

## CHEMISTRY

### BOOKS - VK JAISWAL CHEMISTRY (HINGLISH)

### CO-ORDINATION COMPOUNDS

#### LEVEL 1

1. The common features among the species  $CN^-$ ,  $CO$  and  $NO^+$
- A. bond order three and diamagnetic
  - B. Bond order three and weak field ligands
  - C. Paramagnetic and strong field ligands
  - D. Paramagnetic and  $\pi$ -acceptor ligands

**Answer: A**



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2.  $Ni^{+}$  ion can be estimated by using dimethyl glyoxime and forms a cherry-red precipitate. The complex is stabilized by:

- A. Ionic bonds
- B. Coordinate covalent bonds
- C. Dative  $\pi$ -bonds
- D. Hydrogen bonds

**Answer: D**



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3. Ammonia forms the complex  $[Cu(NH_3)_4]^{2+}$  with copper ions in alkaline solution but not in acid solution. The reasons for it is:

- A. In alkaline solution  $\text{Cu}(\text{OH})_2$  is precipitated which is soluble in excess of alkali
- B. Copper hydroxide is amphoteric substance
- C. In acidic solution hydration protects  $\text{Cu}^{2+}$  ions.
- D. In acidic solution protons are coordinated with ammonia molecules forming  $\text{NH}_4^+$  ion.

**Answer: D**



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4. EAN of a metal carbonyl  $\text{M}(\text{CO})_x$  is 36. If atomic number of metal M is 26, what is the value of x?

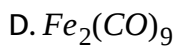
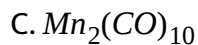
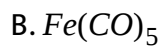
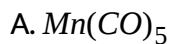
- A. 5
- B. 4
- C. 6

D. none of these

**Answer: C**

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5. Which of the following is an oxidizing agent?



**Answer: A**

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6. The effective atomic number of  $\text{Co}(\text{CO})_4$  is 35 and hence is less stable.

It attains stability by

A. Oxidation of Co

B. Reduction of Co

C. Dimerisation

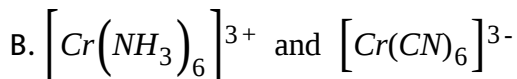
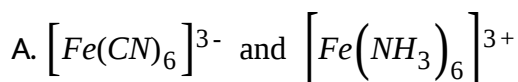
D. Both (b) and (c)

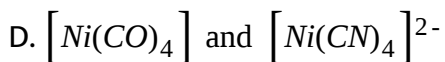
**Answer: D**



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7. In which of the following pair the EAN of central metal atom is not same ?





**Answer: D**

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8.  $[PdCl_2(PMe_3)_2]$  is a diamagnetic complex of Pd (II). How many unpaired electrons are present in analogous complex of Ni (II)?

A. Zero

B. 1

C. 2

D. 3

**Answer: C**

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

A.  $\sqrt{15}$  BM

B.  $\sqrt{8}$  BM

C. (a) and (b) both

D. none of these

**Answer: C**

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10. Consider the following complex  $\left[Co(NH_3)_5CO_3\right]ClO_4$

The coordination number, oxidation number number of d-electrons and number of unpaired d-electrons on the metal are respectively

A. 6,2,7,3

B. 7,2,7,1

C. 5,3,6,4

D. 6,3,6,0

**Answer: D**

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11. Consider the following complex  $\left[Co(NH_3)_5CO_3\right]ClO_4$

The coordination number, oxidation number number of d-electrons and number of unpaired d-electrons on the metal are respectively

A.

Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
6	3	6	0

B.

Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
7	2	7	1

C.

Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
7	1	6	4

D.

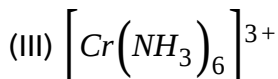
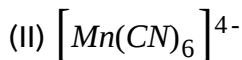
Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
6	2	7	3

**Answer: A**



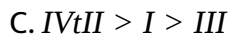
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**12.** The magnetic moment of complex given below are in the order:



A. IgtIIgtIIIgtIV

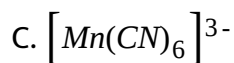
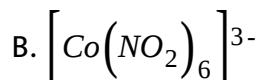
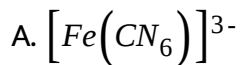
B.  $I < II < III < IV$



**Answer: B**

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**13. Which is a low spin complex?**

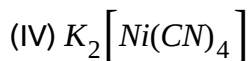
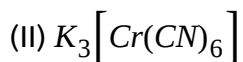
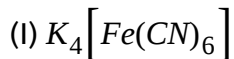


D. all of these

**Answer: D**

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14. Which of the following are diamagnetic?



Select the correct answer using the codes given below:

A. I, II and IV

B. I, III and IV

C. II and III

D. I and IV

**Answer: B**



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15. The spin magnetic moment of cobalt in the compound  $Hg[Co(SCN)_4]$  is

A.  $\sqrt{3}$

B.  $\sqrt{8}$

C.  $\sqrt{15}$

D.  $\sqrt{24}$

**Answer: C**



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16. The species having tetrahedral shape is



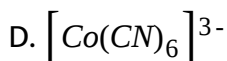
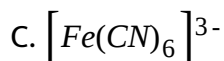
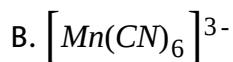
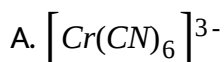




**Answer: D**

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17. Which one of the following has lowest value of paramagnetic behaviour?



**Answer: D**

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18. Which of the following statements is correct?

- A.  $[CoF_6]^{3-}$  and  $[Co(NH_3)_6]^{3+}$  both are paramagnetic complexes
- B.  $[CoF_6]^{3-}$  and  $[Co(NH_3)_6]^{3+}$  both are high spin complexes
- C.  $[CoF_6]^{3-}$  is octahedral while  $[Co(NH_3)_6]^{3+}$  has a pentagonal pyramid shape
- D.  $[CoF_6]^{3-}$  is outer orbital complex while  $[Co(NH_3)_6]^{3+}$  is inner orbital complex

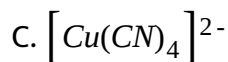
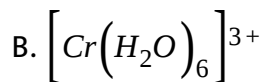
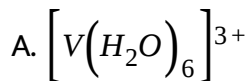
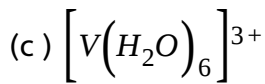
Answer: D



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19. The magnetic moment of a complex ion is  $2.83BM$ . The complex ion is

- (a)  $[Cr(H_2O)_6]^{3+}$
- (b)  $[Cu(CN)_6]^{2-}$

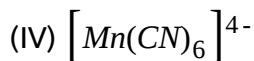
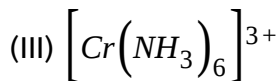
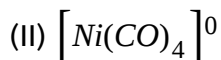
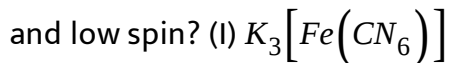


**Answer: A**



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**20.** Which of the following complex compound(s) is/are paramagnetic



A. I

B. II

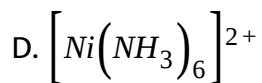
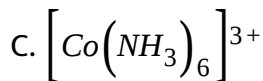
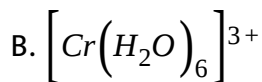
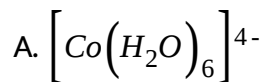
C. III

D. IV

**Answer: A and C**

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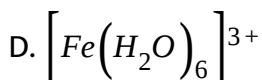
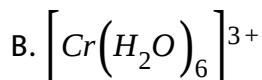
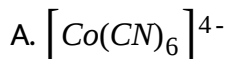
**21. The diamagnetic species is:**



**Answer: C**

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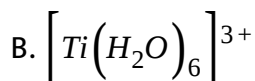
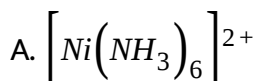
22. The species which has four unpaired electron is:

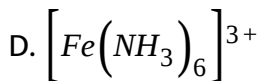
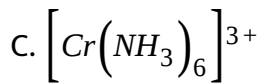


Answer: C

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23. Which of the following is a low spin (spin-paired) complex?





**Answer: D**

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24. The structure of  $K\left[PtCl_3(C_2H_5)\right]$  and hybridisation of Pt respectively are:

A. square planar,  $sp^2d^2$

B. square planar,  $dsp^2$

C. tetrahedral,  $sp^3$

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

**Answer: B**

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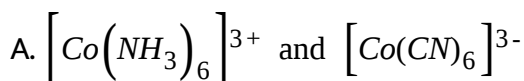
25. For which of the following types of ions is the number of unpaired electrons in octahedral complexes fixed at the same number as in the free ion no matter, how weak or strong the crystal field is?

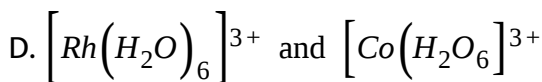
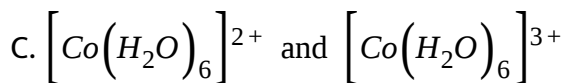
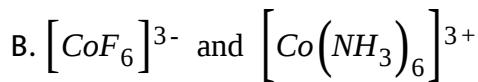


**Answer: A**

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26. Among the following pairs of complexes, in which case the  $\Delta_0$  value is higher for the first one?





**Answer: D**

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27. Dimethyl glyoxime forms a square planar complex with  $Ni^{2+}$ . This complex should be :

A. diamagnetic

B. paramagnetic having 1 unpaired electron

C. Paramagnetic having 2 unpaired electrons

D. ferromagnetic

**Answer: A**

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28. What is the magnetic moment ( spin only) and hybridisation of the brown ring complex  $\left[ Fe(H_2O)_5NO \right] SO_4$ ?

A.  $\sqrt{3}BM, sp^3d^2$

B.  $\sqrt{3}BM, d^2sp^3$

C.  $\sqrt{15}BM, sp^3d^2$

D.  $\sqrt{15}BM, d^2sp^3$

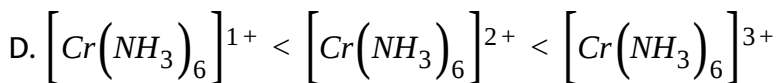
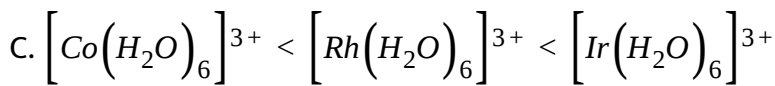
Answer: C

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29. Choose incorrect stability order:

A.  $\left[ Cu(NH_3)_4 \right]^{2+} < \left[ Cu(en)_2 \right]^{2+} < \left[ Cu(trien) \right]^{2+}$

B.  $\left[ Fe(H_2O)_6 \right]^{3+} < \left[ Fe(NO_2)_6 \right]^{3-} < \left[ Fe(NH_3)_6 \right]^{3+}$



**Answer: B**

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30. Aqueous solution of  $Ni^{2+}$  contains  $\left[Ni(H_2O)_6\right]^{2+}$  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 BM
- C. it decreases from 2.83 BM
- D. It cannot be predicated theoretically

**Answer: A**

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31. The correct order of energies of d-orbitals of metal ion in a square planar complex is

A.  $d_{xy} = d_{yz} = d_{zx} > d_{x^2-y^2} = d_{z^2}$

B.  $d_{x^2-y^2} = d_{z^2} > d_{xy} = d_{yz} = d_{zx}$

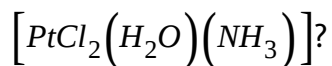
C.  $d_{x^2-y^2} > d_{z^2} > d_{xy} = d_{yz} = d_{zx}$

D.  $d_{x^2-y^2} > d_{xy} > d_{z^2} > d_{zx} = d_{yz}$

Answer: D

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32. Which of the following is true about the complex



A. It exhibits geometrical isomerism

- B. It is paramagnetic complex
- C. its geometry is tetrahedron
- D. platinum is  $sp^3$  hybridised

**Answer: A**

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33. The crystal field stabilisation energy of  $[Co(NH_3)_6]Cl_3$  is:

- A.  $-7.2\Delta_0$
- B.  $-0.4\Delta_0$
- C.  $-2.4\Delta_0$
- D.  $-3.6\Delta_0$

**Answer: C**

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34. The magnitude of crystal field stabilisation energy in octahedral field depends on:

(I) the nature of the ligand

(II) the charge on the metal ion.

(III) whether the metal is in the first, second or third row of the transition elements

A. I, II, III only correct

B. I, II only correct

C. II, III only correct

D. III only correct

**Answer: A**



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35. Complex compound  $[Cr(NCS)(NH_3)_5][ZnCl_4]$  will be,

- A. colourless and diamagnetic
- B. green coloured and diamagnetic
- C. green coloured and shows coordination isomerism
- D. diamagnetic and shows linkage isomerism

**Answer: C**

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**36.** The most stable ion is:

- A.  $\left[Fe(C_2O_4)_3\right]^{3-}$
- B.  $\left[Fe(CN)_6\right]^{3-}$
- C.  $\left[Fe(CN)_6\right]^{4-}$
- D.  $\left[Fe(H_2O)_6\right]^{3+}$

**Answer: B**

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37. In the complex  $K_2Fe[Fe(CN)_6]$ :

- A. both Fe atoms are in the same oxidation state
- B. Both Fe atoms are in different oxidation state
- C. the coordination number of ion is 4
- D. the complex is a high spin complex

Answer: A



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38. In  $Na_2[Fe(CN)_5NO]$ , sodium nitroprusside:

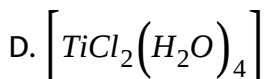
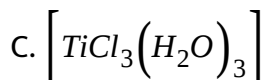
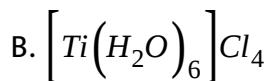
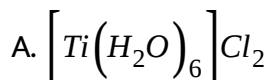
- A. oxidation state of Fe is +2
- B. this has  $NO^+$  as ligand
- C. both are correct

D. none is correct

**Answer: C**

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39. An aqueous solution of titanium bromide shows zero magnetic moment. Assuming the complex as octahedral in aqueous solution, the formula of the complex is .



**Answer: B**

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40. Which of the following pairs of complexes are isomeric with each other but their aqueous solutions exhibit different molar conductivities ?

- A.  $\left[PtCl_2(NH_3)_4\right]Br_2$  and  $\left[PtBr_2(NH_3)_4\right]Cl_2$
- B.  $\left[CoCl_2(NH_3)_4\right]NO_2$  and  $\left[CoCl(NO_2)(NH_3)_4\right]Cl$
- C.  $\left[Co(NO_2)(NH_3)_5\right]Cl_2$  and  $\left[Co(ONO)(NH_3)_5\right]Cl_2$
- D.  $\left[CoBr(NH_3)_5\right]SO_4$  and  $\left[Co(SO_4)(NH_3)_5\right]Br$

Answer: D

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41. The Compounds  $\left[Cr(H_2O)_6\right]Cl_3$ ,  $\left[Cr(H_2O)_5Cl\right]Cl_2 \cdot H_2O$  and  $\left[Cr(H_2O)_4Cl_2\right] \cdot 2H_2O$  exhibit

- A. linkage isomerism
- B. geometrical isomerism

C. ionization isomerism

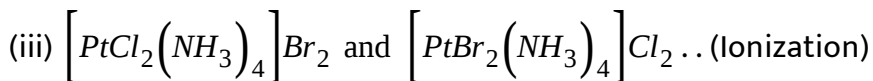
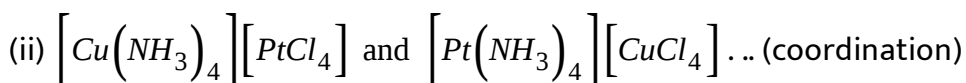
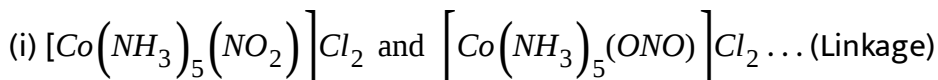
D. hydrate isomerism

**Answer: D**



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**42.** Which one of the following pairs of isomers and types of isomerism are correctly matched?



Select the correct answer using the codes given below:

A. (ii) and (iii)

B. (i), (ii) and (iii)

C. (i) and (iii)

D. (i) and (ii)

**Answer: B**

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43. The two compounds sulphato penta-ammine cobalt (III) bromide and sulphato penta-ammine cobalt (III) chloride represent:

- A. Linkage isomerism
- B. Ionization isomerism
- C. Coordination isomerism
- D. No isomerism

**Answer: D**

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44. Select the correct code about complex  $\left[Cr(NO_2)(NH_3)_5\right]\left[ZnCl_4\right]$ :

(I) IUPAC name of compound is pentaamminenitrito-*N* - chromium (III)

tetrachlorozincate (II)

(II) It shows geometrical isomerism

(III) It shows linkage isomerism

(IV) It shows coordination isomerism`

A. III, IV

B. I, III, IV

C. II, III and IV

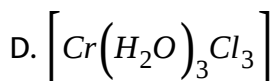
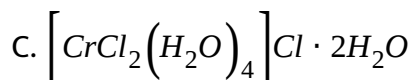
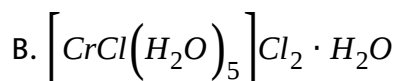
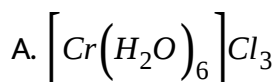
D. I, II, III and IV

**Answer: B**



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45. A six coordination complex of formula  $CrCl_3 \cdot 6H_2O$  has green colour. A 0.1 M solution of the complex when treated with excess of  $AgNO_3$  gas 28.7g of white precipitate. The formula of the complex would be:



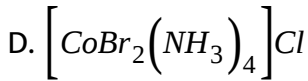
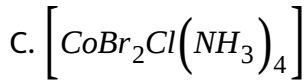
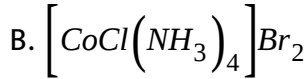
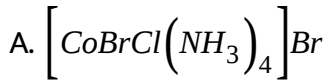
**Answer: B**

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46. A complex has a composition corresponding to the formula  $CoBr_2Cl.4NH_3$ . What is the structural formula if conductance

measurements show two ions per formula unit ? Silver nitrate solution

given an immediate precipitate of AgCl but AgBr :-



**Answer: D**



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47. A mixture  $x$  containing 0.02 mol of  $\left[ \text{Co}(\text{NH}_3)_5\text{SO}_4 \right] \text{Br}$  and 0.02 mol of  $\left[ \text{Co}(\text{NH}_3)_5\text{Br} \right] \text{SO}_4$  was prepared in 2L of solution.

1L of mixture  $X$  + excess  $\text{AgNO}_3 \rightarrow Y$

1L of mixture  $X$  + excess  $\text{BaCl}_2 \rightarrow Z$

The number of moles of  $Y$  and  $Z$  are

A. 0.01, 0.02

B. 0.02, 0.01

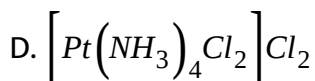
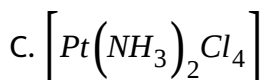
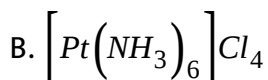
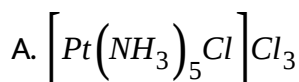
C. 0.01, 0.01

D. 0.02, 0.02

**Answer: C**

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**48.** A complex of platinum, ammonia and chloride produces four ions per molecule in the solution. The structure consistent with the observation is:



**Answer: A**

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

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

**Answer: D**

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50. Which statement about coordination number of a cation is true?

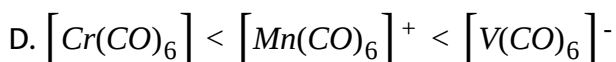
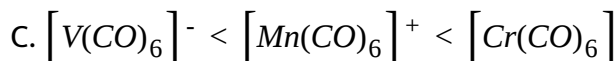
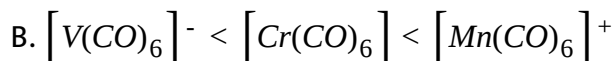
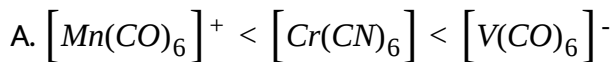
- A. Most metal ions exhibit only a single characteristic coordination number
- B. The coordination number is equal to the number of ligands bonded to the metal atom
- C. the coordination number is determined solely by the tendency to surround the metal atom with the same number of electrons as one of the rare gases
- D. For most cations, the coordination number depends on the size, and charge of the cation.

**Answer: D**



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51. In the Iso-electronic series of metal carbonyls, the C-O bond strength is expected to increase in the order:-



Answer: D



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52. Which is not true about metal carbonyls?

A. Here CO acts as a Lewis base as well Lewis acid

B. here metal acts as lewis base as well as lewis acid

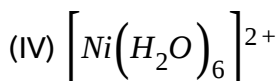
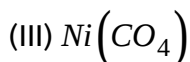
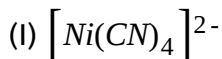
C. here  $d\pi - p\pi$  back bonding takes place

D. Here  $p\pi - p\pi$  back bonding takes place

**Answer: D**

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**53.** There are four complexes of Ni. Select the complex(es) which will be attracted by magnetic field:



A. I only

B. IV only

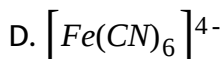
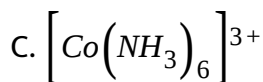
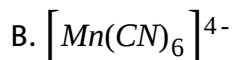
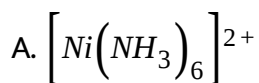
C. II, III and IV

D. II and IV

**Answer: D**

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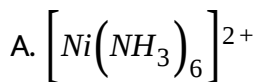
**54.** Which of the following complex is an outer orbital complex?

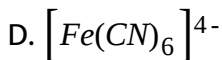
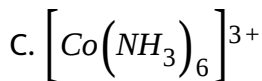
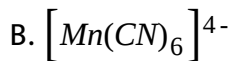


**Answer: A**

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**55.** Which of the following complex is an outer orbital complex?





**Answer: A**

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56. The magnetic moment of  $[MnX_4]^{2-}$  is 5.9 BM. The geometry of the complex ion is: (X=monodentate halide ion)

A. tetrahedral

B. square planar

C. both are possible

D. none of these

**Answer: A**

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57. The geometry of  $[Ni(CO)_4]$  and  $[NiCl_2(PPh_3)_2]$  are :

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

**Answer: C**

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58.  $[Fe(H_2O)_6]^{2+}$  and  $[Fe(CN)_6]^{4-}$  differ in :

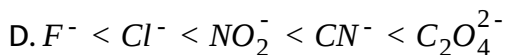
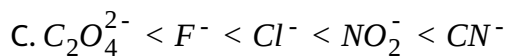
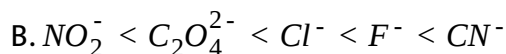
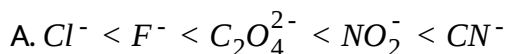
- A. geometry, magnetic moment
- B. geometry, hybridization
- C. magnetic moment, colour

D. hybridization number of d-electrons

**Answer: C**

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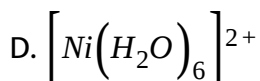
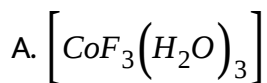
59. Which of the following order is correct in spectrochemical series of ligands?



**Answer: A**

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60. The species with spin only magnetic moment of  $\sqrt{24}$  BM is:

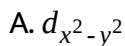


**Answer: A**



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61. For the complexes showing the square pyramidal structure, the d-orbital involved in the hybridisation is:



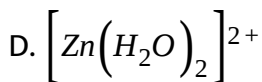
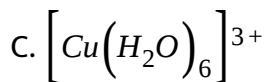
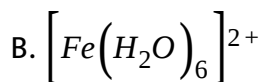
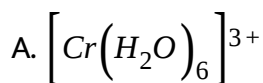


D.  $d_{xz}$

**Answer: A**

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62. Which of the following aquated metal ions has the highest paramagnetism?



**Answer: B**

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63. The hybridization states of the central atom in the complexes

$[Fe(CN)_6]^{3-}$ ,  $[Fe(CN)_6]^{4-}$  and  $[Co(NO_2)_6]^{3-}$  are:

- A.  $d^2sp^3$ ,  $sp^3d^2$  and  $dsp^2$  respectively
- B.  $d^2sp^3$ ,  $sp^3d^2$  and  $sp^3d^2$  respectively
- C.  $d^2sp^3$ ,  $sp^3d^2$  and  $d^2sp^3$  respectively
- D. all  $d^2sp^3$

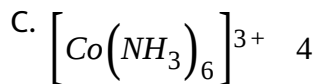
Answer: D

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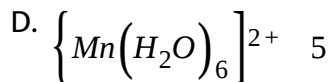
64. Which of the following is incorrectly matched?

- | Complex              | Number of unpaired electrons |
|----------------------|------------------------------|
| A. $[FeF_6]^{3-}$    | 5                            |
| Complex              | Number of unpaired electrons |
| B. $[Cr(en)_3]^{2+}$ | 2                            |

Complex                      Number of unpaired electrons



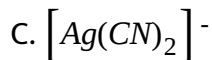
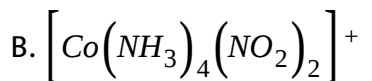
Complex                      Number of unpaired electrons



**Answer: C**

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65. Which of the following complexes have a maximum number of unpaired electrons?



**Answer: D**

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66. The degeneracy of d-orbitals is lost under:

- (I) Strong field ligand
- (II) Weak field ligand
- (III) Mixed field ligand
- (IV) Chelated Ligand field

Choose the correct code:

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

**Answer: C**



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67. The complex ion  $[Fe(CN)_6]^{4-}$  contains:

- A. total of 36 electrons on  $Fe^{2+}$  cation
- B.  $sp^3d^2$  hybrid orbitals with octahedral structure
- C. total of 104 electrons
- D. six sigma bonds

Answer: A

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68. In  $[Pt(NH_3)_2Cl_2]$ , Pt-Cl bond length is 2 Å and Cl-Cl distance is 2.88 Å then the compound is:

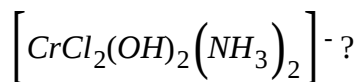
- A. tetrahedral
- B. square pyramidal
- C. cis-square planar

D. trans-square planar

**Answer: C**

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69. Which of the following isomerism, exhibited by



A. Ionization

B. Linkage

C. Geometrical

D. Hydrate

**Answer: C**

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70. Which kind of isomerism is exhibited by octahedral  $\left[Co(NH_3)_4Br_2\right]Cl$ ?

- A. Geometrical and ionization
- B. Geometrical and optical
- C. Optical and ionization
- D. Geometrical only

**Answer: A**



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71. A metal complex of coordination number six having three different types of ligands a, b and c of composition  $Ma_2b_2c_2$  can exist in several geometrical isomeric forms, the total number of such isomers is:

- A. 3

B. 5

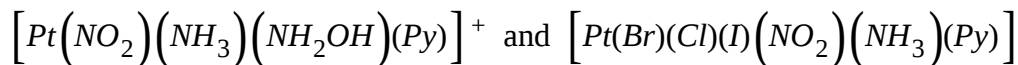
C. 7

D. 9

**Answer: B**

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72. How many geometrical isomers and stereoisomers are possible for



respectively?

A. 3 and 15

B. 3 and 30

C. 4 and 15

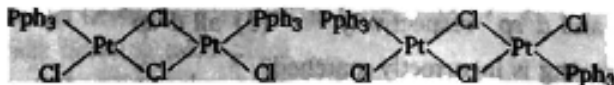
D. 4 and 30

**Answer: B**



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73. Complexes given below show:

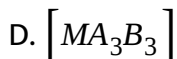
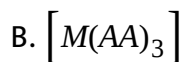
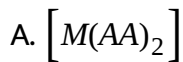


- A. optical isomerism
- B. coordinate isomerism
- C. Geometrical isomerism
- D. Bridge isomerism

**Answer: C**

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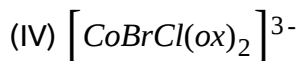
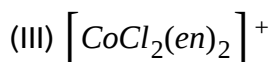
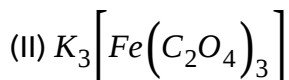
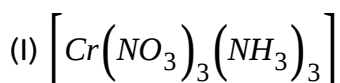
74. Fac, mer isomerism is associated with which of the following general formula ?



**Answer: D**

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**75.** Which of the following will have two stereoisomeric forms?



A. I only

B. I and II

C. III and IV

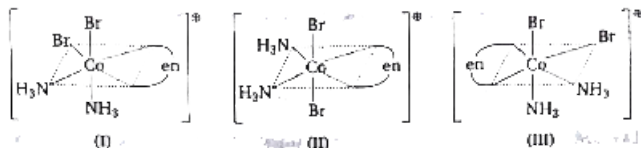
D. All of these

Answer: B

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76. Three arrangements are shown for the complexes

$\left[CoBr_2(NH_3)_2(en)\right]^{\oplus}$ . Which one is wrong statement?



A. I and II are geometrical isomers

B. II and III are optically active isomers

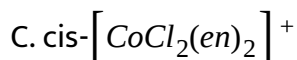
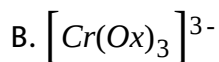
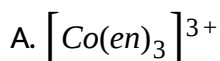
C. I and III are optically active isomers

D. II and III are geometrical isomers

**Answer: B**

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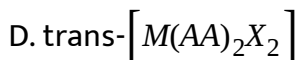
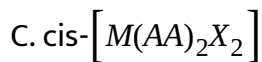
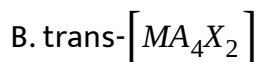
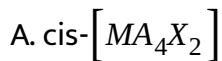
77. Which of the following is not optically active?



**Answer: D**

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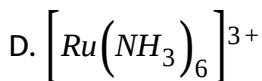
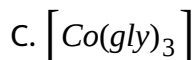
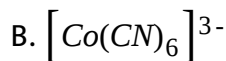
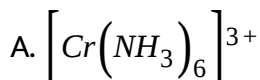
78. Where among the following metal complexes the one which exhibits optical activity is: (AA=bidentate ligand, A, X=monodentate ligand)



**Answer: C**

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**79.** The optically active species among the following is:



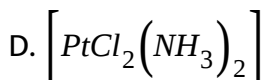
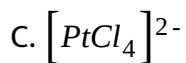
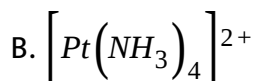
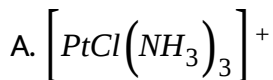
**Answer: C**

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80. Cis-trans isomerism is exhibited by:

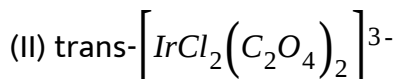
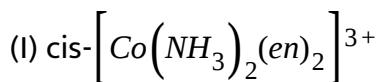


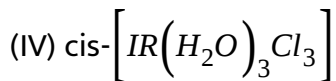
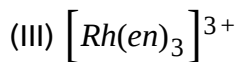
Answer: D



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81. Which of the following will show optical isomers?





A. I, III only correct

B. II, IV only correct

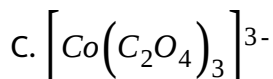
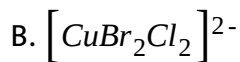
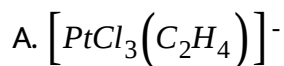
C. I, III, IV only correct

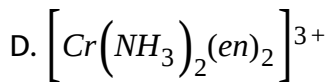
D. III only correct

**Answer: A**

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**82.** The complex with a maximum number of stereoisomers is:





**Answer: D**

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83. A complex with the composition  $[MA_3B]^{n\pm}$  is found to have no geometrical isomers. The possible structure (s) of the complex is (where A and B are monodentate ligands)

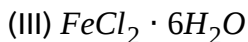
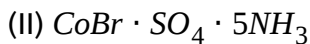
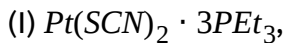
- A. tetrahedral
- B. Square planar
- C. Both (a) and (b)
- D. cannot be predicted

**Answer: C**

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84. Which of the following isomerism is not possible for complexes having molecular formulae?



A. Optical

B. Linkage

C. Ionisation

D. Hydrate

**Answer: A**



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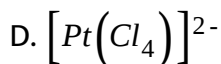
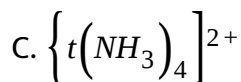
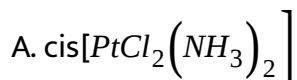
85. Coordination compounds have great importance in biological systems. In this context which of the following statements is incorrect:

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

**Answer: D**

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**86.** Which one of the following platinum complexes is used in cancer chemotherapy?

