



NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY,
JABI - ABUJA.

FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2024 1 EXAMINATION

COURSE CODE: CHM 406
COURSE TITLE: NUCLEAR AND RADIOCHEMISTRY
COURSE UNIT: 2
TIME: 2 HOURS
INSTRUCTION: *Answer question one and any other two questions.*
Question 1 score 30marks with the other two scoring 20marks each

Question 1

- 1i. Differentiate between natural and induced radioactivity? (6mark)
- 1ii. Describe the principle of "Gas Counter" (6mark)
- 1iii. Write on the four principles of conservation that apply to radioactive decay(6mark)
- iv. A piece of wood taken from a cave in New Mexico is found to have a carbon-14 activity (per gram of carbon) only 0.636 times that of wood cut today. What is the age of the wood? The half life of carbon-14 is 5730 years. (6mark)
- v. What rules are valid in the potential well which forms the basis for Single particle model(6mark)

Question 2

- 2i. Describe the control measure used in nuclear fusion reactor(2mark)
- 2ii. Write short note on scintillating techniques? (5mark)
- 2iii. Show the solution of the Schrödinger equation for Single particle model(3mark)
- 2iv. Solid State Nuclear Track Detector (SSNTD) (5.5mark)
- 2v. Show how Neutron - Proton Ratio relates to Nuclear Stability thus tell the stability trend(4.5marks)

Question 3

- i. Discuss the use of ^{14}C , its half life, limitations and remedy (5mark)

- ii. With regards to decay energy, type of radiation produced, mode of decay; Discuss radioactive decay(5.5mark)
- iii. Using only nuclear reaction equation; show the following nuclear reaction.
- Alpha decay(2mark)
 - Beta decay(2mark)
- iv. Discuss; ion chamber(5.5mark).

Question 4

- i. For a reaction where X represents nucleus or elementary particles. X_1 and X_2 may be unstable nucleus and bombarding particles while X_3 and X_4 are products formed. State the conservation laws that holds(5mark)
- ii. Write a short note on radioactive decay products (6mark)
- iii. Discuss two forces present in the nucleus (6mark).
- iv. State three industrial uses of radioactivity(3marks)

Question 5

- i. What is inelastic scattering(4mark)
- ii. The half-life of radioactive decay of calcium -47 is 4.5 days. If a sample has an activity of 1.0 μ g after 27 days, what is the initial activity of the sample? (6marks)
- iii With the aid of a table, present six differences between chemical reaction and nuclear reaction? (6 mark)
- iv. What is Positron decay(4mark)