gradeup

Get Ready to Crack CSIR NET 2021

(Important Questions on Coordination Chemistry)

www.gradeup.co

Sahi Prep Hai Toh Life Set Hai

Important questions: COORDINATION CHEMISTRY

1. The order of reactivity of ligands NMe_3, PMe_3 and CO with complexes $MeTiCl_3$ and $(CO)_5Mo(Ph)$ are:
A. Co > PMe_3 > NMe_3 and CO > NMe_3 > PMe_3
B. PMe_3 > CO > NMe_3 and NMe_3 > CO > PMe_3
C. NMe_3 > PMe_3 > CO and CO > PMe_3 > NMe_3
D. NMe_3 > CO > PMe_3 and PMe_3 > NMe_3 > CO

2. The reaction of $PtCl_4$ with NH_3 gives product A while its reaction with $[NO_2]^{-2}$ followed by NH_3 gives product B. The A and B respectively, are:
A. Trans-$[Pt(NH_3)\ Cl_2]$ and trans-$[Pt(NH_3)\ Cl_2(NO_2)]^-$
B. Cis-$[Pt(NH_3)\ Cl_2]$ and trans-$[Pt(NH_3)\ Cl_2(NO_2)]^-$
C. Cis-$[Pt(NH_3)\ Cl_2]$ and cis-$[Pt(NH_3)\ Cl_2(NO_2)]^-$
D. Trans-$[Pt(NH_3)\ Cl_2]$ and cis-$[Pt(NH_3)\ Cl_2(NO_2)]^-$

3. CFAE is also known as:
A. The difference between CFSE of reactant and product
B. The difference between CFSE of reactant and intermediate
C. The Difference between CFSE of product and intermediate
D. The CFSE of reactant only

4. Consider the following reaction:
(i) $[Cr\ (H_2O)_6]^{+2} + [CO\ Cl\ (NH_3)_5]^{+2} \rightarrow [Co(NH_3)_5H_2O]^{+2} + [Cr\ Cl\ (H_2O)_5]^{+2}$
(ii) $[Fe(CN)_6]^{-4} + [Mo(CN)_8]^{-3} \rightarrow [Fe(CN)_6]^{-3} + [Mo(CN)_8]^{-4}$
Which one of the following is the correct statement?

A. Both involve an inner sphere mechanism.
B. Both involve an outer sphere mechanism.
C. Reaction (i) follow an inner sphere and reaction (ii) follows outer sphere mechanism.
D. Reaction (i) follows an outer sphere and reaction (ii) follows inner sphere mechanism.

5. The correct order of Trans effect is:
A. H^- > SCN^- > H_2O
B. CO > C_2H_5 > Py > H_2O
C. $C_6H_5^-$ > I^- <Py > -OH
D. CO > H_2O > CH_3 > Py > CN

6. Mention the correct statement:
A. Complexes having sp^3d^2 hybridization have strong bonds than the complexes having d^2sp^3
B. Complexes having d^2sp^3 hybridization have strong bonds than the complexes having sp^3d^2
C. Both have equal bond strength
D. It cannot be decided

7. $[Co(NH_3)_5X]^{+2} + H_2O \rightarrow [Co(NH_3)_5(H_2O)]^{+3} + X^-$
Mention the correct statement about the above reaction
A. It is found to be second order
B. It is found to be zero order
C. H_2O is involved in rate determining step
D. H_2O does not affect the rate of reaction

8. Which of the following statements is/are true about S_n1 reactions?
(I) In S_n1 mechanism, the rate determining slowest step is metal-ligand bond breaking step.
(II) In S_n1 mechanism, the rate determining slowest step is metal-ligand bond making step.
(III) In S_n1 mechanism, the coordination no. of the complex is decreased from 6 to 5.
A. I and II
B. I and III
C. I, II and III
D. Only I

9. The substitutionally inert complex ion amongst the following is:
A. $[Cr (H_2O_6]^{+3}$
B. $[Fe (H_2O)_6]^{+2}$
C. $[Cr (H_2O)_6]^{+2}$
D. $[Ni (H_2O)_6]^{+2}$

10. The reaction is an example of:
$[Co(NH_3)_5Cl]^{+} + Hg^{+2} \rightarrow [Hg(NH_3)_5Cl]^{+} + Co^{+2}$
A. Electrophilic substitution reaction
B. Nucleophilic substitution reaction
C. Electrophilic addition reaction
D. Nucleophilic addition reaction

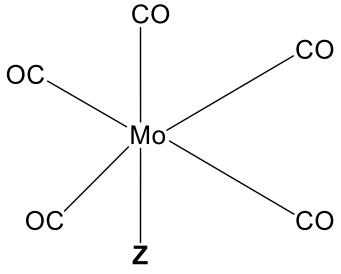
Answer Key:

1. C
2. B
3. B
4. C
5. B
6. B
7. D
8. D
9. A
10. A

Solutions:

Solution 1:

For $(CO)_5Mo(Ph)$, those ligands whose π-acidity is more will react faster and thus have more reactivity. Since we know that, order of π-acidity is CO > PMe_3 > NMe_3 so, the same is order of reactivity here.



