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 [Cu(NH₃)₅]Cl₂:
   (a) Triamminetrichlorochromate(III)
   (b) Triamminetrichlorochromium(III)
   (c) Trichlorotriamminochromium(III)
   (d) Trichlorodiamminochromium(III)

3. Select the correct I.U.P.A.C. name for [Cr(NH₃)₅] [PtCl₄]
   (a) Tetraamminecopper(II) tetrachlorodipalladium(II)
   (b) Tetraamminecopper(II) tetrachlorodipalladium(IV)
   (c) Tetraamminecopper(II) tetrachlorodipalladinate(II)
   (d) Tetraamminecuprate(II) tetrachlorodiplatinate(II)

4. Select the correct I.U.P.A.C. name for Cr(C₆H₅)(CO)₆:
   (a) (η⁶-benzene) tricarbonylchromate (0)
   (b) Tricarbonyl (η⁶-benzene) chromate (0)
   (c) Tricarbonyl (η⁶-benzene)chromium (0)
   (d) (η⁶-benzene) tricarbonylchromium (0)

5. I.U.P.A.C. name for complex [Mn(C₆H₅)(CO)₆]:
   (a) Tricarbonyl (η⁶-cyclopentadiene)manganese(II)
   (b) Tricarbonyl (η⁶-cyclopentadiene)mangate(II)
   (c) Tricarbonyl (η⁶-cyclopentadienyl)manganese(II)
   (d) (η⁶-cyclopentadienyl) tricarbonyl manganese(II)

6. Select the correct order of E.A.N.:
   (a) [Cr(CO)₆] > [Cr(CO)₅] > [Cr(CO)₄] > [Cr(CO)₃]
   (b) [Cr(CO)₅] > [Cr(CO)₄] > [Cr(CO)₃] > [Cr(CO)₂]
   (c) [Cr(CO)₆] > [Cr(CO)₅] > [Cr(CO)₄] > [Cr(CO)₂]
   (d) [Cr(CO)₆] > [Cr(CO)₅] > [Cr(CO)₄] > [Cr(CO)₃]

7. Which of following complex has higher Δ₂ value?
   (a) [Fe(H₂O)₆]³⁺
   (b) [Fe(H₂O)₅]²⁺
   (c) [Fe(CN)₆]³⁻
   (d) All have equal

8. Among the following ions which one has the highest paramagnetism?
   (a) [Cr(H₂O)₆]³⁺
   (b) [Fe(H₂O)₅]²⁺
   (c) [Cu(H₂O)₄]²⁺
   (d) [Zn(H₂O)₆]²⁺

9. The calculated value of magnetic moment of ²²Ti³⁺ is:
   (a) 1.73 μₜ
   (b) 2.83 μₜ
   (c) 3.87 μₜ
   (d) 4.9 μₜ

10. The I.U.P.A.C. name for [Fe(CN)₆]³⁻ ion is:
    (a) Hexacyanidoferrate(II) ion
    (b) Hexacyanidoferrate(II) ion
    (c) Hexacyanidoferrate(II) ion
    (d) Iron(III) hexacyanide ion
11. The I.U.P.A.C. name for \([\text{Ni(CO)}_4]\) is:
   (a) Tetracarbonylnickel(II)
   (b) Tetracarbonylnickel(0)
   (c) Tetracarbonylnickelate(II)
   (d) Tetracarbonylnickelate(0)

12. The number of ions produced by the complex \([\text{Co(NH}_3)_4\text{Cl}_3]\) is:
   (a) 2     (b) 3
   (c) 4     (d) 6

13. The I.U.P.A.C. name for \([\text{Ni(CN)}_4]^2-\) 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 \(K_3[\text{Co(NO}_3)_4]\) is:
   (a) Potassium(I) hexanitrocobaltate(II)
   (b) Potassium(I) hexanitrocobaltate(IV)
   (c) Potassium hexanitrocobaltate(0)
   (d) Potassium hexanitrocobaltate(III)

15. Which of the following complex ions is diamagnetic?
   (a) \([\text{CoF}_3]^-\)  (b) \([\text{NiCl}_4]^2-\)
   (c) \([\text{Ni(NH}_3)_3]^{2+}\)  (d) \([\text{Ni(CN)}_4]^2-\)

16. Which of the following is a tridentate ligand?
   (a) \(\text{NO}_3^-\)  (b) Oxalate ion
   (c) Glycinate ion  (d) Dien

17. How many ions are produced from \([\text{Co(NH}_3)_4\text{Cl}_3]\) in the solution?
   (a) 3     (b) 4
   (c) 5     (d) 6

18. A complex involving \(d^0\)sp\(^3\) hybridization has:
   (a) A square planar geometry
   (b) A tetrahedral geometry
   (c) An octahedral geometry
   (d) Trigonal planar geometry

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   (b) A tetrahedral geometry
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   (d) Trigonal planar geometry

20. Zeise's salt is:
   (a) \(\text{Fe}([\text{C}_2\text{H}_4])_2\)
   (b) \(\text{Cr}([\text{C}_2\text{H}_4])_2\)
   (c) \(K[\text{Pt}([\text{C}_2\text{H}_4])_2]\)
   (d) \(K[\text{Pt}([\text{C}_2\text{H}_4])_2\text{Cl}_2]\)

21. Which of the following complex ion possesses \(d^0\)sp\(^3\) hybridization?
   (a) \([\text{Ni(NH}_3)_4]^{2+}\)  (b) \([\text{CoF}_6]^{3-}\)
   (c) \([\text{Co(NH}_3)_3]^{3+}\)  (d) \([\text{FeF}_6]^{3-}\)

22. Which of the following complex ion possesses \(d^0\)sp\(^2\) hybridization?
   (a) \([\text{Ni(CN)}_4]^2-\)  (b) \([\text{Ni(CO)}_4]\)
   (c) \([\text{NiCl}_4]^2-\)  (d) \([\text{Ni(PF}_3)_3]\)

23. Which of the following complex ion possesses sp\(^3\)d\(^2\) hybridization?
   (a) \([\text{Cr(NH}_3)_6]^{3+}\)  (b) \([\text{FeF}_6]^{3-}\)
   (c) \([\text{Co(NO}_3)_6]^{3+}\)  (d) \([\text{TIF}_6]^{3-}\)

24. Which of the following complexes is paramagnetic?
   (a) \(K_3[\text{Ni(CN)}_4]\)  (b) \(K_3[\text{Fe(CN)}_6]\)
   (c) \(K_3[\text{Co(NH}_3)_3]\)  (d) \(K_3[\text{Cr(H}_2\text{O})_6]\)

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 are:
   (a) Raised by \((2/5)\Delta_s\)  (b) Lowered by \((2/5)\Delta_s\)
   (c) Raised by \((3/5)\Delta_s\)  (d) Lowered by \((1/5)\Delta_s\)

27. Which is the pair of ambident ligands?
   (a) \(\text{CN}^-\), \(\text{NO}_3^-\)  (b) \(\text{NO}_3^-\), \(\text{SCN}^-\)
   (c) \(\text{N}_2\text{O}_5\), \(\text{NO}_3^-\)  (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 \(\text{Cu}^{2+}\) in \(\text{CuSO}_4\cdot\text{H}_2\text{O}\) is:
   (a) 5  (b) 4
   (c) 3  (d) 2

30. Coordination number of calcium is six in:
   (a) \([\text{Ca(EDTA)}]^{2-}\)  (b) \(\text{CaCl}_2\)
   (c) \([\text{Ca(C}_2\text{O}_4)_2]^{2-}\)  (d) \(\text{CaSO}_4\cdot\text{4H}_2\text{O}\)

31. Increasing order of EAN of the metals in \([\text{Ni(CN)}_4]^{2-}\), \([\text{Fe(CN)}_6]^{3-}\) and \([\text{Cu(CN)}_4]^{2-}\) is:
   (a) \([\text{Ni(CN)}_4]^{2-}\) \(<\) \([\text{Fe(CN)}_6]^{3-}\) \(<\) \([\text{Cu(CN)}_4]^{2-}\)
   (b) \([\text{Ni(CN)}_4]^{2-}\) \(<\) \([\text{Fe(CN)}_6]^{3-}\) \(<\) \([\text{Cu(CN)}_4]^{2-}\)
(c) $[\text{Ni}(\text{CN})_4]^2- < [\text{Cu}(\text{CN})_4]^2- < [\text{Fe}(\text{CN})_6]^{3-}$
(d) $[\text{Cu}(\text{CN})_4]^2- < [\text{Fe}(\text{CN})_6]^{3-} < [\text{Ni}(\text{CN})_4]^2-$

