Chapter 9

Coordination Compounds

Solutions (Set-1)

Very Short Answer Type Questions :

1. Identify the complex ion and counter ion in $K_4[Fe(CN)_6]$.

Sol. $[Fe(CN)_6]^{4-}$ and K^+ respectively.

2. Write coordination number of central metal atom in $[Pt(en)_2Cl_2]$.

Sol. 6

3. Calculate oxidation number of underlined atom in $K_3[\underline{Fe}(C_2O_4)_3]$.

Sol. +3

4. Calculate EAN of underlined atom in $[\underline{Cr}(NH_3)_6]Cl_3$.

Sol. 33

5. Write IUPAC name of $Na[Co(CO)_4]$.

Sol. Sodium tetracarbonylcobaltate(–I)

6. Assign the charge (x) on coordination sphere $[Ni(DMG)_2]^x$.

Sol. 0 as Ni(II)

7. Why does ammonia readily form complex while ammonium ion does not?

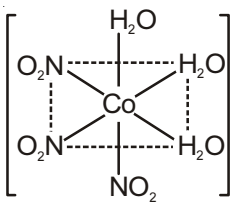
Sol. Ammonium ion (NH_4^+) neither has lone pair of electrons nor a vacant orbital.

8. What is the charge (x) present on $[Fe(CO)_4]^x$?

Sol. x = O

9. Draw the structure of fac-triaquatrinitrito-N-cobalt(III).

Sol.



10. Calculate magnetic moment in $Ni(CO)_4$.

Sol. Zero, as it has no unpaired electron.

Short Answer Type Questions :

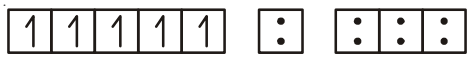
11. $K_2[PtCl_6]$ is ionized to three ions, when dissolved in water. Will it give white precipitate with $AgNO_3$?

Sol. No, because all Cl^- are in complex sphere which are not free in solution.

$$K_2[PtCl_6] \rightleftharpoons 2K^+ + [PtCl_4]^{2-}$$

12. Calculate number of unpaired electrons of central atom in $[MnCl_4]^{2-}$.

Sol. Manganese is present as Mn(II) and Cl^- is weak ligand. Hence it has five unpaired electrons

Mn^{+2} 

13. Aqueous solution of potassium ferrocyanide does not give test of iron(II) and it is not poisonous like potassium cyanide. Why?

Sol. Being a complex salt, it ionizes to $4K^+$ and $[Fe(CN)_6]^{4-}$ ions. Absence of Fe(II) does not give the test of iron. Absence of free CN^- makes it non-poisonous.

14. What is difference between oxygenation and oxidation?

Sol. In oxygenation, O_2 ligand is incorporated intact while in oxidation, it loses its identity.

15. Which type of *d*-electron configuration exhibit both low and high spin in octahedral complexes?

Sol. d^4, d^5, d^6, d^7.

16. All the octahedral complexes of Ni^{2+} are outer orbital complexes, why?

Sol. Ni^{+2} : 

Thus, only one 3*d*-orbital is available if all electrons paired up due to strong field ligand. Therefore, d^2sp^3 hybridisation is not possible. Only sp^3d^2 is possible which represents outer orbital complex.

17. $NH_2 - NH_2$ although possesses two electron pair for donation but not acts as chelating agent. Why?

Sol. The coordination by $NH_2 - NH_2$ leads to a three membered highly unstable strained ring and thus it does not act as chelating agent.

18. Why complex $[Al(NH_3)_6]^{3+}$ does not exist in aqueous solution?

Sol. $[Al(NH_3)_6]^{3+}$ undergoes the change into $[Al(H_2O)_6]^{3+}$ in aqueous medium due to higher heat of hydration of aluminium ion on account of its small size.

$$[Al(NH_3)_6]^{3+} + 6H_2O \longrightarrow [Al(H_2O)_6]^{3+} + 6NH_3$$

19. SCN^- shows linkage isomerism in coordination compounds. Explain.

Sol. Because it is ambidentate ligand.

