

Coordination Compounds Important Questions With Answers

NEET Chemistry 2023

1. The formula of the complex diamminechloro- (ethylenediamine) nitroplatinum(IV) chloride is  
**a)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{en})\text{NO}_2]\text{Cl}_2$**     b)  $\text{Pt}[\text{Pt}(\text{NH}_3)_2(\text{en})\text{Cl}_2\text{NO}_2]$     c)  $\text{Pt}[(\text{NH}_3)_2(\text{en})\text{NO}_2]\text{Cl}_2$     d)  $\text{Pt}[(\text{NH}_3)_2(\text{en})\text{NO}_2\text{Cl}_2]$

2. The charges x and y on the following ions are  
 (i)  $[\text{Co}(\text{NH}_3)_2\text{Cl}_4]^x$  (ii)  $[\text{Fe}(\text{CN})_6]^y$  (Oxidation state of Co is +3 and Fe is +2 in their respective complexes.)  
 a)  $x=+1, y=-1$     b)  $x=-1, y=+3$     **c)  $x=-1, y=-4$**     d)  $x=-2, y=-3$

**Solution : -**

In  $[\text{Co}(\text{NH}_3)_2\text{Cl}_4]^x$ , oxidation state of Co = +3

Hence,  $x = +3 + 2 \times 0 + 4 \times (-1) = -1$

In  $[\text{Fe}(\text{CN})_6]^y$ , oxidation state of Fe = +2

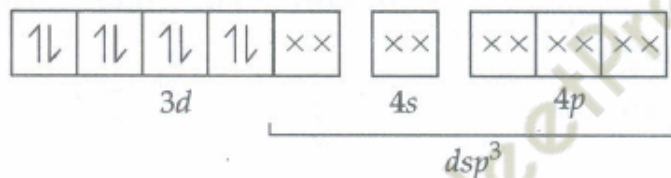
Hence,  $y = +2 + 6 \times (-1) = -4$

3. Shape of  $\text{Fe}(\text{CO})_5$  is :  
 a) octahedral    b) square planar    **c) trigonal bipyramidal**    d) square pyramidal

**Solution : -**

In  $\text{Fe}(\text{CO})_5$ , the Fe-atom is  $dsp^3$  hybridised and has shape of trigonal bipyramidal.

$\text{Fe}_{Z=26} = [\text{Ar}] 3d^6 4s^2$



4. Atomic number of Cr and Fe are respectively 24 and 26, which of the following is paramagnetic with the spin of electron?  
 a)  $[\text{Cr}(\text{CO})_6]$     b)  $[\text{Fe}(\text{CO})_5]$     c)  $[\text{Fe}(\text{CN})_6]^{4-}$     **d)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$**

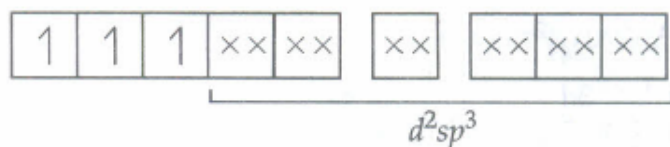
**Solution : -**

Atoms, ions or molecules containing unpaired electrons are paramagnetic.

In  $[\text{Cr}(\text{NH}_3)_6]^{3+}$

$\text{Cr}^{+3} = [\text{Ar}] 3d^3 4s^0$

In excited state



Number of unpaired electrons = 3

Rest all others are diamagnetic.

