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 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 $^{4}_{2}\alpha$ 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) $^{4}_{2}\alpha$ 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)