

**COORDINATION CHEMISTRY**

- The correct sequence of ligands in the order of decreasing field strength is :
  - $\text{CO} > \text{H}_2\text{O} > \text{F}^- > \text{S}^{2-}$
  - $\text{OH}^- > \text{F}^- > \text{NH}_3 > \text{CN}^-$
  - $\text{NCS}^- > \text{EDTA}^{4-} > \text{CN}^- > \text{CO}$
  - $\text{S}^{2-} > \text{OH}^- > \text{EDTA}^{4-} > \text{CO}$
- Number of complexes from the following with even number of unpaired "d" electrons is \_\_\_\_.  
 $[\text{V}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ ,  
 $[\text{Ni}(\text{H}_2\text{O})_6]^{3+}$ ,  $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$   
 [Given atomic numbers: V = 23, Cr = 24, Fe = 26, Ni = 28, Cu = 29]
  - 2
  - 4
  - 5
  - 1
- Number of ambidentate ligands among the following is \_\_\_\_.  
 $\text{NO}_2^-$ ,  $\text{SCN}^-$ ,  $\text{C}_2\text{O}_4^{2-}$ ,  $\text{NH}_3$ ,  $\text{C}_3\text{N}_3$ ,  $\text{SO}_4^{2-}$ ,  $\text{H}_2\text{O}$
- Given below are two statements : one is labelled as **Assertion (A)** and the other is labelled as **Reason (R)**.  
**Assertion (A):** The total number of geometrical isomers shown by  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$  complex ion is three  
**Reason (R):**  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$  complex ion has an octahedral geometry.  
 In the light of the above statements, choose the **most appropriate** answer from the options given below :
  - Both **(A)** and **(R)** are correct and **(R)** is the correct explanation of **(A)**.
  - (A)** is correct but **(R)** is not correct.
  - (A)** is not correct but **(R)** is correct.
  - Both **(A)** and **(R)** are correct but **(R)** is not the correct explanation of **(A)**.

- Match List I with List II.

List-I		List-II	
A.	$\text{K}_2[\text{Ni}(\text{CN})_4]$	I.	$\text{sp}^3$
B.	$[\text{Ni}(\text{CO})_4]$	II.	$\text{sp}^3\text{d}^2$
C.	$[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$	III.	$\text{dsp}^2$
D.	$\text{Na}_3[\text{CoF}_6]$	IV.	$\text{d}^2\text{sp}^3$

Choose the correct answer from the options given below:

- A-III, B-I, C-II, D-IV
  - A-III, B-II, C-IV, D-I
  - A-I, B-III, C-II, D-IV
  - A-III, B-I, C-IV, D-II
- The coordination environment of  $\text{Ca}^{2+}$  ion in its complex with  $\text{EDTA}^{4-}$  is :
  - tetrahedral
  - octahedral
  - square planar
  - trigonal prismatic
- Number of complexes with even number of electrons in  $t_{2g}$  orbitals is -  
 $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ ,  
 $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ ,  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ 
  - 1
  - 3
  - 2
  - 5
- Given below are two statements:  
**Statement I :**  $\text{N}(\text{CH}_3)_3$  and  $\text{P}(\text{CH}_3)_3$  can act as ligands to form transition metal complexes.  
**Statement II:** As N and P are from same group, the nature of bonding of  $\text{N}(\text{CH}_3)_3$  and  $\text{P}(\text{CH}_3)_3$  is always same with transition metals.  
 In the light of the above statements, choose the **most appropriate** answer from the options given below:
  - Statement I is incorrect but Statement II is correct
  - Both Statement I and Statement II are correct
  - Statement I is correct but Statement II is incorrect
  - Both Statement I and Statement II are incorrect

**COORDINATION CHEMISTRY**

9. An octahedral complex with the formula  $\text{CoCl}_3\text{nNH}_3$  upon reaction with excess of  $\text{AgNO}_3$  solution given 2 moles of  $\text{AgCl}$ . Consider the oxidation state of Co in the complex is 'x'. The value of "x + n" is \_\_\_\_\_.