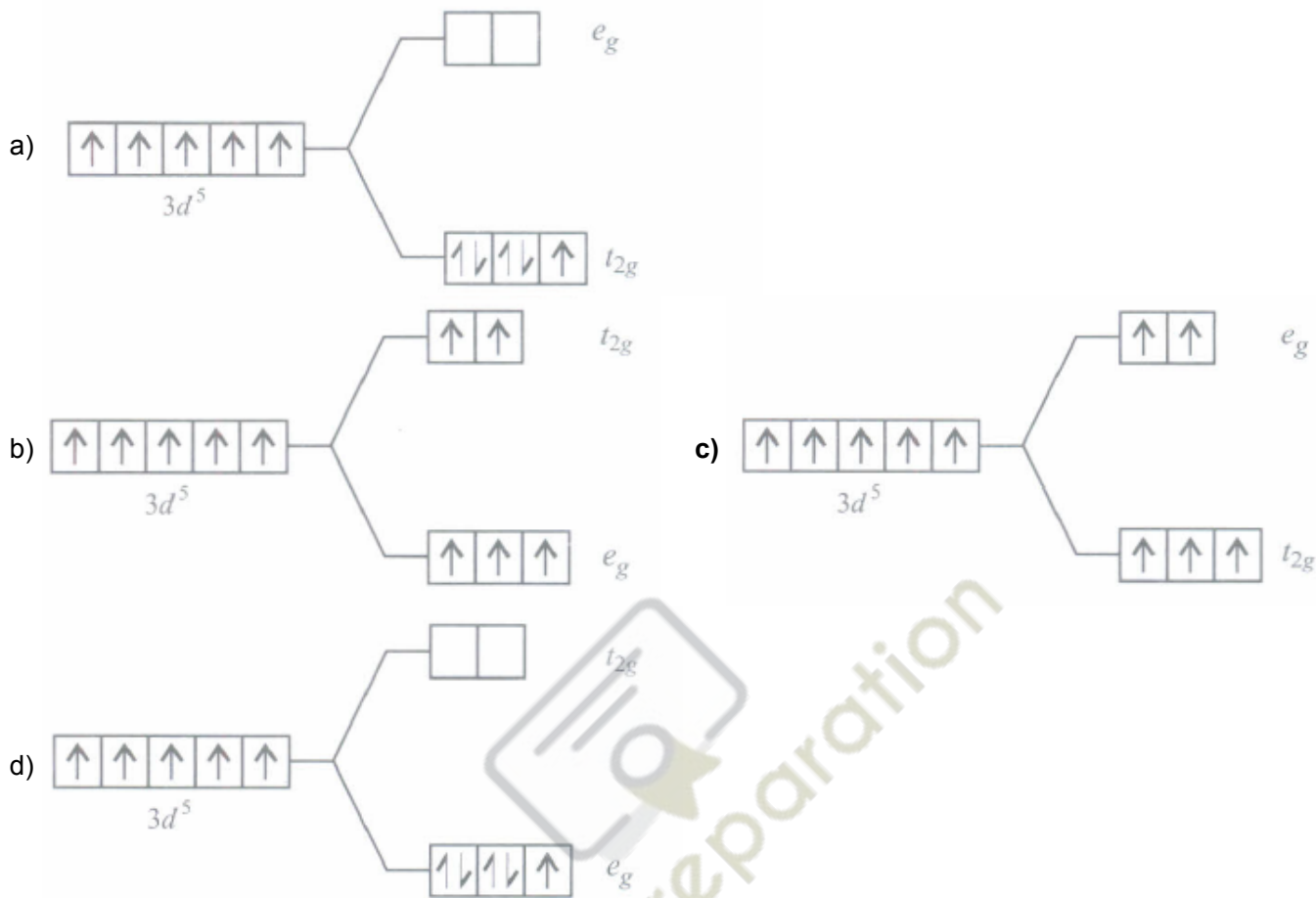
5. Which of the following complex species is not expected to exhibit optical isomerism?

- a)  $[\text{CO}(\text{en})(\text{NH}_3)_2\text{Cl}_2]^+$    b)  $[\text{CO}(\text{en})_3]^{3+}$    c)  $[\text{CO}(\text{en})_2\text{Cl}_2]^+$    **d)  $[\text{CO}(\text{NH}_3)_3\text{Cl}_3]$**

**Solution : -**

$[\text{CO}(\text{NH}_3)_3\text{Cl}_3]$  will not exhibit optical isomerism due to presence of plane of symmetry.

6. Which of the following energy level diagram for  $[\text{FeF}_6]^{3-}$  is correct on the basis of crystal field theory?



7. Which of the following pairs of isomers is not correctly matched with its type of isomerism?

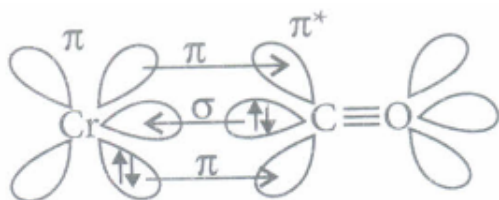
- a)  $[\text{Cr}(\text{NH}_3)_6]$   $[\text{Cr}(\text{CN})_6]$  and  $[\text{Cr}(\text{NH}_3)_4(\text{CN})_2]$   $[\text{Cr}(\text{NH}_3)_2(\text{CN})_4]$  - Coordination isomerism  
 b)  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  and  $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$  - Linkage isomerism  
**c)  $[\text{Co}(\text{py})_2(\text{H}_2\text{O})_2\text{Cl}_2]\text{Cl}$  and  $[\text{Co}(\text{py})_2(\text{H}_2\text{O})\text{Cl}_3]\text{H}_2\text{O}$  - Coordination isomerism**  
 d)  $[\text{Pt}(\text{NH}_3)_4\text{Br}_2]\text{Cl}_2$  and  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Br}_2$  - Ionisation isomerism

**Solution : -**

$[\text{Co}(\text{py})_2(\text{H}_2\text{O})_2\text{Cl}_2]\text{Cl}$  and  $[\text{Co}(\text{py})_2(\text{H}_2\text{O})\text{Cl}_3]\text{H}_2\text{O}$  show hydrate isomerism.

8. Cr-C bond in the compound  $[\text{Cr}(\text{CO})_6]$  shows  $\pi$ -character due to  
 a) coordinate bonding   **b) synergic bonding**   c) ionic bonding.   d) covalent bonding

**Solution : -**



Cr-C  $\pi$  bond is formed by the donation of a pair of electrons from a filled d-orbital of Cr into the vacant antibonding  $\pi^*$  orbital of CO. This is synergic bonding due to which both  $\sigma$  and  $\pi$  character is shown in Cr-C bond.

