Check Your Learning

Coordination Chemistry

Questions from JEE Main 2025

Chemistry Affinity

Conceptual, Real World, Happy Learning

Match the **LIST-I** with **LIST-II**

JEE Main 2025

LIST-I (Complex/ Species)	LIST-II (Shape & magnetic moment)
A. $[Ni(CO)_4]$	I. Tetrahedral, 2.8 BM
B. $[Ni(CN)_4]^{2-}$	II. Square planar, 0 BM
C. $[NiCl_4]^{2-}$	III. Tetrahedral, 0 BM
D. $[MnBr_4]^{2-}$	IV. Tetrahedral, 5.9 BM

A. A-I, B-II, C-III, D-IV

B. A-IV, B-I, C-III, D-II

C. A-III, B-II, C-I, D-IV

D. A-III, B-IV, C-II, D-I

A. $Ni(CO)_4$ => Tetrahedral => Ni(0) => d^{10} => 0 BM => III

B. $[Ni(CN)_4]^{2-}$ => Square planar => Ni(II) => d^8 => 0 BM => II

C. $[NiCl_4]^{2-}$ => Tetrahedral => Ni(II) => d^8 => 2 unpaired electron => I

D. $[MnBr_4]^{2-}$ => Tetrahedral => Mn(II) => d^5 => 5 unpaired electron => IV

The number of species from the following that are involved in sp^3d^2 hybridization is :

$[Co(NH_3)_6]^{3+}$, SF_6, $[CrF_6]^{3-}$, $[CoF_6]^{3-}$, $[Mn(CN)_6]^{3-}$, and $[MnCl_6]^{3-}$

(A) 4, (B) 3, (C) 5, (D) 6

JEE Main 2025

sp^3d^2 hybridization

SF_6

$[CrF_6]^3$

$[CoF_6]^{3-}$

$[MnCl_6]^{3-}$

d^2sp^3 hybridization

$[Co(NH_3)_6]^{3+}$,

$[Mn(CN)_6]^{3-}$

Correct option:(A) 4

Given below are two statements:

JEE Main 2025

Statement I: A homoleptic octahedral complex, formed using monodentate ligands, will not show stereoisomerism.

Statement II: cis- and trans- platin are heteroleptic complexes of Pd.

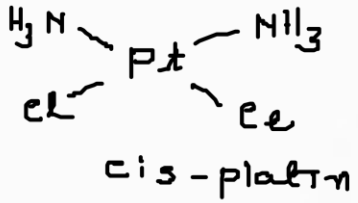
In the light of the above statements, choose the correct answer from the options given below:

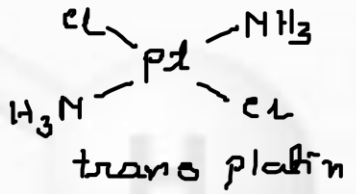
A Statement I is true but Statement II is false

B Both Statement I and Statement II are true

C Both Statement I and Statement II are false

D Statement I is false but Statement II is true





Match List - I with List - II.

JEE Main 2025

List - I (Complex)	List - II (Primary valency and Secondary valency)
(A) $[Co(en)_2Cl_2]Cl$	(I) 3, 6
(B) $[Pt(NH_3)_2Cl(NO_2)]$	(II) 3, 4
(C) Hg $[Co(SCN)_4]$	(III) 2, 6
(D) $[Mg\ (EDTA)]^{2-}$	(IV) 2, 4

A => (I)

B => (IV)

C => (II)

D => (III)

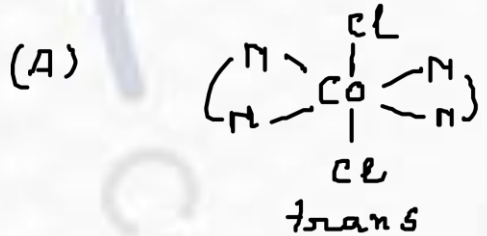
option (C)

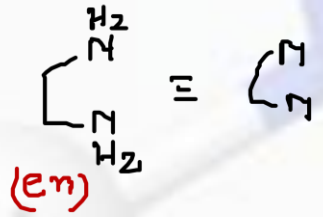
A. (A)-(I), (B)-(III), (C)-(II), (D)-(IV)

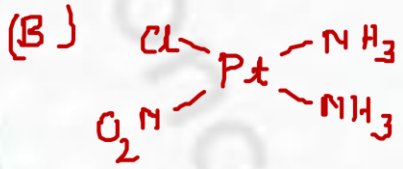
B. (A)-(II), (B)-(III), (C)-(IV), (D)-(I)

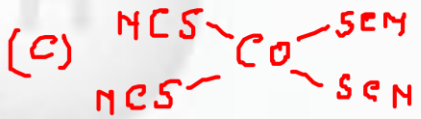
C. (A)-(I), (B)-(IV), (C)-(II), (D)-(III)

