KISII UNIVERSITY

UNIVERSITY EXAMINATIONS

FOURTH YEAR EXAMINATION FOR THE AWARD OF THE DEGREE OF BACHELOR OF EDUCATION SCIENCE
FIRST SEMESTER 2022/2023
(JUNE - SEPTEMBER, 2022)

CHEM 417: RADIATION AND NUCLEAR CHEMISTRY

STREAM: Y4 S1 **TIME: 2 HOURS**

DAY: TUESDAY, 9:00 AM – 11.00 AM **DATE: 06/09/2022**

INSTRUCTIONS:

1. ***Do not write anything on this question paper.***
2. ***Answer ALL Questions in section A and any other TWO Questions in section B.***

SECTION A

1a. Which type of radiation does the most tissue damage, but only when the emitter is internally ingested? (3 marks)

b. Technetium-99 is prepared from ^{98}Mo. Molybdenum-98 combines with a neutron to give molybdenum-99, an unstable isotope that emits a β particle to yield an excited form of technetium-99, represented as $^{99}Tc^{*}$. This excited nucleus relaxes to the ground state, represented as ^{99}Tc, by emitting a γ ray. The ground state of ^{99}Tc then emits a β particle. Write the equations for each of these nuclear reactions. (2 marks)

c. With an example explain a radioactive isotope (3 marks)

2a. Account for ionising radiation and give three forms of ionising radiations (4 marks)

b. Why are alpha and beta particles considered directly ionising.(3 marks)

c. State four sources of radiation exposure. (4 marks)

3a. Give three methods of reducing radiation exposure. (3 marks)

b. Name four effects of radiation on cells. (4 marks)

c. Define an acute dose in chronic radiation. (2 marks)

4a. Give four effects of an acute dose in chronic radiation. (4 marks)

b. State and fully explain two somatic effects. (3 marks)

5a. Show the effects of the four types of rays on a hand with the effect of a diagram. (3 marks)

5b. Give the main components that should balance between reactants and the products in balancing nuclear reactions. (2 marks)

SECTION B

6a. Account for the working of gas filled detectors with the help of a diagram. (3 marks)

b. Using a well elaborate diagram state and account for nuclear chain reaction. (4 marks)

c. write complete nuclear equations for the following processes:

i. Mn-50 decays by positron emission (2 marks)

ii. Cs-118 is produced when a radio nuclide decays by beta emission.

(2 marks)

d. Using a well elaborate diagram explain X-ray emission (4 marks)

7a. With the help of a diagram define nuclear fusion reaction of Helium. (5 marks)

b. Determine **x** in the following reaction. (5 marks)

$$^{249}_{98}Cf^{98+} + {}^{18}_{8}O^{+8} \longrightarrow {}^{b}_{a}X^{c} + 4{}^{1}_{0}n^{0}$$

c. Explain nuclear fission and types of nuclear fission giving an example in each. (5 marks)

8a. Account for nuclear reaction and explain how it takes place(4 marks)

b. Name the applications of radiochemistry in different fields of life. (5 marks)

c. List the differences between a chemical reaction and a nuclear reaction (6 marks)