THE MOMBASA POLYTECHNIC UNIVERSITY COLLEGE

(A constituent of JKUAT)

Faculty of Applied and Health Sciences

DEPARTMENT OF PURE AND APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR THE DEGREE OF BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY

ACH 4211: NUCLEAR CHEMISTRY OF RADIOCHEMISTRY

SPECIAL/SUPPLEMENTARY EXAMINATION

FEBRUARY 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) Which of the following has the greatest penetrating ability: an ¤ particle, a β particle or a γ ray?
(1mark)

b) What type of shield is necessary to stop the following:

(i) X-rays

(ii) β particles

(iii) γ Rays

(iv) ¤ particles

(1mark each)

c) Fill in the missing symbol in each of the following nuclear equations

(i) $^{210}_{83}Bi \rightarrow {}^{4}_{2}\alpha +$ _____

(ii) $^{15}_{8}O \rightarrow {}^{15}_{7}N + \_\_\_\_\_$

(iii) $\_\_\_\_\_ \rightarrow {}^{4}_{2}\alpha + {}^{222}_{86}Rn$

(iv) $^{9}_{4}Be + \_\_\_\_\_ \rightarrow {}^{12}_{6}C + {}^{1}_{0}n$

(v) $^{27}_{13}Al + {}^{2}_{1}H \rightarrow \_\_\_\_\_ + {}^{4}_{2}\alpha$

(1mark each)

d) What is the effect on the mass number and atomic number of the reacting isotope when he following transmutations occur?

(i) A β particle is emitted

(ii) An ¤ particle emitted

(iii) A γ ray is emitted

(2marks each)

e) How does a breeder nuclear reactor produce more fuel than it uses? **(6marks)**

f) With the aid of a diagram describe how a Geiger counter works and how radioactivtity is detected **(8marks)**

Question TWO

With the aid of diagrams write succinct notes on:

a) ¤ particles, ¤ particles and γ rays in an electric field **(10marks)**

b) The Half-life of Radioisotopes **(10marks)**

Question THREE

a) Describe the effects on Humans of short-Term whole-body exposure to the following doses of radiation doses in rems:

<50

50 – 250

250 – 500

500 – 1000

1000 – 10,000

100,000

(2marks each)

b) The half-life of ^{222}Ra radon is 3.8days. If the basement of a house contains 45g of ^{222}Ra will remain after 8.5 days (assuming that only radioactive decay is the cause of the depletion of the ^{222}Ra)? **(8marks)**

Question FOUR

a) Write an account of neutron-proton ratios and the stability of nuclei. **(10marks)**

b) Define the kinetics of radioactive decay **(4marks)**

c) The ^{14}C activity of an archeological wooden sample is 11.6 disintegrations per second. The activity of a fresh wood carbon sample of equal mass is 15.2 disintegrations per second. The half-life of ^{14}C is 5715 years. What is the age of the archeological sample?

(6marks)

Question FIVE

Discuss the uses of radioisotopes as radioactive tracers in:

(i) Studying reaction mechanisms
(5marks)

(ii) Diagnosis of disease **(5marks)**

(iii) Industry **(5marks)**

(iv) Agriculture
(5marks)