

**SINGLE OPTION CORRECT :**

**Double salt and complex compound**

1. 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

2. Aqueous solution of  $\text{FeSO}_4$  gives tests for both  $\text{Fe}^{2+}$  and  $\text{SO}_4^{2-}$  but after addition of excess of KCN, solution ceases to give test for  $\text{Fe}^{2+}$ . This is due to the formation of

- (A) the double salt  $\text{FeSO}_4 \cdot 2\text{KCN} \cdot 6\text{H}_2\text{O}$       (B)  $\text{Fe}(\text{CN})_3$   
 (C) the complex ion  $[\text{Fe}(\text{CN})_6]^{4-}$       (D) the complex ion  $[\text{Fe}(\text{CN})_6]^{3-}$

**Werner theory**

3. Consider the following statements:

According to the Werner's theory.

- (a) Ligands are connected to the metal ions by covalent bonds.  
 (b) Secondary valencies have directional properties  
 (c) Secondary valencies are non-ionisable

Of these statements:

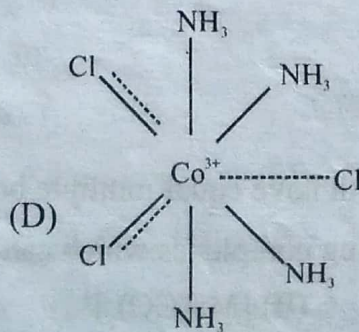
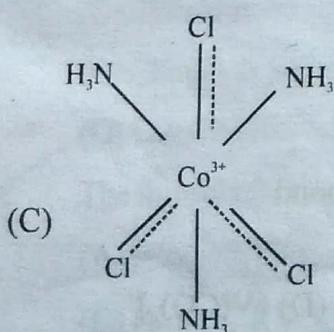
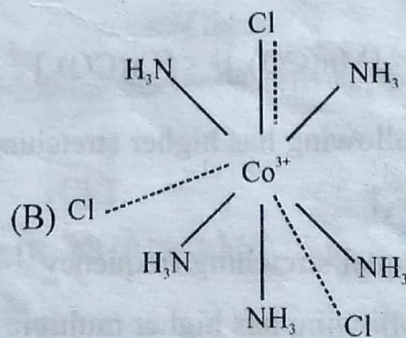
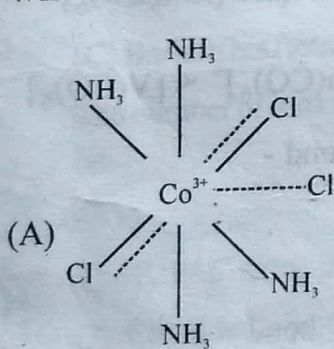
- (A) a, b and c are correct      (B) b and c are correct  
 (C) a and c are correct      (D) a and b are correct

**SBG STUDY**

4. A complex of platinum, ammonia and chloride produces four ions per molecule in the solution. The structure consistent with the observation is:

- (A)  $[\text{Pt}(\text{NH}_3)_4]\text{Cl}_4$       (B)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_4]$       (C)  $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$       (D)  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$

