National Open University of Nigeria
Plot 91, Cadastral Zone, Nnamdi Azikiwe Expressway, Jabi - Abuja
Faculty of Science
2020_2 EXAMINATION

COURSE CODE: CHM 426
COURSE TITLE: Chemistry of lanthanides and actinides
CREDIT: 2 Units
TIME ALLOWED: 2 Hours
INSTRUCTION: Answer Question ONE (1) and any other Three (3) Questions

1. a. Arrange La^{3+}, Ce^{3+}, Pr^{3+}, $Nd^{3+}$and Pm^{3+} in increasing order of basicity. **5 marks**

b. i. Justify the result of lanthanide contraction on the properties of lanthanides **3 marks**

ii. What are the most stable oxidation state for lanthanide element and give the reason for your answer?

c. Give three physical and three chemical properties of Lanthanide Series elements. **6 marks**

d. i. Some atoms in lanthanide series are paramagnetic while others are diamagnetic, explain. **3 marks**

ii. Explain why some lanthanides ions are coloured and others are not coloured. **2 marks**

e. i. Write an equation for effective electron voltage and define each term **3 marks**

ii. Distinguish between Aufbau order and Reasserts hydrogenic order **3 marks**

2. a. i. Give reasons why the atoms of lanthanide elements with an even atomic number are found to be more abundant in their Ores? **3 marks**

ii. Mention four types of compounds of lanthanide **2 marks**

b. Give reasons for formation of coloured ions by some lanthanides ions while others cannot. **2 marks**

c. Write out on the reactivity of lanthanides with non-metals; oxygen, hydrogen and fluorine **4** marks

d. Briefly explain the nature of lanthanides in +3 oxidation state **4 marks**

3. a. What is the periodic trend of metallic character in lanthanides? **3 marks**

b. What are the possible geometry for complex compounds with the coordination numbers 4, 6 and 7? **3 marks**

c. What are the reasons why the organometallic compounds of the lanthanoids are dominated by good donor ligands while complexes of acceptor ligands are rare? **4 marks**

d. i. Mention the type of transition responsible for the optical and spectra properties of complexes

of lanthanides **2 marks**

ii. Discuss the reason why the salts of La^{3+}, Ce^{3+} and Lu^{3+} appear colorless **3 marks**

4. a. i. What are the methods used to isolate enriched uranium from the mixture of uranium isotopes? **4.5 marks**

ii. Which of the methods mentioned in 4 a i. above is more efficient? **1.5 marks**

b. What are the physical properties of Uranium? **4 marks**

c. Write on the urinates **5 marks**

5.

a. i. What are applications of lanthanoid complexes that is attributed to their distinct luminescence properties? **3 marks**

ii. How are lanthanides separated from other elements during extraction from their mineral Ores? **3 marks**

b.

i. Write the electronic configuration of the following lanthanide ions; La^{3+}, Tb^{4+} and Yb^{2+} **3 marks**

ii. Classify the ions in 12 b. i. above based on their stability as having Zero, Half-filled or Completely filled 4f sub-orbitals **3 marks**

c. Write the chemical formula for any two typical examples of double salt of lanthanide ions **3 marks**