



# TECHNICAL UNIVERSITY OF MOMBASA

FACULTY OF APPLIED AND HEALTH SCIENCES

DEPARTMENT OF PURE & APPLIED SCIENCES

UNIVERSITY EXAMINATION FOR:

## BACHELOR OF TECHNOLOGY IN APPLIED CHEMISTRY (BTAC14S & BTAC 15S2)

Type program name

ACH 4211 NUCLEAR CHEMISTRY AND RADIOCHEMISTRY Type unit code : Type

unit name.

END OF SEMESTER EXAMINATION PAPER 1

**SERIES:** APRIL 2016

**TIME:** 2 HOURS

**DATE:** Pick Date Select Month Pick Year

### Instructions to Candidates

You should have the following for this examination

-Answer Booklet, examination pass and student ID

This paper consists of Choose No questions. Attempt Choose instruction.

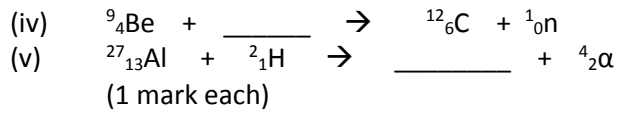
**Do not write on the question paper.**

### Question ONE

- 
- Which of the following has; (i) the greatest penetrating ability (ii) the least penetration ability: a particle, a  $\beta$  particle, or a  $\gamma$  ray? (2 marks)
  - What type of shield is necessary to stop the following?
    - X-rays
    - B Particles
    - $\Gamma$  Rays
    - A Particles(1 mark each)

© Fill in the missing symbol in each of the following nuclear equations

  - ${}^{210}_{83}\text{Bi} \rightarrow {}^4_2\alpha + \underline{\hspace{2cm}}$
  - ${}^{15}_8\text{O} \rightarrow {}^{15}_7\text{N} + \underline{\hspace{2cm}}$
  - $\underline{\hspace{2cm}} \rightarrow {}^4_2\alpha + {}^{222}_{86}\text{Rn}$



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

- (i) A  $\beta$  particle is emitted
- (ii) An  $\alpha$  particle is emitted
- (iii) A  $\gamma$  ray is emitted

(2 marks each)

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

(6 marks)

(f) A 5.00 mg sample of pure  ${}^{238}\text{UO}_2$  contains 4.41 mg of  ${}^{238}\text{U}$ . If the decay rate of the uranium is 1,014 counts per minute (cpm) on an alpha detector of efficiency 0.315. what is the half-life of the  ${}^{238}\text{U}$ ? (7 marks)

## Question TWO

(a) Draw an annotated diagram of a Geiger-Muller counter. (10 marks)

(b) Describe how the Geiger-Muller counter works and how radioactivity is Detected (5 marks)

© How did scientists determine the half-life of  ${}^{238}\text{U}$  to be about 4.5 billion years? (5 marks)

## Question THREE

3. (a) Describe the effects on Humans of Short-Term Whole-Body exposure To the following radiation doses in **rems** :

<50	(1 mark)
50 -250	(2 marks)
250 -500	(2 marks)
500 – 1000	(2 marks)
1000- 10,000	(2 marks)
100,000	(1 mark)

(b) Analysis of a metal pipe showed that it contained 0.30g of  $^{60}\text{Co}$ .

Another measurement made 1.4 years later showed 0.25 g of  $^{60}\text{Co}$  to be remaining.

What is the half-life of  $^{60}\text{Co}$ ? (10 marks)

**4. Question FOUR**

5.

6. Give an account of the contributions of William Conrad Roentgen, Henri Becquerel, Marie Curie, Ernest Rutherford and J.J. Thomson to Nuclear Chemistry with Special reference to: the discovery of radioactivity; discovery and characteristics of alpha, beta and gamma particles; growth and decay of radioactive nuclei; and the structure of the atom. (20 marks)

**Question FIVE**

7.

8. Write succinct notes on:

(a) Describe the determination of arsenic in a plant sample by Neutron Activation Analysis (12 marks)

(b) Tabulate the differences between Chemical reactions and Nuclear reactions (8 marks)