5. Which of the following Werner's complex has least electrical conductivity ?





## Classification of ligand

6. How many EDTA<sup>-4</sup> molecules are required to make an octahedral complex with a Ca<sup>2+</sup> ion?  
 (A) Six (B) Three (C) One (D) Two
7.  $\pi$ -bonding is not involved in:  
 (A) ferrocene (B) dibenzene chromium (C) Zeise's salt (D) Grignard reagent
8. Which of the following is not considered as an organometallic compound?  
 (A) Ferrocene (B) Cis-platin (C) Ziese's salt (D) Grignard reagent
9. Diethylene triamine is:  
 (A) Chelating agent (B) Polydentate ligand  
 (C) Tridentate ligand (D) All of these
10. Which of the following species is not expected to be a ligand  
 (A) NO<sup>+</sup> (B) NH<sub>4</sub><sup>+</sup> (C) NH<sub>2</sub>-NH<sub>3</sub><sup>+</sup> (D) CO
11. The disodium salt of ethylene diamine tetraacetic acid can be used to estimate the following ion(s) in the aqueous solution  
 (A) Mg<sup>2+</sup> ion (B) Ca<sup>2+</sup> ion (C) Na<sup>+</sup> ion (D) both Mg<sup>2+</sup> and Ca<sup>2+</sup>
12. Which of the following ligand does not act as bidentate ligand  
 (A) dipy (B) dien (C) gly<sup>-</sup> (D) dmg<sup>-</sup>
- Synergic bonding**  $S, B \propto \frac{1}{\beta \cdot L}$
13. Which of the following order is correct for the IR vibrational frequency of CO.  
 (A) [Fe(CO)<sub>4</sub>]<sup>2-</sup> < [Co(CO)<sub>4</sub>]<sup>-</sup> < [Ni(CO)<sub>4</sub>] (B) [Fe(CO)<sub>4</sub>]<sup>2-</sup> > [Co(CO)<sub>4</sub>]<sup>-</sup> > [Ni(CO)<sub>4</sub>]  
 (C) [Fe(CO)<sub>4</sub>]<sup>2-</sup> > [Co(CO)<sub>4</sub>]<sup>-</sup> < [Ni(CO)<sub>4</sub>] (D) [Fe(CO)<sub>4</sub>]<sup>2-</sup> < [Co(CO)<sub>4</sub>]<sup>-</sup> > [Ni(CO)<sub>4</sub>]
14. In the isoelectronic series of metal carbonyl, the C-O bond strength is expected to increase in the order  
 (A) [Mn(CO)<sub>6</sub>]<sup>+</sup> < [Cr(CO)<sub>6</sub>] < [V(CO)<sub>6</sub>]<sup>-</sup> (B) [V(CO)<sub>6</sub>]<sup>-</sup> < [Cr(CO)<sub>6</sub>] < [Mn(CO)<sub>6</sub>]<sup>+</sup>  
 (C) [V(CO)<sub>6</sub>]<sup>-</sup> < [Mn(CO)<sub>6</sub>]<sup>+</sup> < [Cr(CO)<sub>6</sub>] (D) [Cr(CO)<sub>6</sub>] < [Mn(CO)<sub>6</sub>]<sup>+</sup> < [V(CO)<sub>6</sub>]<sup>-</sup>
15. Which of the following has higher stretching frequency for C-O bond -  
 (A) [Ni(CO)<sub>3</sub>PF<sub>3</sub>] (B) [Ni(CO)<sub>3</sub>(PMe<sub>3</sub>)]  
 (C) both have equal stretching frequency (D) None of these
16. Which of the following has higher multiple bond character in M-C bond -  
 (A) [Ni(CO)<sub>4</sub>]  
 (B) [Co(CO)<sub>4</sub>]<sup>-</sup>  
 (C) [Fe(CO)<sub>4</sub>]<sup>2-</sup>  
 (D) (B) and (C) both have equal multiple bond character in M-C bond
17. Among the following complexes which can act as oxidising agent.  
 (A) [Mn(CO)<sub>6</sub>] (B) [Mn(CO)<sub>6</sub>]<sup>+</sup> (C) [Mn(CO)<sub>5</sub>]<sup>-</sup> (D) [V(CO)<sub>6</sub>]



18. The V-C distance in  $V(CO)_6$  and  $[V(CO)_6]^-$  are respectively (in pm)-  
(A) 200, 200 (B) 193, 200 (C) 200, 193 (D) 193, 193

**Co-ordination number and E.A.N.**

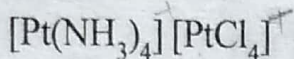
19. Which of the following statement is correct regarding the compound " $[(CO)_3Fe(CO)_3Fe(CO)_3]^{2+}$ ".  
(A) The  $d_{C-O}$  (bridging) is greater than  $d_{C-O}$  (terminal)  
(B) The bond order of bridging C - O bond is greater than that of terminal C - O bond  
(C) The E.A.N. value of each Fe-atom is 35  
(D) The oxidation state of Fe in this complex is (-I)
20. How many  $\pi$  electrons are donated by  $C_5H_5^-$  ligand -  
(A) 2 (B) 4 (C) 5 (D) 6
21. Effective atomic number of  $Co(CO)_4$  is 35, hence it is less stable. It attains stability by  
(A) Oxidation of Co (B) Reduction of Co  
(C) Dimerization (D) Both (B) & (C)
22. In the complex  $Fe(CO)_x$ , the value of x is:  
(A) 3 (B) 4 (C) 5 (D) 6
23. The EAN of platinum in potassium hexachloroplatinate (IV) is:  
(A) 46 (B) 86 (C) 36 (D) 84
24. The EAN of metal atoms in  $Fe(CO)_2(NO)_2$  and  $Co_2(CO)_8$  respectively are  
(A) 34, 35 (B) 34, 36 (C) 36, 36 (D) 36, 35