Solution 2:

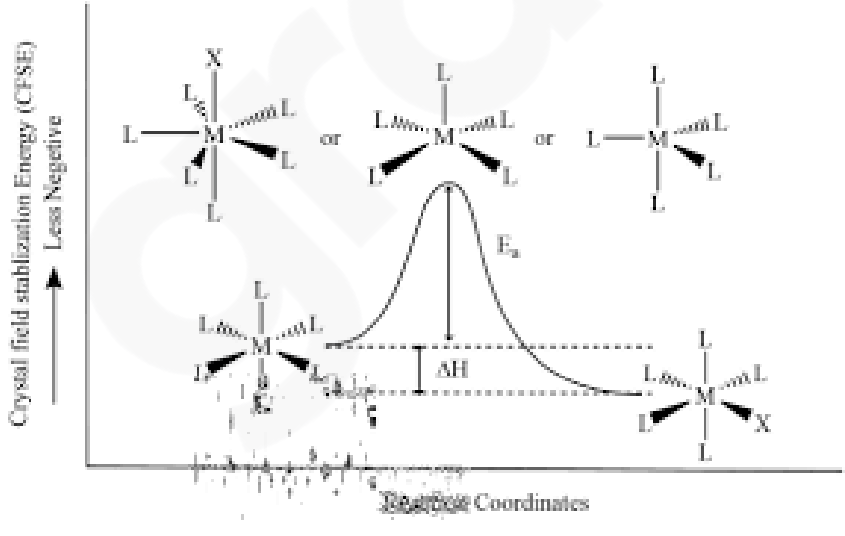
The reactions given follows Trans-effect.

The order of trans effect is as follow:NO_2 > Cl > NH_3

So, when $PtCl_4$ reacts with NH_3, first NH_3 replaces one Cl; and second NH_3 goes to trans of Cl since trans effect of Cl > NH_3

Similarly, when $PtCl_4$ reacts with $[NO_2]^{-2}$, it replaces one Cl. Thereafter, reaction with NH_3 makes NH_3 to occupy position trans to $[NO_2]^{-2}$ because trans effect of NO_2 > Cl > NH_3.

Solution 3:



Solution 4:

In reaction (i), bridged activated complex is formed. Also, group transfer occurs.

While in reaction (ii), no bridging ligand is present and no group transfer occurs. It is also a type of Cross reaction.

	Inner Sphere	Outer Sphere
Definition	It is most common method of electron transfer. It occurs between complexes via a binding ligand	It occurs between separate chemical species. Also, it occurs between complexed that do not undergo substitution
Oxidant and reductant	Lined via covalent bond	Separate and intact
Electron transfer method	Through the covalent bond	By force through the space
Intermediate formation	Electron transfer occurs after the formation of a bridging intermediate	Does not involve any bridging intermediate formation

Solution 5:

The order of trans-effect is: CN > CO > NO > C_2H_5 > PR_3 > H > C_6H_5 > NO_2 > I > SCN > Br > Cl > Py > NH_3 > OH > H_2O

Solution 6:

Complexes having d^2sp^3 hybridisation involves use of inner orbitals, thus form strong bonds whereas, complexes having sp^3d^2 hybridisation involves use of outer orbitals and are much less strong than outer orbital complexes.

Solution 7:

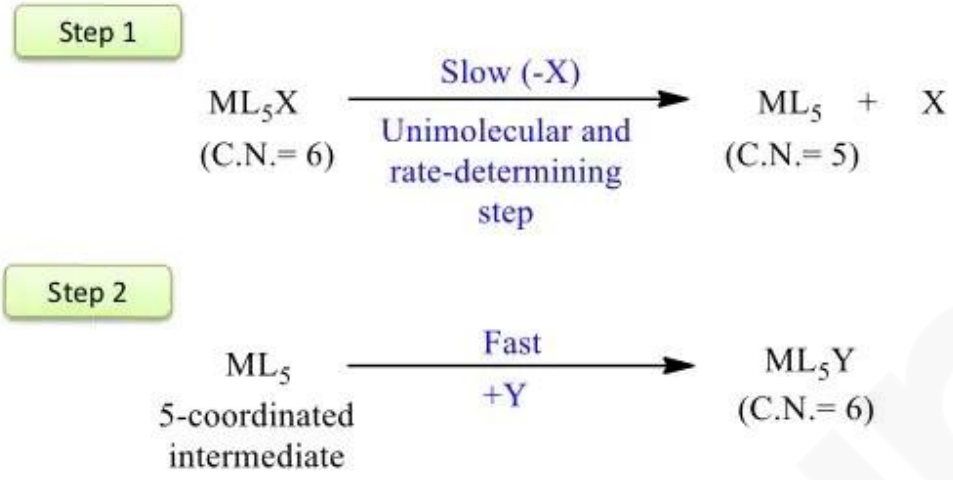
It is an example of acid hydrolysis reaction.

The rates of hydrolysis of reaction of this type have been studied and found to be FIRST ORDER reactions.

Since in aqueous solution, concentration of water is always constant, the effect of changes in water concentration on rate of reaction cannot be determined.

Rate law for this reaction becomes: $rate = k'[Co\ (NH_3)_5X^{+2}][\ H_2O]$. Thus, the rate law does not tell us whether water is involved in rate determining step.

Solution 8:



Solution 9:

Order of inertness is: L.S. Oh > d^3 = d^8 (Oh H.S. and L.S.) > d^4 (Oh L.S.) > d^5 (Oh L.S.)
Cr^{+3} is d^3 Fe^{+2} is d^6 Cr^{+2} is d^4 Ni^{+2} is d^8
So, Cr^{+3} is most inert of all.

Solution 10:

Hg^{+2} substitutes Cobalt in this reaction and becomes $Hg^{(0)}$ indicating it's an Electrophilic Substitution Reaction.