EMBU UNIVERSITY COLLEGE

(A Constituent College of the University of Nairobi)

2015/2016 ACADEMIC YEAR
FIRST SEMESTER EXAMINATION
EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE

SPH 401: ATOMIC PHYSICS

DATE: DECEMBER 8, 2015   TIME: 11:00-13:00

INSTRUCTIONS:

Answer Question ONE and ANY Other TWO Questions.

QUESTION ONE

a) What are the parameters on which electrons per second ejection from a plate and the incident radiation energy depend on during photoelectric effect?   (2 marks)

b) Describe Rutherford's atomic model.   (4 marks)

c) Which are the quantum numbers that are adequate to describe the state of any electron in an atom?   (4 marks)

d) What is Zeeman's effect? Explain.   (2 marks)

e) Evaluate the expectation value $< \psi_1 | \hat{P} \psi_1 >$ where ψ_1 is the ground state of the particle in a box.   (4 marks)

f) What are the modifications that sommerfield introduced to Bohrs atomic theory? Explain.

                                    (3 marks)

g) What conclusions can be drawn from Moseley's work?   (4 marks)

h) Sketch the continuous x-ray radiation spectrum from a tungsten target.   (4 marks)

i) During an experiment an electron possessed a velocity of V m/s. find the minimum wavelength of the radiated wave.   (3 marks)

QUESTION TWO

Briefly explain the fine structure of the hydrogen atom with respect atomic structure.

(20 marks)

QUESTION THREE

a) Briefly explain stark effect.   (7 marks)
b) Briefly describe the sodium spectrum.   (13 marks)

QUESTION FOUR

Discuss the characteristics of a continuous x – ray spectrum.   (20 marks)

QUESTION FIVE

a) A cobalt target is bombarded with electrons and the wavelength of its characteristic x-ray spectrum is measured. There is also a second fainter characteristic spectrum which is due to an impurity in cobalt. The wavelength of the K lines are 178.9pm (cobalt) and 143.5pm (impurity). Given that for Cobalt z=27, find the atomic number z of the impurity.

(7 marks)

b) Show that the magnetic measurement μ, for an electron spinning in an atom is given by

$$\mu l = \frac{e\hbar}{2m} \sqrt{e(e+1)}$$ (13 marks)

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