20. Explain and arrange the following complexes in increasing order of molar conductivity on the basis of Werner theory :

(i) $[Cr(NH_3)_3(NO_2)_3]$

(ii) $K[Co(NH_3)_2(NO_2)_4]$

(iii) $K_2[Cr(NH_3)(NO_2)_5]$

Sol. i < ii < iii

Molar conductivity $\propto$ number of ions

21. How would you distinguish between $[Co(NH_3)_5SO_4]Br$ and $[Co(NH_3)_5Br]SO_4$ by chemical test?

Sol. $[Co(NH_3)_5SO_4]Br$ will give yellow precipitate of AgBr with $AgNO_3$, while $[Co(NH_3)_5Br]SO_4$ will give white precipitate of $BaSO_4$ with $BaCl_2$.

22. On the basis of VBT, explain geometry, nature of hybridisation and magnetic property of $[Co(ox)_3]^{3-}$.

Sol. Hybridisation – sp^3d^2

Geometry – octahedral

Paramagnetic in nature due to presence of four unpaired electrons.

23. Square planar complexes do not show optical isomerism. Why?

Sol. Because they contain a plane of symmetry.

24. $Ni(CO)_4$ possesses tetrahedral geometry, while $[Pt(NH_3)_4]^{2+}$ is square planar. Why?

Sol. $Ni(CO)_4$ possesses sp^3 hybridisation and then tetrahedral, whereas $[Pt(NH_3)_4]^{2+}$ possesses dsp^2 hybridisation, thus square planar.

25. Why does $[CoF_6]^{3-}$ give a high spin complex?

Sol. F^- is weak field ligand so it cannot pair up the electrons.

26. $[CuCl_4]^{2-}$ exists but $[CuI_4]^{2-}$ does not. Why?

Sol. $[CuI_4]^{2-}$ decomposed as $[CuI_4]^{2-} \longrightarrow 2CuI + 3I_2$. The instability may be explained as it is complex of oxidising agent (Cu^{2+}) and reducing agent (I^-). Also, I^- is poor electron donor than Cl^- and steric effect may also play some role.

27. What are essential requirements for regarding a compound as an organometallic? Give some examples.

Sol. In organometallic compounds, carbon forms bond with atom (metal/non-metal) which is less electronegative than carbon. For *e.g.*, $B(CH_3)_3$, $SiCl_3(CH_3)$ etc.

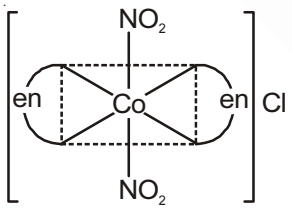
Long Answer Type Questions :

28. CO and N_2 are isoelectronic, but CO forms a number of complexes while N_2 forms very few. Explain.

Sol. N_2 is weaker σ-donor being very symmetrical and weaker π-acceptor than CO, so N_2 complexes are not much stable.

29. A compound $Co(en)_2 \cdot (NO_2)_2Cl$ exists in different isomeric forms. If it does not show optical activity, reacts with $AgNO_3$ but not with ethane-1,2-diammine, identify its structure.

Sol. It is trans isomer. It reacts with $AgNO_3$, so Cl atom is ionizable. It does not react with 'en', so two NO_2 groups are not adjacent.



30. The coordination number of Ni^{2+} in given complexes is 4.

$NiCl_2$ + KCN (excess) $\longrightarrow$ A (cyano complex)

$NiCl_2$ + conc. KCl (excess) $\longrightarrow$ B (chlorido complex)

Identify A and B, their magnetic moment with geometry.

Sol. $A = K_2[Ni(CN)_4]$

$B = K_2[NiCl_4]$

A is square planar with dsp^2 configuration. Due to absence of unpaired electron, it is diamagnetic (zero magnetic moment).

