26. Coordination Compounds – Multiple Choice Questions

1. Basic Terms

1. $[Pt(NH_3)_6]Cl_4$ complex gives

(a) 4 ions (b) 3 ions

(c) 2 ions (d) 5 ions

2. Ligand in a complex salt are

(a) Anions linked by coordinate bonds to a central metal atom or ion

(b) Cations linked by coordinate bonds to a central metal atom or ion

(c) Molecules linked by coordinate bonds to a central metal atom or ion

(d) Ions or molecules linked by coordinate bonds to a central metal atom or ion

3. A group of atoms can function as a ligand only when

(a) It is a small molecule

(b) It has an unshared electron pair

(c) It is a negatively charged ion

(d) It is a positively charged ion

4. The coordination number of Cu in complex $[Cu(H_2O)_4]^{++}$ is

(a) 4 (b) 3

(c) 2 (d) 1

5. Potassium ferrocyanide is a

(a) Normal salt (b) Mixed salt

(c) Double salt (d) Complex salt

6. Which of the following is the odd one out

(a) Potassium ferrocyanide

(b) Ferrous ammonium sulphate

(c) Potassium ferricyanide

(d) Tetrammine copper (II) sulphate

7. The number of ions given by the complex compound $[Co(NH_3)_4Cl_2]Cl$ is

(a) 2 (b) 3

(c) 4 (d) 5

8. Which one is ambidentate ligand

(a) SO_3^{2-} (b) CN^-

(c) NH_3 (d) H_2O

9. Carnallite in solution in H_2O, shows the properties of

(a) K^+, Mg^{2+}, Cl^- (b) $K^+, Cl^-, SO_4^{2-}, Br^-$

(c) K^+, Mg^{2+}, CO_3^{2-} (d) K^+, Mg^{2+}, Cl^-, Br^-

10. In complex compounds, metal ligand bond is

(a) Coordinate bond (b) Hydrogen bond

(c) Ionic bond (d) Covalent bond

11. An aqueous solution of potash alum gives

(a) Two types of ions (b) Only one type of ion

(c) Four types of ions (d) Three types of ions

12. In the complex ion $[Co(NH_3)_6]^{3+}$, the NH_3 molecules are linked to the central metal ion by

(a) Ionic bonds (b) Covalent bonds

(c) Coordinate bonds (d) Hydrogen bonds

13. Which of the following ligand possess only one coordination site

(a) O^{2-} (b) CO_3^{2-}

(c) SO_4^{2-} (d) $[OX]^{2-}$

14. Which of the following is a neutral complex

(a) $[Pt(NH_3)_2Cl_2]$ (b) $[Co(NH_3)_6]Cl_3$

(c) $[Ni(NH_3)_6]Cl_2$ (d) $K_4[Fe(CN)_6]$

15. $[EDTA]^{4-}$ is a

(a) Monodentate ligand (b) Bidentate ligand

(c) Quadridentate ligand (d) Hexadentate ligand

16. Which of the following species is not expected to be a ligand

(a) NO (b) NH_4^+

(c) $NH_2CH_2CH_2NH_2$ (d) CO

17. Which of the following is a negatively charged bidentate ligand

(a) Dimethyl glyoximato (b) Cyano

(c) Ethylene diamine (d) Acetato

18. When *EDTA* solution is added to Mg^{2+} ion solution, then which of the following statements is not true

(a) Four coordinate sites of Mg^{2+} are occupied by *EDTA* and remaining two sites are occupied by water molecules

(b) All six coordinate sites of Mg^{2+} are occupied

(c) *pH* of the solution is decreased

(d) Colourless $[Mg - EDTA]^{2-}$ chelate is formed

19. A chelating agent has two or more than two donor atoms to bind to a single metal ion. Which of the following is not a chelating agent

(a) Thiosulphato (b) Oxalato

(c) Glycinato (d) Ethane-1, 2-diamine

20. The anion of acetylacetone (acac) forms $Co\,(acac)_3$ chelate with Co^{3+}. The rings of the chelate are

(a) Five membered (b) Four membered

(c) Six membered (d) Three membered

21. Among the following, the π – acid ligand is

(a) F (b) NH_3

(c) CN^- (d) I^-

2. Nomenclature, Oxidation state

1. NH_3 group in a coordination compound is named as

(a) Ammonium (b) Ammine

(c) Amine (d) Ammonia

2. Oxidation state of nitrogen is incorrectly given for

	Compound	**Oxidation state**
(a)	$[Co(NH_3)_5Cl]Cl_2$	0
(b)	NH_2OH	–1
(c)	$(N_2H_5)_2SO_4$	+2
(d)	Mg_3N_2	–3

3. The IUPAC name of $[Co(NH_3)_3(NO_2)_3]$ is

(a) Trinitrotriammine cobalt (III)

(b) Triamminetrinitro cobalt (III)

(c) Trinitrotriammine cobalt (III) ion

(d) Trinitrotriammine cobaltate (III)

4. The IUPAC name of compound $Na_3[Co(ONO)_6]$ will be

(a) Hexanitritocobalt (III) sodium

(b) Sodium cobalt nitrite

(c) Sodium hexanitrocobaltate (III)

(d) Sodium hexanitritocobaltate (III)

5. IUPAC name of $[Co(ONO)(NH_3)_5]Cl_2$ is

(a) Pentaammine nitro cobalt (III) chloride

(b) Pentaammine nitrito cobalt (III) chloride

(c) Pentaammine nitroso cobalt (III) chloride

(d) Pentaammine oxo-nitro cobalt (III) chloride

6. The oxidation number, *d*-orbital occupation and co-ordination number of *Cr* in the complex $cis[Cr(en)_2Cl_2]Cl$ are respectively

(a) +3, $3d$ and 4 (b) +3, $4d$ and 6

(c) +3, $3d$ and 6 (d) +2, $3d$ and 6

7. The correct IUPAC name of $[Pt(NH_3)_2Cl_2]$ is

(a) Diamminedichloridoplatinum (II)

(b) Diamminedichloridoplatinum (IV)

(c) Diamminedichloridoplatinum (0)

(d) Dichloridodiammineplatinum (IV)

8. IUPAC name of $[Pt(NH_3)_2Cl(NO_2)]$ is

(a) Platinum diaminechloronitrite

(b) Chloronitrito-N-ammineplatinum (II)

(c) Diamminechloridonitrito-N-platinum (II)

(d) Diamminechloronitrito-N-platinate (II)

9. The IUPAC name of the compound $[CuCl_2(CH_3NH_2)_2]$ is

(a) Dichloro *bis* (dimethyl amine) copper (II)

(b) Dichloro *bis* (methyl amine) copper (II)

(c) Dimethyl amine copper (II) chloride

(d) *Bis* (dimethyl amine) copper (II) chloride

10. Which one of the following has the highest molar conductivity

(a) Diamminedichloroplatinum(II)

(b) Tetraamminedichlorocobalt(III) chloride

(c) Potassium hexacyanoferrate(II)

(d) Hexaaquochromium(III) bromide

(e) Pentacarbonyliron(0)

11. Oxidation state of iron in $[Fe(H_2O)_5NO]SO_4$ is

(a) +1 (b) +2

(c) +3 (d) +4

12. The correct IUPAC name for $[CrF_2(en)_2]Cl$ is

(a) Chloro difluorido ethylene diaminechromium (III) chloride

(b) Difluoridobis (ethylene diamine) chromium (III) chloride

(c) Difluorobis-(ethylene diamine) chromium (III) chloride

(d) Chloro difluoridobis (ethylene diamine) chromium (III)

13. Name the complex $Ni(PF_3)_4$

(a) Tetrakis (phosphorus tri fluoride) nickel (0)

(b) Tetra (phosphorus (III) fluoride) nickel

(c) Nickel tetrakis phosphorus (III) fluoride

(d) (Phosphorus (III) tetrakis fluoride) nickel (0)

14. As per IUPAC norms, the name of the complex $[Co(en)_2(ONO)Cl]Cl$ is

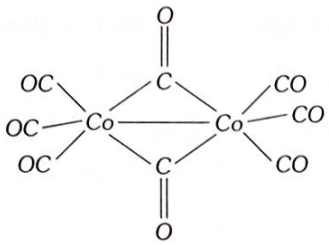
(a) Chloridobis (ethane-1, 2-diamine) nitro-O-cobalt (III) chloride

(b) Chlorobis (ethylenediamine) nitro-O-cobalt (III) chloride

(c) Chloridodi (ethylene diamine) nitrocobalt (III) chloride

(d) Chloroethylenediaminenitro-O-cobalt (III) chloride

15. The oxidation state of cobalt in the following molecule is



(a) 3 (b) 1

(c) 2 (d) 0

3. Isomerism

1. $[Co(NH_3)_5NO_2]Cl_2$ and $[Co(NH_3)_5(ONO)]Cl_2$ are related to each other as

(a) Geometrical isomers (b) Optical isomers

(c) Linkage isomers (d) Coordination isomers

2. $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are examples of which type of isomerism

(a) Linkage (b) Geometrical

(c) Ionization (d) Optical

3. Which of the following compounds exhibits linkage isomerism

(a) $[Co(en)_3]Cl_3$ (b) $[Co(NH_3)_6][Cr(CN)_6]$

(c) $[Co(en)_2NO_2Cl]Br$ (d) $[Co(NH_3)_5Cl]Br_2$

4. The complexes $[Co(NH_3)_6][Cr(C_2O_4)_3]$ and $[Cr(NH_3)_6][Co(C_2O_4)_3]$ will have which type of isomerism

(a) Linkage isomerism (b) Geometrical isomerism

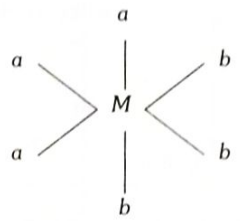
(c) Coordination isomerism (d) Ionisation isomerism