- (1) 3 (2) 6  
(3) 8 (4) 5

10. Match List-I with List-II.

List-I (Complex ion)	List-II (Spin only magnetic moment in B.M.)
(A) $[\text{Cr}(\text{NH}_3)_6]^{3+}$	(I) 4.90
(B) $[\text{NiCl}_4]^{2-}$	(II) 3.87
(C) $[\text{CoF}_6]^{3-}$	(III) 0.0
(D) $[\text{Ni}(\text{CN})_4]^{2-}$	(IV) 2.83

Choose the **correct** answer from the options given below :

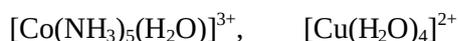
- (1) (A)-(I), (B)-(IV), (C)-(II), (D)-(III)  
(2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)  
(3) (A)-(II), (B)-(IV), (C)-(I), (D)-(III)  
(4) (A)-(II), (B)-(III), (C)-(I), (D)-(IV)

11. Total number of unpaired electrons in the complex ion  $[\text{Co}(\text{NH}_3)_6]^{3+}$  and  $[\text{NiCl}_4]^{2-}$  is

12. Consider the following complexes.



- (A) (B)



- (C) (D)

The correct order of A, B, C and D in terms of wavenumber of light absorbed is :

- (1)  $C < D < A < B$  (2)  $D < A < C < B$   
(3)  $A < C < B < D$  (4)  $B < C < A < D$

13. Given below are two statements:

**Statement I:**  $\text{PF}_5$  and  $\text{BrF}_5$  both exhibit  $\text{sp}^3\text{d}$  hybridisation.

**Statement II:** Both  $\text{SF}_6$  and  $[\text{Co}(\text{NH}_3)_6]^{3+}$  exhibit  $\text{sp}^3\text{d}^2$  hybridisation.

In the light of the above statements, choose the **correct** answer from the options given below:

- (1) **Statement I** is true but **Statement II** is false  
(2) Both **Statement I** and **Statement II** are true  
(3) Both **Statement I** and **Statement II** are false  
(4) **Statement I** is false but **Statement II** is true

14. The correct IUPAC name of  $[\text{PtBr}_2(\text{PMe}_3)_2]$  is:

- (1) bis(trimethylphosphine)dibromoplatinum(II)  
(2) bis[bromo(trimethylphosphine)]platinum(II)  
(3) dibromobis(trimethylphosphine)platinum(II)  
(4) dibromodi(trimethylphosphine)platinum(II)

15. Match List-I with List-II

List-I Tetrahedral Complex	List-II Electronic configuration
-------------------------------	-------------------------------------

- |                            |                    |
|----------------------------|--------------------|
| (A) $\text{TiCl}_4$        | (I) $e^2, t_2^0$   |
| (B) $[\text{FeO}_4]^{2-}$  | (II) $e^4, t_2^3$  |
| (C) $[\text{FeCl}_4]^-$    | (III) $e^0, t_2^0$ |
| (D) $[\text{CoCl}_4]^{2-}$ | (IV) $e^2, t_2^3$  |

Choose the **correct** answer from the option given below:

- (1) (A)-(I), (B)-(III), (C)-(IV), (D)-(II)  
(2) (A)-(IV), (B)-(III), (C)-(I), (D)-(II)  
(3) (A)-(III), (B)-(IV), (C)-(II), (D)-(I)  
(4) (A)-(III), (B)-(I), (C)-(IV), (D)-(II)

16. Which one of the following complexes will exhibit the least paramagnetic behaviour ?

[Atomic number, Cr = 24, Mn = 25, Fe = 26, Co = 27]

- (1)  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$  (2)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$   
(3)  $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$  (4)  $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$

17. The correct order of ligands arranged in increasing field strength.

- (1)  $\text{Cl}^- < \text{OH}^- < \text{Br}^- < \text{CN}^-$   
(2)  $\text{F}^- < \text{Br}^- < \text{I}^- < \text{NH}_3$   
(3)  $\text{Br}^- < \text{F}^- < \text{H}_2\text{O} < \text{NH}_3$   
(4)  $\text{H}_2\text{O} < \text{OH}^- < \text{CN}^- < \text{NH}_3$

