



## CHEMISTRY

# FOR IIT JEE ASPIRANTS OF CLASS 12 FOR CHEMISTRY

## CO-ORDINATE COMPOUNDS

### Example

1. The EAN of Ni in  $[Ni(CN)_4]^{2-}$  is

A. 32

B. 35

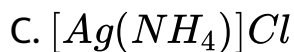
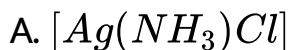
C. 34

D. 36

**Answer:**

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2. The chemical formula of diammine silver (I) chloride is



**Answer:**



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3. The complexes  $[Co(NH_3)_6][Cr(C_2O_4)_3]$  and  $[Cr(NH_3)_6][Co(C_2O_4)_3]$

- A. geometrical isomerism
- B. ionisation energy
- C. coordination isomerism
- D. linkage isomerism

**Answer:**



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4. Which one of the following high-spin complexes has the largest CFSE (Crystal Field stabilization energy) ?

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5. Statement-1:  $[Ti(H_2O)_6]^{3+}$  is violet in colour while  $Ti^{3+}$  is colourless.

Statement-2: Light corresponding to energy of blue-green region is absorbed by the complex to excite the electron from  $t_{2g}$  level to  $e_g$  level.

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6. Coloured Compounds



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7. The colour of  $[Ti(H_2O)_6]^{3+}$  is due to



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8.  $[Fe(CN)_6]^{4-}$  and  $[Fe(H_2O)_6]^{2+}$  are of different colours in dilute solutions why?



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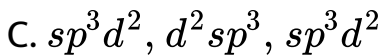
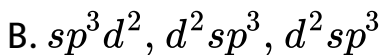
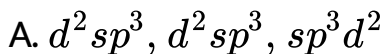
9. What will be the correct order for the wavelengths of absorption in the visible region for the following:

$[Ni(NO_2)_6]^{4-}$ ,  $[Ni(NH_3)_6]^{2+}$ ,  $[Ni(H_2O)_6]^{2+}$  ?



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10. Among  $[Fe(H_2O)_6]^{3+}$ ,  $[Fe(CN)_6]^{3-}$ ,  $[FeCl_6]^{3-}$  species, the hybridisation state of the Fe atom are, respectively.



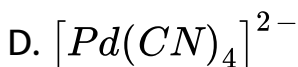
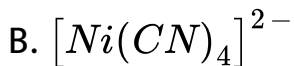
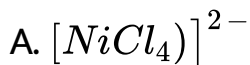
D. None of these

**Answer:**



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11. The species having tetrahedral shape is



**Answer:**



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12. Coordination compounds have great importance in biological system. In this context which of the following statements is incorrect ?

- A. Haemoglobin is the red pigment of blood and contains iron
- B. Cyanocobalamin is  $B_{12}$  and contains cobalt
- C. Chlorophylls are green pigments in plant and contains calcium
- D. Carboxypeptidase-A an enzyme that contains zinc

**Answer:**

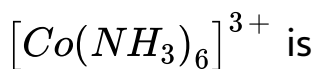


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**Evaluate Yourself 1**



1. The effective atomic number of cobalt in the complex



A. 36

B. 24

C. 33

D. 30

**Answer: A**



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2. The IUPAC name of  $[Co(NH_3)_6]Cl_3$  is.....

A. hexammine cobalt (II) chloride

B. triammine cobalt (III) trichloride

C. hexammine cobalt (III) chloride

D. None of these

**Answer: C**



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3. Which of the following cannot show linkage isomerism?

A.  $NO_2^-$

B.  $NH_3$

C.  $CN^-$

D.  $SCN^-$

**Answer: B**

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## Evaluate Yourself 2

1. What is the magnetic moment of  $K_3[FeF_6]$  ?

A. 3.87BM

B. 4.89BM

C. 5.91BM

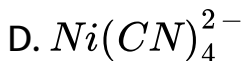
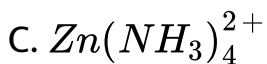
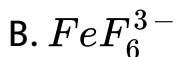
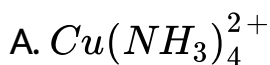
D. 6.92BM

**Answer: C**



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2. Which one of the following is an example of octahedral complex ?



**Answer: B**



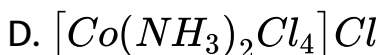
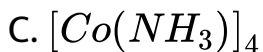
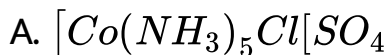
3. Which of the following is not an organometallic compounds ?

- A. Sodium ethoxide
- B. Trimethyl aluminium
- C. Tetraethyl lead
- D. ethyl magnesium bromide

**Answer: A**

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1. The following does not give a precipitate either with  $AgNO_3$  or  $BaCl_2$



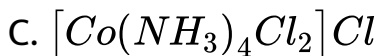
**Answer: A::B::C::D**



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2. Which of the following has highest molar conductivity





**Answer: A::B::C**



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**3. The transition metals have a strong tendency to form complexes because of**

(i) smaller sizes of the metal ions

(ii) variable oxidation states

(iii) high ionic charges of metal ions

(iv) availability of vacant d-orbitals for bond formation.

A. I only

B. II only

C. I and II

D. I, II,III

**Answer: D**



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4. The ionizable valency of Ni in  $Ni(CO)_4$  is

A. 2

B. 4

C. 0



D. 1

**Answer: C**



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5. According to Werner's theory transition metals possesses

- A. only one type of valency
- B. two types of valencies
- C. three types of valencies
- D. four types of valenceis

**Answer: B**



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6. The primary valency of the metal ion is satisfied by

A. neutral molecules

B. positive ions

C. negative ions

D. all the above

**Answer: C**



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7. No of ionizable & non-ionizable  $Cl^-$  ions in  $CoCl_3 \cdot 5NH_3$  representively are

A. 3,0

B. 2,1

C. 1,2

D. 0,3

**Answer: B::C**



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8. Central metal ion in complex compound acts as

A. Lewis acid

B. Lewis base

C. Arrhenium acid

D. Arrhenius base

**Answer: A**



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9. Which one of the following acts as a Lewis base in complexes

A.  $CO_2$

B.  $BF_3$

C.  $NH_3$

D.  $BCl_3$

**Answer: A::C::D**

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**10.** Potassium ferrocyanide is a

A. Complex salts

B. Normals salts

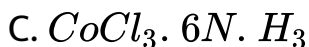
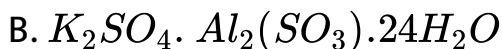
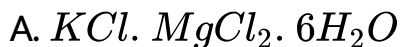
C. Double salts

D. Basic salts

**Answer: A**

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11. Example for a coordination compound is

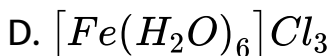
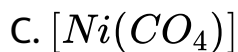
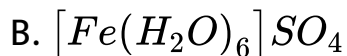


Answer: C



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12. in which of the following transition metal complexes does the metal exhibits zero oxidation state.



**Answer: C**



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**13.** The number of ions formed from a formula unit of potassium ferricyanide in solution is

A. 2

B. 4

C. 5

D. 6

**Answer: B::C::D**



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**14. Metal-Isothiocyanato is indicated by**

A. M-SCN

B. M-NCS

C. M-CNS

D. M-CSN

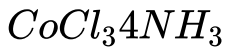
**Answer: B**





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15. Number of chlorides satisfying secondary valency in



A. 2

B. 3

C. 4

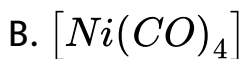
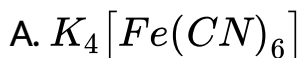
D. 1

**Answer: A**



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16. Which of the following is cationic complex?



**Answer: D**



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17. The no. of moles of AgCl obtained when excess  $AgNO_3$

is added to one mole of  $[Cr(NH_3)_4Cl_2]Cl$

A. 1

B. 2

C. 3

D. 4

**Answer: A**



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**18. Ligand in a metal carbonyl complex is**

A.  $NH_3$

B. CO

C. CN

D.  $SCN^-$

**Answer: B**

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**19.** The no. of moles of AgCl precipitated when excess of  $AgNO_3$  is mixed with one mole of  $[Cr(NH_3)_3Cl_3]$  is

A. 0

B. 1

C. 2

D. 3

**Answer: A**

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20. IUPAC name of the complex  $CoCl_3 \cdot 5NH_3$  is

- A. Cobalt trichloride penta amonium
- B. Penta amine carbonyl chloride
- C. Trichloro penta amino cobalt
- D. Pentaaminechlorocobalt (III) chloride

**Answer: B::C::D**



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21. The property of possessing atleast one atom that is attached to four non-identical groups in tetrahedral geometry is called

A. polarisation

B. chirality

C. enantiomerism

D. meridionity

**Answer: A::B::C**



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**22.** A racemic mixture has a net rotation

A. to right of original plane

B. to left of original plane

C. to right or left of original plane

D. zero

**Answer: D**

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**23.** Optical isomer have

- A. property of chirality
- B. almost identical chemical properties
- C. almost identical physical properties
- D. all the above

**Answer: A::C::D**

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24. The effective atomic number of iron in  $[Fe(CN)_6]^{3-}$  is

A. 34

B. 36

C. 37

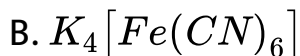
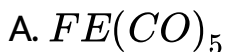
D. 35

**Answer: D**

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25. Which does not obey EAN rule?



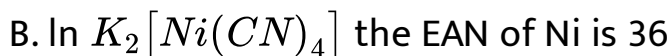
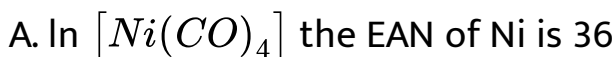


**Answer: A::B::C::D**



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**26.** The effective atomic number of central metal ion is wrongly calculated in the following complex?