5. Which of the following can participate in linkage isomerism

(a) NO_2^- (b) $H_2\ddot{N}CH_2CH_2\ddot{N}H_2$

(c) H_2O (d) $:NH_3$

6. Octahedral complex is



(a) cis (b) trans

(c) mer (d) fac

7. Indicate the complex ion which shows geometrical isomerism

(a) $[Cr(H_2O)_4Cl_2]^+$ (b) $[Pt(NH_3)_3Cl]$

(c) $[Co(NH_3)_6]^{3+}$ (d) $[Co(CN)_5(NC)]^{3-}$

8. Due to the presence of ambidentate ligands coordination compounds show isomerism. Palladium complexes of the type $[Pd(C_6H_5)_2(SCN)_2]$ and $[Pd(C_6H_5)_2(NCS)_2]$ are

(a) Linkage isomers (b) Coordination isomers

(c) Ionisation isomers (d) Geometrical isomers

9. The compounds $[Co(SO_4)(NH_3)_5]Br$ and $[Co(SO_4)(NH_3)_5]Cl$ represent

(a) Linkage isomerism (b) Ionisation isomerism

(c) Coordination isomerism (d) No isomerism

10. What kind of isomerism exists between $[Cr(H_2O)_6]Cl_3$, (violet) and $[Cr(H_2O)_5Cl]Cl_2.H_2O$ (grayish-green)

(a) Linkage isomerism (b) Solvate isomerism

(c) Ionisation isomerism (d) Coordination isomerism

11. Which one of the following will not show geometrical isomerism

(a) $[Cr(NH_3)_4Cl_2]Cl$ (b) $[Co(en)_2Cl_2]Cl$

(c) $[Co(NH_3)_5NO_2]Cl_2$ (d) $[Pt(NH_3)_2Cl_2]$

12. The possible number of optical isomers in $[Co(en)_2Cl_2]^+$ are

(a) 2 (b) 3

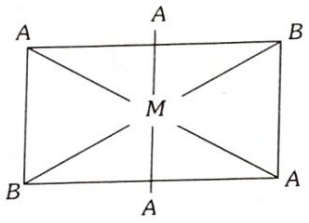
(c) 4 (d) 6

13. For the given complex $[CoCl_2(en)(NH_3)_2]^+$, the number of geometrical isomers, the number of optical isomers and total number of isomers of all type possible respectively are

(a) 2, 2 and 4 (b) 2, 2 and 3

(c) 2, 0 and 2 (d) 0, 2 and 2

14. The isomer is



(a) Dextro isomer (b) Laevo isomer

(c) cis-isomer (d) trans-isomer

15. In a particular isomer of $[Co(NH_3)_4Cl_2]^0$, the $Cl-Co-Cl$ angle is 90^0, the isomer is known as

(a) Optical isomer (b) Cis-isomer

(c) Position isomer (d) Linkage isomer

16. The number of isomers possible for the octahedral complex $[CoCl_2(en)(NH_3)_2]^+$ is

(a) Two (b) Three

(c) No isomer (d) Four isomers

17. The number of geometrical isomers of $[CrCl_2(en)(NH_3)_2]$, where en = ethylenediamine, is

(a) 2 (b) 3

(c) 4 (d) 1

18. Among the following complexes, the one that can exhibit optical activity is

(a) $[CoCl_6]^{3-}$ (b) $[Co(en)Cl_4]^-$

(c) $cis-[Co(en)_2Cl_2]^{3+}$ (d) $trans-[Co(en)_2Cl_2]^+$

4. Werner's Coordination Theory

1. The secondary valency of platinum in tetra ammine dichloroplatinum (IV) chloride is

(a) +4 (b) +2

(c) 3 (d) 6

2. Pick out from the following complex compounds, a poor electrolytic conductor in solution

(a) $K_2[PtCl_6]$ (b) $[Co(NH_3)_3(NO_2)_3]$

(c) $K_4[Fe(CN)_6]$ (d) $[Cu(NH_3)_4]SO_4$

3. Which of the following will not give a precipitate with $AgNO_3$

(a) $[Co(NH_3)_3Cl_3]$ (b) $[Co(NH_3)_4Cl_2]Cl$

(c) $[Co(NH_3)_5Cl]Cl_2$ (d) $[Co(NH_3)_6]Cl_3$

4. A co-ordination complex compound of cobalt has the molecular formulae containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three mole ions in an aqueous solution on reacting with excess of $AgNO_3$, $AgCl$ precipitate. The ionic formula for this complex would be

(a) $[Co(NH_3)_5(NO_2)]Cl_2$

(b) $[Co(NH_3)_5Cl][Cl(NO_2)]$

(c) $[Co(NH_3)_4(NO_2)Cl][(NH_3)Cl]$

(d) $[Co(NH_3)_5][(NO_2)_2Cl_2]$

5. When 0.1 mol $CoCl_3(NH_3)_5$ is treated with excess of $AgNO_3$, 0.2 mol of $AgCl$ are obtained. The conductivity of solution will correspond to

(a) 1 : 3 electrolyte (b) 1 : 2 electrolyte

(c) 1 : 1 electrolyte (d) 3 : 1 electrolyte

6. When 1 mole of $CrCl_3.6H_2O$ is treated with excess of $AgNO_3$, 3 moles of $AgCl$ are obtained. The formula of the complex is

(a) $[CrCl_3(H_2O)_3].3H_2O$ (b) $[CrCl_2(H_2O)_4]Cl.2H_2O$

(c) $[CrCl(H_2O)_5]Cl_2.H_2O$ (d) $[Cr(H_2O)_6]Cl_3$

7. The coordination number of a metal in coordination compounds is

(a) Same as primary valency

(b) Sum of primary and secondary valencies

(c) Same as secondary valency

(d) None of these

8. Given the molecular formula of the hexa coordinated complexes (A) $CoCl_3.6NH_3$ (B) $CoCl_3.5NH_3$ (C) $CoCl_3.4NH_3$. If the number of co-ordinated NH_3 molecules in A, B and C respectively are 6, 5 and 4, the primary valency in (A), (B) and (C) are

(a) 6, 5, 4 (b) 3, 2, 1

(c) 0, 1, 2 (d) 3, 3, 3

9. Which compound is zero valent metal complex

(a) $[Cu(NH_3)_4]SO_4$ (b) $[Pt(NH_3)_2Cl_2]$

(c) $[Ni(CO)_4]$ (d) $K_3[Fe(CN)_6]$

10. The number of ions produced in water by dissolution of the complex having the empirical formula, $CoCl_3 4NH_3$, is

(a) 1 (b) 2

(c) 4 (d) 3

5. Valence Bond Theory and Geometry and Magnetic Nature of Coordination Compounds

1. Magnetic moment of $(NH_4)_2[MnBr_4]$ is ..... BM

(a) 5.91 (b) 4.91

(c) 3.91 (d) 2.46

2. Which of the following is diamagnetic in nature

(a) Co^{3+} octahedral complex with weak field ligands

(b) Co^{3+} octahedral complex with strong field ligands

(c) Co^{2+} in tetrahedral complex

(d) Co^{2+} in square planar complex

3. What will be the theoretical value of magnetic moment (μ) when CN^- ligands join Fe^{3+} ion to yield complex

(a) 2.83 *BM* (b) 3.87 *BM*

(c) 5.92 *BM* (d) 1.73 *BM*

4. Which of the following species will be diamagnetic

(a) $[Fe(CN)_6]^{3-}$ (b) $[FeF_6]^{3-}$

(c) $[Co(C_2O_4)_3]^{3-}$ (d) None of the above

5. The reaction $[Fe(CNS)_6]^{3-} \rightarrow [FeF_6]^{3-}$ takes place with

(a) Decrease in magnetic moment

(b) Increase in magnetic moment

(c) Decrease in co–ordination number

(d) Increase in co–ordination number

6. Which among the following is a paramagnetic complex

(a) $[Co(NH_3)_6]^{3+}$ (b) $[Pt(en)Cl_2]$

(c) $[CoBr_4]^{2-}$ (d) $Mo(CO)_6$

(At. no. $Mo = 42$, $Pt = 78$)

7. What type of hybridization is involved in $[Fe(CN)_6]^{3-}$

(a) d^2sp^3 (b) dsp^2

(c) sp^3d^2 (d) dsp^3

8. Which of the following shell form an outer octahedral complex

(a) d^4 (low spin) (b) d^8 (high spin)

(c) d^6 (low spin) (d) None of these

9. Hybridisation, shape and magnetic moment of $K_3[Co(CO_3)_3]$ is

(a) d^2sp^3, octahedral, 4.9 BM

(b) sp^3d^2, octahedral, 4.9 BM

(c) dsp^2, square planar, 4.9 BM

(d) sp^3, tetrahedral, 4.9 BM

10. In $Fe(CO)_5$, the $Fe \leftarrow CO$ σ bond results by the overlap between filled sp hybrid orbital of C – atom of CO molecule and vacant

(a) d^2sp^3 (b) sp^3

(c) dsp^3 (d) dsp^2 hybrid orbital of Fe

11. Both $[Ni(CO)_4]$ *and* $[Ni(CN)_4]^{2-}$ are diamagnetic. The types of hybridization of Ni in these complexes are____and____ respectively