9.  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  (at. no. 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)  $3d_{xy}^1, 3d_{(x^2-y^2)}^1, 3d_{yz}^1$

**Solution : -**

Magnetic moment indicates that there are three unpaired electrons present in chromium. These must be present in lower energy orbitals which are  $3d_{xy}$ ,  $3d_{yz}$  and  $3d_{zx}$

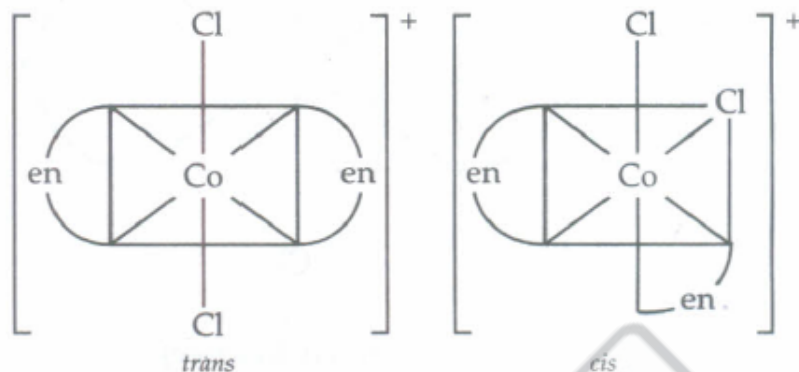
10. Which one of the following complexes will have four isomers?

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

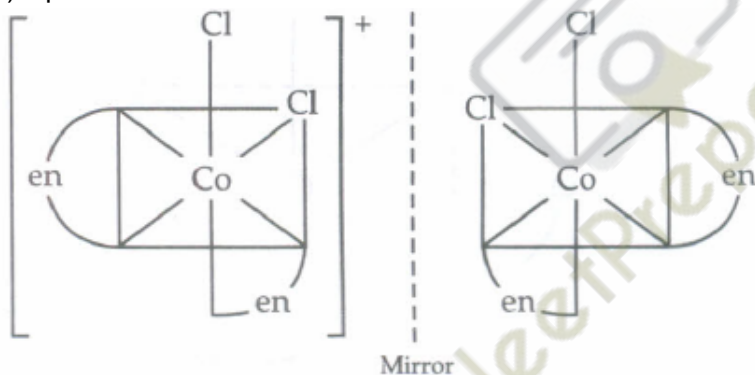
**Solution : -**

Complex  $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$  show 4 different isomerism

(i) Geometrical isomers



(ii) Optical isomers



Optical active cis- $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$

11. The correct IUPAC name the  $[\text{CrF}_2(\text{en})_2]\text{Cl}$  is \_\_\_\_\_.

- a) Chloro diflurido ethylene diaminechromium (III) chloride  
**b) Difluoridobis (ethylene diamine) chromium (III) chloride**  
 c) Difluorobis-(ethylene diamine) chromium (III) chloride  
 d) Chloro difluoridobis (ethylene diamine) chromium(III)

12. Crystal field splitting energy for high spin  $d^4$  octahedral complex is \_\_\_\_\_.

- a)  $-1.2\Delta_0$    b)  $-0.6\Delta_0$    c)  $-0.8\Delta_0$    d)  $-1.6\Delta_0$

**Solution : -**

$$\text{CFSE} = (-0.4x + 0.6y) \Delta_0$$

where, x = No. of electrons occupying  $t_{2g}$  orbitals y = No. of electrons occupying  $e_g$  orbitals

$$= (-0.4 \times 3 + 0.6 \times 1) \Delta_0$$

$$[\because \text{High spin } d^4 = t_{2g}^3 e_g^1]$$

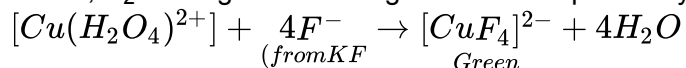
$$= (-1.2 + 0.6) \Delta_0 = -0.6 \Delta_0$$



- c) On adding KF,  $\text{Cu}^{2+}$  are replaced by  $\text{K}^+$  forming a green complex.  
 d) Blue colour of  $\text{CuSO}_4$  and yellow colour of KI form green colour on mixing.

**Solution : -**

Aqueous  $\text{CuSO}_4$  solution contains  $[\text{Cu}(\text{H}_2\text{O})_4]^{2+}$  ions which are blue in colour. When aqueous solution of KF is added,  $\text{H}_2\text{O}$  being weak field ligand can be replaced by  $\text{F}^-$  ions forming  $[\text{CuF}_4]^{2-}$  which is green in colour.



19. **Assertion:** Aqueous solution of the compound  $\text{COCl}_3 \cdot 4\text{NH}_3$  when treated with excess of  $\text{AgNO}_3$  1 mole of  $\text{AgCl}$  is precipitated.