C. In  $K_3[Fe(CN)_6]$  the EAN of Fe is 35

D. In  $[Cr(NH_3)_6]Cl_3$  the EAN of Cr is 33.

**Answer: A::B::C::D**



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**27.** According to effective atomic number rule the central metal acquires:

A. inert gas configuration

B. octet

C. duplet

D. quartet

**Answer: A**

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**28.** The shape of the complex species will be square planar if its coordination number is

A. 2

B. 6

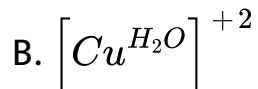
C. 5

D. 4

**Answer: D**

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29. Which of the following is outer orbital complex?



D. Both 1 and 2

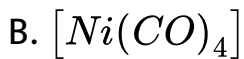
Answer: A::B::C::D



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30.  $sp^3d^2$  hybridisation is present in



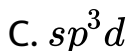
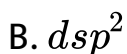
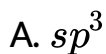


**Answer: A::C::D**



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**31.** The type of hybridisation present in  $[Cu(NH_3)_4]^{+2}$  ion is



D.  $sp^3d^2$

**Answer: B**

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**32.** The shape of  $[CoF_6]^{-3}$  is

- A. Square Planar
- B. Trigonal bipyramidal**
- C. Octahedral
- D. Tetrahedral

**Answer: A::B::C::D**

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33. The hybridisation of metal atom & geometry of complex in  $[Ag(NH_3)_2]^{-3}$  are

A.  $sp$ , linear

B.  $sp^2$ , linear

C.  $sp^2$ , trigonal planar

D.  $sp$ , angular

**Answer: A**

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34. The magnetic moment of  $[Ni(Cl)_4]^{2-}$  is

A. 2.85BM

B. 1.83BM

C. 4.86BM

D. 5.95BM

**Answer: A**



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**35.** Which of the following system has maximum number of the unpaired electrons in an inner octahedral complex?

A.  $d^4$

B.  $d^9$



C.  $d^7$

D.  $d^5$

**Answer: A**



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**36.** In an octahedral crystal field, the correct set of low orbitals are

A.  $d(xy), d_{xz}, d_{x^2-y^2}$

B.  $d_{x^2-y^2}, d_{z^2}$

C.  $d_{xy}, d_{xz}, d_{yz}$

D.  $d_{xy}, d_{x^2-y^2}$

**Answer: C**

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**37.** For the same metal, the stabilizing energies of tetrahedral and octahedral complex are related as

A.  $\Delta_t = \Delta_0$

B.  $\Delta_t \times 4 = \Delta_0 \times 6$

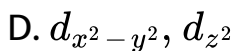
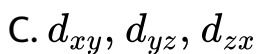
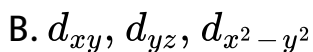
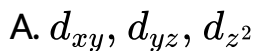
C.  $\Delta_t = \frac{4}{9} \Delta_0$

D.  $\Delta_t \times 6 = \Delta_0 \times 4$

**Answer: A::C::D**

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38. The orbitals having lower energy in tetrahedral complexes according to CFT are



**Answer: D**



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39. The metal which does not form poly nuclear carbonyl is



B. Fe

C. Cr

D. Co

**Answer: A**



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**40. Nessler's reagent is**

A.  $K_2HgI_4$

B.  $K_2HgI_2$

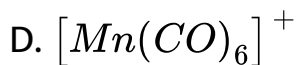
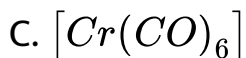
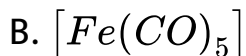
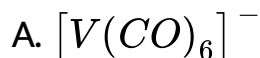
C.  $K_2HgCl_4$

D.  $HgI_2$

**Answer: A::B::D**

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**41.** Among the following metal carbonyls, the  $C - O$  bond order is lowest in



**Answer: A**

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1. Which of the following is not a draw back of Werner's theory?

A. does not explain the valency of metal ions in the complex

B. does not give any explanation for the colour of complex compounds

C. does not explain the magnetic behaviour of complex compounds

D. does not correlate electronic configuration of the metal with the formation of complex

**Answer: A**

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2. Coordination compound.

A. Ferrous ammonium sulphate

B. Potassium ferrocyanide

C. Camallite

D. Gypsum

**Answer: C**

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3. Aqueous solution of  $[Co(H_2O)_5SO_4]Cl$  gives precipitate with

A.  $BaCl_{(2)}(aq)$

B.  $AgNO_{(3)}(aq)$

C. both 1 and 2

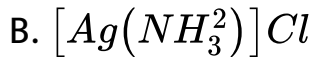
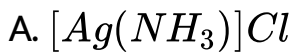
D. neither 1 nor 2

**Answer: B**

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4. Silver chloride dissolves in excess ammonia due to the formation of a soluble complex whose formula is



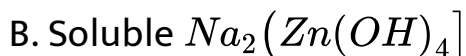


**Answer: A::B::C**



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5.  $Zn^{+2}$  dissolves in excess of NaOH due to the formation of



C. Soluble Na  $[Zn(OH)_3]$

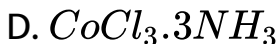
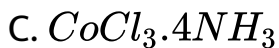
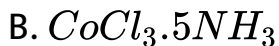
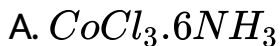
D. ZnO

**Answer: B**



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6. Example of neutral complex compound in the following is



**Answer: D**



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7. Which of the following releases metal slowly to give uniform coating in electroplating is?

- A. metal salts
- B. double salts
- C. Complex salts
- D. alums

**Answer: C**



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8. IUPAC name of the complex  $[Cu(NH_3)_4]SO_4$  is

- A. cuprammonium sulphate
- B. copper sulphate tetraammonia
- C. tetraamminecopper (II) sulphate
- D. copper ammonium (IV) sulphate

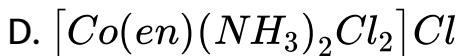
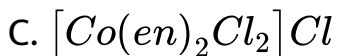
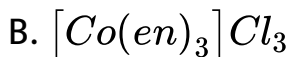
**Answer: C**



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9. Which of the following does not exhibit optical isomerism?

- A.  $[Co(NH_3)_3Cl_3]$



**Answer: A**



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**10.** Co-ordination compounds

$Pt(NH_3)_3(NCS)]$  and  $[Pt(NH_3)_3(SCN)]$  are example

of -- isomerism

A. Co-ordination

B. Ionization

C. Linkage

D. Optical

**Answer: C**

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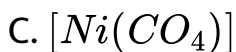
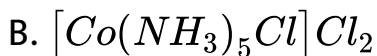
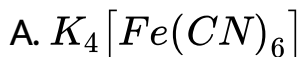
11. Geometrical isomerism is observed in

- A. Tetrahedral complex
- B. Square planar complexes
- C. Linear complex
- D. Planar triangle complexes

**Answer: B**

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12. Stable complex based on EAN rule



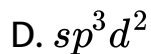
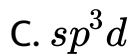
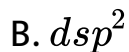
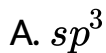
D. all of the above

Answer: D



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13. The hybridisation of the complex  $[NiCl_4]^{-2}$  ? is



**Answer: A**

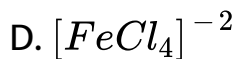


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**14.** Which one of the following has a square planar geometry ?



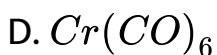
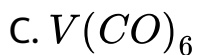
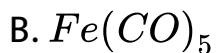
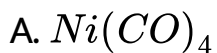




**Answer: B**

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15. Which of the following is paramagnetic



**Answer: C**



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16. The number of ions formed when cuprammonium sulphate is dissolved in water is

A. 1

B. 2

C. 4

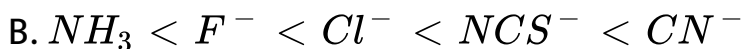
D. zero

**Answer: B**



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17. Which of the following is correct arrangement of ligands in terms of field strength

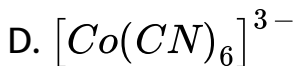
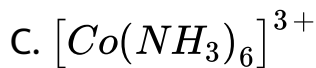
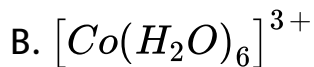
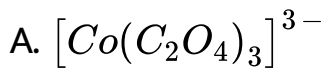


**Answer: A**



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18. In which of the following octahedral complexes of Co (at. no. 27), will the magnitude of  $\Delta_o$  be the highest?

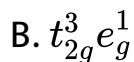
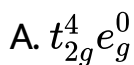


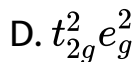
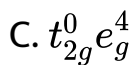
**Answer: A::B::C::D**



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**19.** If  $\Delta_0 < P$ , the correct electronic configuration for  $d^4$  system will be (P = pairing energy)





**Answer: A::B::D**



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**20.** Ammonium ions are detected with

A. Nessler's reagent

B. Borsh reagent

C. Tollen's reagent

D. Fehling's solution

**Answer: A**



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21.  $[(Ph_3P)_3RhCl]$  is a familiar catalyst used in

- A. hydrogenation of oils
- B. dehydration of alcohols
- C. hydration of alcohols
- D. hydration of aldehydes

**Answer: B**



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22. Metals those can be extracted commercially with aqueous solution of sodium cyanide as complexes are

A. Au and Ag

B. Fe and Ag

C. Au and Hg

D. Hg and Fe

**Answer: A**



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23. If  $Ag^+ + NH_3 \rightleftharpoons [Ag(NH_3)]^+$ ,  $K_1 = 3.5 \times 10^{-3}$

and  $[Ag(NH_3)]^+ + NH_3 \rightleftharpoons [Ag(NH_3)_2]^+$ ,

$K_2 = 1.74 \times 10^{-3}$ . The formation constant of

$[Ag(NH_3)_2]^+$  is :

A.  $1.7 \times 10^{-3}$

B.  $5.92 \times 10^{-6}$

C.  $1.8 \times 10^3$

D.  $1.7 \times 10^7$

**Answer: A::B**



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**Exercise 1 H W**



1. The complex formed by the combination of calcium ions and ethylene di ammine tetra acetate.  $(EDTA)^{-4}$

Number of moles of calcium ions produced by dissolving of one moles of calcium ions produced by dissolving of one mole of that complex in excess of water is

A. one

B. two

C. four

D. five

**Answer: A::B::C::D**

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2. Which is a double salt?

