

## Coordination Compounds

### JEE (Main) Exercises

#### Single Correct Answer Type

1. Ligand with two or more points of attachment to single metal atoms are called:
  - (a) Monodentate ligand
  - (b) Chelating ligand
  - (c) Ambidentate ligand
  - (d) None of these
2. Select the correct I.U.P.A.C. name for  $[\text{Cr}(\text{NH}_3)_5\text{Cl}_3]$  complex:
  - (a) Triaminetrichloridochromate(III)
  - (b) Triaminetrichloridochromium(III)
  - (c) Trichloridotriamminechromium(III)
  - (d) Trichloridotriamminechromate(III)
3. Select the correct I.U.P.A.C. name for  $[\text{Cu}(\text{NH}_3)_4]\text{[PtCl}_4]$ :
  - (a) Tetraamminecopper(II) tetrachloridoplatinum(II)
  - (b) Tetraamminecopper(II) tetrachloridoplatinum(IV)
  - (c) Tetraamminecopper(II) tetrachloridoplatinate(II)
  - (d) Tetraamminecuprate(II) tetrachloridoplatinate(II)
4. Select the correct I.U.P.A.C. name for  $\text{Cr}(\text{C}_6\text{H}_6)(\text{CO})_3$ :
  - (a) ( $\eta^6$ -benzene) tricarbonylchromate (0)
  - (b) Tricarbonyl ( $\eta^6$ -benzene)chromate (0)
  - (c) Tricarbonyl ( $\eta^6$ -benzene)chromium (0)
  - (d) ( $\eta^6$ -benzene) tricarbonylchromium (0)
5. I.U.P.A.C. name for complex  $[\text{Mn}(\pi-\text{C}_5\text{H}_5)(\text{CO})_3]$ :
  - (a) Tricarbonyl ( $\eta^5$ -cyclopentadiene)manganese(I)
  - (b) Tricarbonyl ( $\eta^5$ -cyclopentadiene)mangate(I)
  - (c) Tricarbonyl ( $\eta^5$ -cyclopentadienyl)manganese(I)
  - (d) ( $\eta^5$ -cyclopentadienyl) tricarbonyl manganese(I)
6. Select the correct order of E.A.N:
  - (a)  $[\text{Cr}(\text{CO})_6] > [\text{Cr}(\text{CO})_6]^{\ominus} > [\text{Cr}(\text{CO})_6]^{\oplus}$
  - (b)  $[\text{Cr}(\text{CO})_6]^+ > [\text{Cr}(\text{CO})_6]^{\ominus} > [\text{Cr}(\text{CO})_6]$
  - (c)  $[\text{Cr}(\text{CO})_6]^{\ominus} > [\text{Cr}(\text{CO})_6] > [\text{Cr}(\text{CO})_6]^{\oplus}$
  - (d)  $[\text{Cr}(\text{CO})_6]^{\ominus} = [\text{Cr}(\text{CO})_6] > [\text{Cr}(\text{CO})_6]^+$
7. Which of following complex has higher  $\Delta_o$  value?
  - (a)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
  - (b)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
  - (c)  $[\text{Fe}(\text{CN})_6]^{3-}$
  - (d) All have equal
8. Among the following ions which one has the highest paramagnetism?
  - (a)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
  - (b)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
  - (c)  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$
  - (d)  $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$
9. The calculated value of magnetic moment of  $_{22}\text{Ti}^{3+}$  is:
  - (a)  $1.73 \mu_B$
  - (b)  $2.83 \mu_B$
  - (c)  $3.87 \mu_B$
  - (d)  $4.9 \mu_B$
10. The I.U.P.A.C. name for  $[\text{Fe}(\text{CN})_6]^{3-}$  ion is:
  - (a) Hexacyanidoferrate(II) ion
  - (b) Hexacyanidoferrate(III) ion
  - (c) Hexacyanideiron(II) ion
  - (d) Iron(III) hexacyanide ion

- 11.** The I.U.P.A.C. name for  $[\text{Ni}(\text{CO})_4]$  is:  
 (a) Tetracarbonylnickel(II)  
 (b) Tetracarbonylnickel(0)  
 (c) Tetracarbonylnickelate(II)  
 (d) Tetracarbonylnickelate(0).
- 12.** The number of ions produced by the complex  $[\text{Co}(\text{N}-\text{H}_3)_4\text{Cl}_2]\text{Cl}$  is:  
 (a) 2                          (b) 3  
 (c) 4                           (d) 6
- 13.** The I.U.P.A.C. name for  $[\text{Ni}(\text{CN})_4]^{2-}$  is:  
 (a) Tetracyanidonickel (II) ion  
 (b) Tetracyanidonickel (0) ion  
 (c) Tetracyanidonickelate (II) ion  
 (d) Tetracyanidonickelate (0) ion
- 14.** The I.U.P.A.C. name for  $\text{K}_3[\text{Co}(\text{NO}_2)_6]$  is:  
 (a) Potassium(I) hexanitrocobaltate (II)  
 (b) Potassium(I) hexanitrocobaltate (IV)  
 (c) Potassium hexanitrocobalt (0)  
 (d) Potassium hexanitrocobaltate (III)
- 15.** Which of the following complex is diamagnetic?  
 (a)  $[\text{CoF}_6]^{3-}$                           (b)  $[\text{NiCl}_4]^{2-}$   
 (c)  $[\text{Ni}(\text{NH}_3)_6]^{2+}$                         (d)  $[\text{Ni}(\text{CN})_4]^{2-}$
- 16.** Which of the following is a tridentate ligand?  
 (a)  $\text{NO}_2^-$                                      (b) Oxalate ion  
 (c) Glycinate ion                                 (d) Dien
- 17.** How many ions are produced from  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$  in the solution?  
 (a) 3    (b) 4  
 (c) 5    (d) 6
- 18.** A complex involving  $dsp^2$ -hybridization has:  
 (a) A square planar geometry  
 (b) A tetrahedral geometry  
 (c) An octahedral geometry  
 (d) Trigonal planar geometry
- 19.** A complex involving  $d^2sp^3$ -hybridization is:  
 (a) A square planar geometry  
 (b) A tetrahedral geometry  
 (c) An octahedral geometry  
 (d) Trigonal planar geometry
- 20.** Zeise's salt is:  
 (a)  $\text{Fe}(\eta^5-\text{C}_5\text{H}_5)_2$   
 (b)  $\text{Cr}(\eta^6-\text{C}_6\text{H}_6)_2$   
 (c)  $\text{K}[\text{Pt}(\eta^2-\text{C}_2\text{H}_4)\text{Cl}_3]$   
 (d)  $\text{K}[\text{Pt}(\eta^2-\text{C}_2\text{H}_4)_2\text{Cl}_2]$
- 21.** Which of the following complex ion possesses  $d^2sp^3$  hybridization?  
 (a)  $[\text{Ni}(\text{NH}_3)_6]^{2+}$                           (b)  $[\text{CoF}_6]^{3-}$   
 (c)  $[\text{Co}(\text{NH}_3)_6]^{3+}$                              (d)  $[\text{FeF}_6]^{3-}$
- 22.** Which of the following complex ion possesses  $dsp^2$  hybridization?  
 (a)  $[\text{Ni}(\text{CN})_4]^{2-}$                               (b)  $[\text{Ni}(\text{CO})_4]$   
 (c)  $[\text{NiCl}_4]^{2-}$                                       (d)  $[\text{Ni}(\text{PF}_3)_4]$
- 23.** Which of the following complex ion possesses  $sp^3d^2$  hybridization?  
 (a)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$                               (b)  $[\text{FeF}_6]^{3-}$   
 (c)  $[\text{Co}(\text{NO}_2)_6]^{3-}$                               (d)  $[\text{TiF}_6]^{3-}$
- 24.** Which of the following complex is paramagnetic?  
 (a)  $\text{K}_2[\text{Ni}(\text{CN})_4]$                                  (b)  $\text{K}_4[\text{Fe}(\text{CN})_6]$   
 (c)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$                               (d)  $[\text{Cr}(\text{H}_2\text{O})_6]\text{SO}_4$
- 25.** The color of a complex compound is due to:  
 (a) Promotion of  $3d$ -electrons of the central atom/ion to  $4s$ -orbital  
 (b) Promotion of  $3d$ -electrons of the central atom/ion to  $4p$ -orbitals  
 (c) Promotion of  $3d$ -electrons of the central atom/ion within  $d$ -orbitals  
 (d) Promotion of  $4s$ -electrons of the central atom/ion to  $4p$ -orbitals
- 26.** Relative to the average energy in the spherical crystal field, the  $t_{2g}$  orbitals in tetrahedral field is:  
 (a) Raised by  $(2/5)\Delta_t$                             (b) Lowered by  $(2/5)\Delta_t$ ,  
 (c) Raised by  $(3/5)\Delta_t$                                 (d) Lowered by  $(1/5)\Delta_t$
- 27.** Which is the pair of ambident ligands?  
 (a)  $\text{CN}^-$ ,  $\text{NO}_2^-$                                      (b)  $\text{NO}_3^-$ ,  $\text{SCN}^-$   
 (c)  $\text{N}_3^-$ ,  $\text{NO}_2^-$                                       (d)  $\text{NCS}^-$ ,  $\text{C}_2\text{O}_4^{2-}$
- 28.** The closed ring compounds formed by bidentate ligands, on binding to a metal or metal ions, are called:  
 (a) Monodentate                                      (b) Chelates  
 (c) Ambidentate                                        (d) None of these
- 29.** Coordination number of  $\text{Cu}^{2+}$  is ..... in  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ :  
 (a) 5    (b) 4  
 (c) 3    (d) 2
- 30.** Coordination number of calcium is six in:  
 (a)  $[\text{Ca}(\text{EDTA})]^{2-}$                               (b)  $\text{CaC}_2\text{O}_4$   
 (c)  $[\text{Ca}(\text{C}_2\text{O}_4)_2]^{2-}$                             (d)  $\text{CaSO}_4 \cdot 4\text{H}_2\text{O}$
- 31.** Increasing order of EAN of the metals in  $[\text{Ni}(\text{CN})_4]^{2-}$ ,  $[\text{Fe}(\text{CN})_6]^{3-}$  and  $[\text{Cu}(\text{CN})_4]^{3-}$  is:  
 (a)  $[\text{Ni}(\text{CN})_4]^{2-} < [\text{Fe}(\text{CN})_6]^{3-} < [\text{Cu}(\text{CN})_4]^{3-}$   
 (b)  $[\text{Ni}(\text{CN})_4]^{2-} < [\text{Fe}(\text{CN})_6]^{3-} = [\text{Cu}(\text{CN})_4]^{3-}$