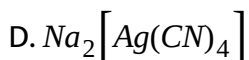
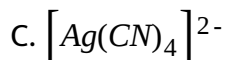
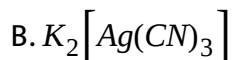
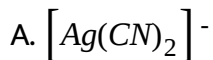


**Answer: A**



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**87.** The cyanide complex of silver formed in the silver extraction in MacArthur's Forrest cyanide process is:



**Answer: A**



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**88.** Complexes formed in the following methods are:

(I) Mond's process for purification of nickel

(II) Removal of unreacted AgBr from photographic plate

(III) Removal of lead poisoning from the body

- I                      II                      III
- A.  $Ni(CO)_4$      $[Ag(CN)_2]^-$      $[Pb(EDTA)]^{2-}$
- I                      II                      III
- B.  $Ni(CO)_4$      $[Ag(S_2O_3)_2]^{3-}$      $[Pb(EDTA)]^{2-}$
- C. (I, II, III),  $(Ni(CO)_6, Ag(S_2O_3)_2)^{3-}$ ,  $([Pb(EDTA)]^{4-})$
- I                      II                      III
- D.  $Ni(CO)_6$      $[Ag(S_2O_3)]^-$      $[Pb(EDTA)]^{2-}$

**Answer: B**

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89. The oxidation state of iron in  $[Fe(H_2O)_5NO]^{2+}$  is

A. +2

B. +3

C. +1

D. 0

**Answer: C**

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90. Oxidation number of Fe in violet coloured complex

$Na_4[Fe(CN)_5(NOS)]$  is :

A. +1

B. +2

C. +3

D. zero

**Answer: B**

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91. The correct name for the complex ion  $[CoCl(ONO)(en)_2]^+$  is:

- A. chlorobis(ethylenediamine)nitrito-O-cobaltate (III) ion
- B. chlorodiethyldiaminenitrito-O-cobalt (III) ion
- C. chloronitrito-O-diethyldiamine cobaltate (III) ion
- D. chlorobis(ethylenediamine) nitrito-O-cobalt (III) ion

Answer: D

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92. IUPAC name of  $[Fe(O_2)(CN)_4Cl]^{4-}$  is:

- A. Chlorotetracyano dioxoferrate (II) ion
- B. Chlorotetracyano peroxyferrate (II) ion
- C. Chlorotetracyano superoxyferrate (II)ion
- D. Tetracyanochloro superoxyferrate (II)ion

**Answer: C**

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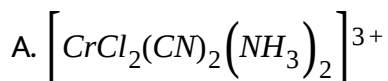
93. The IUPAC name of Wilkinson's catalyst  $\left[ RhCl(PPh_3)_3 \right]$  is

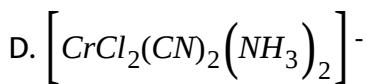
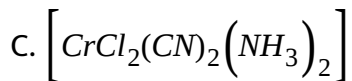
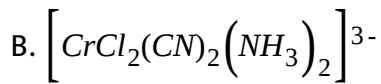
- A. Chlorotris (triphenylphosphine) rhodium (I)
- B. Chlorotris (triphenylphosphine) rhodium (IV)
- C. Chlorotris (triphenylphosphine) rhodium (0)
- D. Chlorotris (triphenylphosphine) rhodium (VI)

**Answer: A**

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94. The correct formula of diammine dichlorodicyano chromate (III) is :-





**Answer: D**

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95. The IUPAC name for  $K_2\left[ Cr(CN)_2O_2(O_2)NH_3 \right]$  is:

- A. Potassium amminedicyanotetraoxo chromium (III)
- B. Potassium amminedicyanodioxogendioxo chromate (IV)
- C. Potassium amminedicyanosuperoxoperoxo chromate (III)
- D. Potassium amminedicyanodioxoperoxo chromate (VI)

**Answer: D**

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96. IUPAC name of  $H_2[PtCl_6]$  is

- A. Hydrogen hexachloroplatinate (IV)
- B. dihydrogen hexachloroplatinate (IV)
- C. hydrogen hexachloroplatinic (IV) acid
- D. hexachloroplatinic (IV) acid

Answer: D



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97. The IUPAC name for  $[PtCl(NH_2CH_3)(NH_3)_2]Cl$  is:

- A. diamminechloro(methylamine)platinum(II)chloride
- B. (dimethylamine)chlorodiamminoplatinum(II)chloride
- C. bis(ammine)chloro(methylamine)platinate(II)chloride

D. diaminechloro(methylamine)platinum(II)chloride

**Answer: A**

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98. The IUPAC nomenclature for the complex  $Na [PtBrCl(NO_2)(NH_3)]$  is:

- A. Sodium amminechlorobromonitro-N-platinum (II)
- B. Sodium nitrochlorobromoammine-N-platinate(II)
- C. Sodium amminebromochloronitro-N-Platinate(II)
- D. Sodium amminebromochloronitro-N-platinum(II)

**Answer: C**

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99. The IUPAC name of  $Xe[PtF_6]$  is:

- A. Hexafluoroplatinate(VI) xenon
- B. Xenonhexafluoroplatinate(IV)
- C. Xenonhexafluoroplatinate(VI)
- D. Xenoniumhexafluoroplatinum(V)

Answer: B



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100. The magnetic moment of  $[NiX_4]^{2-}$  ion is found to be zero. Then the ion is : (X=monodentate anionic ligand)

- A.  $sp^3$  hybridised
- B.  $sp^2$  hybridised
- C.  $dsp^2$  hybridised

D.  $d^2sp$  hybridised

**Answer: C**



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**101.** The hybridised orbitals used by silver in the complex  $[Ag(NH_3)_2]^+$  are of the type:

A.  $sp^2$

B.  $sp$

C.  $sp^3$

D.  $dsp^2$

**Answer: B**



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102. The common features among the species  $CN^-$ ,  $CO$  and  $NO^+$  are

- A. bond order three and diamagnetic
- B. Bond order three and weak field ligands
- C. Paramagnetic and strong field ligands
- D. Paramagnetic and  $\pi$ -acceptor ligands

Answer: A



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103.  $Ni^+$  ion can be estimated by using dimethyl glyoxime and forms a cherry-red precipitate. The complex is stabilized by:

- A. Ionic bonds
- B. Coordinate covalent bonds
- C. Dative  $\pi$ -bonds

## D. Hydrogen bonds

**Answer: D**

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**104.** Ammonia forms the complex  $\left[ \text{Cu}(\text{NH}_3)_4 \right]^{2+}$  with copper ions in alkaline solution but not in acidic solution. The reason for this is

- A. In alkaline solution  $\text{Cu}(\text{OH})_2$  is precipitated which is soluble in excess of alkali
- B. Copper hydroxide is amphoteric substance
- C. In acidic solution hydration protects  $\text{Cu}^{2+}$  ions.
- D. In acidic solution protons are coordinated with ammonia molecules forming  $\text{NH}_4^+$  ion.

**Answer: D**

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105. If EAN of central metal cation  $M^{2+}$  in a non-chelating complex is 36 and atomic no. of metal M is 26, then the number of monodentate ligand in this complex are

- A. 5
- B. 4
- C. 6
- D. none of these

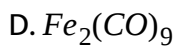
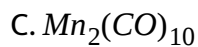
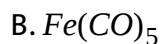
**Answer: C**



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106. Which of the following is an oxidizing agent?

- A.  $Mn(CO)_5$



**Answer: A**

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**107.** An effective atomic number of  $Co(CO)_4$  is 35 and hence is less stable. It attains stability by:

A. Oxidation of Co

B. Reduction of Co

C. Dimerisation

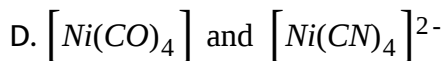
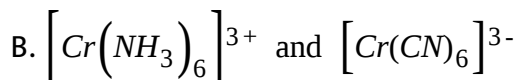
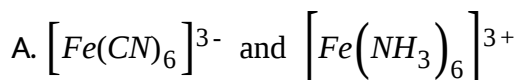
D. Both (b) and (c)

**Answer: D**

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108. Which of the following pair of EAN of central metal atom is not same?



Answer: D



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109.  $[PdCl_2(PMe_3)_2]$  is a diamagnetic complex of Pd (II). How many unpaired electrons are present in analogous complex of Ni (II)?

A. Zero

B. 1

C. 2

D. 3

**Answer: C**

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

A.  $\sqrt{15}$  BM

B.  $\sqrt{8}$  BM

C. (a) and (b) both

D. none of these

**Answer: C**

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111. Consider the following complex:  $\left[Co(NH_3)_5CO_3\right]ClO_4$

The coordination number, oxidation number, no. of d-electrons and number of unpaired d-electrons on the metal are respectively:

A. 6,2,7,3

B. 7,2,7,1

C. 5,3,6,4

D. 6,3,6,0

**Answer: D**



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112. Consider the following:  $\left[Co(CO_3)(NH_3)_5\right]ClO_4$

mark the correct option:

A.

Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
6	3	6	0

B.

Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
7	2	7	1

C.

Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
7	1	6	4

D.

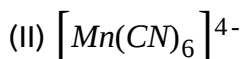
Coordination no.	Oxidation no.	No. of d-electrons	Unpaired d-electron
6	2	7	3

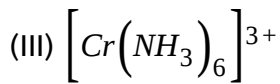
**Answer: A**



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





A. IgtIIgtIIIgtIV

B.  $I < II < III < IV$

C.  $IV > I > III$

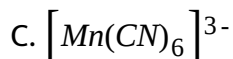
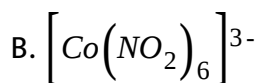
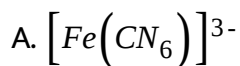
D.  $IV < II < I < III$

**Answer: B**



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**114.** Which is low spin complex?



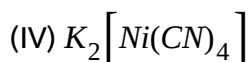
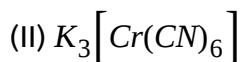
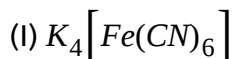
D. all of these

**Answer: D**



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**115.** Which of the following are diamagnetic?



Select the correct answer using the codes given below:

A. I, II and IV

B. I, III and IV

C. II and III

D. I and IV

**Answer: B**



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116. The spin magnetic moment of cobalt in  $Hg[Co(SCN)_5]$  is

A.  $\sqrt{3}$

B.  $\sqrt{8}$

C.  $\sqrt{15}$

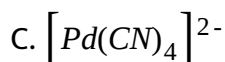
D.  $\sqrt{24}$

Answer: C



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117. The species having tetrahedral shape is

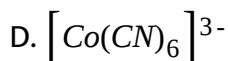
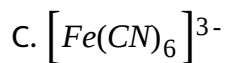
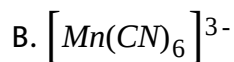
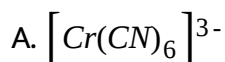




**Answer: D**

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**118.** Which one of the following has lowest value of paramagnetic behaviour?



**Answer: D**

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119. Which of the following statements is correct?

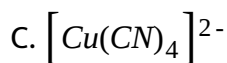
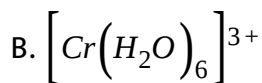
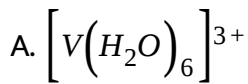
- A.  $[CoF_6]^{3-}$  and  $[Co(NH_3)_6]^{3+}$  both are paramagnetic complexes
- B.  $[CoF_6]^{3-}$  and  $[Co(NH_3)_6]^{3+}$  both are high spin complexes
- C.  $[CoF_6]^{3-}$  is octahedral while  $[Co(NH_3)_6]^{3+}$  has a pentagonal pyramid shape
- D.  $[CoF_6]^{3-}$  is outer orbital complex while  $[Co(NH_3)_6]^{3+}$  is inner orbital complex

Answer: D

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120. Consider that a  $d^6$  metal ion ( $M^{2+}$ ) forms a complex with aqua ligands, and the spin only magnetic moment of the complex is 4.90 BM. The geometry and the crystal field stabilization energy of the complex is

:

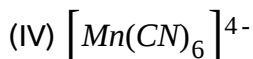
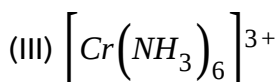
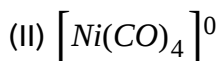


**Answer: A**



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**121.** Which of the following complex compound(s) is/are paramagnetic and low spin? (I)  $K_3[Fe(CN)_6]$



A. I only

B. II and III

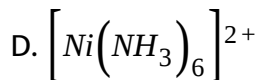
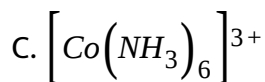
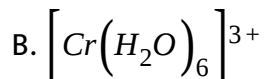
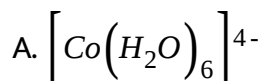
C. I and IV

D. IV only

**Answer: C**

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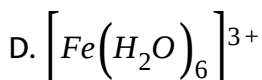
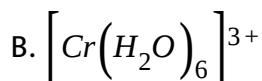
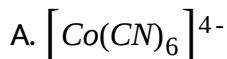
**122.** The diamagnetic species is:



**Answer: C**

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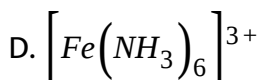
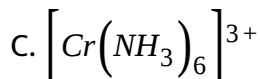
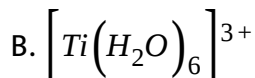
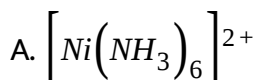
123. The species which has four unpaired electron is:



Answer: C

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124. Which of the following is a low spin (spin-paired) complex?



**Answer: D**

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**125.** The structure of  $K[PtCl_3(C_2H_4)]$  and hybridisation of Pt respectively are:

A. square planar,  $sp^2d^2$

B. square planar,  $dsp^2$

C. tetrahedral,  $sp^3$

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

**Answer: B**

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**126.** For which of the following types of ions is the number of unpaired electrons in octahedral complexes fixed at the same number as in the

free ion no matter, how weak or strong the crystal field is?

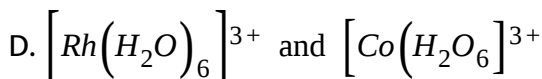
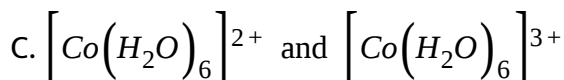
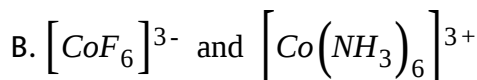
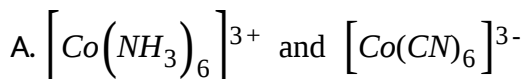


**Answer: A**



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**127.** Among the following pairs of complexes, in which case the  $\Delta_0$  value is higher for the first one?



**Answer: D**



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**128.** Dimethyl glyoxime forms a square planar complex with  $Ni^{2+}$ . This complex should be :

- A. diamagnetic
- B. paramagnetic having 1 unpaired electron
- C. Paramagnetic having 2 unpaired electrons
- D. ferromagnetic

**Answer: A**



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129. What is the magnetic moment ( spin only) and hybridisation of the brown ring complex  $\left[Fe(H_2O)_5NO\right]SO_4$ ?

A.  $\sqrt{3}BM, sp^3d^2$

B.  $\sqrt{3}BM, d^2sp^3$

C.  $\sqrt{15}BM, sp^3d^2$

D.  $\sqrt{15}BM, d^2sp^3$

Answer: C

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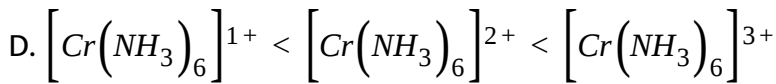
130. Choose incorrect stability order:

A.  $\left[Cu(NH_3)_4\right]^{2+} < \left[Cu(en)_2\right]^{2+} < [Cu(trien)]^{2+}$

B.  $\left[Fe(H_2O)_6\right]^{3+} < \left[Fe(NO_2)_6\right]^{3-} < \left[Fe(NH_3)_6\right]^{3+}$

C.  $\left[Co(H_2O)_6\right]^{3+} < \left[Rh(H_2O)_6\right]^{3+} < \left[Ir(H_2O)_6\right]^{3+}$





**Answer: B**

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**131.** Aqueous solution of  $Ni^{2+}$  contains  $\left[Ni(H_2O)_6\right]^{2+}$  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 BM
- C. it decreases from 2.83 BM
- D. It cannot be predicated theoretically

**Answer: A**

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132. The correct order of energies of d-orbitals of metal ion in a square planar complex is

A.  $d_{xy} = d_{yz} = d_{zx} > d_{x^2-y^2} = d_{x^2}$

B.  $d_{x^2-y^2} = d_{x^2} > d_{xy} = d_{yz} = d_{zx}$

C.  $d_{x^2-y^2} > d_{x^2} > d_{xy} = d_{yz} = d_{zx}$

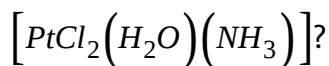
D.  $d_{x^2-y^2} > d_{xy} > d_{x^2} > d_{zx} = d_{yz}$

Answer: D



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133. Which of the following is true about the complex



A. It exhibits geometrical isomerism

B. It is paramagnetic complex

C. its geometry is tetrahedron

D. platinum is  $sp^3$  hybridised

**Answer: A**

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**134.** The crystal field stabilisation energy of  $[Co(NH_3)_6]Cl_3$  is:

A.  $-7.2\Delta_0$

B.  $-0.4\Delta_0$

C.  $-2.4\Delta_0$

D.  $-3.6\Delta_0$

**Answer: C**

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**135.** The magnitude of crystal field stabilisation energy in octahedral field depends on:

(I) the nature of the ligand

(II) the charge on the metal ion.

(III) whether the metal is in the first, second or third row of the transition elements

A. I, II, III only correct

B. I, II only correct

C. II, III only correct

D. III only correct

**Answer: A**



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**136.** Complex compound  $[Cr(NCS)(NH_3)_5][ZnCl_4]$  will be,

A. colourless and diamagnetic

B. green coloured and diamagnetic

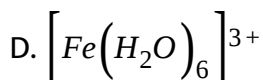
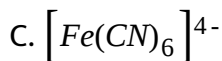
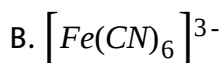
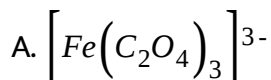
C. green coloured and shows coordination isomerism

D. diamagnetic and shows linkage isomerism

**Answer: C**

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**137.** The most stable ion is:



**Answer: B**

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138. In the complex  $K_2Fe[Fe(CN)_6]$ :

- A. both Fe atoms are in the same oxidation state
- B. Both Fe atoms are in different oxidation state
- C. the coordination number of ion is 4
- D. the complex is a high spin complex

**Answer: A**

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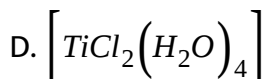
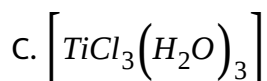
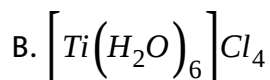
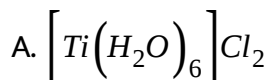
139. In  $Na_2[Fe(CN)_5NO]$ , sodium nitroprusside:

- A. oxidation state of Fe is +2
- B. this has  $NO^+$  as ligand
- C. both are correct
- D. none is correct

**Answer: C**

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**140.** An aqueous solution of titanium chloride, when subjected to magnetic measurement, measured zero magnetic moment. Assuming the octahedral complex in aqueous solution, the formulae of the complex is:



**Answer: B**

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141. Which of the following pairs of complexes are isomeric with each other but their aqueous solution exhibit different molar conductivities?

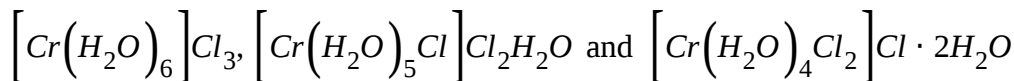
- A.  $\left[PtCl_2(NH_3)_4\right]Br_2$  and  $\left[PtBr_2(NH_3)_4\right]Cl_2$
- B.  $\left[CoCl_2(NH_3)_4\right]NO_2$  and  $\left[CoCl(NO_2)(NH_3)_4\right]Cl$
- C.  $\left[Co(NO_2)(NH_3)_5\right]Cl_2$  and  $\left[Co(ONO)(NH_3)_5\right]Cl_2$
- D.  $\left[CoBr(NH_3)_5\right]SO_4$  and  $\left[Co(SO_4)(NH_3)_5\right]Br$

Answer: D



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142. The \_\_\_\_\_ compounds



exhibits:

- A. linkage isomerism



B. geometrical isomerism

C. ionization isomerism

D. hydrate isomerism

**Answer: D**

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**143.** Which one of the following pairs of isomers and types of isomerism are correctly matched?

(i)  $[Co(NH_3)_5(NO_2)]Cl_2$  and  $[Co(NH_3)_5(ONO)]Cl_2 \dots$  (Linkage)

(ii)  $[Cu(NH_3)_4][PtCl_4]$  and  $[Pt(NH_3)_4][CuCl_4] \dots$  (coordination)

(iii)  $[PtCl_2(NH_3)_4]Br_2$  and  $[PtBr_2(NH_3)_4]Cl_2 \dots$  (ionization)

Select the correct answer using the codes given below:

A. (ii) and (iii)

B. (i), (ii) and (iii)

C. (i) and (iii)

D. (i) and (ii)

**Answer: B**

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**144.** the two compounds pentaamminesulphatocobalt (III) bromide and pentaamminesulphatocobalt (III) chloride represent:

A. Linkage isomersm

B. Ionization isomerism

C. Coordination isomerism

D. No isomerism

**Answer: D**

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145. Select the correct code about complex  $\left[Cr(NO_2)(NH_3)_5\right]\left[ZnCl_4\right]$ :

(I) IUPAC name of compound is pentaamminenitrito-N-chromium (III)

tetrachlorozincate (II)

(II) it shows geometrical isomerism

(III) It shows linkage isomerism

(IV) it shows coordination isomerism

A. III, IV

B. I, III, IV

C. II, III and IV

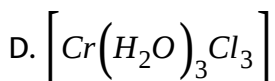
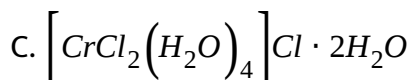
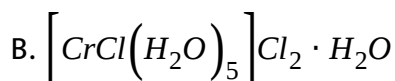
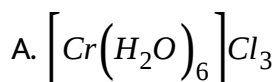
D. I, II, III and IV

**Answer: B**



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**146.** A six coordination complex of formula  $CrCl_3 \cdot 6H_2O$  has green colour. A 0.1 M solution of the complex when treated with excess of  $AgNO_3$  gas 28.7g of white precipitate. The formula of the complex would be:

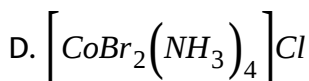
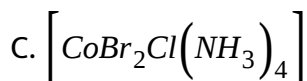
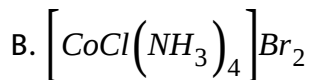
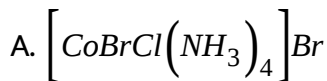


**Answer: B**

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**147.** A complex has a composition corresponding to the formula  $CoBr_2Cl.4NH_3$ . What is the structural formula if conductance

measurements show two ions per formula unit? Silver nitrate solution given an immediate precipitate of AgCl but no AgBr.



**Answer: D**



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**148.** Mixture X of 0.02 mole of  $\left[Co(NH_3)_5SO_4\right]$  and 0.02 mole of

$\left[Co(NH_3)_5Br\right]SO_4$  was prepared in 2 litre of solution:

1 litre of mixture X + excess of  $AgNO_3 \rightarrow Y$

1 litre of mixture X + excess of  $BaCl_2 \rightarrow Z$ .

Number of moles of Y and Z respectively are:

A. 0.01, 0.02

B. 0.02, 0.01

C. 0.01, 0.01

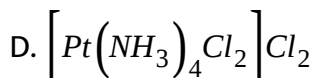
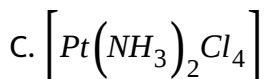
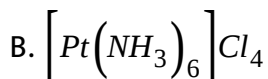
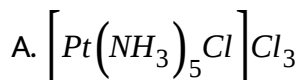
D. 0.02, 0.02

**Answer: C**



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**149.** A Pt complex of ammonia and chlorine produces four ions per molecule in the solution is



**Answer: A**

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

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

**Answer: D**

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**151.** Which statement about coordination number of a cation is true?

- A. Most metal ions exhibit only a single characteristic coordination number
- B. The coordination number is equal to the number of ligands bonded to the metal atom
- C. the coordination number is determined solely by the tendency to surround the metal atom with the same number of electrons as one of the rare gases
- D. For most cations, the coordination number depends on the size, and charge of the cation.

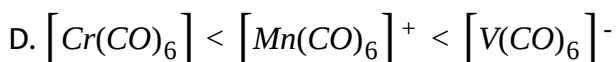
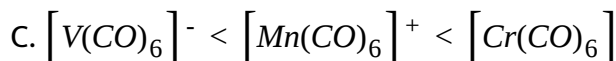
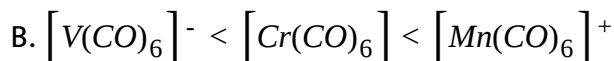
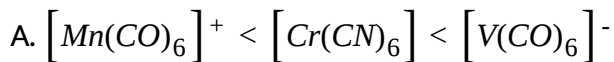
**Answer: D**



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152. In the isoelectronic series of metal carbonyl, the CO bond strength is expected to increase in the order:



Answer: D



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153. Which is not true about metal carbonyls?

A. Here CO acts as a Lewis base as well Lewis acid

B. here metal acts as lewis base as well as lewis acid

C. here  $d\pi - p\pi$  back bonding takes place

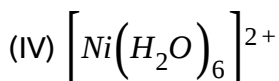
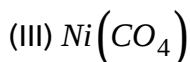
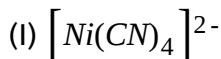
D. Here  $p\pi - p\pi$  back bonding takes place

**Answer: B**



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**154.** There are four complexes of Ni. Select the complex(es) which will be attracted by magnetic field:



A. I only

B. IV only

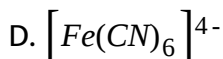
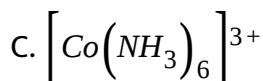
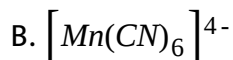
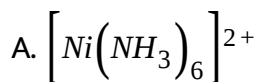
C. II, III and IV

D. II and IV

**Answer: D**

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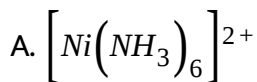
**155.** Which of the following complex is an outer orbitals complex?

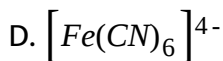
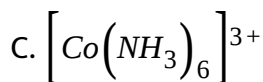
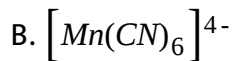


**Answer: A**

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**156.** Which of the following complex is an outer orbital complex?





**Answer: A**

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157. The magnetic moment of  $[MnX_4]^{2-}$  is 5.9 BM. The geometry of the complex ion is: (X=monodentate halide ion)

A. tetrahedral

B. square planar

C. both are possible

D. none of these

**Answer: A**

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158. The geometry of  $[Ni(CO)_4]$  and  $[NiCl_2(PPh_3)_2]$  are:

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

**Answer: C**

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159.  $[Fe(H_2O)_6]^{2+}$  and  $[Fe(CN)_6]^{4-}$  differ in:

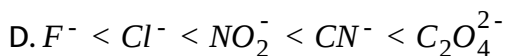
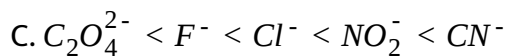
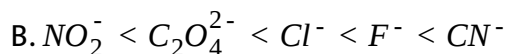
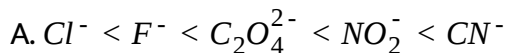
- A. geometry, magnetic moment
- B. geometry, hybridization
- C. magnetic moment, colour

D. hybridization number of d-electrons

Answer: C

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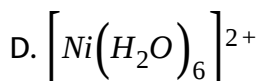
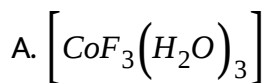
160. Which of the following order is correct in spectrochemical series of ligands?



Answer: A

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161. The species with spin only magnetic moment of  $\sqrt{24}$  BM is:

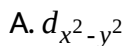


Answer: A



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162. For the complexes showing the square pyramidal structure, the d-orbital involved in the hybridisation is:

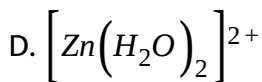
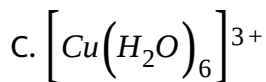
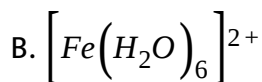
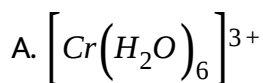


D.  $d_{xz}$

**Answer: A**

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**163.** Which of the following aquated metal ions has the highest paramagnetism?



**Answer: B**

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164. The hybridization states of the central atom in the complexes

$[Fe(CN)_6]^{3-}$ ,  $[Fe(CN)_6]^{4-}$  and  $[Co(NO_2)_6]^{3-}$  are:

- A.  $d^2sp^3$ ,  $sp^3d^2$  and  $dsp^2$  respectively
- B.  $d^2sp^3$ ,  $sp^3d^2$  and  $sp^3d^2$  respectively
- C.  $d^2sp^3$ ,  $sp^3d^2$  and  $d^2sp^3$  respectively
- D. all  $d^2sp^3$

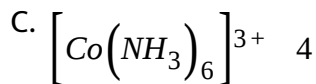
Answer: D

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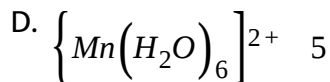
165. Which of the following is incorrectly matched?

- | Complex              | Number of unpaired electrons |
|----------------------|------------------------------|
| A. $[FeF_6]^{3-}$    | 5                            |
| Complex              | Number of unpaired electrons |
| B. $[Cr(en)_3]^{2+}$ | 2                            |

Complex                      Number of unpaired electrons



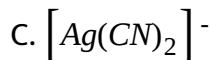
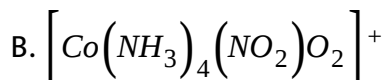
Complex                      Number of unpaired electrons



**Answer: C**

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**166.** Which of the following complexes have a maximum number of unpaired electrons?



**Answer: D**

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**167.** The degeneracy of d-orbitals is lost under:

- (I) Strong field ligand
- (II) Weak field ligand
- (III) Mixed field ligand
- (IV) Chelated Ligand field

Choose the correct code:

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

**Answer: C**



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168. The complex ion  $[Fe(CN)_6]^{4-}$  contains:

- A. total of 36 electrons on  $Fe^{2+}$  cation
- B.  $sp^3d^2$  hybrid orbitals with octahedral structure
- C. total of 104 electrons
- D. six sigma bonds

Answer: A

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169. In  $[Pt(NH_3)_2Cl_2]$ , Pt-Cl bond length is 2 Å and Cl-Cl distance is 2.88 Å then the compound is:

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

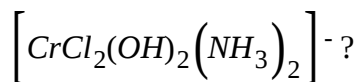
D. trans-square planar

**Answer: C**



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170. Which of the following isomerism, exhibited by



A. Ionization

B. Geometrical

C. Hydrate

D. Linkage

**Answer: B**



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171. Which kind of isomerism is exhibited by octahedral  $[Co(NH_3)_2Br_2]Cl$ ?

- A. Geometrical and ionization
- B. Geometrical and optical
- C. Optical and ionization
- D. Geometrical only

**Answer: A**

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172. A metal complex of coordination number six having three different types of ligands a, b and c of composition  $Ma_2b_2c_2$  can exist in several geometrical isomeric forms, the total number of such isomers is:

- A. 3

B. 5

C. 7

D. 9

**Answer: B**

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**173.** How many geometrical isomers and stereoisomers are possible for

$[Pt(NO_2)(NH_3)(NH_2OH)(Py)]^+$  and  $[Pt(Br)(Cl)(I)(NO_2)(NH_3)(Py)]$  respectively?

A. 3 and 15

B. 3 and 30

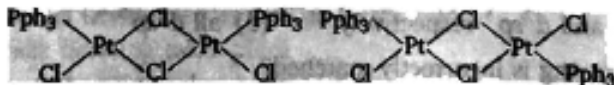
C. 4 and 15

D. 4 and 30

**Answer: B**

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174. Complexes given below show:



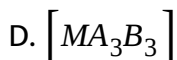
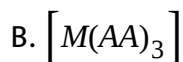
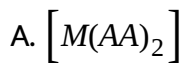
- A. optical isomerism
- B. coordinate isomerism
- C. Geometrical isomerism
- D. Bridge isomerism

**Answer: C**

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175. Fac and Mer isomerism is associated with which of the following general formula?