- A. Carnalite
- B. Potassium ferrocyanide
- C. Potassium ferricyanide
- D. Nessler's reagent

**Answer: A**

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3. Bonds present in  $K_4[Fe(CN)_6]$  are

- A. Only ionic
- B. Only covalent

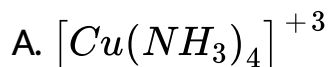
C. Ionic and Covalent

D. Ionic, covalent and coordinate covalent.

**Answer: D**

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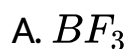
4. Copper sulphate solution forms blue coloured complex with excess of ammonia. Its formula is



**Answer: B**

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5. Which of the following cannot act as a ligand?



**Answer: A::C::D**

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6. Alum in aqueous solution gives positive test for

(A)  $K^+$  (B)  $Al^{3+}$  (C)  $SO_4^{2-}$

A. A only

B. B only

C. A and B

D. A,B and C

**Answer: A::B::C::D**



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7. Chelates are used in

A. Analytical chemistry

B. Water softning

C. Removal of  $Pb^{+2}$  from the blood

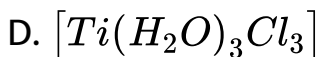
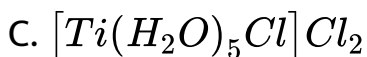
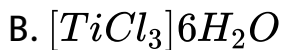
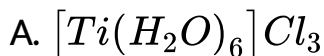
D. All of these

**Answer: D**



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**8. Hexaquotitanium (II) Chloride represented as**



**Answer: A**

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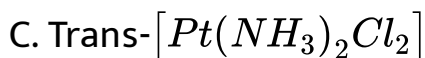
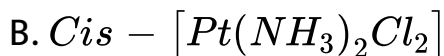
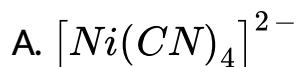
9. IUPAC name of  $Li[AlH_4]$  is

- A. Lithium aluminium hydride
- B. Lithium tetrahydrido aluminate [III]
- C. Tetrahydride aluminium lithionate
- D. Aluminium lithium hydride

**Answer: B**

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10. Dipole moment will be zero in the complexes



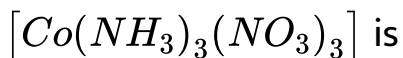
D. Both 1 and 3

Answer: A::B::C::D



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11. The number of geometrical isomers of



A. 0



B. 2

C. 3

D. 4

**Answer: B**



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12. For the given complex  $[CoCl_2(en)(NH_3)_2]^+$ , the number of geometrical isomers, the number of optical isomers and total number of isomers of all type possible respectively are

A. 2,2 and 4

B. 2,2 and 3

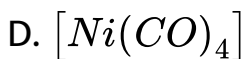
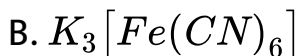
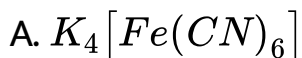
C. 2,0 and 2

D. 0,2 and 2

**Answer: B**

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**13. Which does not obey EAN rule?**



**Answer: B**



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14. The following solutions requires three moles of  $AgNO_3$  for the complete precipitation of all the chloride ions present in it

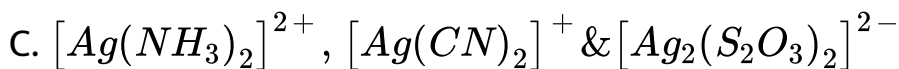
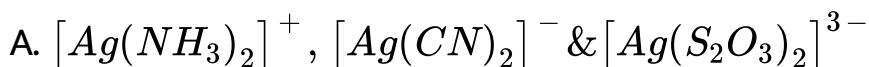
- A. One litre of 1M  $[Co(NH_3)_6]Cl_3$
- B. Three litres of 1M  $[Co(NH_3)_4Cl_2]Cl$
- C. One litre of 1.5 M  $[Co(NH_3)_5Cl]Cl_2$
- D. All of these

**Answer: D**



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15.  $AgCl$  dissolved in excess of  $NH_3$ ,  $KCN$  and  $Na_2S_2O_3$  solutions the complex produces ions



**Answer: A**



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16. The secondary valency of chromium in  $[Cr(en)_3]Cl_3$  is

A. 6

B. 3

C. 2

D. 4

**Answer: A**



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**17.** Stabilisation energy of octahedral complex with  $d^7$  configuration

(A)  $-1.8\Delta_0$  with one unpaired electron

(B)  $1.8\Delta_0$  with three unpaired electrons

(C)  $-0.8\Delta_0$  with one unpaired electron

(D)  $0.8\Delta_0$  with three unpaired electrons

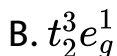
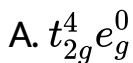
- A.  $\Delta_0$  with one unpaired electron
- B.  $\Delta_0$  with three unpaired electrons
- C.  $\Delta_0$  with one unpaired electron
- D.  $\Delta_0$  with three unpaired electrons

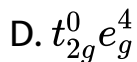
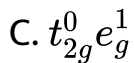
**Answer: A**



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**18.** If  $\Delta_0 > P$ , the correct electronic configuration for  $d^4$  system will be ( $p$  = pairing energy)

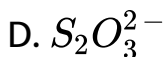
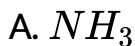




**Answer: A**

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**19.** The ligand that gives dark blue color with curic ion in the laboratory is



**Answer: D**

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20. The configuration of an elements 'X' is  $3d^{10}4s^1$ . The wrong statement regarding the element 'X' is

- A. it forms complexes
- B. it exhibits variable valency
- C. it forms paramagnetic ions only
- D. It can form coloured salts

**Answer: A::C::D**

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21. In the qualitative analysis of group 3 cations blood red colouration is a test for

- A. iron using cyanide as ligand
- B. chromium using cyanide as ligand
- C. iron using thiocyanide as ligand
- D. chromium using thiocyanide as ligand

**Answer: C**



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**Exercise 2 C W**

1. The oxidation number of cobalt in  $K[Co(CO)_4]$  is:

A. +1

B. +3

C. -1

D. -3

**Answer: C**



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2.  $EDTA^{4-}$  is an important ligand. Which statement about this ligand is/are true ?

A. Monodentate ligand

B. Bidentate ligand

C. Tridentate ligand

D. Hexadentate ligand

**Answer: B::C::D**



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3. en' is an example of a



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4. The proper name for  $K_2[PtCl_6]$  is

A. Potassiumhexachloroplatinum

B. Potassiumhexachloroplatinum(IV)

C. Potassium hexachloroplatinate(IV)

D. Dipotassium hexa chloro platinum

**Answer: C**



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5. IUPAC name of  $[Pt(NH_3)_3(Br)(NO_2)Cl]Cl$  is

A. Triamminechlorobromonitroplatinum (IV) chloride

B. Triamminebromonitrochloroplatinum (IV) chloride

C. Triamminebromochloronitroplatinum (IV) chloride

D. Triamminenitrochlorobromoplatinum (IV) chloride

**Answer: C**

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6. Tetrammine diaqua copper (II) hydroxide is given by the formula

- A.  $[Cu(NH_3)_4](OH)_2 \cdot 2H_2O$
- B.  $[Cu(NH_3)_4(OH)_2] \cdot 2H_2O$
- C.  $[Cu(NH_3)_4(H_2O)_2](OH)_2$
- D.  $[Cu(NH_3)_4(H_2O)(OH)_2]$

**Answer: C**

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7. The complexes  $[Co(NH_3)_6][Cr(C_2O_4)_3]$  and  $[Cr(NH_3)_6][Co(C_2O_4)_3]$

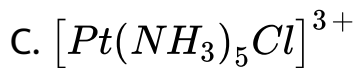
- A. geometrical isomerism
- B. Ionization isomerism
- C. Co-ordination isomerism
- D. linkage isomerism

**Answer: C**



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8. Which of the following complex or the complex ion will show geometrical isomerism?

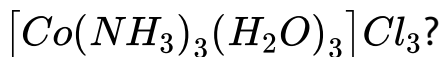


**Answer: A**



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**9. Which isomerism is exhibited by**



A. Geometrical isomerism

B. Linkage isomerism

C. Coordination isomerism

D. Ionization isomerism

**Answer: A**

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10. The IUPA name of  $[Co(NH_3)_4Cl(NO_2)]Cl$  is

A. Linkage isomerism, ionization isomerism and

geometrical isomerism

B. Ionisation isomerism, geometrical isomerism and

optical isomerism



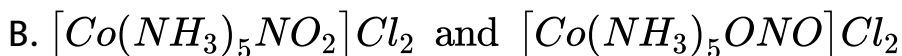
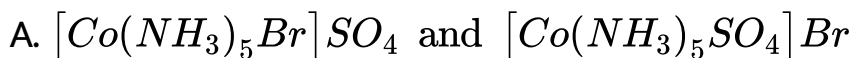
C. Linkage isomerism, geometrical isomerism and optical isomerism

D. Linkage isomerism, ionization isomerism and optical isomerism.

**Answer: A**

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**11.** Which one of the following is an example of coordination isomerism?





D.

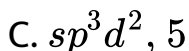
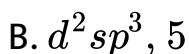
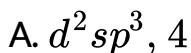


**Answer: D**



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12.  $[FeF_6]^{3+}$  has Fe atom ..... Hybridized with unpaired .....  
Electrons.



D.  $sp^3d^2$ , 3

**Answer: A::C::D**

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**13.** How many EDTA molecules are required to make an octahedral complex with a  $Ca^{2+}$  ion?

A. two

B. six

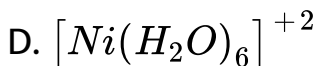
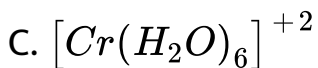
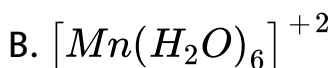
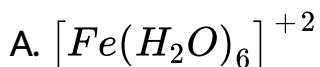
C. three

D. one

**Answer: D**

14. The d electron configuration of  $Cr^{2+}$ ,  $Mn^{2+}$ ,  $Fe^{2+}$  and  $Ni^{2+}$  are  $3d^4$ ,  $3d^5$ ,  $3d^6$  and  $3d^8$  respectively. Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour ?