32. $[\text{Co(NH}_3)_6][\text{Cr(CN)}_6]$ and $[\text{Cr(NH}_3)_6][\text{Co(CN)}_4]$ 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) $\Delta_o = \frac{4}{9} \Delta_t$  
(b) $\Delta_o = \frac{1}{2} \Delta_t$  
(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) c at-platin  
(b) Zeiss'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) $[\text{Fe(}\text{CO})_3]$  
(b) $[\text{Ni(}\text{CN})_4]$  
(c) $\text{Fe}_2\text{O}_3$  
(d) $\text{Cr}_2\text{O}_3$

37. A square planar complex is formed by hybridization of which atomic orbitals?
(a) $s, p_x, p_y, d_z$  
(b) $s, p_x, p_y, d_z^2 - d_x^2$  
(c) $s, p_x, p_y, d_z$  
(d) $s, p_x, p_y, d_z^2$

38. The type of isomerism present in pentammine nitrochromium(III) chloride is:
(a) Optical  
(b) Linkage  
(c) Hydrate  
(d) Polymerization

39. Which one of the following has the largest number of isomers?
(a) $[\text{Co(}\text{en})_2]Cl^+$  
(b) $[\text{Co(NH}_3)_2Cl]^{2-}$  
(c) $[\text{Ir(}\text{PR}_3)_2]\text{H(CO)}^2+$  
(d) $[\text{Ru(NH}_3)_4Cl]^{2-}$

40. The correct order of magnetic moment (spin values in B.M.) is:
(Atomic no. $\text{Mn} = 25$, $\text{Fe} = 26$, $\text{Co} = 27$)
(a) $[\text{Fe(CN)}_6]^{3-} > [\text{CoCl}_4]^{2-} > [\text{MnCl}_4]^{2-}$
(b) $[\text{MnCl}_6]^{2-} > [\text{Fe(CN)}_6]^{3-} > [\text{CoCl}_4]^{2-}$
(c) $[\text{Fe(CN)}_6]^{3-} > [\text{MnCl}_4]^{2-} > [\text{CoCl}_4]^{2-}$
(d) $[\text{MnCl}_6]^{2-} > [\text{CoCl}_4]^{2-} > [\text{Fe(CN)}_6]^{3-}$

41. Which one of the following has the regular tetrahedral structure?
(a) $[\text{Ni(CN)}_4]^{2-}$  
(b) $\text{SF}_4$  
(c) $\text{BF}_4^-$  
(d) $\text{XeF}_4$

42. The IUPAC name of the coordination compound $K_4[\text{Fe(CN)}_6]$ is:
(a) Potassium hexacyanoferrate(II)  
(b) Potassium hexacyanoferrate(III)  
(c) Potassium hexacyanoferron(II)  
(d) Tripotassium hexacyanoferron(II)

43. Which one of the following has the lowest value of paramagnetic behavior:
(a) $[\text{Cr(CN)}_6]^{3-}$  
(b) $[\text{Mn(CN)}_6]^{3-}$  
(c) $[\text{Fe(CN)}_6]^{2-}$  
(d) $[\text{Co(CN)}_6]^{3-}$

44. The species having tetrahedral shape is:
(a) $[\text{PdCl}_4]^{2-}$  
(b) $[\text{Ni(CN)}_4]^{2-}$  
(c) $[\text{Pt(CN)}_4]^{2-}$  
(d) $[\text{NiCl}_4]^{2-}$

45. $[\text{Cr(H}_2\text{O})_6]\text{Cl}_3$ (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) $3d_{x^2-y^2}, 3d_{x^2}, 3d_{y^2}$  
(b) $3d_{x^2-y^2}, 3d_{x^2}, 3d_{y^2}$  
(c) $3d_{x^2}, 3d_{x^2-y^2}$  
(d) $3d_{x^2}, 3d_{x^2-y^2}, 3d_{x^2}$

46. A complex compound in which the oxidation number of metal is zero:
(a) $[\text{Ni(CO)}_4]$  
(b) $[\text{Pt(NH}_3)_2\text{Cl}_2]$  
(c) $K_4[\text{Fe(CN)}_6]$  
(d) $K_4[\text{Fe(CN)}_6]$

47. $[\text{Co(NH}_3)_2\text{NO}_2]\text{Cl}_2$ and $[\text{Co(NH}_3)_2\text{ONO}]\text{Cl}_2$ 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) $\text{Mn}_4$  
(b) $\text{Mn}_4$  
(c) $\text{Mn}_4$  
(d) $\text{Mn}_4$

49. $K_4[\text{Fe(CN)}_6]$ is called:
(a) Potassium hexacyanoferrate(II)  
(b) Potassium ferricyanate  
(c) Potassium ferrocyanide  
(d) Prussian blue

50. Among the following ions which one has the highest paramagnetism?
(a) $[\text{Cr(H}_2\text{O})_6]^{3+}$  
(b) $[\text{Fe(H}_2\text{O})_6]^{3+}$  
(c) $[\text{Cu(H}_2\text{O})_4]^{2+}$  
(d) $[\text{Zn(H}_2\text{O})_4]^{2+}$

51. The number of geometrical isomers of $[\text{Co(NH}_3)_2\text{(NO}_2)_3]$ is:
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 [Ni(C₂O₄)₆]³⁻ is:
   (a) 3  (b) 6  (c) 4  (d) 5

54. Both geometrical and optical isomerisms are shown by:
   (a) [Co(en)₂Cl₂]⁺  (b) [Co(NH₃)₃Cl]²⁺  (c) [Co(NH₃)₂Cl₂]+  (d) [Cr(OX)₃]³⁻

55. In [Cr(C₂O₄)₃]⁻, the isomerism shown is:
   (a) Ligand  (b) Optical  (c) Geometrical  (d) Ionization

56. The hypothetical complex chlorido dinaquaammine cobalt (III) chloride can be represented as:
   (a) [Co(NH₃)₂(H₂O)₂Cl]Cl₂  (b) [Co(NH₃)₃H₂OCl]Cl₂  (c) [Co(NH₃)₃(H₂O)Cl]Cl₂  (d) [Co(NH₃)₃(H₂O)₃]Cl₂

57. In the coordination compound K₄[Ni(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 (4 and 8 are monodentate ligands)?
   (a) [M₂A₂B₄]  (b) [M₄A₄B₄]  (c) [M₂A₄B₄]  (d) [M₂B₄]

59. The geometry of [Ni(CN)₄]²⁻ and [NiCl₄]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-[Co(NH₃)₃Cl]Cl  (b) cis-[PtCl₂(NH₃)₂]  (c) cis-K₄[PtCl₂Br₄]  (d) Na₃[CoCl₄]

61. The ligand called π-acid is:
   (a) CO  (b) NH₃  (c) C₂O₄⁻  (d) Ethylene diamine

62. The effective atomic number of cobalt in the complex [Co(NH₃)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) [M(μ₂-A)]  (b) [M₂B₂]  (c) [M₂A₄]  (d) [M₂ABC]

64. Which one of the following is a tridentate ligand?
   (a) NO₂⁻  (b) Oxalate ion  (c) Glycinate ion  (d) Dien

65. Assign the hybridization, shape, and magnetic moment of K₃[Co(CO)₄] are:
   (a) sp³, tetrahedral, 1.73 B.M.  (b) dsp², square planar, 1.73 B.M.  (c) sp³, tetrahedral, 2.44 B.M.  (d) dsp², 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) Na₂[Co(PO₄)₃]  (b) Na₂[Mg(EDTA)]  (c) Na₂[Pb(EDTA)]  (d) [Ca(SO₄)₂]²⁻

67. The I.U.P.A.C. name for [Ni(NH₃)₆][NiCl₄] is:
   (a) Tetrachloridonickel(II)-tetraamminenickel(II)
   (b) Tetraamminenickel(II)-tetrachloridonickelate(II)
   (c) Tetrachloridonickel(II)-tetraamminenickelate(II)
   (d) Tetrachloridonickel(II)-tetraamminenickelate(II)

68. In which of the following coordination entities, the magnitude of Δ₀[CFSE in octahedral field] will be maximum?
   (a) [Co(CN)₆]³⁻  (b) [Co(NO₃)₆]³⁻  (c) [CoF₆]³⁻  (d) [Co(NH₃)₆]³⁺

69. Hybridization, shape, and magnetic moment of K₃[Co(CO)₄] are:
   (a) d⁴sp³, octahedral, 4.9 B.M.  (b) dsp³, octahedral, 4.9 B.M.  (c) dsp², square planar, 4.9 B.M.  (d) sp³, tetrahedral, 4.9 B.M.

