CHUKA  **UNIVERSITY**

UNIVERSITY EXAMINATIONS

RESIT/SPECIAL EXAMINATION

EXAMINATION FOR THE AWARD OF DEGREE OF BACHELOR OF

CHEM 417: RADIATION AND NUCLEAR CHEMISTRY

STREAMS: **TIME: 2 HOURS**

DAY/DATE: TUESDAY 02/02/2021 **8.30 A.M – 10.30 A.M.**

INSTRUCTIONS:

QUESTION ONE (30 Marks)

1a (i) Why is it necessary for a chemist to have knowledge of the radiation interaction process related to the energy transfer to the irradiated target? (2 marks)

(ii). Briefly discuss brem-strahlung (4 marks)

(iii). Explain how isotopes can be used in elucidating reaction mechanism of the frii dalcrafts reaction given below:

C6H6 + ClCOCH3 $\longrightarrow$ C6H5COCH3 +HCl (4 marks)

B(i) Describe how the age of the rock can be estimated using the ratio of lead to uranium. (6 marks)

(ii)A sample of a radioactive material contains 10 18 atoms. The half –life of the materials is 2.0 days. Calculate:

(I)The fraction remaining after 5 days (3 marks)

(ii) The activity of the sample after 5.0 days [1bq=$1s^{-1}$=1 disintegration/s]. (1 marks)

C(i). Describe with the help of a suitable diagram how alpha (α) and (β) particles can be determined using scintillation counter. (4 marks)

(iii)Calculate the energy per nucleon in the atom $^{4}_{2}He$ which has a mass of 4.0026 amu. Mass of a neutron = 1.008655 and mass of 1hydrogen atom =1.007825 amu (1amu =931.5 meV.

(6 Marks)

QUESTION TWO (20 MARKS)

2a). Outline the disposal procedures of solid radioactive waste. (7 marks)

b) Give the stages which are involved in developing a geological repository within any national programme. (9 marks)

c). Explain what is meant by binding energy. (4 marks)

QUESTION THREE (30 marks)

3 (a) Explain the difference between a nuclear reaction and a chemical reaction. (8 marks)

(b) Derive the general expression for the activity of a daughter nuclide in terms of half –life. (9 marks)

(c) With the help of a binding energy curve, explain the stability of the nucleus. (3 marks)
