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

DEPARTMENT OF PURE AND APPLIED SCIENCE

SEPTEMBER, 2020_1 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*

Constant values:
M_n= 1.009 M_H=1.007825   1 amu =931Mev

$$^{98}_{42}Mo := 97.907 \ ^{16}_{8}O := 15.994920 \ ^{235}_{92}U := 235.004 \ ^{136}_{54}Xe := 135.917$$

M $_n$ =1.00898U, M $_p$ =1.000759U $^{4}_{2}He$ nucleus mass= 4.00277. 1U= 931MeV

$^{16}_{8}O$ =15.994915U, $^{17}_{8}O$ =16.999133U

QUESTION 1

a. What is nuclide?   **(2 marks)**

b. What do you understand by the following terms?

i). Packing fraction   **(3marks)**

ii). Isotones   **(2 marks)**

iii). Excess mass   **(3 marks)**

iv). Isomers   **(2 marks)**

v). Isobars   **(2 marks)**

c. State the relationship between the radius of nucleus (r) and the number particle (A)   **(2 marks)**

d. Differentiate between excess mass and packing fraction   **(6 marks)**

QUESTION 2

a. What is mass defect? **(3 marks)**

b. What do you understand by the terms Nuclear Binding energy and Separation energy? **(3 marks)**

c. Calculate the separation energy of neutron $^{17}_{8}O$ .Make a brief comment from the result above.

$^{16}_{8}O$ =15.994915U, $^{17}_{8}O$ =16.999133   M $_n$ =1.00898U **(6 marks)**

QUESTION 3

a. List three ways by which γ - rays can dislodge electrons from both inner and outer orbits.

(4.5 marks)

b. What is radioactivity decay? (**3 marks**)

c. List three radioactive series **(4.5 marks**)

QUESTION 4

a. Define the following terms:

i. Activity **(3 marks)**

ii. Half-life **(3 marks)**

b. Show that Half-life $T_{\frac{1}{2}} = \dfrac{0.693}{\lambda}$ 6 marks)

QUESTION 5

a. What is the nuclear radius of ^{40}Ca ? **(3 marks)**

b. What is the ratio of the radii of ^{238}U and ^{4}He Make brief comment on your answer. **(5 marks)**

c. Show that ^{8}Be is unstable with respect to decay into two alpha particles. **(4 marks)**

QUESTION 6

a. Calculate in MeV the energy liberated when helium nucleus 4_{He} is produced by fusing two neutrons and two protons (M $_n$ =1.00898U, M $_p$ =1.000759U $^{4}_{2}He$ nucleus mass= 4.00277. 1U= 931MeV   )

(5 marks)

b. What do you understand by nuclear reaction? **(3 marks)**

c. What is the difference between nuclear fission reaction and nuclear fusion reaction? **(4 marks)**