**Naming of complex compound**

25. The IUPAC name for the coordination compound  $Ba[BrF_4]_2$  is  
(A) Barium tetrafluorobromate (V) (B) Barium tetrafluorobromate (III)  
(C) Barium bis (tetrafluorobromate) (III) (D) none of these
26. The number of ions formed, when bis (ethane-1,2-diamine) copper (II) sulphate is dissolved in water will be  
(A) 1 (B) 2 (C) 3 (D) 4
27. The IUPAC name of the Wilkinson's catalyst  $[RhCl(PPh_3)_3]$  is  
(A) Chloridotris(triphenylphosphine)rhodium(I)  
(B) Chloridotris(triphenylphosphine)rhodium(IV)  
(C) Chloridotris(triphenylphosphine)rhodium(0)  
(D) Chloridotris(triphenylphosphine)rhodium(VI)
28. The formula for the compound tris (ethane-1, 2-diamine)cobalt (III) sulphate is  
(A)  $[Co(en)_3]SO_4$  (B)  $[Co(SO)_4(en)_3]$   
(C)  $[Co(en)_3](SO_4)_2$  (D)  $[Co(en)_3]_2(SO_4)_3$



29. Which of the following statement is incorrect regarding the following compound

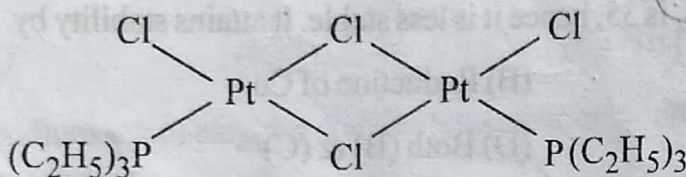


- (A) It is the polymerisation isomer of  $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]$   
 (B) E.A.N. of cationic part is equal to that of anionic part  
 (C) It is the co-ordination isomer of  $[\text{Pt}(\text{NH}_3)_3\text{Cl}][\text{Pt}(\text{NH}_3)\text{Cl}_3]$   
 (D) Synergic bonding is not involved in the complex

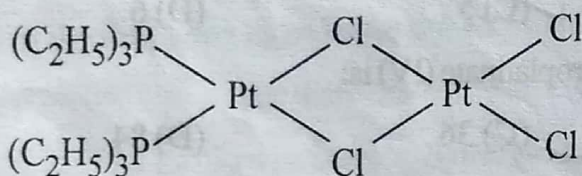
30. The type of isomerism present in pentaamminenitrochromium (III) chloride is :

- (A) optical (B) linkage (C) hydrate (D) polymerisation

31. The complexes given below show:



and



- (A) Optical isomerism (B) Co-ordination isomerism  
 (C) Geometrical isomerism (D) Co-ordination position isomerism

32. Which of the following complex shows ionization isomerism

- (A)  $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$  (B)  $[\text{Cr}(\text{en})_2]\text{Cl}_2$   
 (C)  $[\text{Cr}(\text{en})_3]\text{Cl}_3$  (D)  $[\text{CoBr}(\text{NH}_3)_5]\text{SO}_4$

### Stereoisomerism

33. Find the name of the hydrate isomer of  $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ , which is having lowest electrical conductivity excluding zero value of conductivity.