**Reason:** The compound  $\text{COCl}_3 \cdot 4\text{NH}_3$  has six primary valencies and one secondary valency.

- a) If both assertion and reason are true and reason is the correct explanation of assertion.  
 b) If both assertion and reason are true but reason is not the correct explanation of assertion.  
 c) If assertion is true but reason is false    d) If both assertion and reason are false.

**Solution : -**

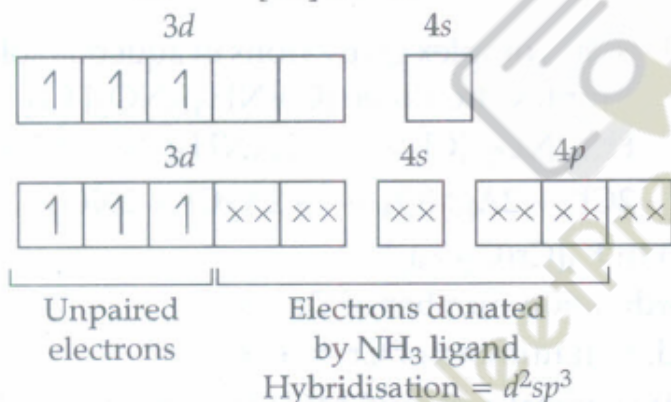
The compound  $\text{COCl}_3 \cdot 4\text{NH}_3$  has six secondary valencies and three primary valencies.

20. Which of the following complex ions is expected to absorb visible light? [Atomic number of Zn = 30, Sc = 21, Ti = 22, Cr = 24]

- a)  $[\text{Sc}(\text{H}_2\text{O})_3(\text{NH}_3)_3]^{3+}$     b)  $[\text{Ti}(\text{en})_2(\text{NH}_3)_2]^{4+}$     c)  $[\text{Cr}(\text{NH}_3)_6]^{3+}$     d)  $[\text{Zn}(\text{NH}_3)_6]^{2+}$

**Solution : -**

In  $[\text{Cr}(\text{NH}_3)_6]^{3+}$ , Cr is present as  $\text{Cr}^{+3}$



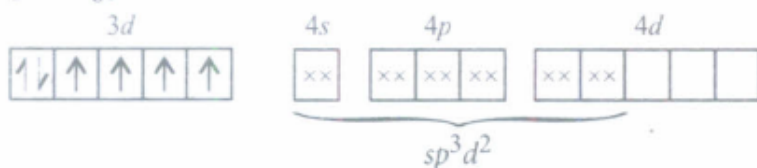
Due to presence of 3 unpaired electrons it absorbs light of visible region

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

- a) paramagnetic and undergoes  $sp^3d^2$  hybridisation    b) diamagnetic and undergoes  $d^2sp^3$  hybridisation  
 c) paramagnetic and undergoes  $sp^3d$  hybridisation    d) diamagnetic and undergoes  $sp^3$  hybridisation.

**Solution : -**

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



22. IUPAC name of  $[\text{Pt}(\text{NH}_3)_2\text{Cl}(\text{NO}_2)]$  is

- a) platinum diaminechloronitrite    b) chloronitrito-N-ammineplatinum (II)  
 c) diamminechloridonitrito- N-platinum (II)    d) diamminechloronitrito- N-platinate (II).

23. A substance appears coloured because

a) **it absorbs light at specific wavelength in the visible part and reflects rest of the wavelengths**

b) ligands absorb different wavelengths of light which give colour to the complex

c) it absorbs white light and shows different colours at different wavelength d) it is diamagnetic in nature.

**Solution : -**

A substance absorbs light at specific wavelength in the visible part of the spectrum and reflects the rest of the wavelengths. Each wavelength represents a different colour hence corresponding colour is observed.

24. The increasing order of crystal field splitting strength of the given ligands is:

a)  $\text{NH}_3 < \text{Cl}^- < \text{CN}^- < \text{F}^- < \text{CO} < \text{H}_2\text{O}$  b)  $\text{F}^- < \text{Cl}^- < \text{NH}_3 < \text{CN}^- < \text{H}_2\text{O} < \text{CO}$

c)  **$\text{Cl}^- < \text{F}^- < \text{H}_2\text{O} < \text{NH}_3 < \text{CN}^- < \text{CO}$**  d)  $\text{CO} < \text{CN}^- < \text{NH}_3 < \text{H}_2\text{O} < \text{F}^- < \text{Cl}^-$

**Solution : -**

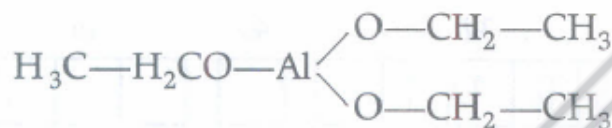
In general, the ligands can be arranged in a series in the order of increasing field strength as  $\text{I}^- < \text{Br}^- < \text{S}^{2-} < \text{SCN}^- < \text{Cl}^- < \text{F}^- < \text{OH}^- < \text{Ox}^{2-} < \text{EDTA}^{4-} < \text{NH}_3 < \text{en} < \text{NO}_2^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^- < \text{CO}$

