



NATIONAL OPEN UNIVERSITY OF NIGERIA
PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA
FACULTY OF SCIENCE
DEPARTMENT OF PURE AND APPLIED SCIENCE
OCTOBER/NOVEMBER, 2019 EXAMINATION

COURSE CODE: CHM426

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

- 1a)i With the aid of electronic configurations, provide lanthanides that are zero, half and fully filled 4f orbital (Give one example for each group). (3 marks)
- ii State three catalytic applications of lanthanides (3 marks)
- b)i Highlight the principles for the extraction of lanthanides (5 marks)
- ii What is the consequence of nuclear criticality in actinides? (2 marks)
- c)i Give three properties of actinides (3 marks)
- ii Write suitable equations to show the reaction of lanthanide with cold and hot water (3 marks)
- d)i Outline the steps to recover uranium from nitric acid solution? (3 marks)
- ii Itemize three application of actinides? (3 marks)
- 2a) i What is responsible for the colour of lanthanides? (3 marks).
- ii What are the features of lanthanides that make it colourless? (3 marks).
- b)i Explain why some lanthanides ions are coloured and others are not coloured. (4 marks).
- ii Why are transition metal ions with zero, partially and completely filled orbital colourless. (5 marks).

3a) i what is the range of values for the oxidation states of actinides? (2 marks)

ii How does the oxidation state vary ? (3 marks)

iii What is the minimum number of oxidation state for each actinide ? (3 marks)

b) Attempt the following under reaction of actinium (III) hydroxide with hydrofluoric acid,

i) Write and balance the equation (4 marks)

ii) Explain difference in oxidation state of actinium as compared to other actinides, (3 marks)

4a) Differential between lanthanide contraction and actinide contraction? (6 marks)

b) Justify the position of scandium on the periodic table with two facts. (4 marks)

c) i. List three different particles emitted by depleted uranium (DU) (3 marks)

ii. Mention one way by which depleted uranium (DU) can be blocked (2 marks)

5a) Write an equation for calculating the effective electron voltage and define all the terms in the equation (5 marks).

b) Calculate the spin only magnetic moment of the following ions:

(i) La^{3+} (ii) Lu^{3+} (iii) Gd^{3+} (iv) Ce^{3+} (v) Eu^{3+} (10 marks)