REV-01
MSC/75/38/43

2024/11

SET B

M.Sc. CHEMISTRY
THIRD SEMESTER
INORGANIC CHEMSTRY III
MSC – 303

[USE OMR FOR OBJECTIVE PART]

Duration: 1:30 hrs. **Full Marks: 35**

Objective

Time: 15 mins. **Marks: 10**

Choose the correct answer from the following: ***1×10=10***

1. Stronger M-C bond
   a. increases the tendency of CO ligand to leave the metal ion
   b. neither increases nor decreases the tendency of CO ligand to leave the metal ion
   c. decreases the tendency of CO ligand to leave the metal ion
   d. helps CO ligand to form CO_2

2. 1, 2 Insertion reaction
   a. takes place with change in oxidation state
   b. is reverse of β-hydride elimination
   c. is migratory elimination
   d. is β-hydride elimination

3. What is the result of NH_3 substitution in labile complex like $[Cu(H_2O)_6]^{2+}$
   a. rapid substitution reaction
   b. decrease thermodynamic stability
   c. increase kinetic stability
   d. no change in stability

4. Associatively activated substitution even in 18-electron complex with NO ligand is feasible because
   a. a linear NO switches to angular NO
   b. angular NO switches to linear NO
   c. It becomes 20 electron complex
   d. It becomes 22 electron complex

5. Which of the following is a characteristic feature of SN^1CB mechanism?
   a. single step reaction
   b. stereospecific inversion of configuration
   c. nucleophillic attack on a leaving group
   d. formation of a carbocation intermediate

6. The solution becomes blue, when conc. HCl is added to $[Ni(H_2O)_6]^{2+}$ as_____ formed
   a. $[Ni(H_2O)_5Cl]^{2+}$
   b. $[Ni(H_2O)_4Cl_2]^{2+}$
   c. $[Ni(H_2O)_3Cl_3]^{2+}$
   d. $[NiCl_4]^{2+}$

7. Which one of the following ligand is not a π-acceptor ligand
   a. NO
   b. PF_3
   c. H_2O
   d. both (a) and (b)

8. The reactivity of ferrocene is similar to that of
   a. benzene
   b. naphthalene
   c. thiophene and phenol
   d. anthracene

9. The reactions of benzene are mainly electrophilic substitution but as coordinated ligand it undergoes

a. free radical reactions
b. nucleophillic substitution
c. redox reactions
d. electrophilic addition

10. Which of the following statement is true about the overall formation constant value (β)

a. a higher β value indicates less stable complex
b. a higher β value indicates a more stable complex
c. "β" is only relevant for 1:1 complex
d. both (b) & (c)

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Descriptive

Time : 1 hr. 15 mins. **Marks: 25**

[Answer question no.1 & any two (2) from the rest]

1. **a.** How does the concept of Tolman's Cone Angle determine the reaction mechanism of a reaction? **2+3=5**

   b. "Amide ligand acts as an σ-donor & strong π-donor ligand"- Justify the statement.

2. **a.** Why does aqua complex of Cu^{2+} ion more stable than Ni^{2+} complex? **3+2+3+2 =10**

   b. What is the Irving-William Series? Explain it with one example?

   c. Write two application of chelating ligand complex? Draw the structure of "EDTA"?

   d. Calculate the overall formation constant (β) for the following reaction: $Cu^{2+} + 4NH_3 \rightleftharpoons [Cu(NH_3)_4]^{2+}$
   Given, $k_1 = 10^3$, $k_2 = 10^4$, $k_3 = 10^5$ and $k_4 = 10^6$

3. **a.** Define the term stepwise formation constant (Ki). Give one example. **1.5+2+ 1.5+1+4 =10**

   b. Discuss the stability of [Fe(H2O)6]3+ and [Fe(CN)6]3- complexes based on electronic effect.

   c. What is macrocyclic ligand? Give one example of crown ether and draw the structure.

   d. Define anation reaction with an example?

   e. Discuss the SN1CB mechanism of transition metal complex? Give the diagrammatic represantation of association?

4. **a.** "Substitution of hexa carbonyl complex takes place by dissociation of CO from the complex" –Justify. **2+3+3+ 2=10**

   b. Discuss the role of solvent like tetrahydrofuran in the replacement of carbonyl group from $Co(CO)_6$ by other ligands.

c. What is oxidative addition? How does it differ from reductive elimination?

d. How is the loss of CO from hexa carbonyl complexes achieved thermally and photochemically?

5. a. Explain with suitable example that the oxidative addition reactions normally require unsaturated metal centres. **2+3+3+2=10**

b. Discuss alkene metathesis reaction with Grubb's catalyst.

c. What is Second Generation Grubb's Catalyst? Discuss its role.

d. Explain with suitable example that as coordinated ligand benzene undergoes nucleophillic substitution.

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