25. Which of the following does not have a metalcarbon bond?

a)  **$\text{Al}(\text{OC}_2\text{H}_5)_3$**  b)  $\text{C}_2\text{H}_5\text{MgBr}$  c)  $\text{K}[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]$  d)  $\text{Ni}(\text{CO})_4$

**Solution : -**

$\text{Al}(\text{OC}_2\text{H}_5)_3$  does not have metal-carbon bond. Its structure is



26. Which of the following is not a neutral ligand?

a)  $\text{H}_2\text{O}$  b)  $\text{NH}_3$  c)  **$\text{ONO}$**  d)  $\text{CO}$

**Solution : -**

$\text{ONO}$  is an anionic ligand ( $\text{ONO}^-$ ).

27. Which of the following statements is incorrect regarding the importance of coordination compounds in biological systems?

a) **Vitamin  $\text{B}_{12}$  used to prevent anaemia is a complex compound of zinc.**

b) Haemoglobin is the red pigment of blood and contains iron.

c) Chlorophyll is the green pigment of plants and contains magnesium. d) All are correct.

**Solution : -**

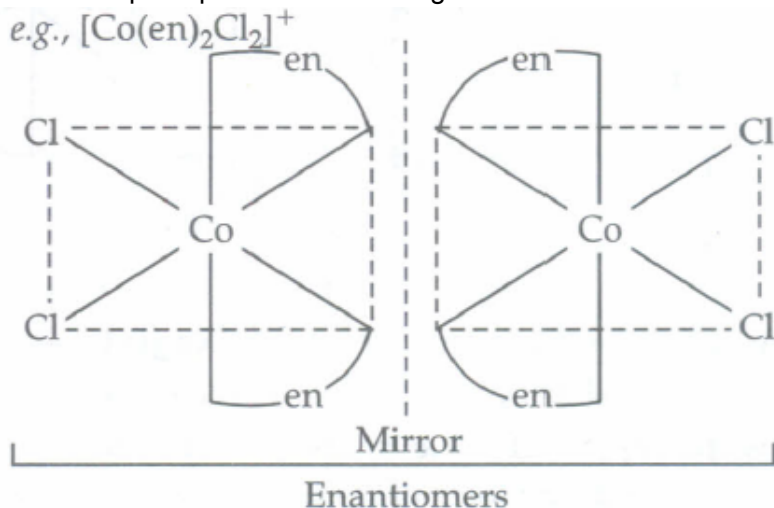
Vitamin  $\text{B}_{12}$  used to prevent anaemia is a complex compound of cobalt.

28. Which of the following will give a pair of enantiomers? ( $\text{en} = \text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ )

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

**Solution : -**

The non-superimposable mirror images are enantiomers.



29. Identify the statement which is not correct.

- Coordination compounds are mainly known for transition metals.
- Coordination number and oxidation state of a metal are same**
- A ligand donates at least one electron pair to the metal atom to form a bond.
- $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$  is a heteroleptic complex.

**Solution : -**

Coordination number is the number of ligands that are directly bound to the central metal atom by coordinate bonds. Oxidation state is the residual charge on the central metal atom left after removing all ions.

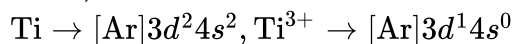
30. Which of the following complex compounds will exhibit highest paramagnetic behaviour?

(At. No. Ti = 22, Cr = 24, Co = 27, Zn = 30)

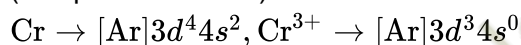
- $[\text{Ti}(\text{NH}_3)_6]^{3+}$
- $[\text{Cr}(\text{NH}_3)_6]^{3+}$
- $[\text{Co}(\text{NH}_3)_6]^{3+}$
- $[\text{Zn}(\text{NH}_3)_6]^{2+}$

**Solution : -**

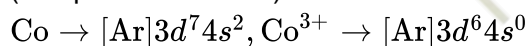
Given,



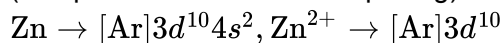
(1 unpaired electron)



(3 unpaired electrons)



(0 unpaired electrons due to pairing)



(no unpaired electrons)

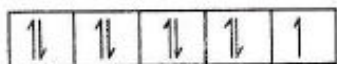
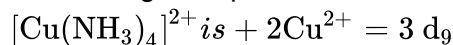
Hence  $[\text{Cr}(\text{NH}_3)_6]^{3+}$  shows highest paramagnetic behaviours as it contains 3 unpaired electrons.

31. A magnetic moment at 1.73 BM will be shown by one among of the following:

- $\text{TiCl}_4$
- $[\text{CoCl}_6]^{4-}$
- $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- $[\text{Ni}(\text{CN})_4]^{2-}$

**Solution : -**

If take the given option, oxidation state of Cu in



It has one unpaired electron ( $n=1$ ), then

$$\mu = \sqrt{n(n+2)} = \sqrt{1(1+2)} = \sqrt{3} = 1.73\text{BM}$$

32. The name of the compound  $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$  will be  
 a) penta ammino nitro cobalt(II) chloride    b) penta ammine nitro chloridocobaltate(III)  
**c) penta ammine nitro cobalt(III) chloride**    d) penta nitroso ammine chlorocobaltate(III).

