**NATIONAL OPEN UNVERSITY OF NIGERIA**

PLOT 91, CADASTRAL ZONE, NNAMDI AZIKIWE EXPRESSWAY, JABI - ABUJA

**FACULTY OF SCIENCES**

**DEPARTMENT OF CHEMISTRY**

**OCTOBER 2022 EXAMINATION**

**COURSE CODE:** CHM 423 **CREDIT UNIT:** 3

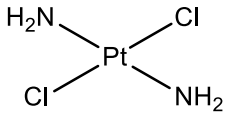
**COURSE TITLE: COORDINATION** Chemistry **TIME:** 2 ½ HRS

**INSTRUCTION: Answer Question ONE (1) and any other Three (3) Questions**

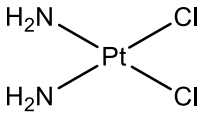
**QUESTION ONE**

**2.a** Write the IUPAC names of the following compounds

(i)




(a)

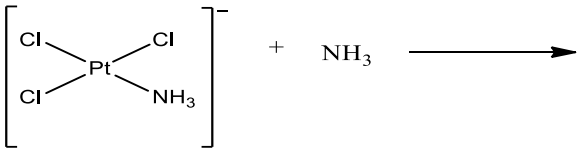



(b)

(3 marks)

(ii) State the geometrics of coordination compounds with the following coordination number (CN): 4,3,2,and 1 respectively. (4 marks)

b(i) Complete the following equations




(3 marks)

$[Ni(CO)_4] + 4PCl_3 \longrightarrow$ (3 marks)

$[PtCl_4]^{2-} + 4NH_3 \longrightarrow$ (3 marks)

(ii) Write the order for the trans effects with respect to the coordination of the following ligands to Pt(II) is CO, $CN^-$, $I^-$, $PH_3$, $NO_2^-$, $I^-$ $Br^-$, $Cl^-$, $NH_3$, $HO^-$, $H_2O$ (4 marks)

(i) What is reaction mechanism with respect to complexes. State the two extreme cases of reaction mechanism in complexes (3 marks)

(ii) Given two neutral ligands, X and Y, write two equations to show the fast and slow steps involved in solvent interaction of the ligand with water (2 marks)

## QUESTION TWO

2.a(i) Highligh the concept the molecular orbital theory uses to explain boding in complexes with respect to two unique orbitals (4 marks)

(ii) Based on the molecular orbital theory, What is the dominant bonding in octahedral complexes (2 mark)

(iii) Explain the expected change in electron environment of a metal ion, when it is surrounded by ligands and when it is alone. Hence relate the consequence of such positioning to explain nephelauxetic effect (9 marks)

## QUESTION THREE

3.a(i) What is isomerism in coordination chemistry and what are the two types of isomerism in coordination chemistry? (3 marks)

(ii) What is the relationship between coordination number and isomerism. Also state one useful application of isomerism (2 marks)

(iii) State two different coordination numbers that supports isomerism in complexes and another two that do not support isomerism ( 1 marks)

b.(i) State the two types of stereo isomers in complexes. State the geometrics in which each of these isomers is favoured (3 marks)

(ii) State the six classes of structural isomers (6 marks)

## QUESTION FOUR

4.a(i) Highlight three factors that can affect crystal field theory (4 marks)

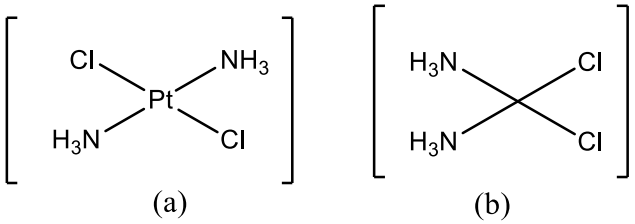
(ii) Give a reason to explain why the splitting pattern in 5d is the greatest (2 mark)

(iii) Highlight the merit and limitation of the crystal field theory (6 marks)

.b. State three factors that affect the shape of coordination compounds (3 marks)

## QUESTION FIVE

5.a(i) State the geometric and identify the cis and trans isomers from the following pairs (2 marks)




(a) (b)

(ii) Based on the geometric of the compounds shown in 5a(i) above, differentiate between cis and trans isomers (2 marks)

(iii) Briefly discuss (in not more than three sentences), how the crystal and the ligand field theory is developed from the crystal field theory (4 marks)

(iv) Under what condition can the molecular field theory replace the ligand field theory in the explanation of the geometric of a molecule (3 marks)

(v) Compare the ligand filed theory with electrostatic and covalent description of molecule and state the sources of data for the ligand field theory (4 marks)

## QUESTION SIX

6.(a) Define the following terms and state how they arise in complexes

(i) Diamagnetism (4 marks)

(ii) Paramagnetism (4 marks)

b.(i) At 300 K, the observed value of $\mu_{eff}$ for a complex is 3.9 BM. Calculate the magnetic moment using S and n for a $d^3$ complex and compared the given value with your result. (7 marks)