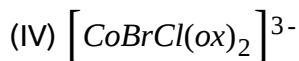
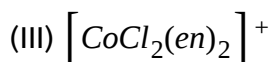
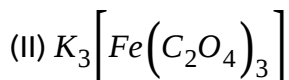
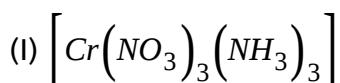


**Answer: D**



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**176.** Which of the following will have two stereoisomeric forms?



A. I only

B. I and II

C. III and IV

D. All of these

Answer: B

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177. Three arrangements are shown for the complexes

$\left[ \text{CoBr}_2(\text{NH}_3)_2(\text{en}) \right]^\oplus$ . Which one is wrong statement?



A. I and II are geometrical isomers

B. II and III are optically active isomers

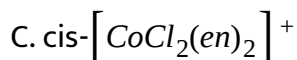
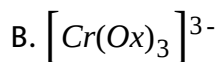
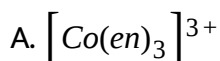
C. I and III are optically active isomers

D. II and III are geometrical isomers

**Answer: B**

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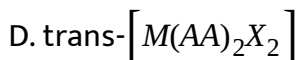
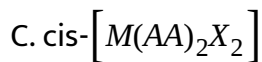
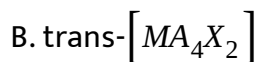
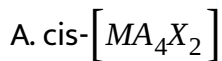
**178.** Which of the following is not optically active?



**Answer: D**

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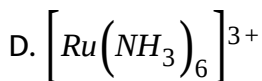
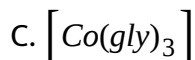
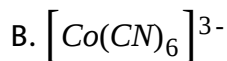
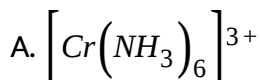
**179.** Where among the following metal complexes the one which exhibits optical activity is: (AA=bidentate ligand, A, X=monodentate ligand)



**Answer: C**

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**180.** The optically active species among the following is:

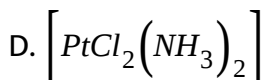
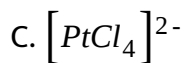
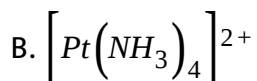
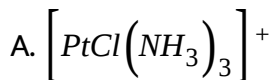


**Answer: C**

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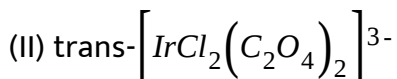
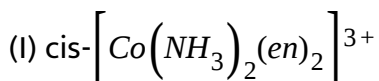
181. Cis-trans isomerism is exhibited by:

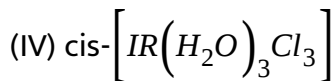
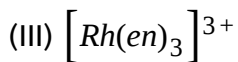


Answer: D

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182. Which of the following will show optical isomers?





A. I, III only correct

B. II, IV only correct

C. I, III, IV only correct

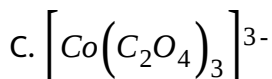
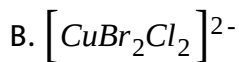
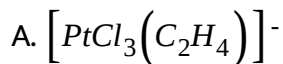
D. III only correct

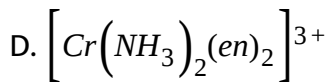
**Answer: A**



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**183.** The complex with a maximum number of stereoisomers is:





**Answer: D**

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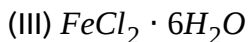
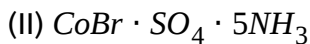
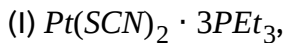
**184.** A complex with the composition  $[MA_3B]^{n\pm}$  is found to have no geometrical isomers. The possible structure (s) of the complex is (where A and B are monodentate ligands)

- A. tetrahedral
- B. Square planar
- C. Both (a) and (b)
- D. cannot be predicted

**Answer: C**

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185. Which of the following isomerism is not possible for complexes having molecular formulae?



A. Optical

B. Linkage

C. Ionisation

D. Hydrate

Answer: A



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

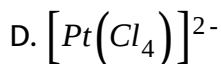
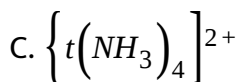
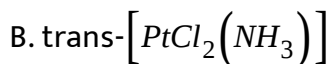
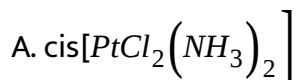


- A. Carboxypeptidase-A is an enzyme and contains zinc
- B. Haemoglobin is the red pigment of blood and contains iron
- C. Cyanocobalamin is  $B^{12}$  and contains cobalt
- D. Chlorophylls are green pigments in plants and contain calcium

**Answer: D**

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**187.** Which one of the following platinum complexes is used in cancer chemotherapy?

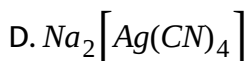
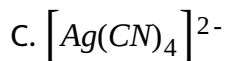
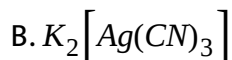
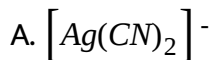


**Answer: A**



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**188.** The cyanide complex of silver formed in the silver extraction in MacArthur's Forrest cyanide process is:



**Answer: A**



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**189.** Complexes formed in the following methods are:

(I) Mond's process for purification of nickel

(II) Removal of unreacted AgBr from photographic plate

(III) Removal of lead poisoning from the body

- I*                      *II*                      *III*
- A.  $Ni(CO)_4$      $[Ag(CN)_2]^-$      $[Pb(EDTA)]^{2-}$
- I*                      *II*                      *III*
- B.  $Ni(CO)_4$      $[Ag(S_2O_3)_2]^{3-}$      $[Pb(EDTA)]^{2-}$
- C. (*I*, *II*, *III*),  $(Ni(CO)_6, Ag(S_2O_3)_2)^{3-}$ ,  $([Pb(EDTA)]^{4-})$
- I*                      *II*                      *III*
- D.  $Ni(CO)_6$      $[Ag(S_2O_3)]^-$      $[Pb(EDTA)]^{2-}$

**Answer: B**

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**190.** What is the oxidation number of Fe in  $[Fe(H_2O)_5(NO)]^{2+}$  ion?

A. +2

B. +3

C. +1

D. 0

**Answer: C**



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**191.** The oxidation state of iron in  $Na_4[Fe(CN)_5(NOS)]$  is:

A. +1

B. +2

C. +3

D. zero

**Answer: B**



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**192.** The correct name for the complex ion  $[CoCl(ONO)(en)_2]^+$  is:

- A. chlorobis(ethylenediamine)nitrito-O-cobaltate (III) ion
- B. chlorodiethyldiaminenitrito-O-cobalt (III) ion
- C. chloronitrito-O-diethyldiamine cobaltate (III) ion
- D. chlorobis(ethylenediamine) nitrito-O-cobalt (III) ion

**Answer: D**

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193. IUPAC name of  $[Fe(O_2)(CN)_4Cl]^{4-}$  is:

- A. Chlorotetracyano dioxoferrate (II) ion
- B. Chlorotetracyano peroxoferrate (II) ion
- C. Chlorotetracyano superoxoferrate (II)ion
- D. Tetracyanochloro superoxoferrate (II)ion

**Answer: C**

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194. The IUPAC name of Wilkinson's catalyst  $\left[ RhCl(PPh_3)_3 \right]$  is

- A. Chlorotris (triphenylphosphine) rhodium (I)
- B. Chlorotris (triphenylphosphine) rhodium (IV)
- C. Chlorotris (triphenylphosphine) rhodium (0)
- D. Chlorotris (triphenylphosphine) rhodium (VI)

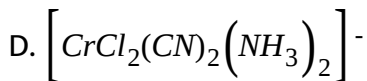
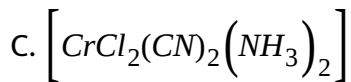
Answer: A



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195. The correct formula of diammine dichlorodicyano chromate (III) is :-

- A.  $\left[ CrCl_2(CN)_2(NH_3)_2 \right]^{3+}$
- B.  $\left[ CrCl_2(CN)_2(NH_3)_2 \right]^{3-}$



**Answer: D**

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**196.** The IUPAC name for  $K_2\left[Cr(CN)_2O_2(O)_2NH_3\right]$  is:

- A. Potassium amminedicyanotetraoxo chromium (III)
- B. Potassium amminedicyanodioxogendioxo chromate (IV)
- C. Potassium amminedicyanosuperoxoperoxo chromate (III)
- D. Potassium amminedicyanodioxoperoxo chromate (VI)

**Answer: D**

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197. IUPAC name of  $H_2[PtCl_6]$  is

- A. Hydrogen hexachloroplatinate (IV)
- B. dihydrogen hexachloroplatinate (IV)
- C. hydrogen hexachloroplatinic (IV) acid
- D. hexachloroplatinic (IV) acid

Answer: D

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198. The IUPAC name for  $[PtCl(NH_2CH_3)(NH_3)_2]Cl$  is:

- A. diamminechloro(methylamine)platinum(II)chloride
- B. (dimethylamine)chlorodiamminoplatinum(II)chloride
- C. bis(ammine)chloro(methylamine)platinate(II)chloride
- D. diamminechloro(methylamine)platinum(II)chloride



**Answer: A**

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**199.** The IUPAC nomenclature for the complex  $Na [PtBrCl(NO_2)(NH_3)]$  is:

- A. Sodium amminechlorobromonitro-N-platinum (II)
- B. Sodium nitrochlorobromoammine-N-platinate(II)
- C. Sodium amminebromochloronitro-N-Platinate(II)
- D. Sodium amminebromochloronitro-N-platinum(II)

**Answer: C**

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**200.** The IUPAC name of  $Xe [PtF_6]$  is:

- A. Hexafluoroplatinate(VI) xenon
- B. Xenonhexafluoroplatinate(IV)
- C. Xenonhexafluoroplatinate(VI)
- D. Xenoniumhexafluoroplatinum(V)

**Answer: B**

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**201.** The magnetic moment of  $[NiX_4]^{2-}$  ion is found to be zero. Then the ion is : (X=monodentate anionic ligand)

- A.  $sp^3$  hybridised
- B.  $spd^2$  hybridised
- C.  $dsp^2$  hybridised
- D.  $d^2sp$  hybridised

**Answer: C**



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202. The hybridised orbitals used by silver in the complex  $[Ag(NH_3)_2]^+$  are of the type:

A.  $sp^2$

B.  $sp$

C.  $sp^3$

D.  $dsp^2$

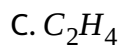
**Answer: B**



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**LEVEL 2**

1. Which of the following ligand does not as  $\pi$  - acid ligand?



**Answer: D**



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2. EAN of a metal carbonyl  $M(CO)_x$  is 36. If atomic number of metal M is 26, what is the value of x?

A. 5

B. 4

C. 6

D. none of these

**Answer: A**



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3.  $[Mn(CO)_4NO]$  is diamagnetic because:

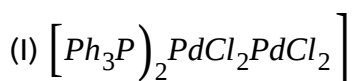
- A. Mn metal is diamagnetic in free state
- B. Mn is in +1 oxidation state in this complex
- C. No is present as positive ligand
- D. All of these

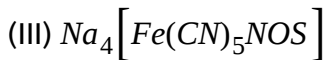
Answer: D



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4. Choose the correct option regarding the following complex compound which follows (F) and does not follow (NF) the Sidwick EAN rule:





A. (I)-NF,(II)-NF,(III)-NF,(IV)-NF

B. (I)-F,(II)-F,(III)-NF,(IV)-F

C. (I)-NF,(II)-NF,(III)-F,(IV)-F

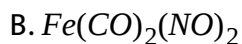
D. (I)-NF,(II)-NF,(III)-F,(IV)-NF

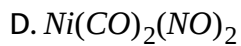
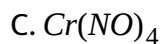
**Answer: C**



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5. If CO ligands are substituted by NO in respective neutral carbonyl compounds then which of the following will not be correct formula?

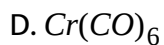
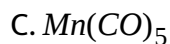
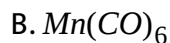
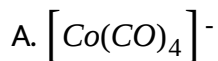




**Answer: D**

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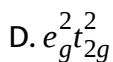
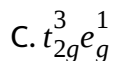
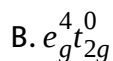
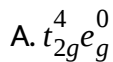
**6. Which of the following species can act as reducing agent ?**



**Answer: D**

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



**Answer: A**



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8. Which of the following statement is not correct?

A. Bis(glycinato)Zinc(II) is optically active

B.  $[NiCl_4]^{2-}$  and  $[PtCl_4]^{2-}$  have different shape

C.  $[Ni(CN)_4]^{4-}$  is square planar complex



D.  $[Ni(CN)_4]^{2-}$  and  $[Ni(CO)_4]$  have the same magnetic moment

**Answer: D**



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9. Give the correct of initials T or F for following statements. Use T if statements is true and F if it is false.

(I) Co(III) is stabilised in presence of weak field ligands, while Co(II) is stabilised in presence of strong field ligand.

((II) Four coordinated complexes of Pd(II) and Pt(II) are diamagnetic and square planar.

(III)  $[Ni(CN)_4]^{4-}$  ion and  $[Ni(CO)_4]$  are diamagnetic tetrahedral and square planar respectively.

(IV)  $Ni^{2+}$  ion does not form inner orbital octahedral complexes

A. TFTF

B. TTTF

C. TTFT

D. FTFT

Answer: D

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List-I	List-II
(I) $[\text{FeF}_6]^{3-}$	(A) 1.73 BM
(II) $[\text{Ti}(\text{H}_2\text{O})_6]^{3+}$	(B) 5.93 BM
(III) $[\text{Cr}(\text{NH}_3)_6]^{3+}$	(C) 0.00 BM
(IV) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$	(D) 2.83 BM
(V) $[\text{Fe}(\text{CN})_6]^{4-}$	(E) 3.88 BM

10.

match List-I with list-II and select the correct answer using the codes given below:

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

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

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

D. I-D,II-E,III\_A,IV-B,V-C

**Answer: D**



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**11.** The value of 'spin only' magnetic moment for one of the following configuration is  $2.84B.M.$  The correct one is:

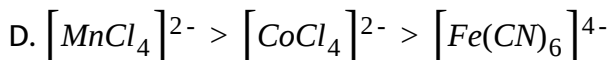
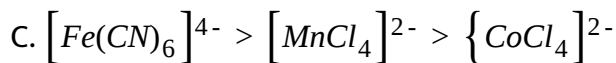
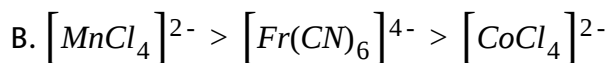
- A.  $d^4$  (in strong field ligand)
- B.  $d^2$  (in weak field ligand)
- C.  $d^3$  (In weak as well as in strong field ligand)
- D.  $d^5$  (in strong field ligand)

**Answer: B**



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

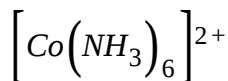


**Answer: D**

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**13.** Which of the following statements is incorrect?

A. The stability constant of  $[Co(NH_3)_6]^{3+}$  is greater than that of



B. The cyano complexes are far more stable than those formed by halide ions

C. The stability of halide complexes follows the order  $I^- < Br^- < Cl^-$

D. The stability constant of  $\left[ \text{Cu}(\text{NH}_3)_4 \right]^{2+}$  is greater than that of  $\left[ \text{Cu}(\text{en})_2 \right]^{2+}$

**Answer: D**

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14. Set of d-orbitals which is used by central metal during formation of  $\text{MnO}_4^-$ ?

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

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

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

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

**Answer: B**

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15.  $FeSO_4$  is a very good absorber for  $NO$ , the new compound formed by this process is found to contain number of unpaired electrons:

- A. 4
- B. 5
- C. 3
- D. 6

Answer: C

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16. A  $[M(H_2O)_6]^{2+}$  complex typically absorbs at around 600 nm. It is allowed to react with ammonia to form a new complex  $[M(NH_3)_6]^{2+}$  that should have absorption at:

- A. 800 nm

B. 580 nm

C. 620 nm

D. 320 nm

**Answer: B**

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17. Given that the energy of the photons of different colours decreases in the order of VIBGYOR (Violet > Indigo > Blue > Green > Yellow > Red ) and that if complex absorbs a photon of low energy then it shows colour of high energy photon. If an ion ,  $M^{2+}$ , forms the complexes  $[M(H_2O)_6]^{2+}$ ,  $[MBr_6]^{4-}$ , and  $[M(en)_3]^{2+}$ . The colours of the complexes, though not necessarily in order, are green, red, and blue. Match the complexes with the appropriate colour. ( Do not use the table of complementary colours for this question )

A. Green, blue and red

B. Blue, and green

C. Green, red and blue

D. Red, blue and green

**Answer: D**

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18. The CFSE for octahedral  $[CoCl_6]^{4-}$  is  $18,000\text{cm}^{-1}$ . The CFSE for tetrahedral  $[CoCl_4]^{2-}$  will be

A.  $18000\text{ cm}^{-1}$

B.  $16000\text{ cm}^{-1}$

C.  $8000\text{ cm}^{-1}$

D.  $2000\text{ cm}^{-1}$

**Answer: D**

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19.  $MnO_4^-$  is of intense pink colour, though  $Mn$  is in (+7) oxidation state. It is due to:

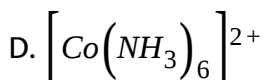
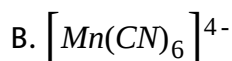
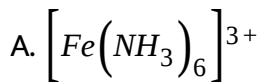
- A. oxygen gives colour to it
- B. Charge transfer when  $Mn(+7)$  gives its electron to oxygen and oxidise to  $Mn(+8)$  temporarily
- C. Charge transfer when oxygen gives its electron to  $Mn(+7)$  changing in  $Mn(+6)$  None is correct explanation.
- D.

**Answer: C**



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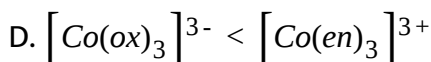
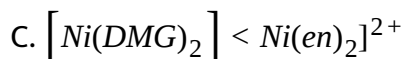
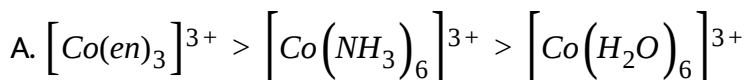
20. In which of the following complex ion the value of magnetic moment (spin only) is  $\sqrt{3}B.M.$  and outer d-orbitals is used in hybridization:



**Answer: A**

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**21. Which of the following order of CFSE is incorrect?**



**Answer: B**



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22. For which of the following  $d^n$  configuration complexes, can not exist in both high spin and low spin forms:

(I)  $d^3$

(II)  $d^5$

(III)  $d^6$

(IV)  $d^8$

A. I, II & III

B. II, III & IV

C. I & IV

D. none of these

**Answer: B**



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23. Consider the complex  $\left[Co(NH_3)_4CO_3\right]ClO_4$ , in which coordination number, oxidation number and number of d-electrons on the metal are respectively

A. 6,3,6

B. 6,2,7

C. 5,3,6

D. 5,3,7

**Answer: A**



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24. The  $\pi$  acid ligand which uses its d-orbital during synergic bonding in its complex compound.

A.  $CN^-$

B.  $PR_3$

C.  $NO$

D.  $N_2$

**Answer: B**

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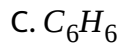
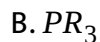
25. The IR stretching frequencies of free  $CO$ , and  $CO$   $[V(CO)_6]^-$ ,  $[Cr(CO)_6]^-$  and  $[Mn(CO)_6]^-$  are  $2143$   $cm^{-1}$ ,  $1860cm^{-1}$ ,  $2000cm^{-1}$  and  $2090cm^{-1}$ , respectively. Then correct statement about metal carbonyl is:

- A. C-O' bond is strongest in the cation and weakest in the anion.
- B. C-O' bond is weakest in the cation and strongest in the anion
- C. C-O' bond is longer in the cation than in the anion
- D. M-C' pi bonding is higher in the cation

**Answer: B**

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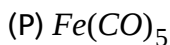
**26.** The  $\pi$ -acid ligand which uses its d-orbital during synergic bonding in its complex compound:



**Answer: A**

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**27.** Correct sequence of CO bond order in given compounds is:



(Q)  $CO$

(R)  $H_3B \leftarrow CO$

(S)  $[Mn(CO)_5]^-$

A.  $P > R > S > Q$

B.  $SgtPgtRgtQ$

C.  $QgtSgtPgtR$

D.  $RgtQgtPgtS$

**Answer: B**



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**28.** Select correct statement regarding  $[Ni(DMG)_2]$  complex compound.

A. it acts as oxidising agent because  $Ni^{2+}$  cation is having E.A.N. 34.

B. It is extra stabilized by hydrogen bonding

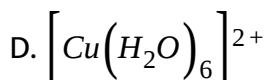
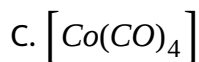
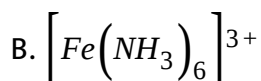
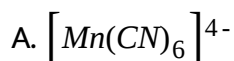
C. It's IUPAC name is Bis(dimethyloximato)nickelate(II)

D. It's ligand contains two different donar sites

**Answer: C**

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29. In which of the following ion the value of magnetic moment (spin only) is  $\sqrt{3}$  BM and outer d-orbitals is used in hybridization.

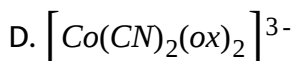
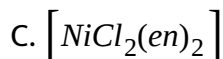
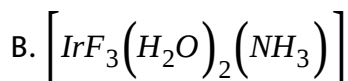
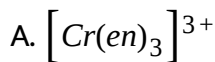


**Answer: D**

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30. The inner orbital complex which exhibits both geometrical as well as optical isomerism.



Answer: D



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31. Select correct statement regarding  $[Ni(DMG)_2]$  complex compound.

A. It acts as oxidising agent because  $Ni^{2+}$  cation is having EAN 34.

B. It is extra-stabilized by hydrogen bonding

C. It's IUPAC name is Bis(dimethylglyoximato) nickelate (II)

D. It's ligand contains two different donar sites

**Answer: D**

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**32. Which of the following correctly matched?**

A.  $[Fe(CN)_6]^{4-}$  and  $[Fe(CN)_6]^{3-}$ -both are octahedral and diamagnetic with  $d^2sp^3$ . Hybridisation.

B.  $Ni(CO)_4$  and  $[Ni(CN)_4]^{2-}$ -both are tetrahedral and diamagnetic with  $sp^3$ -hybridisation

C.  $Ni(CO)_4$  and  $[Co(CO)_4]^-$ -both are tetrahedral and diamagnetic

D.  $[Co(H_2O)_6]^{3+}$  and  $[Cr(H_2O)_6]^{3+}$ -both are paramagnetic and metal is  $d^2sp^3$ -hybridised

**Answer: C**

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33. Match List-I and List-II and select the correct answer using the codes given below the slits:

List-I (Compound)	List-II ( of Central atom)
(A) $[\text{Ni}(\text{NH}_3)_6]^{2+}$	(1) $sp^3$
(B) $[\text{PtCl}_4]^{2-}$	(2) $sp^3d^2$
(C) $[\text{Ni}(\text{CO})_4]$	(3) $dsp^2$
(D) $[\text{Co}(\text{ox})_3]^{3-}$	(4) $d^2sp^3$

A. A-2,B-1,C-3,D-4

B. A-2,B-3,C-1,D-4

C. A-4,B-1,C-3,D-2

D. A-4,B-3,C-1,D-2

Answer: A



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34. Match List-I and List II and select the correct answer using the codes given below the slits:

List-I	List-II
(A) $\text{Ni}(\text{CN})_5^{3-}$	(1) $sp^3$
(B) $\text{CuCl}_5^{2-}$	(2) $dsp^2$
(C) $\text{AuCl}_4^-$	(3) $sp^3d_{z^2}$
(D) $\text{ClO}_4^-$	(4) $d_{x^2-y^2}sp^3$

A. A-1,B-3,C-2,D-4

B. A-3,B-4,C-2,D-1

C. A-4,B-2,C-1,D-3

D. A-4,B-3,C-2,D-1

Answer: D

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35. The hybridization of the complex  $[\text{CrCl}_2(\text{NO}_2)_2(\text{NH}_3)_2]^-$  is:

A.  $sp^3d^2$

B.  $d^2sp^3$

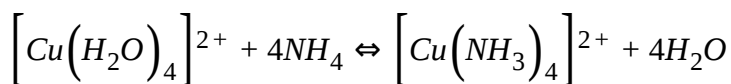
C.  $sp^3d$

D. cannot be predicted

**Answer: C**

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**36.** Which of the following statement is not true for the reaction given below:



A. It is ligand substitution reaction

B.  $\text{NH}_3$  is a relatively strong field ligand while  $\text{H}_2\text{O}$  is a weak field ligand

C. During the reaction, there is a change in colour from light blue to dark blue

D.  $\left[ \text{Cu}(\text{NH}_3)_4 \right]^{2+}$ , has a tetrahedral structure and is paramagnetic

Answer: D

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37. Which of the following match is incorrect?

Complex compounds	:	Type of hybridization
(a) $[\text{V}(\text{NH}_3)_6]^{3+}$	:	$d^2sp^3$
(b) $[\text{CrCl}_3(\text{NMe}_3)_3]$	:	$d^2sp^3$
(c) $[\text{Cu}(\text{CN})(\text{NO}_2)(\text{NH}_3)(\text{py})]$	:	$dsp^2$
(d) $\text{K}_3[\text{Co}(\text{ox})_3]$	:	$sp^3d^2$

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38. Select the correct code of TRUE and FALSE for given statements:

(a) Peroxide ion as well as dioxygen molecule both are paramagnetic species

(b) In set of isomers,  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  and  $[\text{CrCl}(\text{H}_2\text{O})_5]\text{Cl}_2 \cdot \text{H}_2\text{O}$ ,

both compounds can easily lose water molecule on treatment with conc.  $H_2SO_4$

(c) During transformation  $NO \rightarrow NO^+$ , bond length and magnetic behaviour decreases

(d) An ether is more volatile than alcohol both having same molecular formula

A. FTTT

B. FTFT

C. FTTT

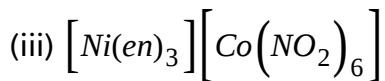
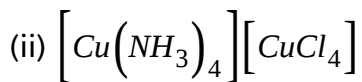
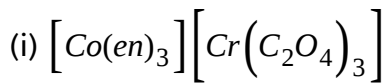
D. TFFT

**Answer: D**



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**39.** The total possible co-ordination isomers for the following compounds respectively are



A. 4,4,4

B. 2,2,2

C. 2,2,4

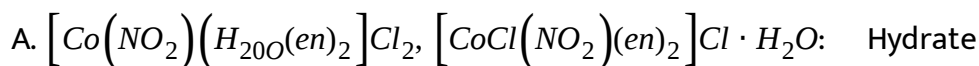
D. 4,2,3

**Answer: D**



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**40.** Select the incorrect match:



isomerism



B.  $\left[ \text{Cu}(\text{NH}_3)_4 \right] \left[ \text{PtCl}_4 \right], \left[ \text{CuCl}(\text{NH}_3)_3 \right] \left[ \text{PtCl}_3(\text{NH}_3) \right]$ : Co-ordination isomersm

C.  $\left[ \text{Ni}(\text{CN})(\text{H}_2\text{O})(\text{NH}_3)_4 \right] \text{Cl}, \left[ \text{NiCl}(\text{H}_2\text{O})(\text{NH}_3)_4 \right] \text{CN}$ : Ionization isomerism

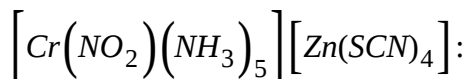
D.  $\left[ \text{Cr}(\text{NO}_2)(\text{NH}_3)_5 \right] \left[ \text{ZnCl}_4 \right], \left[ \text{Cr}(\text{NO}_3)(\text{NH}_3)_5 \right] \left[ \text{ZnCl}_4 \right]$ : Linkage isomerism

Answer: A



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41. Select incorrect statement about complex



A. It shows co-ordination isomersm

B. it shows optical activity

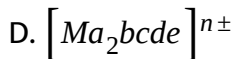
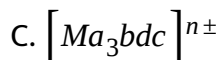
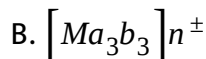
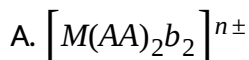
C. It shows linkage isomerism

D. IUPAC name of the compound is pentaamminenitrito-N-chromium(III) tetrathiocyanato-S-zincate(II)

**Answer: B**

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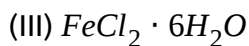
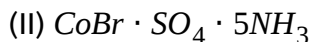
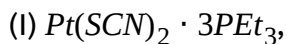
42. Complex compound(s) having even number of space (stereo) isomer is/are: (Where AA-symmetrical bidentate ligand and a,b,c,d,e-monodentate ligands)



**Answer: B**

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43. Which of the following isomerism is not possible for complexes having molecular formulae?



A. Optical

B. Linkage

C. Ionisation

D. Hydrate

**Answer: D**



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44. Unmatched characteristic of complex  $\left[ PdCl_2(H_2O)_2(NH_3)_2 \right]^{2+}$  is:

A. Diamagnetic

B. Low spin

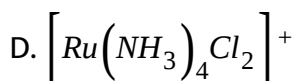
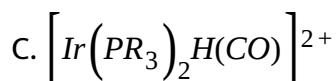
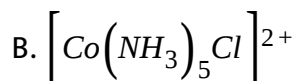
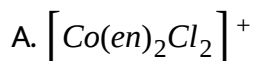
C. Geometrical isomerism

D. Fac. And Mer. Form

**Answer: D**

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45. Which of the following has the largest number of isomers? .

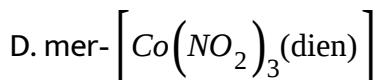
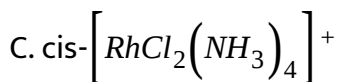
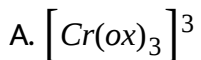


**Answer: A**



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46. Which one of the following complexes exhibit chirality?



Answer: A



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47. Consider the following isomerism:

(i) Ionization

(ii) Hydrate

(iii) Coordination

(iv) Geometrical

(v) Optical

Which of the above isomerism are exhibited by  $\left[Cr(NH_3)_2(O)_2Cl_2\right]^-$ ?

- A. (i) and (v)
- B. (ii) and (iii)
- C. (iii), (ii) and (i)
- D. (iv) and (v)

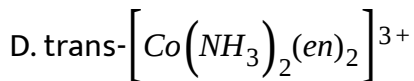
**Answer: C**



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**48.** Which complex is likely to show optical activity :

- A.  $\text{trans-}\left[Co(NH_3)_4Cl_2\right]^+$
- B.  $\left[Cr(H_2O)_6\right]^{3+}$
- C.  $\text{cis-}\left[Co(NH_3)_2(en)_2\right]$



Answer: A

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49. Which of the following statement is true?

A. In  $\left[PtCl_2(NH_3)_2\right]^{2+}$  the cis form is optically inactive while trans form is optically active

B. In  $\left[Fe(C_2O_4)_3\right]^{3-}$ , geometrical isomerism does not exist while optical isomerism exists

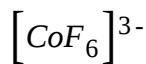
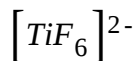
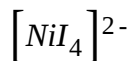
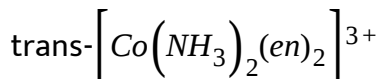
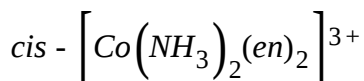
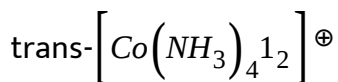
C. In  $Mabcd$ , square planar complexes show both optical as well as geometrical isomerism

D. In  $Mabcd$  tetrahedral complex, optical isomerism cannot be observed

Answer: B

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50. The following complexes are given?



Choose the correct code .