- (c)  $[\text{Ni}(\text{CN})_4]^{2-} < [\text{Cu}(\text{CN})_4]^{3-} < [\text{Fe}(\text{CN})_6]^{3-}$   
 (d)  $[\text{Cu}(\text{CN})_4]^{3-} < [\text{Fe}(\text{CN})_6]^{3-} < [\text{Ni}(\text{CN})_4]^{2-}$
32.  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$  and  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$  are:  
 (a) Linkage isomers      (b) Ionization isomers  
 (c) Coordination isomers      (d) None of these
33. The crystal field splitting energy for octahedral ( $\Delta_o$ ) and tetrahedral ( $\Delta_t$ ) complexes is related as:  
 (a)  $\Delta_t = \frac{4}{9}\Delta_o$       (b)  $\Delta_t = \frac{1}{2}\Delta_o$   
 (c)  $\Delta_o = -2\Delta_t$       (d)  $\Delta_o = -\frac{4}{9}\Delta_t$
34. Which has maximum coordinating (donor) points?  
 (a) DMG      (b) EDTA  
 (c) en      (d) py
35. Which is used in cancer chemotherapy?  
 (a) cis-platin      (b) Zeisse's salt  
 (c) Both (a) and (b)      (d) None of these
36. In which of the following compounds, transition metal may have zero oxidation state?  
 (a)  $[\text{Fe}(\text{CO})_5]$       (b)  $[\text{Ni}(\text{CN})_4]^{2-}$   
 (c)  $\text{Fe}_2\text{O}_3$       (d)  $\text{CrO}_5$
37. A square planar complex is formed by hybridization of which atomic orbitals?  
 (a)  $s, p_x, p_y, d_{yz}$       (b)  $s, p_x, p_y, d_{x^2-y^2}$   
 (c)  $s, p_x, p_y, d_{z^2}$       (d)  $s, p_x, p_z, d_{xy}$
38. The type of isomerism present in pentaammine nitro chromium(III) chloride is:  
 (a) Optical      (b) Linkage  
 (c) Hydrate      (d) Polymerization
39. Which one of the following has the largest number of isomers?  
 (a)  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$       (b)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$   
 (c)  $[\text{Ir}(\text{PR}_3)_2\text{H}(\text{CO})]^{2+}$       (d)  $[\text{Ru}(\text{NH}_3)_4\text{Cl}_2]^+$
40. The correct order of magnetic moment (spin values in B.M.) is:  
 (Atomic no. Mn = 25, Fe = 26, Co = 27)  
 (a)  $[\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-} > [\text{MnCl}_4]^{2-}$   
 (b)  $[\text{MnCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-}$   
 (c)  $[\text{Fe}(\text{CN})_6]^{4-} > [\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-}$   
 (d)  $[\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-}$
41. Which one of the following has the regular tetrahedral structure?  
 (a)  $[\text{Ni}(\text{CN})_4]^{2-}$       (b)  $\text{SF}_4$   
 (c)  $\text{BF}_4^-$       (d)  $\text{XeF}_4$
42. The I.U.P.A.C. name of the coordination compound  $\text{K}_3[\text{Fe}(\text{CN})_6]$  is:  
 (a) Potassium hexacyanidoferate(II)  
 (b) Potassium hexacyanidoferate(III)  
 (c) Potassium hexacyanidoiron(II)  
 (d) Tripotassium hexacyanidoiron(II)
43. Which one of the following has the lowest value of paramagnetic behavior?  
 (a)  $[\text{Cr}(\text{CN})_6]^{3-}$       (b)  $[\text{Mn}(\text{CN})_6]^{3-}$   
 (c)  $[\text{Fe}(\text{CN})_6]^{3-}$       (d)  $[\text{Co}(\text{CN})_6]^{3-}$
44. The species having tetrahedral shape is:  
 (a)  $[\text{PdCl}_4]^{2-}$       (b)  $[\text{Ni}(\text{CN})_4]^{2-}$   
 (c)  $[\text{Pt}(\text{CN})_4]^2$       (d)  $[\text{NiCl}_4]^{2-}$
45.  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  (atomic number of Cr = 24) has a magnetic moment of 3.83 B.M. The correct distribution of 3d-electrons in the chromium present in the complex is:  
 (a)  $3d_{xy}^1, 3d_{yz}^1, 3d_{zx}^1$       (b)  $3d_{xy}^1, 3d_{yz}^1, 3d_{z^2}^1$   
 (c)  $3d_{(x^2-y^2)}^1, 3d_{z^2}^1, 3d_{zx}^1$       (d)  $3d_{xy}^1, 3d_{(x^2-y^2)}^1, 3d_{zx}^1$
46. A complex compound in which the oxidation number of metal is zero:  
 (a)  $[\text{Ni}(\text{CO})_4]$       (b)  $[\text{Pt}(\text{NH}_3)_4]\text{Cl}_2$   
 (c)  $\text{K}_4[\text{Fe}(\text{CN})_6]$       (d)  $\text{K}_3[\text{Fe}(\text{CN})_6]$
47.  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$  are related to each other as:  
 (a) Geometrical isomers  
 (b) Linkage isomers  
 (c) Coordination isomers  
 (d) Ionization isomers
48. Which one of the following will be able to show geometrical isomerism if complexes are square planar?  
 (a)  $\text{Ma}_4$       (b)  $\text{Ma}_3\text{b}$   
 (c)  $\text{Mabcd}$       (d)  $[\text{M}(AA)_2]$
49.  $\text{K}_4[\text{Fe}(\text{CN})_6]$  is called:  
 (a) Potassium hexacyanidoferate(II)  
 (b) Potassium ferricyanate  
 (c) Potassium ferricyanide  
 (d) Prussian blue
50. Among the following ions which one has the highest paramagnetism?  
 (a)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$       (b)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$   
 (c)  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$       (d)  $[\text{Zn}(\text{H}_2\text{O})_4]^{2+}$
51. The number of geometrical isomers of  $[\text{Co}(\text{NH}_3)_3(\text{NO}_3)_3]$  is:

- (a) 0                                  (b) 2  
 (c) 3                                    (d) 4
52. Some salts, although containing two different metallic elements, give test for one of them in solution. Such salts are:  
 (a) Complex salt                      (b) Double salt  
 (c) Normal salt                        (d) None of these
53. Coordination number of Ni in  $[\text{Ni}(\text{C}_2\text{O}_4)_3]^{4-}$  is:  
 (a) 3                                    (b) 6  
 (c) 4                                    (d) 5
54. Both geometrical and optical isomerisms are shown by:  
 (a)  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$                       (b)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$   
 (c)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$                       (d)  $[\text{Cr}(\text{OX})_3]^{3-}$
55. In  $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$ , the isomerism shown is:  
 (a) Ligand                             (b) Optical  
 (c) Geometrical                        (d) Ionization
56. The hypothetical complex chlorido diaquatriamine cobalt (III) chloride can be represented as:  
 (a)  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_2\text{Cl}]\text{Cl}_2$   
 (b)  $[\text{Co}(\text{NH}_3)_3\text{H}_2\text{O}\text{Cl}_3]$   
 (c)  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})\text{Cl}]$   
 (d)  $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_3\text{Cl}_3]$
57. In the coordination compound  $\text{K}_4[\text{Ni}(\text{CN})_4]$ , the oxidation state of Ni is:  
 (a) -1                                    (b) 0  
 (c) +1                                    (d) +2
58. Which of the following octahedral complex does not show geometrical isomerism (*A* and *B* are monodentate ligands)?  
 (a)  $[\text{MA}_3\text{B}_3]$                             (b)  $[\text{MA}_4\text{B}_2]$   
 (c)  $[\text{MA}_5\text{B}]$                                 (d)  $[\text{MA}_2\text{B}_4]$
59. The geometry of  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{NiCl}_4]^{2-}$  ions are:  
 (a) Tetrahedral                        (b) Square planar  
 (c) Square planar, tetrahedral, respectively  
 (d) Tetrahedral and square planar, respectively
60. The complex used as an anticancer agent is:  
 (a) *mer*- $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$                       (b) *cis*- $[\text{PtCl}_2(\text{NH}_3)_2]$   
 (c) *cis*- $\text{K}_2[\text{PtCl}_2\text{Br}_2]$                         (d)  $\text{Na}_2[\text{CoCl}_4]$
61. The ligand called  $\pi$ -acid is:  
 (a) CO                                    (b)  $\text{NH}_3$   
 (c)  $\text{C}_2\text{O}_4^{2-}$                                 (d) Ethylene diamine
62. The effective atomic number of cobalt in the complex  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is:  
 (a) 36                                    (b) 33  
 (c) 24                                    (d) 30
63. Facial-meridional isomers is associated with which one of the following complex? (*M* = central metal)  
 (a)  $[\text{M}(\text{AA})_2]$                             (b)  $[\text{MA}_3\text{B}_3]$   
 (c)  $[\text{M}(\text{AA})_3]$                                 (d)  $[\text{MABCD}]$
64. Which one of the following is a tridenate ligand?  
 (a)  $\text{NO}_2^-$                                 (b) Oxalate ion  
 (c) Glycinate ion                        (d) Dien
65. Assign the hybridization, shape, and magnetic moment of  $\text{K}_2[\text{Cu}(\text{CN})_4]$  are:  
 (a)  $sp^3$ , tetrahedral, 1.73 B.M.  
 (b)  $dsp^2$ , square planar, 1.73 B.M.  
 (c)  $sp^3$ , tetrahedral, 2.44 B.M.  
 (d)  $dsp^2$ , square planar, 2.44 B.M.
66. Hardness of water is estimated by simple complex formation titration. Complex formed by cation in hard water during estimation of hardness is:  
 (a)  $\text{Na}_2[\text{Ca}(\text{PO}_3)_6]$                             (b)  $\text{Na}_2[\text{Mg}(\text{EDTA})]$   
 (c)  $\text{Na}_2[\text{Pb}(\text{EDTA})]$                                 (d)  $[\text{Ca}(\text{SO}_4)_2]^{2-}$
67. The I.U.P.A.C. name for  $[\text{Ni}(\text{NH}_3)_4][\text{NiCl}_4]$  is:  
 (a) Tetrachloridonickel(II)-tetraamminenickel(II)  
 (b) Tetraamminenickel (II)-tetrachloridonickel (II)  
 (c) Tetraamminenickel (II)-tetrachloridonickelate (II)  
 (d) Tetrachloridonickel (II)-tetraamminenickelate (II)
68. In which of the following coordination entities, the magnitude of  $\Delta_0$  [CFSE in octahedral field] will be maximum?  
 (a)  $[\text{Co}(\text{CN})_6]^{3-}$                                 (b)  $[\text{Co}(\text{NO}_2)_6]^{3-}$   
 (c)  $[\text{CoF}_6]^{3-}$                                         (d)  $[\text{Co}(\text{NH}_3)_6]^{3+}$
69. Hybridization, shape, and magnetic moment of  $\text{K}_3[\text{Co}(\text{CO}_3)_3]$  are:  
 (a)  $d^2sp^3$ , octahedral, 4.9 B.M.  
 (b)  $sp^3d^2$ , octahedral, 4.9 B.M.  
 (c)  $dsp^2$ , square planar, 4.9 B.M.  
 (d)  $sp^3$ , tetrahedral, 4.9 B.M.
70. Geometry, hybridization, and magnetic moment of the ions  $[\text{Ni}(\text{CN})_4]^{2-}$ ,  $[\text{MnBr}_4]^{2-}$  and  $[\text{FeF}_6]^{3-}$ , respectively are:  
 (a) Tetrahedral, square planar, octahedral:  $sp^3$ ,  $dsp^2$ ,  $sp^3d^2$ : 5.9, 0, 4.9  
 (b) Tetrahedral, square planar, octahedral:  $dsp^2$ ,  $sp^3$ ,  $sp^3d^2$ : 0, 5.9, 4.9  
 (c) Square planar, tetrahedral, octahedral:  $dsp^2$ ,  $sp^3$ ,  $d^2sp^3$ : 5.9, 4.9, 0  
 (d) Square planar, tetrahedral, octahedral:  $dsp^2$ ,  $sp^3$ ,  $sp^3d^2$ : 0, 5.9, 4.9