70. Geometry, hybridization, and magnetic moment of the ions [Ni(CN)₄]²⁻, [MnBr₄]²⁻ and [FeF₄]⁻, respectively are:
   (a) Tetrahedral, square planar, octahedral: sp³, dsp², sp²d²: 5.9, 0, 4.9
   (b) Tetrahedral, square planar, octahedral: dsp², sp³, sp²d²: 0, 5.9, 4.9
   (c) Square planar, tetrahedral, octahedral: dsp², sp³, dsp³: 5.9, 4.9, 0
   (d) Square planar, tetrahedral, octahedral: dsp², sp³, sp²d²: 0, 5.9, 4.9
71. In Cu-ammonia complex, the state of hybridization of Cu is:
(a) $sp^2$
(b) $d^5$
(c) $sp^3$
(d) $d^sp^2$

72. The total number of possible coordination isomer for the given compound $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2][\text{PtCl}_4]$ is:
(a) 2
(b) 4
(c) 5
(d) 3

73. E.A.N. of $K[\text{PtCl}_3(\eta^2-C_2\text{H}_4)]$ is:
(a) 86
(b) 78
(c) 84
(d) 74

74. $\text{Ag}^+$ forms many complexes, some of these are $[\text{Ag(NH}_3)_2]^+$, $[\text{Ag(CN)}_2]^-$, $[\text{Ag(S}_2\text{O}_8)^2$-$]$. Which of the following statements is true?
(a) In these complexes, $\text{Ag}^+$ is a Lewis base
(b) The hybridization of $\text{Ag}^+$ is $sp^2$
(c) The $\text{Ag}^+$ complexes are good reducing agents
(d) These complexes are all linear

75. The following complexes are given:
(1) $\text{trans-}[\text{Co(NH}_3)_2\text{Cl}_2]^+$
(2) $\text{cis-}[\text{Co(NH}_3)_2\text{en}_2]^+$
(3) $\text{trans-}[\text{Co(NH}_3)_2\text{en}_2]^+$
(4) $[\text{NiCl}_4]^{2-}$
(5) $[\text{TiF}_4]^{2-}$
(6) $[\text{CoF}_4]^{2-}$
Choose the correct code:
(a) 1, 2 are optically active; 3 optically inactive
(b) 2 is optically active; 1, 3 are optically inactive
(c) 4, 5 are colored; 6 is colorless
(d) 4 is colored; 5, 6 are colorless

76. The number of $\sigma$ and $\pi$ bonds in $\text{Fe}_2(\text{CO})_9$, respectively are:
(a) $22\sigma$ and $15\pi$
(b) $23\sigma$ and $15\pi$
(c) $22\sigma$ and $16\pi$
(d) $15\sigma$ 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?
(a) $d^6$
(b) $d^5$
(c) $d^6$
(d) $d^5$

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:
(a) $[\text{Ti(H}_2\text{O})_6]^{2+}$
(b) $[\text{Ti(H}_2\text{O})_6]^{3+}$
(c) $[\text{TiCl}_6]^{2-}$
(d) $[\text{TiCl}_6]^{3-}$

79. Which of the following statements is correct?
(a) With $d^sp^1$ hybridization $[\text{FeCl}(\text{CN})_4\text{O}_2]^{2-}$ complex is diamagnetic
(b) $[\text{NiCl}_4]^{2-}$ complex is more stable than $[\text{Ni(dmg)}_2]$ due to higher C.F.S.E. value
(c) $[\text{V(CO)}_6]$ is not very stable and easily reduces to $[\text{V(CO)}_5]^-$
(d) Ligands such as CO, CN$^-$, NO$^-$ are $\pi$ donors due to the presence of filled $\pi$-molecular orbital

80. Select the correct I.U.P.A.C. name for $[\text{Pt(NH}_3)_4][\text{PtCl}_4]$:
(a) Tetraamminplatinum(II) tetrachloroplatinate(II)
(b) Tetraamminplatinum(II) tetrachloroplatinate(II)
(c) Tetraamminplatinum(II) tetrachloroplatinate(II)
(d) All are correct

81. Select the correct I.U.P.A.C. name for $[\text{Co(NH}_3)_6][\text{Co(NO)}_3]$:
(a) Hexaamminecobalt(II) hexanitro-O cobaltate(II)
(b) Hexaamminecobalt(II) hexanitro-N cobaltate(II)
(c) Hexaamminecobaltate(II) hexanitro-O cobaltate(II)
(d) Hexaamminecobaltate(II) hexanitro-O cobaltate(II)

82. Select the correct I.U.P.A.C. name for $[\text{PtCl}_2(\text{NH}_3)_4][\text{PtCl}_4]$:
(a) Tetraamminedichloroplatinate(IV) tetrachloroplatinate(II)
(b) Tetraamminedichloroplatinate(IV) tetrachloroplatinate(II)
(c) Tetraamminedichloroplatinate(IV) tetrachloroplatinate(II)
(d) All are correct

83. Select the correct I.U.P.A.C. name for $\text{Na}[\text{Co(CO)}_4]$:
(a) Sodium tetracarbonylcobalt (-I)
(b) Sodium tetracarbonylcobalt (0)
(c) Sodium tetracarbonylcobaltate (0)
(d) Sodium tetracarbonylcobaltate (-I)

84. Select the correct I.U.P.A.C. name for $\text{Fe(\pi-C}_6\text{H}_5)_4$:
(a) bis($\eta^5$-cyclopentadienyl) iron(II)
(b) bis($\eta^5$-cyclopentadienyl) ferrate(II)
(c) bis($\eta^5$-cyclopentadienyl) iron(0)
(d) bis($\eta^5$-cyclopentadienyl) iron(II)

85. Select the correct I.U.P.A.C. name for $[\text{Cr(C}_5\text{H}_7)_2]$:
(a) bis($\eta^5$-benzene) chromium(0)
(b) bis($\eta^6$-benzene) chromate(0)
(c) bis($\eta^6$-benzene) chromate(0)
(d) bis($\eta^5$-benzene) chromium(0)
1. Select the correct I.U.P.A.C. name for [Co(CO)]:
(a) (η^3-Allyl) tricarbonyl Cobalt(I)
(b) Tricarbonyl (η^3-allyl) Cobalt(I)
(c) Tricarbonyl (η^3-allyl) cobaltate(I)
(d) Tricarbonyl (η^3-allyl) tricarbonyl cobalt(I)

2. E.A.N. of [Fe(η^3-C_5H_5)(CO)_3Cl]:
(a) 36
(b) 35
(c) 37
(d) 34

3. For Mn^3+ ion, the electron pairing energy P is about 28,000 cm^-1, \Delta_2 values for the complexes [Mn(H_2O)_6]^{3+} and [Mn(CN)_6]^{3-} are 15,800 cm^-1 and 38,500 cm^-1, respectively, which of the following complex is high spin?
(a) [Mn(CN)_6]^{3-}
(b) [Mn(H_2O)_6]^{3+}
(c) Both are high spin
(d) None of these

4. If a transition-metal compound absorbs violet-indigo radiation in the visible region. Its color would be:
(a) Green
(b) Yellow
(c) Orange
(d) Blue