- (A) Hexaaquachromium(III) chloride  
 (B) Tetraaquadichloridochromium(III) chloride dihydrate  
 (C) Pentaquachloridochromium(III) chloride monohydrate  
 (D) Triaquatrichloridochromium(III) chloride trihydrate

34. Which of the following complex shows optical isomerism -

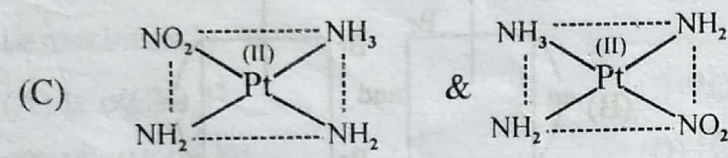
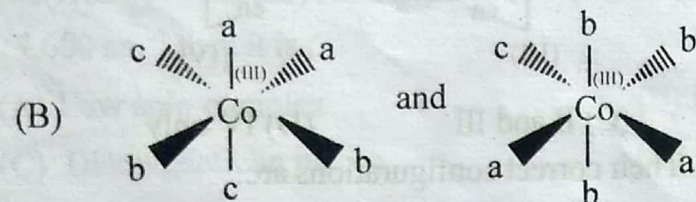
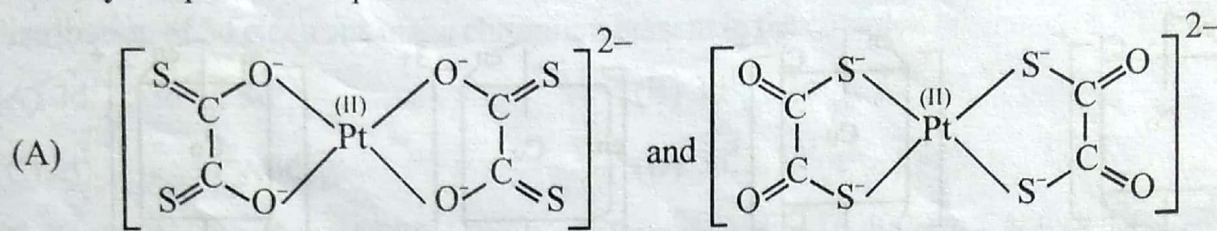
- (A)  $[\text{Cd}(\text{CN})_4]^{2-}$  (B)  $[\text{Cr}(\text{H}_2\text{O})_3\text{Cl}_3] \cdot 3\text{H}_2\text{O}$   
 (C)  $[\text{Zn}(\text{gly})_2]^0$  (D)  $[\text{Ni}(\text{dmg})_2]^0$



35. How many coordination isomers of  $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_4]$  show geometrical isomer.

- (A) All (B) One (C) Two (D) None

36. Identify the pair of complex which are stereoisomer of each other -



- (D) All of the above

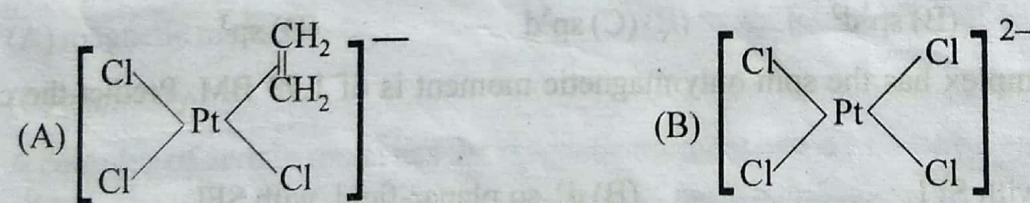
37. Find complex which have maximum number of stereoisomer -

- (A)  $[\text{Ma}_3\text{b}_3]$  (B)  $[\text{Ma}_3\text{b}_2\text{c}]$  (C)  $[\text{Ma}_2\text{b}_2\text{c}_2]$  (D)  $[\text{M}(\text{AA})_2\text{a}_2\text{b}_2]$

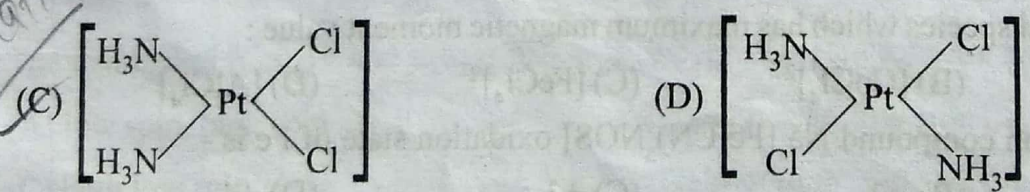
38. In which of the following pairs both the complexes show optical isomerism ?