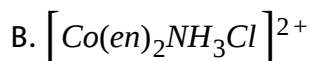
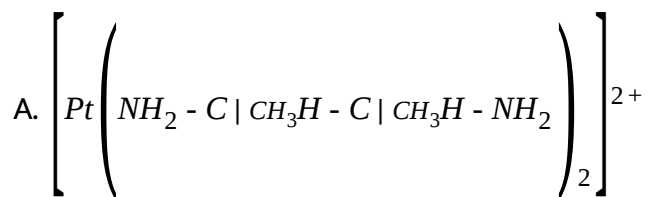
- A. (1), (2) are optically active, (3) is optically inactive
- B. (2) is optically active, (1), (3) are optically inactive
- C. (4),(5) are coloured and (6) is colourless
- D. (4) is coloured and (5), (6) are colourless



Answer: D

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51. Which of the following can show geometrical isomerism?



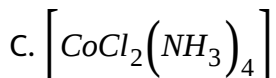
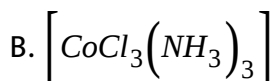
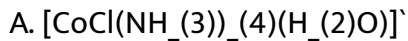
C. Both (a) and (b)

D. none of these

Answer: B

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52. Which of the following complex compound exhibits cis-trans isomerism?



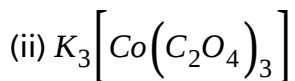
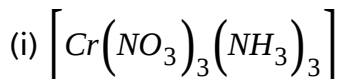
D. All of these

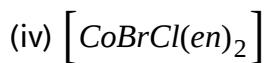
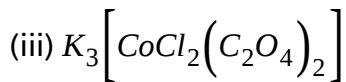
**Answer: D**



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53. Which of the following will have three stereoisomeric forms?





- A. (iii) and (iv)
- B. (i), (iii) and (iv)
- C. (iv) only
- D. all four

**Answer: A**



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54. A coordination complex of type  $MX_2Y_2$  (M-metal ion: X, Y-monodentate ligands), can have either a tetrahedral or a square planar geometry. The maximum number of possible isomers in these two cases are respectively:

- A. 1 and 2

B. 2 and 1

C. 1 and 3

D. 3 and 2

**Answer: A**

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55. The ratio of cis and trans-isomers of the complex  $[Ma_2bcde]^{n\pm}$  is:

A. 5:3

B. 2:1

C. 7:3

D. 3:1

**Answer: B**

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56.  $[PdCl_2(PMe_3)_2]$  is a diamagnetic complex of Pd (II). How many unpaired electrons are present in analogous complex of Ni (II)?

A. zero

B. 1

C. 2

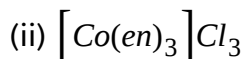
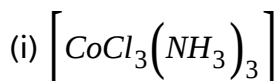
D. 3

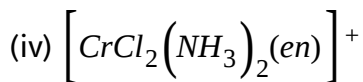
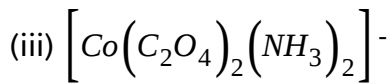
**Answer: B**



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57. Complex compound(s) which is optical active and does not depend upon the orientation of the ligands around metal cation:





A. (ii), (iii) and (iv)

B. (i), (ii) and (iv)

C. (ii) and (iv)

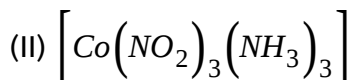
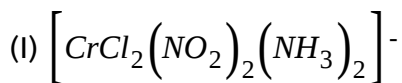
D. only (ii)

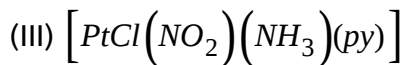
**Answer: A**



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**58.** Choose the correct code regarding, possible number of geometrical isomers exhibited by following complexes:





A. (I)-4,(II)-2,(III)-3,(IV)-1

B. (I)-5,(II)-2,(III)-4,(IV)-0

C. (I)-3,(II)-2,(III)-0,(IV)-1

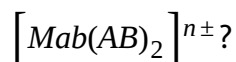
D. (I)-5,(II)-2,(III)-3,(IV)-0

**Answer: C**



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59. How many geometrical isomers are possible for complex



A. 5

B. 4

C. 3

D. 6

**Answer: D**

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60.  $\left[CoCl_2(NH_3)_4\right]^+ + Cl^- \rightarrow \left[CoCl_3(NH_3)_3\right] + NH_3$ . If in this reaction two isomers of the product are obtained, which is true for the initial (reactant) complex:

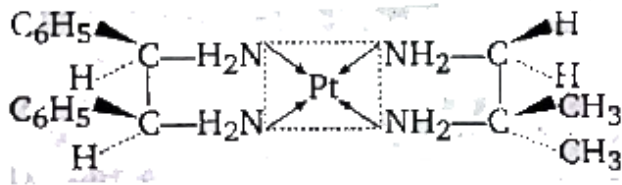
- A. compound is in cis-form
- B. compound is in trans-form
- C. compound is in both (cis and trans)
- D. can't be predicted

**Answer: A**

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61. Select the correct statement about given square planar complex.

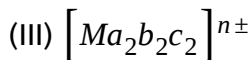
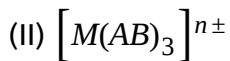
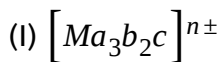


- A. It has no geometrical isomer
- B. it is optically active because it does not have plane of symmetry
- C. it is optically inactive because square planar complex have plane of symmetry
- D. it is optically active because it has symmetric carbon

Answer: B

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62. Select the correct code regarding total number of space isomers for the following compounds:



A. (I)-4,(II)-4,(III)-6

B. (I)-4,(II)-3,(III)-5

C. (I)-3,(II)-3,(III)-5

D. (I)-3,(II)-4,(III)-6

**Answer: D**



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63. How many geometrical isomers are possible for



A. 2

B. 3

C. 5

D. 6

**Answer: C**

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64. How many geometrical isomers are possible  $[Co(acac)_2BrCl]^{\ominus}$  are:

A. 4

B. 3

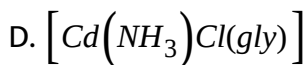
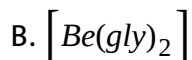
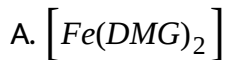
C. 6

D. 2

**Answer: D**

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65. Which of the following complex compound exhibits geometrical isomerism?

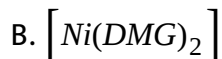
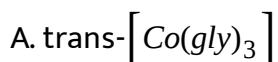


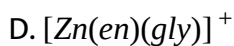
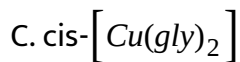
Answer: C



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66. In which case racemic mixture is obtained on mixing its mirror images (d & l form) is 1:1 molar ratio:

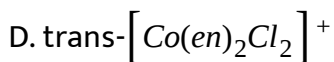
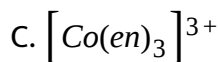
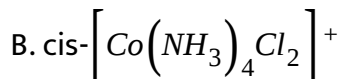
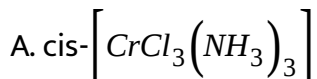




**Answer: D**

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**67.** Which of the following compound show optical isomerism?



**Answer: B**

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68. Match List-I with List-II and select the correct answer using the codes given below:

List-I (Ion involved)		List-II (agent)
(i)	$\text{Ni}^{2+}$	(A) Sodium thiosulphate
(ii)	$\text{Ag}^+$	(B) Sodium nitroprusside
(iii)	$\text{Cu}^{2+}$	(C) Ammonia
(iv)	$\text{S}^{2-}$	(D) Dimethylglyoxime

A. (i)-C,(ii)-A,(iii)-D,(iv)-B

B. (i)-D,(ii)-C,(iii)-A,(iv)-B

C. (i)-D,(ii)-C,(iii)-B,(iv)-A

D. (i)-D,(ii)-A,(iii)-C,(iv)-B

Answer: A



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69. Which of the following is correct IUPAC name of any compound.

A. Tris(acetylacetonato)iron(III)chloride

B. Heachloroplatinum(IV)tetraammine dicyano platinate(IV)

C. Ammine bromochloro methylamine platinum(II)

D. cis-dichloro (ethylenediamine) platinum (II)

**Answer: D**

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**70.** Find out correct IUPAC name of complex compound

A. Triamminetricyanidochromium(III)hexanitrito-N-irridate(III)

B. Pentaamminecyanidochromium(III)hexanitrito-N-irridium(III)

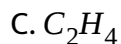
C. Hexanitrito-N-irridium(III)pentaamminecyanidochromate(II)

D. Pentaamminecyanidochromium(III)hexanitrito-n-irridate(III)

**Answer: d**

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71. Which of the following ligand does not as  $\pi$  - acid ligand?



**Answer: C**



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72. If E.A.N. of central metal cation  $M^{2+}$  in a non-chelating complex is 36 and atomic no. of metal M is 26, then the number of monodentate ligand is in this complex are:

A. 5

B. 4



C. 6

D. none of these

**Answer: A**

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73.  $[Mn(CO)_4NO]$  is diamagnetic because:

A. Mn metal is diamagnetic in free state

B. Mn is in +1 oxidation state in this complex

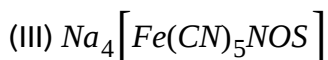
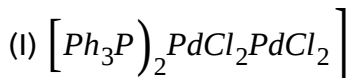
C. No is present as positive ligand

D. All of these

**Answer: D**

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74. Choose the correct option regarding the following complex compound which follows (F) and does not follow (NF) the Sidgwick EAN rule:



A. (I)-NF,(II)-NF,(III)-NF,(IV)-NF

B. (I)-F,(II)-F,(III)-NF,(IV)-F

C. (I)-NF,(II)-NF,(III)-F,(IV)-F

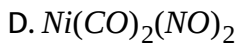
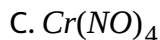
D. (I)-NF,(II)-NF,(III)-F,(IV)-NF

**Answer: D**



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75. If CO ligands are substituted by NO in respective neutral carbonyl compounds then which of the following will not be correct formula?

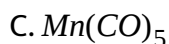
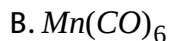
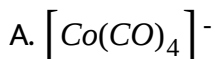


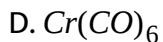
**Answer: D**



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76. Which of the following species can act as reducing agent?

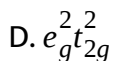
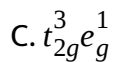
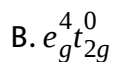
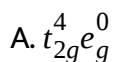




**Answer: D**

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77. What is electronic arrangement of metal atom/ion in octahedral complex with  $d^4$  configuration, if  $\Delta_0 <$  pairing energy?



**Answer: A**

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78. Which of the following statement is not correct?

- A. Bis(glycinato)Zinc(II) is optically active
- B.  $[\text{NiCl}_4]^{2-}$  and  $[\text{PtCl}_4]^{2-}$  have different shape
- C.  $[\text{Ni}(\text{CN})_4]^{4-}$  is square planar complex
- D.  $[\text{Ni}(\text{CN})_4]^{2-}$  and  $[\text{Ni}(\text{CO})_4]$  have the same magnetic moment

Answer: D



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79. Give the correct of initials T or F for following statements. Use T if statements is true and F if it is false.

(I) Co(III) is stabilised in presence of weak field ligands, while Co(II) is stabilised in presence of strong field ligand.

((II) Four coordinated complexes of Pd(II) and Pt(II) are diamagnetic and square planar.

(III)  $[\text{Ni}(\text{CN})_4]^{4-}$  ion and  $[\text{Ni}(\text{CO})_4]$  are diamagnetic tetrahedral and

square planar respectively.

(IV)  $Ni^{2+}$  ion does not form inner orbital octahedral complexes

A. TTF

B. TTTF

C. TTFT

D. FTFT

Answer: D



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List-I	List-II
(I) $[FeF_6]^{3-}$	(A) 1.73 BM
(II) $[Ti(H_2O)_6]^{3+}$	(B) 5.93 BM
(III) $[Cr(NH_3)_6]^{3+}$	(C) 0.00 BM
(IV) $[Ni(H_2O)_6]^{2+}$	(D) 2.83 BM
(V) $[Fe(CN)_6]^{4-}$	(E) 3.88 BM

80.

match List-I with list-II and select the correct answer using the codes given below:

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

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

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

D. I-D,II-E,III\_A,IV-B,V-C

**Answer: D**

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**81.** The value of 'spin only' magnetic moment of one of the following configuration is 2.84 BM. The correct one is

A.  $d^4$  (in strong field ligand)

B.  $d^2$  (in weak field ligand)

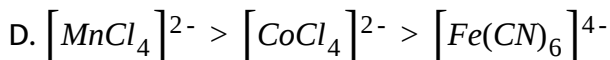
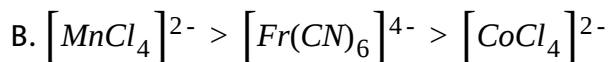
C.  $d^3$  (In weak as well as in strong field ligand)

D.  $d^5$  (in strong field ligand)

**Answer: B**

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82. The correct order of magnetic moments (spin values in BM) among is:



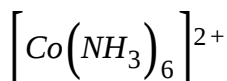
Answer: D



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83. Which of the following statements is incorrect?

A. The stability constant of  $[Co(NH_3)_6]^{3+}$  is greater that of





- B. The cyano complexes are far more stable than those formed by halide ions
- C. The stability of halide complexes follows the order  $I^- < Br^- < Cl^-$
- D. The stability constant of  $[Cu(NH_3)_4]^{2+}$  is greater than that of  $[Cu(en)_2]^{2+}$

**Answer: B**

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**84.** Set of d-orbitals which is used by central metal during formation of  $MnO_4^-$ ?

- A.  $d_{x^2-y^2}$ ,  $d_{x^2}$ ,  $d_{xy}$
- B.  $d_{xy}$ ,  $d_{yz}$ ,  $d_{xz}$
- C.  $d_{x^2-y^2}$ ,  $d_{xy}$ ,  $d_{xz}$
- D.  $d_{x^2-y^2}$ ,  $d_{z^2}$ ,  $d_{xz}$

**Answer: B**



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85.  $FeSO_4$  is a very good absorber for  $NO$ , the new compound formed by this process is found to contain number of unpaired electrons:

A. 4

B. 5

C. 3

D. 6

**Answer: D**



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86. A  $\left[M(H_2O)_6\right]^{2+}$  complex typically absorbs at around 600 nm. It is allowed to react with ammonia to form a new complex  $\left[M(NH_3)_6\right]^{2+}$  that should have absorption at:

- A. 800 nm
- B. 580 nm
- C. 620 nm
- D. 320 nm

**Answer: A**



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87. An ion  $M^{2+}$ , forms the complexes  $\left[M(H_2O)_6\right]^{2+}$ ,  $\left[M(en)_3\right]^{2+}$  and  $\left[MBr_6\right]^{4-}$ , match the complex with the appropriate colour:

A. Green, blue and red

B. Blue, and green

C. Green, red and blue

D. Red, blue and green

**Answer: D**

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88. The SCSE for  $[(CoCl)_6]^{4-}$  complex is  $18000\text{ cm}^{-1}$ . The  $\Delta$  for  $[CoCl_4]^{2-}$  will be:

A.  $18000\text{ cm}^{-1}$

B.  $16000\text{ cm}^{-1}$

C.  $8000\text{ cm}^{-1}$

D.  $2000\text{ cm}^{-1}$

**Answer: D**



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89.  $MnO_4^-$  is off intense pink colour, though Mn is in (+7) oxidation state, it is due to:

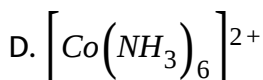
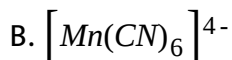
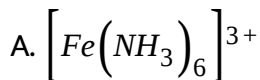
- A. oxygen gives colour to it
- B. Charge transfer when Mn(+7) gives its electron to oxygen and oxidise to Mn (+8) temporarily
- C. Charge transfer when oxygen gives its electron to Mn(+7) changing in Mn(+6) None is correct explanation.
- D.

**Answer: C**



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90. In which of the following complex ion the value of magnetic moment (spin only) is  $\sqrt{3}$ B.M. and outer d-orbitals is used in hybridization:

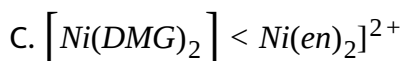
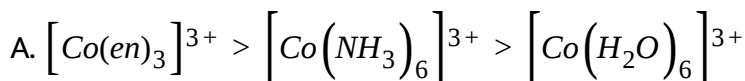


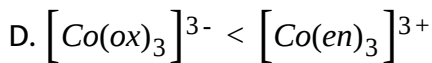
Answer: A



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91. Which of the following order of CFSE is incorrect?





**Answer: B**



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92. For which of the following  $d^n$  configuration complexes, can not exist in both high spin and low spin forms:



A. I, II & III

B. II, III & IV

C. I & IV

D. none of these

**Answer: B**



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93. Consider the complex  $[Co(NH_3)_4CO_3]ClO_4$ , in which coordination number, oxidation number and number of d-electrons on the metal are respectively

A. 6,3,6

B. 6,2,7

C. 5,3,6

D. 5,3,7

**Answer: A**



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94. The  $\pi$  acid ligand which uses its d-orbital during synergic bonding in its complex compound.

A.  $CN^-$

B.  $PR_3$

C.  $NO$

D.  $N_2$

**Answer: C**



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95. The IR stretching frequencies of free CO, and CO  $[V(CO)_6]^-$ ,  $[Cr(CO)_6]^-$  and  $[Mn(CO)_6]^-$  are 2143  $cm^{-1}$ ,  $1860cm^{-1}$ ,  $2000cm^{-1}$  and  $2090cm^{-1}$ , respectively. Then correct statement about metal carbonyl is:

A. C-O' bond is strongest in the cation and weakest in the anion.

B. C-O' bond is weakest in the cation and strongest in the anion

C. C-O' bond is longer in the cation than in the anion

D. M-C' pi bonding is higher in the cation

**Answer: B**

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**96.** The  $\pi$ -acid ligand which uses its d-orbital during synergic bonding in its complex compound:

A.  $NO^+$

B.  $PR_3$

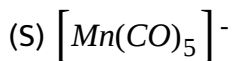
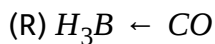
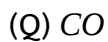
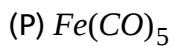
C.  $C_6H_6$

D.  $CO$

**Answer: A**

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97. Correct sequence of CO bond order in given compounds is:



A.  $P > R > S > Q$

B.  $SgtPgtRgtQ$

C.  $QgtSgtPgtR$

D.  $RgtQgtPgtS$

**Answer: B**



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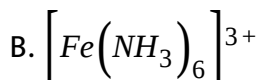
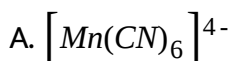
98. Select correct statement(s) regarding  $[Ni(DMG)_2]$  complex compound:

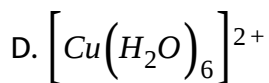
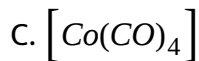
- A. it acts as oxidising agent because  $Ni^{2+}$  cation is having E.A.N. 34.
- B. It is extra stabilized by hydrogen bonding
- C. It's IUPAC name is Bis(dimethyloximato)nickelate(II)
- D. It's ligand contains two different donor sites

Answer: C

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99. In which of the following ion the value of magnetic moment (spin only) is  $\sqrt{3}$  BM and outer d-orbitals is used in hybridization.

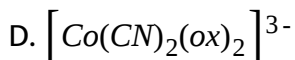
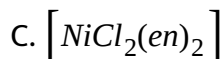
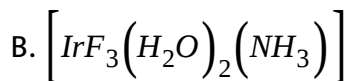
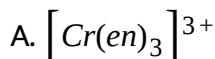




**Answer: D**

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**100.** The inner orbital complex which exhibits both geometrical as well as optical isomerism.



**Answer: D**

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101. Select correct statement regarding  $[Ni(DMG)_2]$  complex compound.

- A. It acts as oxidising agent because  $Ni^{2+}$  cation is having EAN 34.
- B. It is extra-stabilized by hydrogen bonding
- C. It's IUPAC name is Bis(dimethylglyoximate) nickelate (II)
- D. It's ligand contains two different donor sites

Answer: D



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102. Which of the following correctly matched?

- A.  $[Fe(CN)_6]^{4-}$  and  $[Fe(CN)_6]^{3-}$  - both are octahedral and diamagnetic with  $d^2sp^3$  hybridisation.

- B.  $Ni(CO)_4$  and  $[Ni(CN)_4]^{2-}$ -both are tetrahedral and diamagnetic with  $sp^3$ -hybridisation
- C.  $Ni(CO)_4$  and  $[Co(CO)_4]^-$ -both are tetrahedral and diamagnetic
- D.  $[Co(H_2O)_6]^{3+}$  and  $[Cr(H_2O)_6]^{3+}$ -both are paramagnetic and metal is  $d^2sp^3$ -hybridised

Answer: C

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103. Match List-I and List-II and select the correct answer using the codes given below the slits:

List-I (Compound)	List-II ( of Central atom)
(A) $[Ni(NH_3)_6]^{2+}$	(1) $sp^3$
(B) $[PtCl_4]^{2-}$	(2) $sp^3d^2$
(C) $[Ni(CO)_4]$	(3) $dsp^2$
(D) $[Co(ox)_3]^{3-}$	(4) $d^2sp^3$

A. A-2,B-1,C-3,D-4

B. A-2,B-3,C-1,D-4

C. A-4,B-1,C-3,D-2

D. A-4,B-3,C-1,D-2

Answer: A

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104. Match List-I and List-II and select the correct answer using the codes given below the slits:

List-I	List-II
(A) $\text{Ni}(\text{CN})_5^{2-}$	(1) $sp^3$
(B) $\text{CuCl}_5^{2-}$	(2) $dsp^2$
(C) $\text{AuCl}_4^-$	(3) $sp^3d_{z^2}$
(D) $\text{ClO}_4^-$	(4) $d_{x^2-y^2}sp^3$

A. A-1,B-3,C-2,D-4

B. A-3,B-4,C-2,D-1

C. A-4,B-2,C-1,D-3

D. A-4,B-3,C-2,D-1



Answer: A

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105. Which of the following is correct matched?

Column-I	Column-II	Column-III
(a) $[\text{Cr}(\text{CO})_6]$	Paramagnetic	Octahedral, $sp^3d^2$
(b) $[\text{Fe}(\text{CO})_5]$	Paramagnetic	Trigonal bipyramid, $sp^3d$
(c) $[\text{Co}(\text{CO})_4]^-$	Diamagnetic	Tetrahedral, $sp^3$
(d) $[\text{Ni}(\text{CO})_4]$	Diamagnetic	Square planar, $dsp^2$

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106. The hybridization of the complex  $[\text{CrCl}_2(\text{NO}_2)_2(\text{NH}_3)_2]^-$  is:

A.  $sp^3d^2$

B.  $d^2sp^3$

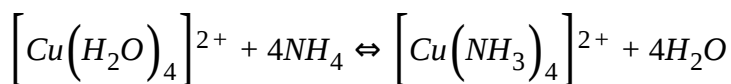
C.  $sp^3d$

D. cannot be predicted

Answer: C

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107. Which of the following statement is not true for the reaction given below:



- A. It is ligand substitution reaction
- B.  $\text{NH}_3$  is a relatively strong field ligand while  $\text{H}_2\text{O}$  is a weak field ligand
- C. During the reaction, there is a change in colour from light blue to dark blue
- D.  $\left[ \text{Cu}(\text{NH}_3)_4 \right]^{2+}$ , has a tetrahedral structure and is paramagnetic

Answer: B

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108. Which of the following match is incorrect?

Complex compounds		Type of hybridization
(a) $[\text{V}(\text{NH}_3)_6]^{3+}$	:	$d^2sp^3$
(b) $[\text{CrCl}_3(\text{NMe}_3)_3]$	:	$d^2sp^3$
(c) $[\text{Cu}(\text{CN})(\text{NO}_2)(\text{NH}_3)(\text{py})]$	:	$dsp^2$
(d) $\text{K}_3[\text{Co}(\text{ox})_3]$	:	$sp^3d^2$



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109. Select the correct code of TRUE and FALSE for given statements:

(a) Peroxide ion as well as dioxygen molecule both are paramagnetic species

(b) In set of isomers,  $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$  and  $[\text{CrCl}(\text{H}_2\text{O})_5]\text{Cl}_2 \cdot \text{H}_2\text{O}$ , both compounds can easily lose water molecule on treatment with conc.  $\text{H}_2\text{SO}_4$

(c) During transformation  $\text{NO} \rightarrow \text{NO}^+$ , bond length and magnetic behaviour decreases

(d) An ether is more volatile than alcohol both having same molecular formula

A. FTTT

B. FTFT

C. FTTT

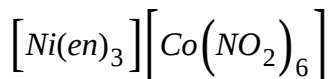
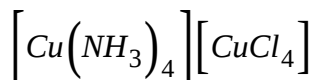
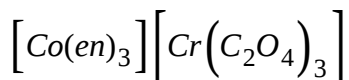
D. TFFT

**Answer: D**



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**110.** The total possible coordination isomers for the following compounds respectively are :



A. 4,4,4

B. 2,2,2

C. 2,2,4

D. 4,2,3

**Answer: D**



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**111.** Select the incorrect match:

A.  $[Co(NO_2)(H_2O)(en)_2]Cl_2, [CoCl(NO_2)(en)_2]Cl \cdot H_2O$ : Hydrate isomerism

B.  $[Cu(NH_3)_4][PtCl_4], [CuCl(NH_3)_3][PtCl_3(NH_3)]$ : Co-ordinatio isomersm

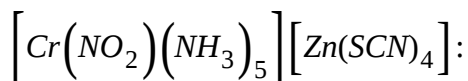
C.  $[Ni(CN)(H_2O)(NH_3)_4]Cl, [NiCl(H_2O)(NH_3)_4]CN$ : Ionization isomerism

D.  $\left[Cr(NO_2)(NH_3)_5\right]\left[ZnCl_4\right]$ ,  $\left[Cr(NO_3)(NH_3)_5\right]\left[ZnCl_4\right]$ : Linkage isomerism

**Answer: A**

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112. Select incorrect statement about complex

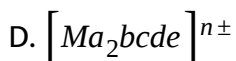
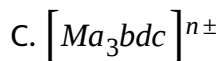
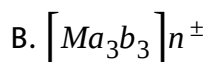
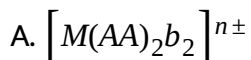


- A. It shows co-ordination isomersm
- B. it shows optical activity
- C. It shows linkage isomerism
- D. IUPAC name of the compound is pentaaminenitrito-N-chromium(III) tetrathiocyanato-S-zincate(II)

**Answer: C**

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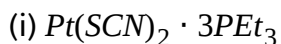
113. Complex compound(s) having even number of space (stereo) isomer is/are: (Where AA-symmetrical bidentate ligand and a,b,c,d,e-monodentate ligands)

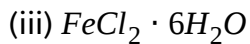
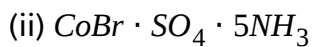


Answer: C

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114. Which of the following isomerism is not possible for complex having molecular formulae:





- A. Optical
- B. Linkage
- C. Ionisation
- D. Hydrate

**Answer: D**



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115. Unmatched characteristic of complex  $\left[ \text{PdCl}_2(\text{H}_2\text{O})_2(\text{NH}_3)_2 \right]^{2+}$  is:

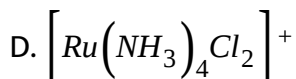
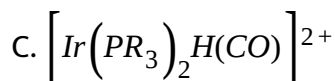
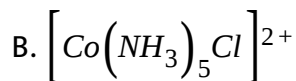
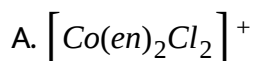
- A. Diamagnetic
- B. Low spin
- C. Geometrical isomerism
- D. Fac. And Mer. Form



Answer: D

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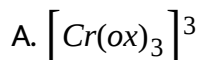
116. Which of the following has largest number of isomers?

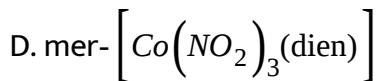
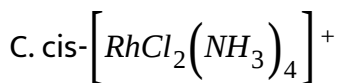
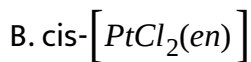


Answer: A

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117. Which one of the following complexes exhibit chirality?





**Answer: A**



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**118.** Consider the following isomerism:

(i) Ionization

(ii) Hydrate

(iii) Coordination

(iv) Geometrical

(v) Optical

Which of the above isomerism are exhibited by  $\left[Cr(NH_3)_2(O)_2Cl_2\right]^-$ ?

A. (i) and (v)

B. (ii) and (iii)

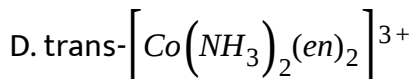
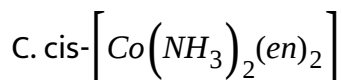
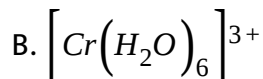
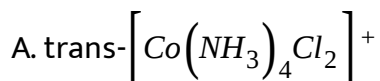
C. (iii), (ii) and (i)

D. (iv) and (v)

**Answer: C**

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**119.** Which complex is likely to show optical activity?



**Answer: A**

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120. Which of the following statement is true?

A. In  $\left[PtCl_2(NH_3)_2\right]^{2+}$  the cis form is optically inactive while trans form is optically active

B. In  $\left[Fe(C_2O_4)_3\right]^{3-}$ , geometrical isomerism does not exist while optical isomerism exists

C. In  $Mabcd$ , square planar complexes show both optical as well as geometrical isomerism

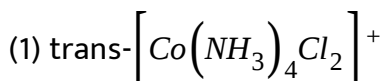
D. In  $Mabcd$  tetrahedral complex, optical isomerism cannot be observed

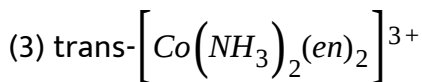
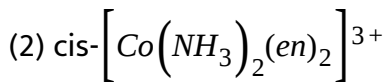
**Answer: C**



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121. The following complexes are given:





Choose the correct code:

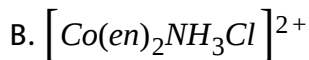
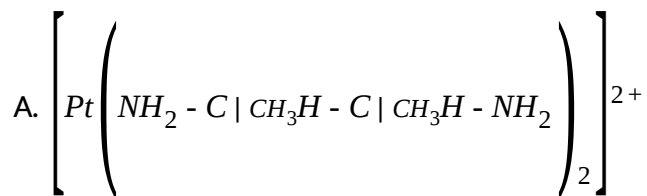
- A. (1), (2) are optically active, (3) is optically inactive
- B. (2) is optically active, (1), (3) are optically inactive
- C. (4),(5) are coloured and (6) is colourless
- D. (4) is coloured and (5), (6) are colourless

**Answer: D**



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**122.** Which of the following can show geometrical isomerism?



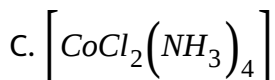
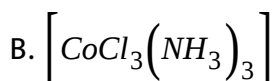
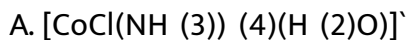
C. Both (a) and (b)

D. none of these

**Answer: A**

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**123.** Which of the following complex compound exhibits cis-trans isomerism?



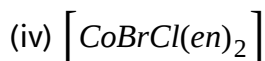
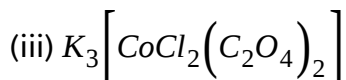
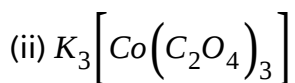
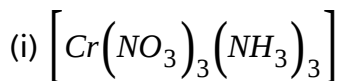
D. All of these

**Answer: C**



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**124.** Which of the following will have three stereoisomeric forms?



A. (iii) and (iv)

B. (i), (iii) and (iv)

C. (iv) only

D. all four

**Answer: C**



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125. A coordination complex of type  $MX_2Y_2$  (M-metal ion: X, Y-monodentate ligands), can have either a tetrahedral or a square planar geometry. The maximum number of possible isomers in these two cases are respectively:

A. 1 and 2

B. 2 and 1

C. 1 and 3

D. 3 and 2

**Answer: A**



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126. The ratio of cis and trans-isomers of the complex  $[Ma_2bcde]^{n\pm}$  is:



A. 5:3

B. 2:1

C. 7:3

D. 3:1

**Answer: C**

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127.  $\left[ PdCl_2(PMe_3)_2 \right]$  is a diamagnetic complex of  $Pd(II)$ . How many total isomers are possible of analogous paramagnetic complex of  $Ni(II)$ ?

