



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI – ABUJA
FACULTY OF SCIENCES
DEPARTMENT OF CHEMISTRY
2025_2 EXAMINATIONS

COURSE CODE: CHM 426

COURSE TITLE: CHEMISTRY OF LANTHANIDES AND ACTINIDES

COURSE UNIT: 2

INSTRUCTION: Answer question one (1) and any other two questions

Time: 2 hours

1. (a). State the features of the lanthanides with respect to (i) position in the Periodic Table (ii) filled orbital – **5 Marks.**
 - (b). Highlight any **FIVE (5)** similarities between the lanthanides and actinides – **5 Marks.**
 - (c). (i). How are artificial elements of the actinide series prepared? – **3 Marks.**
 - (ii). Identify an ore of uranium and the isotopes that can be obtained from it – **3 Marks.**
 - (d). Using suitable examples, explain the magnetic properties of the lanthanides – **4 Marks.**
 - (e). (i). Arrange the following in order of increasing basicity: Eu^{3+} , Ce^{3+} , Nd^{3+} and Tb^{3+} . – **2 Marks.**
 - (ii). State **TWO (2)** effects of lanthanide contraction – **3 Marks.**
 - (f). State any **FIVE (5)** applications of the actinides – **5 Marks.**

2. (a). (i). Describe the formation of hydrides of lanthanoids – **3 Marks.**
 - (ii). Briefly discuss the properties of dihydrides of lanthanoids – **3 Marks.**
 - (b). Outline the formation and properties of the carbides of lanthanides – **5 Marks.**
 - (c). Explain why the organometallic compounds of the lanthanoids are dominated by good donor ligands, with complexes of acceptor ligands being rare – **5 Marks.**
 - (d). Highlight any **FOUR (4)** general chemical properties of lanthanides – **4 Marks.**

3. (a). Identify a stable lanthanide ion with half-filled 4f orbital. Draw the electronic configuration of the element to support your answer – **4 Marks.**
 - (b). What is the most stable oxidation state of the lanthanides. Discuss your answer with appropriate justification. – **5 Marks.**
 - (c). (i). Describe any **TWO (2)** ores of lanthanides – **3 Marks.**
 - (ii). Mention any **TWO (2)** complexing ligands used in the separation of lanthanides – **2 Marks.**
 - (d). Briefly discuss the toxicity of Depleted Uranium (DU) – **6 Marks.**

4. (a). State the naturally occurring elements of the actinide series – **4 Marks.**
 - (b). (i). Describe nuclear criticality in actinides, highlighting its origin and consequence – **4 Marks.**
 - (iii). Highlight any **FOUR (4)** factors that affect nuclear criticality – **4 marks.**
 - (c). Identify the range of oxidation state of the actinides – **3 Marks.**
 - (d). Discuss the chemistry of the fluorides of uranium including its preparation, properties, separation of isotopes and uses – **5 Marks.**

- 5 (a). (i). Write the electronic configuration of the Ce^{3+} ion. – **3 Marks.**
 - (ii). Using the information in 5 (a) (i) above determine to which series it belongs – **2 Marks.**
 - (b). What are uranates? – **4 marks.**
 - (c). (i). Write equation to show the reaction of a lanthanide metal with halogens – **3 Marks.**
 - (ii). Explain what happens when lanthanide metal is dissolved in tetraoxosulphate (VI) acid – **3 Marks.**
 - (d). Highlight **FIVE (5)** similarities between Scandium and lanthanides – **5 Marks.**