33. Arrange the following complexes in increasing order of conductivity of their solutions.

- (i)  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$   
 (ii)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$   
 (iii)  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$   
 (iv)  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$

- a) (i) < (ii) < (iv) < (iii)**    b) (ii) < (i) < (iii) < (iv)    c) (i) < (iii) < (ii) < (iv)    d) (iv) < (i) < (ii) < (iii)

**Solution : -**

Higher the number of ions in the solution, higher is the conductivity.

No. of ions:  $[\text{Co}(\text{NH}_3)_3\text{Cl}_3] = 0$ ;  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl} = 2$  ;  $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2 = 3$  ;  $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3 = 4$

34. **Assertion:**  $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_3$  on heating becomes colourless.

**Reason:** Water is removed on heating  $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_3$ .

- a) If both assertion and reason are true and reason is the correct explanation of assertion.**  
 b) If both assertion and reason are true but reason is not the correct explanation of assertion.  
 c) If assertion is true but reason is false.    d) If both assertion and reason are false.

**Solution : -**

In the absence of ligand, crystal field splitting does not occur and hence the substance is colourless.

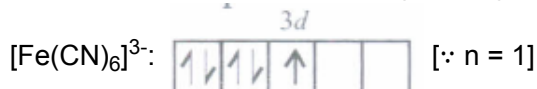
35. Match the column I with column II and mark the appropriate choice.

Column I		Column II	
(A)	$[\text{Fe}(\text{CN})_6]^{3-}$	(i)	Zero
(B)	$[\text{CoF}_6]^{3-}$	(ii)	5.92 B.M
(C)	$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(iii)	4.89 B.M
(D)	$[\text{Co}(\text{NH}_3)_6]^{3+}$	(iv)	1.732 B.M

- a) (A)  $\rightarrow$  (ii), (B)  $\rightarrow$  (iii), (C)  $\rightarrow$  (iv), (D)  $\rightarrow$  (i)  
 b) (A)  $\rightarrow$  (iii), (B)  $\rightarrow$  (ii), (C)  $\rightarrow$  (i), (D)  $\rightarrow$  (iv)  
 c) (A)  $\rightarrow$  (i), (B)  $\rightarrow$  (iii), (C)  $\rightarrow$  (iv), (D)  $\rightarrow$  (ii)  
**d) (A)  $\rightarrow$  (iv), (B)  $\rightarrow$  (iii), (C)  $\rightarrow$  (ii), (D)  $\rightarrow$  (i)**

**Solution : -**

$\text{Fe}^{3+} : 3d^5$ , since CN- is a strong field ligand, pairing will take place.



$$\mu = \sqrt{n(n+2)} = \sqrt{1(1+2)} = \sqrt{3} = 1.732 \text{ B.M}$$

In  $[\text{CoF}_6]^{3-}$ , oxidation state of Co = + 3

$\text{CO}^{3+} : 3d^6$ , since F- is a weak field ligand, pairing will not occur.

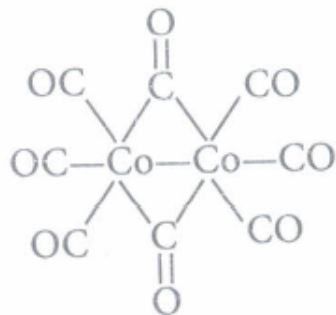
36. The terminal and bridged CO ligands in the compound  $[\text{Co}_2(\text{CO})_8]$  are respectively

- a) 0,2    b) 6,1    **c) 5,2**    d) 6,2

**Solution : -**



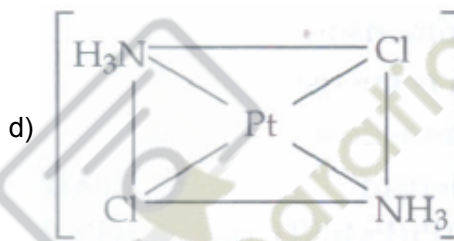
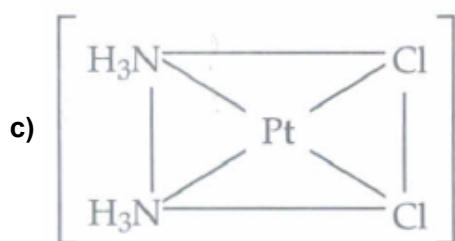
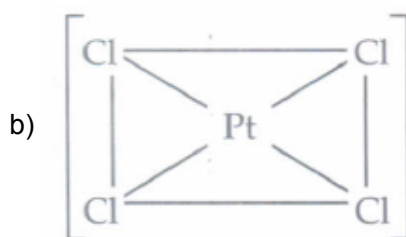
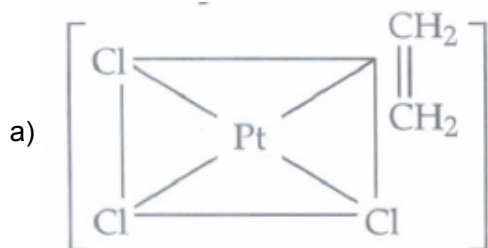
The structure of  $[\text{Co}_2(\text{CO})_8]$  is