B is tetrahedral with sp^3 configuration, having two unpaired electrons (paramagnetic)

$$\mu = \sqrt{2(2+2)} = \sqrt{8} \text{ BM}$$

31. Arrange the following complexes in increasing order of CFSE (Δ_o) :

(i) $[Co(NH_3)_6]^{3+}$

(ii) $[Rh(NH_3)_6]^{3+}$

(iii) $[Ir(NH_3)_6]^{3+}$

Sol. (i) < (ii) < (iii)

Co, Rh and Ir belongs to 3*d*, 4*d* and 5*d* transition series respectively and CFSE increases by 30% between two adjacent members down the group.

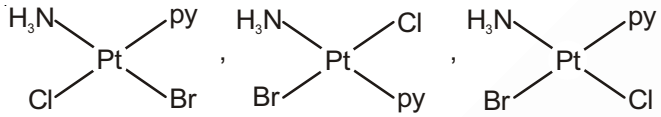
32. Write all the geometrical isomers of $[Pt(NH_3)(Cl)(py)(Br)]$. How many of these will exhibit optical isomerism?

Sol. Oxidation state of Pt = +2

Complex is square planar

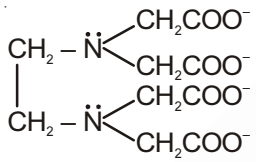
Square planar molecules of M(ABCD) type will not show optical isomerism.

Geometrical isomers are



33. Explain by structure that EDTA is hexadentate ligand.

Sol. EDTA has six sites to donate electrons.



Two N atoms and four O atoms are electron donor sites.

34. A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless. Why?

Sol. The value of energy difference between *d* levels (Δ) for the H_2O complex is in visible region and that for the cyano complex is in UV region.

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Chapter 9

Coordination Compounds

Solutions (Set-2)

1. Of the following, which ligand does not posses the name suggested by IUPAC when it acts as a ligand in complex?

   (1) H_2O, aqua (2) NH_3, ammonia (3) CO, carbonyl (4) F^-, fluoro

Sol. Answer (2)

Fact.

2. Write the structural formula for aqua-bromo-bis (ethylenediamine) chromium (III) chloride

   (1) $[CrBr(H_2O)\ (en)]Cl$ (2) $[CrBr_2(H_2O)\ (en)]Cl_2$ (3) $[CrBr(H_2O)\ (en)_2]Cl_2$ (4) $[CrBr(H_2O)\ (en)_2]Cl_3$

Sol. Answer (3)

$[CrBr(H_2O)(NH_2-CH_2-CH_2-NH_2)_2]Cl_2$

3. The complex cis $[CoCl(NH_3)(NH_2CH_2CH_2NH_2)_2]^{2+}$ has an octahedral geometry. Name of this complex ion according to IUPAC would be

   (1) cis - chloroamminethylenediamine cobalt (II) ion

   (2) cis - amminechloroethylenediamine cobalt (III) ion

   (3) cis - amminechlorobis (ethylenediamine) cobalt (II) ion

   (4) cis - amminechlorobis (ethylenediamine) cobalt (III) ion

Sol. Answer (4)

cis-amminechlorobis (ethylenediamine) cobalt (III) ion.

4. Which complex ion has cis and trans isomer?

   (1) $[PdCl_3NH_3]^-$ (2) $[Pd(CN)_5NH_3]^-$ (3) $[PtCl_2(CN)_2]^{2-}$ (4) $[Pt(C_2O_4)_2]^{2-}$

Sol. Answer (3)

For cis and trans isomer, complex should have $[MA_2B_2]$ or $[MA_2BC]$ or $[MA_4B_2]$ or $[MA_2B_4]$ formula.

5. What is the name of the complex $[Ni(H_2O)_4(NH_2CH_2CH_2NH_2)]SO_4.5H_2O$ as per IUPAC rules?

   (1) Aquaethylenediamine nickel (II) sulphate-1-water

   (2) Tetraaquaethylenediamine nickel (II) sulphate-5-water

   (3) Tetraaqua bis (ethylene diamine) nickel (II) sulphate-5-water

   (4) Tetraaqua bis (ethylene diamine) nickel (III) sulphate-5-water

Sol. Answer (2)

Tetraaquaethylenediamine nickel (II) sulphate-5-water.