- (A)  $\text{cis}-[\text{Cr}(\text{C}_2\text{O}_4)_2\text{Cl}_2]^{3-}$ ,  $\text{trans}-[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$   
 (B)  $[\text{Co}(\text{en})_3]\text{Cl}_3$ ,  $\text{cis}-[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$   
 (C)  $[\text{PtCl}(\text{dien})]\text{Cl}$ ,  $[\text{NiCl}_2\text{Br}_2]^{2-}$   
 (D)  $[\text{Co}(\text{NO}_3)_3(\text{NH}_3)_3]$ ,  $\text{cis}-[\text{Pt}(\text{en})_2\text{Cl}_2]$

39. Which of the following is considered to be an anticancer species ?



*Cis platin*



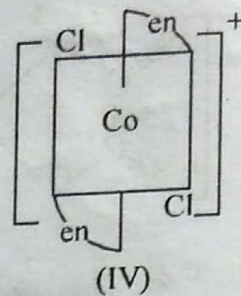
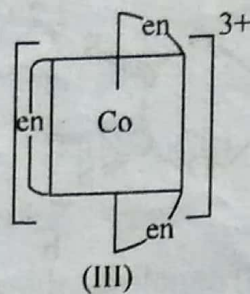
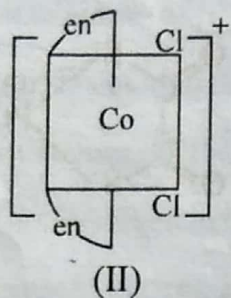
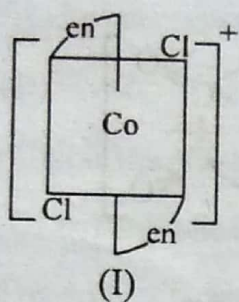
40. Which of the following can exhibit geometrical isomerism ?

- (A)  $[\text{MnBr}_4]^{2-}$  (B)  $[\text{Pt}(\text{NH}_3)_3\text{Cl}]^+$   
 (C)  $[\text{PtCl}_2(\text{P}(\text{C}_2\text{H}_5)_3)_2]$  (D)  $[\text{Fe}(\text{H}_2\text{O})_5\text{NOS}]^{2+}$



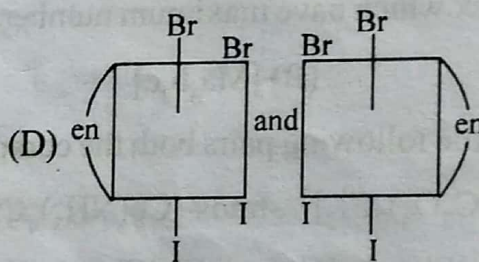
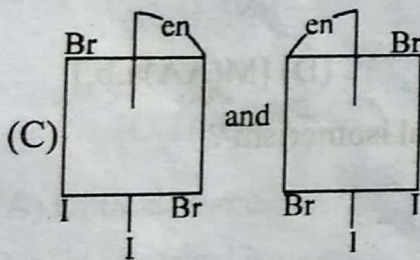
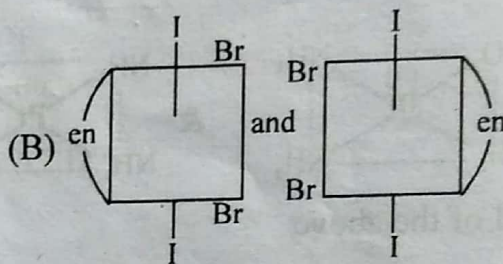
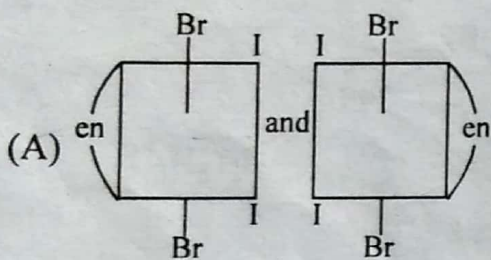
41. The oxidation state of Mo in its oxo-complex species  $[\text{Mo}_2\text{O}_4(\text{C}_2\text{H}_4)_2(\text{H}_2\text{O})_2]^{2-}$  is:  
 (A) +2 (B) +3 (C) +4 (D) +5

