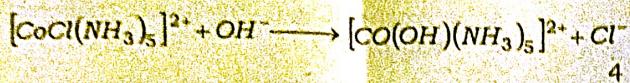


(i) (a) Explain with suitable example how steric crowding at the reaction center influence the rate of substitution reactions in square planar and octahedral complexes.

3+3=6

(ii) Discuss the mechanism of the following substitution reaction :



Total number of printed pages=8

3 (Sem-6/CBCS) CHE HC 1

2024

CHEMISTRY

(Honours Core)

Paper : CHE-HC-6016

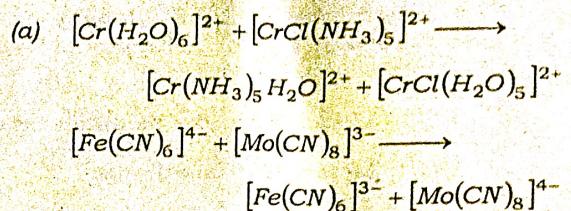
(*Inorganic Chemistry-IV*)

Full Marks : 60

Time : Three hours

The figures in the margin indicate full marks for the questions.

1. Choose the correct answer 1×7=7



Which one of the following is correct statement?

(i) Both involve inner sphere mechanism

Contd.

(a) Both involve outer sphere mechanism

(ii) Reaction I follows inner sphere mechanism and reaction II follows outer sphere mechanism

(iii) Reaction I follows outer sphere mechanism and reaction II follows inner sphere mechanism

(b) Wilkinson's catalyst is

(i) $[RhCl_3(PPh_3)_3]$

(ii) $[RhCl_3(PPh_3)_2]$

(iii) $[RhCl(PPh_3)_3]$

(iv) $[RhCl_2(PPh_3)_2]$

(c) Which one of the following is not important for the formation of stable metal carbonyls?

(i) Metals with low oxidation states

(ii) Metals with small size

(iii) Lowering of carbon-oxygen bond order

(iv) EAN is obeyed

(d) Which of the following is a wrong statement about industrially important catalytic processes?

(i) The proportion of H_2 gas in water-gas mixtures can be increased.

(ii) All metals in Fischer-Tropsch catalytic processes have ability to chemically absorb carbon monoxide.

(iii) Nickel is best surface for methanation in Fischer-Tropsch processes.

(iv) Water gas cannot be obtained from natural gas.

(e) Which of the following precipitates cannot be observed by use of group V reagents?

(i) $BaCO_3$

(ii) $SrCO_3$

(iii) $CuCO_3$

(iv) $CaCO_3$

(f) Which is true about $Mn(CO)_4NO$?

(i) The complex is paramagnetic and follows $18e^-$ rule

(ii) The complex is diamagnetic and follows $18e^-$ rule

(iii) The complex is paramagnetic and does not follow $18e^-$ rule

(iv) The complex is diamagnetic and does not follow $18e^-$ rule

(g) The n in symbol for hapticity (η^n) represents :

- (i) number of ligands attached to the metal
- (ii) number of atoms of the ligand within a bonding distance to the metal
- (iii) charge on the ligand
- (iv) co-ordination number of the metal

2. Answer the following : $2 \times 4 = 8$

- (a) Draw the structure of $Fe_2(CO)_9$ and $CO_2(CO)_8$
- (b) Common ion effect plays an important role in qualitative analysis. Explain.
- (c) Define ground state trans-effect with an example.

(d) What is the number of metal-metal bond in the following compounds?

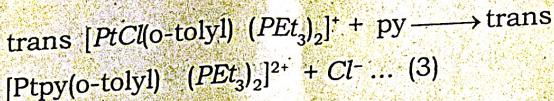
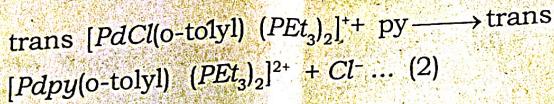
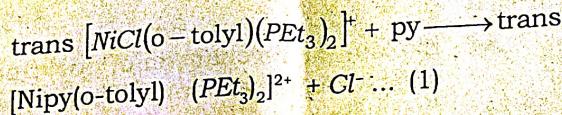
- (i) $Mn_2(CO)_{10}$
- (ii) $K_2Re_2Cl_8$

3. Answer **any three** of the following : $5 \times 3 = 15$

- (a) Explain the mechanism of nucleophilic substitution reaction in square planar complexes.
- (b) Explain EAN rule. Which of the following obey this rule :
 $Cr(CO)_6$; $Fe(\eta - C_5H_5)_2$
- (c) Draw the structure of $\eta^5 - C_5H_5 - Re(CO)_2C_5H_5$
- (d) Discuss the methods of removal of oxalate and phosphate ions during the qualitative analysis of salt mixture.
- (e) Draw the catalytic cycle of the hydroformylation of alkene. Discuss the reactions involved in various steps.
- (f) Explain the mechanism of outer sphere redox reaction of co-ordination compounds. $2+2+1=5$

4. Answer **any three** of the following : $10 \times 3 = 30$

(a) (i) Discuss Eigen-Wilkins mechanism of ligand substitution reactions in octahedral complexes. 4
 (ii) For the following substitution reactions :



The observed rates of reaction (1) is 50 times faster than reaction (2) which, in turn, is about 100,000 times faster than reaction (3). Explain. 2

(iii) Define kinetically labile and inert complexes. The high spin complex ion $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ is labile but the low spin complex ion $[\text{Cr}(\text{CN})_6]^{4-}$ is inert. Explain. 2+2=4

(b) Discuss synthesis, chemical properties of $(\eta-\text{C}_5\text{H}_5)_2\text{Fe}$ and give a description of bonding in this important organometallic compound. 2+2+6=10

(c) Discuss the role of organometallic compounds in catalysis with special reference to

(i) Synthesis gas by metal carbonyl complexes
 (ii) Alkene hydrogenation by Wilkinson's catalyst. 5+5=10

(d) Explain the preparation, structure and bonding of Zeise's salt. The IR stretching frequency of $\text{C}=\text{C}$ bond in metal ethylene complex is found to be 1576 cm^{-1} whereas the corresponding frequency for free C_2H_4 is 1625 cm^{-1} . Explain. 1+2+5+2=10

(e) (i) What is Zeigler-Natta catalyst? How is it prepared? Explain its major application. 2+2+1=5

(ii) What is Wacker process? Give one example. Mention the main three catalytic reaction sequence involved in it. 1+1+3=5