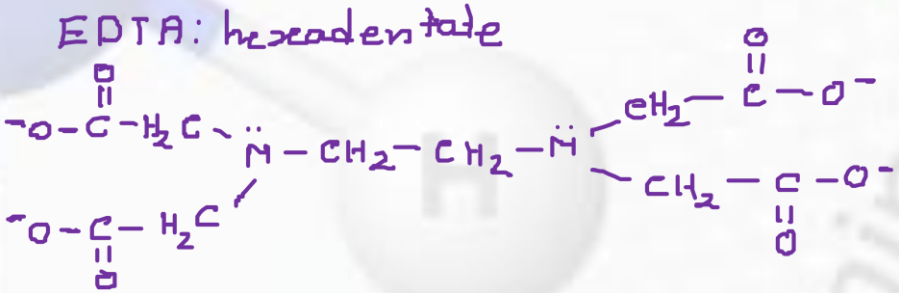
D. (A)-(III), (B)-(I), (C)-(II), (D)-(IV)











The number of unpaired electrons responsible for the paramagnetic nature of the following complex species are respectively :

JEE Main 2025

$[Fe(CN)_6]^{3-}$, $[FeF_6]^{3-}$, $[CoF_6]^{3-}$, $[Mn(CN)_6]^{3-}$

A 1, 5, 4, 2

B 1, 4, 4, 2

C 1, 5, 5, 2

D 1, 1, 4, 2

$[Fe(CN)_6]^{3-}$: Fe^{+3} : d^5 : Low spin : 1 unpaired electron

$[FeF_6]^{3-}$: Fe^{+3} : d^5 : high spin : 5 unpaired electron

$[CoF_6]^{3-}$: Co^{+3} : d^6 : high spin : 4 unpaired electron

$[Mn(CN)_6]^{3-}$: Mn^{+3} : d^4 : Low spin : 2 unpaired electron

option (A)

'X' is the number of acidic oxides among VO_2, V_2O_3, CrO_3, V_2O_5 and Mn_2O_7. The primary valency of cobalt in $[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3$ is Y. The value of X + Y is _____.

JEE Main 2025

(A) 3, (B) 4, (C) 2, (D) 5

VO_2 : V^{+4}

V_2O_3: V^{+3}

V_2O_5 : V^{+5} ⇒ Amphoteric oxide

CrO_3, : Cr^{+6} ⇒ highest oxidation state ⇒ they only can accept electrons ⇒ Lewis Acid

Mn_2O_7 : Mn^{+7}

Therefore $X = 2$

$$\overset{+3}{[Co(H_2NCH_2CH_2NH_2)_3]_2(SO_4)_3}$$

$y = 3$

$x + y = 2 + 3 = 5$

option (D)

An octahedral complex having molecular composition has two isomers A and B. The solution of A gives a white precipitate with $AgNO_3$ solution and the solution of B gives white precipitate with $BaCl_2$ solution. The type of isomerism exhibited by the complex is,

(A) Coordinate isomerism, (B) Ionization isomerism (C) Geometrical isomerism (D) Linkage isomerism

JEE Main 2025

Correct option: (B) Ionization isomerism

' X ' is the number of electrons in t_{2g} orbitals of the most stable complex ion among $[Fe(NH_3)_6]^{3+}$, $[FeCl_6]^{3-}$, $[Fe(C_2O_4)_3]^{3-}$ and $[Fe(H_2O)_6]^{3+}$. The nature of oxide of vanadium of the type V_2O_X is :

JEE Main 2025

A Amphoteric

B Acidic

C Basic

D Neutral

$[Fe(NH_3)_6]^{3+}$: d^5: Low spin: t_{2g}^5

$[FeCl_6]^{3+}$: d^5: high spin: t_{2g}^3, e_g^2

$[Fe(C_2O_4)_3]^{3+}$: d^5: low spin: t_{2g}^5

$[Fe(H_2O)_6]^{3+}$: d^5: high spin: t_{2g}^3, e_g^2

Most stable due to chelation: X = 5
V_2O_5: Amphoteric

Correct option A

JEE Main 2025

The correct order of $[FeF_6]^{3-}$, $[CoF_6]^{3-}$, $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ complex species based on the number of unpaired electrons present is:

A $[CoF_6]^{3-} > [FeF_6]^{3-} > [Ni(CO)_4] > [Ni(CN)_4]^{2-}$

B $[FeF_6]^{3-} > [CoF_6]^{3-} > [Ni(CN)_4]^{2-} > [Ni(CO)_4]$

C $[FeF_6]^{3-} > [CoF_6]^{3-} > [Ni(CN)_4]^{2-} = [Ni(CO)_4]$

D $[Ni(CN)_4]^{2-} > [FeF_6]^{3-} > [CoF_6]^{3-} > [Ni(CO)_4]$

$[FeF_6]^{3-}$: Fe^{+3} : high spin : 5 unpaired electron

$[CoF_6]^{3-}$: Co^{+3} : high spin : d^6

$t_{2g}^4 e_g^2$: 4 unpaired electron

$[Ni(CO)_4]$: Ni [0] : d^{10} ; No unpaired electron

$[Ni(CN)_4]$: Ni^{+2} : d^8 square planar : No unpaired electron

option (c)

Which one of the following complexes will have $\Delta_o = 0$ and $\mu = 5.96$ B.M?

JEE Main 2025

A $[FeF_6]^{4-}$

B $[Mn(SCN)_6]^{4-}$ => Mn^{+2} : d^5 : high spin : $t_{2g}^3 e_g^2$; $\Delta_o = 0$ $\mu = 5.95$ BM

C $[Co(NH_3)_6]^{3+}$

D $[Fe(CN)_6]^{4-}$

All the best