71. In Cu-ammonia complex, the state of hybridization of  $\text{Cu}^{2+}$  is:
- $sp^3$
  - $d^3s$
  - $sp^2$
  - $dsp^2$
72. The total number of possible coordination isomer for the given compound  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2][\text{PtCl}_4]$  is:
- 2
  - 4
  - 5
  - 3
73. E.A.N. of  $\text{K}[\text{PtCl}_3(\eta^2\text{-C}_2\text{H}_4)]$  is:
- 86
  - 78
  - 84
  - 34
74.  $\text{Ag}^+$  forms many complexes, some of these are  $[\text{Ag}(\text{NH}_3)_2]^+$ ,  $[\text{Ag}(\text{CN})_2]^-$ ,  $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$ . Which of the following statements is true?
- In these complexes,  $\text{Ag}^+$  is a Lewis base
  - The hybridization of  $\text{Ag}^+$  is  $sp^2$
  - The  $\text{Ag}^+$  complexes are good reducing agents
  - These complexes are all linear
75. The following complexes are given:
- $trans\text{-}[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$
  - $cis\text{-}[\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$
  - $trans\text{-}[\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$
  - $[\text{NiCl}_4]^{2-}$
  - $[\text{TiF}_6]^{2-}$
  - $[\text{CoF}_6]^{3-}$
- Choose the correct code:
- 1, 2 are optically active; 3 optically inactive
  - 2 is optically active; 1, 3 are optically inactive
  - 4, 5 are colored; 6 is colorless
  - 4 is colored; 5, 6 are colorless
76. The number of  $\sigma$  and  $\pi$ - bonds in  $\text{Fe}_2(\text{CO})_9$ , respectively are:
- $22\sigma$  and  $15\pi$
  - $23\sigma$  and  $15\pi$
  - $22\sigma$  and  $16\pi$
  - $15\sigma$  and  $8\pi$
77. In which of the following configurations will there be the possibility of both para and diamagnetism, depending on the nature of the ligands?
- $d^7$
  - $d^3$
  - $d^6$
  - $d^8$
78. An aqueous solution of titanium chloride, when subjected to magnetic measurement, measured zero magnetic moment. Assuming the complex as octahedral in aqueous solution, the formula of the complex is:
- $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_2$
  - $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_4$
  - $[\text{TiCl}_6]^{3-}$
  - $[\text{Ti}(\text{H}_2\text{O})_4\text{Cl}_2]$
79. Which of the following statements is correct?
- With  $d^2sp^3$  hybridization  $[\text{FeCl}(\text{CN})_4(\text{O}_2)]^{4-}$  complex is diamagnetic
  - $[\text{NiCl}_4]^{2-}$  complex is more stable than  $[\text{Ni}(\text{dmg})_2]$  due to higher C.F.S.E. value
  - $[\text{V}(\text{CO})_6]$  is not very stable and easily reduces to  $[\text{V}(\text{CO})_6]^-$
  - Ligands such as  $\text{CO}$ ,  $\text{CN}^-$ ,  $\text{NO}^+$  are  $\pi e^-$  donor due to the presence of filled  $\pi$ -molecular orbital
80. Select the correct I.U.P.A.C. name for  $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$ :
- Tetraammineplatinum(II) tetrachloridoplatinate(II)
  - Tetraammineplatinum(II) tetrachloridoplatinate(II)
  - Tetraammineplatinum(II) tetrachloridoplatinum(II)
  - All are correct
81. Select the correct I.U.P.A.C. name for  $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{ONO})_6]$ :
- Hexaamminecobalt(II) hexanitrito-O cobalt(II)
  - Hexaamminecobalt(III) hexanitrito-N cobaltate(III)
  - Hexaamminecobaltate(III) hexanitrito-O cobaltate(II)
  - Hexaamminecobalt(III) hexanitrito-O cobaltate(III)
82. Select the correct I.U.P.A.C. name for  $[\text{PtCl}_2(\text{NH}_3)_4][\text{PtCl}_4]$ :
- Tetraamminedichloridoplatinate(IV) tetrachloridoplatinate(II)
  - Tetraamminedichloridoplatinate(II) tetrachloridoplatinate(IV)
  - Tetraamminedichloridoplatinum(IV) tetrachloridoplatinate(II)
  - All are correct
83. Select the correct I.U.P.A.C. name for  $\text{Na}[\text{Co}(\text{CO})_4]$ :
- Sodium tetracarbonylcobalt (-I)
  - Sodium tetracarbonylcobalt (0)
  - Sodium tetracarbonylcobaltate (0)
  - Sodium tetracarbonylcobaltate (-I)
84. Select the correct I.U.P.A.C. name for  $\text{Fe}(\pi\text{-C}_5\text{H}_5)_2$ :
- bis( $\eta^6$ -cyclopentadienyl) iron(II)
  - bis( $\eta^5$ -cyclopentadienyl) ferrate(II)
  - bis( $\eta^5$ -cyclopentadienyl) iron(0)
  - bis( $\eta^5$ -cyclopentadienyl) iron(II)
85. Select the correct I.U.P.A.C. name for  $[\text{Cr}(\text{C}_6\text{H}_6)_2]$ :
- bis( $\eta^5$ -benzene) chromium(0)
  - bis( $\eta^6$ -benzene) chromate(0)
  - bis( $\eta^6$ -benzene) chromate(0)
  - bis( $\eta^6$ -benzene) chromium(0)