5. Transition metal compounds are usually colored. This is due to the electronic transition:
(a) From p-orbital to s-orbital
(b) From d-orbital to s-orbital
(c) From d-orbital to p-orbital
(d) Within the d-orbitals

6. A substance which is not paramagnetic is:
(a) Cr(CIO_4)_3
(b) KMnO_4
(c) TiCl_4
(d) VOBr_2

7. The following represents a pair of enantiomers:
(a) trans-[CrCl_2(en)_2]^{3+}
(b) cis-[CrCl_2(en)_2]^{3+}
(c) trans-[CrCl_2(NH_3)_2]^{3+}
(d) cis-[CrCl_2(NH_3)_2]^{3+}

8. The compound [PtCl_2(NH_3)_2] can form:
(a) Geometrical isomers
(b) Coordination isomers
(c) Linkage isomers
(d) Optical isomers

9. The compound [CoCl_2(NH_3)_2(en)] can form:
(a) Linkage isomers
(b) Coordination isomers
(c) Optical isomers
(d) Linkage as well as optical isomers

10. Which of the following complexes has magnetic moment of 2.83 Bohr magneton?
(a) [Ni(NH_3)_6]^{2+}
(b) [Ni(CN)_4]^{2-}
(c) TiCl_4
(d) [CoCl_4]^{2-}

11. According to crystal field theory, octahedral splitting and tetrahedral splitting of d orbitals caused by the same ligands are related through the expression:
(a) \Delta_e' = \Delta_t'
(b) 4\Delta_e = 9\Delta_t
(c) 9\Delta_e = 4\Delta_t
(d) \Delta_e = 2\Delta_t

12. Relative to the average energy in the spherical crystal field, the t_{2g} orbitals in octahedral field is:
(a) Raised by (2/5)\Delta_e
(b) Lowered by (2/5)\Delta_e
(c) Raised by (1/6)\Delta_e
(d) Lowered by (1/6)\Delta_e

13. Which of the following ligands are correctly represented in an spectrochemical series?
(a) SCN^- < F^- < CN^- (b) SCN^- < CN^- < F^- (c) F^- < SCN^- < CN^- (d) F^- < CN^- < SCN^-

14. In the complex [Pt(O_2)(en)_2(Br)_2]^3- coordination number and oxidation number of platinum are:
(a) 4, 3
(b) 4, 5
(c) 4, 6
(d) 6, 4

15. Coordination number of Cr is six. A complex with C_2O_4^{2-}, en and superoxide O_2^- will be in the ratio to make complex [Cr(C_2O_4)_2(en)_2(O_2^-)_2]:
\[x\text{Cr}^{3+}\text{C}_2\text{O}_4^{2-}\text{en}_2\text{O}_2^-\]
(a) 1 1 1
(b) 1 1 2
(c) 1 2 2
(d) 2 1 1

16. EAN of Fe is ... in [Fe(C_2O_4)_3]^{3-}:
(a) 27
(b) 24
(c) 35
(d) 29

17. EAN of cobalt is 36 in [Co(NH_3)_2(O_2)(en)]Cl. Thus, O_2 is:
(a) Dioxide
(b) Superoxide ion
(c) Peroxide ion
(d) Oxide

18. EAN of Mg is ... in [Mg(EDTA)]^{2-}:
(a) 16
(b) 20
(c) 22
(d) 18

19. Which has maximum EAN of the underlined atoms?
(Cr = 24, Co = 27, Fe = 26, Ni = 28)
(a) [Cr(EDTA)]^{3-}
(b) [Co(en)]^{3+}
(c) [Fe(C_2O_4)_3]^{3-}
(d) [Ni(CN)_4]^{2-}
20. Arrange the following in order of decreasing number of unpaired electrons:
I: [Fe(H₂O)₆]³⁺  II: [Fe(CN)₆]³⁻
III: [Fe(CN)₆]³⁻  IV: [Fe(H₂O)₆]²⁺
(a) IV, I, II, III  (b) I, II, III, IV
(c) III, II, I, IV  (d) II, III, I, IV

21. Among [Ni(NH₃)₆]²⁺, [Ni(CN)₆]³⁻ and [NiCl₄]²⁻ species, the hybridization state of Ni atoms are respectively:
(a) sp³, dsp², dsp²  (b) sp³, dsp², dsp³
(c) sp², dp³, dp³  (d) sp³, dp³, dp³

22. The most stable ion is:
(a) [Fe(C₂O₄)³⁻]²⁻  (b) [FeCl₃]³⁻
(c) [Fe(SCN)₃]³⁻  (d) [Fe(H₂O)₆]²⁺

23. One mole of complex compound Co(NH₃)₂Cl₃ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of AgNO₃ to yield two moles of AgClOp. The complex is:
(a) [Co(NH₃)₂Cl₂]Cl - NH₃  (b) [Co(NH₃)Cl₂]Cl - NH₃
(c) [Co(NH₃)Cl]Cl₂  (d) [Co(NH₃)₂Cl₂] - 2NH₃

24. Which of the following will show optical isomerism?
(a) [Cu(NH₃)₂]²⁺  (b) [ZnCl₂]²⁻
(c) [Cr(H₂O)₆]³⁺  (d) [Fe(NH₃)₆]³⁺

25. The bond length of C—O bond in carbon monoxide is 1.128 Å. The C—O bond in Fe(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) cis-[Cr(C₂O₄)₂Cl₂]³⁻, cis-[Co(NH₃)₂Cl₂]²⁺
(b) [Co(en)₂Cl₂]⁺, cis-[Co(en)₂Cl₂]Cl
(c) [PtCl₂(en)²⁻][NiCl₂Br₂]²⁻
(d) [Co(NO₃)₃(NH₃)₃]⁺, cis-[Pt(en)₂Cl₂]²⁻

27. The oxidation number of Pt in [Pt(C₂H₂)Cl₃]¹⁺ is:
(a) +1  (b) +2
(c) +3  (d) +4

28. Which of the following gives the maximum number of isomers?
(a) [Co(NH₃)₂Cl₂]  (b) [Ni(en)(NH₃)₂]¹⁺
(c) [Ni(C₂O₄)²⁺(en)³⁻]  (d) [Cr(SCN)₂(NH₃)₄]⁺

29. Consider the following complex:
[Co(NH₃)₂(CO)₃ClO₄]

30. The common features among the species CN⁻, CO, and NO²⁻ are:
(a) Bond order three and isoelectronic
(b) Bond order three and weak field ligands
(c) Bond order two and π-acceptors
(d) Isoelectronic and weak field ligands

31. The possible number of optical isomers in [Co(en)²Cl₂]⁺ are:
(a) 2  (b) 3
(c) 4  (d) 6

32. Which of the following does not have optical isomers?
(a) [Co(en)Cl]Cl  (b) [Co(NH₃)₂Cl₂]
(c) [Co(en)₂Cl₂]Cl  (d) [Co(en)₂Cl₂]Cl

33. Which of the following has a square planar geometry?
(a) [PtCl₄]²⁻  (b) [CoCl₄]²⁻
(c) [FeCl₄]⁻  (d) [NiCl₄]²⁻

34. Which of the following will give a pair of enantiomers?
(a) [Cr(NH₃)₆][Co(CN)₆]  (b) [Co(en)₂Cl₂]Cl
(c) [Pt(NH₃)₄][PtCl₆]  (d) [Co(NH₃)₄Cl₂]NO₂

35. Both Co³⁺ and Pt⁴⁺ have a coordination number of 6. Which of the following pairs of complexes will show approximately the same electrical conductance for their 0.001 M aqueous solutions?
(a) CoCl₃4NH₃ and PtCl₄4NH₃
(b) CoCl₃5NH₃ and PtCl₄5NH₃
(c) CoCl₃6NH₃ and PtCl₄6NH₃
(d) CoCl₃5NH₃ and PtCl₄6NH₃

36. The increasing order of the crystal field splitting power of some common ligands is:
(a) H₂O < NO₂⁻ < CN < NH₃
(b) NH₃ < NO₂⁻ < CN < H₂O
(c) H₂O < NH₃ < NO₂⁻ < CN
(d) H₂O < NH₃ < CN < NO₂