6. Which pair of isomers illustrates the concepts of ionisation isomers?

(1) $[Cr(SCN)(NH_3)_5]^{2+}$ and $[Cr(NCS)(NH_3)_5]^{2+}$ (2) $[CoCl(NH_3)_5]SO_4$ and $[Co(SO_4)(NH_3)_5]Cl$

(3) cis $[PtCl_2(NH_3)_2]$ and trans $[PtCl_2(NH_3)_2]$ (4) (+) - $[Co(en)_3]^{3+}$ and (–) - $[Co(en)_3]^{3+}$

Sol. Answer (2)

$[CoCl(NH_3)_5]SO_4 \rightarrow [Co(SO_4)(NH_3)_5]Cl$ give different ions in solution.

7. Which of the following coordination compounds is incapable of showing geometrical isomerism?

(1) $[PtCl_2(NH_3)_2]$ (2) $[CoCl_2(NH_3)_4]^+$ (3) $[Co(NO_2)_3(NH_3)_3]$ (4) $[Co(en)_3]^{3+}$

Sol. Answer (4)

$[Co(en)_3]^{+3}$ does not show geometrical isomerism.

8. Which of the following compounds exhibit geometrical isomer?

(1) $Pt(NH_3)_2Cl_2$ (2) $Zn(NH_3)_2Cl_2$ (3) $Pt(NH_3)_3Cl$ (4) All of these

Sol. Answer (1)

$Pt(NH_3)_2Cl_2$

9. A six coordinate complex of formula $CrCl_3.6H_2O$ has green colour. A 0.1 M solution of the complex when treated with excess of $AgNO_3$ gave 28.7 g of white precipitate. The formula of the complex would be

(1) $[Cr(H_2O)_6]Cl_3$ (2) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ (3) $[Cr(H_2O)_4Cl_2]Cl.2H_2O$ (4) $[Cr(H_2O)_3Cl_3].3H_2O$

Sol. Answer (2)

0.1 mole of complex gives 28.7 gm of AgCl.

Mole of AgCl formed $\frac{28.7}{108+35.5} = 0.2$

So the formula is $[Cr(H_2O)_5Cl]Cl_2.H_2O$.

10. If excess of $AgNO_3$ solution is added to 100 ml of 0.024 M solution of dichlorobis (ethylene diamine) cobalt (III) chloride, how many moles of AgCl will be precipitated?

(1) 0.0012 (2) 0.0016 (3) 0.0024 (4) 0.0048

Sol. Answer (3)

One Cl^- ion is present outside the co-ordination sphere, so, mole of AgCl formed is equal to $\frac{1}{10}$ × mole of complex = 0.0024.

11. The EAN of Pt in potassium hexachloroplatinate (IV) is

(1) 46 (2) 86 (3) 36 (4) 84

Sol. Answer (2)

EAN = (78 – 4) + 2 × 6 = 86

12. Which of the following complex has five unpaired electrons?

(1) $[Mn(H_2O)_6]^{2+}$ (2) $[Mn(CN)_6]^{3-}$ (3) $[CrCl_3(H_2O)_3]$ (4) $[Ag(NH_3)_2]^+$

Sol. Answer (1)

$Mn^{+2} : 3d^5$

H_2O is a weak ligand, so, $[Mn(H_2O)_6]^{+2}$ complex contain 5 unpaired e^-.

13. Which of the following species is diamagnetic?

(1) An isolated, gas-phase V^{3+} ion (2) A high spin ocatahedral Fe^{+2} complex

(3) An isolated, gas phase Cu^{2+} ion (4) A low spin octahedral Co^{3+} complex

Sol. Answer (4)

Low spin complexes of Co^{+3} do not contain any unpaired e^-.