18. The metal atom present in the complex MABXL (where A, B, X and L are unidentate ligands and M is metal) involves  $sp^3$  hybridization. The number of geometrical isomers exhibited by the complex is:  
 (1) 4 (2) 0  
 (3) 2 (4) 3
19. The number of complexes from the following with no electrons in the  $t_2$  orbital is \_\_\_\_\_.  
 $TiCl_4$ ,  $[MnO_4]^-$ ,  $[FeO_4]^{2-}$ ,  $[FeCl_4]^-$ ,  $[CoCl_4]^{2-}$   
 (1) 3 (2) 1  
 (3) 4 (4) 2
20. If an iron (III) complex with the formula  $[Fe(NH_3)_x(CN)_y]^-$  has no electron in its  $g_e$  orbital, then the value of  $x + y$  is  
 (1) 5 (2) 6  
 (3) 3 (4) 4
21. The number of unpaired d-electrons in  $[Co(H_2O)_6]^{3+}$  is \_\_\_\_\_.  
 (1) 4 (2) 2  
 (3) 0 (4) 1
22. The number of molecules/ion/s having trigonal bipyramidal shape is .....  
 $PF_5$ ,  $BrF_5$ ,  $PCl_5$ ,  $[PtCl_4]^{2-}$ ,  $BF_3$ ,  $Fe(CO)_5$
23. Which of the following complex is homoleptic?  
 (1)  $[Ni(CN)_4]^{2-}$  (2)  $[Ni(NH_3)_2Cl_2]$   
 (3)  $[Fe(NH_3)_4Cl_2]^+$  (4)  $[Co(NH_3)_4Cl_2]^+$
24. Given below are two statements:  
**Statement (I):** A solution of  $[Ni(H_2O)_6]^{2+}$  is green in colour.  
**Statement (II):** A solution of  $[Ni(CN)_4]^{2-}$  is colourless.  
 In the light of the above statements, choose the most appropriate answer from the options given below:  
 (1) Both Statement I and Statement II are incorrect  
 (2) Both Statement I and Statement II are correct  
 (3) Statement I is incorrect but Statement II is correct  
 (4) Statement I is correct but Statement II is incorrect
25.  $[Co(NH_3)_6]^{3+}$  and  $[CoF_6]^{3-}$  are respectively known as:  
 (1) Spin free Complex, Spin paired Complex  
 (2) Spin paired Complex, Spin free Complex  
 (3) Outer orbital Complex, Inner orbital Complex  
 (4) Inner orbital Complex, Spin paired Complex
26. Which of the following compounds show colour due to d-d transition?  
 (1)  $CuSO_4 \cdot 5H_2O$  (2)  $K_2Cr_2O_7$   
 (3)  $K_2CrO_4$  (4)  $KMnO_4$
27. The 'Spin only' Magnetic moment for  $[Ni(NH_3)_6]^{2+}$  is \_\_\_\_\_  $\times 10^{-1}$  BM.  
 (Given = Atomic number of Ni : 28)
28. The correct statements from following are:  
 A. The strength of anionic ligands can be explained by crystal field theory.  
 B. Valence bond theory does not give a quantitative interpretation of kinetic stability of coordination compounds.  
 C. The hybridization involved in formation of  $[Ni(CN)_4]^{2-}$  complex is  $dsp^2$ .  
 D. The number of possible isomer(s) of  $cis-[PtCl_2(en)_2]^{2+}$  is one  
 Choose the correct answer from the options given below:  
 (1) A, D only (2) A, C only  
 (3) B, D only (4) B, C only
29. Select the option with correct property -  
 (1)  $[Ni(CO)_4]$  and  $[NiCl_4]^{2-}$  both diamagnetic  
 (2)  $[Ni(CO)_4]$  and  $[NiCl_4]^{2-}$  both paramagnetic  
 (3)  $[NiCl_4]^{2-}$  diamagnetic,  
 $[Ni(CO)_4]$  paramagnetic  
 (4)  $[Ni(CO)_4]$  diamagnetic,  
 $[NiCl_4]^{2-}$  paramagnetic

**COORDINATION CHEMISTRY**
**30.** Match List-I with List-II.

List – I (Complex ion)		List – II (Electronic Configuration)	
A.	$[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$	I.	$t_{2g}^2 e_g^0$
B.	$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	II.	$t_{2g}^3 e_g^0$
C.	$[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$	III.	$t_{2g}^3 e_g^2$
D.	$[\text{V}(\text{H}_2\text{O})_6]^{3+}$	IV.	$t_{2g}^6 e_g^2$

Choose the correct answer from the options given below :