(At. No.  $Cr = 24$ ,  $Mn = 25$ ,  $Fe = 26$ ,  $Ni = 28$ )



**Answer: D**



15. The expected spin only magnetic moment for  $[Fe(CN)_6]^{4-}$  and  $[FeF_6]^{3+}$  are

A. 1.73 and 1.73 B.M

B. 1.73 and 5.93 B.M

C. 0.0 and 1.73 B.M

D. 0.0 and 5.92 B.M

**Answer: D**



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16. The volume (in mL) of 1.0 M  $AgNO_3$  required for complete precipitation of chloride ions present in 30 mL of 0.01 M solution of  $[Cr(H_2O)_6]Cl_3$ , as silver chloride is close to

A. 3

B. 4

C. 5

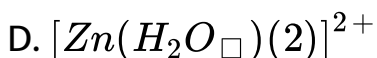
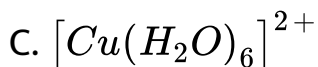
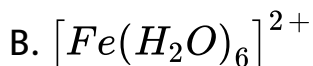
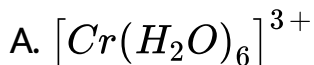
D. 6

**Answer: A::B::C::D**



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17. Among the following ions which one has the highest paramagnetism?

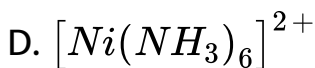
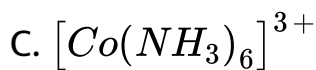
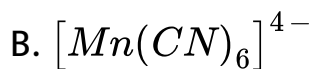
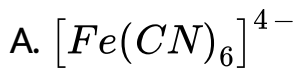


Answer: A::B::C::D



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18. Which of the following complex is an outer orbital complex?



**Answer: D**



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**19.** The EAN of cobalt in the complex ion  $[Co(en)_2Cl_2]^+$

is

A. 27

B. 36



C. 33

D. 35

**Answer: B**



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**20.** For an octahedral complex, which of the following  $d$  electron configuration will give maximum crystal-field stabilisation energy?

A. High spin  $d^6$

B. Low-spin  $d^4$

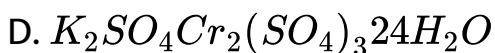
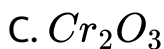
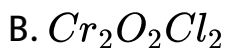
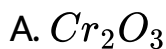
C. Low spin  $d^5$

D. High -spin  $d^7$

**Answer: C**

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**21.** Chromium compound widely used in tanning of leather is



**Answer: D**

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22. Oxidation state of central metal atom and geometry for the Wilkinson's catalyst.  $[Rh(Ph_3P)_3Cl]$  used for hydrogenation of alkenes are .....

- A. Hydrogenation of oils
- B. Hydrogenation of alkynes
- C. Hydrogenation of alkenes
- D. Polymerisation of alkenes

**Answer: C**



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23. Coordination compounds have great importance in biological system. In this context which of the following statements is incorrect ?

A. Chlorophylls are green pigments in plants and contain calcium.

B. Haemoglobin is the red pigment of blood and contains iron.

C. Cyanocobalamin is  $B_{12}$  and contains cobalt.

D. Carboxypeptidase-A is an enzyme and contains zinc.

**Answer: A**



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## Exercise 2 H W

1. An ambidentate ligand is one which

A. is linked to the metal atom at two points

B. has two donor atoms but only one of them has the capacity to form a coordinate bond.

C. has two donor atoms but either of the two can form a co-ordinate bond

D. forms chelate rings

**Answer: C**



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2. Which of the following is not a chelating agent :

- A. Thiosulphato
- B. Oxalato
- C. Glycinato
- D. Ethylene diamine

**Answer: A**



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3. IUPAC name of  $Na [CoCl(NO_2)_5]$  is

- A. Sodium chloropentanitrocobaltate (II)
- B. Sodium cobaltnitrate

C. Trisodium chloropentanitro cobalt

D. Pentanitrocobalt (II) trisodium complex

**Answer: A**

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4. The IUPAC name of Wilkinsons catalyst  $[RhCl(PPh_3)_3]$  is

A. Chlorotris (triphenylphopshine) rhodium (I)

B. Chlorotris (triphenylphosphine) rhodium (IV)

C. Chlorotris (triphenylphosphine) rhodium (0)

D. Chlotrotris (triphenylphosphine) rhodium (VI)

**Answer: A**

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5. IUPAC name  $[Co(NH_3)_5(NO_2)]Cl_2$  is

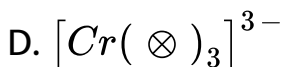
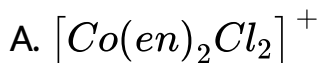
- A. Nitrito-N-pentaammine cobalt (I)chloride
- B. Nitrito-N-pentaammine cobalt (II) chloride
- C. Pentaammine nitrito-N-cobalt (II) chloride
- D. Pentaammine nitrito-N-cobalt (II)chloride

**Answer: D**

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6. Both geometrical and optical isomerism are shown by

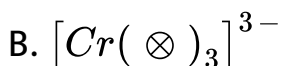
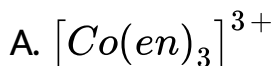


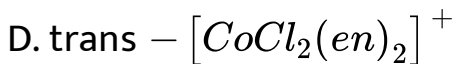
**Answer: A**



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7. Which of the following is not optically active?

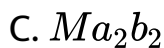
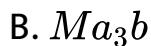




**Answer: D**

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**8.** Cis-trans isomerism is found in square planar complexes of molecular formula: (a and b are monodentate ligands)

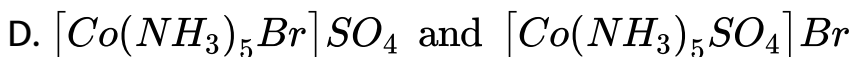


Answer: C

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9. Which of the following isomeric pairs shows ionization isomerism?

A.



Answer: D

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- 10.
- |     | List-I    | List-II                      |
|-----|-----------|------------------------------|
| (A) | $Ti^{+3}$ | 1 Charge transfer phenomenon |
| (B) | $MnO_4^-$ | 2 Impurities                 |
| (C) | $F_2$     | 3 s-transition               |
| (D) | Gems      | 4 d-d transition             |
|     |           | 5 Excitation of electron     |

The correct match which is responsible for colour

A. A-4, B-1, C-2, D-5

B. A-4, B-1, C-5, D-2

C. A-4, B-5, C-1, D-2

D. A-5, B-2, C-3, D-4

**Answer: B**



11. Coordination number of Cr is three. A complex ion of Cr with  $C_2O_4^{2-}$  and superoxide ion,  $O_2^-$  has the formula,  $[Cr(CO_2O_4)_x(en)_y(O_2)_z]^-$ . The ratio  $x : y : z$  will be

A. 1 : 1 : 2

B. 1 : 1 : 1

C. 1 : 2 : 2

D. 2 : 1 : 1

**Answer: A**



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12. The geometries of  $Ni(CO)_4$  and  $Ni(PPh_3)_2Cl_2$  are .

- A. both square planar
- B. tetrahedral and square planar
- C. both tetrahedral
- D. square planar and tetrahedral

**Answer: A::B::C::D**



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13. What are the magnetic moment (in BM) for Ni(II) ion in square planar and octahedral geometry, respectively?

- A. 0 and 2.83

B. 2.83 and 2.83

C. 0 and 1.73

D. 2.83 and 0

**Answer: A**



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**14.** A solution containing 2.675 g of  $CoCl_3 \cdot 6NH_3$  (molar mass =  $267.5 \text{ g mol}^{-1}$ ) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of  $AgNO_3$  to give 4.73 g of  $AgCl$  (molar mass =  $143.5 \text{ g mol}^{-1}$ ). The formula of the complex is (At. mass of Ag = 108 u)

- A.  $[CoCl_3(NH_3)_5]$
- B.  $[CoCl(NH_3)_5]Cl_2$
- C.  $[Co(NH_3)_6]Cl_3$
- D.  $[CoCl_2(NH_3)_4]Cl$

**Answer: C**



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15. The complex  $[Pt(NH_3)_4]^{2+}$  has ..... Structure :

- A. square planar
- B. tetrahedral
- C. pyramidal



D. pentagonal

**Answer: A**

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16. Crystal field stabilization energy for high spin  $d^4$  octahedral complex is

A.  $0.6 \Delta_0$

B.  $1.8 \Delta_0$

C.  $1.6 \Delta_0$

D.  $1.2 \Delta_0$

**Answer: A**



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17. Which of the following is antidote for lead poisoning ?

A.  $\text{CoCl}_3$

B. Cis-platin

C. EDTA

D. DMG

**Answer: C**



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18. EDTA is used for the estimation of

A.  $Na^+$  and  $K^+$  ions

B.  $Cl^-$  and  $Br^-$  ions

C.  $Cu^{2+}$  and  $Ag^+$  ions

D.  $Ca^{2+}$  and  $Mg^{2+}$  ions

**Answer: D**



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**19.** Wilkinson's catalyst used as a homogenous catalyst in the hydrogenation of alkene contains-

A. iron

B. aluminium

C. rhodium

D. cobalt

**Answer: C**



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**20. Ziegler-Natta catalyst is**

A. Solution of  $SnCl_4$  trialkylaluminium

B. Solution of  $TiCl_4$  trialkylaluminium

C. Solution of  $TiCl_4$  + trialkylchromium

D. Solution of  $SnCl_4$  + Tollen's reagent

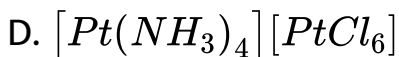
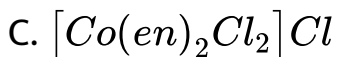
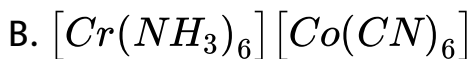
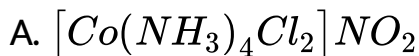
**Answer: B**



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### Exercise 3

1. Which of the following will give a pair of enantiomorphs ?

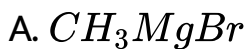


Answer: C



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2. Which of the following is organometallic compound



D. All of these

**Answer: A**

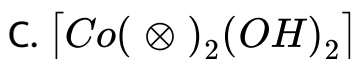
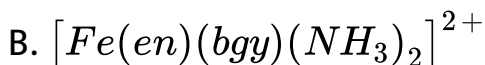


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3. Which of the following complexes exhibits the highest paramagnetic behaviour?

where gly=glycine, en=ethylenediamine and bipy =bipyridyl

(At. no.  $Ti = 22$ ,  $V = 23$ ,  $Fe = 26$ ,  $Co = 27$ )

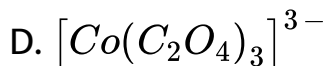
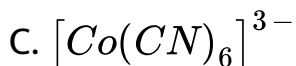
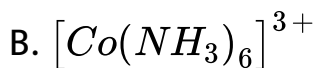
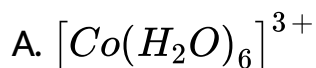


**Answer: C**



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4. In which of the following coordination entities the magnitude of  $\Delta_o$  (CFSE in octahedral field) will be maximum?