Terminal CO = 6

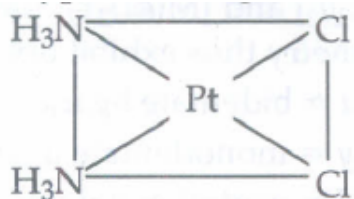
Bridged CO = 2

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



**Solution : -**

Cis-platin is used as an anticancer drug for treating several types of malignant tumours.



38. Which of the following ligands is expected to be bidentate?

- a)  $\text{CH}_3\text{NH}_2$    b)  $\text{CH}_3\text{CN}$    c)  $\text{Br}$    d)  $\text{C}_2\text{O}_4^{2-}$

**Solution : -**

$\text{C}_2\text{O}_4^{2-}$  is a bidentate ligand because it has two donor atoms and can coordinate to the central ion at two positions.

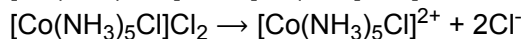
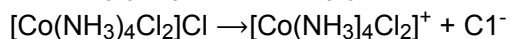
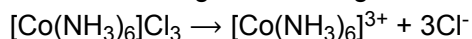
39. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not give test for chloride ions with silver nitrate at  $25^\circ\text{C}$

- a)  $\text{CoCl}_3 \cdot 3\text{NH}_3$    b)  $\text{CoCl}_3 \cdot 4\text{NH}_3$    c)  $\text{CoCl}_3 \cdot 5\text{NH}_3$    d)  $\text{CoCl}_3 \cdot 6\text{NH}_3$

**Solution : -**

$[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$  does not ionize so does not give test for chloride ions.

While all other give  $\text{Cl}^-$  thus give test for chloride ions



40. Which one of the following statements is not correct?
- Mercury (II) iodide dissolves in excess of potassium iodide solution
  - Tin (IV) chloride is made by dissolving tin solution in concentrated hydrochloric acid
  - Zinc dissolves in sodium hydroxide solution
  - Carbon monoxide reduces iron (III) oxide to iron

**Solution :** -

Since the hybridisation of central metal tin  $[\text{Co}(\text{NH}_3)_6]^{3+}$  complex is  $sp^3d^2$  and coordination number of  $\text{Co}^{3+}$  is 6. So, its geometry is octahedral.

41. **Assertion:** Coordination number of Fe and Co in  $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$  and  $[\text{Co}(\text{en})_3]^{3+}$  respectively is 6.

**Reason:**  $\text{C}_2\text{O}_4^{2-}$  and en (ethane-1,2-diamine) are didentate ligands.

- If both assertion and reason are true and reason is the correct explanation of assertion.
  - If both assertion and reason are true but reason is not the correct explanation of assertion.
  - If assertion is true but reason is false
  - If both assertion and reason are false.
42. The stability constants of the complexes formed by a metal ion ( $\text{M}^{2+}$ ) with  $\text{NH}_3$ ,  $\text{CN}^-$ ,  $\text{H}_2\text{O}$  and en are of the order  $10^{11}$ ,  $10^{27}$ ,  $10^{15}$  and  $10^8$  respectively. Then
- en is the strongest ligand
  - $\text{CN}^-$  is the strongest ligand**
  - these values cannot predict the strength of the ligand
  - all ligands are equally strong.

**Solution :** -

$\text{CN}^-$  is the strongest ligand which gives highest value  $10^{27}$  of the stability constant.

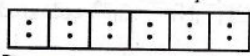
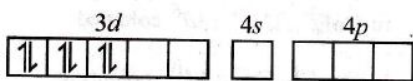
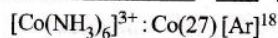
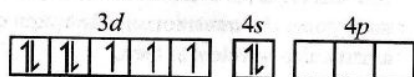
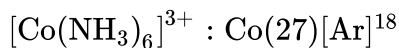
43. In which of the following is an inner optical complex as well as diamagnetic behaviour?

(Atomic number:  $\text{Zn} = 30$ ,  $\text{Cr} = 24$ ,  $\text{Co} = 27$ ,  $\text{Ni} = 28$ )

- $[\text{Zn}(\text{NH}_3)_6]^{2+}$
- $[\text{Cr}(\text{NH}_3)_6]^{3+}$
- $[\text{Co}(\text{NH}_3)_6]^{3+}$**
- $[\text{Ni}(\text{NH}_3)_6]^{2+}$

**Solution :** -

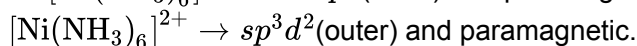
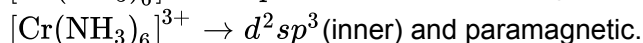
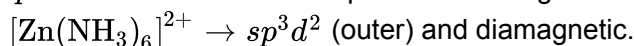
Given condition:



electronic pair from six ligands ( $\text{NH}_3$ )

Electronic pair from six ligands ( $\text{NH}_3$ )

$d^2sp^3 \rightarrow$  inner octahedral complex and diamagnetic.