37. The EAN of Fe atom in (CO)₂Fe(CO)₃Fe(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?
   (a) [CoCl₄]²⁻ and [Co(CO)₄]²⁻
   (b) [Ag(SCN)₄]²⁻ and [NiCl₂]²⁻
   (c) [Co(CO)₄]⁰ and [Ni(CN)₄]²⁻
   (d) [PdCl₂]²⁻ and [Ni(CN)₄]²⁻

39. If $H$ [Pt(y)]$y$ is a monodentate negatively charged ligand then find out the value of $x$:
   (a) 5
   (b) 3
   (c) 6
   (d) None of these

40. Select the correct IUPAC name of K₂[Ca(CN)$_4$]:
   (a) Potassium tetracyanocadmate (II)
   (b) Potassium tetracyanocadmate (−)
   (c) Both (a) and (b)
   (d) None of these

41. Select the correct order of magnetic moment (in B.M.) from the following options:
   (a) [MnCl₄]²⁻ > [CoCl₄]²⁻ > [Fe(CN)$_6$]⁴⁻
   (b) [Fe(CN)$_6$]³⁻ > [MnCl₄]²⁻ > [CoCl₄]²⁻
   (c) [Fe(CN)$_6$]³⁻ > [CoCl₄]²⁻ > [MnCl₄]²⁻
   (d) [MnCl₄]²⁻ > [Fe(CN)$_6$]³⁻ > [CoCl₄]²⁻

42. When K₄[Fe(CN)$_6$] is treated with FeCl₃, a blue color is obtained. It is due to the formation of:
   (a) Fe$^{II}$[Fe$^{III}$ (CN)$_6$]$^-$(b) Fe$^{III}$[Fe$^{II}$ (CN)$_6$]$(a)$
   (c) Both (a) and (b)$ (d)$ None of these

43. In isolated condition C—C bond length of C₂H₄ is $x$, then the bond length of C—C bond of C₂H₄ in Zeise’s salt is:
   (a) Greater than $x$
   (b) Less than $x$
   (c) Equal to $x$
   (d) None of these

44. The correct IUPAC name for H₂[PtCl₄] complex:
   (a) Hexachloroplatinate(IV) acid
   (b) Hexachloroplatinate(IV) acid
   (c) Hydrogenhexachloroplatinate(IV)
   (d) Di hydrogenhexachloroplatinate(IV)

45. Select the correct IUPAC name for Fe₅[Fe(CN)$_6$]:
   (a) Iron(III) hexacyanoferrate(II)
   (b) Iron(III) hexacyanoferrate(II)
   (c) Iron(III) hexacyanoferrate(II)
   (d) Iron(II) hexacyanoferrate(II)

46. Select the correct IUPAC name for [Ti (π—C₆H₆)](π—C₆H₆):
   (a) Bis (cyclopentadieny) bis (η$^2$-cyclopentadieny) titanate(IV)
   (b) Bis (η$^2$-cyclopentadieny) bis (cyclopentadieny) titanate(IV)
   (c) Bis (η$^2$-cyclopentadieny) bis (cyclopentadieny) titanate(IV)
   (d) Bis (η$^2$-cyclopentadieny) bis (cyclopentadieny) titanate(IV)

47. Select the correct IUPAC name for Mo(π—C₆H₆) (π—C₆H₆) (CO)$_2$:
   (a) Allyliccarbonyl (η$^2$-cyclopentadieny) molybdenum(I)
   (b) Allyliccarbonyl (η$^2$-cyclopentadieny) molybdenum(II)
   (c) Triallylic (η$^2$-cyclopentadieny) allyl molybdenum(II)
   (d) Allylicallycarbonyl (η$^2$-cyclopentadieny) molybdenum(II)

48. IUPAC name for Fe(CO)$_5$(π—C₆H₆) (π—C₆H₆) complex:
   (a) Dicarbonyl (η$^2$-cyclopentadieny) (cyclopentadieny) ferrate(II)
   (b) Dicarbonyl (η$^2$-cyclopentadieny) (cyclopentadieny) iron(II)
   (c) Dicarbonyl (η$^2$-cyclopentadieny) (η$^2$-cyclopentadieny) iron(II)
   (d) Dicarbonyl (η$^2$-cyclopentadieny) (cyclopentadieny) iron(II)

49. Select the correct IUPAC name for [Pt(C₆H₅)N]$_4$ [PtCl₄]:
   (a) Tetrayridineplatinate(II) tetrachloroplatinate(II)
   (b) Tetrayridineplatinate(II) tetrachloroplatinate(II)
   (c) Tetrayridineplatinate(II) tetrachloroplatinate(II)
   (d) Dicarbonyl(η$^2$-cyclopentadieny) iron(II)

50. Select the correct IUPAC name for C₄H₄Fe(CO)$_3$ complex:
   (a) η$^1$-cyclobutadiene tricarbonyliron(0)
   (b) Tricarbonyl (η$^1$-cyclobutadieny) iron(0)
   (c) Tricarbonyl (η$^4$-cyclobutadieny) iron(1)
   (d) Tricarbonyl (η$^4$-cyclobutadieny) iron(0)

51. Among the following, the lowest degree of paramagnetism per mole of the compound at 298 K will be shown by:
   (a) MnSO₄•4H₂O
   (b) FeSO₄•H₂O
   (c) CuSO₄•5H₂O
   (d) NiSO₄•6H₂O

52. The color of Cu$^{+}$ compounds is:
   (a) White
   (b) Blue
   (c) Orange
   (d) Yellow
53. Dimethylglyoxime is coordinated to Ni^{2+} through:
   (a) Two oxygen atoms
   (b) Two nitrogen atoms
   (c) Two oxygen and one nitrogen atom
   (d) Two oxygen and two nitrogen atoms

54. Ferrocene is:
   (a) Fe(η^2-C_5H_5)_2
   (b) Fe(η^3-C_5H_5)_2
   (c) Fe(η^1-C_5H_5)_2
   (d) Fe(η^1-C_5H_5)_2

55. Relative to the average energy in the spherical crystal field, the e_g orbitals in octahedral field is:
   (a) Raised by (2/5)Δ_o
   (b) Lowered by (4/5)Δ_o
   (c) Raised by (3/5)Δ_o
   (d) Lowered by (3/5)Δ_o

56. Relative to the average energy in the spherical crystal field, the e_g orbitals in tetrahedral field is:
   (a) Raised by (2/5)Δ_t
   (b) Lowered by (4/5)Δ_t
   (c) Raised by (3/5)Δ_t
   (d) Lowered by (3/5)Δ_t

57. In the complex \{Pt(O_2)(en)_2(Br)_2\}, nature of O_2 is:
   (a) Oxide ion
   (b) Peroxide ion
   (c) Superoxide ion
   (d) Oxygen molecule

58. Among the properties (a) reducing, (b) oxidizing, (c) complexing, the set of properties shown by CN⁻ ion towards metal species is:
   (a) a, b, c
   (b) b, c
   (c) c, a
   (d) a, b

59. The value of "spin only" magnetic moment for one of the following configurations is 2.84 B.M. The correct one is:
   (a) d⁷ (in strong field ligand)
   (b) d⁷ (in weak field ligand)
   (c) d⁷ (in weak as well as in strong field ligand)
   (d) d⁷ (in strong field ligand)

60. The complex ion which has no d-electron in the central metal atom is:
   (a) [MnO₂]⁻
   (b) [Co(NH₃)₆]³⁺
   (c) [Fe(CN)₆]³⁻
   (d) [Cr(H₂O)₆]³⁺

61. The spin magnetic moment of cobalt in H₃[Co(SCN)₄] is:
   (a) √3
   (b) √8
   (c) √15
   (d) √24

62. The pair in which both species have same magnetic moment (spin only value) is:
   (a) [Cr(H₂O)₆]³⁺, [CoCl₄]²⁻
   (b) [Cr(H₂O)₆]³⁺, [Fe(H₂O)₆]²⁺

63. Which of the following compound is not colored?
   (a) Na₂[CuCl₄]
   (b) Na₂[CdCl₄]
   (c) K₄[Fe(CN)₆]
   (d) K₃[Fe(CN)₆]