14. The complex $[Ni(CN)_4]^{2-}$ is diamagnetic and the complex $[NiCl_4]^{2-}$ is paramagnetic. What can you conclude about their molecular geometries?

(1) Both complexes have square planar geometries

(2) Both complexes have tetrahedral geometries

(3) $[NiCl_4]^{2-}$ has a square planar geometry while $[Ni(CN)_4]^{2-}$ has a tetrahedral geometry.

(4) $[NiCl_4]^{2-}$ has a tetrahedral geometry while $[Ni(CN)_4]^{2-}$ has a square planar geometry

Sol. Answer (4)

$[Ni(CN)_4]^{-2} \longrightarrow dsp^2 \rightarrow$ square planar

$(NiCl_4)^{-2} \longrightarrow sp^3 \rightarrow$ Tetrahedral

15. $[PtCl_2(NH_3)_2]$ [Electronic configuration of Pt : $[Xe]5d^86s^2$]

(1) A tetrahedral geometry and is paramagnetic in behaviour

(2) A tetrahedral geometry and is diamagnetic in behaviour

(3) A square planar geometry and is paramagnetic in behaviour

(4) A square planar geometry and is diamagnetic in behaviour

Sol. Answer (4)

Most of the complexes of Pt^{+2} are square planar and diamagnetic.

16. Which of the following complex is considered to be tetrahedral?

(1) $[FeCl_4]^-$ (2) $[Ni(CN)_4]^{2-}$ (3) $[PtCl_4]^{2-}$ (4) $[PdCl_2(NH_3)_2]$

Sol. Answer (1)

$[FeCl_4]^-$ is a tetrahedral complex.

17. Which of the following complex ions is more likely to be colourless?

(1) $[Co(H_2O)_6]^{2+}$ (2) $[Mn(CN)_6]^{3-}$ (3) $[CrCl_3(H_2O)_3]$ (4) $[Ag(NH_3)_2]^+$

Sol. Answer (4)

Ag^+ have $3d^{10}$ electronic configuration. So, no *d-d* transition is allowed.

18. How many unpaired electrons are present in the high spin form of $[CoF_6]^{3-}$ complex and which metal orbitals are used in bonding?

(1) 0 unpaired electrons and 4*s*, 4*p* and 4*d* orbitals to give sp^3d^2 hybridisation

(2) 4 unpaired electrons and 4*s*, 4*p* and 4*d* orbitals to give sp^3d^2 hybridisation

(3) 0 unpaired electrons and 3*d*, 4*s* and 4*p* orbitals to give d^2sp^3 hybridisation

(4) 4 unpaired electrons and 3*d*, 4*s* and 4*p* orbitals to give d^2sp^3 hybridisation.

Sol. Answer (2)

F^- is a weak ligand, so complex of Co^{+3} will be high spin.

hybridization $\rightarrow sp^3d^2$

19. Which of the following complexes are diamagnetic?

$[Mn(CN)_6]^{4-}$, $[Zn(NH_3)_4]^{2+}$, $[Fe(CN)_6]^{4-}$, $[FeF_6]^{3-}$

(1) $[Zn(NH_3)_4]^{2+}$ (2) $[Zn(NH_3)_4]^{2+}$ and $[FeF_6]^{3-}$

(3) $[Zn(NH_3)_4]^{2+}$ and $[Fe(CN)_6]^{4-}$ (4) $[Zn(NH_3)_4]^{2+}$, $[Mn(CN)_6]^{3-}$ and $[Fe(CN)_6]^{4-}$

Sol. Answer (3)

$[Zn(NH_3)_4]^{+2}$ and $[Fe(CN)_6]^{-4}$ are diamagnetic.

20. Which metal ion is likely to form a square planar complex ion with CN^-?

(1) Cu^{+1} (2) Ag^+ (3) Ni^{2+} (4) Zn^{2+}

Sol. Answer (3)

Ni^{+2} form square planar complex ion with CN^-.