42. Which of the following ions are optically active?



- (A) I only (B) II only (C) II and III (D) IV only

43. The complex ion has two optical isomers. Their correct configurations are:



V.B.T/CFT

44. Which of the following complex is coloured and diamagnetic -

- (A)  $\text{MnO}_4^{2-}$  (B)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  (C)  $[\text{CrCl}_6]^{3-}$  (D)  $\text{CrO}_4^{2-}$

45. What is the hybridisation of Fe in  $[\text{Fe}(\text{CO})_4]^{-2}$

- (A)  $d^2sp^3$  (B)  $sp^3d^2$  (C)  $sp^3d$  (D)  $sp^3$

46. One unknown complex has the spin only magnetic moment is of 1.73 BM. Predict the correct situation of it -

- (A)  $d^7$ , Oh-field, with SFL (B)  $d^5$ , sq.planar-field, with SFL  
 (C)  $d^9$ , Td,field with WFL (D) All of these

47. Identify tetrahedral species which has maximum magnetic moment value :

- (A)  $[\text{CuCl}_4]^{2-}$  (B)  $[\text{CoCl}_4]^{2-}$  (C)  $[\text{FeCl}_4]^{2-}$  (D)  $[\text{AlCl}_4]^-$

48. In the co-ordination compound  $\text{Na}_4[\text{Fe}(\text{CN})_5\text{NOS}]$  oxidation state of Fe is -

- (A) +1 (B) +2 (C) +3 (D) +4

49. Which one of the following complex is an outer orbital complex -

- (A)  $[\text{Ni}(\text{H}_2\text{O})_6]^{+2}$  (B)  $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$   
 (C)  $[\text{Fe}(\text{NH}_3)_6]^{+2}$  (D) All of these



50. Which of the following is diamagnetic and  $sp^3$  hybridised -  
 (A)  $[\text{NiCl}_4]^{2-}$  (B)  $[\text{Ni}(\text{CN})_4]^{4-}$  (C)  $[\text{Ni}(\text{CN})_4]^{2-}$  (D)  $[\text{NiCl}_2(\text{PPh}_3)_2]$
51.  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  (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)  $3d_{(x^2-y^2)}^1, 3d_{z^2}^1, 3d_{xz}^1$  (D)  $3d_{xy}^1, 3d_{(x^2-y^2)}^1, 3d_{yz}^1$
52.  $[\text{Fe}(\text{H}_2\text{O})_6]^{+2}$  has Crystal Filled Splitting Energy value  $10,400 \text{ cm}^{-1}$  and pairing energy value  $17,600 \text{ cm}^{-1}$  then it is :  
 (A) Low spin complex (B) Paramagnetic in nature  
 (C) Diamagnetic in nature (D) None of these
53. 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)  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$   
 (C)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$  (D)  $[\text{Co}(\text{NH}_3)_6]^{3+}$
54. The number of unpaired electrons calculated in  $[\text{Co}(\text{NH}_3)_6]^{3+}$  and  $[\text{CoF}_6]^{3-}$  are :  
 (A) 4 and 4 (B) 0 and 2 (C) 2 and 4 (D) 0 and 4
55. An ion  $\text{M}^{2+}$ , forms the complexes  $[\text{M}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{M}(\text{en})_3]^{2+}$  and  $[\text{MBr}_6]^{4-}$ , match the complex with the appropriate colour.  
 (A) Green, blue and red (B) Blue, red and green  
 (C) Green, red and blue (D) Red, blue and green
56. Formula of ferrocene is:  
 (A)  $[\text{Fe}(\text{CN})_6]^{4-}$  (B)  $[\text{Fe}(\text{CN})_6]^{3+}$  (C)  $[\text{Fe}(\text{CO})_5]$  (D)  $[\text{Fe}(\text{C}_5\text{H}_5)_2]$
57.  $\text{Ni}(\text{CO})_4$  and  $[\text{Ni}(\text{NH}_3)_4]^{2+}$  do not differ in  
 (A) magnetic moment (B) oxidation number of Ni  
 (C) geometry (D) EAN  
*ln B Red*  
*R O H*  
*1 Br H<sub>2</sub>O CN*  
*Vibhyan*
58. A complex of certain metal has the magnetic moment of 4.91 BM whereas another complex of the same metal with same oxidation state has zero magnetic moment. The metal ion could be  
 (A)  $\text{Co}^{2+}$  (B)  $\text{Mn}^{2+}$  (C)  $\text{Fe}^{2+}$  (D)  $\text{Fe}^{3+}$
59. The tetrahedral  $[\text{CoI}_4]^{2-}$  and square planar  $[\text{PdBr}_4]^{2-}$  complex ions are respectively  
 (A) low spin, high spin (B) high spin, low spin  
 (C) both low spin (D) both high spin
60. Which one of the following species does not represent cationic species of vanadium formed in aqueous solution  
 (A)  $\text{VO}_2^+$  (B)  $\text{VO}^{2+}$  (C)  $[\text{V}(\text{H}_2\text{O})_6]^{3+}$  (D)  $\text{VO}_2^{2+}$   
*electronic conf.*