64. What is the shape of Fe(CO)₅ molecule and which of the following d-orbitals involved in hybridization?
   (a) Tetrahedral, dₓ² and dᵧ²
   (b) Trigonal bipyramidal, dₓ², dᵧ²
   (c) Trigonal bipyramidal, dₓ² and dᵧ²
   (d) Square pyramidal

65. Mg is an important component of which biomolecule occurring extensively in living world?
   (a) Hemoglobin
   (b) Chlorophyll
   (c) Florogen
   (d) ATP

66. Atomic numbers of Cr and Fe are, respectively, 24 and 26. Which of the following is paramagnetic with spin of electron?
   (a) Cr(CO)₆
   (b) [Fe(CO)₅]⁻
   (c) [Fe(CN)₆]³⁻
   (d) [Cr(NH₃)₆]³⁺

67. Among the following, which is not the π-bonded organometallic compound?
   (a) (C₅H₅)₂Pb
   (b) [Cr(η⁴-C₅H₅)₂]
   (c) [Fe(η⁵-C₅H₅)₂]
   (d) K[PtCl₃(η⁵-C₅H₅)₃]

68. According to the I.U.P.A.C. nomenclature, sodium nitroprusside is named as:
   (a) Sodium nitro-ferrocyanide
   (b) Sodium pentacyanidomonosulphoniumferrate(II)
   (c) Sodium nitroferricyanide
   (d) Sodium pentacyanoditosylferrate(III)

69. Which of the following is not considered as an organo-metallic compound?
   (a) Ferrocene
   (b) cis-platin
   (c) Zeise’s salt
   (d) Grignard reagent

70. The d-electron configurations of Mn⁺², Fe⁺³, Co⁺³, and Ni⁺² are 3d⁸, 3d⁹, 3d⁸, 3d⁸, respectively. Which of the following aqua complexes will exhibit the minimum paramagnetic behavior?
   (a) [Fe(H₂O)₆]³⁺
   (b) [Co(H₂O)₆]³⁺
   (c) [Ni(H₂O)₆]²⁺
   (d) [Mn(H₂O)₆]²⁺

71. The hybridization and geometry of [Fe(CO)₅]²⁻ are:
   (a) sp³d, TBP
   (b) sp³, tetrahedral
   (c) dₓ², square planar
   (d) sp³, TBP
72. Which of the following statements is correct for the complex $\text{K}_2[\text{Fe(CN)}_3 \text{O}_2]$ having $t_s^6 e_g^6$ electronic configuration?
(a) $d^3sp^3$ hybridized and diamagnetic
(b) $sp^3d^2$ hybridized and paramagnetic
(c) $sp^3d^2$ hybridized and diamagnetic
(d) $d^3sp^3$ hybridized and paramagnetic

73. Which of the following statements is correct for the $[\text{Fe(H}_2\text{O})_5\text{NO}][\text{SO}_4]$ complex?
(a) The E.A.N. value of Fe in this complex depends on the charge of NO ligand
(b) The E.A.N. value of Fe in this complex does not depend on the charge of NO ligand
(c) The hybridization of the central atom is $d^3sp^3$
(d) 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?
(a) $\text{Ti(CO)}_6$
(b) $\text{Mn(CO)}_5$
(c) $\text{Mn(CO)}_6$
(d) None of these

75. Select the correct statement for $M[AB]_2[cd]_2$:
(a) All geometrical isomers are optically active
(b) It has four trans isomer with respect to $b$
(c) It has seven geometrical isomers
(d) 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?
(a) $[\text{Cr(H}_2\text{O})_6]^{2+}$
(b) $[\text{Co(CN)}_6]^{3-}$
(c) $[\text{Cu(CN)}_4]^{2-}$
(d) $[\text{Mn(NH}_3)_6]^{2+}$

77. The magnetic moment of a certain complex $A$ of Co was found to be 4.89 B.M. and the E.A.N as 36. Co also forms complex $B$ with magnetic moment 3.87 B.M. and E.A.N 37, and complex $C$ with E.A.N as 36 but diamagnetic. Which of the following statements is true regarding the above observation?
(a) The oxidation states of Co in $(A)$, $(B)$, and $(C)$ are +3, +2, and +3, respectively
(b) Complexes $(A)$ and $(B)$ have $sp^3d^2$ hybridization state while $(C)$ has $sp^3d^6$ hybridization state
(c) The spin multiplicities of Co in $(A)$, $(B)$, and $(C)$ are 4, 3, and 1, respectively
(d) The oxidation states of Co in $(A)$, $(B)$, and $(C)$ are +6, +8, and +1, respectively

78. Oxidation state of “V” in $\text{Rb}_2\text{Na}[\text{HV}_{10}\text{O}_{26}]$ is:
(a) +5
(b) +6
(c) $\frac{7}{5}$
(d) +4

79. Which of the following organometallic compound is $\sigma$ and $\pi$-bonded?
(a) $[\text{Fe(\eta^5-C_2H_5)_2}]$
(b) $K[\text{PtCl}_2(\eta^5-C_2H_5)_2]$
(c) $[\text{Co(CO)}_3\text{NH}_2]^2^+$
(d) $\text{Fe(CH}_3)_3$

80. Spin only magnetic moments of a $d^9$ ion in octahedral, square planar, and tetrahedral complexes, respectively, are:
(a) 2.8, 0, and 2.8 B.M.
(b) 2.8, 2.8, and 2.8 B.M.
(c) 0, 0, and 0 B.M.
(d) None of these

81. Compare $C—C$ bond length $(x)$ of $\text{C}_2\text{H}_4$ in Zeise’s salt and $C—C$ bond length $(y)$ of $\text{C}_2\text{C}_2\text{CN}_4$ in $K[\text{PtCl}_2\text{C}_2\text{CN}_4]$:
(a) $x > y$
(b) $y > x$
(c) $x = y$
(d) None of these

82. Select the correct order of $C—O$ bond order in mixed phosphine carbonyl complex:
(a) $[(\text{Ph}_3\text{P})_2\text{Mo(CO)}_5] > [(\text{Ph}_3\text{P})_2\text{Mo(CO)}_4] > (\text{Ph}_3\text{P})_2\text{Mo(CO)}_5$
(b) $[(\text{Ph}_3\text{P})_2\text{Mo(CO)}_5] < [(\text{Ph}_3\text{P})_2\text{Mo(CO)}_4] < (\text{Ph}_3\text{P})_2\text{Mo(CO)}_5$
(c) $[(\text{Ph}_3\text{P})_2\text{Mo(CO)}_5] > [(\text{Ph}_3\text{P})_2\text{Mo(CO)}_4] > (\text{Ph}_3\text{P})_2\text{Mo(CO)}_5$
(d) $[(\text{Ph}_3\text{P})_2\text{Mo(CO)}_5] < [(\text{Ph}_3\text{P})_2\text{Mo(CO)}_4] > (\text{Ph}_3\text{P})_2\text{Mo(CO)}_5$

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?
$S_1$: In organometallic compounds, carbon is bonded to metals directly
$S_2$: Complexes having $d^0$ or $d^9$ configuration of metal ions are always diamagnetic
$S_3$: Extra stability of metal carbonyls is explained by synergic bonding
$S_4$: In $\text{Fe(CO)}_5$, the Fe—C bond possesses both $\sigma$ and $\pi$ characteristics
(a) $TTTT$
(b) $TFTF$
(c) $FTTF$
(d) $FFT$
8. Select the correct IUPAC name for [CoCl₂(en)₂]SO₄₅₂.
(a) Dichlorodis (ethylenediamine)cobalt(III) sulphate
(b) Dichlorodis (ethane-1, 2-diamine) cobalt(III) sulphate
(c) b(s) dichloroethylenediaminocobalt(III) sulphate
(d) bis(di-chloro)ethylenediaminocobalt(III) sulphate

9. Which of the following complex (s) is/are high spin?
(a) [CoF₆]³⁻
(b) [Co(H₂O)₆]²⁺
(c) [Co(H₂O)₆]³⁺
(d) [Co(H₂O)₆]²⁺

10. Which of the following complex (s) is/are paramagnetic in nature?
(a) K₃[FeO₄]
(b) K₃[CoO₄]
(c) K₃[Fe(CN)₆]
(d) [Co(H₂O)₆]²⁺