A. zero

B. 1

C. 2

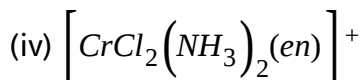
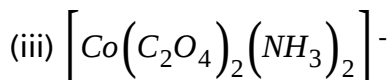
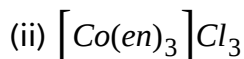
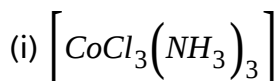
D. 3

**Answer: B**



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**128.** Complex compounds(s) which is optical active and does not depend upon the orientation of the ligands around metal cation:



A. (ii), (iii) and (iv)

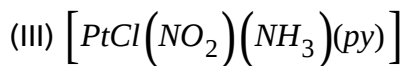
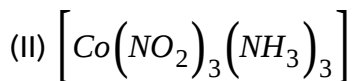
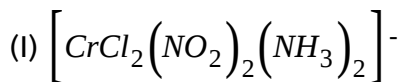
B. (i), (ii) and (iv)

C. (ii) and (iv)

D. only (ii)

**Answer: A**

129. Choose the correct code regarding, possible number of geometrical isomers exhibited by following complexes:



A. (I)-4,(II)-2,(III)-3,(IV)-1

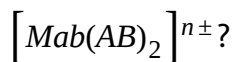
B. (I)-5,(II)-2,(III)-4,(IV)-0

C. (I)-3,(II)-2,(III)-0,(IV)-1

D. (I)-5,(II)-2,(III)-3,(IV)-0

**Answer: C**

130. How many geometrical isomers are possible for complex



A. 5

B. 4

C. 3

D. 6

**Answer: A**



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131.  $[CoCl_2(NH_3)_4]^+ + Cl^- \rightarrow [CoCl_3(NH_3)_3] + NH_3$ . If in this reaction two isomers of the product are obtained, which is true for the initial (reactant) complex:

A. compound is in cis-form

B. compound is in trans-form

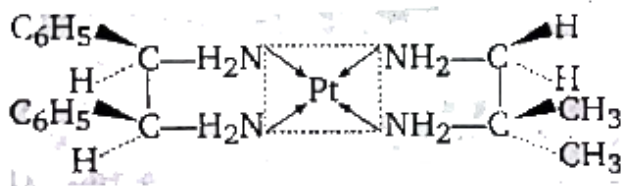
C. compound is in both (cis and trans)

D. can't be predicted

Answer: B

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132. Select the correct statement about given square planar complex.



A. It has no geometrical isomer

B. it is optically active because it does not have plane of symmetry

C. it is optically inactive because square planar complex have plane of symmetry

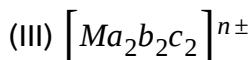
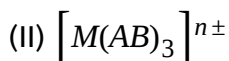
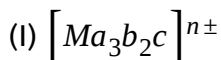
D. it is optically active because it has symmetric carbon

Answer: D



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133. Select the correct code regarding total number of space isomers for the following compounds:



A. (I)-4,(II)-4,(III)-6

B. (I)-4,(II)-3,(III)-5

C. (I)-3,(II)-3,(III)-5

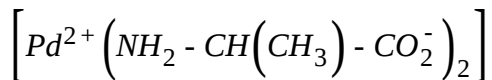
D. (I)-3,(II)-4,(III)-6

Answer: D



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134. How many geometrical isomers are possible or



A. 2

B. 3

C. 5

D. 6

Answer: C



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135. How many geometrical isomers are possible  $\left[ Co(acac)_2BrCl \right]^\ominus$  are:

A. 4

B. 3

C. 6

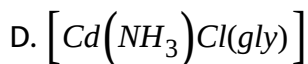
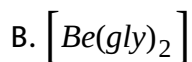
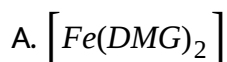
D. 2

**Answer: B**



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**136.** Which of the following complex compound exhibits geometrical isomerism?



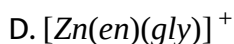
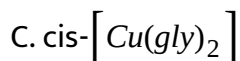
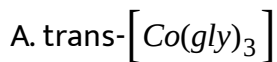
**Answer: C**



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137. In which case racemic mixture is obtained on mixing its mirror images (d & l form) is 1:1 molar ratio:

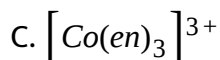
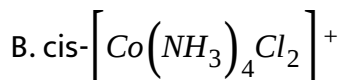
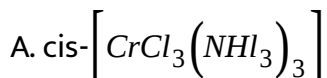


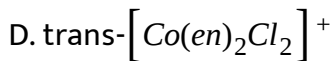
Answer: D



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138. Which of the following compound show optical isomerism?





Answer: B

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139. Match List-II with List-I and select the correct answer using the codes given below:

List-I (Ion involved)		List-II (agent)	
(i)	$\text{Ni}^{2+}$	(A)	Sodium thiosulphate
(ii)	$\text{Ag}^+$	(B)	Sodium nitroprusside
(iii)	$\text{Cu}^{2+}$	(C)	Ammonia
(iv)	$\text{S}^{2-}$	(D)	Dimethylglyoxime

A. (i)-C,(ii)-A,(iii)-D,(iv)-B

B. (i)-D,(ii)-C,(iii)-A,(iv)-B

C. (i)-D,(ii)-C,(iii)-B,(iv)-A

D. (i)-D,(ii)-A,(iii)-C,(iv)-B

Answer: A

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140. A complex whose IUPAC name is not correctly written is:

Complex	Name
(a) $\text{Fe}(\sigma\text{-C}_5\text{H}_5)_2$	Bis( $\eta^5$ -cyclopentadienyl)iron(0)
(b) $\text{Cr}(\text{C}_6\text{H}_6)_2$	Bis( $\eta^6$ -benzene)chromium(0)
(c) $[\text{CoCl}_2(\text{H}_2\text{O})_4]\text{Cl}\cdot 2\text{H}_2\text{O}$	Tetraaquadichlorocobalt (III)chloride-2-water
(d) $[\text{Zn}(\text{NCS})_4]^{2-}$	Tetrathiocyanato-N-zincate (II) ion



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141. Which of the following is correct IUPAC name of any complex compound?

- A. Tris(acetylacetonato)iron(III)chloride
- B. Heachloroplatinum(IV)tetraammine dicyano platinate(IV)
- C. Ammine bromochloro methylamine platinum(II)
- D. cis-dichloro (ethylenediamine) platinum (II)

Answer: D



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142. Find out correct IUPAC name of complex compound

- A. Triamminetricyanidochromium(III)hexanitrito-N-irridate(III)
- B. Pentaamminecyanidochromium(III)hexanitrito-N-irridium(III)
- C. Hexanitrito-N-irridium(III)pentaamminecyanidochromate(II)
- D. Pentaamminecyanidochromium(III)hexanitrito-n-irridate(III)

Answer: A

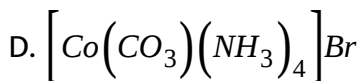
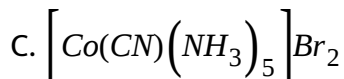
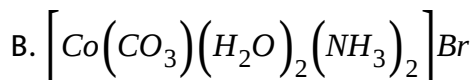
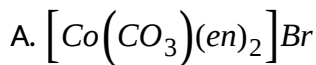


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### LEVEL 3 (PASSAGE TYPE)

1. Magnetic moment, ionic conductance and colligative properties are useful in deciding structure/constitution of a given unknown complex compound.

Q. if molar conductivity of complex is almost equal to that of NaCl and it does not exhibit stereoisomerism then the complex will be:



**Answer: D**

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2. Magnetic moment, ionic conductance and colligative properties are useful in deciding structure/constitution of a given unknown complex compound.

Q. A metal M having electronic configuration  $(n-1)d^8ns^2$  forms complexes with co-ordination No.=4 and 6, if it forms diamagnetic

complexes then permissible oxidation states of metal cation and geometry is:

- A. +2, octahedral
- B. +4, octahedral
- C. +2, square planar
- D. (b) and (c) both

**Answer: D**

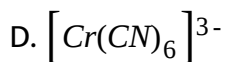
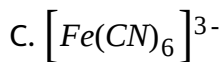


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3. Magnetic moment, ionic conductance and colligative properties are useful in deciding structure/constitution of a given unknown complex compound.

Q. The cyano complex that exhibit highest value of paramagnetism is:

- A.  $[Mn(CN)_6]^{4-}$
- B.  $[Co(CN)_6]^{3-}$

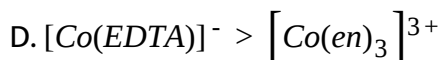
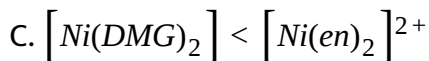
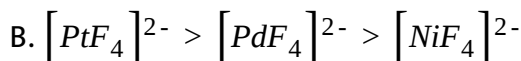
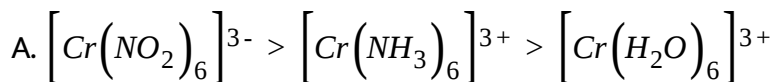


**Answer: D**

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4. The crystal field theory assumes interaction between metal ion and the ligands as a purely electrostatic and ligands are supposed to be point charges.

Q. Which of the following order of CFSE is incorrect?



**Answer: C**



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5. The crystal field theory assumes interaction between metal ion and the ligands as a purely electrostatic and ligands are supposed to be point charges.

Q. Which of the following match are incorrect?

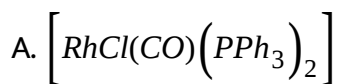
Complex Compound	Magnetic Moment
(a) $[\text{VCl}_3(\text{NMe}_3)_3]$	$\sqrt{8}$ BM
(b) $[\text{CrCl}_3(\text{NMe}_3)_3]$	$\sqrt{15}$ BM
(c) $[\text{Cu}(\text{CN})(\text{NO}_2)(\text{NH}_3)(\text{Py})]$	$\sqrt{3}$ BM
(d) $[\text{Co}(\text{ox})(\text{H}_2\text{O})_4]^+$	$\sqrt{24}$ BM



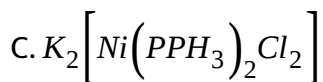
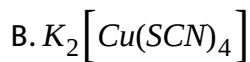
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6. The crystal field theory assumes interaction between metal ion and the ligands as a purely electrostatic and ligands are supposed to be point charges.

Q. Amongst the following complexes which has square planar geometry?





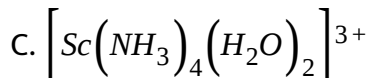
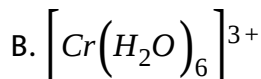
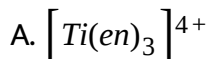


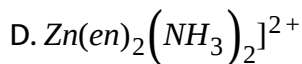
**Answer: A**

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7. The magnetic property, dipole moment, plane of symmetry, colour and absorption band can be helpful in structure elucidation of complex compounds:

Q. Which of the following complex ion is expected to absorb light in 4000 Å to 7800 Å region?





**Answer: B**



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8. The magnetic property, dipole moment, plane of symmetry, colour and absorption band can be helpful in structure elucidation of complex compounds:

Q. Compound 'x' has molecular formula  $CrCl_2Br \cdot 6H_2O$  can show type of isomerism.

(i) hydrate isomerism

(ii) ionization isomerism

(iii) geometrical isomerism

(iv) optical isomerism

A. (i), (ii) and (iii) only

B. (i) and (ii) only

C. (i), (ii), (iii) and (iv)

D. (i) and (iii) only

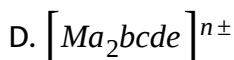
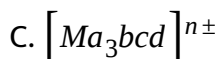
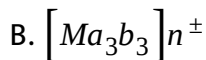
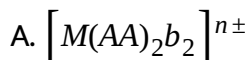
**Answer: A**



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9. The magnetic property, dipole moment, plane of symmetry, colour and absorption band can be helpful in structure elucidation of complex compounds:

Q. Complex compound() having even number of space (stereo) isomers is/are: (Where AA-symmetrical bidentate ligand and a,b,c,d,e-monodentate ligands)

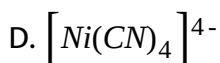
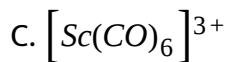
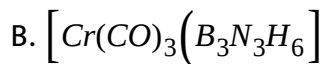
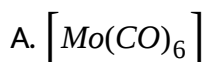


**Answer: B**

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**10.** Ligands are broadly classified into two classes classical and non-classical ligands, depending on their donor and acceptor ability. Classical ligands form classical complexes while non-classical ligands form non-classical complex. Bonding mechanism in non-classical is called synergic bonding.

Q. Synergic bonding is absent in:

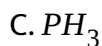
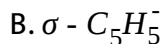
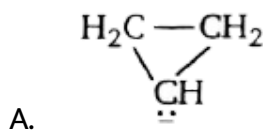


**Answer: C**

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11. Ligands are broadly classified into two classes classical and non-classical ligands, depending on their donor and acceptor ability. Classical ligands form classical complexes while non-classical ligands form non-classical complexes. Bonding mechanism in non-classical is called synergic bonding.

Q. Which is not  $\pi$ -acceptor ligand?



Answer: A

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12. Ligands are broadly classified into two classes classical and non-classical ligands, depending on their donor and acceptor ability. Classical ligands form classical complexes while non-classical ligands form non-classical complexes. Bonding mechanism in non-classical is called synergic bonding.

Q. In compound  $[M(CO)_n]^x$ , the correct match for highest 'M-C' bond length for given M, n and z respectively:

- A. M-Cr, n-6, z-0
- B. M-V, n-6, z- -1
- C. M-Ti, n-6, z- -2
- D. M-Mn, n-6, z- +1

**Answer: D**



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13. An isomerr of the complex  $CoBrCl_2(en)_2(H_2O)$ , on reaction with concentrated  $H_2SO_4$  (dehydrating agent), suffers no loss in weight and on reaction with  $AgNO_3$  solution it gives only white precipitate, which is soluble in  $NH_3$  solution.

Q. The incorrect statement about complex is:

- A. It can show geometrical isomerism
- B. cis isomer is optically active
- C. Trans isomer is optically active
- D. it can exhibit solvate isomerism

**Answer: C**

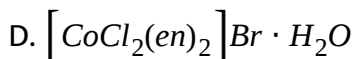
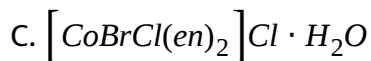
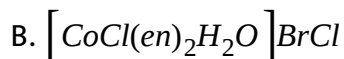
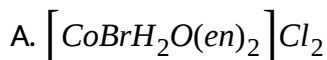


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14. An isomerr of the complex  $CoBrCl_2(en)_2(H_2O)$ , on reaction with concentrated  $H_2SO_4$  (dehydrating agent), suffers no loss in weight and on reaction with  $AgNO_3$  solution it gives only white precipitate, which is

soluble in  $NH_3$  solution.

Q. The correct formula of the complex is:



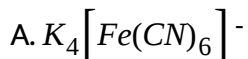
**Answer: A**



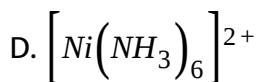
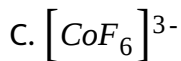
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15. Crystal field theory provides correct electronic distribution of central metal under surrounding ligand field, hence it clearly explains magnetic moment, colour of a complex.

Q. Which of the following complex is high spin?





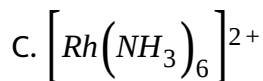
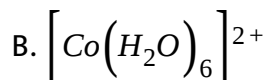
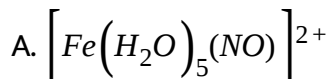


**Answer: C**

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**16.** Crystal field theory provides correct electronic distribution of central metal under surrounding ligand field, hence it clearly explains magnetic moment, colour of a complex.

Q. In which of the following complex transition of electron occurs from one shell to other shell of central metal.

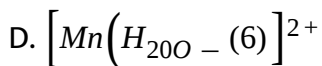
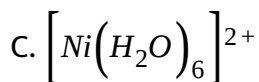
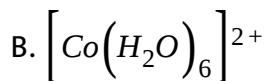
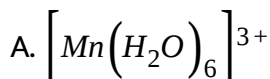


**Answer: C**

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17. Crystal field theory provides correct electronic distribution of central metal under surrounding ligand field, hence it clearly explains magnetic moment, colour of a complex.

Q. Which of the following hydrated complex ion has high intensity colour in aqueous solution.



**Answer: A**

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18. Two important physical evidence support the synergic bonding in non-classical complexes-bond lengths and vibrational spectra. Vibrational spectra is based on the fact that the compression and extension of a bond may be analogous to the behaviour of spring and obeys Hooke's law.

$$\bar{\nu} = \frac{1}{2\pi c} \sqrt{\frac{K}{\mu}} \text{ cm}^{-1}$$

Where, K=force constant of the bond which is directly

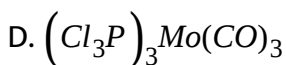
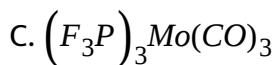
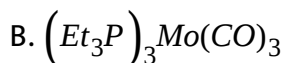
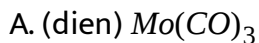
proportional to bond strength

$\mu$  = reduced mass of ligand

$\bar{\nu}$  = stretching frequency of the CO bond

$c$  = velocity of light

In which of the following complex, stretching frequency for C-O bond is least as well as bond energy of M-C bond is highest ?



Answer: A

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19. Two important physical evidences supporting the synergic bonding in non-classical complexes are bond lengths and vibrational spectra. Vibrational spectra is based on the fact that the compression and extension of a bond may be analogous to the behaviour of a spring and obeys Hook's law.

$$\bar{\nu} = \frac{1}{2\pi c} \sqrt{\frac{k}{\mu}} \text{ cm}^{-1}$$

where,  $k$  = force constant of the bond which is directly proportional to bond strength of CO  
 $\mu$  = reduced mass of ligand

$\bar{\nu}$  = stretching frequency of the CO bond

$c$  = velocity of light

Q. In  $Mn_2(CO)_{10}$  carbonyl complex, the d-orbital of Mn-atom which can not be involved in synergic bonding between Mn and CO ligands:

A.  $d_{xz}$

B.  $d_{xy}$

C.  $d_{yz}$

D. none of these

**Answer: B**

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**20.** Two important physical evidences supporting the synergic bonding in non-classical complexes are bond lengths and vibrational spectra. Vibrational spectra is based on the fact that the compression and extension of a bond may be analogous to the behaviour of a spring and obeys Hook's law.

$$\bar{\nu} = \frac{1}{2\pi c} \sqrt{\frac{k}{\mu}} \text{cm}^{-1}$$

where,  $k$  = force constant of the bond which is directly proportional to bond strength of CO  
 $\mu$  = reduced mass of ligand

$\bar{\nu}$  = stretching frequency of the CO bond

$c$  = velocity of light

Q. In which of the following ligand,  $\sigma$ -bond order does not change during synergic bonding in their respective complexes:

A. CO

B.  $N_2$

C.  $CH_2 = CH_2$

D.  $PEt_3$

**Answer: D**



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**21.** Complex compounds that have the same molecular formula but have different structural/space arrangements of ligands around central metal atom/ion are called isomers, these are of two types namely structural and stereoisomers.

Q. Which of the following is different among structural isomers?

A. Oxidation state

B. Co-ordination number

C. IUPAC name

D. None of these

**Answer: C**

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**22.** Complex compounds that have the same molecular formula but have different structural/space arrangements of ligands around central metal atom/ion are called isomers, these are of two types namely structural and stereoisomers.

Q. Type of isomerism exhibited by  $[CrCl_2(NO)_2]_2(NH_3)_2]^-$  complex ion are:

A. ionisation optical

B. hydrate, optical

C. geometrical, optical

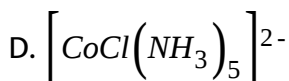
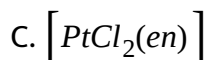
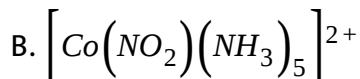
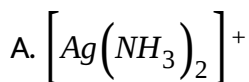
D. co-ordinate, geometrical

**Answer: C**

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**23.** Complex compounds that have the same molecular formula but have different structural/space arrangements of ligands around central metal atom/ion are called isomers, these are of two types namely structural and stereoisomers.

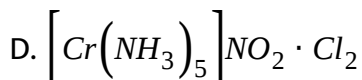
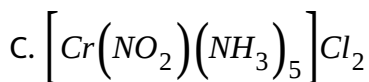
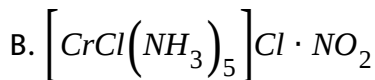
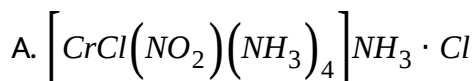
**Q.** Complex species that exhibits isomerism is:



**Answer: B**



24. A complex compound of chromium chromium contains five  $NH_3$  molecules, one nitro group and two chloride ions for one  $Cr^{3+}$  cation. One molecule of this compound produces three ions in aq. Solution, on reacting with excess of  $AgNO_3$  solution, two moles of  $AgCl$  get precipitated. The formula of the complex compound is:



Answer: C

25. A complex compound of chromium chromium contains five  $NH_3$  molecules, one nitro group and two chloride ions for one  $Cr^{3+}$  cation. One molecule of this compound produces three ions in aq. Solution, on reacting with excess of  $AgNO_3$  solution, two moles of  $AgCl$  get precipitated. The types of isomerism shown by the complex compound is:

- A. geometrical, ionization
- B. ionization, linkage
- C. linkage, optical
- D. geometrical, optical

**Answer: B**



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26. A complex compound of chromium chromium contains five  $NH_3$  molecules, one nitro group and two chloride ions for one  $Cr^{3+}$  cation.

One molecule of this compound produces three ions in aq. Solution, on reacting with excess of  $AgNO_3$  solution, two moles of  $AgCl$  get precipitated. Magnetic moment of complex compound is:

A. 0 BM

B.  $\sqrt{24}$  BM

C.  $\sqrt{15}$  BM

D.  $\sqrt{3}$  BM

**Answer: C**

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27. According to C.F.T, attraction between the central metal ion and ligands in a complex is purely electrostatic. The transition metal which forms the central atom cation in the complex is regarded as a positive ion. It is surrounded by negative ligands or neutral molecules which have a lone pair of electrons, if the ligand is a neutral molecule such as

$NH_3$ , the negative end of the dipole in the molecule is directed towards the metal cation. The electrons on the central metal ion are under repulsive forces from those on the ligands. Thus the electrons occupy the d-orbitals remain away from the direction of approach ligands.

Q. Correct relationship between pairing energy (P) and C.F.S.E.

$(\Delta_o)$  in

A.  $\Delta_o < P$

B.  $\Delta_o > P$

C.  $\Delta_o = P$

D. cannot comment

**Answer: B**

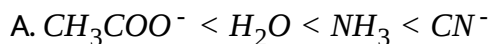


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28. According to C.F.T, attraction between the central metal ion and ligands in a complex is purely electrostatic. The transition metal which

forms the central atom cation in the complex is regarded as a positive ion. It is surrounded by negative ligands or neutral molecules which have a lone pair of electrons, if the ligand is a neutral molecule such as  $NH_3$ , the negative end of the dipole in the molecule is directed towards the metal cation. The electrons on the central metal ion are under repulsive forces from those on the ligands. Thus the electrons occupy the d-orbitals remain away from the direction of approach ligands.

It Brgt Q. The crystal field-splitting order for  $Cr^{3+}$  cation is octahedral field for ligands  $CH_3COO^-$ ,  $NH_3$ ,  $H_2O$ ,  $CN^-$  is:



**Answer: A**



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29. According to C.F.T, attraction between the central metal ion and ligands in a complex is purely electrostatic. The transition metal which forms the central atom cation in the complex is regarded as a positive ion. It is surrounded by negative ligands or neutral molecules which have a lone pair of electrons, if the ligand is a neutral molecule such as  $NH_3$ , the negative end of the dipole in the molecule is directed towards the metal cation. The electrons on the central metal ion are under repulsive forces from those on the ligands. Thus the electrons occupy the d-orbitals remain away from the direction of approach ligands.

ItBrgt Q. The value of 'x' in the complex  $H_x[Co(CO)_4]$  (on the basis of EAN rule), and geometry around Co ion respectively is:

- A. 1, square planar
- B. 2, tetrahedral
- C. 1, tetrahedral
- D. 2, square planar

**Answer: C**



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30. An isomer of the complex  $\text{Co(en)}_2(\text{H}_2\text{O})\text{Cl}_2$ , on reaction with concentrated  $\text{H}_2\text{SO}_4$ , it suffers loss in weight and on reaction with  $\text{AgNO}_3$  solution gives a yellow precipitated which is insoluble in  $\text{NH}_3$  solution.

Q. If all the ligands in the co-ordination sphere of the above complex are replaced by  $\text{CN}^-$  ion, then the magnetic moment of the complex ion will be:

A. 0.0 BM

B. 5.9 BM

C. 4.9 BM

D. 1.73 BM

**Answer: A**



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31. An isomer of the complex  $Co(en)_2(H_2O)ICl_2$ , on reaction with concentrated  $H_2SO_4$ , it suffers loss in weight and on reaction with  $AgNO_3$  solution gives a yellow precipitated which is insoluble in  $NH_3$  solution.

Q. If one mole of original is treated with excess  $Pb(NO_3)_2$  solution, then the number of moles of white precipitate formed will be

A. 2.0

B. 1.0

C. 0.0

D. 3.0

**Answer: C**



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32. An isomer of the complex  $Co(en)_2(H_2O)ICl_2$ , on reaction with concentrated  $H_2SO_4$ , it suffers loss in weight and on reaction with



$AgNO_3$  solution gives a yellow precipitated which is insoluble in  $NH_3$  solution.

Q. Total number of space isomers of the formula of the above complex is:

A. 2

B. 3

C. 4

D. 1

**Answer: B**



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33. In complexes of weak field ligands,  $\Delta_o < P$  (pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively less. Under the influence of strong field ligands,  $\Delta_o > p$  (Pairing energy), the energy

difference between  $t_{2g}$  and  $e_g$  sets is relatively high.

Q. Which of the following is correct statement?

A. Complex  $[Co(H_2O)_6]^{2+}$  is more stable than  $[Co(H_2O)_6]^{3+}$

B. All compounds of  $Ni(II)$  are bound to be outer-d-orbital complexes

C. Stability constant for  $[Ni(en)_3]^{2+}$  is greater than stability constant for  $[Ni(NH_3)_6]^{2+}$

D.  $\Delta_{oct}$  for  $[Cr(H_2O)_6]^{3+}$  is greater than  $\Delta_{oct}$  for  $[Cr(NH_3)_6]^{3+}$

**Answer: C**

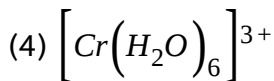
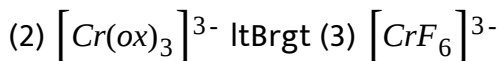
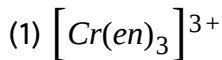


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**34.** In complexes of weak field ligands,  $\Delta_o < P$  (pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively less. Under the influence of strong field ligands,  $\Delta_o > p$  (Pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively high.

Q. Select the correct increasing order of 10 Dq. value of chromium

complexes:



A.  $4 < 3 < 1 < 2$

B.  $3 < 4 < 2 < 1$

C.  $4 < 3 < 2 < 1$

D.  $3 < 4 < 1 < 2$

**Answer: B**

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35. In complexes of weak field ligands,  $\Delta_o < P$  (pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively less. Under the influence of strong field ligands,  $\Delta_o > p$  (Pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively high.

Q. Select the correct statement regarding

$[Cr(en)_2Cl_2]^+$  and  $[Co(C_2O_4)_2(NH_3)_2]^-$  complex ions:

- A. Both are equally stable complexes
- B. Both have equal number of stereoisomers
- C. Both are diamagnetic complexes
- D. a and c both

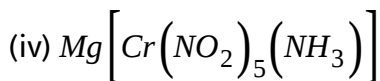
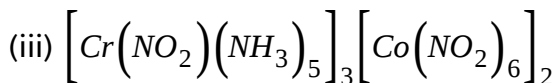
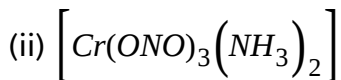
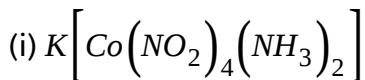
**Answer: B**

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**36.** Complex compounds are molecular compounds which retain their identities even when dissolved in water. They do not give all the simple ions in solution but instead furnish complex ions. The complex compounds are often called coordination compounds because certain groups called ligands are attached to the central metal ion by coordinate or dative bonds. coordination compounds exhibit isomerism,

both structural and stereoisomerism. the structure, magnetic property, colour and electrical properties of complexes are explained by various theories:

Q. Arrange the following compounds in order of their molar conductance:



A. (ii) < (i) < (iv) < (iii)

B. (i) < (ii) < (iii) < (iv)

C. (ii) < (i) < (iii) < (iv)

D. (iv) < (iii) < (ii) < (i)

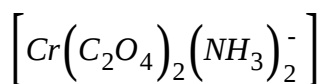
Answer: A



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**37.** Complex compounds are molecular compounds which retain their identities even when dissolved in water. They do not give all the simple ions in solution but instead furnish complex ions. The complex compounds are often called coordination compounds because certain groups called ligands are attached to the central metal ion by coordinate or dative bonds. coordination compounds exhibit isomerism, both structural and stereoisomerism. the structure, magnetic property, colour and electrical properties of complexes are explained by various theories:

Q. The oxidation number, coordination number and magnetic moment in the following complex is:



A. O.N.=+3, C.N.=6, M.M.= $\sqrt{15}BM$

B. O.N.=1, C.N.=6, M.M.= $\sqrt{15}BM$

C. O.N.=+3, C.N.=6, M.M.= $\sqrt{3}BM$

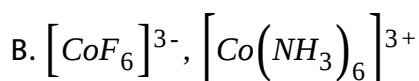
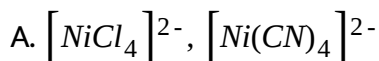
D. O.N.=+3, C.N.=6, M.M.= $\sqrt{12}BM$

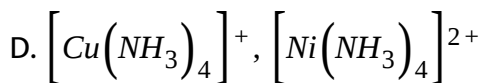
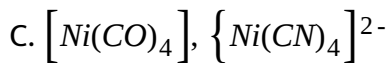
Answer: A

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**38.** Complex compounds are molecular compounds which retain their identities even when dissolved in water. They do not give all the simple ions in solution but instead furnish complex ions. The complex compounds are often called coordination compounds because certain groups called ligands are attached to the central metal ion by coordinate or dative bonds. coordination compounds exhibit isomerism, both structural and stereoisomerism. the structure, magnetic property, colour and electrical properties of complexes are explained by various theories:

Q. In which of the following pairs, both the complexes have the same geometry?



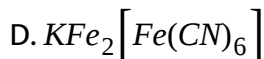
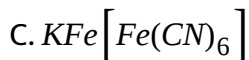
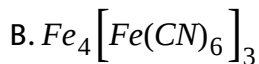
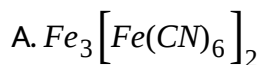


**Answer: B**

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39. Recent X-ray work, IR and other spectroscopic methods have proved that Turnbull's blue is identical to Prussian blue.

Q. What is the common formula of Turnbull's blue and Prussian blue?



**Answer: C**

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40. Recent X-ray work, IR and other spectroscopic methods have proved that Turnbull's blue is identical to Prussian blue.

Q. Intense blue colour arises as a result of:

A. electron transfer between  $Fe(II)$  and  $Fe(I)$

B. electron transfer between  $Fe(II)$  and  $Fe(III)$

C. d-d transition

D. spin magnetic moment

**Answer: B**

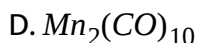
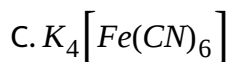
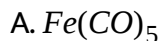


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41. On the basis of stability of complex ion in the solution, complexes may be of two types, perfect and imperfect complexes. The stability depends upon the extent of dissociation which in turn depends upon charge on central metal atom, basic nature of ligand, chelation, and

nature of metal ion and ligand according to HSAB principle.

Qgt Which one of the following does not follow EAN rule?



**Answer: B**



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**42.** On the basic of stability of complex ion in the solution, complexes may be of two types, perfect and imperfect complexes. The stability depends upon the extent of dissociation which in turn depends upon charge on central metal atom, basic nature of ligand, chelation, and nature of metal ion and ligand according to HSAB principle.

Q Which complex is most stable?