- (1) A-III, B-II, C-IV, D-I  
 (2) A-IV, B-I, C-II, D-III  
 (3) A-IV, B-III, C-I, D-II  
 (4) A-II, B-III, C-IV, D-I
- 31.** Number of complexes which show optical isomerism among the following is \_\_\_\_\_.
- $\text{cis} - [\text{Cr}(\text{ox})_2\text{Cl}_2]^{3-}$ ,  $[\text{Co}(\text{en})_3]^{3+}$ ,  
 $\text{cis} - [\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$ ,  $\text{cis} - [\text{Co}(\text{en})_2\text{Cl}_2]^+$ ,  
 $\text{trans} - [\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$ ,  $\text{trans} - [\text{Cr}(\text{ox})_2\text{Cl}_2]^{3-}$
- 32.** The coordination geometry around the manganese in decacarbonyl dimanganese(0)
- (1) Octahedral                      (2) Trigonal bipyramidal  
 (3) Square pyramidal              (4) Square planar
- 33.** The orange colour of  $\text{K}_2\text{Cr}_2\text{O}_7$  and purple colour of  $\text{KMnO}_4$  is due to
- (1) Charge transfer transition in both.  
 (2)  $d \rightarrow d$  transition in  $\text{KMnO}_4$  and charge transfer transitions in  $\text{K}_2\text{Cr}_2\text{O}_7$ .  
 (3)  $d \rightarrow d$  transition in  $\text{K}_2\text{Cr}_2\text{O}_7$  and charge transfer transitions in  $\text{KMnO}_4$ .  
 (4)  $d \rightarrow d$  transition in both.
- 34.** The molecule/ion with square pyramidal shape is:
- (1)  $[\text{Ni}(\text{CN})_4]^{2-}$                       (2)  $\text{PCl}_5$   
 (3)  $\text{BrF}_5$                                   (4)  $\text{PF}_5$

**35.** In which one of the following metal carbonyls, CO forms a bridge between metal atoms?

- (1)  $[\text{Co}_2(\text{CO})_8]$                       (2)  $[\text{Mn}_2(\text{CO})_{10}]$   
 (3)  $[\text{Os}_3(\text{CO})_{12}]$                       (4)  $[\text{Ru}_3(\text{CO})_{12}]$

**36.** Match List I with List II.

List-I (Substances)	List-II (Element Present)
------------------------	------------------------------

- |                            |              |
|----------------------------|--------------|
| A. Ziegler catalyst        | I. Rhodium   |
| B. Blood Pigment           | II. Cobalt   |
| C. Wilkinson catalyst      | III. Iron    |
| D. Vitamin B <sub>12</sub> | IV. Titanium |

Choose the correct answer from the options given below:

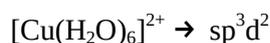
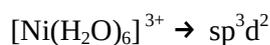
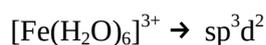
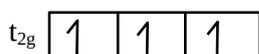
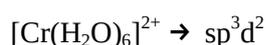
- (1) A-II, B-IV, C-I, D-III  
 (2) A-II, B-III, C-IV, D-I  
 (3) A-III, B-II, C-IV, D-I  
 (4) A-IV, B-III, C-I, D-II
- 37.** The correct IUPAC name of  $\text{K}_2\text{MnO}_4$  is
- (1) Potassium tetraoxopermanganate (VI)  
 (2) Potassium tetraoxidomanganate (VI)  
 (3) Dipotassium tetraoxidomanganate (VII)  
 (4) Potassium tetraoxidomanganese (VI)
- 38.** Identify from the following species in which  $d^2sp^3$  hybridization is shown by central atom:
- (1)  $[\text{Co}(\text{NH}_3)_6]^{3+}$                       (2)  $\text{BrF}_5$   
 (3)  $[\text{Pt}(\text{Cl})_4]^{2-}$                           (4)  $\text{SF}_6$
- 39.** The Spin only magnetic moment value of square planar complex  $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NH}_2\text{CH}_3)]\text{Cl}$  is \_\_\_\_\_ B.M. (Nearest integer)  
 (Given atomic number for Pt = 78)
- 40.** Consider the following complex ions
- $\text{P} = [\text{FeF}_6]^{3-}$   
 $\text{Q} = [\text{V}(\text{H}_2\text{O})_6]^{2+}$   
 $\text{R} = [\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- The correct order of the complex ions, according to their spin only magnetic moment values (in B.M.) is :
- (1)  $\text{R} < \text{Q} < \text{P}$   
 (2)  $\text{R} < \text{P} < \text{Q}$   
 (3)  $\text{Q} < \text{R} < \text{P}$   
 (4)  $\text{Q} < \text{P} < \text{R}$

**SOLUTIONS**
**1. Ans. (1)**

**Sol.** According to spectrochemical series ligand field strength is  $\text{CO} > \text{H}_2\text{O} > \text{F}^- > \text{S}^{2-}$

**2. Ans.(1)**

**Sol.**  $[\text{V}(\text{H}_2\text{O})_6]^{3+} \rightarrow d^2sp^3$

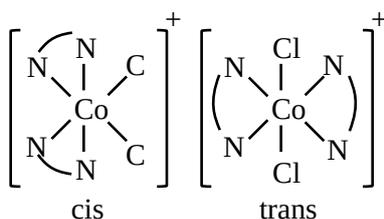

**3. Ans. (3)**

**Sol.** Ligands which have two different donor sites but at a time connects with only one donor site to central metal are ambidentate ligands.