44. According to Werner's theory of coordination compounds,

- primary valency is ionisable**
- secondary valency is ionisable
- primary and secondary valencies are ionisable
- neither primary nor secondary valency is ionisable

45. Which of the following is correct?

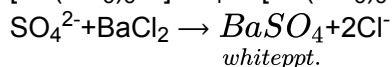
- Valence bond theory explains the colour of the coordination compounds.
- $[\text{NiCl}_4]^{2-}$  is diamagnetic in nature.
- Ambident ligands can show linkage isomerism.**

d) A bidentate ligand can have four coordination sites.

46. Which of the following isomers will give white precipitate with  $\text{BaCl}_2$  solution?

- a)  $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$    **b)  $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$**    c)  $[\text{Co}(\text{NH}_3)_4(\text{SO}_4)_2]\text{Br}$    d)  $[\text{Co}(\text{NH}_3)_4\text{Br}(\text{SO}_4)]$

**Solution : -**



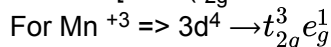
47. Among the following complexes, the one which shows zero crystal field stabilization energy (CFSE) is:

- a)  $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$    **b)  $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$**    c)  $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$    d)  $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$

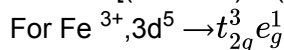
**Solution : -**

CFSE for octahedral complex is given by general formula as follows:

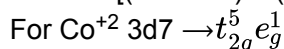
$$\text{CFSE} = [-0.4 (t_{2g} \text{ electrons}) + 0.6 (e_g \text{ electrons})] \Delta_0$$



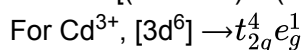
$$\text{CFSE} = [(-0.4 \times 3) + (0.6 \times 1)] \Delta_0 = -0.6 \Delta_0$$



$$\text{CFSE} = [(-0.4 \times 3) + (0.6 \times 2)] \Delta_0 = 0$$



$$\text{CFSE} = [(-0.4 \times 5) + (0.6 \times 2)] \Delta_0 = -0.8 \Delta_0$$



$$\text{CFSE} = [(-0.4 \times 4) + (0.6 \times 2)] \Delta_0 = -0.4 \Delta_0$$

48. The magnitude of magnetic moment (spin only) of  $[\text{NiCl}_4]^{2-}$  will be

- a) 2.82 B.M.**   b) 3.25 B.M.   c) 1.23 B.M.   d) 5.64 B.M.

49. The anion of acetylacetonate (acac) forms  $\text{Co}(\text{acac})_3$  chelate with  $\text{Co}^{3+}$ . The rings of the chelate are:

- a) Five membered   b) Four membered   **c) Six membered**   d) Three membered

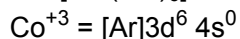
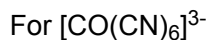
**Solution : -**

Chelating ligands having conjugated double bonds form more stable six membered rings.

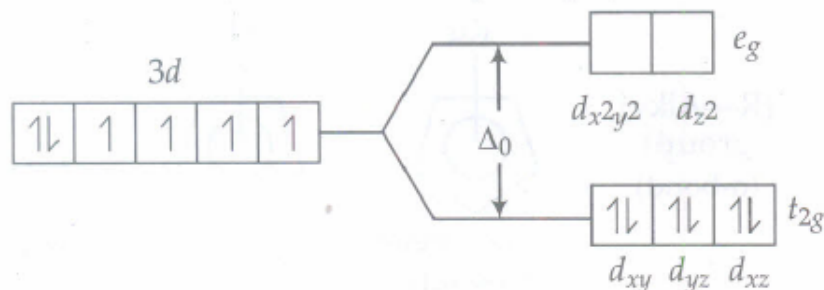
50. Which of these statements about  $[\text{Co}(\text{CN})_6]^{3-}$  is true?

- a)  $[\text{Co}(\text{CN})_6]^{3-}$  has no unpaired electrons and will be in a low spin configuration.**  
 b)  $[\text{Co}(\text{CN})_6]^{3-}$  has four unpaired electrons and will be in a low spin configuration.  
 c)  $[\text{Co}(\text{CN})_6]^{3-}$  has four unpaired electrons and will be in a high spin configuration.  
 d)  $[\text{Co}(\text{CN})_6]^{3-}$  has no unpaired electrons and will be in a high-spin configuration.

**Solution : -**



$\text{CN}^-$  is a strong field ligand and as it approaches the metal ion the electrons must pair up.



$\therefore [\text{Co}(\text{CN})_6]^{3-}$  has no unpaired electrons and will be in a low spin configuration.