8). Briefly explain. (4 marks)
- Outline the rules used in determining the oxidation numbers of an element in a chemical species. (7 marks)
- Draw the Lewis structure of the carbonate ion, CO_3^{2-} . (2 marks)

Question 4 (20 marks)

- By citing appropriate examples briefly discuss Hund's rule (4 marks)
- State Coulomb's law (3 marks)
- Calculate the effective nuclear charge for one of the parent electrons in fluoride ion (4 marks)
- Briefly outline classification of elements in the periodic table (5 marks)
- Calculate the wavelength of radiation emitted when a hydrogen electron moves from n_3 to n_4 (4 marks)

Question 5 (20 marks)

- Write short notes on the Heisenberg's uncertainty principle. (2 marks)
- A radio operator broadcasts at a wavelength of 21.1 m. Calculate the frequency of the radio waves being pulled by the transistor. (4 marks)
- Outline the rules followed in calculating the effective nuclear charge of an atom (4 marks)
- Write the electronic structure of nitrogen (atomic number, $Z = 7$) and specify the quantum number numbers for the last three electrons in the most preferred configuration. (4 marks)
- The following data is about energy changes involved in the formation of LiF from the reaction of Li and F_2 gas.

Process	Quantity of energy (kcal)
Vaporization of lithium	+37.1
Ionization of lithium	+124.3
Dissociation of fluorine gas	+18.9
Electron affinity of fluorine atom	-78.4
Lattice energy of LiF	-242.8

- Write the thermochemical equations for each of the steps involved. (5 marks)
- Calculate the energy of stabilization for formation of $\text{LiF}_{(s)}$. (3 marks)