(a) sp^3, sp^3 (b) sp^3, dsp^2

(c) dsp^2, sp^3 (d) dsp^2, dsp^2

12. The bonds in $K_4[Fe(CN)_6]$ are

(a) All ionic

(b) All covalent

(c) Ionic and covalent

(d) Ionic, covalent and coordinate covalent

13. The spin–only magnetic moments of $[Mn(CN)_6]^{4-}$ and $[MnBr_4]^{2-}$ in Bohr Magneton, respectively, are

(a) 5.92 and 5.92 (b) 4.89 and 1.73

(c) 1.73 and 5.92 (d) 1.73 and 1.73

14. For a tetrahedral complex $[MCl_4]^{2-}$, the spin–only magnetic moment is 3.83 *B.M*. The element M is

(a) Co (b) Cu

(c) Mn (d) Fe

15. The spin-only magnetic moments of $[Fe(NH_3)_6]^{3+}$ and $[FeF_6]^{3-}$ in BM are, respectively,

(a) 1.73 and 1.73 (b) 5.92 and 1.73

(c) 1.73 and 5.92 (d) 5.92 and 5.92

16. The spin only magnetic moment of $[ZCl_4]^{2-}$ is 3.87BM where Z is

(a) Mn (b) Ni

(c) Co (d) Cu

6. Ligand and Crystal Field Theory

1. Which is high spin complex

(a) $[CoF_6]^{3-}$ (b) $[Fe(CN)_6]^{3-}$

(c) $[Fe(CN)_6]^{4-}$ (d) None of these

2. Which of the following configuration of ions has zero *CFSE* in both strong and weak ligand fields

(a) d^{10} (b) d^8

(c) d^6 (d) d^4

3. The complex ion having minimum magnitude of $\Delta_0(CFSE)$ is

(a) $[Co(Cl)_6]^{3-}$ (b) $[Cr(CN)_6]^{3-}$

(c) $[Cr(H_2O)_6]^{3+}$ (d) $[Co(NH_3)_6]^{3+}$

4. $[Co(CN)_6]^{3-}$, a complex ion of cobalt (III), absorbs radiations in violet region of the visible light. Its aqueous solution, therefore, appears

(a) Pink (b) Orange

(c) Blue (d) Yellow

5. The colour of the coordination compounds depends on the crystal field splitting. What will be the correct order of absorption of wavelength of light in the visible region, for the complexes, $[Co(NH_3)_6]^{3+}$,$[Co(CN)_6]^{3-}$, $[Co(H_2O)_6]^{3+}$

(a) $[Co(CN)_6]^{3-} > [Co(NH_3)_6]^{3+} > [Co(H_2O)_6]^{3+}$

(b) $[Co(NH_3)_6]^{3+} > [Co(H_2O)_6]^{3+} > [Co(CN)_6]^{3-}$

(c) $[Co(H_2O)_6]^{3+} > [Co(NH_3)_6]^{3+} > [Co(CN)_6]^{3-}$

(d) $[Co(CN)_6]^{3-} > [Co(NH_3)_6]^{3+} > [Co(H_2O)_6]^{3+}$

6. The $CFSE$ for octahedral $[CoCl_6]^{4-}$ is 18,000 cm^{-1}. The $CFSE$ for tetrahedral $[CoCl_4]^{2-}$ will be

(a) $18,000\,cm^{-1}$ (b) $16,000\,cm^{-1}$

(c) $8,000\,cm^{-1}$ (d) $20,000\,cm^{-1}$

7. The magnitude of crystal field stabilization energy ($CFSE$ of Δ_t) in tetrahedral complexes is considerably less than that in the octahedral field. Because

(a) There are only four ligands instead of six so the ligand field is only 2/3 the size hence the Δ_t is 2/3

(b) The direction of the orbitals does not coincide with the direction of the ligands. This reduces the crystal field stabilization energy (Δ) by further 2/3

(c) Both points (a) and (b) are correct

(d) Both points (a) and (b) are wrong

8. Which of the following configuration can undergo distortion

(a) $t_{2g}^6 e_g^1$ (b) $t_{2g}^6 e_g^2$

(c) $t_{2g}^6 e_g^4$ (d) $t_{2g}^6 e_g^0$

7. Complex Stability, Spectrochemical Series and EAN

1. What is the EAN of nickel in $Ni(CO)_4$

(a) 34 (b) 35

(c) 32 (d) 36

2. If the Effective Atomic Number (EAN) of $[A(NH_3)_6]Cl_3$ is 33, is the atomic number of the element (A) will be

(a) 23 (b) 27

(c) 24 (d) 29

3. Which of the following factors tends to increase the stability of metal ion complexes

(a) Higher ionic radius of the metal ion

(b) Higher charge/size ratio of the metal ion

(c) Lower ionisation potential of the metal ion

(d) Lower basicity of the ligand

4. Which of the following complexes formed by Cu^{2+} ions is most stable

(a) $Cu^{2+} + 4NH_3 \longrightarrow [Cu(NH_3)_4]^{2+}$, $\log K = 11.6$

(b) $Cu^{2+} + 4CN^- \longrightarrow [Cu(CN)_4]^{2-}$, $\log K = 27.3$

(c) $Cu^{2+} + 2en^- \longrightarrow [Cu(en)_2]^{2+}$, $\log K = 15.4$

(d) $Cu^{2+} + 4H_2O \longrightarrow [Cu(H_2O)_4]^{2+}$, $\log K = 8.9$

5. The stabilisation of coordination compounds due to chelation is called the chelate effect. Which of the following is the most stable complex species

(a) $[Fe(CO)_5]$ (b) $[Fe(CN)_6]^{3-}$

(c) $[Fe(C_2O_4)_3]^{3-}$ (d) $[Fe(H_2O)_6]^{3+}$

6. CO is a stronger ligand then Cl^-, because

(a) CO is a neutral molecule (b) CO has π – bonds

(c) CO is poisonous (d) CO is more reactive

7. Which of the following sequence is correct regarding field strength of ligands as per spectrochemical series

(a) $SCN^- < F^- < CN^- < CO$

(b) $F^- < SCN^- < CN^- < CO$

(c) $CN^- < F^- < CO < SCN^-$

(d) $SCN^- < CO < F^- < CN^-$

8. The most stable coordination compound is

(a) $[Fe(H_2O)_6]^{3+}$ (b) $[Fe(NH_3)_6]^{3+}$

(c) $[Fe(C_2O_4)_3]^{3-}$ (d) $[FeCl_6]^{3+}$

9. Pick out the complex compound in which the central metal atom obeys EAN rule strictly

(a) $K_4[Fe(CN)_6]$ (b) $K_3[Fe(CN)_6]$

(c) $[Cr(H_2O)_6]Cl_3$ (d) $[Cu(NH_3)_4]SO_4$

10. The metal ion in complex A has EAN identical to the atomic number of krypton. A is

(At. no. of $Cr = 24$, $Fe = 26$, $Pd = 46$)

(a) $[Pd(NH_3)_6]Cl_4$ (b) $[Cr(NH_3)_5Cl]SO_4$

(c) $Na_4[Fe(CN)_6]$ (d) $K_3[Fe(CN)_6]$

11. The non-existent metal carbonyl among the following is

(a) $Cr(CO)_6$ (b) $Mn(CO)_5$

(c) $Ni(CO)_4$ (d) $Fe(CO)_5$

12. Which of the following compounds is colourless

(a) $Cu_2(CH_3COO)_4.2H_2O$ (b) Cu_2Cl_2

(c) $CuSO_4.5H_2O$ (d) $[Cu(NH_3)_4]SO_4.4H_2O$

13. The most stable complex among the following is

(a) $K_3[Al(C_2O_4)_3]$ (b) $[Pt(en)_2]Cl_2$

(c) $[Ag(NH_3)_2]Cl$ (d) $K_2[Ni(EDTA)]$

14. In spectrochemical series chlorine is above water i.e. $Cl > H_2O$, this is due to

(a) Good π-acceptor properties of Cl

(b) Strong σ-donor and good π-acceptor properties of Cl

(c) Good π-donor properties of Cl

(d) Larger size of Cl than H_2O

15. The most stable complex among the following is

(a) $[Pd(CN)_4]^{4-}$ (b) $[Fe(CO)_5]$

(c) $[Ni(CN)_4]^{4-}$ (d) $[Ni(CN)_4]^{3-}$

16. The energies of d_{xy} and d_z^2 orbitals in octahedral and tetrahedral transition metal complexes are such that

[KVPY 2014]

(a) $E(d_{xy}) > E(d_z^2)$ in both tetrahedral and octahedral complexes

(b) $E(d_{xy}) < E(d_z^2)$ in both tetrahedral and octahedral complexes

(c) $E(d_{xy}) > E(d_z^2)$ in tetrahedral but $E(d_{xy}) < E(d_z^2)$ in octahedral complexes

(d) $E(d_{xy}) < E(d_z^2)$ in tetrahedral but $E(d_{xy}) > E(d_z^2)$ in octahedral complexes

