KIBABII UNIVERSITY

UNIVERSITY EXAMINATIONS
2020/2021 ACADEMIC YEAR

FOURTH YEAR FIRST SEMESTER
MAIN EXAMINATIONS

FOR THE DEGREE OF BACHELOR OF CHEMISTRY

COURSE CODE: SCH 412

COURSE T ITLE: THE STUDY OF LANTHANIDES AND ACTINIDE SERIES

DURATION: 2 HOURS

DATE: 16/07/2021 **TIME:** 9:00-11:00AM

INSTRUCTIONS TO CANDIDATES

- Answer **QUESTION ONE** (Compulsory) and any other two (2) Questions.
- Indicate **answered questions** on the front cover.
- Start every question on a new page and make sure question's number is written on each page.

This paper consists of **3** printed pages. Please Turn Over

QUESTION ONE (COMPULSORY)

(a) Explain the variation in the ionic radii between La^{3+} and Lu^{3+}. [3 mks]

(b) From the knowledge of chemical properties, speculate on why Ce and Eu were the easiest lanthanides to isolate before the development of ion exchange chromatography. [5 mks]

(c) How would you expect the fact that the first and second ionization energy of lanthanides to vary across the series? [3 mks]

(d) Explain the following;

(i) Chemically, actinides show a somewhat wider range of oxidation states than the lanthanides. [3 mks]

(ii) Actinides have a greater tendency to form complexes than lanthanides [3 mks]

(iii) The magnetic and spectral properties of lanthanides differ from those of 3d and 4d block elements. [3 mks]

(e) Give five comparisons between actinides and lanthanides. [5 mks]

(f) What are inner transition elements? Explain their oxidation states, ability to form complexes and magnetic properties. [5 mks]

Question 2 (20 Marks)

(a) Comment on the stability of the various oxidation states of lanthanides (2)

(b) What are the factors that make actinides to be exerting negative impacts on the environment? Discuss each of them. (8)

(c) (i) What is responsible for nuclear criticality in actinides? (1)

(ii)What is the consequence of nuclear criticality (1)

(iii)State the factors that affect nuclear criticality (2)

(d) State any four properties of actinides (4)

(e) State any two uses of actinides (2)

Question 3 (20 Marks)

(a) Highlight three effects of the lanthanide contraction and state its consequences (6)

(b) State three principal ores of lanthanides and highlight two extraction/ purification methods for lanthanides (14)

Question 4 (20 Marks)

The processing of nuclear fuel and separation of the lighter actinide elements, U, Np, and Pu is an important industrial process. Discuss the chemistry involved in the various methods used to extract and separate these elements. [20 mks]

Question 5 (20 Marks)

(a) What is lanthanide contraction? Give its causes and consequences [6 mks]

(b) How do you separate lanthanides by ion – exchange method, solvent extraction and oxidation number? [9mks]

(c) Why is Zr similar to Hf? [2mks]

(d) What are complexiometric titrations? Why is EDTA used in complexiometric titrations? [3mks]