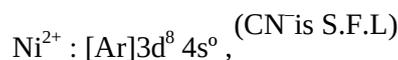
Ambidentate ligands are  $\text{NO}_2^-$ ;  $\text{SCN}^-$ ;  $\text{CN}^-$

**4. Ans. (3)**

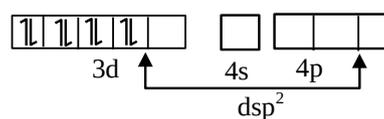
**Sol.**  $[\text{Co}(\text{en})_2\text{Cl}_2]^+$  has octahedral geometry with two geometrical isomers.


**5. Ans. (4)**

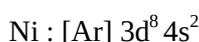
**Sol. (A)**  $\text{K}_2[\text{Ni}(\text{CN})_4]^{2-}$



Pre hybridization state of  $\text{Ni}^{+2}$

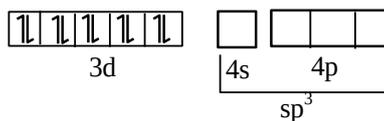


**(B)**  $[\text{Ni}(\text{CO})_4]$



$\text{CO}$  is S.F.L, so pairing occur

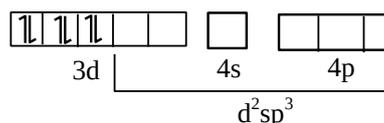
Pre hybridization state of Ni



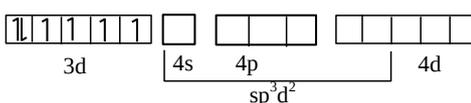
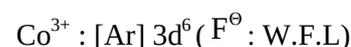
**(C)**  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$



With  $\text{Co}^{3+}$ ,  $\text{NH}_3$  act as S.F.L.



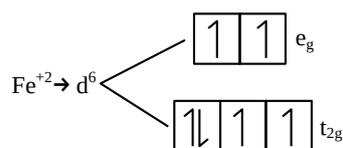
**(d)**  $\text{Na}_3[\text{CoF}_6]$

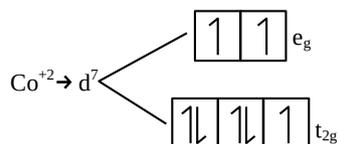

**6. Ans. (2)**

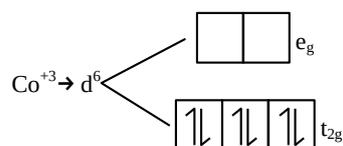
**Sol.**  $\text{EDTA}^{4-} \rightarrow$  Hexadentate ligand

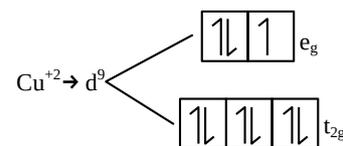


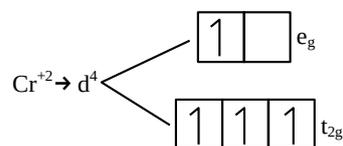
So Coordination environment is octahedral

**COORDINATION CHEMISTRY**
**7. Ans. (2)**
**Sol.**  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ 

 Electron in  $t_{2g} = 4$  (even)

 $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ 

 Electron in  $t_{2g} = 5$  (odd)

 $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ 

 Electron in  $t_{2g} = 6$  (even)

 $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ 

 Electron in  $t_{2g} = 6$  (even)

 $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ 

 Electron in  $t_{2g} = 3$  (odd)

**8. Ans. (3)**
**Sol.**  $\text{N}(\text{CH}_3)_3$  and  $\text{P}(\text{CH}_3)_3$  both are Lewis base and acts as ligand, However,  $\text{P}(\text{CH}_3)_3$  has a  $\pi$ -acceptor character.