61. On treatment of  $[\text{Ni}(\text{NH}_3)_4]^{2+}$  with concentrated HCl, two compounds I and II having the same formula,  $[\text{NiCl}_2(\text{NH}_3)_2]$  are obtained, I can be converted into II by boiling with dilute HCl. A solution of I reacts with oxalic acid to form  $[\text{Ni}(\text{C}_2\text{O}_4)(\text{NH}_3)_2]$  whereas II does not react. Point out the correct statement of the following
- (A) I cis, II trans; both tetrahedral  
 (B) I cis, II trans; both square planar  
 (C) I trans, II cis; both tetrahedral  
 (D) I trans, II cis; both square planar
62. Among the following, the compound that is both paramagnetic and coloured is
- (A)  $\text{K}_2\text{Cr}_2\text{O}_7$  (B)  $(\text{NH}_4)_2[\text{TiCl}_6]$  (C)  $\text{VO}\text{SO}_4$  (D)  $\text{K}_3[\text{Cu}(\text{CN})_4]$
63. The magnetic moment of  $[\text{NiX}_4]^{2-}$  ion is found to be zero. Then the metal of the complex ion is (X = monodentate anionic ligand).
- (A)  $\text{sp}^3$  hybridised (B)  $\text{sp}^2$  hybridised (C)  $\text{dsp}^2$  hybridised (D)  $\text{d}^2\text{sp}^3$  hybridised
64. For which of the following types of  $\text{d}^n$  configuration, the number of unpaired electrons in octahedral complexes remains same irrespective of the ligand field strength.
- (A)  $\text{d}^3$  (B)  $\text{d}^4$  (C)  $\text{d}^5$  (D)  $\text{d}^6$
65. Which of the following electronic arrangement gives the highest value of the magnetic moment?
- (A)  $\text{d}^6$ , strong field (B)  $\text{d}^7$ , high spin (C)  $\text{d}^4$ , weak field (D)  $\text{d}^2$ , strong field
66. Select appropriate ligand for given complex
- $[\text{Co}(\dots)_6]^{3+}$ ;  $\mu = 0 \text{ BM}$
- (A)  $\text{C}_2\text{O}_4^{2-}$  (B) en (C)  $\text{H}_2\text{O}$  (D)  $\text{F}^-$
67. According to C.F.T., ligands are treated as -
- (A) Point charges (B) Lewis acids (C) Proton donor (D) All of the above
68. Which of the following is correct electronic configuration of 3d orbital in excited state of central metal ion, when  $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$  absorbed yellow-green light.
- (A) 3d 

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 (B)  $t_{2g}^1, e_g^0$   
 (C)  $t_{2g}^1, e_g^1$  (D)  $t_{2g}^0, e_g^1$
69. If  $\lambda_{\text{absorbed}}$  for d-d transition is in order  $[\text{Ti}(\text{X})_6]^{3+} > [\text{Ti}(\text{Y})_6]^{3+} > [\text{Ti}(\text{Z})_6]^{3+}$ . Select correct order of strength of ligands (X, Y, Z are monodentate ligand)-
- (A)  $Z > Y > X$  (B)  $X > Y > Z$   
 (C)  $Z > X > Y$  (D) Not predictable