



Technical University of Mombasa

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF
TECHNOLOGY IN INDUSTRIAL MICROBIOLOGY AND BIOTECHNOLOGY
BTMBT 13S

ACH 4107: INORGANIC CHEMISTRY

SEMESTER EXAMINATION

DECEMBER 2013 SERIES

2 HOURS

Instructions to candidates:

This paper consist of **FIVE** questions

Answer question **ONE** (compulsory) and any other **TWO** questions

QUESTION ONE

- a) Fundamental concept of quantum mechanics is that all matter has a wave and particle-like properties
- (i) State de Broglie equation **(1mark)**
- (ii) What is the characteristic wavelength of an electron with a velocity $5.97 \times 10^6 \text{ m/s}$
 $h = 6.626 \times 10^{-34} \text{ Js}$ $m_e = 9.109 \times 10^{-31} \text{ Kg}$ **(1mark)**
- b) (i) What is an atomic orbital **(1mark)**
- (ii) State the **THREE** quantum number that uniquely define on atomic orbital. State the allowed values for each quantum number **(3marks)**
- (iii) Write the electron configuration of the following species ${}_{74}\text{W}$ ${}_{47}\text{Ag}^+$ ${}_{15}\text{P}^{3-}$ **(3marks)**
- c) Define the terms

(i) Electronegativity (1mark)

(ii) Electron affinity (1mark)

Explain why electron affinity increases from left to right across a period (2marks)

d) What type of orbital i.e. is, 3P is designated by the following quantum number:

($n = 5$, $L = 1$, $ML = 0$)

(2marks)

e) Explain the following absorption;

(i) Ionic compounds are usually solids with high melting points while covalent compounds are usually goes liquids or soft solids with low melting points

(4marks)

(ii) Electrical conductivity of metals decrease with increasing temperature when the metal is heated.

(2marks)

(iii) Hydrogen chloride is a covalent compound which dissolves in water (a covalent liquid) resulting in a conducting solution

(4marks)

f) Define the following terms

(i) Aufbau principle

(ii) Ionization energy

(iii) Dipole moment

(iv) Orbital

(v) Hund's rule

(5marks)

QUESTION TWO

a) Define the following terms

(i) Nuclear chemistry

(ii) Natural Radioactivity

(iii) Artificial Radioactivity

(6marks)

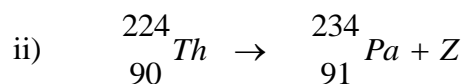
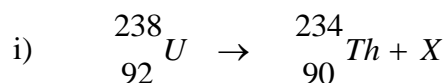
b) Distinguish between the following

(i) Nuclear reactions and chemical reactions

(ii) Nuclear fission nuclear fusion

(4marks)

c) Complete the following reactions.



(4marks)

d) Describe FOUR factors that determine the stability of a nucleus

(4marks)

QUESTION THREE

a) Calculate the energy of the transition from $n_f = 3$ to $n_i = 2$ for the hydrogen atom given that $h = 6.626 \times 10^{-34}\text{Js}$, $R_H = 2.179 \times 10^{-18}\text{J}$ (4marks)

b) Draw the hydrogen spectrum series showing all the four series involved (6marks)

c) Explain the following observations

(i) The first ionization energy of nitrogen is higher than that of oxygen (3marks)

(ii) The first electron affinity of oxygen is -142KJ/mole while the 2nd electron affinity is $+844\text{KJ/Mol}$ (4marks)

(iii) An element X has atomic number 82. Write its electronic configuration and state its period and group number. (4marks)

QUESTION FOUR

a) Briefly describe the following type of bonding

(i) Ionic bonding

(ii) Covalent bonding

(8marks)

b) Draw the Lewis and Valence Bond Structure for the following

(i) Oxygen gas (O_2)

(ii) Carbon monoxide (CO)

(6marks)

c) Write brief notes on hydrogen bonding. Draw a diagram of appropriate how does it affect physical properties of substance. (6marks)

QUESTION FIVE

a) Define the following terms

(i) Equivalent Weight **(2marks)**

(ii) Mass and weight **(2mark)**

(iii) Normality **(2mark)**

b) A common product found in nearly every kitchen contains 27.31% sodium's, 1.20% hydrogen 14.30% carbon and 51.14% oxygen. Find the empirical formula and molecular formula the compound. **(6marks)**

c) A 40ml solution of sulphuric acid neutralizes 0.364g of sodium carbonate

Write down the balanced equation for the above reaction

Calculate

(i) Number of nuclear of sodium carbonate that reacted **(2marks)**

(ii) Number of moles in 40ml of sulphuric acid **(2marks)**

(iii) Molarity of sulphuric acid **(2marks)**

d) Differentiate between oxidizing and reducing agent. **(2marks)**