## JEE (Advanced) Exercises

### Single Correct Answer Type

1. Select the correct I.U.P.A.C. name for  $[\text{Co}(\text{CO})_3(\pi\text{-C}_3\text{H}_5)]$ :
  - ( $\eta^3$ -Allyl) tricarbonyl cobalt(I)
  - (Tricarbonyl) ( $\eta^3$ -allyl) cobalt(I)
  - Tricarbonyl ( $\eta^3$ -allyl) cobaltate(I)
  - Tricarbonyl ( $\eta^3$ -allyl) tricarbonylcobalt(I)
2. E.A.N. of  $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)(\text{CO})_2\text{Cl}]$ :
  - 36
  - 35
  - 37
  - 34
3. For  $\text{Mn}^{3+}$  ion, the electron pairing energy  $P$  is about  $28,000 \text{ cm}^{-1}$ ,  $\Delta_o$  values for the complexes  $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$  and  $[\text{Mn}(\text{CN})_6]^{3-}$  are  $15,800 \text{ cm}^{-1}$  and  $38,500 \text{ cm}^{-1}$ , respectively, which of the following complex is high spin:
  - $[\text{Mn}(\text{CN})_6]^{3-}$
  - $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$
  - Both are high spin
  - None of these
4. If a transition-metal compound absorbs violet-indigo radiation in the visible region. Its color would be:
  - Green
  - Yellow
  - Orange
  - Blue
5. Transition metal compounds are usually colored. This is due to the electronic transition:
  - From  $p$ -orbital to  $s$ -orbital
  - From  $d$ -orbital to  $s$ -orbital
  - From  $d$ -orbital to  $p$ -orbital
  - Within the  $d$ -orbitals
6. A substance which is not paramagnetic is:
  - $\text{Cr}(\text{ClO}_4)_3$
  - $\text{KMnO}_4$
  - $\text{TiCl}_3$
  - $\text{VOBr}_2$
7. The following represents a pair of enantiomers:
  - $trans$ - $[\text{CrCl}_2\text{en}_2]^+$
  - $cis$ - $[\text{CrCl}_2\text{en}_2]^+$
  - $trans$ - $[\text{CrCl}_2(\text{NH}_3)_4]^+$
  - $cis$ - $[\text{CrCl}_2(\text{NH}_3)_4]^+$
8. The compound  $[\text{PtCl}_2(\text{NH}_3)_2]$  can form:
  - Geometrical isomers
  - Coordination isomers
  - Linkage isomers
  - Optical isomers
9. The compound  $[\text{CoCl}_2(\text{NH}_3)_2(\text{en})]$  can form:
  - Linkage isomers
  - Coordination isomers
  - Optical isomers
  - Linkage as well as optical isomers
10. Which of the following complexes has magnetic moment of  $2.83 \text{ Bohr magneton}$ ?
  - $[\text{Ni}(\text{NH}_3)_6]^{2+}$
  - $[\text{Ni}(\text{CN})_4]^{2-}$
  - $\text{TiCl}_4$
  - $[\text{CoCl}_6]$
11. According to crystal field theory, octahedral splitting and tetrahedral splitting of  $d$  orbitals caused by the same ligands are related through the expression:
  - $\Delta_o = \Delta_t$
  - $4\Delta_o = 9\Delta_t$
  - $9\Delta_o = 4\Delta_t$
  - $\Delta_o = 2\Delta_t$
12. Relative to the average energy in the spherical crystal field, the  $t_{2g}$  orbitals in octahedral field is:
  - Raised by  $(2/5)\Delta_o$
  - Lowered by  $(2/5)\Delta_o$
  - Raised by  $(1/5)\Delta_o$
  - Lowered by  $(3/5)\Delta_o$
13. Which of the following ligands are correctly represented in an spectrochemical series?
  - $\text{SCN}^- < \text{F}^- < \text{CN}^-$
  - $\text{SCN}^- < \text{CN}^- < \text{F}^-$
  - $\text{F}^- < \text{SCN}^- < \text{CN}^-$
  - $\text{F}^- < \text{CN}^- < \text{SCN}^-$
14. In the complex  $[\text{Pt}(\text{O}_2)(\text{en})_2(\text{Br})]^{2+}$ , coordination number and oxidation number of platinum are:
  - 4, 3
  - 4, 5
  - 4, 6
  - 6, 4
15. Coordination number of Cr is six. A complex with  $\text{C}_2\text{O}_4^{2-}$ , en and superoxide  $\text{O}_2^-$  will be in the ratio to make complex  $[\text{Cr}(\text{C}_2\text{O}_4)_x(\text{en})_y(\text{O}_2)_z]^-$ :
 

	$x$	$y$	$z$
(a)	1	1	1
(b)	1	1	2
(c)	1	2	2
(d)	2	1	1
16. EAN of Fe is ... in  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ :
  - 27
  - 24
  - 35
  - 29
17. EAN of cobalt is 36 in  $[\text{Co}(\text{NH}_3)_2\text{O}_2(\text{en})\text{Cl}]$ . Thus,  $\text{O}_2$  is:
  - Dioxide
  - Superoxide ion
  - Peroxide ion
  - Oxide
18. EAN of Mg is ... in  $[\text{Mg}(\text{EDTA})]^{2-}$ :
  - 16
  - 20
  - 22
  - 18
19. Which has maximum EAN of the underlined atoms? ( $\text{Cr} = 24$ ,  $\text{Co} = 27$ ,  $\text{Fe} = 26$ ,  $\text{Ni} = 28$ )
  - $[\text{Cr}(\text{EDTA})]^-$
  - $[\text{Co}(\text{en})_3]^{3+}$
  - $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$
  - $[\text{Ni}(\text{CN})_4]^{2-}$

20. Arrange the following in order of decreasing number of unpaired electrons:

- |   |  |
|---|--|
| I: $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ | II: $[\text{Fe}(\text{CN})_6]^{3-}$          |
| III: $[\text{Fe}(\text{CN})_6]^{4-}$        | IV: $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ |
| (a) IV, I, II, III                          | (b) I, II, III, IV                           |
| (c) III, II, I, IV                          | (d) II, III, I, IV                           |

21. Among  $[\text{Ni}(\text{CO})_4]$ ,  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{NiCl}_4]^{2-}$  species, the hybridization state of Ni atoms are respectively:

- |                                |                               |
|--------------------------------|-------------------------------|
| (a) $sp^3$ , $ds^2p$ , $dsp^2$ | (b) $sp^3$ , $dsp^2$ , $sp^3$ |
| (c) $sp^3$ , $sp^3$ , $dsp^2$  | (d) $dsp^2$ , $sp^3$ , $sp^3$ |

22. The most stable ion is:

- |  |  |
|--|--|
| (a) $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ | (b) $[\text{Fe}(\text{Cl})_6]^{3-}$          |
| (c) $[\text{Fe}(\text{SCN})_6]^{3-}$           | (d) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ |

23. One mole of complex compound  $\text{Co}(\text{NH}_3)_5\text{Cl}_3$  gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of  $\text{AgNO}_3$  to yeild two moles of  $\text{AgCl}_{(s)}$ . The complex is:

- |   |  |
|---|--|
| (a) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl} \cdot \text{NH}_3$  |  |
| (b) $[\text{Co}(\text{NH}_3)_4\text{Cl}] \text{Cl}_2 \cdot \text{NH}_3$ |  |
| (c) $[\text{Co}(\text{NH}_3)_5\text{Cl}] \text{Cl}_2$                   | (d) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3] \cdot 2\text{NH}_3$ |

24. Which of the following will show optical isomerism?

- |  |                                     |
|--|-------------------------------------|
| (a) $[\text{Cu}(\text{NH}_3)_4]^{2+}$          | (b) $[\text{ZnCl}_4]^{2-}$          |
| (c) $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$ | (d) $[\text{Co}(\text{CN})_6]^{3-}$ |

25. The bond length of C—O bond in carbon monoxide is 1.128 Å. The C—O bond in  $\text{Fe}(\text{CO})_5$  is:

- |             |             |
|-------------|-------------|
| (a) 1.115 Å | (b) 1.128 Å |
| (c) 1.178 Å | (d) 1.150 Å |

26. In which of the following pairs both the complexes show optical isomerism?

- |   |  |
|---|--|
| (a) <i>cis</i> - $[\text{Cr}(\text{C}_2\text{O}_4)_2\text{Cl}_2]^{3-}$ , <i>cis</i> - $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$ |  |
| (b) $[\text{Co}(\text{en})_3]\text{Cl}_3$ , <i>cis</i> - $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$                       |  |
| (c) $[\text{Pt}(\text{Cl})(\text{en})\text{Cl}]$ , $[\text{NiCl}_2\text{Br}_2]^{2-}$  |  |
| (d) $[\text{Co}(\text{NO}_3)_3(\text{NH}_3)_3]$ , <i>cis</i> - $[\text{Pt}(\text{en})_2\text{Cl}_2]$                          |  |

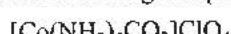
27. The oxidation number of Pt in  $[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]^{\Theta}$  is:

- |        |        |
|--------|--------|
| (a) +1 | (b) +2 |
| (c) +3 | (d) +4 |

28. Which of the following gives the maximum number of isomers?

- |  |  |
|--|--|
| (a) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$          | (b) $[\text{Ni}(\text{en})(\text{NH}_3)_4]^{2+}$   |
| (c) $[\text{Ni}(\text{C}_2\text{O}_4)(\text{en})_2]$ | (d) $[\text{Cr}(\text{SCN})_2(\text{NH}_3)_4]^{+}$ |

29. Consider the following complex:



the coordination number, oxidation number, number of *d*-electrons, and number of unpaired *d*-electrons of the metal are respectively:

- |                |                |
|----------------|----------------|
| (a) 6, 3, 6, 0 | (b) 7, 2, 7, 1 |
| (c) 7, 1, 6, 4 | (d) 6, 2, 7, 3 |

30. The common features among the species  $\text{CN}^-$ ,  $\text{CO}$ , and  $\text{NO}^+$  are:

- |   |  |
|---|--|
| (a) Bond order three and isoelectronic      |  |
| (b) Bond order three and weak field ligands |  |
| (c) Bond order two and $\pi$ -acceptors     |  |
| (d) Isoelectronic and weak field ligands    |  |

31. The possible number of optical isomers in  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$  are:

- |       |       |
|-------|-------|
| (a) 2 | (b) 3 |
| (c) 4 | (d) 6 |

32. Which of the following does not have optical isomers?

- |  |   |
|--|---|
| (a) $[\text{Co}(\text{en})_3]\text{Cl}_3$          | (b) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$                     |
| (c) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ | (d) $[\text{Co}(\text{en})(\text{NH}_3)_2\text{Cl}_2]\text{Cl}$ |

33. Which of the following has a square planar geometry?

- |                            |                            |
|----------------------------|----------------------------|
| (a) $[\text{PtCl}_4]^{2-}$ | (b) $[\text{CoCl}_4]^{2-}$ |
| (c) $[\text{FeCl}_4]^{2-}$ | (d) $[\text{NiCl}_4]^{2-}$ |

34. Which of the following will give a pair of enantiomorphs?

- |  |  |
|--|--|
| (a) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ | (b) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$     |
| (c) $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_6]$          | (d) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_2$ |

35. Both  $\text{Co}^{3+}$  and  $\text{Pt}^{4+}$  have a coordination number of 6. Which of the following pairs of complexes will show approximately the same electrical conductance for their 0.001M aqueous solutions?

