



NATIONAL OPEN UNIVERSITY OF NIGERIA
UNIVERSITY VILLAGE, PLOT 91 CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESS WAY,
JABI - ABUJA.
FACULTY OF SCIENCES
DEPARTMENT OF PURE AND APPLIED SCIENCE
OCTOBER/NOVEMBER, 2019 SECOND SEMESTER EXAMINATION

COURSE CODE: CHM 303
COURSE TITLE: INORGANIC CHEMISTRY III
COURSE UNIT: 3
TIME: 2½ HOURS
INSTRUCTION: Answer question one and any other four questions.

QUESTION ONE (22 MARKS)

- 1ai.) State four reasons why beryllium is different from other members of group II. (4 marks)
- 1aii.) Explain why caesium is a stronger reducing agent than sodium. (2 marks)
- 1bi.) Account why compounds of Sc^{3+} , Ti^{4+} , Cu^+ and Zn^{2+} are white or colourless. (3 marks)
- 1bii.) Cu^{2+} ions are coloured and paramagnetic while Zn^{2+} ions are colourless and diamagnetic. Explain. (5 marks)
- 1ci.) Explain briefly why the noble gases have very low melting and boiling points unlike other elements of comparable atomic or molecular weights. (3 marks)
- 1cii.) Write one chemical equation for the reactions of lanthanum (Ln) with:
(i) water and (ii) oxygen (3½ marks)
- 1d.) State three classes of coordination compounds. (1½ marks)

QUESTION TWO (12 MARKS)

- 2a.) What are interstitial compounds? Hence give one example each of a stoichiometric and non-stoichiometric interstitial compound. (3 marks)
- 2b.) Explain briefly why transition elements have variable oxidation states. (2 marks)
- 2c.) What is lanthanide contraction? (3 marks)
- 2d.) Explain the process of differential floatation in metallurgical process. (4 marks)

QUESTION THREE (12 MARKS)

3ai.) Discuss the periodic trend in atomic radii among transition elements. (4 marks)

3aii) Distinguish between main group, transition and inner transition elements. (5 marks)

3b.) Complete the following chemical equations:



QUESTION FOUR (12 MARKS)

4ai.) Provide the unknown x, y and z in the equation: $2\text{XeF}_2 + 2\text{H}_2\text{O} \rightarrow x + y + z$ (3 marks)

4aii.) Distinguish between diamagnetic, paramagnetic and ferromagnetic substances. (3 marks)

4bi.) The experimental magnetic moment (μ_s) of $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is 4.80 BM, what will be the calculated value and by how much is it greater than experimental value. (3 marks)

4bii) Explain why there is a general trend of lesser number of oxidation states at each end of the transition series and a higher number in the middle. (3 marks)

QUESTION FIVE (12 MARKS)

5a.) Write short notes on each of the following types of minerals

(a) Native minerals (3 marks)

(b) Sulphide minerals (2 marks)

(c) Oxide minerals (3 marks)

(d) Oxosalt (2 marks)

5b.) The principal quantum number n in 3d is lower than that of 4s. However, the 4s orbital is usually filled before 3d orbital in K and Ca, explain? (2 marks)

QUESTION SIX (12 MARKS)

6a.) With the aid of suitable equations, explain the process of roasting in metallurgy (4 marks)

6bi.) What is beneficiation? Hence, state two metallurgy applications of beneficiation. (2½ marks)

6bii.) Outline the methods associated with the beneficiation of the following ores:

(i) Haematite (ii) Cassiterite (iii) Chromite (3 marks)

6c.) Explain why reduction with carbon is not a satisfactory method for producing Mg and Al metals in a pure form. (2½ marks)