21. $CuSO_4 + \underset{\text{excess}}{KCN} \longrightarrow \text{Complex}$

Correct regarding complex in this reaction is

(1) Octahedral, paramagnetic (2) Tetrahedral, paramagnetic

(3) Square planar, diamagnetic (4) Tetrahedral, diamagnetic

Sol. Answer (4)

22. Which of the given metal ion form high tendency to complex with CO?

(1) Sc^{+3} (2) Ti^{+3} (3) Mn^{+2} (4) Fe^{+2}

Sol. Answer (4)

Due to presence of high number of e^- in *d*-orbital.

23. Effective atomic number of Fe in $Fe_2(CO)_9$ is

(1) 35 (2) 36

(3) 37 (4) Cannot be calculated

Sol. Answer (2)

36

24. Which of the following divalent metal ion form the most stable complexes?

(1) Mn^{2+} (2) Fe^{2+} (3) Ni^{2+} (4) Cu^{2+}

Sol. Answer (4)

On the basis of Erwin William series, stability of complex increases as

$Mn^{+2} < Fe^{+2} < CO^{+2} < Ni^{+2} < Cu^{+2} > Zn^{+2}$.

25. Which of the following is most stable complex?

(1) $[Co(NH_3)_6]^{+2}$ (2) $[Co(NH_3)_6]^{+3}$ (3) $[Co(en)_2(NH_3)_2]^{+3}$ (4) $[Co(en)_3]^{+3}$

Sol. Answer (4)

Due to Chelation Effect.

26. For which of the following complex formula number of possible stereoisomers is maximum? (a, b and c are monodentate ligands]

(1) $[Ma_3b_3]$ (2) $[Ma_3b_2c]$ (3) $[Ma_4b_2]$ (4) $[Ma_4bc]$

Sol. Answer (2)

In case of $[Ma_3b_2c]$, no. of stereoisomers is 3 while for others it is 2.

27. The correct order of increasing field strength of following ligands is

I^- Br^- SCN^- Cl^-

I II III IV

(1) (I) < (II) < (III) < (IV) (2) (I) < (II) < (IV) < (III)

(3) (IV) < (III) < (II) < (I) (4) (III) < (I) < (II) < (IV)

Sol. Answer (1)

Correct order is

$I^- < Br^- < SCN^- < Cl^-$

28. In octahedral complexes for which of the following configuration of central metal atom magnitude of crystal field stabilisation energy (CFSE) is maximum in presence of ligand CN^- ?

(1) d^5 (2) d^6 (3) d^{10} (4) d^9

Sol. Answer (2)

In strong field ligands like CN^-, CFSE is maximum (magnitude) for d^6 configuration.

29. For complex $[Co(NH_3)_4(NO_2)_2]NO_3$ the isomerism which is not possible is

(1) Geometrical (2) Linkage (3) Co-ordination (4) Ionisation

Sol. Answer (3)

For complex $[Co(NH_3)_4(NO_2)_2]NO_3$ only co-ordination isomerism is not possible.

30. For which of the following complex effective atomic number (EAN) of central atom is not equal to its nearest noble gas?

(1) $[Mn_2(CO)_{10}]$ (2) $[Ni(CO)_4]$ (3) $[Pd(NH_3)_6]^{4+}$ (4) $[Fe(CN)_6]^{3-}$

Sol. Answer (4)

Effective atomic no. of Fe in $[Fe(CN)_6]^{3-}$ is 35.

31. Consider the following complex compound

Compound	Absorbed wavelength
A : $[Cr(H_2O)_6]^{3+}$	λ_1
B : $[Cr(CN)_6]^{3-}$	λ_2
C : $[Cr(H_2O)_3(NH_3)_3]^{3+}$	λ_3
D : $[Cr(H_2O)_4(NH_3)_2]^{3+}$	λ_4

The correct order of wavelength is

(1) $\lambda_2 < \lambda_3 < \lambda_4 < \lambda_1$ (2) $\lambda_2 < \lambda_4 < \lambda_3 < \lambda_1$ (3) $\lambda_1 < \lambda_4 < \lambda_3 < \lambda_2$ (4) $\lambda_1 < \lambda_3 < \lambda_4 < \lambda_2$

Sol. Answer (1)

Spliting increases as strength of ligand increases so absorbed wavelength decreases.