**9. Ans. (3)**
**Sol.**  $[\text{Co}(\text{NH}_3)_5 \text{Cl}] \text{Cl}_2 + \text{excess AgNO}_3 \rightarrow 2\text{AgCl}$ 

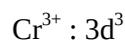
(2 moles)

$$x + 0 - 1 - 2 = 0$$

$$x = +3$$

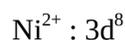
$$n = 5$$

$$\therefore x + n = 8$$

**10. Ans. (3)**
**Sol. (A)**  $[\text{Cr}(\text{NH}_3)_6]^{3+}$ 


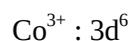
$$n = 3 \text{ (unpaired electrons)}$$

$$\propto \cancel{\neq} 3.87 \text{ B.M. (II)}$$

**(B)**  $[\text{NiCl}_4]^{2-}$ 


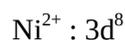
$$n = 2$$

$$\propto \cancel{\neq} 2.83 \text{ B.M. (IV)}$$

**(C)**  $[\text{CoF}_6]^{3-}$ 


$$n = 4$$

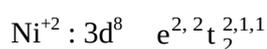
$$\propto \cancel{\neq} 4.90 \text{ B.M. (I)}$$

**(D)**  $[\text{Ni}(\text{CN})_4]^{2-}$ 


$$n = 0$$

$$\propto = 0 \text{ B.M. (III)}$$

**11. Ans. (2)**
**Sol.**  $\text{Co}^{+3} : 3d^6 \quad t_{2g}^{2,2,2} e_g^{0,0}$ 

 Unpaired  $e^- = 0$ 

 Unpaired  $e^- = 2$ 
**12. Ans. (2)**
**Sol.** As ligand field increases, light of more energy is absorbed

 Energy  $\propto$  wave number

 $(\bar{\nu})$ 
**13. Ans. (3)**
**Sol.**

Hybridisation

Hybridisation

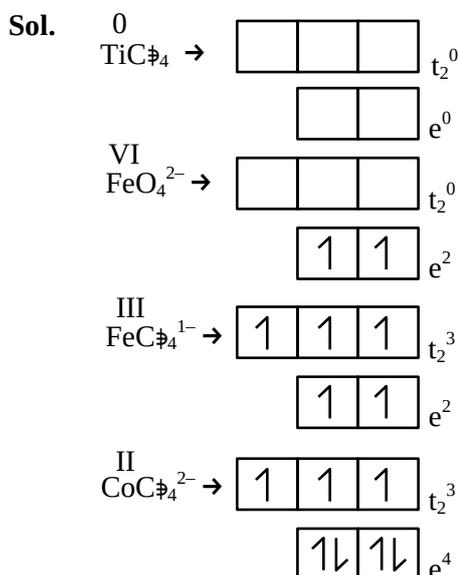
 $\text{PF}_5$ 
 $sp^3d$ 
 $\text{SF}_6$ 
 $sp^3d^2$ 
 $\text{BrF}_5$ 
 $sp^3d^2$ 
 $[\text{Co}(\text{NH}_3)_6]^{+3}$ 
 $d^2sp^3$ 

Both Statement (1) and (2) are false.

14. Ans. (3)

Sol. Dibromo bis(trimethylphosphine) platinum (II)

15. Ans. (4)



16. Ans. (1)

Sol.

	Number of unpaired $e^-$	$\propto \sqrt{n(n+2)}$ B.M.
$[\text{Co}(\text{H}_2\text{O})_6]^{2+}$	3	3.87
$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	4	4.89
$[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$	5	5.92
$[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$	4	4.89

Least paramagnetic behaviour =  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$

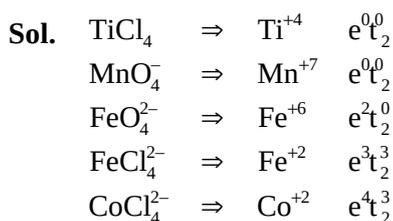
17. Ans. (3)

Sol. Experimental order  $\text{Br}^- < \text{F}^- < \text{H}_2\text{O} < \text{NH}_3$

18. Ans. (2)

Sol. Tetrahedral complex does not show geometrical isomerism.

19. Ans. (1)



20. Ans. (2)

Sol. Complex is  $[\text{Fe}(\text{NH}_3)_2(\text{CN})_4]^\ominus$

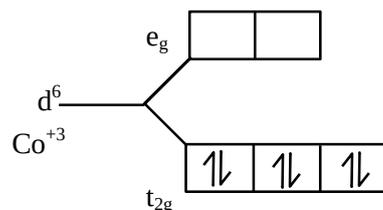
$$x = 2$$

$$y = 4$$

$$\text{so } x + y = 6$$

21. Ans.(3)

Sol.  $\Rightarrow [\text{Co}(\text{H}_2\text{O})_6]^{+3}$



No unpaired electrons

22. Ans. (3)

Sol.  $\text{PF}_5$ ,  $\text{PCl}_5$ ,  $\text{Fe}(\text{CO})_5$ ; Trigonal bipyramidal

$\text{BrF}_5$ ; Square pyramidal

$[\text{PtCl}_4]^{2-}$ ; Square planar

$\text{BF}_3$ ; Trigonal planar

23. Ans. (1)

Sol. In Homoleptic complex all the ligand attached with the central atom should be the same. Hence  $[\text{Ni}(\text{CN})_4]^{2-}$  is a homoleptic complex.

