



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCES

DEPARTMENT OF PURE AND APPLIED SCIENCE

OCT/NOV 2019 EXAMINATIONS

COURSE CODE: PHY 402
COURSE TITLE: NUCLEAR PHYSICS
CREDIT UNIT: 3
TIME ALLOWED: (2½ HRS)

INSTRUCTION: *Answer question 1 and any other four questions*

QUESTION 1

- a. Define the following terms: (i) Excess mass and (ii) packing fraction (4 marks)
- b. List the properties of nuclear force. (4 marks)
- c. Define the term radioactivity. (3 marks)
- d. State four properties of α - particles (4 marks)
- e. Differentiate between X-ray and γ -ray (4 marks)
- f. What are the physical quantities that are conserved in any nuclear reaction? (3 marks)

QUESTION 2

- (a) Discuss the following nuclear models:
 - i. The liquid drop model (3 marks)
 - ii. The Collective Model (3 marks)
- (b) i. List three physical processes that could occur during transformation (3 marks)
 - ii. State three properties of β - particles (3 marks)

QUESTION 3

- a. What are radioactive series? (3 marks)
- b. List the four known radioactive series. (4 marks)

c. Give the reasons for using radioactivity to determine the age of matter. **(5 marks)**

QUESTION 4

a. What is photoelectric effect? **(2 marks)**

b. Explain the processes of pair production. **(4 marks)**

c. Define the following terms:

(i) isotopes **(2 marks)** (ii) isobars **(2 marks)** (iii) isotones. **(2 marks)**

QUESTION 5

a. Calculate in MeV the energy liberated when helium nucleus ${}^4_2\text{He}$ is produced by fusing two neutrons and two protons.

(**Take:** $M_n = 1.00898\text{U}$, $M_p = 1.000759\text{U}$, ${}^4_2\text{He}$ nucleus mass = 4.00277 , $1\text{U} = 931\text{MeV}$)

(5 marks)

b. What is nuclear reaction? **(3 marks)**

c. State difference between nuclear fission reaction and nuclear fusion reaction? **(4 marks)**

QUESTION 6

a. Briefly explain Compton Effect. **(4 marks)**

b. How can neutrons be classified? **(3 marks)**

c. What are the types of nuclear reaction that can occur? **(5 marks)**