**Answer: C**



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5. Assertion:  $[CoF_6]^{3-}$  is a paramagnetic.

Reason:  $Co^{3+}$  has  $3d^6$  outer electronic configuration.

The unpaired electrons do not pair up because of weak field provided by  $F^-$ .

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

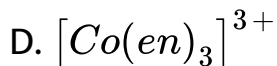
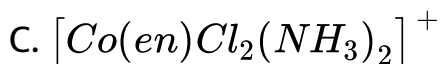
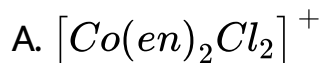
D. Both Assertion and Reason are false

**Answer: A**



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6. Which of the following does not show optical isomerism ?

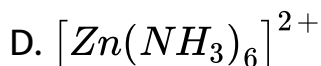
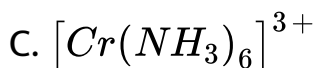
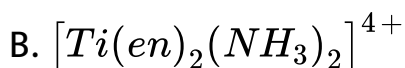
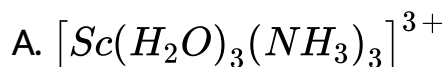


**Answer: B**



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7. Which of the following complex ions is expected to absorb visible light?

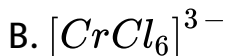
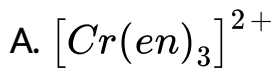


**Answer: C**



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8. Which of the following coordination entities should be expected to absorb light of lowest frequency?



**Answer: B**



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9. Assertion : CO and  $CN^-$  are referred as π acid L ligands.

Reason : In CO and  $CN^-$  vacant p type orbitals are present.

- A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. Assertion is true but Reason is false
- D. Both Assertion and Reason are false

**Answer: A**

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10. Assertion : If  $\beta_4$  for  $[Cu(NH_3)_4]^{2+}$  is  $2.1 \times 10^{13}$  its instability constant is  $4.76 \times 10^{-14}$ .

Reason :Overall dissociation equilibrium constant varies inversely with formation constant.

A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion

B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion

C. Assertion is true but Reason is false

D. Both Assertion and Reason are false

**Answer: A**



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11. Assertion:  $K_4[Fe(CN)_6]$  is diamagnetic and  $[Fe(H_2O)_6]Cl_3$  is paramagnetic.

Reason: Hybridisation of central metal in  $K_4[Fe(CN)_6]$  is  $sp^3d^2$ , which in  $[Fe(H_2O)_6]Cl_3$  is  $d^2sp^3$ .

- A. Both Assertion and Reason are true and Reason is the correct explanation of Assertion
- B. Both Assertion and Reason are true but Reason is not the correct explanation of Assertion
- C. Assertion is true but Reason is false
- D. Both Assertion and Reason are false

**Answer: C**



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12. What is (are) number (s) of unpaired electron(s) in the square planar  $[Pt(CN)_4]^{2-}$  ion ?

A. Zero

B. 1

C. 4

D. 6

**Answer: A**



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13. IUPAC name of  $[Fe(CN)_6]^{3-}$  ion is

- A. hexacyanoferrate (II) ion
- B. hexacyanoferrate (III) ion
- C. hexacyanide iron (III) ion
- D. iron (III) hexacyanide ion

**Answer: B**



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14. Crystal field stabilization energy for high spin  $d^4$  octahedral complex is

- A.  $-0.6D_0$

B.  $-1.8D_0$

C.  $-1.6D_0 + P$

D.  $-1.2D_0$

**Answer: A::C::D**



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**15.** The existence of two different coloured complexes with the composition  $[\text{Co}(\text{NH}_3)_2\text{Cl}_2]^+$  is due to

A. Ionisation isomerism

B. Linkage isomerism

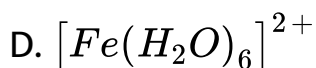
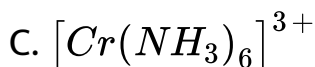
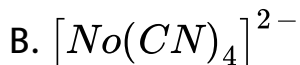
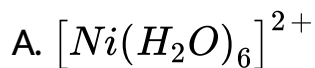
C. Geometrical isomerism

## D. Coordination isomerism

**Answer: A::C::D**

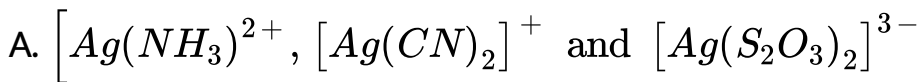
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**16.** Which of the following complex ion is not expected to absorb visible light?



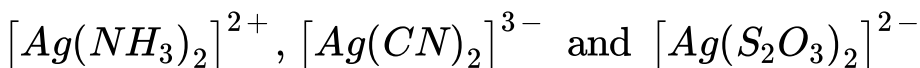
**Answer: B**

17.  $AgCl$  dissolved in excess of  $NH_3$ ,  $KCN$  and  $Na_2S_2O_3$  solutions the complex produces ions

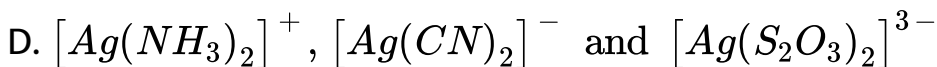
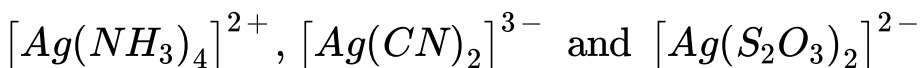


\

B.



C.

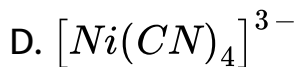
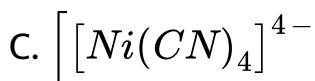
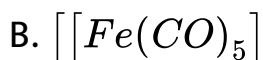
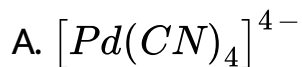


**Answer: D**



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18. The most stable complex among the following



Answer: B



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19. Choose the correct statement

- A.  $[Co(NH_3)_6]^{2+}$  is oxidised to diamagnetic  $[Co(NH_3)_6]^{3+}$  by the oxygen in air
- B. Tetrahedral complexes are more stable than octahedral complexes
- C.  $[Fe(CN)_6]^{3-}$  is stable but  $[FeF_6]^{3-}$  is unstable
- D. The  $[Cu(NH_3)_4]^{2+}$  ion has a tetrahedral geometry and is diamagnetic X

**Answer: A**



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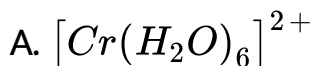
20. In the complex ion  $[Co(NH_3)_6]^{3+}$ , the  $NH_3$  molecules are linked to the central metal ion by

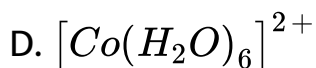
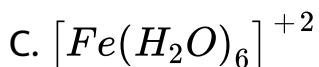
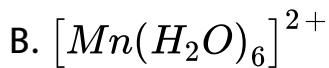
- A. ionic bonds
- B. covalent bonds
- C. coordinate bonds
- D. hydrogen bonds

**Answer: C**

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**21.** The d-electron configurations of  $Cr^{2+}$ ,  $Mn^{2+}$ ,  $Fe^{2+}$  and  $Co^{2+}$  are  $d^4$ ,  $d^5$ ,  $d^6$  and  $d^7$  respectively. Which one of the following will exhibit minimum paramagnetic behaviour?



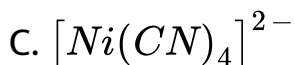


**Answer: D**

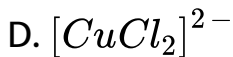


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**22.** Of the following complex ions, which is diamagnetic in nature?







**Answer: C**

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23. The complexes



are the examples of which type of isomerism?

- A. Geometrical isomerism
- B. Linkage isomerism
- C. Ionisation isomerism
- D. Coordination isomerism

**Answer: D**

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**24.** The complex,  $[Pt(py)(NH_3)BrCl]$  will have how many geometrical isomers?

A. 2

B. 3

C. 4

D. 0

**Answer: B**

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25. From four transition metal octahedral complexes , (the choice given below) low spin electronic configuration arises only for

A.  $d^1$  to  $d^3$  complexes

B.  $d^4$  to  $d^7$  complexes

C.  $d^7$  to  $d^9$  complexes

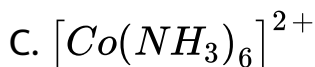
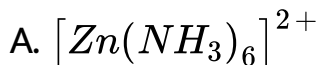
D.  $d^7$  to  $d^0$  complexes

**Answer: B**



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26. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour ?

