



NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY, JABI - ABUJA.
FACULTY OF SCIENCES
DEPARTMENT OF PURE AND APPLIED SCIENCE
2023_2 EXAMINATIONS

COURSE CODE: CHM406
COURSE TITLE: Nuclear and radiochemistry
TIME: 2 Hours
INSTRUCTION: Answer question one and any three questions.

QUESTION ONE

- 1a. In a tabular form differentiate between nuclear fusion and nuclear fission. (5 marks)
- 1b. Describe the four types of emission undergone by radioactive isotopes (5 marks each = 20 marks)

QUESTION TWO

- 2a. Given that N = number of atom of A initially before disintegration, t = time taken for disintegration, $t_{1/2}$ = half life, k = decay constant, show that $t_{1/2} = 0.693/K$ (5 marks)
- b. Cobalt – 60 nucleus decay with the emission of beta particle – gamma rays with half life of 5.27 years. According to the equation ${}^{60}_{27}\text{Co} \rightarrow {}^{60}_{28}\text{Ni} + \beta + \gamma$ how much of a 3.42 mg sample will remain after 30.0 years? (5 marks)
- c. Discuss the following
- Unifield model for deforming nuclei
 - Single particle module (5 marks)

QUESTION THREE

- 3a. With relevant example explain the following terms:

- i. Isobars ii. Isotopes

(2¹/₂ marks each = 5 marks)

3b. Consider the equation $^{12}_5\text{B} + ^4_2\text{He} \rightarrow \text{-----} + ^x_y\text{Q} + ^1_0\text{n}$

- i. What element does Q represent in the periodic table? Explain (3 marks)
 ii. How many nucleons does Q possess? Explain (2 marks)

3c) Explain briefly the basic principles of a detector (5 marks)

QUESTION FOUR

- 4a. List and explain the two basic principles for minimizing radiation exposure (4marks)
 b. List 2 uses and 3 disadvantages of nuclear fission (5 marks)
 c. Write short notes on the following methods of measuring radiation
 i. Scintillator detector
 ii. Solid scintillators (6marks)

QUESTION FIVE

- 5a Arrange α , β , and γ particles in order of
 i. Increasing penetration energy
 ii. Increase ionization energy
 iii. Increasing wavelengths
 iv. Increasing speed (1.5marks each)
- b. Give 5 properties of the alpha particles (5 marks)
- c. Alpha particles are only slightly deflected towards the negative plate of an electric field
 i. Why is the deflection towards the negative plate (2 marks)
 ii. Why is the deflection only slightly? (2 marks)