8. Preparation and Application of Coordination Compounds

1. Chlorophyll is a coordination compound of

(a) Iron (b) Magnesium

(c) Manganese (d) Chromium

(e) Zinc

2. Complex salt can be made by the combination of $[Co^{III}(NH_3)_5Cl]^X$ with

(a) PO_4^{3-} (b) Cl^-

(c) $2Cl^-$ (d) $2K^+$

3. Cold ferrous sulphate solution on absorption of NO develops brown colour due to the formation of

(a) Paramagnetic $[Fe(H_2O)_5(NO)]SO_4$

(b) Diamagnetic $[Fe(H_2O)_5(N_3)]SO_4$

(c) Paramagnetic $[Fe(H_2O)_5(NO_3)](SO_4)_2$

(d) Diamagnetic $[Fe(H_2O)_4(SO_4)]NO_3$

4. In the brown ring complex $[Fe(H_2O)_5(NO)]SO_4$, nitric oxide behaves as

(a) NO^+ (b) Neutral NO molecule

(c) NO^- (d) NO^{2-}

5. Addition of excess potassium iodide solution to a solution of mercuric chloride gives the halide complex

(a) Tetrahedral $K_2[HgI_4]$ (b) Trigonal $K[HgI_3]$

(c) Linear Hg_2I_2 (d) Square planar $K_2[HgCl_2I_2]$

9. Organometallic Compounds

1. Which of the following is formed when *n*-butyl lithium reacts with tin (II) chloride

(a) $LiBr$ (b) Et_4Pb

(c) $(C_4H_9)_4Sn$ (d) $(C_2H_5)_4Pb$

2. Which one is not an organometallic compound

(a) $RMgX$ (b) C_2H_5ONa

(c) $(CH_3)_4Sn$ (d) KC_4H_9

3. Which one is organometallic compound

(a) Lithium methoxide (b) Lithium dimethyl amide

(c) Lithium acetate (d) Methyl lithium

4. In which compound synergic effect is present

(a) $[Ni(CO)_4]$ (b) $[NiCl_4]^{2-}$

(c) $[CuCl_4]^{2-}$ (d) $[Mn(H_2O)_6]^{2+}$

5. Ziegler-Natta catalyst is an organometallic compound of which metal

(a) Iron (b) Zirconium

(c) Rhodium (d) Titanium

6. The π – bonded organo metallic compound which has ethene as one of its component is

(a) Zeise's salt (b) Ferrocene

(c) Dibenzene chromium (d) Tetraethyl tin

7. π-bonding is not present in

(a) Grignard reagent/ Tetramethyl lead

(b) Dibenzene chromium

(c) Zeise's salt

(d) Ferrocene

8. Which of the following is not true for metal carbonyls

(a) The oxidation state of the metal in the carbonyls is zero

(b) The secondary carbonyls are obtained from photo-decomposition

(c) Metal carbonyls are single bonded species

(d) $d\pi - p\pi$ overlap is observed in metal carbonyls

10. IIT-JEE/ AIEEE

1. How many EDTA (ethylenediaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion **[2006]**

(a) Six (b) Three

(c) One (d) Two

2. The coordination number of a central metal atom in a complex is determined by **[2004]**

(a) The number of ligands around a metal ion bonded by sigma and pi-bonds both

(b) The number around a metal ion bonded by pi-bonds

(c) The number of ligands around a metal ion bonded by sigma bonds

(d) The number of only anionic ligands bonded to the metal ion

3. Among the properties (i) reducing (ii) oxidising (iii) complexing, the set of properties shown by CN^- ion towards metal species is **[2004]**

(a) iii, i (b) ii, iii

(c) i, ii (d) i, ii, iii

4. Ammonia forms the complex ion $[Cu(NH_3)_4]^{2+}$ with copper ions in alkaline solutions but not in acidic solution. What is the reason for it **[2003]**

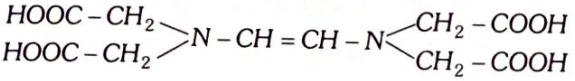
(a) In acidic solutions hydration protects copper ions

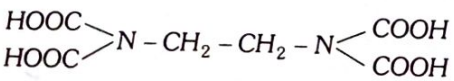
(b) In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available

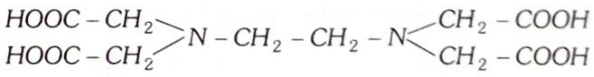
(c) In alkaline solutions insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali

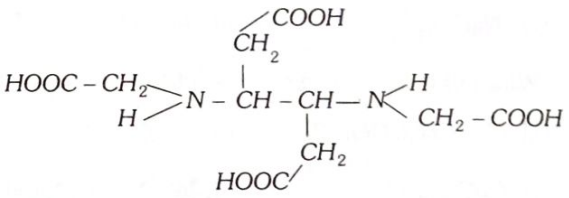
(d) Copper hydroxide is an amphoteric substance

5. The correct structure of ethylenediaminetetraacetic acid (EDTA) is **[2010]**

(a) 

(b) 

(c) 

(d) 

6. IUPAC name of $K_3Fe(CN)_6$ is **[2005]**

(a) Potassium ferrocyanide (II)

(b) Potassium hexaferrocyanate (III)

(c) Potassium ferrohexacyanate (II)

(d) Potassium hexacyanoferrate (III)

7. In the coordination compound, $K_4[Ni(CN)_4]$ oxidation state of nickel is **[2003]**

(a) –1 (b) 0

(c) +1 (d) +2

8. The IUPAC name of $[Co(NH_3)_6]Cl_3$ is **[1994]**

(a) Hexammine cobalt (III) chloride

(b) Hexammine cobalt (II) chloride

(c) Triammine cobalt (III) trichloride

(d) None of these

9. IUPAC name of $[Co(NH_3)_5NO_2]Cl_2$ **[2006]**

(a) Pentamminenitrocobalt (III) chloride

(b) Pentamminenitrosocobalt (III) chloride

(c) Pentamminenitrocobalt (II) chloride

(d) None of these

10. As per IUPAC nomenclature, the name of the complex $[Co(H_2O)_4(NH_3)_2]Cl_3$ is **[2012]**

(a) Tetraaquadiaminecobalt (III) chloride

(b) Tetraaquadiamminecobalt (III) chloride

(c) Diaminetetraaquacobalt (III) chloride

(d) Diamminetetraaquacobalt (III) chloride

11. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide **[2012]**

(a) $[Cr(en)_3]Br_3$ (b) $[Cr(en)_2Br_2]Br$

(c) $[Cr(en)Br_4]^-$ (d) $[Cr(en)Br_2]Br$

12. The IUPAC name of $[Ni(NH_3)_4][NiCl_4]$ is **[2008]**

(a) Tetrachloronickel (II) – tetraamminenickel (II)

(b) Tetraamminenickel (II) – tetrachloronickel (II)

(c) Tetraamminenickel (II)- tetrachloronickelate(II)

(d) Tetrachloronickel(II) – tetraamminenickelate (0)

13. The coordination number and the oxidation state of the element 'E' in the complex

$[E(en)_2(C_2O_4)]NO_2$ (where (en) is ethylene diamine) are, respectively **[2008]**

(a) 4 and 2 (b) 4 and 3

(c) 6 and 3 (d) 6 and 2

14. The pair of the compounds in which both the metals are in the highest possible oxidation state is **[2004]**

(a) $[Fe(CN)_6]^{3-}, [Co(CN)_6]^{3-}$ (b) CrO_2Cl_2, MnO_4^-

(c) TiO_3, MnO_2 (d) $[Co(CN)_6]^{3-}, MnO_3$

15. The type of isomerism present in nitropentammine chromium (III) chloride is **[2002]**

(a) Optical (b) Linkage

(c) Ionization (d) Polymerisation

16. Which of the following pairs represents linkage isomers **[2009]**

(a) $[Cu(NH_3)_4][Pt\,Cl_4]$ and $[Pt(NH_3)_4][CuCl_4]$

(b) $[Pd(P\,Ph_3)_2(NCS)_2]$ and $[Pd(P\,Ph_3)_2(SCN)_2]$

(c) $[Co\,(NH_3)_5NO_3]SO_4$ and $[Co\,(NH_3)_5SO_4]NO_3$

(d) $[Pt\,Cl_2(NH_3)_4]Br_2$ and $[Pt\,Br_2(NH_3)_4]Cl_2$

17. The ionization isomer of $[Cr(H_2O)_4\,Cl(NO_2)]Cl$ is **[2010]**

(a) $[Cr(H_2O)_4(O_2N)]Cl_2$ (b) $[(Cr(H_2O)_4\,Cl_2](NO_2)$

(c) $[Cr(H_2O)_4\,Cl(ONO)]Cl$ (d) $[Cr(H_2O)_4\,Cl_2(NO_2)]H_2O$

18. Which of the following compounds shows optical isomerism **[2005]**

(a) $[Cu(NH_3)_4]^{2+}$ (b) $[ZnCl_4]^{2-}$

(c) $[Cr(C_2O_4)_3]^{3-}$ (d) $[Co(CN)_6]^{3-}$

19. Which of the following has an optical isomer **[2009]**

(a) $[Co(NH_3)_3Cl]^+$ (b) $[Co(en)(NH_3)_2]^{2+}$

(c) $[Co(H_2O)_4(en)]^{3+}$ (d) $[Co(en)_2(NH_3)_2]^{3+}$

20. The number of geometric isomers that can exist for square planar $[Pt\,(Cl)(py)(NH_3)(NH_2OH)]^+$ is (py = pyridine) **[2015]**

(a) 2 (b) 3

(c) 4 (d) 6

21. Which one of the following complexes shows optical isomerism **[2016]**

(a) $cis[Co(en)_2Cl_2]Cl$ (b) $trans[Co(en)_2Cl_2]Cl$

(c) $[Co(NH_3)_4Cl_2]Cl$ (d) $[Co(NH_3)_3Cl_3]$

(en = ethylenediamine)

22. Which of the following does not have optical isomer **[2013]**

(a) $[Co(NH_3)_3Cl_3]$ (b) $[Co(en)_3]Cl_3$

(c) $[Co(en)_2Cl_2]Cl$ (d) $[Co(en)(NH_3)_2Cl_2]Cl$

23. Which one of the following has largest number of isomers **[2004]**

(a) $[Ir(Ph_3)_2H(CO)]^{2+}$ (b) $[Co(NH_3)_5Cl]^{2+}$

(c) $[Ru(NH_3)_4Cl_2]^+$ (d) $[Co(en)_2Cl_2]^+$

(R = Alkyl group; en = Ethylenediamine)

24. Which kind of isomerism is exhibited by octahedral $Co(NH_3)_4Br_2Cl$ **[2005]**

(a) Geometrical and Ionization

(b) Geometrical and Optical

(c) Optical and Ionization

(d) Geometrical only

25. Consider the following reaction and statements

$[Co(NH_3)_4\,Br_2]^+ + Br^- \rightarrow [Co(NH_3)_3Br_3] + NH_3$

(I) Two isomers are produced if the reactant complex ion is a *cis*–isomer

(II) Two isomers are produced if the reactant complex ion is a *tran*–isomer

(III) Only one isomer is produced if the reactant complex ion is a *trans*–isomer

(IV) Only one isomer is produced if the reactant complex ion is a *cis*– isomer

The correct statements are **[2018]**

(a) (III) and (IV) (b) (II) and (IV)