32. For octahedral complexes which configuration of central metal atom/ion in presence of ligand Cl^- which among the following do not have two electrons in e_g set?

(1) d^5 (2) d^6 (3) d^4 (4) d^8

Sol. Answer (3)

33. Select the correct order of increasing field strength of following molecules or ions :

F^-, OH^-, en, CN^-

(I) (II) (III) (IV)

(1) (I) < (II) < (III) < (IV) (2) (IV) < (III) < (II) < (I) (3) (II) < (I) < (III) < (IV) (4) (II) < (I) < (IV) < (III)

Sol. Answer (1)

Correct order : $F^- < OH^- <$ en $< CN^-$

34. In which of the following EAN of central metal atom is different from others?

(1) $[Mn_2(CO)_{10}]$ (2) $[Ni(CO)_4]$ (3) $[Fe(CN)_6]^{3-}$ (4) $[Fe(CO)_5]$

Sol. Answer (3)

EAN of Fe^{+3} in $[Fe(CN)_6]^{3-}$ = 35

In others EAN of central metal atom = 36

35. The ligand which cannot show linkage isomerism is

(1) NO_2^- (2) $C_2O_2S_2^{2-}$ (3) NO (4) $C_2O_4^{2-}$

Sol. Answer (4)

Oxalate ion has only oxygen as donor atom.

36. For which of the following complex salts, primary valency of central atom is same as that of ionizable chlorides?

(1) $[Co(NH_3)_6]Cl_3$ (2) $[Co(NH_3)_5Cl]Cl_2$ (3) $[Co(NH_3)_3Cl_3]$ (4) $[Co(NH_3)_4Cl_2]Cl$

Sol. Answer (1)

In case of $[Co(NH_3)_6]Cl_3$

Primary valency of Co = 3

Number of ionizable chlorines = 3

37. Which of the following is correct statement?

(1) $NO_2^{\ominus}$, $SCN^{\ominus}$ and $CN^{\ominus}$ are ambidentate ligand

(2) Secondary valency of nickel is 4 in tetracarbonylnickel(0) complex

(3) Diamminesilver(I) dicyanoargentate(I) can show isomerism

(4) All of these

Sol. Answer (4)

NO_2^-, SCN^- and CN^- have more than donor site.

38. Formula of compound A is $NiCl_2.6H_2O$ and geometry is octahedral. If complex A react with excess of $AgNO_3$ then 2 mol of AgCl precipitate, then correct statement about A is

(1) A is homoleptic complex (2) A can show geometrical isomer

(3) A can show optical isomer (4) Secondary valency of central atom in A is 2

Sol. Answer (1)

A is $[Ni(H_2O)_6]Cl_2$

39. Formation constant (k_f) data and dissociation constant (k_d) data is given, then select most stable complex.

(1) $[Ni(a)_6]^{+2}$ $k_f = 10^{12}$ (2) $[Ni(b)_6]^{+2}$ $k_f = 10^{10}$

(3) $[Ni(c)_6]^{+2}$ $k_d = 10^{-15}$ (4) $[Ni(d)_6]^{+2}$ $k_d = 10^{-8}$

Sol. Answer (3)

$$k_d = \frac{1}{k_f}$$

40. Chemical formula for the complex potassium hexacyanidoferrate (II) is

(1) $K_4[Fe(CN)_6]$ (2) $Fe[K_4(CN)_6]$ (3) $K_6[Fe(CN)_6]$ (4) $K_4[Fe_2(CN)_6]$

Sol. Answer (1)

$K_4[Fe(CN)_6]$

41. Which of the following can show geometrical isomerism? [here a and b are monodentate ligand. AA → sym. bidendate ligand]

(1) Ma_6 (2) Ma_5b (3) $M(AA)_3$ (4) Ma_3b_3

Sol. Answer (4)

Ma_3b_3 form fac and mer isomer.

