SOLUTION TEST-B

1. More the number of ions present, higher the van't Hoff factor and higher will be the boiling point.

$[Cr(NH_3)_6]_2(SO_4)_3 \longrightarrow 2[Cr(NH_3)_6]^{3+} + 3SO_4^{2-}$ i = 5

$[Fe(H_2O)_6]Cl_3 \longrightarrow [Fe(H_2O)_6]^{3+} + 3Cl^-$ i = 4

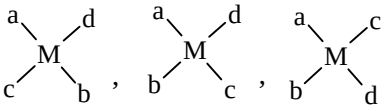
$[Pt(NH_3)_6]Cl_2 \longrightarrow [Pt(NH_3)_6]^{2+} + 2Cl^-$ i = 3

$K_2[NiCl_4] \longrightarrow 2K^+ + [NiCl_4]^{2-}$ i = 3

The correct answer is (i)

2. Fe is d^2sp^3 hybridised with one unpaired electron in this octahedral complex.

The correct answer is (iii)

3. 

The correct answer is (iii)

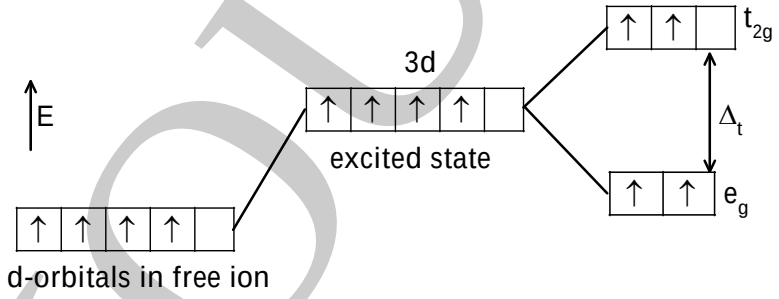
4. EDTA is a chelating ligand and form cyclic complexes with Mg^{2+} and Ca^{2+} ions present in hard water.

The correct answer is (ii)

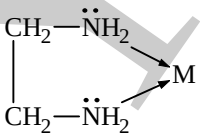
5. Wilkinson's catalyst is a complex of rhodium. Its formula is $[RhCl(PPh_3)_3]$ and IUPAC name is chloridotris (triphenyl phosphine) rhodium (I).

The correct answer is (iv)

6. Three
7. Pentaamminenitrito-N-cobalt (III) sulphate
8. **d^4 weak field ligand**



9. (i) Coordination number =6
   Oxidation state of Cr = +3
   (ii) Ethane-1, 2-diamine

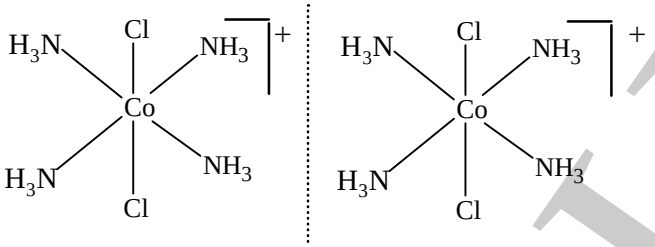


10. (i) Formula: $[Co(NH_3)_4Cl_2]Cl$
    (ii) Name: Tetramminedichloridocobalt (III) chloride.
11. (i) Refining of nickel by Mond's process the complex is $Ni(CO)_4$.
    (ii) Cisplatin, cis-$[Pt(NH_3)_2Cl_2]$ is used in the treatment of cancer.
    (iii) Haemoglobin, complex of iron is used in carrying oxygen to different parts of the body.
12. (i) $[Mn(CN)_6]^{4-} < [CrCl_6]^{3-} > [FeF_6]^{3-}$
    (ii) $[CoF_6]^{3-} < [Co(NH_3)_6]^{3+} < [Co(en)_3]^{3+}$

13. (i) In $K_4[Fe(CN)_6]$, Fe^{2+} has [Ar] $3d^6$ configuration which corresponds to fully filled [Ar] t_{2g}^6 since CN^- is a strong field ligand. There is no unpaired electron present. Hence $K_4[Fe(CN)_6]$ is diamagnetic.
In $K_3[Fe(CN)_6]$, there is one unpaired electron in t_{2g} orbitals, hence, it is weakly paramagnetic.

(ii) In $[CrCl_6]^{3-}$ and $[Cr(CN)_6]^{3-}$, Cr^{3+} has three unpaired electrons in the half filled t_{2g}^3 configuration. Hence, both the complexes are inner orbitals using two orbitals from e_g, one from 4s and three form 4p subshell.

(iii) This is because the mirror image is superimpossible on the original structure.



Both are identical structures. Hence, no optical isomerism.

14. (i) $[Fe(C_2O_4)_3]^{3-}$
Hybridisation: d^2sp^3
Magnetic properties: weakly paramagnetic due to one unpaired electron.
Geometry: Octahedral.

(ii) $[MnBr_4]^{2-}$
Hybridisation: sp^3
Magnetic properties: Paramagnetic due to presence of five unpaired electrons.
Geometry: Tetrahedral.

15. (a) (i) Stability constant is an equilibrium constant corresponding to the formation of a coordination compound.

$M^{n+} + xL^{y-} \rightleftharpoons MLxa$

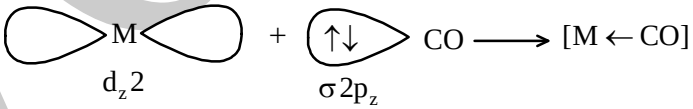
where a = + n – xy

and $K_s = \frac{[MLx^a]}{[M^{n+}][L^{y-}]^x}$

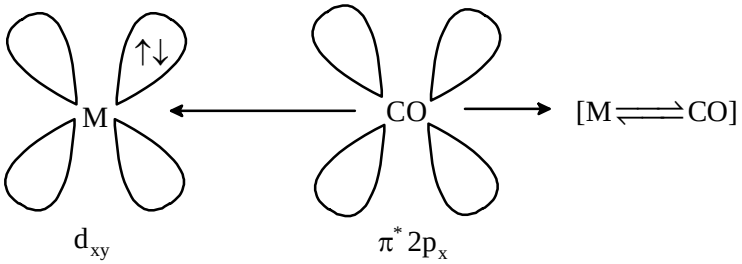
(ii) For $[Cu(NH_3)_4]^{2+}$; $K_s = \frac{[Cu(NH_3)_4^{2+}]}{[Cu^{2+}][NH_3]^4}$

(iii) Factors on which the stability constant depends are:
→ Nature of the metal atom
→ Nature of the ligand.

(b) Step-(i) is the formation of a sigma bond between the $\sigma 2p_z$ molecular orbital of CO and the empty d_z^2 orbital of metal.



In this step, CO acting as a σ donor.
Step-(ii) Metal donates electron pair back to CO. This involves sideways overlapping between d_{xy} orbital of metal and $\pi^* 2p_x$ molecular orbital of CO.



In the second step, CO acting as a π-acceptor.

