PHYSICAL / INORGANIC CHEMISTRY

DPP
DAILY PRACTICE PROBLEMS

DPP No. 7

Total Marks : 37

Max. Time : 41 min.

Topic : Coordination Compounds

Type of Questions		M.M., Min.
Single choice Objective ('–1' negative marking) Q.1 to Q.5	(3 marks, 3 min.)	[15, 15]
Comprehension ('–1' negative marking) Q.6 to Q.7	(3 marks, 3 min.)	[6, 6]
Subjective Questions ('–1' negative marking) Q.8 to Q.11	(4 marks, 5 min.)	[16, 20]

1. A coordination compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three moles of ions in an aqueous solution. The aqeuous solution on treatment with an excess of $AgNO_3$ gives two moles of AgCl as a precipitate. The formula of this complex would be :

(A) $Co[NH_3)_4NO_2Cl][NH_3Cl]$ (B) $[Co(NH_3)Cl]\ [ClNO_2]$

(C) $[Co(NH_3)_5NO_2]Cl_2$ (D) $[Co(NH_3)_5]\ [(NO_2)_2Cl_2]$

2. A complex with the molecular formula $CrCl_3.6H_2O$ is such that 1/3 of the total chloride is precipitated by adding $AgNO_3$ to its aqueous solution. Then, which of the following is its best representation :

(A) $CrCl_3.6H_2O$ (B) $[Cr(H_2O)_3\ Cl_3].3H_2O$

(C) $[CrCl_2(H_2O)_4]Cl.2H_2O$ (D) $[CrCl(H_2O)_5]Cl_2.H_2O$

3. Match list I with list II and select the correct answer :

List (I) (Equiv. conductance at infinite dilution)	**List (II)** (Formula)
(1) 229	(a) $[Pt(NH_3)_5Cl]Cl_3$
(2) 97	(b) $[Pt(NH_3)_3Cl_3]Cl$
(3) 404	(c) $[Pt(NH_3)_4Cl_2]Cl_2$
(4) 523	(d) $[Pt(NH_3)_6]Cl_4$

The code :

	1	2	3	4
(A)	e	a	b	d
(B)	a	c	d	b
(C)	a	d	c	b
(D)	c	b	a	d

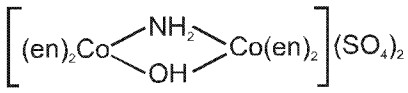
4. Which of the following complex ions obeys Sidgwick's effective atomic number (EAN) rule ?

(A) $[Fe(CN)_6]^{3-}$ (B) $[Fe(CN)_6]^{4-}$ (C) $[Cr(NH_3)_6]^{3+}$ (D) $[Ni(en)_3]^{2+}$

5. In which of the following complexes the effective atomic number is not equal to the atomic number of a inert gas

(A) $Ni(CO)_4$ (B) $[Co(NH_3)_6]^{3+}$ (C) $[Fe(CN)_6]^{4-}$ (D) $[CuCl_2]^-$

Comprehension # (Q.6 to Q.7)

The compound 

6. Correct IUPAC name of the above compound is :

(A) μ-amido-μ–hydroxidobis(bis(ethylenediammine)cobalt(III)) sulphate

(B) bis(ethylenediamine)cobalt(III)–μ–amido–μ–hydroxidobis(ethylenediamine)cobalt(III) sulphate

(C) Both A & B

(D) Neither (A) nor (B)

7. In the above compound bridging ligand(s) is/are :

(A) NH_2^- only (B) OH^- only (C) Both NH_2^- and OH^- (D) en and NH_2^-

8. Two compounds have the molecular formula, $Co(H_2O)_4(NO_2)_3$. In aqueous solution, one of these compounds does not conduct electricity while the other does. Write the possible structures of these two compounds.

9. Explain the following, giving appropriate reasons.

(i) Out of $K_4[Fe(CN)_6]$ and $K_3[Fe(NH_3)_6]$ solutions, the former has higher value of molar conductivity.

(ii) $[Pt(NH_3)_2Cl_2]$ and $[Pt(NH_3)_6]Cl_4$ differ in their electrolytic conductance

(iii) The value of molar conductivity of the aqueous solution of $[CoCl_3(NH_3)_3]$ is zero.

10. Arrange the following complexes in the increasing order of their electrical conductivity :

$[Co(NH_3)_3Cl_3]$, $[Co(NH_3)_6]Cl_3$ and $[Co(NH_3)_5Cl]Cl$.

11. The compound $CoCl_3.4NH_3$ contains only one Cl^- ion that is precipitated immediately on the addition of Ag^+ ions. Draw the structure of the compound on the basis of Werner's coordination theory.

Answer Key

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1.	C	**2.**	C	**3.**	D	**4.**	B	**5.**	D
6.	C	**7.**	C						

8. $Co(H_2O)_4(NO_2)_3$ $[Co(H_2O)_3(NO_2)_3]$. H_2O does not conduct electricity because no ion is generated in aq. sol. $[Co(H_2O)_4(NO_2)_2]NO_2$ will conduct electricity.

9. (i) $K_4[Fe(CN)_6]$ will produce 5 ions while $K_3[Fe(CN)_6]$ will produce 4 ions in aq. solution. So, higher molar conductivity.
(ii) $[Pt(NH_3)_2Cl_2]$ produce no ions but $[Pt(NH_3)_6]Cl_4$ produce 5 ions in aqueous solution. So, higher molar conductivity.
(iii) $[CoCl_3(NH_3)_3]$ will not produce any ion in aq. solution. So, conductivity. is zero.

10. Electrical conductivity depends on number of ions produced.
$[Co(NH_3)_6]Cl_3 > [Co(NH_3)_5Cl]Cl > [Co(NH_3)_3Cl_3]$

11. $CoCl_3\,4NH_3$
Since only one Cl^- ion is precipiteated by Ag^+ ion. This implies that only one Cl^- ion outside coordination sphere.

Hints & Solutions

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1. $Co(NH_3)_5NO_2Cl_2$
1 mole of this complex gives 3 moles of ions in aq. solution.
1 mole of this complex gives 2 mole of AgCl $\Rightarrow$ $2Cl^-$ outside the coordination sphere.
$\therefore$ $[Co(NH_3)_5NO_2]Cl_2$
$Co(NH_3)_5NO_2Cl_2$

2. $[CrCl_2(H_2O)_4]Cl.2H_2O$ will liberate $\frac{1}{3}$ of the total chloride ions for precipitation.

3. Eq. conductance at infinite dilution depends on no. of ions produced in the sol.
$[Pt(NH_3)_6]Cl_4 > [Pt(NH_3)_3Cl]Cl_3 > [Pt(NH_3)_4Cl_2]Cl_2 > [Pt(NH_3)_3Cl_3]Cl \longrightarrow$ no. of ions produced in the solution.

4. (B) E.A.N. = 26 – 2 + 12 = 36

5. In $[CuCl_2]^-$ EAN = 28 + 4 = 32

6. According rule of bridging ligand(s) naming

7. Bridging ligands are NH_2^- and OH^-