



**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 423.

COURSE TITLE: COORDINATION CHEMISTRY

COURSE UNIT: 2

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

Time: 3 Hours

QUESTION 1 (25 marks)

- A) How many orbitals are involved in the formation of the following hybrid orbitals
i) sp , ii) sp^2 , iii) sp^3 , iv) d^2sp^3 , v) sp^3d^2 (5 marks)
- B) Write the IUPAC name of the following complexes. (6 marks)
- i) $K_2[Ni(CN)_4]$
ii) $[Cu(NH_3)_6]Cl_3$
iii) $[Co(NH_3)_5Cl]Cl_2$
- C) State the coordination numbers and valences of the metals in each of the following-
complexes. (4 marks)
- i) $[Ni(CO)_4]$, and
ii) $[Fe((CN)_4)]^{3-}$
- D) Describe the phenomena; Intra-ligand transition. (10 marks),

QUESTION 2. (15 marks)

- A) A solution of cobalt complex with empirical formula of $CoCl_3 \cdot 6NH_3$ gave three moles of chloride ions on treatment with $AgNO_3$ solution. Derive the molecular formula of the complex and state the reason for your answer. (5 marks)
- B) Explain the term Diamagnetism in transition metal complexes. (10 marks)

QUESTION 3. (15 marks)

- Highlight the various applications of coordination compounds (5 marks)
- B) Explain the differences between Orgel diagram and Tanabe-Sugano diagram (10 marks)

QUESTION 4. (15 marks)

- A) Briefly explain the valence bond theory and its limitations. (5 marks)
- B) Describe briefly the geometry of Coordination number 4. (10 marks)

QUESTION 5. (15 marks)

The electronic spectral of $[Ti(H_2O)_6]^{3+}$ gave as single band at $20,300\text{ cm}^{-1}$, account for this observation. (15 marks)

QUESTION 6. (15 marks)

- A) Define the following terms (4 marks)
- i) Coordination compound
ii) Ligand
- B) Give the formula of the following complexes. (6 marks)
- i) Potassium hexathiocyanatoferrate(II)
ii) Bis(Oxalato)nickelate(II)
iii) Potassiumdicyanato aurate(I)
- C) At 300 K, the observed value of μ_{eff} for $[V(NH_3)_5]Cl_2$ is 3.9 BM, show that it agrees with that obtain by the spin only formula (5 marks)