MERU UNIVERSITY OF SCIENCE AND TECHNOLOGY

P.O. Box 972-60200 – Meru-Kenya.
Tel: +254 (0)799529958, +254 (0)799529959, +254 (0)712524293
Website: www.must.ac.ke Email: info@must.ac.ke

University Examinations 2022/2023

FOURTH YEAR, SECOND SEMESTER EXAMINATION FOR THE DEGREE OF BACHELOR OF SCIENCE (CHEMISTRY)

SCH 3455: F-BLOCK AND BIOINORGANIC CHEMISTRY

DATE: APRIL 2023 **TIME:2 HOURS**

INSTRUCTIONS: *Answer question one and any other two questions*

QUESTION ONE (30 MARKS)

a) Account for each of the following statements

(i) Lanthanoids and actinoids have similar physical and chemical properties (2 marks)

(ii) $SM^{2+,}$ Eu^{2+} and Yb^{2+} ions in solution are good reducing agents but an aqueous solution of Ce^{4+} is a good oxidizing agent (4 marks)

b) State any three general properties of actinoids (3 marks)

c) Write the electronic configuration of the following ions and hence determine to which series they belong (4 marks)

(i) Ce^{3+} (Z = 58)

(ii) Am^{3+} (Z = 95)

d) What are heavy metals? (2 marks)

e) Why are heavy metals poisonous? (2 marks)

f) Explain the role of transition metal in biological system (6 marks)

g) Name any two major ores of Lanthanides and any two major ores of actinoids (4 marks)

h) Briefly explain how lanthanoids are separated (3 marks)

QUESTION TWO (20 MARKS)

a) What is lanthanoid contraction? (2 marks)

b) What causes lanthanoid contraction? (2 marks)

c) Explain any three consequences of lanthanoid contraction (3 marks)

d) Actinoid contraction is greater from element to element than lanthanoid contraction. Why? (2 marks)

e) Use Hund's rule to derive the electronic configuration Ce^{2+} ion and calculate its magnetic moment on the basis of spin only formula (3 marks)

f) On basis of both spin only formula and spin-orbital contribution to magnetic moment of cerium (III) (3 marks)

g) The chemistry of the actinoids element is not too smooth as that of the lanthanoids. Justify this statement (3 marks)

h) Name two members of the lanthanoid series that exhibit an oxidation state of +4 (2 marks)

QUESTION THREE (20 MARKS)

a) Provide any four main differences between lanthanoids and actinoids (8 marks)

b) Account for each of the following statements

(i) Most lanthanoids ions are weakly colored (3 marks)

(ii) Isolable carbonyl complexes of lanthanoids are very rare (3 marks)

(iii) Thorium and uranium are the most stable actinoids (2 marks)

(iv) Size of trivalent lanthanoids cations decrease with increase in atomic number (2 marks)

(v) Lanthanoids have very high magnetic susceptibility (2 marks)

QUESTION FOUR (20 MARKS)

a) Discuss the specific applications of each of the following activities (5 marks)

(i) Uranium

(ii) Thorium

(iii) Plutonium

(iv) Californium

(v) Curium

b) Write short notes on each of the following terms

   i. Cofactor (2 marks)

   ii. Coenzyme (2 marks)

c) Explain the three properties of iron than can account for its extensive use in terrestrial biological reactions (6 marks)

d) Explain why do we need oxygen (3 marks)

e) What happened to oxygen in our body and where does it happen? (2 marks)