- |   |  |
|---|--|
| (a) $\text{CoCl}_3 \cdot 4\text{NH}_3$ and $\text{PtCl}_4 \cdot 4\text{NH}_3$ |  |
| (b) $\text{CoCl}_3 \cdot 3\text{NH}_3$ and $\text{PtCl}_4 \cdot 5\text{NH}_3$ |  |
| (c) $\text{CoCl}_3 \cdot 6\text{NH}_3$ and $\text{PtCl}_4 \cdot 5\text{NH}_3$ |  |
| (d) $\text{CoCl}_3 \cdot 5\text{NH}_3$ and $\text{PtCl}_4 \cdot 6\text{NH}_3$ |  |

36. The increasing order of the crystal field splitting power of some common ligands is:

- |   |  |
|---|--|
| (a) $\text{H}_2\text{O} < \text{NO}_2^- < \overset{\ominus}{\text{CN}} < \text{NH}_3$ |  |
| (b) $\text{NH}_3 < \text{NO}_2^- < \overset{\ominus}{\text{CN}} < \text{H}_2\text{O}$ |  |
| (c) $\text{H}_2\text{O} < \text{NH}_3 < \text{NO}_2^- < \overset{\ominus}{\text{CN}}$ |  |
| (d) $\text{H}_2\text{O} < \text{NH}_3 < \overset{\ominus}{\text{CN}} < \text{NO}_2^-$ |  |

37. The EAN of Fe atom in  $(\text{CO})_5\text{Fe}(\text{CO})_3\text{Fe}(\text{CO})_3$  is:

- |        |        |
|--------|--------|
| (a) 34 | (b) 35 |
| (c) 36 | (d) 37 |

38. Which of the pair of complex compounds are tetrahedral as well as diamagnetic?
- $[\text{CoCl}_4]^-$  and  $[\text{Co}(\text{CO})_4]^-$
  - $[\text{Ag}(\text{SCN})_4]^{2-}$  and  $[\text{NiCl}_4]^{2-}$
  - $[\text{Co}(\text{CO})_4]^-$  and  $[\text{Ni}(\text{CN})_4]^{4-}$
  - $[\text{PdCl}_4]^{2-}$  and  $[\text{Ni}(\text{CN})_4]^{2-}$
39. If  $H_x[\text{Pt} y_6]$ ,  $y$  is a monodentate negatively charged ligand then find out the value of  $x$ :
- 5
  - 3
  - 6
  - None of these
40. Select the correct IUPAC name of  $\text{K}_2[\text{Cd}(\text{CN})_4]$ :
- Potassium tetracyanidocadmite (II)
  - Potassium tetracyanidocadmite (2-)
  - Both (a) and (b)
  - None of these
41. Select the correct order of magnetic moment (in B.M.) from the following options:
- $[\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-}$
  - $[\text{Fe}(\text{CN})_6]^{4-} > [\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-}$
  - $[\text{Fe}(\text{CN})_6]^{2-} > [\text{CoCl}_4]^{2-} > [\text{MnCl}_4]^{2-}$
  - $[\text{MnCl}_4]^{2-} > [\text{Fe}(\text{CN})_6]^{4-} > [\text{CoCl}_4]^{2-}$
42. When  $\text{K}_4[\text{Fe}(\text{CN})_6]$  is treated with  $\text{FeCl}_3$ , a blue color is obtained. It is due to the formation of:
- $\text{Fe}^{\text{II}}[\text{Fe}^{\text{III}}(\text{CN})_6]^-$
  - $\text{Fe}^{\text{III}}[\text{Fe}^{\text{II}}(\text{CN})_6]^-$
  - Both (a) and (b)
  - None of these
43. In isolated condition C—C bond length of  $\text{C}_2\text{H}_4$  is  $x$ , than the bond length of C—C bond of  $\text{C}_2\text{H}_4$  in Zeise's salt is:
- Greater than  $x$
  - Less than  $x$
  - Equal to  $x$
  - None of these
44. The correct I.U.P.A.C. name for  $\text{H}_2[\text{PtCl}_6]$  complex:
- Hexachloridoplatinic(IV) acid
  - Hexachloridoplatinate(IV) acid
  - Hydrogenhexachloridoplatinate(IV)
  - Di hydrogenhexachloridoplatinate(IV)
45. Select the correct I.U.P.A.C. name for  $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$ :
- Iron(III) hexacyanidoferrate(II)
  - Iron(III) hexacyanidoferrate(III)
  - Iron(III) hexacyanidoiron(III)
  - Iron(II) hexacyanidoiron(II)
46. Select the correct I.U.P.A.C. name for  $[\text{Ti}(\pi-\text{C}_5\text{H}_5)_2(\sigma-\text{C}_5\text{H}_5)_2]$ :
- Bis (cyclopentadienyl) bis ( $\eta^5$ -cyclopentadienyl) titanate(IV)
  - Bis ( $\eta^5$ -cyclopentadienyl) bis (cyclopentadienyl) titanium(IV)
47. Select the correct I.U.P.A.C name for  $\text{Mo}(\sigma-\text{C}_5\text{H}_5)(\pi-\text{C}_5\text{H}_5)(\text{CO})_3$ :
- Allytricarbonyl ( $\eta^5$  – cyclopentadiene) molybdenum(II)
  - Allyltricarbonyl ( $\eta^5$ -cyclopentadienyl) molybdate(II)
  - Tricarbonyl ( $\eta^5$ -cyclopentadienyl) allyl molybdate(II)
  - Allyl tricarbonyl ( $\eta^5$ -cyclopentadienyl) molybdenum(II)
48. I.U.P.A.C. name for  $\text{Fe}(\text{CO})_2(\sigma-\text{C}_5\text{H}_5)(\pi-\text{C}_5\text{H}_5)$  complex:
- Dicarbonyl ( $\eta^5$ -cyclopentadienyl) (cyclopentadienyl)ferrate(II)
  - Dicarbonyl ( $\eta^5$ -cyclopentadiene) (cyclopentadienyl)iron(II)
  - Dicarbonyl ( $\eta^5$ -cyclopentadienyl) ( $\eta^5$ -cyclopentadienyl)iron(II)
  - Dicarbonyl ( $\eta^5$ -cyclopentadienyl) (cyclopentadienyl)iron(II)
49. Select the correct I.U.P.A.C. name for  $[\text{Pt}(\text{C}_5\text{H}_5\text{N})_4]\text{[PtCl}_4]$ :
- Tetrapyridineplatinato(II) tetrachloridoplatinato(II)
  - Tetrapyridineplatinato(II) tetrachloridoplatinate(II)
  - Tetrapyridineplatinato(II) tetrachloridoplatinum(II)
  - Tetrapyridineplatinum(II) tetrachloridoplatinato(II)
50. Select the correct I.U.P.A.C. name for  $\text{C}_4\text{H}_4\text{Fe}(\text{CO})_3$  complex:
- $\eta^4$ -cyclobutadiene tricarbonyliron(0)
  - Tricarbonyl ( $\eta^4$ -cyclobutadienyl) iron(0)
  - Tricarbonyl ( $\eta^4$ -cyclobutadiene) iron(I)
  - Tricarbonyl ( $\eta^4$ -cyclobutadiene) iron(0)
51. Among the following, the lowest degree of paramagnetism per mole of the compound at 298 K will be shown by:
- $\text{MnSO}_4 \cdot 4\text{H}_2\text{O}$
  - $\text{FeSO}_4 \cdot \text{H}_2\text{O}$
  - $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$
  - $\text{NiSO}_4 \cdot 6\text{H}_2\text{O}$
52. The color of  $\text{Cu}^+$  compounds is:
- White
  - Blue
  - Orange
  - Yellow

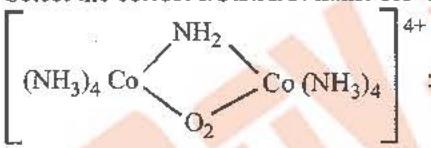
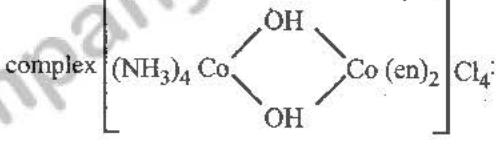
53. Dimethylglyoxime is coordinated to  $\text{Ni}^{2+}$  through:
- Two oxygen atoms
  - Two nitrogen atoms
  - Two oxygen and one nitrogen atoms
  - Two oxygen and two nitrogen atoms
54. Ferrocene is:
- $\text{Fe}(\eta^2\text{-C}_6\text{H}_5)_2$
  - $\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2$
  - $\text{Fe}(\eta^6\text{-C}_6\text{H}_6)_2$
  - $\text{Fe}(\eta^3\text{-C}_3\text{H}_3)_2$
55. Relative to the average energy in the spherical crystal field, the  $e_g$  orbitals in octahedral field is:
- Raised by  $(2/5)\Delta_o$
  - Lowered by  $(4/5)\Delta_o$
  - Raised by  $(3/5)\Delta_o$
  - Lowered by  $(3/5)\Delta_o$
56. Relative to the average energy in the spherical crystal field, the  $e_g$  orbitals in tetrahedral field is:
- Raised by  $(2/5)\Delta_t$
  - Lowered by  $(4/5)\Delta_t$
  - Raised by  $(3/5)\Delta_t$
  - Lowered by  $(3/5)\Delta_t$
57. In the complex  $[\text{Pt}(\text{O}_2)(\text{en})_2(\text{Br})]^{2+}$ , nature of  $(\text{O}_2)$  is:
- Oxide ion
  - Peroxide ion
  - Superoxide ion
  - Oxygen molecule
58. Among the properties (a) reducing, (b) oxidizing, (c) complexing, the set of properties shown by  $\text{CN}^-$  ion towards metal species is:
- a, b, c
  - b, c
  - c, a
  - a, b
59. The value of "spin only" magnetic moment for one of the following configuration is 2.84 B.M. The correct one is:
- $d^4$  (in strong field ligand)
  - $d^7$  (in weak field ligand)
  - $d^3$  (in weak as well as in strong field ligand)
  - $d^6$  (in strong field ligand)
60. The complex ion which has no  $d$  electron in the central metal atom is:
- $[\text{MnO}_4]^-$
  - $[\text{Co}(\text{NH}_3)_6]^{3+}$
  - $[\text{Fe}(\text{CN})_6]^{3-}$
  - $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
61. The spin magnetic moment of cobalt in  $\text{Hg}[\text{Co}(\text{SCN})_4]$  is:
- $\sqrt{3}$
  - $\sqrt{8}$
  - $\sqrt{15}$
  - $\sqrt{24}$
62. The pair in which both species have same magnetic moment (spin only value) is:
- $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}, [\text{CoCl}_4]^{2-}$
  - $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}, [\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
63. Which of the following compound is not colored?
- $\text{Na}_2[\text{CuCl}_4]$
  - $\text{Na}_2[\text{CdCl}_4]$
  - $\text{K}_4[\text{Fe}(\text{CN})_6]$
  - $\text{K}_3[\text{Fe}(\text{CN})_6]$
64. What is the shape of  $\text{Fe}(\text{CO})_5$  molecule and which of the following  $d$ -orbitals involved in hybridization?
- Tetrahedral  $d_{x^2-y^2}$
  - Trigonal bipyramidal,  $d_{x^2-y^2}$
  - Trigonal bipyramidal,  $d_{z^2}$
  - Square pyramidal
65. Mg is an important component of which biomolecule occurring extensively in living world?
- Hemoglobin
  - Chlorophyll
  - Florigen
  - ATP
66. Atomic numbers of Cr and Fe are, respectively, 24 and 26. Which of the following is paramagnetic with spin of electron?
- $\text{Cr}(\text{CO})_6$
  - $[\text{Fe}(\text{CO})_5]$
  - $[\text{Fe}(\text{CN})_6]^{4-}$
  - $[\text{Cr}(\text{NH}_3)_6]^{3+}$
67. Among the following, which is not the  $\pi$ -bonded organometallic compound?
- $(\text{CH}_3)_4\text{Pb}$
  - $[\text{Cr}(\eta^6\text{-C}_6\text{H}_6)_2]$
  - $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2]$
  - $\text{K}[\text{PtCl}_3(\eta^2\text{-C}_2\text{H}_4)]$
68. According to the I.U.P.A.C. nomenclature, sodium nitroprusside is named as:
- Sodium nitro-ferrocyanide
  - Sodium pentacyanidonitrosoniumferrate(II)
  - Sodium nitroferricyanide
  - Sodium pentacyanonitrosylferrate(III)
69. Which of the following is not considered as an organometallic compound?
- Ferrocene
  - cis*-platin
  - Zeise's salt
  - Grignard reagent
70. The  $d$ -electron configurations of  $\text{Mn}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Co}^{3+}$ , and  $\text{Ni}^{2+}$  are  $3d^5$ ,  $3d^6$ ,  $3d^6$ ,  $3d^8$ , respectively. Which of the following aqua complexes will exhibit the minimum paramagnetic behavior?
- $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
  - $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
  - $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
  - $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
71. The hybridization and geometry of  $[\text{Fe}(\text{CO})_4]^{2-}$  are:
- $sp^3d$ , TBP
  - $sp^3$ , tetrahedral
  - $dsp^2$ , square planar
  - $sp^3$ , TBP