24. Ans. (2)

Sol.  $[\text{Ni}(\text{H}_2\text{O})_6]^{+2} \rightarrow$  Green colour solution due to d-d transition.

$[\text{Ni}(\text{CN})_4]^{2-} \rightarrow$  is diamagnetic and it is colourless.

25. Ans. (2)

Sol.  $[\text{Co}(\text{NH}_3)_6]^{3+}$

$\text{Co}^{3+}$  (strong field ligand)  $\Rightarrow 3d^6 (t_{2g}^6, e_g^0)$ ,

Hybridisation :  $d^2sp^3$

Inner orbital complex (spin paired complex)

Pairing will take place.

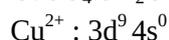
$[\text{CoF}_6]^{3-}$

$\text{Co}^{3+}$  (weak field ligand)  $\Rightarrow 3d^6 (t_{2g}^4, e_g^2)$

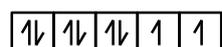
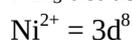
Hybridisation :  $sp^3d^2$

Outer orbital complex (spin free complex)

no pairing will take place

**COORDINATION CHEMISTRY**
**26. Ans. (1)**
**Sol.**  $\text{CuSO}_4 \cdot 5\text{H}_2\text{O}$ 


unpaired electron present so it show colour due to d-d transition.

**27. Ans. (28)**
**Sol.**  $\text{NH}_3$  act as WFL with  $\text{Ni}^{2+}$ 


No. of unpaired electron = 2

$$\infty = \sqrt{n(n+2)} = \sqrt{8} = 2.82 \text{ BM}$$

$$= 28.2 \times 10^{-1} \text{ BM}$$

$$x = 28$$

**28. Ans. (4)**
**Sol.** B. VBT does not explain stability of complex

 C. Hybridisation of  $[\text{Ni}(\text{CN})_4]^{-2}$  is  $dsp^2$ .

**29. Ans. (4)**
**Sol.**  $[\text{Ni}(\text{CO})_4] \rightarrow$  diamagnetic,  $sp^3$  hybridisation, number of unpaired electrons = 0

 $[\text{NiCl}_4]^{2-}, \rightarrow$  paramagnetic,  $sp^3$  hybridisation, number of unpaired electrons = 2

**30. Ans. (4)**
**Sol.**  $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$  Contains  $\text{Cr}^{3+} : [\text{Ar}]3d^3 : t_{2g}^3 e_g^0$ 
 $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$  Contains  $\text{Fe}^{3+} : [\text{Ar}]3d^5 : t_{2g}^3 e_g^2$ 
 $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  Contains  $\text{Ni}^{2+} : [\text{Ar}]3d^8 : t_{2g}^6 e_g^2$ 
 $[\text{V}(\text{H}_2\text{O})_6]^{3+}$  Contains  $\text{V}^{3+} : [\text{Ar}]3d^2 : t_{2g}^2 e_g^0$ 
**31. Ans. (4)**
**Sol.**  $\text{cis} - [\text{Cr}(\text{ox})_2\text{Cl}_2]^{3-} \rightarrow$  can show optical isomerism (no POS & COS)

 $[\text{Co}(\text{en})_3]^{3+} \rightarrow$  can show (no POS & COS)

 $\text{cis} - [\text{Pt}(\text{en})_2\text{Cl}_2]^{2+} \rightarrow$  can show (no POS & COS)

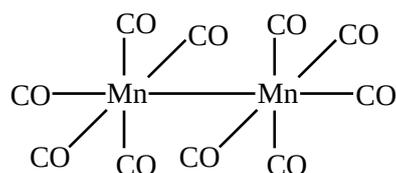
 $\text{cis} - [\text{Co}(\text{en})_2\text{Cl}_2]^+ \rightarrow$  can show (no POS & COS)

 $\text{trans} - [\text{Pt}(\text{en})_2\text{Cl}_2]^{2+} \rightarrow$  can't show

(contains POS &amp; COS)

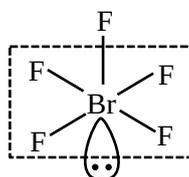
 $\text{trans} - [\text{Cr}(\text{ox})_2\text{Cl}_2]^{3-} \rightarrow$  can't show

(contains POS &amp; COS)