11. Which of the following complex ion(s) are paramagnetic?
(a) [Ni(CN)₆]²⁻
(b) [NiCl₂]²⁻
(c) [CoF₆]²⁻
(d) [Co(NH₃)₆]²⁺

12. Bidentate ligands are:
(a) C₅O₂⁻ (oxalate)
(b) en (ethylene diamine)
(c) DMG (dimethyl glyoxime)
(d) Gly (glycine)

13. Which of the following complex(s) is/are having correct name?
(a) K₃[Pt(NH₃)₄Cl₆] - Potassium ammoniapentachloroplatinate(IV)
(b) [Ag(CN)₂]⁻ - Dicyanidougernate(I) ion
(c) K₃[Cr(C₂O₄)₃] - Potassium trioxalochromate(III) ion
(d) Na₂[Na₂(EDTA)] - Sodium ethylenediaminetetraacetic acid(II)

14. d₃₄,5 orbital is involved in which of the following hybridization?
(a) sp³d (sq. pyramidal)  
(b) dsp²  
(c) sp³p²  
(d) sp³d²

15. Which of the following statement(s) is/are correct?
(a) The stability constant of [Co(NH₃)₆]²⁺ is larger than that of [Co(NH₃)₆]²⁺.
(b) The cyano complexes are more stable than those formed by halide ions
(c) The stability of halide complexes follows the order \( F^- < Br^- < Cl^- \)
(d) The stability constant of \([\text{Cu(NH}_3\text{)}_4]^2\) is larger than that of \([\text{CuCl}_4]^2\).

16. The complexes \([\text{Co(NO)}_3(\text{NH}_3)_3]\text{Cl}_2\) and \([\text{Co(NO)}_2(\text{OH})_3]\text{Cl}_2\) are not the examples of:
   (a) Geometrical isomers   (b) Optical isomers
   (c) Coordination isomers   (d) Linkage isomers

17. The complexes \([\text{Cr}(\text{NH}_3)_6]\text{[Cr(CN)}_6\text{]}\) and \([\text{Co}(\text{NH}_3)_6]\text{[Cr(CN)}_6\text{]}\) are not the examples of:
   (a) Geometrical isomers   (b) Optical isomers
   (c) Coordination isomers   (d) Linkage isomers

18. Which of the following statements is/are true?
   (a) \([\text{Ni(CO)}_4]\) is paramagnetic
   (b) \([\text{Fe(CN)}_4]^2\) contains one unpaired electron
   (c) \([\text{Fe(CN)}_4]^2\) involves \(sp^3d^2\)-hybridization
   (d) \([\text{Ni(CN)}_4]^2\) is square planar and diamagnetic

19. In the complex \([\text{Fe(NH}_3\text{)}_6]\)\(^{2+}\):
   (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 is 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) \(\text{MX}_4\)

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) \([\text{Ni(CO)}_4]\) — Tetrahedral, paramagnetic
   (b) \([\text{Ni(CN)}_4]^2\) — Square planar, diamagnetic
   (c) \([\text{Ni(CO)}_4]\) — Tetrahedral, diamagnetic
   (d) \([\text{NiCl}_4]^2\) — Tetrahedral, paramagnetic

24. Which of the following statements is/are correct?
   (a) The complexes \([\text{NiCl}_4]^2\) and \([\text{Ni(CN)}_4]^2\) differ in state of hybridization of nickel
   (b) The complexes \([\text{NiCl}_4]^2\) and \([\text{Ni(CN)}_4]^2\) differ in geometry
   (c) The complexes \([\text{NiCl}_4]^2\) and \([\text{Ni(CN)}_4]^2\) differ in the magnetic properties
   (d) The complexes \([\text{NiCl}_4]^2\) and \([\text{Ni(CN)}_4]^2\) differ in primary valencies of nickel

25. Both geometrical and optical isomerisms are not shown by:
   (a) dichlorobis (ethylenediamine) cobalt(III) ion
   (b) trimaminetrichloro cobalt(III) ion
   (c) tetraaminedichloro cobalt(III) ion
   (d) trioxalatocobaltate(III) ion

26. Which of the following molecule(s) is/are showing optical isomerism?
   (a) \([\text{Co(NH}_3\text{)}_2\text{Cl}_3]\)   (b) \([\text{Co(en)}_3\text{Cl}_2(\text{NH}_3\text{)}_2]\)
   (c) \([\text{Co(en)}_3]\)\(^{12+}\)   (d) \([\text{Co(en)}_2\text{Cl}_2]\)

27. Select the correct I.U.P.A.C. name for the following

   \[
   \begin{array}{c}
   \text{N}_2\text{H}_4 \text{Co} \\
   & \text{O}_2 \\
   & \text{Co(\text{NH}_3)_4} \\
   \end{array}
   \]

   (a) Tetraminocobalt(III)-\(\mu\)-amido-\(\mu\)-superoxido-tetraminocobalt(III) ion
   (b) \(\mu\)-Amido-\(\mu\)-superoxidobis(tetraminocobalt) cobalt(III) ion
   (c) \(\mu\)-Amido-\(\mu\)-superoxido(tetraminocobalt) cobalt(III) ion
   (d) \(\mu\)-Amido-\(\mu\)-superoxidocteaaminediglobin(III) ion

28. Select the correct I.U.P.A.C. name for the following

   \[
   \begin{array}{c}
   \text{N}_2\text{H}_4 \text{Co} \\
   \text{OH} \\
   \text{OH} \\
   \text{Co(\text{en})}_2 \\
   \text{Cl}_4 \text{.}
   \end{array}
   \]

   (a) Tetraminocobalt (III)-\(\mu\)-dihydroxido bis(ethylenediamine) cobalt(III) chloride
   (b) \(\mu\)-Dihydroxidotetraaminenbis(ethylenediamine) dicobalt(III) chloride
   (c) Tetrammine cobalt (III)-\(\mu\)-dihydroxido bis(ethylenediamine) cobalt(III) chloride
   (d) Tetraminocobalt(III)-\(\mu\)-dihydroxido (ethylenediamine) cobalt(III) tetrachloride

29. Select the correct I.U.P.A.C. name for \(\text{Mn(CO)}_3\) (\(\sigma\)-\(\text{C}_3\text{H}_5\)):
   (a) Allylpentacarbonylmanganese(I)
   (b) Cyclopropypentacarbonylmanganese(I)
   (c) Pentacarbonylcyclopropymanganese(I)
   (d) Pentacarbonylallylmanganese(I)

30. Which of the following molecules have E.A.N. = 367?
   (a) \([\text{Fe(CO)}_4]^2\)   (b) \([\text{Co(\eta}^5\text{-}\text{C}_3\text{H}_5)]^+$
   (c) \(\text{Co}_2\text{CO}_3\)   (d) \(\text{Mn}_2\text{(CO)}_{10}\)
31. The aqueous solution of the following salts will be colored in the case of:
   (a) Zn(NO₃)₂  (b) LiNO₃  
   (c) Co(NO₃)₂  (d) CrCl₃

32. In which of the following cases, the synergic bonding takes place at the π-orbital of the ligand?
   (a) [PtCl₂(C₂H₄)]⁺  (b) [Ni(PF₃)₆]⁻
   (c) [Cr(C₆H₆)₃]⁻  (d) [Fe(π-C₆H₅)₂]

33. Which of the following complexes are diamagnetic:
   (a) [AuCl₄]⁻  (b) [Co(H₂O)₆]³⁺
   (c) [CoF₆]³⁻  (d) [Co(CO)₆]⁻

34. Which of the following is/are represent the correct sequence of indicated property?
   (a) Mn²⁺ < Ni²⁺ < Co²⁺ < Fe²⁺: magnetic moment
   (b) FeO > CoO > NiO: basic character
   (c) Sc < Ti < Cr < Mn: number of oxidation states
   (d) 1.73 µ; one unpaired e⁻