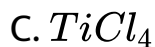
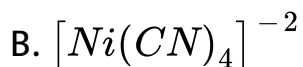
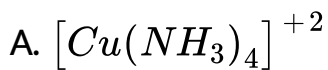


**Answer: B::C::D**



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27. A magnetic moment of 1.73 B.M. will be shown by one among the following:

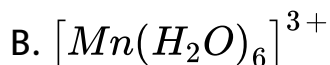
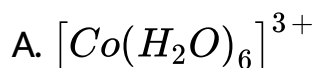


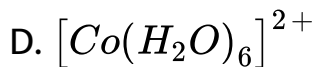
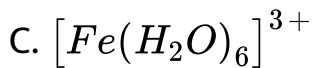
**Answer: A**



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





**Answer: C**

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**29.** The name of complex ion,  $[Fe(CN_6)]^{3-}$  is

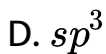
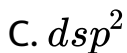
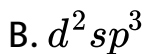
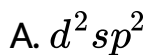
- A. Tricyanoferrate (III) ion
- B. Hexacyanoferrate (III) ion
- C. Hexacyanoiron (III) ion
- D. Hexacyanitoferrate (III) ion

**Answer: B**



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30. The hybridization involved in complex  $[Ni(CN)_4]^{2-}$  is (At. No. Ni = 28)



Answer: C



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31. The sum of coordination number and oxidation number of the metal M in the complex  $[M(en)_2(C_2O_4)]Cl$  (where en is ethylenediamine) is:

A. 7

B. 8

C. 9

D. 6

**Answer: C**



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32. Number of possible isomer for the complex

$[Co(en)_2Cl_2]Cl$  will be: (em = ethylenediamine)

A. 3

B. 4

C. 2

D. 1

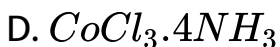
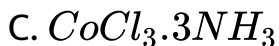
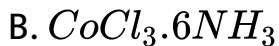
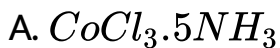
**Answer: A**



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33. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not

give test for chloride ions with silver nitrate at  $25^{\circ}C$ ?



**Answer: C**



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**34.** Which of the following has longest  $[CO(CN)_6]^{3-}$  bond length?

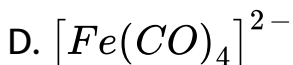
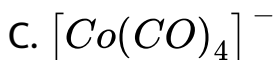
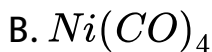
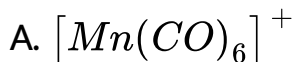
- A.  $[\text{Co}(\text{CN})_6]^{3-}$  has four unpaired electrons and will be in a high-spin configuration
- B.  $[\text{Co}(\text{CN})_6]^{3-}$  has four no unpaired electrons and will be in a high-spin configuration
- C.  $[\text{Co}(\text{CN})_6]^{3-}$  has four unpaired electrons and will be in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

**Answer: C**



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35. Which of the following has longest  $C - O$  bond length? (Free  $C - O$  bond length in CO is  $1.128\text{\AA}$ ).



**Answer: D**



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36. The correct increasing order of trans-effect of the following species is

A.  $d^9$

B.  $d^7$

C.  $d^8$

D.  $d^4$

**Answer: C**

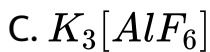


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**37.** Jahn - Teller effect is not observed in high spin complexes of

A.  $K[AlF_3H]$

B.  $K_3[AlF_3H_3]$



**Answer: C**

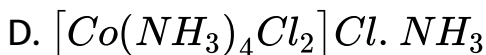
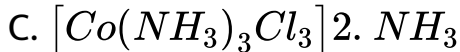
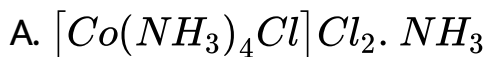
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**38.**  $AlF_3$  is soluble in  $HF$  only in presence of  $KF$ . It is due to the formation of

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**Exercise 4**

1. One mole of complex compound  $Co(NH_3)_5Cl_3$  gives 3 moles of ions on dissolution in water. One mole of same complex reacts with two moles of  $AgNO_3$  to yield two moles of  $AgCl(s)$ . The complex is:



**Answer: B**



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2. The primary and secondary valencies of chromium in the complex ion, dichlorodioxalatochromium (III), are respectively

A. 3,4

B. 4,3

C. 3,6

D. 6,3

**Answer: C**



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3. In the complex with formula  $MCl_3 \cdot 4H_2O$  the coordination number of the metal M is six. And there is a no molecule of hydration in it. The volume of 0.1 M  $AgNO_3$  solution needed to precipitate the free chloride ions in 200 ml of 0.01 M solution of the complex is

A. 40ml

B. 20ml

C. 60ml

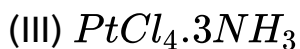
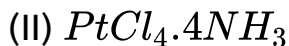
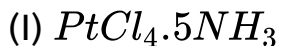
D. 80ml

**Answer: B**



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4. The molar ionic conductances of octahedral complexes.



A.  $I < III < IV$

B.  $IV < III < II < I$

C.  $III < IV < II < I$

D.  $IV < III < I < III$

**Answer: B**



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5. The coordination number of a central metal atom in a complex is determined by:

- A. the number of ligands around a metal ion bonded by sigma bonds
- B. the number of ligands around a metal ion bonded by  $\pi$  -bonds
- C. the number of ligands around a metal ion bonded by sigma and pi bonds both.
- D. the number of only anionic ligands bonded to the metal ion.

**Answer: A**



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6. Among the following which are ambidentate ligands?

(a)  $\text{NO}_2^-$  (b)  $\text{NO}_3^-$  (c)  $\text{EDTA}^+$

(d)  $\text{C}_2\text{O}_4^{2+}$  (e)  $\text{SCN}^-$  (f)  $\text{H}_2\text{NCH}_2\text{CH}_2\text{NH}_2$

A. a and b

B. c and d

C. a and f

D. a and e

**Answer: D**



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7. The number of donor sites in dimethyl glyoxime, glycinato, diethylene triamine and *EDTA* are respectively

(a) 2, 2, 3 and 4

(b) 2, 2, 3 and 6

(c) 2, 2, 2 and 6

(d) 2, 3, 3 and 6 .

A. 2,2,3 and 6

B. 2,2,3 and 4

C. 2,2,2 and 6

D. 2,3,3 and 6

**Answer: A**



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8. The IUPAC name of the coordination compound  $K_3[Fe(CN)_6]$  is:

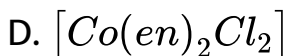
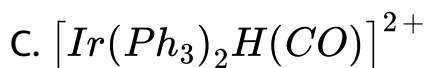
- A. potassium hexacyanoferrate (II)
- B. potassium hexacyanoferrate (III)
- C. potassium hexacyanoiron (II)
- D. tripotassium hexacyanoiron (II)

**Answer: B**



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9. Which one of the following has largest number of isomers?

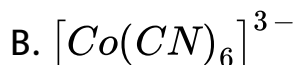
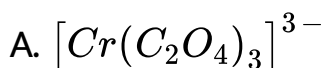


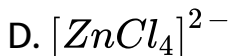
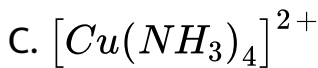
**Answer: D**



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**10.** Which of the following compounds shows optical isomerism?

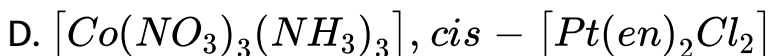
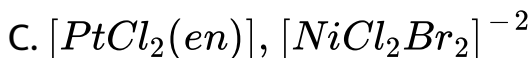
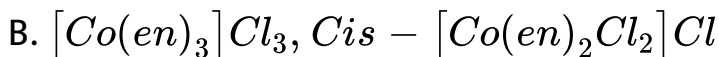
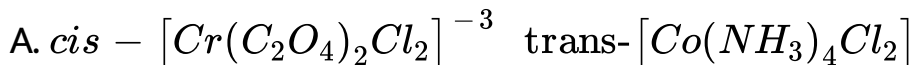




**Answer: A**

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**11.** In which of the following pairs both the complexes do not show optical isomerism?

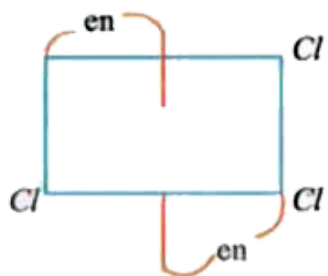




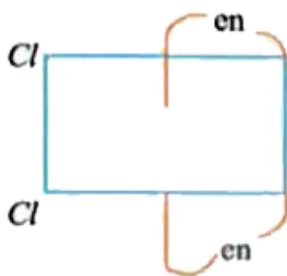
Answer: C

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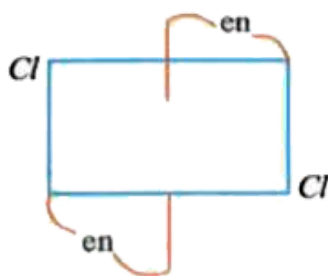
12. Of the following, the optical isomers are



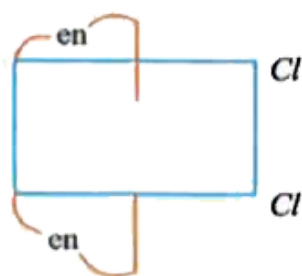
(I)



(II)



(III)



(IV)

A. I and II

B. I and III

C. II and IV

D. II and III

**Answer: C**



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13. Which kind of isomerism is shown by  $Co(NH_3)_4Br_2Cl$

?

A. Optical and isomerism

B. Geometrical and optical

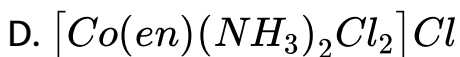
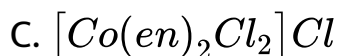
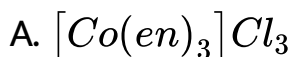
C. Geometrical and ionisation

D. Only geometrical

**Answer: C**

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14. Which of the following does not have optical isomer



**Answer: B**

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15. The complex  $K_3[Fe(CN)_6]$  should have a spin only magnetic of

A.  $\sqrt{48}BM$

B.  $2\sqrt{5}BM$

C.  $\sqrt{35}BM$

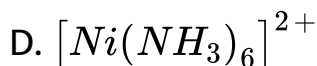
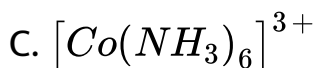
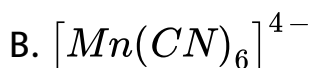
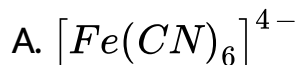
D.  $6BM$

**Answer: C**



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16. Which of the following complex is an outer orbital complex?