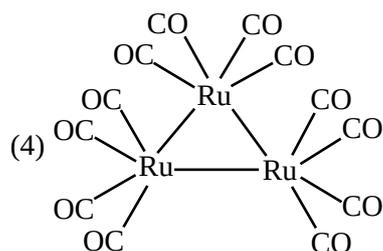
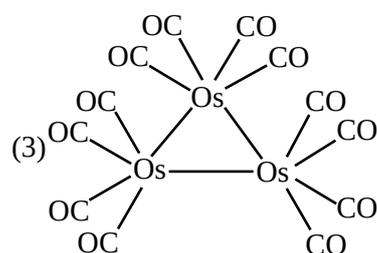
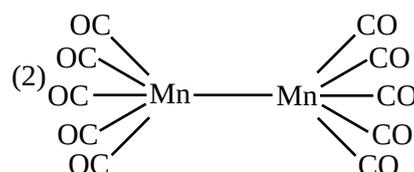
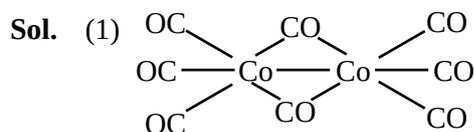
**32. Ans. (1)**
**Sol.**  $\text{Mn}_2(\text{CO})_{10}$ 


Octahedral around Mn

**33. Ans. (1)**
**Sol.**  $\text{K}_2\text{Cr}_2\text{O}_7 \rightarrow \text{Cr}^{+6} \rightarrow$  No d-d transition } Charge transfer  
 $\text{KMnO}_4 \rightarrow \text{Mn}^{7+} \rightarrow$  No d-d transition }

**34. Ans. (3)**
**Sol.**  $\text{BrF}_5$ 


Square Pyramidal.

**35. Ans. (1)**


36. Ans. (4)

Sol. Ziegler catalyst → Titanium  
 Blood pigment → Iron  
 Wilkinson catalyst → Rhodium  
 Vitamin B<sub>12</sub> → Cobalt

37. Ans. (2)

Sol. K<sub>2</sub>MnO<sub>4</sub>  
 $2 + x - 8 = 0$   
 $\Rightarrow x = +6$   
 O.S. of Mn = +6

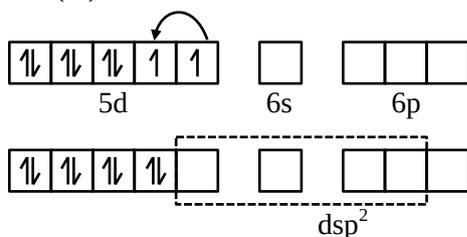
IUPAC Name = Potassium tetraoxidomanganate(VI)

38. Ans.(1)

Sol. [Co(NH<sub>3</sub>)<sub>6</sub>]<sup>+3</sup> – d<sup>2</sup>sp<sup>3</sup> hybridization  
 BrF<sub>5</sub> – sp<sup>3</sup>d<sup>2</sup> hybridization  
 [PtCl<sub>4</sub>]<sup>-2</sup> – dsp<sup>2</sup> hybridization  
 SF<sub>6</sub> – sp<sup>3</sup>d<sup>2</sup> hybridization

39. Ans.(0)

Sol. Pt<sup>2+</sup> (d<sup>8</sup>)



Pt<sup>2+</sup> → dsp<sup>2</sup> hybridization and have no unpaired e

∴ Magnetic moment = 0

40. Ans.(3)

Sol. [FeF<sub>6</sub>]<sup>3-</sup> : Fe<sup>+3</sup> : [Ar] 3d<sup>5</sup>

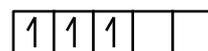
F : Weak field Ligand  $\boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow}$

No. of unpaired electron's = 5

$$\infty = \sqrt{5(5+2)}$$

$$\infty = \sqrt{35} \text{ BM}$$

[V(H<sub>2</sub>O)<sub>6</sub>]<sup>+2</sup> : V<sup>+2</sup> : 3d<sup>3</sup>



No. of unpaired electron's = 3

$$\infty = \sqrt{3(3+2)}$$

$$\infty = \sqrt{15} \text{ BM}$$

[Fe(H<sub>2</sub>O)<sub>6</sub>]<sup>+2</sup> : Fe<sup>+2</sup> : 3d<sup>6</sup>

H<sub>2</sub>O : Weak field Ligand  $\boxed{\uparrow\downarrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow} \boxed{\uparrow}$

No. of unpaired electron's = 4

$$\infty = \sqrt{4(4+2)}$$

$$\infty = \sqrt{24} \text{ BM}$$