A.  $[Cu(CN)_2]^- K_d = 1 \times 10^{-16}$

B.  $[Fe(CN)_6]^{4-} K_d = 1 \times 10^{-37}$

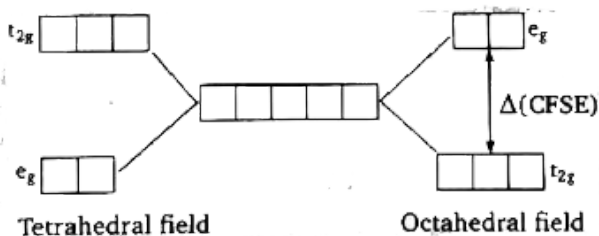
C.  $[Fe(CN)_6]^{3-} K_d = 1 \times 10^{-44}$

D.  $[Ag(CN)_2]^- K_d = 1 \times 10^{-20}$

**Answer: C**

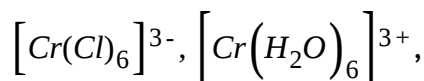
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43. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  are either stabilized or destabilized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

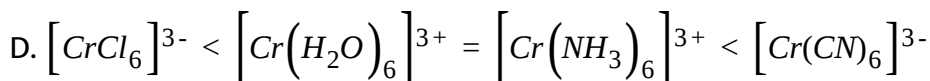
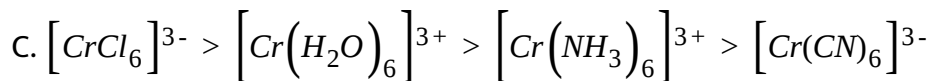
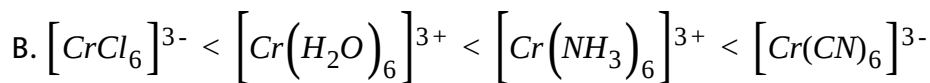
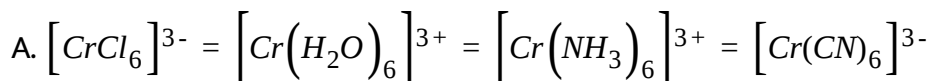


Value of CFSE depends upon nature of ligand and a spectrochemical series has been made experimentally, for tetrahedral complexes,  $\Delta$  is about  $4/9$  times to  $\Delta_0$  (CFSE for octahedral complex). this energy lies in visible region and i.e., why electronic transition are responsible for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

Q.  $Cr^{3+}$  form four complexes with four different ligands which are



$[Cr(NH_3)_6]^{3+}$  and  $[Cr(CN)_6]^{3-}$ , the order of CFSE ( $\Delta_0$ ) in these complexes in the order:

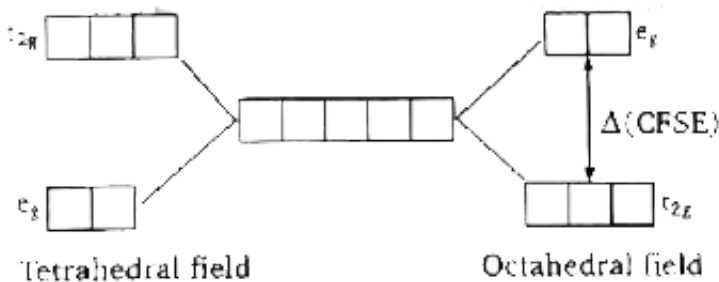


**Answer: B**



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44. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  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 d-orbitals, which are stabilized in an octahedral magnetic field, are:

A.  $d_{xy}$  and  $d_{x^2-y^2}$

B.  $d_{x^2-y^2}$  and  $d_{x^2}$

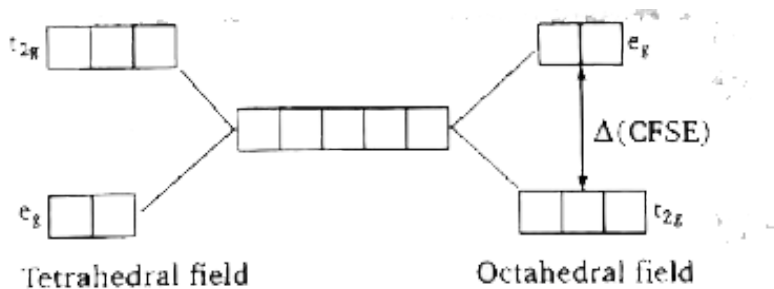
C.  $d_{xy}$ ,  $d_{xz}$  and  $d_{yz}$

D.  $d_{x^2}$  only

**Answer: C**

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45. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2} - d_{x^2-y^2})$  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. For an octahedral complex, which of the followin d-electron configuration will give maximum CFSE?

- A. High spin  $d^6$
- B. Low spin  $d^4$
- C. Low spin  $d^5$
- D. High spin  $d^7$

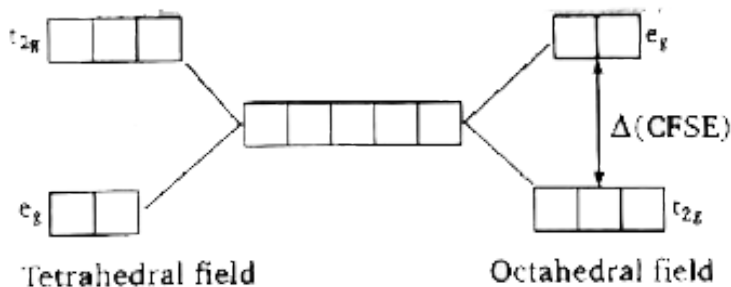
**Answer: C**



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**46.** When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneray is lost. The two set

$t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  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.  $Ti^{3+}(aq)$ . is purple while  $Ti^{4+}(aq)$ . is colourless because:

- A. there is not crystal field effec in  $Ti^{4+}$
- B. The energy difference between  $t_{2g}$  and  $e_g Ti^{4+}$  is quite high and does not fall in the visible region
- C.  $Ti^{4+}$  has  $d^0$  configuration

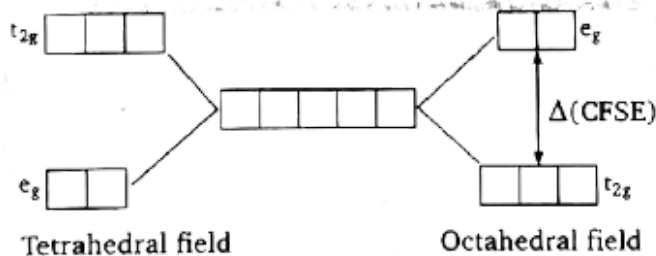


D.  $Ti^{4+}$  is very small in comparison to  $Ti^{3+}$  and hence does not absorb any radiation

Answer: C

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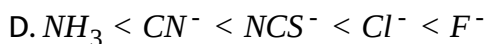
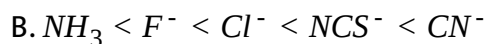
47. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}$  ( $d_{xy}, d_{yz}, d_{xz}$ ) and  $e_g$  ( $d_{x^2-y^2}, d_{z^2}$ ) are either stabilized or destabilized depending upon the nature of magnetic field. 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. Which of the following is correct arrangement of ligand in terms of the  $Dq$  values of their complexes with any particular 'hard' metal ion:

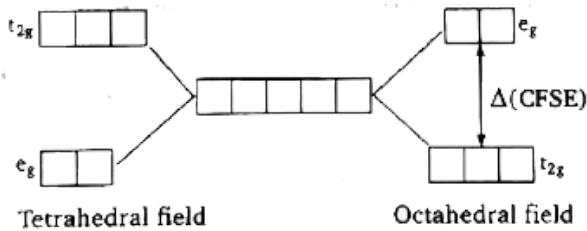


**Answer: A**

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**48.** When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  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:

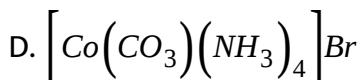
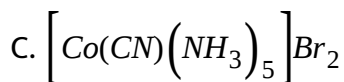
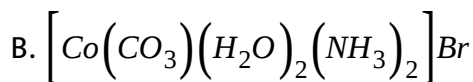
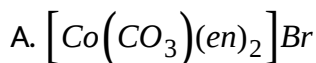
- A.  $Fe(III) < Cr(III) < Rh(III) < Ir(III)$
- B.  $Cr(III) < Fe(III) < (Rh(III) < Ir(III)$
- C.  $Ir(III) < Rh(III) < Fe(III) < Cr(III)$
- D.  $Fe(III) = Cr(III) < Rh(III) < Ir(III)$

**Answer: A**

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**49.** Magnetic moment, ionic conductance and colligative properties are useful in deciding structure/constitution of a given unknown complex compound.

Q. if molar conductivity of complex is almost equal to that of NaCl and it does not exhibit stereoisomerism then the complex will be:



**Answer: D**

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50. Magnetic moment, ionic conductance and colligative properties are useful in deciding structure/constitution of a given unknown complex compound.

Q. A metal M having electronic configuration  $(n-1)d^8ns^2$  forms complexes with co-ordination No.=4 and 6, if it forms diamagnetic complexes then permissible oxidation states of metal cation and geometry is:

- A. +2, octahedral
- B. +4, octahedral
- C. +2, square planar
- D. (b) and (c) both

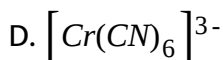
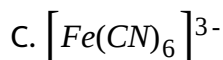
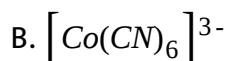
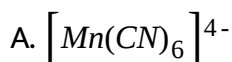
**Answer: D**



[View Text Solution](#)

51. Magnetic moment, ionic conductance and colligative properties are useful in deciding structure/constitution of a given unknown complex compound.

Q. The cyano complex that exhibit highest value of paramagnetism is:

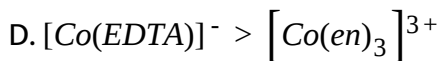
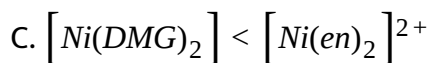
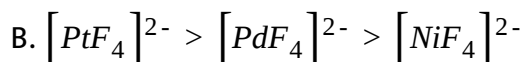
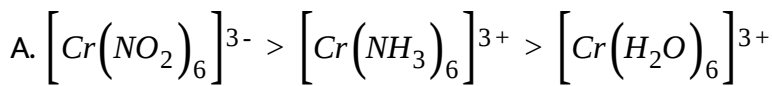


**Answer: D**

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52. The crystal field theory assumes interaction between metal ion and the ligands as a purely electrostatic and ligands are supposed to be point charges.

Q. Which of the following order of CFSE is incorrect?



**Answer: C**

 [View Text Solution](#)

53. The crystal field theory assumes interaction between metal ion and the ligands as a purely electrostatic and ligands are supposed to be point charges.

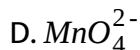
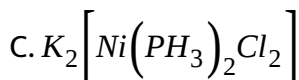
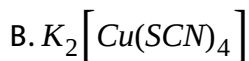
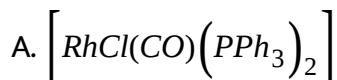
Q. Which of the following match are incorrect?

Complex Compound	Magnetic Moment
(a) $[VCl_3(NMe_3)_3]$	$\sqrt{8}$ BM
(b) $[CrCl_3(NMe_3)_3]$	$\sqrt{15}$ BM
(c) $[Cu(CN)(NO_2)(NH_3)(Py)]$	$\sqrt{3}$ BM
(d) $[Co(ox)(H_2O)_4]^+$	$\sqrt{24}$ BM

 [View Text Solution](#)

54. The crystal field theory assumes interaction between metal ion and the ligands as a purely electrostatic and ligands are supposed to be point charges.

Q. Amongst the following complexes which has square planar geometry?



**Answer: A**

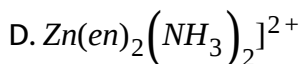
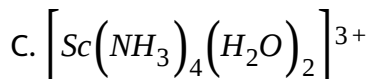
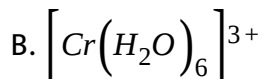
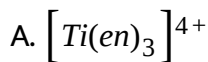


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55. The magnetic property, dipole moment, plane of symmetry, colour and absorption band can be helpful in structure elucidation of complex compounds:



Q. Which of the following complex ion is expected to absorb light in 4000 Å to 7800 Å region?



**Answer: B**



[View Text Solution](#)

**56.** The magnetic property, dipole moment, plane of symmetry, colour and absorption band can be helpful in structure elucidation of complex compounds:

Q. Compound 'x' has molecular formula  $CrCl_2Br \cdot 6H_2O$  can show type of isomerism.

(i) hydrate isomerism

(ii) ionization isomerism

(iii) geometrical isomerism

(iv) optical isomerism

A. (i), (ii) and (iii) only

B. (i) and (ii) only

C. (i), (ii), (iii) and (iv)

D. (i) and (iii) only

**Answer: A**

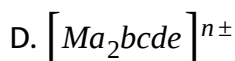
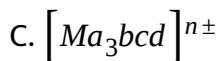
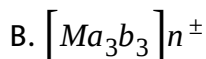
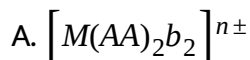


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57. The magnetic property, dipole moment, plane of symmetry, colour and absorption band can be helpful in structure elucidation of complex compounds:

Q. Complex compound() having even number of space (stereo) isomers

is/are: (Where AA-symmetrical bidentate ligand and a,b,c,d,e-monodentate ligands)



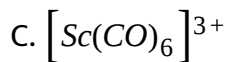
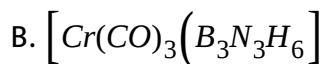
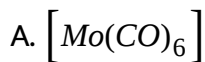
**Answer: B**



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**58.** Ligands are broadly classified into two classes classical and non-classical ligands, depending on their donor and acceptor ability. Classical ligands form classical complexes while non-classical ligands form non-classical complex. Bonding mechanism in non-classical is called synergic bonding.

Q. Synergic bonding is absent in:



Answer: C

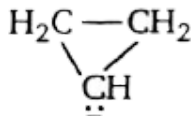


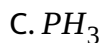
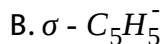
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59. Ligands are broadly classified into two classes classical and non-classical ligands, depending on their donor and acceptor ability. Classical ligands form classical complexes while non-classical ligands form non-classical complex. Bonding mechanism in non-classical is called synergic bonding.

Q. Which is not  $\pi$ -acceptor ligand?

A.



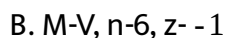
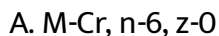


**Answer: A**

 [View Text Solution](#)

**60.** Ligands are broadly classified into two classes classical and non-classical ligands, depending on their donor and acceptor ability. Classical ligands form classical complexes while non-classical ligands form non-classical complexes. Bonding mechanism in non-classical is called synergic bonding.

**Q.** In compound  $[M(CO)_n]^x$ , the correct match for highest 'M-C' bond length for given M, n and z respectively:



C. M-Ti, n-6, z- -2

D. M-Mn, n-6, z- +1

**Answer: D**

 [View Text Solution](#)

61. An isomer of the complex  $CoBrCl_2(en)_2(H_2O)$ , on reaction with concentrated  $H_2SO_4$  (dehydrating agent), suffers no loss in weight and on reaction with  $AgNO_3$  solution it gives only white precipitate, which is soluble in  $NH_3$  solution.

Q. The incorrect statement about complex is:

A. It can show geometrical isomerism

B. cis isomer is optically active

C. Trans isomer is optically active

D. it can exhibit solvate isomerism

Answer: C

 [View Text Solution](#)

62. An isomer of the complex  $CoBrCl_2(en)_2(H_2O)$ , on reaction with concentrated  $H_2SO_4$  (dehydrating agent), suffers no loss in weight and on reaction with  $AgNO_3$  solution it gives only white precipitate, which is soluble in  $NH_3$  solution.

Q. The correct formula of the complex is:

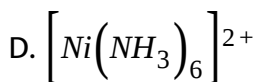
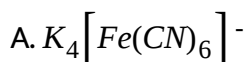
- A.  $[CoBrH_2O(en)_2]Cl_2$
- B.  $[CoCl(en)_2H_2O]BrCl$
- C.  $[CoBrCl(en)_2]Cl \cdot H_2O$
- D.  $[CoCl_2(en)_2]Br \cdot H_2O$

Answer: A

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63. Crystal field theory provides correct electronic distribution of central metal under surrounding ligand field, hence it clearly explains magnetic moment, colour of a complex.

Q. Which of the following complex is high spin?



**Answer: C**

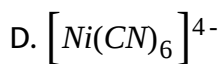
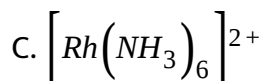
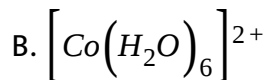
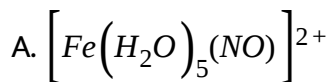


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64. Crystal field theory provides correct electronic distribution of central metal under surrounding ligand field, hence it clearly explains magnetic moment, colour of a complex.



Q. In which of the following complex transition of electron occurs from one shell to other shell of central metal.



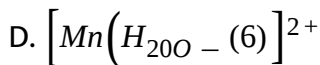
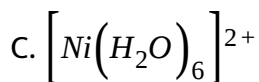
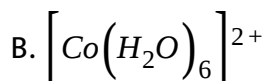
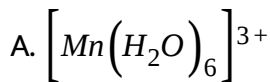
**Answer: C**



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**65.** Crystal field theory provides correct electronic distribution of central metal under surrounding ligand field, hence it clearly explains magnetic moment, colour of a complex.

Q. Which of the following hydrated complex ion has high intensity colour in aqueous solution.



**Answer: A**



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**66.** Two important physical evidences supporting the synergic bonding in non-classical complexes are bond lengths and vibrational spectra. Vibrational spectra is based on the fact that the compression and extension of a bond may be analogous to the behaviour of a spring and obeys Hook's law.

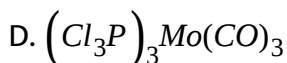
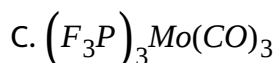
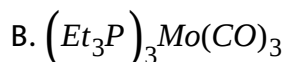
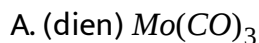
$$\bar{\nu} = \frac{1}{2\pi c} \sqrt{\frac{k}{\mu}} \text{cm}^{-1}$$

where,  $k$  = force constant of the bond which is directly proportional to bond strength of CO  $\mu$  = reduced mass of ligand

$\bar{\nu}$ =stretching frequency of the CO bond

$c$ =velocity of light

Q. In which of the following complex stretching frequency for CO ligand is least as well as bond energy of M-C bond is higher.



**Answer: A**



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67. Two important physical evidences supporting the synergic bonding in non-classical complexes are bond lengths and vibrational spectra. Vibrational spectra is based on the fact that the compression and extension of a bond may be analogous to the behaviour of a spring and

obeys Hook's law.

$$\bar{\nu} = \frac{1}{2\pi c} \sqrt{\frac{k}{\mu}} \text{cm}^{-1}$$

where,  $k$  = force constant of the bond which is directly proportional to bond strength of CO  
 $\mu$  = reduced mass of ligand

$\bar{\nu}$  = stretching frequency of the CO bond

$c$  = velocity of light

Q. In  $Mn_2(CO)_{10}$  carbonyl complex, the d-orbital of Mn-atom which can not be involved in synergic bonding between Mn and CO ligands:

A.  $d_{xz}$

B.  $d_{xy}$

C.  $d_{yz}$

D. none of these

**Answer: B**



[View Text Solution](#)

68. Two important physical evidences supporting the synergic bonding in non-classical complexes are bond lengths and vibrational spectra. Vibrational spectra is based on the fact that the compression and extension of a bond may be analogous to the behaviour of a spring and obeys Hook's law.

$$\bar{\nu} = \frac{1}{2\pi c} \sqrt{\frac{k}{\mu}} \text{cm}^{-1}$$

where,  $k$  = force constant of the bond which is directly proportional to bond strength of CO  
 $\mu$  = reduced mass of ligand

$\bar{\nu}$  = stretching frequency of the CO bond

$c$  = velocity of light

Q. In which of the following ligand,  $\sigma$ -bond order does not change during synergic bonding in their respective complexes:

A. CO

B.  $N_2$

C.  $CH_2 = CH_2$

D.  $PEt_3$

**Answer: D**



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**69.** Complex compounds that have the same molecular formula but have different structural/space arrangements of ligands around central metal atom/ion are called isomers, these are of two types namely structural and stereoisomers.

Q. Which of the following is different among structural isomers?

- A. Oxidation state
- B. Co-ordination number
- C. IUPAC name
- D. None of these

**Answer: C**



[View Text Solution](#)

70. Complex compounds that have the same molecular formula but have different structural/space arrangements of ligands around central metal atom/ion are called isomers, these are of two types namely structural and stereoisomers.

Q. Type of isomerism exhibited by  $[CrCl_2(NO)_2]_2(NH_3)_2]^-$  complex ion are:

- A. ionisation optical
- B. hydrate, optical
- C. geometrical, optical
- D. co-ordinate, geometrical

**Answer: C**

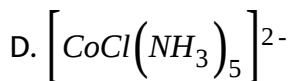
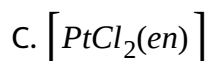
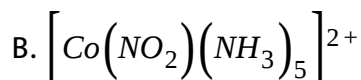
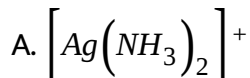


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71. Complex compounds that have the same molecular formula but have different structural/space arrangements of ligands around central metal

atom/ion are called isomers, these are of two types namely structural and stereoisomers.

Q. Complex species that exhibits isomerism is:



**Answer: B**

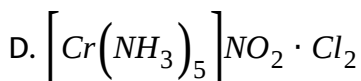
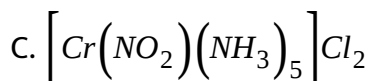
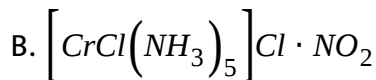
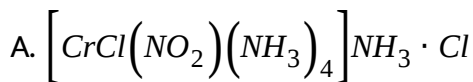
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**72.** A complex compound of chromium chromium contains five  $NH_3$  molecules, one nitro group and two chloride ions for one  $Cr^{3+}$  cation. One molecule of this compound produces three ions in aq. Solution, on reacting with excess of  $AgNO_3$  solution, two moles of  $AgCl$  get



precipitated

Q. The formula of the complex compound is:



**Answer: C**



[View Text Solution](#)

**73.** A complex compound of chromium chromium contains five  $NH_3$  molecules, one nitro group and two chloride ions for one  $Cr^{3+}$  cation. One molecule of this compound produces three ions in aq. Solution, on reacting with excess of  $AgNO_3$  solution, two moles of  $AgCl$  get precipitated

Q. The types of isomerism shown by the complex compound is:

A. geometrical, ionization

B. ionization, linkage

C. linkage, optical

D. geometrical, optical

**Answer: B**

 [View Text Solution](#)

74. A complex compound of chromium chromium contains five  $NH_3$  molecules, one nitro group and two chloride ions for one  $Cr^{3+}$  cation. One molecule of this compound produces three ions in aq. Solution, on reacting with excess of  $AgNO_3$  solution, two moles of  $AgCl$  get precipitated

Q. Magnetic moment off complex compound is:

A. 0 BM

B.  $\sqrt{24}$  BM

C.  $\sqrt{15}$  BM

D.  $\sqrt{3}$  BM

**Answer: C**

 [View Text Solution](#)

75. According to C.F.T, attraction between the central metal ion and ligands in a complex is purely electrostatic. The transition metal which forms the central atom cation in the complex is regarded as a positive ion. It is surrounded by negative ligands or neutral molecules which have a lone pair of electrons, if the ligand is a neutral molecule such as  $NH_3$ , the negative end of the dipole in the molecule is directed towards the metal cation. The electrons on the central metal ion are under repulsive forces from those on the ligands. Thus the electrons occupy the d-orbitals remain away from the direction of approach ligands.

Q. Correct relationship between pairing energy (P) and C.F.S.E. ( $\Delta_o$ ) in

A.  $\Delta_o < P$

B.  $\Delta_o < P$

C.  $\Delta_o = P$

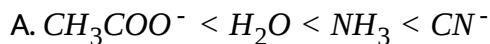
D. cannot comment

**Answer: B**

 [View Text Solution](#)

**76.** According to C.F.T, attraction between the central metal ion and ligands in a complex is purely electrostatic. The transition metal which forms the central atom cation in the complex is regarded as a positive ion. It is surrounded by negative ligands or neutral molecules which have a lone pair of electrons, if the ligand is a neutral molecule such as  $NH_3$ , the negative end of the dipole in the molecule is directed towards the metal cation. the electrons on the central metal ion are under repulsive forces from those on the ligands. thus the electrons occupy the d-orbitals remain away from the direction of approach ligands.

Q. The crystal field-splitting order for  $Cr^{3+}$  cation is octahedral field for ligands  $CH_3COO^-$ ,  $NH_3$ ,  $H_2O$ ,  $CN^-$  is:



**Answer: A**



[View Text Solution](#)

77. According to C.F.T, attraction between the central metal ion and ligands in a complex is purely electrostatic. The transition metal which forms the central atom cation in the complex is regarded as a positive ion. It is surrounded by negative ligands or neutral molecules which have a lone pair of electrons, if the ligand is a neutral molecule such as  $NH_3$ , the negative end of the dipole in the molecule is directed towards

the metal cation. the electrons on the central metal ion are under repulsive forces from those on the ligands. thus the electrons occupy the d-orbitals remain away from the direction of approach ligands.

Q. The value of 'x' in the complex  $H_x[Co(CO)_4]$  (on the basis of EAN rule), and geometry around Co ion respectively is:

A. 1, square planar

B. 2, tetrahedral

C. 1, tetrahedral

D. 2, square planar

**Answer: C**

 [View Text Solution](#)

78. An isomer of the complex  $Co(en)_2(H_2O)Cl_2$ , on reaction with concentrated  $H_2SO_4$ , it suffers loss in weight and on reaction with  $AgNO_3$  solution gives a yellow precipitated which is insoluble in  $NH_3$

solution.

Q. If all the ligands in the co-ordination sphere of the above complex are replaced by  $CN^-$  ion, then the magnetic moment of the complex ion will be:

A. 0.0 BM

B. 5.9 BM

C. 4.9 BM

D. 1.73 BM

**Answer: A**



[View Text Solution](#)

79. An isomer of the complex  $Co(en)_2(H_2O)ICl_2$ , on reaction with concentrated  $H_2SO_4$ , it suffers loss in weight and on reaction with  $AgNO_3$  solution gives a yellow precipitated which is insoluble in  $NH_3$  solution.

Q. If one mole of original is treated with excess  $Pb(NO_3)_2$  solution, then the number of moles of white precipitate formed will be

A. 2.0

B. 1.0

C. 0.0

D. 3.0

**Answer: C**



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80. An isomer of the complex  $Co(en)_2(H_2O)Cl_2$ , on reaction with concentrated  $H_2SO_4$ , it suffers loss in weight and on reaction with  $AgNO_3$  solution gives a yellow precipitated which is insoluble in  $NH_3$  solution.

Q. Total number of space isomers of the formula of the above complex is:



A. 2

B. 3

C. 4

D. 1

**Answer: B**



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**81.** In complexes of weak field ligands,  $\Delta_o < P$  (pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively less. Under the influence of strong field ligands,  $\Delta_o > p$  (Pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively high.

Q. Which of the following is correct statement?

A. Complex  $[Co(H_2O)_6]^{2+}$  is more stable than  $[Co(H_2O)_6]^{3+}$

B. All compounds of  $Ni(II)$  are bound to be outer-d-orbital complexes

C. Stability constant for  $[Ni(en)_3]^{2+}$  is greater than stability constant for  $[Ni(NH_3)_6]^{2+}$

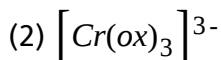
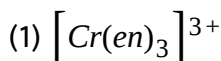
D.  $\Delta_{oct}$  for  $[Cr(H_2O)_6]^{3+}$  is greater than  $\Delta_{oct}$  for  $[Cr(NH_3)_6]^{3+}$

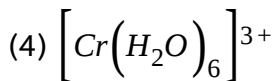
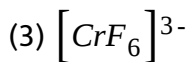
**Answer: C**

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**82.** In complexes of weak field ligands,  $\Delta_o < P$  (pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively less. Under the influence of strong field ligands,  $\Delta_o > p$  (Pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively high.

**Q.** Select the correct increasing order of 10 Dq. value of chromium complexes:





A.  $4 < 3 < 1 < 2$

B.  $3 < 4 < 2 < 1$

C.  $4 < 3 < 2 < 1$

D.  $3 < 4 < 1 < 2$

**Answer: B**



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**83.** In complexes of weak field ligands,  $\Delta_o < P$  (pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively less. Under the influence of strong field ligands,  $\Delta_o > p$  (Pairing energy), the energy difference between  $t_{2g}$  and  $e_g$  sets is relatively high.

Q. Select the correct statement regarding

$[Cr(en)_2Cl_2]^+$  and  $[Co(C_2O_4)_2(NH_3)_2]^-$  complex ions:

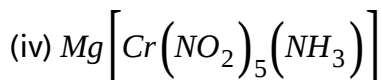
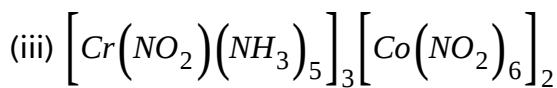
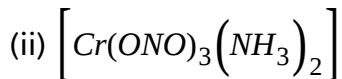
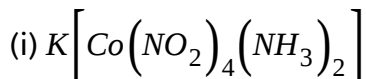
- A. Both are equally stable complexes
- B. Both have equal number of stereoisomers
- C. Both are diamagnetic complexes
- D. a and c both

**Answer: B**

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**84.** Complex compounds are molecular compounds which retain their identities even when dissolved in water. They do not give all the simple ions in solution but instead furnish complex ions. The complex compounds are often called coordination compounds because certain groups called ligands are attached to the central metal ion by coordinate or dative bonds. coordination compounds exhibit isomerism, both structural and stereoisomerism. the structure, magnetic property, colour and electrical properties of complexes are explained by various theories:

Q. Arrange the following compounds in order of their molar conductance:



A. (ii) < (i) < (iv) < (iii)

B. (i) < (ii) < (iii) < (iv)

C. (ii) < (i) < (iii) < (iv)

D. (iv) < (iii) < (ii) < (i)

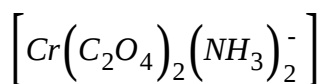
**Answer: A**



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**85.** Complex compounds are molecular compounds which retain their identities even when dissolved in water. They do not give all the simple ions in solution but instead furnish complex ions. The complex compounds are often called coordination compounds because certain groups called ligands are attached to the central metal ion by coordinate or dative bonds. coordination compounds exhibit isomerism, both structural and stereoisomerism. the structure, magnetic property, colour and electrical properties of complexes are explained by various theories:

Q. The oxidation number, coordination number and magnetic moment in the following complex is:



A. O.N.=+3, C.N.=6, M.M.= $\sqrt{15}BM$

B. O.N.=1, C.N.=6, M.M.= $\sqrt{15}BM$

C. O.N.=+3, C.N.=6, M.M.= $\sqrt{3}BM$

D. O.N.=+3, C.N.=6, M.M.= $\sqrt{12}BM$

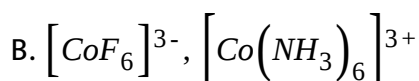
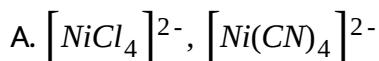
Answer: A

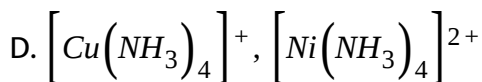
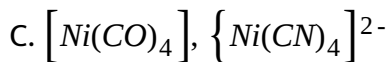


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**86.** Complex compounds are molecular compounds which retain their identities even when dissolved in water. They do not give all the simple ions in solution but instead furnish complex ions. The complex compounds are often called coordination compounds because certain groups called ligands are attached to the central metal ion by coordinate or dative bonds. coordination compounds exhibit isomerism, both structural and stereoisomerism. the structure, magnetic property, colour and electrical properties of complexes are explained by various theories:

Q. In which of the following pairs, both the complexes have the same geometry?



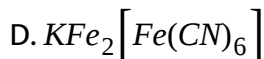
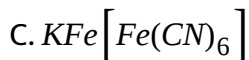
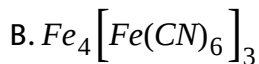
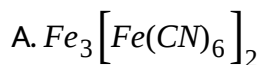


**Answer: B**

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87. Recent X-ray work, IR and other spectroscopic methods have proved that Turnbull's blue is identical to Prussian blue.

