

**DEPARTMENT OF CHEMISTRY**  
**SCHOOL OF NATURAL AND APPLIED SCIENCES**  
**FEDERAL UNIVERSITY OF TECHNOLOGY, MINNA**  
**FIRST SEMESTER EXAMINATION 2012/2013 SESSION**

**COURSE CODE:** CHM 412:

**COURSE TITLE:** RADIO AND NUCLEAR CHEMISTRY

**UNITS:** 2

**TIME ALLOWED:** 2HRS

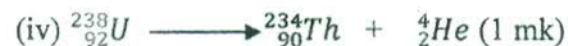
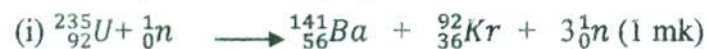
**INSTRUCTION:** ATTEMPT ANY THREE QUESTIONS

1 (a) Define the following terms with appropriate examples:

(i) Isotopes (ii) Isobars (iii) Radioisotopy (iv) Isotones (v) Nuclear isomers (10 marks).

b). Give the differences between natural and artificial radioactivity (6 mks)

c). Identify the following types of nuclear reactions:



2 What do you understand by the term "radioactivity"? (2 mks)

a). List the major radiations that are usually associated with the radioactivity of some elements and give two properties of each. (6 mks)

b). State the differences between ordinary chemical reactions and nuclear reactions (4 mks)

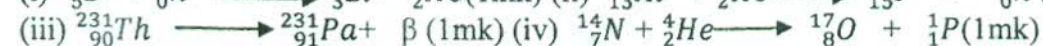
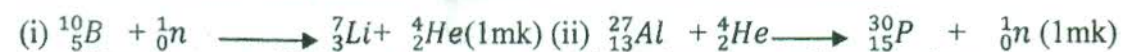
c). What is generally responsible for the instability of some nuclides? Predict whether the following nuclides are stable or unstable (4 mks)

(i)  ${}_{8}^{16}\text{O}$  (1Mk) (ii)  ${}_{7}^{14}\text{N}$  (1Mk) (iii)  ${}_{8}^{17}\text{O}$  (1Mk) (iv)  ${}_{21}^{45}\text{Sc}$  (1Mk)

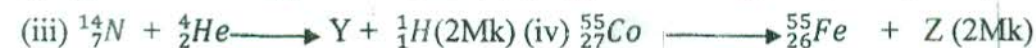
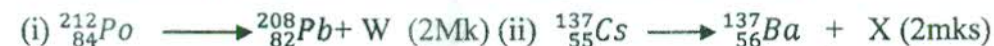
3. What are nuclear reactions? (2mks)

a). The nuclide  ${}_{99}^{247}\text{Es}$  was obtained by bombarding  ${}_{92}^{238}\text{U}$  in a reaction that emits five neutrons. Identify the bombarding projectile (6mks).

b). Write the following nuclear reaction in their short hand notations:



c). Identify W, X, Y and Z in the following nuclear reactions:



4a) Explain the following terms and give one example in each case:

(i) Nuclear fusion (2.5 mks)

(ii) Nuclear fission (2.5mks)

b). (i) Give three peaceful uses of nuclear energy (3mks)

(ii) Under what conditions does nuclear fusion occurs? (2mks)

c) (i) What do you understand by the term "half-life" of a radioactive isotopes? (2mks)

(ii) The half-life of a radioisotope is 3.8 days. After how many days will one twentieth of the isotope be left over? (8mks)