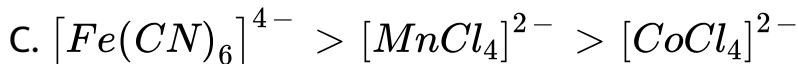
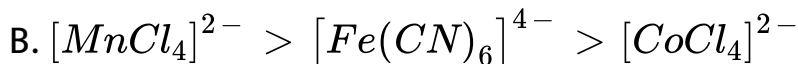
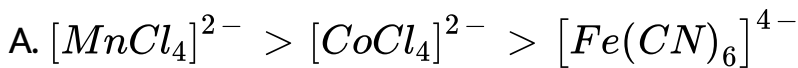


**Answer: D**



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17. The correct order of magnetic moments (spin values in B.M.) among is:



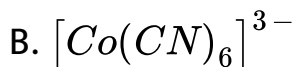
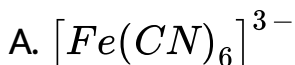
**Answer: B**

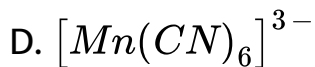
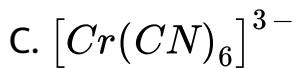


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**18.** Which one of the cyano complexes would exhibit the lowest value of para magnetic behaviour ?

(At. No. Cr = 24, Mn = 25, Fe = 26, Co = 27)





**Answer: B**

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**19.** Which of the following statements is not correct?

A. The complexes  $[NiCl_4]^{2-}$  and  $[Ni(CN)_4]^{2-}$

differ in their magnetic properties

B. The complexes  $[Ni(Cl)_4]^{2-}$  and  $[Ni(CN)_4]^{2-}$

differ in the state of hybridisation of nickel.

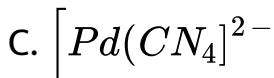
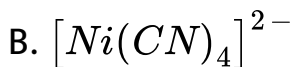
C. The complex  $[Ni(Cl)_4]^{2-}$  and  $[Ni(CN)_4]^{2-}$  differ in geometry.

D. The complexes  $[Ni(Cl)_4]^{2-}$  and  $[Ni(CN)_4]^{2-}$  differ in primary valencies of nickel.

**Answer: D**

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20. The species having tetrahedral shape is





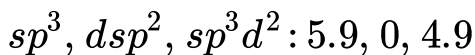


**Answer: D**

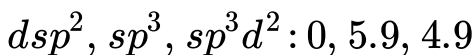
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21.  $[Ni(CN)_4]^{2-}$ ,  $[MnBr_4]^{2-}$  and  $[FeF_6]^{3-}$ . Geometry, hybridisation and magnetic moment of the ions respectively are

A. Tetrahedral, square planar, octahedral:



B. Tetrahedral, square planar, octahedral:



C. Square planar, tetrahedral, octahedral:

$$dsp^2, sp^3, d^2sp^3 : 5, 9, 4.9, 0$$

D. Square planar, tetrahedral, octahedral:

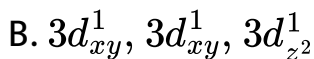
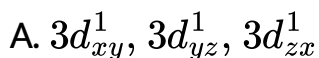
$$dsp^2, sp^3, sp^2d^2 : 0, 5.9, 4.9$$

**Answer: D**



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22.  $[Cr(H_2O)_6]Cl_3$  (at no. of Cr = 24) has a magnetic moment of  $3.83B.M.$  The correct distribution of  $3d$  electrons the chromium of the complex.



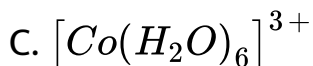
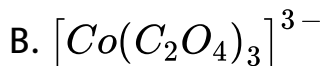
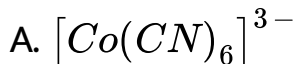
C.  $3d_{(x^2-y^2)^1}, 3d_{z^2}^1, 3d_{xz}^1$

D.  $3d_{xy}^1, 3d_{(x^2-y^2)^1}, 3d_{yz}^1$

**Answer: A**

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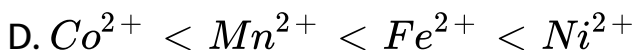
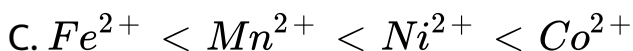
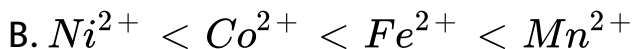
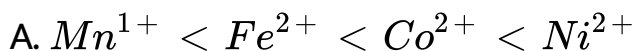
**23.** In which of the following octahedral complexes will the magnitude of  $\Delta_0$  be the highest



**Answer: A**

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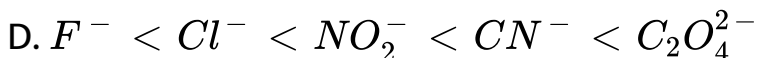
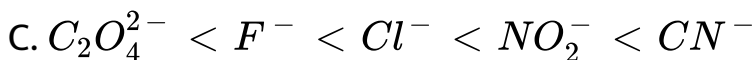
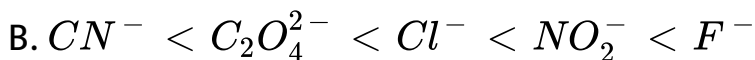
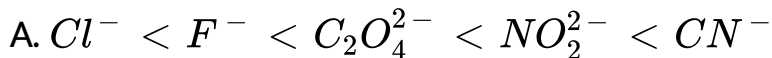
**24.** Which of the following is a correct Irving-Williams order? (Tendency of complex formation)



**Answer: A**

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25. Which of the following order is correct in spectrochemical series of ligands?



**Answer: A**



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26. Which of the following ligands is called  $\pi$ - acceptors?



(I)   (II)   (III)

A. I, II, III

B. I,II only

C. I, III only

D. III only

**Answer: A**



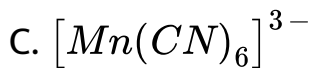
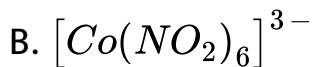
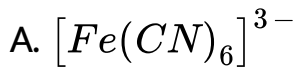
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27. In  $Fe(CO)_5$ , the Fe- C bond possesses



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28. Which is a low spin complex?



D. All of these

**Answer: D**



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**29.** Aqueous solution of  $Ni^{2+}$  contains  $[Ni(H_2O)_6]^{2+}$  and its magnetic moment is 2.83 B.M. When ammonia is added in it, the predicted change in the magnetic moment of solution is:

A. It will remain same

B. It increases from 2.83 B.M.

C. It decreases from 2.83 B.M.

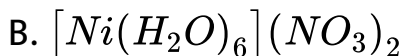
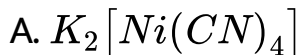
D. It can not be predicted theoretically.

**Answer: A**



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**30.** Which of the following complexes is a paramagnetic complex?



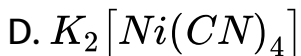
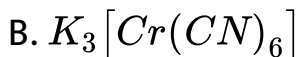
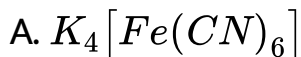




**Answer: B**

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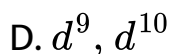
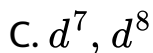
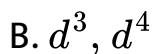
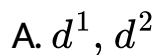
**31. Which of the following are paramagnetic?**



**Answer: B**

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32. Which of the following pairs of d-electron configuration exhibit both low and high spin tetrahedral complex



**Answer: B**



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33. Assign the hybridisation, shape and magnetic moment of  $K_2[Cu(CN)_4]$

A.  $sp^3$  tetrahedral, 1.73 BM

B.  $dsp^2$  square planar, 1.73 BM

C.  $sp^3$  tetrahedral, 2.8 BM

D.  $dsp^2$ , square planar, 2.8 BM

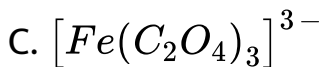
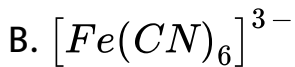
**Answer: B**



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34. Which of the following is most stable.

A.  $[Fe(H_2O)_6]^{3+}$



**Answer: C**



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35. Valence bond theory successfully explains the magnetic behaviour of complexes. The substances which contains unpaired electrons, and paramagnetic character increases as the number of unpaired electrons increases. Magnetic moment of a complex can be determined experimentally and by using formula  $\sqrt{n(n+2)}$  and we can determine the number of unpaired electrons in it. This

information is important in writing the electronic structure of complex which in turn is also useful in deciding the geometry of complex.

The magnetic moments (spin only) of  $[NiCl_4]^{2-}$  and  $[Ni(CN)_4]^{2-}$  are:

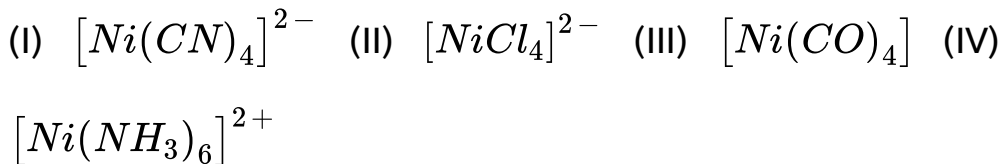
- A. 0,0
- B. 2.82 B.M., 2.82 B.M.
- C. 0,2.82 B.M.
- D. 2.82 B.M., 0

**Answer: D**



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36. There are four complexes of Ni. Select the complexes/es which will be attracted by magnetic field :



A. I only

B. I and IV

C. II, III and IV

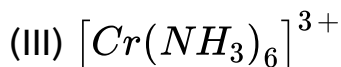
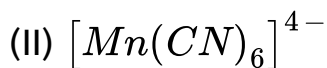
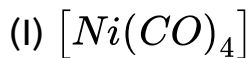
D. II and IV

**Answer: D**



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37. The magnetic moment of complex given below are in the order:



A.  $I > II > III > IV$

B.  $I < II < III < IV$

C.  $IV > II > I > III$

D.  $IV < II < I < III$

**Answer: B**



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38. The magnetic moments of  $[Cu(NH_3)_4]^{2+}$  was found to be 1.73 B.M. The number of unpaired electrons in the complex is:

A. 0

B. 1

C. 2

D. 3

**Answer: B**



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**39.** When two or more simple salts are mixed in stoichiometric proportions and allowed to crystallise together, crystals of new compounds are formed. The new compound is known as addition compound.