Q. What is the common formula of Turnbull's blue and Prussian blue?



**Answer: C**

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88. Recent X-ray work, IR and other spectroscopic methods have proved that Turnbull's blue is identical to Prussian blue.

Q. Intense blue colour arises as a result of:

A. electron transfer between  $Fe(II)$  and  $Fe(I)$

B. electron transfer between  $Fe(II)$  and  $Fe(III)$

C. d-d transition

D. spin magnetic moment

**Answer: B**

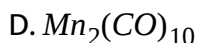
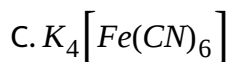
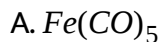


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89. On the basis of stability of complex ion in the solution, complexes may be of two types, perfect and imperfect complexes. The stability depends upon the extent of dissociation which in turn depends upon charge on central metal atom, basic nature of ligand, chelation, and

nature of metal ion and ligand according to HSAB principle.

Q> Which one of the following does not follow EAN rule?



**Answer: B**



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**90.** On the basis of stability of complex ion in the solution, complexes may be of two types, perfect and imperfect complexes. The stability depends upon the extent of dissociation which in turn depends upon charge on central metal atom, basic nature of ligand, chelation, and nature of metal ion and ligand according to HSAB principle.

Q> Which complex is most stable?

A.  $[Cu(CN)_2]^- K_d = 1 \times 10^{-16}$

B.  $[Fe(CN)_6]^{4-} K_d = 1 \times 10^{-37}$

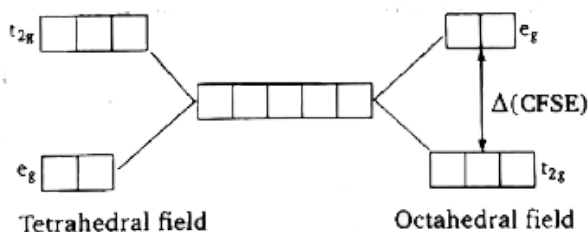
C.  $[Fe(CN)_6]^{3-} = 1 \times 10^{-44}$

D.  $[Ag(CN)_2]^- K_d = 1 \times 10^{-20}$

**Answer: C**

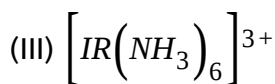
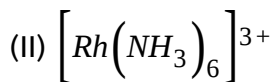
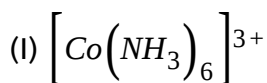
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91. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  are either stabilized or destabilized 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  $\frac{4}{9}$  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 value of CFSE ( $\Delta_0$ ) for complexes given below follow the order,



A.  $I < II < III$

B.  $I > II > III$

C.  $I < II > III$

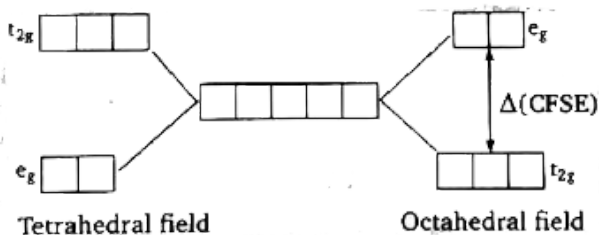
D.  $I = II = III$

**Answer: A**



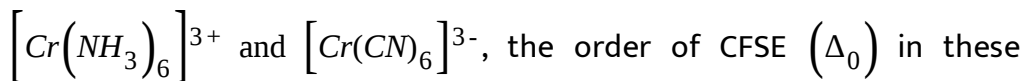
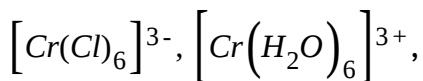
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92. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  are either stabilized or destabilized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

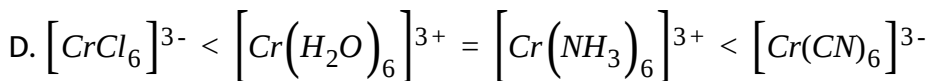
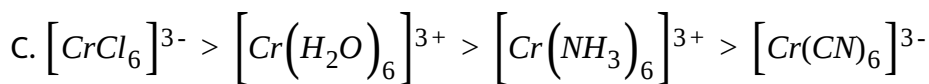
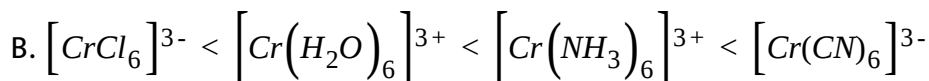
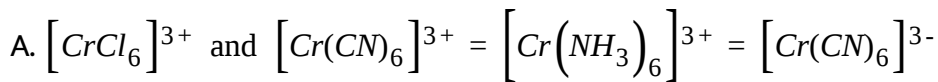


Value of CFSE depends upon nature of ligand and a spectrochemical series has been made experimentally, for tetrahedral complexes,  $\Delta$  is about  $4/9$  times to  $\Delta_0$  (CFSE for octahedral complex). this energy lies in visible region and i.e., why electronic transition are responsible for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

Q.  $\text{Cr}^{3+}$  form four complexes with four different ligands which are



complexes in the order:

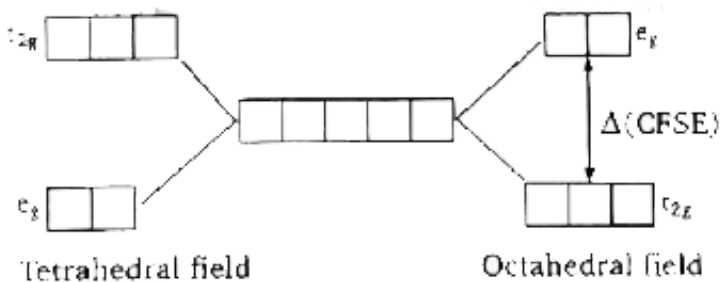


**Answer: B**



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**93.** When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two set  $t_{2g}(d_{xy}, d_{yz}, d_{xz})$  and  $e_g(d_{x^2-y^2}, d_{z^2})$  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  $\frac{4}{9}$  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 d-orbitals, which are stabilized in an octahedral magnetic field, are:

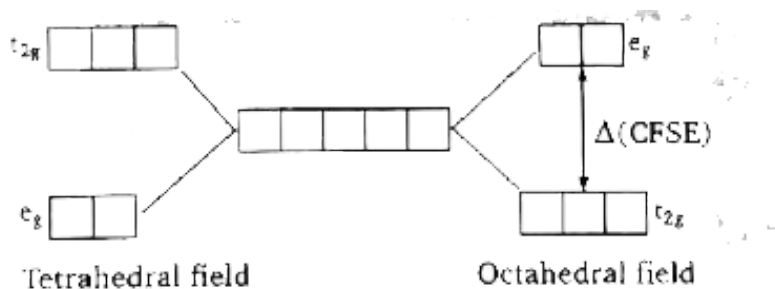
- A.  $d_{xy}$  and  $d_{x^2}$
- B.  $d_{x^2-y^2}$  and  $d_{x^2}$
- C.  $d_{xy}$ ,  $d_{xz}$  and  $d_{yz}$
- D.  $d_{x^2}$  only

**Answer: C**



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



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Q. For an octahedral complex, which of the followin d-electron configuration will give maximum CFSE?



A. High spin  $d^6$

B. Low spin  $d^4$

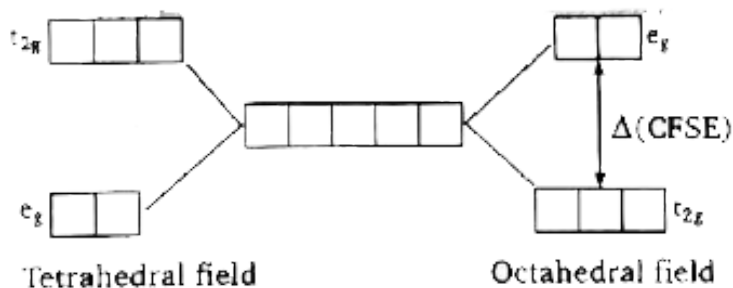
C. Low spin  $d^5$

D. High spin  $d^7$

**Answer: C**

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



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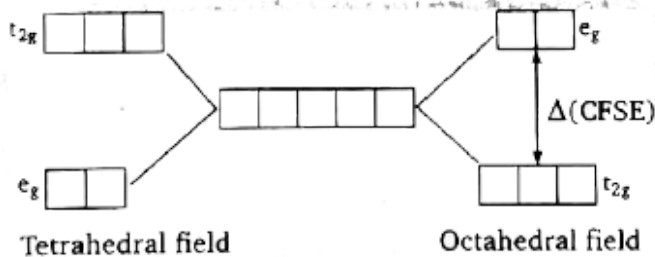
Q.  $Ti^{3+}(aq)$ . is purple while  $Ti^{4+}(aq)$ . is colourless because:

- A. there is not crystal field effec in  $Ti^{4+}$
- B. The energy difference between  $t_{2g}$  and  $e_g$   $Ti^{4+}$  is quite high and does not fall in the visible region
- C.  $Ti^{4+}$  has  $d^0$  configuration
- D.  $Ti^{4+}$  is very small in comparison to  $Ti^{3+}$  and hence does not absorb any radiation

Answer: C

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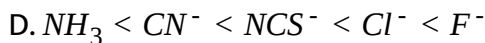
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Q. Which of the following is correct arrangement of ligand in terms of the  $Dq$  values of their complexes with any particular 'hard' metal ion:

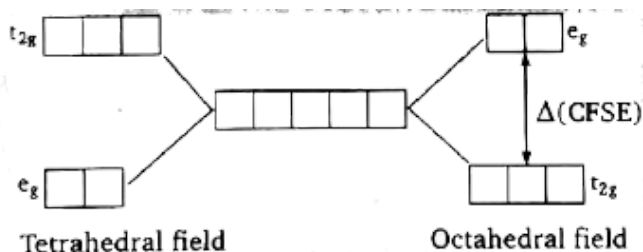




Answer: A

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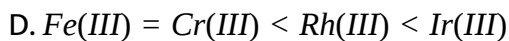
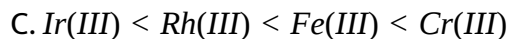
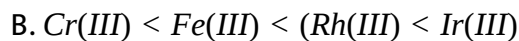
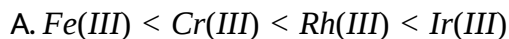
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about  $\frac{4}{9}$  times to  $\Delta_0$  (CFSE for octahedral complex). this energy lies in visible region and i.e., why electronic transition are responsible for colour. such transition are not possible with  $d^0$  and  $d^{10}$  configuration.

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



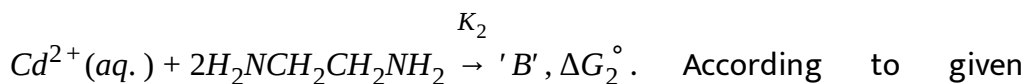
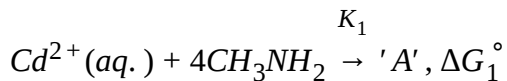
**Answer: A**



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**ONE OR MORE ANSWERS IS/ARE CORRECT**

1. Consider the following two reactions:



According to given information the correct statement(s) is/are:

- A.  $\Delta G_2^\circ$  is more negative than  $\Delta G_1^\circ$
- B. Compound 'A' is optically inactive
- C. Compound 'B' is optically active
- D. Formation constant  $K_2$  is greater than formation constant  $K_1$

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

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2. Complex compound  $\left[Co(SCN)_2(NH_3)_4\right]Cl$  exhibits:

- A. Ionization isomerism

B. Geometrical isomerism

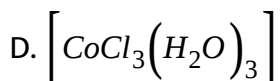
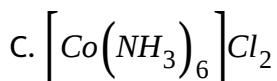
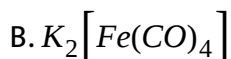
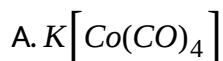
C. Optical isomerism

D. Linkage isomerism

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

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3. Which of the following compound has/have effective atomic number equal to the atomic number of a noble gas ?



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

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4. Select correct statement(s) regarding octahedron complex having

$$CFSE = -1.2\Delta_0.$$

A. Compound is neither low spin nor high spin complex

B. Type of hybridisation complex does not depend upon nature of ligands

C. Magnetic moment of complex compounds is either

$$\sqrt{15}B. M \text{ or } \sqrt{8}B. M.$$

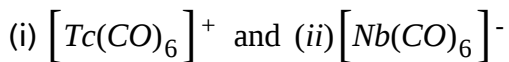
D. All are incorrect statements

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



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5. Consider the following two carbonyl compounds





Select incorrect statement(s) for given carbonyl compounds.

- A.  $\{Tc(CO)_6\}^+$  acts as reducing agent and  $[Nb(CO)_6]^-$  acts as oxidizing agent
- B.  $[Nb(CO)_6]^-$  acts as reducing agent and  $[Tc(CO)_6]^+$  acts as oxidizing agent
- C. Nb-C bond order in  $[Nb(CO)_6]^-$  is greater than in  $\{Tc(CO)_6\}^+$
- D. "CO" bond order is greater in  $[Nb(CO)_6]^-$  than in  $[Tc(CO)_6]^+$

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

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6. Which of the following ligand does not act as  $\pi$  - acid ligand?

- A.  $\sigma$ -cyclopentadienyl
- B.  $\pi$ -allyl
- C.  $B_3N_3H_6$

D.  $\pi$ -cyclopentadienyl

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

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7. Find out correct IUPAC name of complex compound

A. Pentaamminecyanidochromium(II) hexanitrito-N-irridate(III)

B. Triamminetricyanidochromium(III)hexanitrito-N-irridate(III)

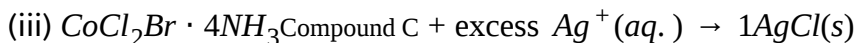
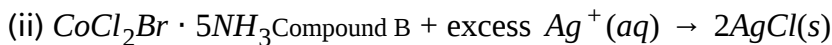
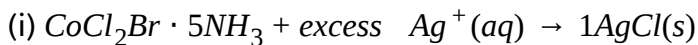
C. Hexanitrito-N-irridium(III)pentaamminecyanidochromate(II)

D. Pentaamminecyanidochromium(III)hexanitrito-N-irridate(III)

**Answer: A::D**

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8. Consider the following reactions of complex compounds A,B and C



Then according to the given information the correct statement(s) is/are:

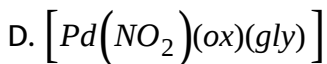
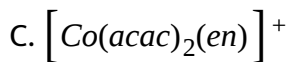
- A. Compounds(A) and (B) are ionisation isomers
- B. Molar conductivity of compounds (A) and (B) are almost same
- C. Compounds (A), (B) and (C) do not exhibit geometrical isomerism
- D. Order of CFSE values,  $\Delta_0(\text{A}) > \Delta_0(\text{B}) > \Delta_0(\text{C})$

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



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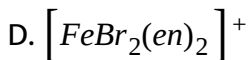
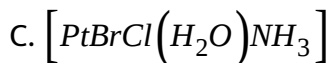
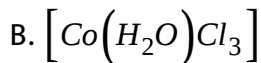
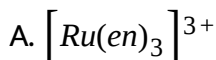
9. Which complex species does/do not exhibit geometrical and only have two stereoisomers.



**Answer: A:C**

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**10.** Which of the following complex(s) can not exhibit both geometrical and optical isomerism?



**Answer: B**



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11. Complex ions  $[NiCl_6]^{4-}$ ,  $[Ni(CN)_6]^{4-}$  similar in their given properties:

- A. oxidation state, geometry
- B. co-ordination number, EAN
- C. magnetic moment, geometry
- D. stability, colour

Answer: A::B::C



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12. Select correct statement(s) regarding given complexes:

- A.  $[Fe(CO)_5]$ , the orbitals used for hybridisation in Fe atom are  $s$ ,  $p_x$ ,  $p_y$ ,  $p_z$ ,  $d_{z^2}$  and it is high spin complex

B.  $\left[Pt(NH_3)_2Cl_2\right]$ , the orbitals used for hybridization on Pt atom are

$s, p_x, p_y, d_{x^2-y^2}$  and it is low spin complex

C.  $\left[Cr(H_2O)_6\right]^{3+}$ , the orbitals used for hybridization in Cr atom are

$s, p_x, p_y, p_z, p_{x^2}, d_{x^2-y^2}$  and it is high spin complex

D.  $Ni(CO)_4$ , the orbitals used of hybridization in Ni atom are  $s,$

$p_x, p_y, p_z,$  and it is low spin complex

**Answer: B::D**

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13. Complex compound  $\left[Co(SCN)_2(NH_3)_4\right]Cl$  exhibits:

A. Ionization isomerism

B. geometrical isomerism

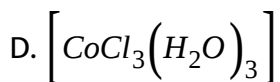
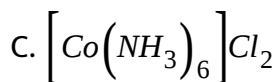
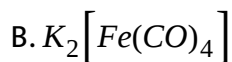
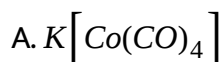
C. optical isomerism

D. linkage isomerism

Answer: A::B::D

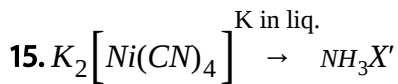
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14. Which of the following compound has/have effective atomic number equal to the atomic number of a noble gas?

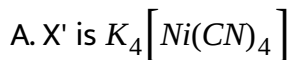


Answer: A::B::D

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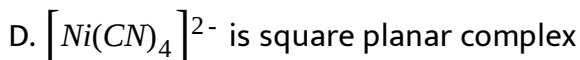


Regarding this reaction correct statement is/are:



B. The oxidation state of Ni changed +2 to zero

C. The structure of 'X' is tetrahedral



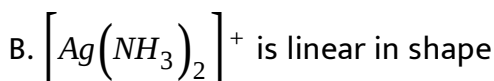
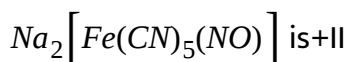
Answer: A::B::C::D



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16. Which of the following statement(s) is/are correct?

A. The oxidation state of iron in sodium nitro prusside





C. In  $\left[Fe(H_2O)_6\right]^+$ , Fe is  $d^2sp^3$  hybridized

D. In  $\left[Co(H_2O)_6\right]^{3+}$  complex ion, Co is  $d^2sp^3$  hybridized

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

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17. Which one of the following statement(s) is/are false?

A. weak ligands like  $F^-$ ,  $Cl^-$  and  $OH^-$  usually form low spin complexes

B. Strong ligand like  $CN^-$  and  $NO_2^-$ , generally form high spin complexes

C.  $\left[FeF_6\right]^{3-}$  is high spin complex

D.  $\left[Ni(CO)_4\right]$  is high spin complex

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

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18. A d-block element forms octahedral complex but its spin magnetic moment remains same either in strong field or in weak field ligand.

Which of the following is/are correct ?

- A. Element always forms colourless compound
- B. Number of electron in  $t_{2g}$  orbitals are higher than in  $e_g$  orbitals
- C. It can have either  $d^3$  or  $d^8$  configuration
- D. It can have either  $d^7$  or  $d^8$  configuration

**Answer: B::C**

19. For which of the following  $d^n$  configuration of octahedral complex(es), cannot exist in both high spin and low spin forms?

A.  $d^3$

B.  $d^5$

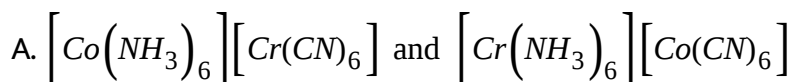
C.  $d^6$

D.  $d^8$

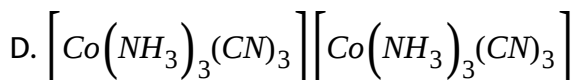
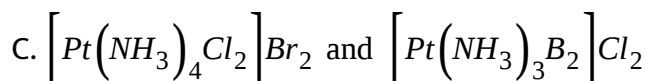
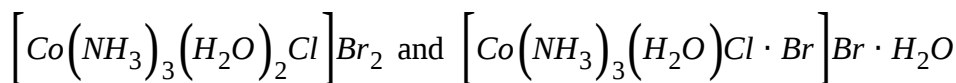
**Answer: A:D**

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



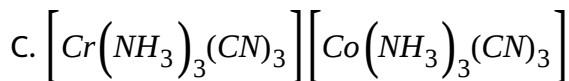
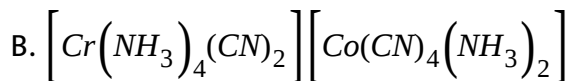
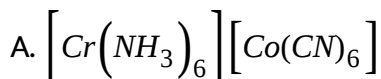
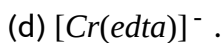
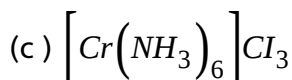
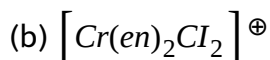
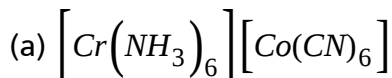
B.



Answer: A::D

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21. Which would exhibit coordination isomerism

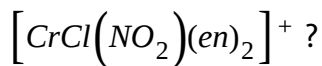


D. none of these

Answer: A::B

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22. Which of the following statements is not true about the complex ion



- A. It has two geometrical isomers cis and trans
- B. cis and trans forms are not diastereomers to each other
- C. only the cis isomer displays optical activity
- D. it has three optically active isomers: *d*, *l* and trans forms

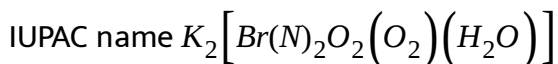
Answer: B::D

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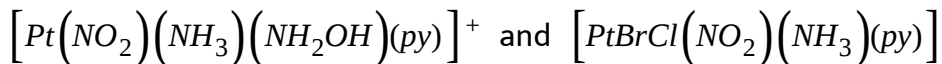
23. Which of the following statement(s) is/are incorrect?

- A. In  $[CrBrCl(en)_2]^+$  geometrical isomerism exists, while optical isomerism does not exist

B. Potassium aquadicyanosuperoxoperoxoperoxochromate(III) is



C. There are 3 geometrical and 15 stereoisomers possible for



respectively

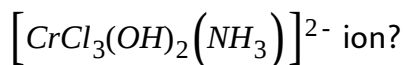
D. cis and trans forms are not diastereomers to each other

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



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24. Which of the following statement is true about the complex



A. It has three geometrical isomers

B. Only one space isomers is optically active and remaining are

inactive

C. There are total four space isomers

D. The magnetic moment of complex ion is 3.89 BM

**Answer: A::D**

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25. Which of the following is correct about Tetraamminedithiocyanato-cobalt(III) tris(oxalato)cobaltate(III)?

A. Formula of the complex is  $\left[Co(SCN)_2(NH_3)_4\right]\left[Co(ox)_3\right]$

B. It is a chelating complex and show linkage isomerism

C. it shows optical isomerism

D. it shows geometrical isomerism

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

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26. Which of the following statement(s) is/are false?

A. In  $\left[PtCl_2(NH_3)_4\right]^{2+}$  complex ion, the cis-form is optically active, while trans-form is optically inactive

B. In  $\left[Fe(C_2O_4)_3\right]^{3-}$ , geometrical isomerism does not exist, while optical isomerism exist

C. In  $[Mabcd]^{n\pm}$  tetrahedral complexes, optical isomerism cannot be observed

D. In  $[Mabcd]^{n\pm}$  square planar complex, optical isomerism can be observed

Answer: A::C::D



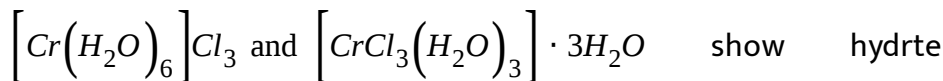
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27. Which of the following statement(s) is/are true?



A. In metal carbonyl complexes  $d_{C-O}$  increases compared to that in CO molecule

B. The pair of compounds



isomerism

C.  $d_{x^2}$  orbital of central metal atom/ion is used in  $dsp^2$  hybridisation

D. Facial and Meridional isomers associated with  $[Ma_3b_3]^{n\pm}$  type complex compound, both are optically inactive.

**Answer: A::D**

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**28.** Select the correct statement:

A. Chelation effect is maximum for five and six membered rings

B. Greater the charge on the central metal cation, greater the value of  $\Delta(CFSE)$

C. In complex ion  $[CoF_6]^{3-}$ ,  $F^-$  is a weak field ligand, so that  $\Delta_{oct} < P$  (Pairing energy) and it is low spin complex

D.  $[CoCl_2(NH_3)_2(en)]^{\oplus}$  complex ion will have four different isomers

Answer: A::B::D

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29. Which of the following statement(s) is/are true?

A. In ferrocyanide ion, the effective atomic number is 36.

B. Chelating ligands are atleast bidentate ligand

C.  $[CrCl_2(CN)_2(NH_3)_2]^{\ominus}$  and  $[CrCl_3(NH_3)_3]$  both have  $d^2sp^3$  hybridization

D. As the number of rings in complex increases, stability of complex (chelate) also increases

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

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30. In test of  $NO_3^-$  ion, the dark brown ring complex is formed, which is true of this complex?

A. the colour is due to charge transfer spectra

B. iron and NO both have +1 charge

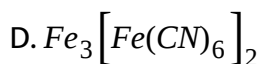
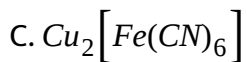
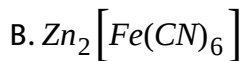
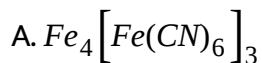
C. The complex species can be represented as  $[Fe^I(H_2O)_5NO]^{2+}$

D. Iron has +2 oxidation state and NO is neutral

Answer: A::B::C

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31. The complex(es) which is/are blue in colour:



Answer: A:D



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32. What is/are the coordination number(s) of Au in the complexes formed by Au?

A. 6

B. 4

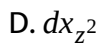
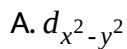
C. 5

D. 2

**Answer: B::D**

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**33.** The d-orbitals involved in  $sp^3d^2$  or  $d^2sp^3$  hybridization of the central metal ion are:



**Answer: A::D**

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34. Which is not correctly matched?

Complex compounds	IUPAC name
(a) $K[CrF_4O]$	Potassium tetrafluorooxo chromate (v)
(b) $Na[BH(OCH_3)_3]$	Sodium hydrido trimethoxy borate (III)
(c) $[Be(CH_3 - CO - CH - CO - C_6H_5)_2]^0$	Bis (Benzoylacetato) beryllium (III)
(d) $H[AuCl_4]$	Hydrogen tetrachloro aurate (III)



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35. Which of the following statement(s) is(are) correct?

- A. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in the magnetic properties
- B. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in the geometry
- C. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in primary valencies of nickel
- D. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in the state of hybridization of nickel

Answer: A::B::D

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36. Which is/are correct statement(s)?

A.  $\left[Ag(NH_3)_2\right]^+$  is linear with sp hybridisation  $Ag^+$  ions

B.  $NiCl_4^{2-}$ ,  $CrO_4^{2-}$  and  $MnO_4^-$  have tetrahedral geometry

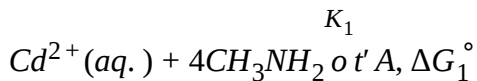
C.  $\left[Cu(NH_3)_4\right]^{2+}$ ,  $\left[[Pt(NH_3)_4]^{2+}\right]$  and  $\left[Ni(CN)_4\right]^{2-}$  have  $dsp^2$  hybridisation of the metal ion

D.  $Fe(CO)_5$  has trigonal bipyramidal structure with  $d_2sp^3$  hybridised ion

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

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37. Consider the following two reactions:



According to given information the correct statement(s) is/are:

- A.  $\Delta G_2^\circ$  is more negative than  $\Delta G_1^\circ$
- B. Compound 'A' is optically inactive
- C. Compound 'B' is optically active
- D. Formation constant  $K_2$  is greater than formation constant  $K_1$

Answer: A::B::D

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38. Complex compound  $[Co(SCN)_2(NH_3)_4]Cl$  exhibits:

- A. Ionization isomerism



B. Geometrical isomerism

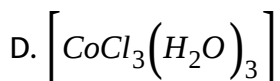
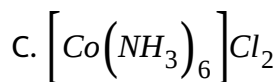
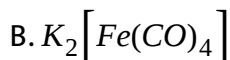
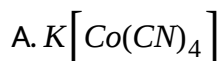
C. Optical isomerism

D. Linkage isomerism

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

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**39.** Which of the following compound has/have effective atomic number equal to the atomic



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

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40. Select correct statement(s) regarding octahedron complex having

$$CFSE = -1.2\Delta_0.$$

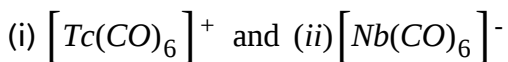
- A. Compound is neither low spin nor high spin complex
- B. Type of hybridisation complex does not depend upon nature of ligands
- C. Magnetic moment of complex compounds is either  $\sqrt{15}B.M$  or  $\sqrt{8}B.M$ .
- D. All are incorrect statements

Answer: A::B::C



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41. Consider the following two carbonyl compounds



Select incorrect statement(s) for given carbonyl compounds.

- A.  $\{t(\text{CO})_6\}^+$  acts as reducing agent and  $[\text{Nb}(\text{CO})_6]^-$  acts as oxidizing agent
- B.  $[\text{Nb}(\text{CO})_6]^-$  acts as reducing agent and  $[\text{Tc}(\text{CO})_6]^+$  acts as oxidizing agent
- C. Nb-C bond order in  $[\text{Nb}(\text{CO})_6]^-$  than in  $\{\text{Tc}(\text{CO})_6\}^+$
- D. "CO" bond order is greater in  $[\text{Nb}(\text{CO})_6]^-$  than in  $[\text{Tc}(\text{CO})_6]^+$

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



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42. Which of the following ligand(s) can act as  $\pi$ -acid ligand.?

- A.  $\sigma$ -cyclopentadienyl
- B.  $\pi$ -allyl
- C.  $B_3N_3H_6$

D.  $\pi$ -cyclopentadienyl

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

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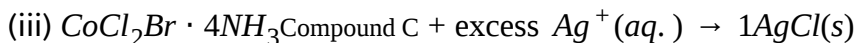
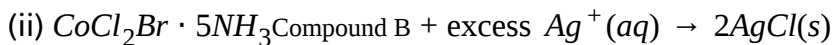
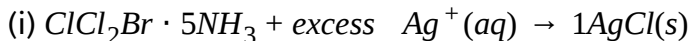
**43.** Find out correct IUPAC name of complex compound

- A. Pentaamminecyanidochromium(II) hexanitrito-N-irridate(III)
- B. Triamminetricyanidochromium(III)hexanitrito-N-irridate(III)
- C. Hexanitrito-N-irridium(III)pentaamminecyanidochromate(II)
- D. Pentaamminecyanidochromium(III)hexanitrito-N-irridate(III)

**Answer: A::D**

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44. Consider the following reactions of complex compounds A,B and C



Then according to the given information the correct statement(s) is/are:

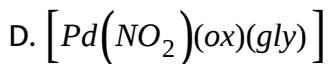
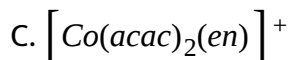
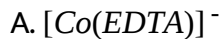
- A. Compounds(A) and (B) are ionisation isomers
- B. Molar conductivity of compounds (A) and (B) are almost same
- C. Compounds (A), (B) and (C) do not exhibit geometrical isomerism
- D. Order of CFSE values,  $\Delta_0(A) > \Delta_0(B) > \Delta_0(C)$

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



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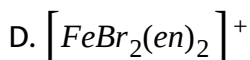
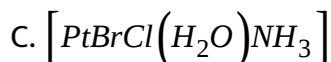
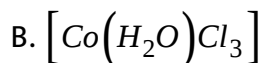
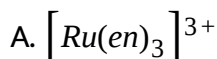
45. Which complex species does/do not exhibit geometrical and optical isomerism?



**Answer: A:C**

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**46.** Which of the following complex(s) can not exhibit both geometrical and optical isomerism?