72. Which of the following statements is correct for the complex  $K_4[Fe(CN)_5O_2]$  having  $t_{2g}^6, e_g^0$  electronic configuration?
- $d^2sp^3$  hybridized and diamagnetic
  - $sp^3d^2$  hybridized and paramagnetic
  - $sp^3d^2$  hybridized and diamagnetic
  - $d^2sp^3$  hybridized and paramagnetic
73. Which of the following statements is correct for the  $[Fe(H_2O)_5NO]SO_4$  complex?
- The E.A.N. value of Fe in this complex depends on the charge of NO ligand
  - The E.A.N. value of Fe in this complex does not depend on the charge of NO ligand
  - The hybridization of the central atom is  $d^2sp^3$
  - It is paramagnetic with  $\mu = 1.73$  B.M.
74. Which of the following complex can act as an oxidizing agent as well as reducing agent?
- $Ti(CO)_6$
  - $Mn(CO)_3$
  - $Mn(CO)_6$
  - None of these
75. Select the correct statement for  $[M(AB)b_2cd]$ :
- All geometrical isomers are optically active
  - It has four *trans* isomer with respect to *b*
  - It has seven geometrical isomers
  - It has three *cis* and two *trans* isomers with respect to *b*
76. Which of the following complex is inner orbital as well as low spin complex?
- $[Cr(H_2O)_6]^{3+}$
  - $[Fe(CN)_6]^{3-}$
  - $[Cu(CN)_4]^{3-}$
  - $[Mn(NH_3)_6]^{2+}$
77. The magnetic moment of a certain complex (*A*) of Co was found to be 4.89 B.M. and the EAN as 36. Co also forms complex (*B*) with magnetic moment 3.87 B.M. and EAN 37, and complex (*C*) with EAN as 36 but diamagnetic. Which of the following statements is true regarding the above observation?
- The oxidation states of Co in (*A*), (*B*), and (*C*) are +3, +2, and +3, respectively
  - Complexes (*A*) and (*B*) have  $sp^3d^2$  hybridization state while (*C*) has  $dsp^3$  hybridization state
  - The spin multiplicities of Co in (*A*), (*B*), and (*C*) are 4, 3, and 1, respectively
  - The oxidation states of Co in (*A*), (*B*), and (*C*) are +6, +8, and +1, respectively
78. Oxidation state of "V" in  $Rb_4Na[HV_{10}O_{28}]$  is:
- +5
  - +6
  - $+\frac{7}{5}$
  - +4
79. Which of the following organometallic compound is  $\sigma$  and  $\pi$ -bonded?
- $[Fe(\eta^5-C_5H_5)_2]$
  - $K[PtCl_3(\eta^2-C_2H_4)]$
  - $[Co(CO)_5NH_3]^{2+}$
  - $Fe(CH_3)_3$
80. Spin only magnetic moments of a  $d^8$  ion in octahedral, square planar, and tetrahedral complexes, respectively, are:
- 2.8 B.M., 0, and 2.8 B.M.
  - 2.8, 2.8, and 2.8 B.M.
  - 0, 0, and 0 B.M.
  - None of these
81. Compare C — C bond length (*x*) of  $C_2H_4$  in Zeise's salt and C — C bond length (*y*) of  $C_2(CN)_4$  in  $K[PtCl_3C_2(CN)_4]$ :
- $x > y$
  - $y > x$
  - $x = y$
  - None of these
82. Select the correct order of C — O bond order in mixed phosphine carbonyl complex:
- $[(Ph_3P)_3Mo(CO)_3] > [(Ph_2PCl)_3 Mo(CO)_3] > (Ph PCl_2)_3 Mo (CO)_3$
  - $[(Ph_3P)_3Mo(CO)_3] < [(Ph_2PCl)_3 Mo(CO)_3] < (Ph PCl_2)_3 Mo (CO)_3$
  - $[(Ph_3P)_3Mo(CO)_3] = [(Ph_2PCl)_3 Mo(CO)_3] > (Ph PCl_2)_3 Mo (CO)_3$
  - $[(Ph_3P)_3Mo(CO)_3] < [(Ph_2PCl)_3 Mo(CO)_3] > (Ph PCl_2)_3 Mo (CO)_3$
83. Which bond properties are consistent with one another?
- | Bond order | Bond length | Vibrational frequency |
|------------|-------------|-----------------------|
| (a) Higher | shorter     | higher                |
| (b) Higher | longer      | lower                 |
| (c) Lower  | shorter     | lower                 |
| (d) Lower  | longer      | higher                |
84. Which of the following statement(s) is/are true or false?
- S<sub>1</sub>: In organometallic compounds, carbon is bonded to metals directly
- S<sub>2</sub>: Complexes having  $d^0$  or  $d^{10}$  configuration of metal ions are always diamagnetic
- S<sub>3</sub>: Extra stability of metal carbonyls is explained by synergic bonding
- S<sub>4</sub>: In  $Fe(CO)_5$ , the Fe—C bond possesses both  $\sigma$  and  $\pi$  characteristics
- T T T T
  - T T F F
  - F T F T
  - F T T T
85. Which of the following is incorrect about Wilkinson's catalyst?

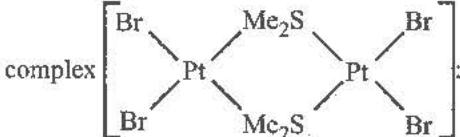
- (a) It is a non-ionic complex
- (b) It is a diamagnetic complex
- (c) It is a tetrahedral complex
- (d) It is very effective for selective hydrogenation of organic molecule at room temperature and pressure

