



EMBU UNIVERSITY COLLEGE

(A Constituent College of the University of Nairobi)

2015/2016 ACADEMIC YEAR

FIRST SEMESTER EXAMINATION

FIRST YEAR EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE
BACHELOR OF EDUCATION SCIENCE, BACHELOR OF SCIENCE IN
BIOTECHNOLOGY, ANALYTICAL CHEMISTRY AND INDUSTRIAL CHEMISTRY

SCH 101: GENERAL AND INORGANIC CHEMISTRY

DATE: 1st DECEMBER, 2015

TIME: 14:00-16:00

INSTRUCTIONS:

Answer question ONE and any other TWO questions

Some useful Data

Avogadro constant, $N_A = 6.023 \times 10^{23} \text{ mol}^{-1}$ Plank's constant, $h = 6.626 \times 10^{-34} \text{ Js}$

Speed of light, $c = 2.9979 \times 10^8 \text{ m/s}$ or $2.9979 \times 10^{10} \text{ cm/s}$

QUESTION ONE

- a) Using the spd notation write the electronic configuration of the following elements (4 marks)
- i) ${}_{29}\text{Cu}$
 - ii) ${}_{88}\text{Ra}$
- b) Briefly explain the terms below. (4 marks)
- i) Ionizing energy
 - ii) Shielding effect
- c) State the three rules which are followed when filling electrons in a multi-electron atom. (3 marks)
- d) Derive the deBroglie's equation as used to explain to the dual nature of matter (4marks)
- e) Briefly describe the Rutherford nuclear model of the atom.

(4 marks)

f) Using the bond energies below, calculate the heat of formation for $C_2H_4Cl_2$.

(4 marks)



$$Cl - Cl = 242 \text{ KJ mol}^{-1}$$

$$C - Cl = 338 \text{ KJ mol}^{-1}$$

$$C = C = 612 \text{ KJ mol}^{-1}$$

$$C - H = 348 \text{ KJ mol}^{-1}$$

$$C - C = 348 \text{ KJ mol}^{-1}$$

g) Explain the following observations:

i) $AlCl_3$ forms an acidic solution in water.

(4 marks)

ii) Ionic radius of **Argon** is greater than that of **Flourine** ion.

(2 marks)

h) Draw the dot Lewis structures for the compounds below

(3 marks)

i) HCl

ii) NH_3

iii) H_2O

QUESTION TWO

a) Explain all the necessary conditions for an acceptable wave function.

(6 marks)

b) Explain the physical significance of Ψ and Ψ^2 in the schrodiger equation

(4 marks)

c) The symbols and numbers represent atoms and their atomic numbers. M- 22, N- 53, Q- 82.

For each element, write the electronic configuration and state the group and period it belongs to.

(6 marks)

d) Explain variation in melting points and density in both sodium and magnesium. (5 marks)

QUESTION THREE

a) Calculate energy of one mole of photons of radiation whose frequency is 5×10^{14} Hz.

(5 marks)

b) The threshold frequency ν_0 for a metal is $7.0 \times 10^{14} \text{ s}^{-1}$. Calculate the kinetic energy of an electron emitted when radiation of frequency $\nu = 1.0 \times 10^{15} \text{ s}^{-1}$ hits the metal. (5 marks)

c) State and explain the significance of the Heisenberg uncertainty principle.

(5 marks)

- d) Identify the total number of orbitals associated with the principal quantum number $n = 3$?
(5 marks)

QUESTION FOUR

- a) i) What values of the orbital quantum number, or angular momentum (l) and magnetic (ml) quantum numbers are allowed for a principle quantum number (n) of 3?
(5 marks)
ii) How many orbitals are allowed for $n = 3$?
(5 marks)
- b) Briefly explain the Valence bond theory
(10 marks)

QUESTION FIVE

- a) State the Bohr postulates of atomic structure
(5 marks)
- b) Explain the Heisenberg uncertainty principle and illustrate it using a mathematical expression identifying all the variables used.
(6 marks)
- c) Explain the failures of the Bohr Theory
(3 marks)
- d) Sketch all the p orbital
(6 marks)

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