(c) (I) and (II) (d) (I) and (III)

26. One mole of the complex compound $Co(NH_3)_5Cl_3$, gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of $AgNO_3$ solution to yield two moles of $AgCl(s)$. The structure of the complex is **[2003]**

(a) $[Co(NH_3)_5Cl]Cl_2$ (b) $[Co(NH_3)_3Cl_3].2NH_3$

(c) $[Co(NH_3)_4Cl_2]Cl.NH_3$ (d) $[Co(NH_3)_4Cl]Cl_2.NH_3$

27. A Solution containing 2.675 g of $CoCl_3.6NH_3$ (molar mass = 267.5 mol^{-1}) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of $AgNO_3$ to give 4.78 g of $AgCl$ (molar mass = 143.5 $g\ mol^{-1}$). The formula of the complex is

(At. mass of Ag = 108 u) **[2010]**

(a) $[CoCl(NH_3)_5]Cl_2$ (b) $[Co(NH_3)_6]Cl_3$

(c) $[CoCl_2(NH_3)_4]Cl$ (d) $[CoCl_3(NH_3)_3]$

28. Mixture $X = 0.02 mol$ of $[Co(NH_3)_5SO_4]Br$ and 0.02 *mol* of $[Co(NH_3)_5Br]SO_4$ was prepared in 2 *litre* of solution

1 *litre* of mixture X + excess $AgNO_3 \rightarrow Y$

1 *litre* of mixture X + excess $BaCl_2 \rightarrow Z$

Number of moles of Y and Z are **[2003]**

(a) 0.01, 0.01 (b) 0.02, 0.01

(c) 0.01, 0.02 (d) 0.02, 0.02

29. Among the following ions which one has the highest paramagnetism **[1993]**

(a) $[Cr(H_2O)_6]^{3+}$ (b) $[Fe(H_2O)_6]^{2+}$

(c) $[Cu(H_2O)_6]^{2+}$ (d) $[Zn(H_2O)_6]^{2+}$

30. The compound which does not show paramagnetism is **[1992]**

(a) $[Cu(NH_3)_4]Cl_2$ (b) $[Ag(NH_3)_2]Cl$

(c) NO (d) NO_2

31. The type of magnetism exhibited by $[Mn(H_2O)_6]^{2+}$ ion is **[1994]**

(a) Paramagnetism (b) Diamagnetism

(c) Both (a) and (b) (d) None of these

32. The complex ion which has no 'd' electrons in the central metal atom is **[2001]**

(a) $[MnO_4]^-$ (b) $[Co(NH_3)_6]^{3+}$

(c) $[Fe(CN)_6]^{3-}$ (d) $[Cr(H_2O)_6]^{3+}$

33. The value of the 'spin only' magnetic moment for one of the following configurations is 2.84 *BM*. The correct one **[2005]**

(a) d^4 (in strong ligand field)

(b) d^2 (in weak ligand field)

(c) d^3 (in weak as well as in strong fields)

(d) d^5 (in strong ligand field)

34. The spin only magnetic moment value (in Bohr magneton units) of $Cr(CO)_6$ is **[2009]**

(a) 0 (b) 2.84

(c) 4.90 (d) 5.92

35. The pair in which both species have same magnetic moment (spin only value) is **[2016]**

(a) $[Cr(H_2O)_6]^{2+}$, $[CoCl_4]^{2-}$

(b) $[Cr(H_2O)_6]^{2+}$, $[Fe(H_2O)_6]^{2+}$

(c) $[Mn(H_2O)_6]^{2+}$, $[Cr(H_2O)_6]^{2+}$

(d) $[CoCl_4]^{2-}$, $[Fe(H_2O)_6]^{2+}$

36. The complex showing a spin-only magnetic moment of 2.82 *B.M.* is **[2010; 2011]**

(a) $Ni(CO)_4$ (b) $[NiCl_4]^{2-}$

(c) $Ni(PPh_3)_4$ (d) $[Ni(CN)_4]^{2-}$

37. $NiCl_2\{P(C_2H_5)_2(C_6H_5)\}_2$ exhibits temperature dependent magnetic behaviour (paramagnetic/ diamagnetic). The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are respectively **[2012]**

(a) Tetrahedral and tetrahedral

(b) Square planar and square planar

(c) Tetrahedral and square planar

(d) Square planar and tetrahedral

38. Which of the following facts about the complex $[Cr(NH_3)_6]Cl_3$ is wrong **[2011]**

(a) The complex involves d^2sp^3 hybridisation and is octahedral in shape

(b) The complex is paramagnetic

(c) The complex is an outer orbital complex

(d) The complex gives white precipitate with silver nitrate solution

39. Nickel (Z = 28) combines with a uni-negative monodentate ligand X^- to form a paramagentic complex $[NiX_4]^{2-}$. The number of unpaired electrons (s) in the nickel and geometry of this complex ion are, respectively **[2006]**

(a) One, tetrahedral (b) Two, tetrahedral

(c) One, square planar (d) Two, square planar

40. Among $[Ni(CO)_4], [Ni(CN)_4]^{2-}, [NiCl_4]^{2-}$ species, the hybridization states at the Ni atom are, respectively **[2008]**

(a) sp^3, sp^3, dsp^2 (d) dsp^2, sp^3, sp^3

(c) sp^3, dsp^2, dsp^2 (d) sp^3, dsp^2, sp^3

(At. no. of Ni = 28)

41. Geometrical shapes of the complexes formed by the reaction of Ni^{2+} with Cl^-, CN^- and H_2O, respectively, are **[2011]**

(a) Octahedral, tetrahedral and square planar

(b) Tetrahedral, square planar and octahedral

(c) Square planar, tetrahedral and octahedral

(d) Octahedral, square planar and tetrahedral

42. Among the following complexes (*K–P*),

$K_3[Fe(CN)_6](K), [Co(NH_3)_6]Cl_3\ (L), Na_3[Co(\text{oxalate})_3]$

(M), $[Ni(H_2O)_6]Cl_2\ (N), K_2[Pt(CN)_4](O)$ and

$[Zn(H_2O)_6](NO_3)_2(P)$ the diamagnetic complexes are

[2011]

(a) K, L, M, N (b) K, M, O, P

(c) L, M, O, P (d) L, M, N, O

43. The correct order of magnetic moments (spin only values in B.M.) among is **[2004]**

(a) $[Fe(CN)_6]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

(b) $[MnCl_4]^{2-} > [Fe(CN)_6]^{4-} > [CoCl_4]^{2-}$

(c) $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$

(d) $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

(Atomic nos. $Mn = 25, Fe = 26, Co = 27$)

44. Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$ **[1991]**

(a) $Ni(CO)_4$ and $[NiCl_4]^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic

(b) $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic

(c) $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic

(d) $Ni(CO)_4$ is diamagnetic and $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic

45. Which one of the following has a square planar geometry **[2007]**

(a) $[CoCl_4]^{2-}$ (b) $[FeCl_4]^{2-}$

(c) $[NiCl_4]^{2-}$ (d) $[PtCl_4]^{2-}$

46. The geometry of $Ni(CO)_4$ and $Ni(PPh_3)_2Cl_2$ are **[1999]**

(a) Both square planar

(b) Tetrahedral and square planar respectively

(c) Both tetrahedral

(d) Square planar and tetrahedral respectively

47. Among the following , the coloured compound is **[2008]**

(a) $CuCl$ (b) $K_3[Cu(CN)_4]$

(c) CuF_2 (d) $[Cu(CH_3CN)_4]BF_4$

48. In which of the following coordination entities the magnitude of Δ_0 ($CFSE$ in octahedral field) will be maximum **[2008]**

(a) $[Co(CN)_6]^{3-}$ (b) $[Co(C_2O_4)_3]^{3-}$

(c) $[Co(H_2O)_6]^{3+}$ (d) $[Co(NH_3)_6]^{3+}$

(Atomic no. $Co = 27$)

49. Which of the following compounds is not coloured yellow **[2015]**

(a) $Zn_2[Fe(CN)_6]$ (b) $K_3[Co(NO_2)_6]$

(c) $(NH_4)_3[As(Mo_3O_{10})_4]$ (d) $BaCrO_4$

50. The most stable ion is **[2002]**

(a) $[Fe(OH)_6]^{3-}$ (b) $[Fe(Cl)_6]^{3-}$

(c) $[Fe(CN)_6]^{3-}$ (d) $[Fe(H_2O)_6]^{3+}$

51. $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)]^+ ; k_1 = 1.6 \times 10^3$

$[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+ ; k_2 = 6.8 \times 10^3$ then. The formation constant of $[Ag(NH_3)_2]^+$ is **[2006]**

(a) 1.088×10^6 (b) 6.08×10^3

(c) 1.088×10^7 (d) 1.6×10^3

52. The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1, L_2, L_3 and L_4 absorb wavelengths in the region of red, green, yellow and blue, respectively. The increasing order of ligand strength of the four ligands is **[2014]**

(a) $L_4 < L_3 < L_2 < L_1$ (b) $L_1 < L_3 < L_2 < L_4$

(c) $L_3 < L_2 < L_4 < L_1$ (d) $L_1 < L_2 < L_4 < L_3$

53. On treatment of 100 mL of 0.1 M solution of $CoCl_3.6H_2O$ with excess $AgNO_3$; 1.2×10^{22} ions are precipitated. The complex is **[2017]**