35. Which of the following statement(s) is/are correct?
   (a) Primary valency of the central metal of a complex is always satisfied by anions
   (b) Secondary valency of the central metal of a complex may be satisfied by either negative ions or neutral molecules
   (c) Species which show primary valencies in a complex compound can be precipitated out
   (d) None of these

36. Select correct statements:
   (a) [Ni(en)₃]Cl₂ is less stable than [Ni(NH₃)₆]Cl₂
   (b) Increase in stability of the complexes due to the presence of multidentate cyclic ligand is called macro-cyclic effect
   (c) [Ni(en)₃]Cl₂ is more stable than [Ni(NH₃)₆]Cl₂
   (d) For a given ion and ligand, the greater the charge on the metal ion, the greater is the stability

37. The complex [Fe(H₂O)₅(NO₃)]²⁺ is formed in the brown ring test for nitrates when freshly prepared FeSO₄ solution is added to aqueous solution of NO₃⁻ followed by addition of conc. H₂SO₄. Select correct statements about this complex:
   (a) Color change is due to charge transfer
   (b) It has iron in +1 oxidation state and nitrosyl as NO⁺
   (c) It has magnetic moment of 3.87 B.M. confirming three unpaired electrons in Fe
   (d) In complex Fe has dsp³ hybridization

38. Which of the following complex ion(s) is/are not expected to absorb visible light?
   (a) [Ti(en)₂(NH₃)₃]⁺⁺  (b) [Cr(NH₃)₆]³⁺
   (c) [Zn(NH₃)₆]²⁺  (d) [Sc(H₂O)₃(NH₃)₃]³⁺

39. Which of the following molecule(s) is/are not showing optical isomerism?
   (a) [Co(NH₃)₆]Cl₂  (b) [Co(en)₂(NH₃)₂]⁺
   (c) [Co(H₂O)₆(en)]⁺⁺  (d) [Co(en)₂(NH₃)₆]⁺⁺

40. Colorless, tetrahedral complexes among the following are:
   (a) K₃[Co(CN)₆]  (b) Na₂[CrCl₆]
   (c) K[B₄]  (d) Ni(CO)₄

41. Which of the following statement is correct regarding metal carbonyl?
   (a) In Mn₃(CO)₁₂, bond order of Mn—Mn is 0
   (b) In Fe₃(CO)₁₂, number of Fe—Fe bonds is 1
   (c) In Ni(CO)₄, all bond length are same
   (d) Fe(CO)₄ is diamagnetic

42. Select the correct I.U.P.A.C. name for [(NH₃)₄Co(OH)](NH₃)₂Co(NH₃)₆⁻:
   (a) μ-Amino-μ-hydroxido bis(tetraammine cobalt(III))⁻
   (b) μ-Amino-μ-hydroxido bis(tetraammine cobalt(II))⁻
   (c) μ-Amino-μ-hydroxido bis(tetraammine cobaltate(4⁺))⁻
   (d) μ-Amino-μ-hydroxido bis(tetraammine cobaltate(III))⁻

43. The compound(s) that exhibit(s) geometrical isomerism is(are):
   (a) [Pt(en)Cl₂]  (b) [Pt(en)₂Cl₂]
   (c) [Pt(en)Cl₂]Cl₂  (d) [Pt(en)Cl₃]Cl

44. Select the correct I.U.P.A.C. name for [(C₆H₅)₃P]Cl PdCl₂, PdCl₂[C₆H₅]Cl₂:
   (a) Chlorido(triphenylphosphine)palladium(I)-μ-dichloro(dichlorido(triphenylphosphine)palladium(II))
   (b) μ-Dichlorido(dichlorido(triphenylphosphine))dipalladium(II)
   (c) μ-Dichlorido(dichlorido(triphenylphosphine))palladium(II)
   (d) Bis(μ-chlorido(dichlorido(triphenylphosphine))palladium(II))

45. [(Cl₃Sn)₆RhCl₂ Rh₂(C₁₆H₁₆)₆]⁺ as:
   (a) Bis(trichlororstanato)rhodate(I)-μ-dichloroditris(trichlororstanato)rhodate(I) ion
(b) μ-Dichloridotetrakis (trichlorostannato) dirodate(I)ion
(c) μ-Dichlorodibis (bis (trichlorido stannato) rhodate(I)ion)
(d) μ-Dichloridotetrakis (trichloro stannato) dimodiurn(I)ion

46. Select the correct I.U.P.A.C. name for the following complex:

\[
\begin{array}{c}
\text{Br} \\
\text{Pt} \\
\text{Me}_2\text{S} \\
\text{Pt} \\
\text{Me}_2\text{S} \\
\text{Br}
\end{array}
\]

(a) Di bromidoplatinum(II) bis-μ-(dimethylthioether) dibromidoplatinum(II)
(b) Bis-μ-(dimethylthioether) dibromidoplatinum(II)
(c) Bis-μ-dimethylthioether tetramethiodiplatinum(II)
(d) Bis-μ-dimethylthioether tetrabromidodiplatinic(II)

47. Select the correct I.U.P.A.C. name for Na₃[Fe(CN)₆]NO complex:
(a) Sodium pentacyanidonomium ferrate(II)
(b) Sodium pentacyanidocomplex(II)
(c) Sodium pentacyanidomunosyl ferrate(II)
(d) Sodium pentacyanidomunosyliron(ll)

48. Select the correct I.U.P.A.C. name for [Fe(H₂O)₆(NO)]SO₄:
(a) Pentaquanitrosinium iron(I) sulphate
(b) Pentaquanitrosium iron(I) sulphate
(c) Pentaquanitrosyliron(II) sulphate
(d) Pentaquanitrosiumferrate(II) sulphate

49. Select the correct I.U.P.A.C. name for [(NH₄)₃CoNH₄NO₂Co(NH₃)₃(NO)₃]₄:
(a) Tetraamminecobalt(III)-μ-amido-μ-nitrito-n tetraamminecobalt(III) nitrate
(b) μ-Amido-μ-nitrito-N-octamminedecobalt(III) nitrate
(c) μ-Amido-μ-nitrito-N-bis (tetrammine) dicobalt(III) nitrate
(d) μ-Amido-μ-nitrito-O-octamminedecobaltate(III) nitrate

50. [Co(H₂O)₆]³⁺ complex is:
(a) High spin complex
(b) Having \( d^{3}sp^{3} \) hybridization
(c) Low spin complex
(d) Having octahedral structure

51. Select the correct statement:
(a) [Co(H₂O)₆]³⁺ is Co(III), low spin, 0 unpaired electron, diamagnetic
(b) [CoF₆]³⁻ is Co(III), high spin \( d^{6} \), 4 unpaired electron, paramagnetic
(c) [RhF₆]³⁻ is Rh(III), low spin \( d^{6} \), 0 unpaired electrons, diamagnetic
(d) [Fe(CN)₅]⁴⁻ is high spin \( d^{6} \), 0 unpaired electron diamagnetic

52. Which of the following is/are example(s) of σ-bonded organometallic compound?
(a) Al₂(CH₃)₆
(b) Pb(CH₃)₄
(c) Zn(C₂H₅)₂
(d) Ferrocene

53. Which of the following is an example of π-bonded organometallic complex?
(a) Ferrocene
(b) Dibenzenechromium
(c) Zn(C₂H₅)₂
(d) Pb(CH₃)₄

54. Which of the following statement(s) is/are incorrect?
(a) Metal carbynols are the examples of only σ-bonded organometallic complexes
(b) Metal carbynols are the examples of only π-bonded organometallic complexes
(c) Metal carbynols are the examples of organometallic complexes which involve both σ- and π-bonds between metal and carbon of the carbonyl group
(d) Metal carbynols involve both σ- and π-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) [Cu(NH₃)₅]⁺
(b) [Cr(H₂O)₆]⁺
(c) [Ni(NH₃)₆]²⁺
(d) [Ni(NH₃)₆Cl₂]

57. The complex \( K_{4}[Zn(CN)₄(O₂)₂] \) is oxidized into \( K_{2}[Zn(CN)₄(O₂)₂] \), then which of the following is/are correct?
(a) Zn(II) is oxidized into Zn(IV)