### Multiple Correct Answers Type

1. Select the correct I.U.P.A.C. name from following:
  - (a) Diamminesilver(I) chloride:  $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$
  - (b) Potassium hexacyanidoferate(III):  $\text{K}_3[\text{Fe}(\text{CN})_6]$
  - (c) Tetraamminecopper(II) sulphate:  $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$
  - (d) Hexamminecobalt(III) chloride:  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$
2. Select the correct I.U.P.A.C. name for  $[\text{Pt}(\text{NH}_3)_4]^{2+}$  complex ion:
  - (a) Tetraammineplatinum(II) ion
  - (b) Tetraammineplatinum(2+) ion
  - (c) Tetraammineplatinate(II) ion
  - (d) Tetraammineplatinate(2+) ion
3. Select the correct I.U.P.A.C. name for  $[\text{PtCl}_4]^{2-}$ :
  - (a) Tetrachloridoplatinum(II) ion
  - (b) Tetrachloridoplatinum(2-) ion
  - (c) Tetrachloridoplatinate(II) ion
  - (d) Tetrachloridoplatinate(2-) ion
4. Select the correct I.U.P.A.C. name for  $[\text{PtCl}_6]^{2-}$ :
  - (a) Hexachloridoplatinate(IV) ion
  - (b) Hexachloridoplatinum(II) ion
  - (c) Hexachloridoplatinate(2-) ion
  - (d) Hexachloridoplatinum(2-) ion
5. Select the correct statement(s) for double salt:
  - (a) Double salts are stable in solid state but loose their identity in aqueous solution
  - (b) In double salt the properties of constituent ions are not changed in their aqueous solution
  - (c) Double salts are stable in solid state and do not loose their identity in aqueous solution
  - (d) In double salt the properties of constituent ions are changed in their aqueous solution
6. Select the paramagnetic complex compound:
  - (a)  $\text{K}_4[\text{Fe}(\text{CN})_5\text{O}_2]$
  - (b)  $\text{Fe}(\text{CO})_5$
  - (c)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$
  - (d)  $[\text{Ni}(\text{CN})_6]^{4-}$
7. Which of the following ligand(s) is/are ambidentate?
  - (a)  $\text{NOS}^\ominus$
  - (b)  $\overset{\ominus}{\text{SCN}}$
  - (c)  $\text{NO}_2^\pm$
  - (d)  $\text{CH}_3\text{COO}^\ominus$
8. Select the correct I.U.P.A.C. name for  $[\text{CoCl}_2(\text{en})_2]\text{SO}_4$ :
  - (a) Dichloridobis (ethylenediamine)cobalt(III) sulphate
  - (b) Dichloridobis (ethane-1, 2-diamine) cobalt(III) sulphate
  - (c) bis { dichloridoethylenediaminecobalt(III)} sulphate
  - (d) bis { di(chlorido)ethylenediaminecobalt(III)} sulphate
9. Which of the following complex (s) is/are high spin?
  - (a)  $[\text{CoF}_6]^{3-}$
  - (b)  $[\text{Co}(\text{H}_2\text{O})_3\text{F}_3]$
  - (c)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
  - (d)  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$
10. Which of the following complex (s) is/are paramagnetic in nature?
  - (a)  $\text{K}_2[\text{NiF}_6]$
  - (b)  $\text{K}_3[\text{CoF}_6]$
  - (c)  $\text{K}_3[\text{Fe}(\text{CN})_6]$
  - (d)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
11. Which of the following complex ion(s) are paramagnetic?
  - (a)  $[\text{Ni}(\text{CN})_4]^{2-}$
  - (b)  $[\text{NiCl}_4]^{2-}$
  - (c)  $[\text{CoF}_6]^{3-}$
  - (d)  $[\text{Co}(\text{NH}_3)_6]^{3+}$
12. Bidentate ligands are:
  - (a)  $\text{C}_2\text{O}_4^{2-}$  (oxalate)
  - (b) en (ethylenediamine)
  - (c) DMG (dimethyl glyoxime)
  - (d) Gly (glycine)
13. Which of the following complex(s) is/are having correct name?
  - (a)  $\text{K}[\text{Pt}(\text{NH}_3)\text{Cl}_5]$  – Potassium amminepentachloridoplatinate(IV)
  - (b)  $[\text{Ag}(\text{CN})_2]^-$  – Dicyanoargentate(I) ion
  - (c)  $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3]$  – Potassium trioxalatochromate(III)
  - (d)  $\text{Na}_2[\text{Ni}(\text{EDTA})]$  – Sodium ethylenediaminetetraacetatonickel(II)
14.  $d_{x^2-y^2}$  orbital is involved in which of the following hybridization?
  - (a)  $sp^3d$  (sq. pyramidal)
  - (b)  $dsp^2$
  - (c)  $sp^3d^2$
  - (d)  $sp^3d^3$
15. Which of the following statement(s) is/are correct?
  - (a) The stability constant of  $[\text{Co}(\text{NH}_3)_6]^{3+}$  is larger than that of  $[\text{Co}(\text{NH}_3)_6]^{2+}$
  - (b) The cyano complexes are more stable than those formed by halide ions
  - (c) The stability of halide complexes follows the order  $\text{I}^- < \text{Br}^- < \text{Cl}^-$

- (d) The stability constant of  $[\text{Cu}(\text{NH}_3)_4]^{2+}$  is larger than that of  $[\text{CuCl}_4]^{2-}$
16. The complexes  $[\text{CoNO}_2(\text{NH}_3)_5]\text{Cl}_2$  and  $[\text{Co}(\text{ONO})(\text{NH}_3)_5]\text{Cl}_2$  are not the examples of:  
 (a) Geometrical isomers (b) Optical isomers  
 (c) Coordination isomers (d) Linkage isomers
17. The complexes  $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$  and  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$  are not the examples of:  
 (a) Geometrical isomers (b) Optical isomers  
 (c) Coordination isomers (d) Linkage isomers
18. Which of the following statement(s) is/are true?  
 (a)  $\text{Ni}(\text{CO})_4$  is paramagnetic  
 (b)  $[\text{Fe}(\text{CN})_6]^{3-}$  contains one unpaired electron  
 (c)  $[\text{FeF}_6]^{3-}$  involves  $sp^3d^2$ -hybridization  
 (d)  $[\text{Ni}(\text{CN})_4]^{2-}$  is square planar and diamagnetic
19. In the complex  $[\text{Fe}(\text{NH}_3)_6]^{3+}$ :  
 (a)  $\text{Fe}^{3+}$  is a Lewis acid (b)  $\text{NH}_3$  is a Lewis base  
 (c)  $\text{NH}_3$  is Lewis acid (d)  $\text{Fe}^{3+}$  is a Lewis base
20. Which can form chelates?  
 (a) Ethylene diamine (b) Oxalate  
 (c) Glycinate (d) Cyanide
21. In which case geometrical isomer *cis* possible with  $M$  as metal ion if complexes are square planar having C.N. = 4?  
 (a)  $\text{MX}_2\text{Y}_2$  (b)  $\text{MX}_2\text{Y}_4$   
 (c)  $\text{MX}_2\text{Y}_2\text{Z}_2$  (d)  $\text{Ma}_4$
22. Ethylenediamine is/are not an example of a ..... ligand:  
 (a) Monodentate (b) Bidentate  
 (c) Tridentate (d) Hexadentate
23. Which of the following statement(s) is/are correct?  
 (a)  $\text{Ni}(\text{CO})_4$ —Tetrahedral, paramagnetic  
 (b)  $[\text{Ni}(\text{CN})_4]^{2-}$ —Square planar, diamagnetic  
 (c)  $[\text{Ni}(\text{CO})_4]$ —Tetrahedral, diamagnetic  
 (d)  $[\text{NiCl}_4]^{2-}$ —Tetrahedral, paramagnetic
24. Which of the following statements(s) is/are correct?  
 (a) The complexes  $[\text{NiCl}_4]^{2-}$  and  $[\text{Ni}(\text{CN})_4]^{2-}$  differ in state of hybridization of nickel  
 (b) The complexes  $[\text{NiCl}_4]^{2-}$  and  $[\text{Ni}(\text{CN})_4]^{2-}$  differ in geometry  
 (c) The complexes  $[\text{NiCl}_4]^{2-}$  and  $[\text{Ni}(\text{CN})_4]^{2-}$  differ in the magnetic properties  
 (d) The complexes  $[\text{NiCl}_4]^{2-}$  and  $[\text{Ni}(\text{CN})_4]^{2-}$  differ in primary valencies of nickel
25. Both geometrical and optical isomerisms are not shown by:  
 (a) dichlorobis (ethylenediamine) cobalt(III) ion  
 (b) triamminetrichloro cobalt(III) ion  
 (c) tetraamminedichloro cobalt(III) ion  
 (d) trioxalatochromate(III) ion
26. Which of the following molecule(s) is/are showing optical isomerism?  
 (a)  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  (b)  $[\text{Co}(\text{en})\text{Cl}_2(\text{NH}_3)_2]^+$   
 (c)  $[\text{Co}(\text{en})_3]^{3+}$  (d)  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
27. Select the correct I.U.P.A.C. name for the following  

- (a) Tetramminecobalt(III)- $\mu$ -amido- $\mu$ -superoxido-tetraamminecobalt(III) ion  
 (b)  $\mu$ -Amido- $\mu$ -superoxidobis(tetraammine)dico-balt(III) ion  
 (c)  $\mu$ -Amido- $\mu$ -superoxidobis(tetraamminecobalt(III)) ion  
 (d)  $\mu$ -Amido- $\mu$ -superoxidoctaamminedicobalt(III) ion
28. Select the correct I.U.P.A.C. name for the following  
 complex 
- (a) Tetraamminecobalt (III)- $\mu$ -dihydroxidobis (ethylenediamine)cobalt(III) chloride  
 (b)  $\mu$ -Dihydroxidotetraamminebis(ethylenediamine) dicobalt(III) chloride  
 (c) Tetraammine cobalt (III)- $\mu$ -dihydroxidobis (ethane-1,2-diamine)cobalt(III) chloride  
 (d) Tetraamminecobalt (III)- $\mu$ -dihydroxidobis (ethylenediamine)cobalt(III) tetrachloride
29. Select the correct I.U.P.A.C. name for  $\text{Mn}(\text{CO})_5(\sigma-\text{C}_3\text{H}_5)$ :  
 (a) Allylpentacarbonylmanganese(I)  
 (b) Cyclopropylpentacarbonylmanganese(I)  
 (c) Pentacarbonylcyclopropylmanganese(I)  
 (d) Pentacarbonyl allylmanganese(I)
30. Which of the following molecules have E.A.N. = 36?  
 (a)  $[\text{Fe}(\text{CO})_4]^{2-}$  (b)  $[\text{Co}(\eta^5-\text{C}_5\text{H}_5)_2]^+$   
 (c)  $\text{Co}_2\text{CO}_8$  (d)  $\text{Mn}_2(\text{CO})_{10}$

