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
APRIL/MAY, 2019 EXAMINATION

COURSE CODE: **CHM 406**
COURSE TITLE: **Nuclear and radiochemistry**
COURSE UNIT: **2**
TIME: **2 Hours**
INSTRUCTION: **Answer question one and any three questions.**

QUESTION ONE

1ai. Are the nuclei above the stability belt neutron rich or neutron poor? 1 mark

1aii. Explain how the nuclei with high ratio of neutron to protons than those within the stability belt can attain stability. 6 marks

1b. Identify the symbol X in each of the following:

i) $^{0}_{-1}X = ?^{(1/2)}$ 2 mks (ii) $^{4}_{2}X = ?^{(1/2)}$ 2mks (iii) $^{0}_{+1}X = ?^{(1/2)}$ 2 mks (iv) $^{1}_{0}X = ?^{(1/2)}$ 2 mks

1c. . In energetic of nuclear radiation study, list the objectives a facilitator intends to achieve. 3 marks

1d. Explain (i) Thermal neutrons (ii) Moduration 3 marks
1e. In large organization, discuss the three stages involved in protection of radiation. 4 marks

QUESTION TWO

2a. Define radioactive decay. 2 marks

2b. Enumerate the properties of particles emitted by radioactive decay. 9 marks

2c. Differentiate K-capture from L-capture. 2 marks

2d. Complete and balance the following equations:

i) $^{14}_{7}N + ^{1}_{?}n \rightarrow ^{?}_{6}C + ^{1}_{1}H$ 1 mark

ii) $^{14}_{6}C \rightarrow {}^{14}_{7}N + ?$ 1 mark

QUESTION THREE

3a. Explain briefly the following:

i. Chain reaction 2 mark
ii. Nuclear Fission 2 mark
iii. Nuclear Fusion 2 mark
iv. Nuclear Fusion Reactor 3 mark

3b. Complete and balance the equations below:

i) $^{1}_{0}n \longrightarrow {}^{1}_{1}P + ?$ 2 mark

ii) $? \longrightarrow {}^{40}_{20}Ca + {}^{0}_{-1}\beta$ 2 mark

iii) $^{4}He_2 + {}^{14}N_1 \longrightarrow {}^{1}H_1 + ?$ 2 mark

QUESTION FOUR

4a. With specific examples explain the application of radiation in

i) Agriculture 2 mks (ii) Industry 3 mks (iii) Medical uses 3 mks (iv) Scientific research 2 mks (v) Archeology 1 mk

4bi.Under what condition do you say that the nucleus of an atom is dense?

2 marks

4b ii) $^{97}_{40}Zr \rightarrow {}^{97}_{41}Nb + ?$ 2 marks

QUESTION FIVE

5a. Identify and discuss the radioactive process in the chemical equation below

$$^{238}_{92}U \longrightarrow {}^{234}_{90}Th + {}^{4}_{2}He$$ 5 marks

5b. Mention any three rules that guide prediction of nuclear stability. 3 marks

5c. Explain decay process in terms of energy loss. 3 marks

5d.Complete the following nuclear reactions using the symbol X to represent the new element formed or particle involved.

i. $^{38}_{19}K \longrightarrow X + {}^{0}_{+1}\beta$ 2 marks

ii. $^{106}_{47}Ar + X \longrightarrow {}^{106}_{46}Pd$ 2 marks