42. In which of the following complex, central atom is inner orbital hybridized?

(1) $K_4[Ni(CN)_6]$ (2) $K_2[Zn(CN)_4]$ (3) $K_4[Fe(CN)_6]$ (4) $K_2[ZnCl_4]$

Sol. Answer (3)

$K_4[Fe(CN)_6]$ is inner orbital complex.

43. Which of the following compound absorb highest wavelength of light?

(1) $[Fe(H_2O)_6]^{3+}$

(2) $[Fe(ox)_3]^{3-}$

(3) $[Fe(CN)_6]^{3-}$

(4) All compound absorb equal wavelength of light

Sol. Answer (1)

H_2O is weak ligand.

44. I. $[Co(H_2O)_5Cl]\ Cl_2 . H_2O$ can show hydrate isomerism

II. $[Fe(NH_3)_5NO_2]SO_4$ can show linkage isomerism

(1) Statement I is true (2) Statement II is true

(3) Both I and II are true (4) Neither I nor II is true

Sol. Answer (3)

Both I and II are true.

45. In which of the following ion magnetic moment of the co-ordination compound is not affected by nature of ligand?

(1) Zn^{2+} (2) Fe^{3+} (3) Fe^{2+} (4) Ni^{2+}

Sol. Answer (1)

Zn^{+2} configuration $\Rightarrow |Ar|4s^0 3d^{10}$

Zn^{2+} is diamagnetic and no effect of ligand

Fe^{3+} configuration $\Rightarrow |Ar|4s^0 3d^5$

With strong field and weak ligand magnetic moment is different

$Fe^{2+} = |Ar|4s^0 3d^6$

With strong field ligand magnetic moment is zero and with weak field unpaired electron is 4 (octahedral complex)

$Ni^{2+} = |Ar|4s^0 3d^8$

Different magnetic moment with strong and weak field ligand.

46. Which of the following is spin free complex?

(1) $[CoF_6]^{3-}$ (2) $K_2[Ni(CN)_4]$ (3) $[Co(CN)_6]^{3+}$ (4) $K_2[PtCl_4]$

Sol. Answer (1)

Co^{3+} with weak field ligand form high spin or spin free complex.

47. In the given below complex, which of the following is the most stable complex?

(1) $[Fe(NH_3)_6]^{+2}$ (2) $[Fe(H_2O)_6]SO_4$ (3) $Na_2[Fe(EDTA)]$ (4) $Na_4[Fe(C_2O_4)_3]$

Sol. Answer (3)

Chelating complexes are more stable.

48. Which of the following is correct about Potassium hexacyanoplatinate(IV)?

(1) Compound can show isomerism

(2) Compound is inner orbital hybridized and diamagnetic

(3) If all cyanide are replaced by chlorine geometry will be octahedral

(4) All of these are correct

Sol. Answer (4)

$K_2[Pt(CN)_6]$ can show linkage isomerism and inner hybridized with $\mu = 0$

49. Which of the following statement is incorrect?

(1) In coordination compounds metals show two types of valences that are primary and secondary

(2) The primary valences are generally ionisable

(3) The secondary valences are non-ionisable in coordination compound

(4) The groups bound by secondary linkages to metal have no characteristic spatial arrangements

Sol. Answer (4)

Geometry is decided by secondary valency.

50. For Ag^+ metal ion, correct sequence regarding ligand strength is

(1) $F^- > Cl^- > Br^- > I^-$ (2) $I^- > Br^- > Cl^- > F^-$

(3) $Cl^- > Br^- > F^- > I^-$ (4) $F^- > Br^- > I^- > Cl^-$

Sol. Answer (2)

$I^- > Br^- > Cl^- > F^-$

51. Which of the following ligands may be flexidentate?

(1) $[EDTA]^{4-}$ (2) CO_3^{-2} (3) NO_3^- (4) All of these

Sol. Answer (4)

All these are flexidentate ligand.

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