(a) $[Co(H_2O)_3Cl_3].3H_2O$ (b) $[Co(H_2O)_6]Cl_3$

(c) $[Co(H_2O)_5Cl]Cl_2.H_2O$ (d) $[Co(H_2O)_4Cl_2]Cl.2H_2O$

54. In the process of extraction of gold,

Roasted gold ore $+ CN^- + H_2O \xrightarrow{O_2} [X] + OH^-$

$[X] + Zn \rightarrow [Y] + Au$

Identify the complexes [X] and [Y] **[2003]**

(a) $X = [Au(CN)_2]^-, Y = [Zn(CN)_4]^{2-}$

(b) $X = [Au(CN)_4]^{3-}, Y = [Zn(CN)_4]^{2-}$

(c) $X = [Au(CN)_2]^-, Y = Zn(CN)_6]^{4-}$

(d) $X = [Au(CN)_4]^-, Y = [Zn(CN)_4]^{2-}$

55. $CuSO_4$ decolourises on addition of KCN , the product is **[2006]**

(a) $[Cu(CN)_4]^{2-}$

(b) Cu^{2+} get reduced to from $[Cu(CN)_4]^{3-}$

(c) $Cu(CN)_2$

(d) $CuCN$

56. In $Fe(CO)_5$, the Fe–C bond possesses **[2006]**

(a) π-character only (b) Both σ and π characters

(c) Ionic character (d) σ-character only

57. Coordination compounds have great importance in biological systems. In this context which of the following statements is incorrect **[2004]**

(a) Cyanocobalamin is B_{12} and contains cobalt

(b) Haemoglobin is the red pigment of blood and contains iron

(c) Chlorophylls are green pigments in plants and contains calcium

(d) Carboxypepticase-*A* is an enzyme and contains zinc

58. Among the following metal carbonyls, the $C-O$ bond order is lowest in **[2007]**

(a) $[Mn(CO)_6]^+$ (b) $[Fe(CO)_5]$

(c) $[Cr(CO)_6]$ (d) $[V(CO)_6]^-$

59. On hydrolysis $(Me)_2SiCl_2$ will produce **[2003]**

(a) $(Me)_2Si(OH)_2$ (b) $(Me)_2Si=O$

(c) $\dagger O-(Me)_2Si-O\dagger_n$ (d) $Me_2SiCl(OH)$

11. NEET/ AIPMT/ CBSE-PMT

1. Which of the following ligands is expected to be bidentate **[1994]**

(a) Br (b) $C_2O_4^{2-}$

(c) CH_3NH_2 (d) $CH_3C\equiv N$

2. IUPAC name of $[Pt(NH_3)_3(Br)(NO_2)Cl]Cl$ is **[1998]**

(a) Triamminechlorobromonitroplatinum (IV) chloride

(b) Triamminebromonitrochloroplatinum (IV) chloride

(c) Triamminebromochloronitroplatinum (IV) chloride

(d) Triamminenitrochlorobromoplatinum (IV) chloride

3. The IUPAC name of $K_4[Fe(CN)_6]$ is **[1990]**

(a) Potassium hexacyanoferrate (II)

(b) Potassium ferrocyanide

(c) Tetrapotassium hexacyanoferrate (II)

(d) Tetrapotassium ferroushexacyanide (II)

4. The oxidation number of *Cr* in $[Cr(NH_3)_6]Cl_3$ is **[2001]**

(a) 8 (b) 6

(c) 4 (d) 3

5. The name of complex ion, $[Fe(CN)_6]^{3-}$ is **[2015]**

(a) Hexacyanoiron (III) ion (b) Hexacyanitoferrate (III) ion

(c) Tricyanoferrate (III) ion (d) Hexacyanidoferrate (III) ion

6. The sum of coordination number and oxidation number of the metal M in the complex $[M(en)_2(C_2O_4)]Cl$ (where *en* is ethylenediamine) is **[2015]**

(a) 9 (b) 6

(c) 7 (d) 8

7. The complex chloro diaquatriammine cobalt (III) chloride is represented as **[2002]**

(a) $[Co(NH_3)_3(H_2O)_3]Cl_2$ (b) $[Co(NH_3)_3(H_2O)_2]Cl_2$

(c) $[CoCl(NH_3)_3(H_2O)_2]Cl_3$ (d) $[CoCl(NH_3)_3(H_2O)_2]Cl_2$

8. The coordination number and oxidation state of *Cr* in $K_3[Cr(C_2O_4)_3]$ are, respectively **[1995]**

(a) 4 and +2 (b) 6 and +3

(c) 3 and +3 (d) 3 and 0

9. According to IUPAC nomenclature sodium nitroprusside is named as **[2003]**

(a) Sodium pentacyanonitrosyl ferrate (III)

(b) Sodium nitroferricyanide

(c) Sodium nitroferrocyanide

(d) Sodium pentacyanonitrosyl ferrate (II)

10. The number of geometrical isomers of the complex $[Co(NO_2)_2(NH_3)_2]$ is **[1997]**

(a) 2 (b) 3

(c) 4 (d) 0

11. $[Pt(NH_3)_4Cl_2]Br_2$ and $[Pt(NH_3)_4Br_2]Cl_2$ are related to each other as **[2001]**

(a) Optical isomers (b) Coordination isomers

(c) Ionization isomers (d) Linkage isomers

12. Which of the following will give a pair of enantiomorphs **[2007]**

(a) $[Co(NH_3)_4Cl_2]NO_2$ (b) $[Cr(NH_3)_6][Co(CN)_6]$

(c) $[Co(en)_2Cl_2]Cl$ (d) $[Pt(NH_3)_4][PtCl_6]$

$(en = NH_2CH_2CH_2NH_2)$

13. The complexes $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are the examples of which type of isomerism **[2011]**

(a) Geometrical isomerism (b) Linkage isomerism

(c) Ionization isomerism (d) Coordination isomerism

14. The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^-$ is due to **[2010]**

(a) Ionization isomerism (b) Linkage isomerism

(c) Geometrical isomerism (d) Coordination isomerism

15. Which one of the following octahedral complexes will not show geometric isomerism (A and B are monodentate ligands) **[2003]**

(a) $[MA_5B]$ (b) $[MA_2B_4]$

(c) $[MA_3B_3]$ (d) $[MA_4B_2]$

16. Number of possible isomers for the complex $[Co(en)_2Cl_2]Cl$ will be (en = ethylenediamine) **[2015]**

(a) 2 (b) 1

(c) 3 (d) 4

17. Which of the following coordination compounds would exhibit optical isomerism **[2004]**

(a) *trans*-dicyanobis (ethylenediamine) chromium (III) chloride

(b) *tris*-(ethylenediamine) cobalt (III) bromide

(c) Pentaamminenitrocobalt (III) iodide

(d) Diamminedichloroplatinum (II)

18. $[Co(NH_3)_4(NO_2)_2]Cl$ exhibits **[2006]**

(a) Ionization isomerism, geometrical isomerism and optical isomerism

(b) Linkage isomerism, geometrical isomerism and optical isomerism

(c) Linkage isomerism, ionization isomerism and optical isomerism

(d) Linkage isomerism, ionization isomerism and geometrical isomerism

19. The complex, $[Pt(Py)(NH_3)BrCl]$ will have how many geometrical isomers **[2011]**

(a) 2 (b) 3

(c) 4 (d) 0

20. The total number of possible isomers for the complex compound $[Cu^{II}(NH_3)_4][Pt^{II}Cl_4]$ are **[1998]**

(a) 3 (b) 4

(c) 5 (d) 6

21. Which one of the following complexes is not expected to exhibit isomerism **[2010]**

(a) $[Ni(NH_3)_4(H_2O)_2]^{2+}$ (b) $[Pt(NH_3)_2Cl_2]$

(c) $[Ni(NH_3)_2Cl_2]$ (d) $[Ni(en)_3]^{2+}$

22. The type of isomerism shown by the complex $[CoCl_2(en)_2]$ is **[2018]**

(a) Geometrical isomerism (b) Coordination isomerism

(c) Ionization isomerism (d) Linkage isomerism

23. Iron carbonyl, $Fe(CO)_5$ is **[2018]**

(a) Tetranuclear (b) Mononuclear

(c) Trinuclear (d) Dinuclear

24. The number of unpaired electrons in the complex ion $[CoF_6]^{3-}$ is (Atomic no. of $Co = 27$) **[2003]**

(a) Zero (b) 2

(c) 3 (d) 4

25. The d-electron configurations of $Cr^{2+}, Mn^{2+}, Fe^{2+}$ and Co^{2+} are d^4, d^5, d^6 and d^7 respectively. Which one of the following will exhibit minimum paramagnetic behaviour **[2011]**

(a) $[Cr(H_2O)_6]^{2+}$ (b) $[Mn(H_2O)_6]^{2+}$

(c) $[Fe(H_2O)_6]^{2+}$ (d) $[Co(H_2O)_6]^{2+}$

(At. no. $Cr = 24$, $Mn = 25$, $Fe = 26$, $Co = 27$)

26. Considering H_2O as a weak field ligand, the number of unpaired electrons in $[Mn(H_2O)_6]^{2+}$ will be (At. no. of $Mn = 25$)

(a) Two (b) Four

(c) Three (d) Five

27. A magnetic moment of $1.73\,BM$ will be shown by one among the following **[2013]**

(a) $[CoCl_6]^{4-}$ (b) $[Cu(NH_3)_4]^{2+}$

(c) $[Ni(CN)_4]^{2-}$ (d) $TiCl_4$

28. $[Cr(H_2O)_6]Cl_3$ (at. no. of $Cr = 24$) has a magnetic moment of 3.83 *B.M.* The correct distribution of $3d$ electrons in the chromium of the complex is **[2006]**

(a) $3d^1_{xy}, 3d^1_{yz}, 3d^1_{xz}$ (b) $3d^1_{xy}, 3d^1_{yz}, 3d^1_{z^2}$

(c) $3d^1_{x^2-y^2}, 3d^1_{z^2}, 3d^1_{xz}$ (d) $3d^1_{xy}, 3d^1_{x^2-y^2}, 3d^1_{yz}$