The addition compound is a

- A. double salt only
- B. coordination compound only
- C. either double salt or coordination compound
- D. mixture of two salts

**Answer: C**

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40. Mohr's salt on dissociation in water gives

A. positive test for  $Fe^{2+}$

B. positive test for  $Fe^{2+}$  and  $SO_4^{2-}$

C. positive test for  $Fe^{3+}$ ,  $SO_4^{2-}$  and  $NH_4^+$

D. positive test for  $Fe^{2+}$ ,  $NH_4^+$  and  $SO_4^{2-}$

**Answer: D**

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41. Complex compound is made up of

A. simple cation and complex anion

B. complex cation and simple anion

C. complex cation and complex anion

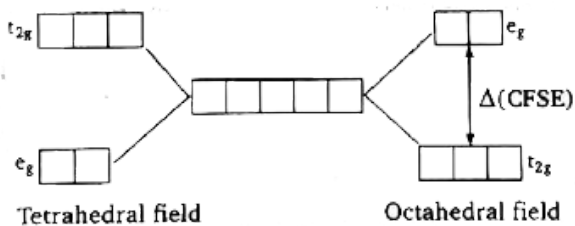
D. all of these

**Answer: D**



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42. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two sets  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2})$  are either stabilized or destabilized depending upon the nature of magnetic field. It can be expressed diagrammatically as:



Value of CFSE depends upon nature of ligand and a spectrochemical series has been made experimentally, for tetrahedral complexes,  $\Delta$  is about  $4/9$  times to  $\Delta_0$  (CFSE for octahedral complex). this energy lies in visible region and i.e., why electronic transition are responsible for colour. such transition are not possible with  $d^0$  and  $d^{10}$  configuration.

Q. The extent of crystal field splitting in octahedral complexes of the given metal with particular weak field ligand are:

- A. the nature of the metal cation
- B. nature of the ligands

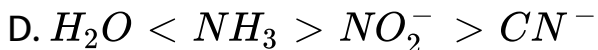
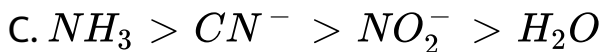
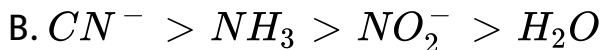
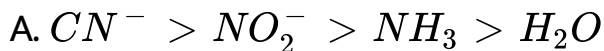
C. geometry of the complex

D. all of these

**Answer: D**

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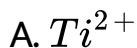
**43.** The reducing power of the metal decreases in the order:



**Answer: A**

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44. Which of these species has same number of unpaired electrons with weak field as well as with strong field ligands.



D. All of these

**Answer: D**

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45. Why are low spin tetrahedral complexes not formed ?

- A. For tetrahedral complexes, the CFSE is lower than pairing energy
- B. For tetrahedral complexes, the CFSE is higher than pairing energy.
- C. Electrons do not to in case of tetrahedral complexes
- D. Tetrahedral complexes are formed by weak field ligands only

**Answer: A**



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46. Value of CFSE, in tetrahedral complex having  $3d^4$  configuration of metal ion, surrounded by weak field ligands. will be

A.  $-\frac{2}{5} \Delta_t$

B.  $+\frac{2}{5} \Delta_t$

C.  $-\frac{4}{5} \Delta_t$

D.  $+\frac{3}{5} \Delta_t$

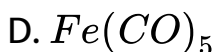
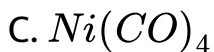
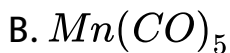
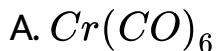
**Answer: A**



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47. The non-existent metal carbonyl among the following is`



**Answer: A::B::C**



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48. The  $\pi$  - bounded organometallic compound which has ethylene as one of its component is

A. Zeise's salt

B. ferrocene

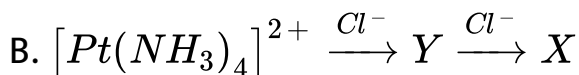
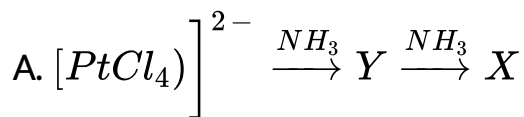
C. dibenzene chromium

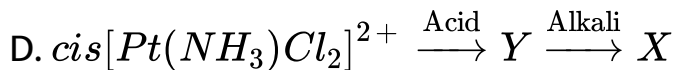
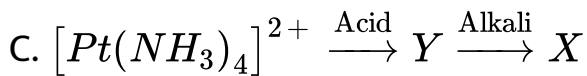
D. tetraethyl tin

**Answer: A**

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**49.** If 'X' is a Anti cancerous drug which of the following conversions will give 'X'





**Answer: A::B::C::D**

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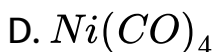
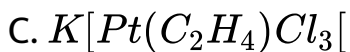
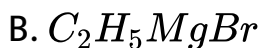
50. Which of the following configuration will not give Jahn-teller distortion ( In both HS & LS complexes ) ?



**Answer: A**

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**51.** Which of the following does not have a metal carbon bond?



**Answer: A**

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52.  $Fe_4[Fe(CN)_6]_3$  a blue coloured complex. Average oxidation number of Fe in  $Fe_4[Fe(CN)_6]_3$  is 'a', oxidation number of central iron atom 'b', oxidation number of counter iron atom 'c', a, b, c are respectively:

A.  $+\frac{5}{2}$ , + 2, + 3

B.  $+\frac{5}{2}$ , + 3, + 2

C.  $+\frac{18}{7}$ , + 2, + 3

D.  $+\frac{18}{7}$ , + 3, + 2

**Answer: A**



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53. Magnetic moment (spin only) of octahedron complex having  $SFSE = -0.8\Delta_0$  and surrounded by weak field ligands can be:

A. 4.9 B.M.

B. 3.87 B.M.

C. 5.91 B.M.

D. 0

**Answer: A**



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54. Given that maximum absorption for d-d transition in  $[Ti(H_2O)_6]^{3+}$  occurs at  $20300\text{ cm}^{-1}$  predict where the peak (d-d transition) will occur for  $[Ti(CN)_6]^{3-}$  and  $[Ti(CI)_6]^{3-}$  respectively:

A.  $2300\text{ cm}^{-1}$ ,  $32000\text{ cm}^{-1}$

B.  $18000\text{ cm}^{-1}$ ,  $21300\text{ cm}^{-1}$

C.  $23000\text{ cm}^{-1}$ ,  $17300\text{ cm}^{-1}$

D.  $18000\text{ cm}^{-1}$ ,  $17300\text{ cm}^{-1}$

**Answer: A**



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55. The CFSE for octahedral  $[CoCl_6]^{4-}$  is  $18,000\text{cm}^{-1}$ .

The CFSE for tetrahedral  $[CoCl_4]^{2-}$  will be

A.  $18,000\text{cm}^{-1}$

B.  $16,000\text{cm}^{-1}$

C.  $8,000\text{cm}^{-1}$

D.  $20,000\text{cm}^{-1}$

**Answer: C**



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56. Which of the following ion does not exist

A.  $[CuI_4]^{2-}$





**Answer: A**

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57. Low spin complex of  $d^6$ -cation in an octahedral field will have the following energy:

A.  $-\frac{2}{5} \Delta_0 + 2P$

B.  $-\frac{2}{5} \Delta_0 + P$

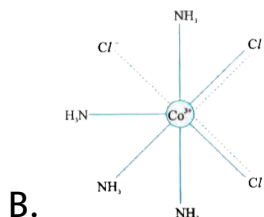
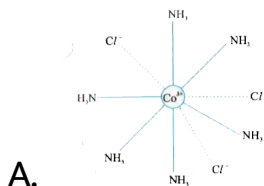
C.  $\frac{-12}{5} \Delta_0 + P$

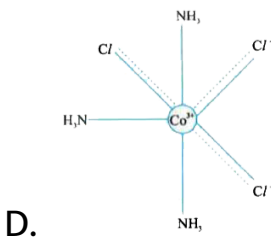
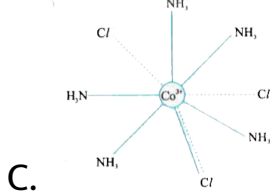
$$D. \frac{-12}{5} \Delta_0 + 3P$$

Answer: D

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58. Which of the following complex (Werner presentation) have minimum electrical conductance in aqueous solution

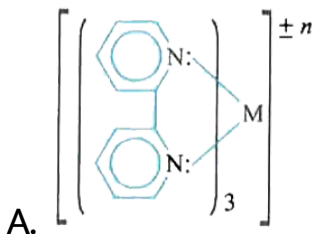


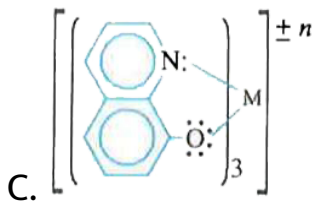
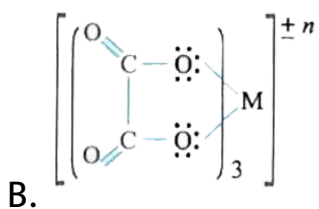


**Answer: D**

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59. Which of the following octahedral complexes shown geometrical as well as optical isomerism





D. None

**Answer: C**

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60. The coordination number of Fe in  $\left[ \text{Fe}(\eta^5 - \text{C}_5\text{H}_5)_2 \right]$  is  $2x$ . Then  $x$  will be \_\_\_\_\_

A. 2

B. 1

C. 5

D. 6

**Answer: C**



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