31. The aqueous solution of the following salts will be colored in the case of:
- $\text{Zn}(\text{NO}_3)_2$
  - $\text{LiNO}_3$
  - $\text{Co}(\text{NO}_3)_2$
  - $\text{CrCl}_3$
32. In which of the following cases, the synergic bonding takes place at the  $\pi$ -orbital of the ligand?
- $[\text{PtCl}_3(\text{C}_2\text{H}_4)]^-$
  - $[\text{Ni}(\text{PF}_3)_4]$
  - $[\text{Cr}(\text{C}_6\text{H}_5)_2]$
  - $[\text{Fe}(\pi-\text{C}_5\text{H}_5)_2]$
33. Which of the following complexes are diamagnetic:
- $[\text{AuCl}_4]$
  - $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
  - $[\text{CoF}_6]^{3-}$
  - $[\text{Co}(\text{CO})_4]^-$
34. Which of the following is/are represent the correct sequence of indicated property?
- $\text{Mn}^{2+} < \text{Ni}^{2+} < \text{Co}^{2+} < \text{Fe}^{2+}$ : magnetic moment
  - $\text{FeO} > \text{CoO} > \text{NiO}$ : basic character
  - $\text{Sc} < \text{Ti} < \text{Cr} < \text{Mn}$ : number of oxidation states
  - $1.73 \mu$ : one unpaired  $e^\ominus$
35. Which of the following statement(s) is/are correct?
- Primary valency of the central metal of a complex is always satisfied by anions
  - Secondary valency of the central metal of a complex may be satisfied by either negative ions or neutral molecules
  - Species which show primary valencies in a complex compound can be precipitated out
  - None of these
36. Select correct statements:
- $[\text{Ni}(\text{en})_3]^{2+}$  is less stable than  $[\text{Ni}(\text{NH}_3)_6]^{2+}$
  - Increase in stability of the complexes due to the presence of multidentate cyclic ligand is called macro-cyclic effect
  - $[\text{Ni}(\text{en})_3]^{2+}$  is more stable than  $[\text{Ni}(\text{NH}_3)_6]^{2+}$
  - For a given ion and ligand, the greater the charge on the metal ion, the greater is the stability
37. The complex  $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$  is formed in the brown ring test for nitrates when freshly prepared  $\text{FeSO}_4$  solution is added to aqueous solution of  $\text{NO}_3^-$  followed by addition of conc.  $\text{H}_2\text{SO}_4$ . Select correct statements about this complex:
- Color change is due to charge transfer
  - It has iron in +1 oxidation state and nitrosyl as  $\text{NO}^+$
  - It has magnetic moment of 3.87 B.M. confirming three unpaired electrons in Fe
  - In complex Fe has  $d^2sp^3$  hybridization
38. Which of the following complex ion(s) is/are not expected to absorb visible light?
- $[\text{Ti}(\text{en})_2(\text{NH}_3)_2]^{4+}$
  - $[\text{Cr}(\text{NH}_3)_6]^{3+}$
  - $[\text{Zn}(\text{NH}_3)_6]^{2+}$
  - $[\text{Sc}(\text{H}_2\text{O})_3(\text{NH}_3)_3]^{3+}$
39. Which of the following molecule(s) is/are not showing optical isomerism?
- $[\text{Co}(\text{NH}_3)_3\text{Cl}]^+$
  - $[\text{Co}(\text{en})(\text{NH}_3)_2]^{2+}$
  - $[\text{Co}(\text{H}_2\text{O})_4(\text{en})]^{3+}$
  - $[\text{Co}(\text{en})_2(\text{NH}_3)_2]^{3+}$
40. Colorless, tetrahedral complexes among the following are:
- $\text{K}_3[\text{Cu}(\text{CN})_4]$
  - $\text{Na}_2[\text{NiCl}_4]$
  - $\text{K}[\text{BF}_4]$
  - $\text{Ni}(\text{CO})_4$
41. Which of the following statement is correct regarding metal carbonyl?
- In  $\text{Mn}_2(\text{CO})_{10}$ , bond order of Mn—Mn is 0
  - In  $\text{Fe}_2(\text{CO})_9$ , number of Fe—Fe bonds is 1
  - In  $\text{Ni}(\text{CO})_4$ , all bond length are same
  - $\text{Fe}(\text{CO})_5$  is diamagnetic
42. Select the correct I.U.P.A.C. name for  $[(\text{NH}_3)_4\text{Co}(\text{OH})(\text{NH}_2)\text{Co}(\text{NH}_3)_4]^{4+}$ :
- $\mu\text{-Amido-}\mu\text{-hydroxidobis}\{\text{tetraammine cobalt(4+)}\}$  ion
  - $\mu\text{-Amido-}\mu\text{-hydroxidobis}\{\text{tetraammine cobalt(III)}\}$  ion
  - $\mu\text{-Amido-}\mu\text{-hydroxidobis}\{\text{tetraammine cobaltate(4+)}\}$  ion
  - $\mu\text{-Amido-}\mu\text{-hydroxidobis}\{\text{tetraammine cobaltate(III)}\}$  ion
43. The compound(s) that exhibit(s) geometrical isomerism is/are:
- $[\text{Pt}(\text{en})\text{Cl}_2]$
  - $[\text{Pt}(\text{en})_2]\text{Cl}_2$
  - $[\text{Pt}(\text{en})_2\text{Cl}_2]\text{Cl}_2$
  - $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$
44. Select the correct I.U.P.A.C. name for  $[(\text{C}_6\text{H}_5)_3\text{PClPdCl}_2\text{PdCl}(\text{C}_6\text{H}_5)_3\text{P}]$ :
- Chloridotriphenylphosphinepalladium(II)  $\mu$ -dichlorodichloridotriphenylphosphinepalladium(II)
  - $\mu$ -Dichlorodichlorodobis(triphenylphosphine) dipalladium(II)
  - $\mu$ -Dihlorodobis(chloridotriphenylphosphinepalladium)(II)
  - Bis ( $\mu$ -chlorodichloridotriphenylphosphinepalladium)(II)
45.  $[(\text{Cl}_3\text{Sn})_2\text{RhCl}_2\text{Rh}(\text{SnCl}_3)_2]^{4-}$  as:
- Bis (trichlorostannato) rhodate(I)- $\mu$ -dichlorodobis (trichlorostannato)rhodate(I) ion

- (b)  $\mu$ -Dichloridotetrakis (trichlorostannito) dirhodate(I)ion  
 (c)  $\mu$ -Dichloridobis{bis (trichlorido stannito) rho-dato(I)ion}  
 (d)  $\mu$ -Dichloridotetrakis (trichloro stannito) dirmodium(I) ion
46. Select the correct I.U.P.A.C name for the following complex
- 
- (a) Di bromidoplatinum(II) bis- $\mu$ -(dimethylthioether) dibromidoplatinum(II)  
 (b) Bis ( $\mu$  (dimethylthioether) dibromidoplatinum(II))  
 (c) Bis- $\mu$ -dimethylthioethertetrabromidodiplatinum(II)  
 (d) Bis- $\mu$ -dimethylthioethertetrabromidodiplatinate(II)
47. Select the correct I.U.P.A.C. name for  $\text{Na}_2[\text{Fe}(\text{CN})_5\text{NO}]$  complex:
- (a) Sodiumpentacyanidonitrosoniumferrate(II)  
 (b) Sodiumpentacyanidonitrosylferrate(II)  
 (c) Sodiumpentacyanidonitrosyl ferrate(II)  
 (d) Sodiumpentacyanidonitrosyliron(II)
48. Select the correct I.U.P.A.C. name for  $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]\text{SO}_4$ :
- (a) Penta aquanitrosonium iron(I) sulphate  
 (b) Penta aquanitrosyliron(I) sulphate  
 (c) Penta aquanitrosyliron(II) sulphate  
 (d) Penta aquanitrosoniumferrate(II) sulphate
49. Select the correct I.U.P.A.C. name for  $[(\text{NH}_3)_4\text{CoNH}_2\text{NO}_2\text{Co}(\text{NH}_3)_4](\text{NO}_3)_4$ :
- (a) Tetraamminecobalt(III)- $\mu$ -amido- $\mu$ -nitrito-*n* tetraamminecobalt(III) nitrate  
 (b)  $\mu$ -Amido- $\mu$ -nitrito-N-octaamminedicobalt(III) nitrate  
 (c)  $\mu$ -Amido- $\mu$ -nitrito-N-bis (tetraamine) dico-balt(III) nitrate  
 (d)  $\mu$ -Amido- $\mu$ -nitrito-O-octaamminedicobaltate(III) nitrate
50.  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  complex is:
- (a) High spin complex  
 (b) Having  $d^2sp^3$ -hybridization  
 (c) Low spin complex  
 (d) Having octahedral structure

51. Select the correct statement:
- (a)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  is Co(III), low spin, 0 unpaired electron, diamagnetic  
 (b)  $[\text{CoF}_6]^{3-}$  is Co(III), high spin  $d^6$ , 4 unpaired electron, paramagnetic  
 (c)  $[\text{RhF}_6]^{3-}$  is Rh(III), low spin  $d^6$ , 0 unpaired electrons diamagnetic  
 (d)  $[\text{Fe}(\text{CN})_6]^{4-}$  is high spin  $d^6$ , 0 unpaired electron diamagnetic
52. Which of the following is/are example(s) of  $\sigma$ -bonded organometallic compound?
- (a)  $\text{Al}_2(\text{CH}_3)_6$  (b)  $\text{Pb}(\text{CH}_3)_4$   
 (c)  $\text{Zn}(\text{C}_2\text{H}_5)_2$  (d) Ferrocene
53. Which of the following is an example of  $\pi$ -bonded organometallic complex?
- (a) Ferrocene (b) Dibenzenechromium  
 (c)  $\text{Zn}(\text{C}_2\text{H}_5)_2$  (d)  $\text{Pb}(\text{C}_2\text{H}_5)_4$
54. Which of the following statement(s) is/are incorrect?
- (a) Metal carbonyls are the examples of only  $\sigma$ -bonded organometallic complexes  
 (b) Metal carbonyls are the examples of only  $\pi$ -bonded organometallic complexes  
 (c) Metal carbonyls are the examples of organometallic complexes which involve both  $\sigma$ - and  $\pi$ -bonds between metal and carbon of the carbonyl group  
 (d) Metal carbonyls involve both  $\sigma$ - and  $\pi$ -bonds between metal and oxygen of the carbonyl group
55. The coordination number of a central metal atom in a complex(s) is/are not determined by:
- (a) The number of only anionic ligands bonded to the metal ion  
 (b) The number of ligands around a metal ion bonded by  $\pi$ -bonds  
 (c) The number of ligands around a metal ion bonded by both  $\sigma$  and  $\pi$ -bonds  
 (d) The number of ligands around a metal ion bonded by  $\sigma$ -bonds
56. Which of the following complex(s) is/are an example of homoleptic complex?
- (a)  $[\text{Co}(\text{NH}_3)_6]^{3+}$  (b)  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$   
 (c)  $[\text{Ni}(\text{NH}_3)_6]^{2+}$  (d)  $[\text{Ni}(\text{NH}_3)_4\text{Cl}_2]$
57. The complex  $\text{K}_4[\text{Zn}(\text{CN})_4(\text{O}_2)_2]$  is oxidized into  $\text{K}_2[\text{Zn}(\text{CN})_4(\text{O}_2)_2]$ , then which of the following is/are correct:
- (a) Zn(II) is oxidized into Zn(IV)