29. Which of the following complex compounds will exhibit highest paramagnetic behaviour **[2011]**

(a) $[Co(NH_3)_6]^{3+}$ (b) $[Zn(NH_3)_6]^{2+}$

(c) $[Ti(NH_3)_6]^{3+}$ (d) $[Cr(NH_3)_6]^{3+}$

(At. no. $Ti = 22$, $Cr = 24$, $Co = 27$, $Zn = 30$)

30. Which of the following complex ion is not expected to absorb visible light **[2010]**

(a) $[Ni(H_2O)_6]^{2+}$ (b) $[Ni(CN)_4]^{2-}$

(c) $[Cr(NH_3)_6]^{3+}$ (d) $[Fe(H_2O)_6]^{2+}$

31. What is the shape of $Fe(CO)_5$ **[2000]**

(a) Linear (b) Tetrahedral

(c) Square planar (d) Trigonal bipyramidal

32. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour **[2012]**

(a) $[Co(NH_3)_6]^{3+}$ (b) $[Mn(CN)_6]^{4-}$

(c) $[Fe(CN)_6]^{4-}$ (d) $[Ni(NH_3)_6]^{2+}$

Atomic nos. : $(Mn = 25, Fe = 26, Co = 27, Ni = 28)$

33. Which of these statements about $[Co(CN)_6]^{3-}$ is true **[2015]**

(a) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a low-spin configuration

(b) $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a high-spin configuration

(c) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a high-spin configuration

(d) $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a low-spin configuration

34. The diamagnetic species is **[2013]**

(a) $[Ni(CN)_4]^{2-}$ (b) $[NiCl_4]^{2-}$

(c) $[CoCl_4]^{2-}$ (d) $[CoF_6]^{2-}$

35. Which one of the following is an inner orbital complex as well as diamagnetic in behaviour (Atomic number : Zn=30, Cr = 24, Co = 27, Ni = 28) **[2005]**

(a) $[Zn(NH_3)_6]^{2+}$ (b) $[Cr(NH_3)_6]^{3+}$

(c) $[Co(NH_3)_6]^{3+}$ (d) $[Ni(NH_3)_6]^{2+}$

36. Atomic number of Cr and Fe are 24 and 26 respectively. Which of the following is paramagnetic with the spin of electron **[2002]**

(a) $[Cr(NH_3)_6]^{+3}$ (b) $[Fe(CO)_5]$

(c) $[Fe(CN)_6]^{-4}$ (d) $[Cr(CO)_6]$

37. Which of the following complexes exhibits the highest paramagnetic behaviour **[2008]**

(a) $[Co(ox)_2(OH)_2]^{2-}$ (b) $[Ti(NH_3)_6]^{3+}$

(c) $[V(gly)_2(OH)_2(NH_3)_2]^{+}$ (d) $[Fe(en)(bpy)(NH_3)_2]^{2+}$

Where gly = glycine, en = ethylenediamine and bpy = bipyridylmoities)

(At no. Ti = 22, V = 23, Fe = 26, Co = 27)

38. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal $Ni(II)$. Which of the following statements is not true **[2012]**

(a) Red complex has a square planar geometry

(b) Complex has symmetrical H-bonding

(c) Red complex has a tetrahedral geometry

(d) Dimethylglyoxime functions as bidentate ligand

$$\left[\text{dimethylglyoxime} = \begin{matrix} H_3C - C = N & OH \\ | & \\ H_3C - C = N & OH \end{matrix}\right]$$

39. Pick out the correct statement with respect to $[Mn(CN)_6]^{3-}$ **[2017]**

(a) It is sp^3d^2 hybridized and octahedral

(b) It is sp^3d^2 hybridized and tetrahedral

(c) It is d^2sp^3 hybridized and octahedral

(d) It is dsp^2 hybridized and square planar

40. Which one of the following ions exhibits $d-d$ transition and paramagnetism as well **[2018]**

(a) CrO_4^{2-} (b) $Cr_2O_7^{2-}$

(c) MnO_4^- (d) MnO_4^{2-}

41. The geometry and magnetic behaviour of the complex $[(NiCO)_4]$ are **[2018]**

(a) Square planar geometry and diamagnetic

(b) Tetrahedral geometry and diamagnetic

(c) Square planar geometry and paramagnetic

(d) Tetrahedral geometry and paramagnetic

42. Match the metal ions given in Column I with the spin magnetic moments of the ions given in Column II and assign the correct code **[2018]**

Column I	**Column II**
1. Co^{3+}	i. $\sqrt{8}$ B.M.
2. Cr^{3+}	ii. $\sqrt{35}$ B.M.
3. Fe^{3+}	iii. $\sqrt{3}$ B.M.
4. Ni^{2+}	iv. $\sqrt{24}$ B.M.
	v. $\sqrt{15}$ B.M.

	1	2	3	4
(a)	iv	v	ii	i
(b)	i	ii	iii	iv
(c)	iv	I	ii	iii
(d)	iii	v	I	ii

43. Which of the following complex ions is expected to absorb visible light **[2009]**

(a) $[Sc(H_2O)_3(NH_3)_3]^{3+}$ (b) $[Ti(en)_2(NH_3)_2]^{4+}$

(c) $[Cr(NH_3)_6]^{3+}$ (d) $[Zn(NH_3)_6]^{2+}$

(At. no. $Zn = 30$, $Sc = 21$, $Ti = 22$, $Cr = 24$)

44. Jahn-Teller effect is not observed in high spin complexes of **[2016]**

(a) d^9 (b) d^7

(c) d^8 (d) d^4

45. Crystal field stabilization energy for high spin d^4 octahedral complex is **[2010; 2013]**

(a) $-0.6\Delta_0$ (b) $-1.8\Delta_0$

(c) $-1.6\Delta_0 + P$ (d) $-1.2\Delta_0$

46. Low spin complex of d^6 – cation in an octahedral field will have the following energy **[2012]**

(a) $\frac{-12}{5}\Delta_0 + P$ (b) $\frac{-12}{5}\Delta_0 + 3P$

(c) $\frac{-2}{5}\Delta_0 + 2P$ (d) $\frac{-2}{5}\Delta_0 + P$

(Δ_0 = Crystal Field Splitting Energy in an octahedral field, P= Electron pairing energy)

47. Among the following complexes the one which shows **Zero** crystal field stabilization energy (*CFSE*) is **[2014]**

(a) $[Co(H_2O)_6]^{2+}$ (b) $[Co(H_2O)_6]^{3+}$

(c) $[Mn(H_2O)_6]^{3+}$ (d) $[Fe(H_2O)_6]^{3+}$

48. Correct increasing order for the wavelength of absorption in the visible region for the complexes of Co^{3+} is **[2017]**

(a) $[Co(en)_3]^{3+}, [Co(NH_3)_6]^{3+}, [Co(H_2O)_6]^{3+}$

(b) $[Co(H_2O)_6]^{3+}, [Co(en)_3]^{3+}, [Co(NH_3)_6]^{3+}$

(c) $[Co(H_2O)_6]^{3+}, [Co(NH_3)_6]^{3+}, [Co(en)_3]^{3+}$

(d) $[Co(NH_3)_6]^{3+}, [Co(en)_3]^{3+}, [Co(H_2O)_6]^{3+}$

49. The correct increasing order of trans-effect of the following species is **[2016]**

(a) $CN^- > Br^- > C_6H_5^- > NH_3$

(b) $NH_3 > CN^- > Br^- > C_6H_5^-$

(c) $CN^- > C_6H_5^- > Br^- > NH_3$

(d) $Br^- > CN^- > NH_3 > C_6H_5^-$

50. CN^- is a strong field ligand. This is due to the fact that **[2004]**

(a) It can accept electron from metal species

(b) It forms high spin complexes with metal species

(c) It carries negative charge

(d) It is a pseudohalide

51. $AgCl$ precipitate dissolves in ammonia due to the formation of **[1998]**

(a) $[Ag(NH_4)_2]OH$ (b) $[Ag(NH_4)_2]Cl$

(c) $[Ag(NH_3)_2]OH$ (d) $[Ag(NH_3)_2]Cl$

52. In any ferric salt, on adding potassium ferrocyanide, a prussian blue colour is obtained, which is **[1990, 1992]**

(a) $K_3Fe(CN)_6$ (b) $KFe[Fe(CN)_6]$

(c) $FeSO_4.Fe(CN)_6$ (d) $Fe_4[Fe(CN)_6]_3$

53. The complex used as an anticancer agent is **[2004, 14]**

(a) *trans* $-[Co(NH_3)_3Cl_3]$ (b) *cis* $-[PtCl_2(NH_3)_2]$

(c) *cis* $-K_2[PtCl_2Br_2]$ (d) Na_2CO_3

54. The correct order of the stoichiometries of $AgCl$ formed when $AgNO_3$ in excess is treated with the complexes $CoCl_3.6NH_3, CoCl_3.5NH_3, CoCl_3.4NH_3$ respectively is **[2017]**

