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63/1 (SEM-6) CC13/CHMHC6136

2024

CHEMISTRY

Paper : CHMHC6136

(Inorganic Chemistry-IV)

Full Marks : 60

Pass Marks : 24

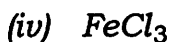
Time : Three hours

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

1. Choose the correct answer : **(any five)**

1×5=5

(a) Which is the correct formula of precipitation of iron in group (III) of cations ?



- (b) The solubility of lead sulfate in water is $1.03 \times 10^{-4} \text{ gL}^{-1}$. Solubility product of it is
- (i) 1.09×10^{-5}
 - (ii) 1.06×10^{-8}
 - (iii) 1.07×10^{-10}
 - (iv) 1.07×10^{-21}
- (c) The number of M-M bond in the complex $\text{Ir}_4(\text{CO})_{12}$ is
- (i) 1
 - (ii) 3
 - (iii) 4
 - (iv) 6
- (d) Which is a π -acid ligand ?
- (i) CO
 - (ii) NH_3
 - (iii) Ethylene diammine
 - (iv) F^-
- (e) Predict the wrong statement about hydroformylation :
- (i) It is also known as oxoprocess.
 - (ii) Hydroformylation often includes hydrogenation of alkenes.

- (iii) Internal alkenes are more reactive towards hydroformylation.
 - (iv) It may also be termed as hydrocarbonylation reaction.
- (f) Which cannot represent the geometry of transition state of unimolecular nucleophilic substitution in octahedral complexes ?
- (i) Square pyramidal
 - (ii) Trigonal bipyramidal
 - (iii) Pentagonal bipyramidal
 - (iv) Both (i) and (ii)
- (g) Which of the mechanism of substitution in octahedral complexes can involve pentagonal bipyramidal intermediate ?
- (i) S_N^1
 - (ii) S_N^2
 - (iii) E_1
 - (iv) Both (i) and (ii)

(h) Which is the wrong statement about Wilkinson's catalyst?

(i) $RhCl (PPh_3)_3$ is homogeneous catalyst known as Wilkinson's catalyst.

(ii) It is a square planar complex.

(iii) The effective atomic number is 18 in this complex.

(iv) Rhodium is in +1 oxidation state in the complex.

(i) The effective number of electrons in $Fe(C_6H_5)_2$ is

(i) 36

(ii) 18

(iii) 54

(iv) 72

(j) What is the oxidation number of Pt-metal in Zeise's salt?

(i) 0

(ii) +1

(iii) +2

(iv) +3

2. Answer the following questions : (any five)

2×5=10

(a) What are interfering radicals? Give examples. 1+1=2

(b) Write a note on π -acidity of CO ligand.

(c) Show whether the compounds $Cr(CO)_6$ obey the EAN rule.

(d) Define coal gasification with proper reactions. How can proportion of H_2 gas be increased in water gas mixture?

(e) Write the method of removal of borate (BO_3^{3-}) radical before proceeding for qualitative analysis of group-III of cations and beyond.

(f) The mechanism of substitution reactions of square planar complexes appears to be associative S_N^2 rather than dissociative S_N^1 . Explain it.

(g) Discuss the oxidation reduction reactions through electron transfer.

3. Answer the following questions : **(any five)**

5×5=25

- (a) Draw stepwise structural arrangement observed in associative mechanism in square planar substitution reaction.
- (b) What are labile and inert complexes? Give examples of each.
- (c) Explain why NH_4Cl is added before the addition of NH_4OH in the analysis of group III (Al^{3+} , Cr^{3+} , and Fe^{3+}).
- (d) What are metal olefin complexes? Discuss the bonding and structure of Zeise's salt. 1+4=5
- (e) How do you prepare real acetaldehyde using Wacker process?
- (f) Write a method of preparation, structure and bonding of Ferrocene. 1+1+3=5
- (g) Write the formula of Wilkinson's catalyst. Explain the different steps of cycle involved in hydrogenation reaction of alkenes using Wilkinson catalyst. 1+4=5

(h) What is trans effect? Which theory of trans effect explains better the trans effect of CO compared to that of pyridine? 1+4=5

(i) Showing the dissociation of aqueous solution of silver ammonia complex ion $[Ag(NH_3)_2]^+$, explain the Thermodynamic and Kinetic Stability.

4. Answer the following questions : **(any two)**

10×2=20

- (a) Explain the π -acceptor behaviour of CO along with σ -bonding in mononuclear metal carbonyl with example. Write any two methods of preparation of $Mo(CO)_6$ and discuss its structure. 4+2+4=10
- (b) Define activation energy. Establish a relation between crystal field activation energy (CFAE) and crystal field stabilization energy (CFSE) of reacting complex. Explain the mechanism of substitution reactions of octahedral complexes. 1+1+8=10
- (c) Describe the complete mechanism of the addition of molecular oxygen into alkene by the Wacker process.

- (d) Discuss the structure and bonding of dimer $(Al(CH_3)_2Ph)_2$. How can Ziegler-Natta Catalyst help in the preparation of polythene from ethene? (Give mechanism of the reaction).

5+5=10
