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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 ?

   (i) Fe_2S_3

   (ii) $Fe(OH)_3$

   (iii) Fe_2CO_3

   (iv) $FeCl_3$

Contd.

(b) The solubility of lead sulfate in water is $1{\cdot}03 \times 10^{-4}\ gL^{-1}$. Solubility product of it is

(i) $1{\cdot}09 \times 10^{-5}$

(ii) $1{\cdot}06 \times 10^{-8}$

(iii) $1{\cdot}07 \times 10^{-10}$

(iv) $1{\cdot}07 \times 10^{-21}$

(c) The number of M–M bond in the complex $Ir_4(CO)_{12}$ 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_N1

(ii) S_N2

(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_N2 rather than dissociative S_N1. 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 acetalldehyde 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 Zieglar-Natta Catalyst help in the preparation of polythene from ethene ?
(Give mechanism of the reaction).
5+5=10