(a) $1AgCl, 3AgCl, 2AgCl$ (b) $3AgCl, 1AgCl, 2AgCl$

(c) $3AgCl, 2AgCl, 1AgCl$ (d) $2AgCl, 3AgCl, 1AgCl$

55. Among the following, which is not the π-bonded organometallic compound **[2003]**

(a) $(CH_3)_4Sn$ (b) $K[PtCl_3(\eta^2 - C_2H_4)]$

(c) $Fe(\eta^5 - C_5H_5)_2$ (d) $Cr(\eta^6 - C_6H_6)_2$

56. Which of the following does not have a metal carbon bond **[2004]**

(a) $K[Pt(C_2H_4)Cl_3]$ (b) $Ni(CO)_4$

(c) $Al(OC_2H_5)_3$ (d) C_2H_5MgBr

57. Which of the following carbonyls will have the strongest *C–O* bond **[2011]**

(a) $V(CO)_6^-$ (b) $Fe(CO)_5$

(c) $Mn(CO)_6^+$ (d) $Cr(CO)_6$

58. Which of the following has longest *C–O* bond length? (Free *C–O* bond length in *CO* is 1.128Å) **[2016]**

(a) $Ni(CO)_4$ (b) $[Co(CO)_4]^{\ominus}$

(c) $[Fe(CO)_4]^{2-}$ (d) $[Mn(CO)_6]^+$

59. An example of a sigma bonded organometallic compound is **[2017]**

(a) Ruthenocene (b) Grignard's reagent

(c) Ferrocene (d) Cobaltocene

12. AIIMS

1. Which of the following is a π – acid ligand **[2003]**

(a) NH_3 (b) CO

(c) F^- (d) Ethylene diamine

2. In the compound lithium tetrahydroaluminate, the ligand is **[1997]**

(a) H^+ (b) H^-

(c) H (d) None of these

3. $[Fe(NO_2)_3Cl_3]$ and $[Fe(O-NO)_3Cl_3]$ shows **[2008]**

(a) Linkage isomerism (b) Geometrical isomerism

(c) Optical isomerism (d) None of the above

4. The number of possible isomers of an octahedral complex $[Co(C_2O_4)_2(NH_3)_2]^-$ is **[2006]**

(a) 1 (b) 2

(c) 3 (d) 4

5. Which one of the following has an optical isomer **[2005]**

(a) $[Zn(en)_2]^{2+}$ (b) $[Zn(en)(NH_3)_2]^{2+}$

(c) $[Co(en)_3]^{3+}$ (d) $[Co(H_2O)_4(en)]^{3+}$

6. In which of the following pairs both the complexes show optical isomerism **[2015]**

(a) $cis-[Cr(C_2O_4)_2Cl_2]^{3-}$, $cis-[Co(NH_3)_4Cl_2]$

(b) $[Co(en)_3]Cl_3$, $cis-[Co(en)_2Cl_2]Cl$

(c) $[PtCl(dien)]Cl$, $[NiCl_2Br_2]^{2-}$

(d) $[Co(NO_3)_3(NH_3)_3]$, $cis-[Pt(en)_2Cl_2]$

7. In $[Ag(CN)_2]^-$, the number of π bonds is **[2006]**

(a) 2 (b) 3

(c) 4 (d) 6

8. Which one of the following shows maximum paramagnetic character **[1998]**

(a) $[Cr(H_2O)_6]^{3+}$ (b) $[Fe(CN)_6]^{4-}$

(c) $[Fe(CN)_6]^{3-}$ (d) $[Cu(H_2O)_6]^{2+}$

9. The number of unpaired electrons in tetrahedral $[Ni(CO)_4]$ is **[1997]**

(a) 0 (b) 2

(c) 3 (d) 4

10. The species having tetrahedral shape is **[2007]**

(a) $[PdCl_4]^{2-}$ (b) $[Ni(CN)_4]^{2-}$

(c) $[Pd(CN)_4]^{2-}$ (d) $[NiCl_4]^{2-}$

11. In $[Cu(NH_3)_4]SO_4$, ; Cu has following hybridization **[1988]**

(a) dsp^2 (b) sp^3

(c) sp^2 (d) sp^3d^2

12. The correct order for the wavelength of absorption in the visible region is **[2005]**

(a) $[Ni(NO_2)_6]^{4-} < [Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+}$

(b) $[Ni(NO_2)_6]^{4-} < [Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+}$

(c) $[Ni(H_2O)_6]^{2+} < [Ni(NH_3)_6]^{2+} < [Ni(NO_2)_6]^{4-}$

(d) $[Ni(NH_3)_6]^{2+} < [Ni(H_2O)_6]^{2+} < [Ni(NO_2)_6]^{4-}$

13. The ligands in anti-cancer drug cisplatin are **[2006]**

(a) NH_3, Cl (b) NH_3, H_2O

(c) Cl, H_2O (d) NO, Cl

14. Which one of the following forms with an excess of CN^- (Cyanide) a complex having coordination number two **[2004]**

(a) Cu^+ (b) Ag^+

(c) Ni^{2+} (d) Fe^{2+}

15. An aqueous solution of $CoCl_2$ on addition of excess of concentrated HCl turns blue due to formation of **[2005]**

(a) $[Co(H_2O)_4Cl_2]$ (b) $[Co(H_2O)_2Cl_4]^{2-}$

(c) $[CoCl_4]^{2-}$ (d) $[Co(H_2O)_2Cl_2]$

16. Which of the following is an organometallic compound **[1997]**

(a) $Ti(C_2H_5)_4$ (b) $Ti(OC_2H_5)_4$

(c) $Ti(OCOCH_3)_4$ (d) $Ti(OC_6H_5)_4$

17. Which of the following is not considered as an organometallic compound **[2004]**

(a) Cis-platin (b) Ferrocene

(c) Zeise's salt (d) Grignard reagent

18. Dimethyl glyoxime gives a red precipitate with Ni^{2+}, which is used for its detection. To get this precipitate readily the best *pH* range is **[2004]**

(a) < 1 (b) 2-3

(c) 3-4 (d) 9-11

19. The formula of sodium nitroprusside is **[1992]**

(a) $Na_4[Fe(CN)_5NOS]$ (b) $Na_2[Fe(CN)_5NO]$

(c) $NaFe[Fe(CN)_6]$ (d) $Na_2[Fe(CN)_6NO_2]$

13. Assertion and Reason

1. Assertion : The $[Ni(en)_3]Cl_2$ (en = ethylene diamine) has lower stability than $[Ni(NH_3)_6]Cl_2$.

Reason : In $[Ni(en)_3]Cl_2$ the geometry of Ni is trigonal bipyramidal.

2. Assertion : H_2N-NH_2 is a chelating ligand.

Reason : A chelating ligand must possess two or more lone pairs at such a distance that it may form suitable strain free rings at the metal ion.

3. Assertion : $[Ti(H_2O)_6]^{3+}$ is coloured while $[Sc(H_2O)_6]^{3+}$ is colourless.

Reason : *d-d transition* is not possible in $[Sc(H_2O)_6]^{3+}$.

4. Assertion : All the octahedral complexes of Ni^{2+} must be outer orbital complexes.

Reason : Outer orbital octahedral complexes are given by weak ligands.

5. Assertion : Potassium ferrocyanide is diamagnetic whereas potassium ferricyanide is paramagnetic.

Reason : Crystal field splitting in ferrocyanide ion is greater than that of ferricyanide ion.

[AIIMS 2005]

6. Assertion : $[Co(NO_2)_3(NH_3)_3]$ does not show optical isomerism.

Reason : It has a plane of symmetry.

[AIIMS 2006]

26. Coordination Compounds – Answers Keys

1. Basic Terms

1	d	2	d	3	b	4	a	5	d
6	b	7	a	8	b	9	a	10	a
11	d	12	c	13	a	14	a	15	d
16	b	17	a	18	a	19	a	20	c
21	c								

2. Nomenclature, Oxidation State

1	b	2	a	3	b	4	d	5	b
6	c	7	a	8	c	9	b	10	c
11	a	12	b	13	a	14	a	15	d

3. Isomerism

1	c	2	c	3	c	4	c	5	a
6	d	7	a	8	a	9	d	10	b
11	c	12	b	13	b	14	d	15	b
16	d	17	b	18	c				

4. Werner's Coordination Theory

1	d	2	b	3	a	4	a	5	b
6	d	7	c	8	b	9	c	10	b

5. Valence Bond Theory and Geometry and Magnetic Nature of Coordination Compounds

1	a	2	b	3	d	4	d	5	b
6	c	7	a	8	b	9	b	10	c
11	b	12	d	13	c	14	a	15	b
16	c								

6. Ligand and Crystal Field Theory

1	a	2	a	3	a	4	d	5	c
6	c	7	c	8	a				

7. Complex Stability, Spectrochemical Series and EAN

1	d	2	c	3	b	4	b	5	c
6	b	7	a	8	c	9	a	10	c
11	b	12	b	13	d	14	b	15	b
16	c								

8. Preparation and Application of Coordination Compounds

1	b	2	c	3	a	4	a	5	a

9. Organometallic Compounds

1	c	2	b	3	d	4	a	5	d
6	a	7	a	8	c				

10. IIT-JEE/ AIEEE

1	c	2	d	3	a	4	b	5	c
6	d	7	b	8	a	9	a	10	d
11	b	12	c	13	c	14	b	15	b
16	b	17	b	18	c	19	d	20	b
21	a	22	a	23	d	24	a	25	d
26	a	27	b	28	a	29	b	30	b
31	a	32	a	33	b	34	a	35	b
36	b	37	c	38	c	39	b	40	d
41	b	42	c	43	c	44	c	45	d
46	c	47	c	48	a	49	a	50	c
51	c	52	b	53	c	54	a	55	d
56	b	57	c	58	b	59	c		

11. NEET/ AIPMT/ CBSE-PMT

1	b	2	c	3	a	4	d	5	d
6	a	7	d	8	b	9	d	10	a
11	c	12	c	13	d	14	c	15	a
16	c	17	b	18	d	19	b	20	d

21	c	**22**	a	**23**	b	**24**	d	**25**	d
26	d	**27**	b	**28**	a	**29**	d	**30**	b
31	d	**32**	d	**33**	d	**34**	a	**35**	c
36	a	**37**	a	**38**	c	**39**	c	**40**	d
41	b	**42**	a	**43**	c	**44**	c	**45**	a
46	b	**47**	d	**48**	a	**49**	c	**50**	d
51	d	**52**	d	**53**	b	**54**	c	**55**	a
56	c	**57**	c	**58**	c	**59**	b		

12. AIIMS

1	b	**2**	b	**3**	a	**4**	c	**5**	c
6	b	**7**	c	**8**	a	**9**	a	**10**	d
11	a	**12**	a	**13**	a	**14**	b	**15**	c
16	a	**17**	a	**18**	d	**19**	b		

13. Assertion & Reason

1	d	**2**	e	**3**	a	**4**	b	**5**	c
6	a								