



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

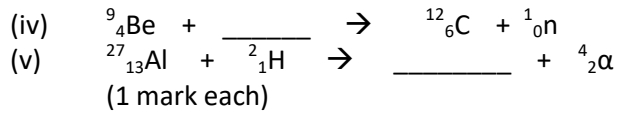
-Answer Booklet, examination pass and student ID

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

Do not write on the question paper.

Question ONE

- 1.
2. (a) Which of the following has; (I) the greatest penetrating ability (ii) the least penetration ability: a particle, a β particle, or a γ ray? (2 marks)
(b) What type of shield is necessary to stop the following?
 - (I) X-rays
 - (ii) B Particles
 - (iii) Γ Rays
 - (iv) A Particles(1 mark each)
© Fill in the missing symbol in each of the following nuclear equations
 - (i) ${}^{210}_{83}\text{Bi} \rightarrow {}^4_2\alpha + \underline{\hspace{2cm}}$
 - (ii) ${}^{15}_8\text{O} \rightarrow {}^{15}_7\text{N} + \underline{\hspace{2cm}}$
 - (iii) $\underline{\hspace{2cm}} \rightarrow {}^4_2\alpha + {}^{222}_{86}\text{Rn}$



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

- (i) A β particle is emitted
- (ii) An α particle is emitted
- (iii) A γ 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}Co .

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

What is the half-life of ^{60}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)