**Answer: B**



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47. Complex ions  $[\text{NiCl}_6]^{4-}$ ,  $[\text{Ni}(\text{CN})_6]^{4-}$  similar in their given properties:

- A. oxidation state, geometry
- B. co-ordination number, EAN
- C. magnetic moment, geometry
- D. stability, colour

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



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48. Select correct statement(s) regarding given complexes:

- A.  $[\text{Fe}(\text{CO})_5]$ , the orbitals used for hybridisation in Fe atom are  $s$ ,  $p_x$ ,  $p_y$ ,  $p_z$ ,  $d_{z^2}$  and it is high spin complex

B.  $\left[Pt(NH_3)_2Cl_2\right]$ , the orbitals used for hybridization on Pt atom are

$s, p_x, p_y, d_{x^2-y^2}$  and it is low spin complex

C.  $\left[Cr(H_2O)_6\right]^{3+}$ , the orbitals used for hybridization in Cr atom are

$s, p_x, p_y, p_z, p_{x^2}, d_{x^2-y^2}$  and it is high spin complex

D.  $Ni(CO)_4$ , the orbitals used of hybridization in Ni atom are s,

$p_x, p_y, p_z$ , and it is low spin complex

**Answer: B::D**



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49. Complex compound  $\left[Co(SCN)_2(NH_3)_4\right]Cl$  exhibits:

A. Ionization isomerism

B. geometrical isomerism

C. optical isomerism



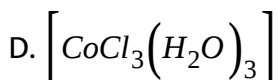
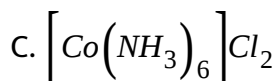
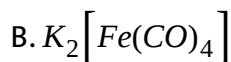
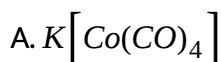
D. linkage isomerism

Answer: A::B::D



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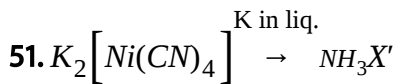
50. Which of the following compound has/have effective atomic number equal to the atomic number of a noble gas?



Answer: A::B::D



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Regarding this reaction correct statement is/are:

- A. X' is  $K_4 \left[ Ni(CN)_4 \right]$
- B. The oxidation state of Ni changed +2 to zero
- C. The structure of 'X' is tetrahedral
- D.  $\left[ Ni(CN)_4 \right]^{2-}$  is square planar complex

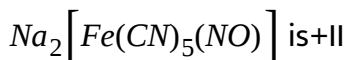
Answer: A::B::C::D



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52. Which of the following statement(s) is/are correct?

A. The oxidation state of iron in sodium nitro prusside



B.  $\left[ Ag(NH_3)_2 \right]^+$  is linear in shape

C. In  $\left[Fe(H_2O)_6\right]^+$ , Fe is  $d^2sp^3$  hybridized

D. In  $\left[Co(H_2O)_6\right]^{3+}$  complex ion, Co is  $d^2sp^3$  hybridized

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

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53. Which one of the following statement(s) is/are false?

A. weak ligands like  $F^-$ ,  $Cl^-$  and  $OH^-$  usually form low spin complexes

B. Strong ligand like  $CN^-$  and  $NO_2^-$ , generally form high spin complexes

C.  $\left[FeF_6\right]^{3-}$  is high spin complex

D.  $\left[Ni(CO)_4\right]$  is high spin complex

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

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54. A d-block element forms octahedral complex but its magnetic moment remains same either in strong field or in weak field ligand.

Which of the following is/are correct?

- A. Element always forms colourless compound
- B. Number of electron in  $t_{2g}$  orbitals are higher than in  $e_g$  orbitals
- C. It can have either  $d^3$  or  $d^8$  configuration
- D. It can have either  $d^7$  or  $d^8$  configuration

**Answer: B::C**



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55. For which of the following  $d^n$  configuration of octahedral complex(es), cannot exist in both high spin and low spin forms?

A.  $d^3$

B.  $d^5$

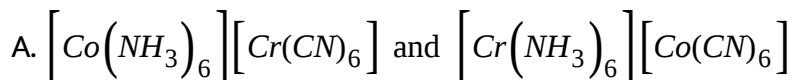
C.  $d^6$

D.  $d^8$

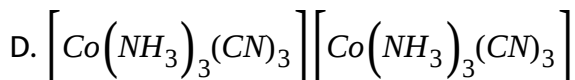
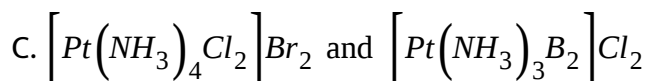
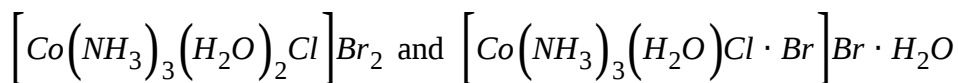
Answer: A:D

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56. Which of the following pairs show coordination isomerism?



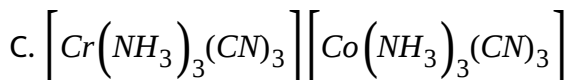
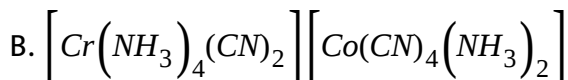
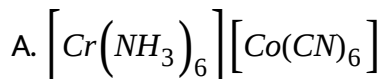
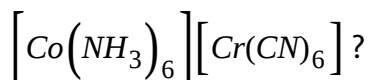
B.



Answer: A::D

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57. Which of the following are coordination isomers of

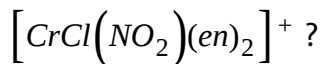


D. none of these

Answer: A::B

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58. Which of the following statements is not true about the complex ion



- A. It has two geometrical isomers cis and trans
- B. cis and trans forms are not diastereomers to each other
- C. only the cis isomer displays optical activity
- D. it has three optically active isomers: *d*, *l* and trans forms

Answer: B::D

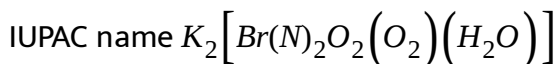


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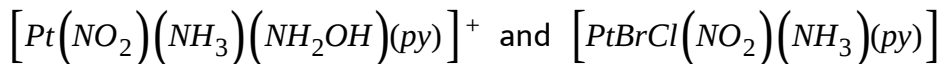
59. Which of the following statement(s) is/are incorrect?

- A. In  $[CrBrCl(en)_2]^+$  geometrical isomerism exists, while optical isomerism does not exist

B. Potassium aquadicyanosuperoxoperoxoperoxochromate(III) is



C. There are 3 geometrical and 15 stereoisomers possible for



respectively

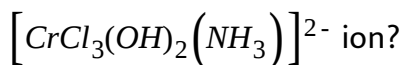
D. cis and trans forms are not diastereomers to each other

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



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60. Which of the following statement is true about the complex



A. It has three geometrical isomers

B. Only one space isomers is optically active and remaining are inactive



C. There are total four space isomers

D. The magnetic moment of complex ion is 3.89 BM

**Answer: A::D**

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**61.** Which of the following is correct about Tetraamminedithiocyanato-cobalt(III) tris(oxalato)cobaltate(III)?

A. Formula of the complex is  $\left[Co(SCN)_2(NH_3)_4\right]\left[Co(ox)_3\right]$

B. It is a chelating complex and show linkage isomerism

C. it shows optical isomerism

D. it shows geometrical isomerism

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

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62. Which of the following statement(s) is/are false?

A. In  $\left[PtCl_2(NH_3)_4\right]^{2+}$  complex ion, the cis-form is optically active, while trans-form is optically inactive

B. In  $\left[Fe(C_{20}O_4)_3\right]^{3-}$ , geometrical isomerism does not exist, while optical isomerism exist

C. In  $[Mabcd]^{n\pm}$  tetrahedral complexes, optical isomerism cannot be observed

D. In  $[Mabcd]^{n\pm}$  square planar complex, optical isomerism can be observed

Answer: A::C::D

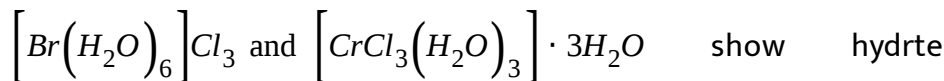


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63. Which of the following statement(s) is/are true?

A. In metal carbonyl complexes  $d_{C-O}$  increases compared to that in CO molecule

B. The pair of compounds



isomerism

C.  $d_{x^2}$  orbital of central metal atom/ion is used in  $dsp^2$  hybridisation

D. Facid Meridional isomers associated with  $[Ma_3b_3]^{n\pm}$  type

complex compound, both are optically inactive.

**Answer: A::D**

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**64.** Select the correct statement:

A. Chelation effect is maximum for five and six membered rings

- B. Greater the charge on the central metal cation, greater the value of  $\Delta(CFSE)$
- C. In complex ion  $[CoF_6]^{3-}$ ,  $F^-$  is a weak field ligand, so that  $\Delta_{oct} < P$  (Pairing energy) and it is low spin complex
- D.  $[CoCl_2(NH_3)_2(en)]^{\oplus}$  complex ion will have four different isomers

Answer: A::B::D

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65. Which of the following statement(s) is/are true?

- A. In ferrocyanide ion, the effective atomic number is 36.
- B. Chelating ligands are atleast bidentate ligand
- C.  $[CrCl_2(CN)_2(NH_3)_2]^{\ominus}$  and  $[CrCl_3(NH_3)_3]$  both have  $d^2sp^3$  hybridization

D. As the number of rings in complex increases, stability of complex (chelate) also increases

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

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66. In test of  $NO_3^-$  ion, the dark brown ring complex is formed, which is true of this complex?

A. the colour is due to charge transfer spectra

B. iron and NO both have +1 charge

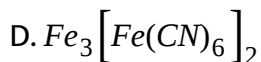
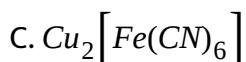
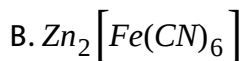
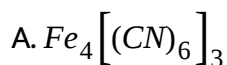
C. The complex species can be represented as  $[Fe^{+1}(H_2O)_5(NO)]^{3+}$

D. Iron has +2 oxidation state and NO is neutral

Answer: A::B::C

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67. The complex(es) which is/are blue in colour:



Answer: A::D



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68. What is/are the coordination number(s) of Au in the complexes formed by Au?

A. 6

B. 4

C. 5

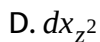
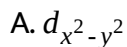
D. 2

**Answer: B::D**



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69. The d-orbitals involved in  $sp^3d^2$  or  $d^2sp^3$  hybridization of the central metal ion are:



**Answer: A::D**



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70. Which is not correctly matched?

Complex compounds	IUPAC name
(a) $K[CrF_4O]$	Potassium tetrafluorooxo chromate (v)
(b) $Na[BH(OCH_3)_3]$	Sodium hydrido trimethoxy borate (III)
(c) $[Be(CH_3 - CO - CH - CO - C_6H_5)_2]^0$	Bis (Benzoylacetato) beryllium (III)
(d) $H[AuCl_4]$	Hydrogen tetrachloro aurate (III)



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71. Which of the following statement(s) is(are) correct?

- A. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in the magnetic properties
- B. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in the geometry
- C. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in primary valencies of nickel
- D. The complexes  $[NiCl_4]^{2-}$  and  $[NiCN_4]^{2-}$  differ in the state of hybridization of nickel



Answer: A::B::D

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72. Which if correct statement(s)/

A.  $\left[Ag(NH_3)_2\right]^+$  is linear with sp hybridisation  $Ag^+$  ions

B.  $NiCl_4^{2-}$ ,  $CrO_4^{2-}$  and  $MnO_4^-$  have tetrahedral geometry

C.  $\left[Cu(NH_3)_4\right]^{2+}$ ,  $\left[Pt(NH_3)_4\right]^{2+}$  and  $\left[Ni(CN)_4\right]^{2-}$  have  $dsp^2$  hybridisation of the metal ion

D.  $Fe(CO)_5$  has trigonal bipyramidal structure with  $d_2sp^3$  hybridised ion

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

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## MATCH THE COLUMN

### Column-I

- (A)  $\text{Co}^{2+}$  (aq.)  
 (B)  $\text{Mn}^{2+}$  (aq.)  
 (C)  $\text{V}^{2+}$  (aq.)  
 (D)  $\text{Ti}^{3+}$  (aq.)

### Column-II

- (P) Pink/Light Pink  
 (Q) Purple  
 (R) Outer orbital complex and M.M. =  $\sqrt{15}$  B.M.  
 (S) inner orbital complex and M.M. =  $\sqrt{3}$  B.M.  
 (T) Paramagnetic

1.



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### Column-I

- (A)  $[\text{Pt}(\text{NO}_2)_2(\text{en})]^{2+}$   
 (B)  $[\text{Cr}(\pi\text{-C}_6\text{H}_6)(\text{NO})_2]$   
 (C)  $[\text{Ir}(\text{SCN})(\text{SO}_4)(\text{NH}_3)_4]$   
 (D)  $[\text{Cr}(\text{C}_2\text{H}_4)(\text{CO})_5]$

### Column-II (Characteristics of complex ion compound)

- (P) Stable according to E.A.N. rule  
 (Q) Ligand acts as ambidentate  
 (R) Bond order of  $M-L$  bond  $> 1.0$   
 (S) Bond order of ligand decreases  
 (T) Co-ordination number of central metal is six

2.



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**Column-I**  
**(Complex compounds)**

- (A)  $[\text{PtBrCl}(\text{acac})(\text{H}_2\text{O})_2]\text{NO}_3$   
(B)  $[\text{IrBr}_2(\text{en})(\text{H}_2\text{O})(\text{NH}_3)]\text{Br}$   
(C)  $[\text{CrCl}_2(\text{acac})(\text{H}_2\text{O})_2]$   
(D)  $[\text{Pt}(\text{ox})_2(\text{NH}_3)_2]$

**Column-II**  
**(Characteristics of complex)**

- (P) Difference between optical isomers and optically active isomers is two  
(Q) Only *cis* configurations are optically active.  
(R) Exhibit structural isomerism.  
(S) Two *trans* are optically inactive.  
(T) Optically active when both monodentate neutral ligands are at adjacent sites in *cis* configuration.

3.



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4. Match the following columns

**Column-I**

- (A)  $[\text{Cr}(\text{CN})_3(\text{NO}_2)_3]^{4-}$   
(B)  $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$   
(C)  $[\text{Fe}(\text{EDTA})]^-$   
(D)  $[\text{Ni}(\text{en})_3](\text{NO}_3)_2$

**Column-II**

- (P) Outer orbital complex  
(Q) Inner orbital complex  
(R)  $\mu = 2.83$  BM  
(S) Shows optical activity  
(T)  $\mu = 0$



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Column-I (complex ion)	Column-II (CFSE and hybridisation)
(A) $[\text{Cr}(\text{NH}_3)_6]^{3+}$	(P) $0.0 \Delta_o, sp^3d^2$ -hybridisation
(B) $[\text{Cu}(\text{NH}_3)_6]^{2+}$	(Q) $-0.6 \Delta_o, sp^3d^2$ -hybridisation
(C) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(R) $-1.2 \Delta_o, d^2sp^3$ -hybridisation
(D) $[\text{IrF}_6]^{3-}$	(S) Diamagnetic
	(T) Paramagnetic

5.



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6. Match the following columns

Column-I	Column-II
(A) $[\text{MnCl}_4]^{2-}$	(P) $sp^3$ hybridisation
(B) $[\text{Ni}(\text{CN})_4]^{2-}$	(Q) Diamagnetic
(C) $[\text{Ni}(\text{CO})_4]$	(R) Paramagnetic
(D) $[\text{Cu}(\text{NH}_3)_4]^{2+}$	(S) $dsp^2$ hybridisation



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7. Match the following columns

**Column-I**

- (A)  $[\text{Fe}(\text{CN})_6]^{4-}$
- (B)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
- (C)  $[\text{Cu}(\text{NH}_3)_6]^{2+}$
- (D)  $[\text{Ni}(\text{CN})_6]^{4-}$

**Column-II**

- (P) Paramagnetic
- (Q) Diamagnetic
- (R) Inner orbital complex
- (S) Outer orbital complex

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8. Match the following columns

**Column-I**

- (A)  $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$
- (B)  $[\text{Co}(\text{CN})_2(\text{NH}_3)_4]\text{OC}_2\text{H}_5$
- (C)  $[\text{IrCl}_6]^{3-}$
- (D)  $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$

**Column-II**

- (P)  $d^2sp^3$  hybridisation
- (Q) Ionisation isomerism
- (R)  $\mu = 2.83 \text{ BM}$
- (S)  $\Delta_o < P$

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9. Match the following columns

**Column-I**

- (A)  $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$
- (B)  $[\text{Co}(\text{CN})_2(\text{NH}_3)_4]\text{OC}_2\text{H}_5$
- (C)  $[\text{IrCl}_6]^{3-}$
- (D)  $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$

**Column-II**

- (P)  $d^2sp^3$  hybridisation
- (Q) Ionisation isomerism
- (R)  $\mu = 2.83 \text{ BM}$
- (S)  $\Delta_o < P$

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10. Match the following columns

Column-I	Column-II
(A) Sodium nitroprusside	(P) $\mu = 0$ BM
(B) Brown ring complex	(Q) Octahedral
(C) Complex of Ag formed during its extraction	(R) $\mu = \sqrt{15}$ BM
(D) Potassium ferrocyanide	(S) $\text{NO}^+$ ligand

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11. Match the following columns

Column-I (Pair of complex compounds)	Column-II (Property which is different in given pair)
(A) $[\text{Ni}(\text{CO})_4]$ and $\text{K}_2[\text{Ni}(\text{CN})_4]$	(P) Magnetic moment
(B) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ and $\text{K}_3[\text{Cu}(\text{CN})_4]$	(Q) Oxidation no. of central metal
(C) $\text{K}_2[\text{NiCl}_4]$ and $\text{K}_4[\text{Ni}(\text{CN})_4]$	(R) Geometry
(D) $\text{K}_2[\text{NiCl}_4]$ and $\text{K}_2[\text{PtCl}_4]$	(S) EAN of central metal

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12. Match the following columns

**Column-I**  
(Pair of complexes)

- (A)  $[\text{Fe}(\text{CN})_6]^{3-}$  and  $[\text{Co}(\text{NH}_3)_6]^{2+}$   
(B)  $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{Fe}(\text{CN})_6]^{4-}$   
(C)  $[\text{Ni}(\text{CN})_4]^{4-}$  and  $[\text{Ni}(\text{CO})_4]$   
(D)  $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$  and  $[\text{NiCl}_4]^{2-}$

**Column-II**  
(Property which is similar in given pair)

- (P) Magnetic moment  
(Q) Geometry  
(R) Hybridisation  
(S) Number of  $d$ -electrons

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13. Match the following columns

**Column-I**  
(Coordination compound)

- (A)  $\text{Na}_2[\text{Pt}(\text{SCN})_2(\text{ox})_2]$   
(B)  $[\text{CrCl}_2(\text{NH}_3)_4]\text{NO}_3$   
(C)  $[\text{Pt}(\text{NO}_2)(\text{Gly})(\text{NH}_3)]$   
(D)  $\text{K}_3[\text{Fe}(\text{OH})_2(\text{C}_2\text{O}_4)_2]$

**Column-II**  
(Type of isomerism shown)

- (P) Ionization isomerism  
(Q) Linkage isomerism  
(R) Geometrical isomerism  
(S) Optical isomerism

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**Column-I**

- (A)  $\text{K}_3[\text{Fe}(\text{CN})_5(\text{CO})]$   
(B)  $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$   
(C)  $\text{Na}[\text{Co}(\text{CO})_4]$   
(D)  $\text{V}(\text{CO})_6$

**Column-II**

- (P) Complex having lowest bond length of CO ligand  
(Q) Follow rule of EAN  
(R) Complex involved in synergic bonding  
(S) Complex having highest bond length of CO ligand

14.

15. Match the following columns

**Column-I**  
(Molar conductance at infinite dilution)

- (A) 229
- (B) 0
- (C) 404
- (D) 523

**Column-II**  
(Complex compound)

- (P)  $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$
- (Q)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_4]$
- (R)  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$
- (S)  $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$

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16. Match the following columns

**Column-I**  
(Complex ions)

- (A)  $[\text{CrF}_6]^{4-}$
- (B)  $[\text{MnF}_6]^{4-}$
- (C)  $[\text{Cr}(\text{CN})_6]^{4-}$
- (D)  $[\text{Mn}(\text{CN})_6]^{4-}$

**Column-II**  
(Number of unpaired electrons)

- (P) One
- (Q) Two
- (R) Three
- (S) Four
- (T) Five

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17. Match the following columns

**Column-I**  
**(Complexes)**

- (A)  $\text{Ni}(\text{CO})_4$
- (B)  $[\text{Ni}(\text{CN})_4]^{2-}$
- (C)  $[\text{Fe}(\text{CN})_6]^{4-}$
- (D)  $[\text{MnF}_6]^{4-}$

**Column-II**  
**(Hybridization of central atom)**

- (P)  $sp^3$
- (Q)  $dsp^2$
- (R)  $sp^3d^2$
- (S)  $d^2sp^3$

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18. Match the following columns

**Column-I**  
**(Coordination compounds)**

- (A)  $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$
- (B)  $[\text{Co}(\text{en})_3]\text{Cl}_2$
- (C)  $[\text{Co}(\text{en})_2(\text{NO}_2)\text{Cl}]\text{SCN}$
- (D)  $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$

**Column-II**  
**(Type of isomerism)**

- (P) Optical isomerism
- (Q) Ionization isomerism
- (R) Coordination isomerism
- (S) Geometrical isomerism

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**Column-I**

- (A)  $\text{Co}^{2+}$  (aq.)
- (B)  $\text{Mn}^{2+}$  (aq.)
- (C)  $\text{V}^{2+}$  (aq.)
- (D)  $\text{Ti}^{3+}$  (aq.)

**Column-II**

- (P) Pink/Light Pink
- (Q) Purple
- (R) Outer orbital complex and M.M. =  $\sqrt{15}$  B.M.
- (S) Inner orbital complex and M.M. =  $\sqrt{3}$  B.M.
- (T) Paramagnetic

19.



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**Column-I**

- (A)  $[\text{Pt}(\text{NO}_2)_2(\text{en})]^{2+}$
- (B)  $[\text{Cr}(\pi\text{-C}_6\text{H}_6)(\text{NO})_2]$
- (C)  $[\text{Ir}(\text{SCN})(\text{SO}_4)(\text{NH}_3)_4]$
- (D)  $[\text{Cr}(\text{C}_2\text{H}_4)(\text{CO})_5]$

**Column-II (Characteristics of complex ion compound)**

- (P) Stable according to E.A.N. rule
- (Q) Ligand acts as ambidentate
- (R) Bond order of  $M-L$  bond  $> 1.0$
- (S) Bond order of ligand decreases
- (T) Co-ordination number of central metal is six

20.



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**Column-I**

**(Complex compounds)**

- (A)  $[\text{PtBrCl}(\text{acac})(\text{H}_2\text{O})_2]\text{NO}_3$
- (B)  $[\text{IrBr}_2(\text{en})(\text{H}_2\text{O})(\text{NH}_3)]\text{Br}$
- (C)  $[\text{CrCl}_2(\text{acac})(\text{H}_2\text{O})_2]$
- (D)  $[\text{Pt}(\text{ox})_2(\text{NH}_3)_2]$

**Column-II**

**(Characteristics of complex)**

- (P) Difference between optical isomers and optically active isomers is two
- (Q) Only *cis* configurations are optically active.
- (R) Exhibit structural isomerism.
- (S) Two *trans* are optically inactive.
- (T) Optically active when both monodentate neutral ligands are at adjacent sites in *cis* configuration.

21.



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- | Column-I   | Column-II                   |
|--|-----------------------------|
| (A) $[\text{Cr}(\text{CN})_3(\text{NO}_2)_3]^{4-}$ | (P) Outer orbital complex   |
| (B) $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$     | (Q) Inner orbital complex   |
| (C) $[\text{Fe}(\text{EDTA})]^-$                   | (R) $\mu = 2.83 \text{ BM}$ |
| (D) $[\text{Ni}(\text{en})_3](\text{NO}_3)_2$      | (S) Shows optical activity  |
|  | (T) $\mu = 0$               |

22.

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- | Column-I<br>(complex ion)                    | Column-II<br>(CFSE and hybridisation)       |
|--|---|
| (A) $[\text{Cr}(\text{NH}_3)_6]^{3+}$        | (P) $0.0 \Delta_o, sp^3d^2$ -hybridisation  |
| (B) $[\text{Cu}(\text{NH}_3)_6]^{2+}$        | (Q) $-0.6 \Delta_o, sp^3d^2$ -hybridisation |
| (C) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ | (R) $-1.2 \Delta_o, d^2sp^3$ -hybridisation |
| (D) $[\text{IrF}_6]^{3-}$                    | (S) Diamagnetic                             |
|  | (T) Paramagnetic                            |

23.

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- | Column-I                              | Column-II                 |
|---------------------------------------|---------------------------|
| (A) $[\text{MnCl}_4]^{2-}$            | (P) $sp^3$ hybridisation  |
| (B) $[\text{Ni}(\text{CN})_4]^{2-}$   | (Q) Diamagnetic           |
| (C) $[\text{Ni}(\text{CO})_4]$        | (R) Paramagnetic          |
| (D) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ | (S) $dsp^2$ hybridisation |

24.

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- | Column-I                                     | Column-II                 |
|--|---------------------------|
| (A) $[\text{Fe}(\text{CN})_6]^{4-}$          | (P) Paramagnetic          |
| (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ | (Q) Diamagnetic           |
| (C) $[\text{Cu}(\text{NH}_3)_6]^{2+}$        | (R) Inner orbital complex |
| (D) $[\text{Ni}(\text{CN})_6]^{4-}$          | (S) Outer orbital complex |
- 25.

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- | Column-I   | Column-II                   |
|--|-----------------------------|
| (A) $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$                 | (P) $d^2sp^3$ hybridisation |
| (B) $[\text{Co}(\text{CN})_2(\text{NH}_3)_4]\text{OC}_2\text{H}_5$ | (Q) Ionisation isomerism    |
| (C) $[\text{IrCl}_6]^{3-}$   | (R) $\mu = 2.83 \text{ BM}$ |
| (D) $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$                    | (S) $\Delta_o < P$          |
- 26.

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- | Column-I   | Column-II                   |
|--|-----------------------------|
| (A) $[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$                 | (P) $d^2sp^3$ hybridisation |
| (B) $[\text{Co}(\text{CN})_2(\text{NH}_3)_4]\text{OC}_2\text{H}_5$ | (Q) Ionisation isomerism    |
| (C) $[\text{IrCl}_6]^{3-}$   | (R) $\mu = 2.83 \text{ BM}$ |
| (D) $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$                    | (S) $\Delta_o < P$          |
- 27.

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- | Column-I                                       | Column-II                |
|--|--------------------------|
| (A) Sodium nitroprusside                       | (P) $\mu = 0$ BM         |
| (B) Brown ring complex                         | (Q) Octahedral           |
| (C) Complex of Ag formed during its extraction | (R) $\mu = \sqrt{15}$ BM |
| (D) Potassium ferrocyanide                     | (S) $\text{NO}^+$ ligand |
- 28.

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29. Match the following Column - I and Column - II

Column-I (Pair of complex compounds)	Column-II (Property which is different in given pair)
(A) $[\text{Ni}(\text{CO})_4]$ and $\text{K}_2[\text{Ni}(\text{CN})_4]$	(P) Magnetic moment
(B) $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ and $\text{K}_3[\text{Cu}(\text{CN})_4]$	(Q) Oxidation no. of central metal
(C) $\text{K}_2[\text{NiCl}_4]$ and $\text{K}_4[\text{Ni}(\text{CN})_4]$	(R) Geometry
(D) $\text{K}_2[\text{NiCl}_4]$ and $\text{K}_2[\text{PtCl}_4]$	(S) EAN of central metal

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- | Column-I<br>(Pair of complexes)  | Column-II<br>(Property which is similar in given pair) |
|--|--|
| (A) $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{Co}(\text{NH}_3)_6]^{2+}$        | (P) Magnetic moment                                    |
| (B) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{Fe}(\text{CN})_6]^{4-}$ | (Q) Geometry   |
| (C) $[\text{Ni}(\text{CN})_4]^{4-}$ and $[\text{Ni}(\text{CO})_4]$               | (R) Hybridisation                                      |
| (D) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ and $[\text{NiCl}_4]^{2-}$          | (S) Number of <i>d</i> -electrons                      |
- 30.

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31.

**Column-I**  
(Coordination compound)

- (A)  $\text{Na}_2[\text{Pt}(\text{SCN})_2(\text{ox})_2]$   
 (B)  $[\text{CrCl}_2(\text{NH}_3)_4]\text{NO}_3$   
 (C)  $[\text{Pt}(\text{NO}_2)(\text{Gly})(\text{NH}_3)]$   
 (D)  $\text{K}_3[\text{Fe}(\text{OH})_2(\text{C}_2\text{O}_4)_2]$

**Column-II**  
(Type of isomerism shown)

- (P) Ionization isomerism  
 (Q) Linkage isomerism  
 (R) Geometrical isomerism  
 (S) Optical isomerism

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32.

**Column-I**

- (A)  $\text{K}_3[\text{Fe}(\text{CN})_5(\text{CO})]$   
 (B)  $\text{K}[\text{PtCl}_3(\text{C}_2\text{H}_4)]$   
 (C)  $\text{Na}[\text{Co}(\text{CO})_4]$   
 (D)  $\text{V}(\text{CO})_6$

**Column-II**

- (P) Complex having lowest bond length of CO ligand  
 (Q) Follow rule of EAN  
 (R) Complex involved in synergic bonding  
 (S) Complex having highest bond length of CO ligand

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33.

**Column-I**  
(Molar conductance at infinite dilution)

- (A) 229  
 (B) 0  
 (C) 404  
 (D) 523

**Column-II**  
(Complex compound)

- (P)  $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$   
 (Q)  $[\text{Pt}(\text{NH}_3)_2\text{Cl}_4]$   
 (R)  $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$   
 (S)  $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$

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34.

Column-I (Complex ions)	Column-II (Number of unpaired electrons)
(A) $[\text{CrF}_6]^{4-}$	(P) One
(B) $[\text{MnF}_6]^{4-}$	(Q) Two
(C) $[\text{Cr}(\text{CN})_6]^{4-}$	(R) Three
(D) $[\text{Mn}(\text{CN})_6]^{4-}$	(S) Four
	(T) Five


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35.

Column-I (Complexes)	Column-II (Hybridization of central atom)
(A) $\text{Ni}(\text{CO})_4$	(P) $sp^3$
(B) $[\text{Ni}(\text{CN})_4]^{2-}$	(Q) $dsp^2$
(C) $[\text{Fe}(\text{CN})_6]^{4-}$	(R) $sp^3d^2$
(D) $[\text{MnF}_6]^{4-}$	(S) $d^2sp^3$


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36.

Column-I (Coordination compounds)	Column-II (Type of isomerism)
(A) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$	(P) Optical isomerism
(B) $[\text{Co}(\text{en})_3]\text{Cl}_2$	(Q) Ionization isomerism
(C) $[\text{Co}(\text{en})_2(\text{NO}_2)\text{Cl}]\text{SCN}$	(R) Coordination isomerism
(D) $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$	(S) Geometrical isomerism


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## ASSERTION-REASON TYPE QUESTIONS

1. Assertion: In  $N_2$  Molecule, any N-atom can coordinate with central atom/ion.

Reason:  $N_2$  molecule can also act as ambidentate ligand.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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2. Assertion: In  $N_2H_4$ , any one N-atom can coordinate with central metal cation in a coordination compound.

Reason:  $N_2H_4$  can also act as ambidentate ligand.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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3. These questions consist of two statements each, printed as Assertion and Reason. While answering these questions you are required to

choose any one of the following four responses:

Assertion:  $\left[ \text{Ti}(\text{H}_2\text{O})_6 \right]^{3+}$  is coloured while  $\left[ \text{Sc}(\text{H}_2\text{O})_6 \right]^{3+}$  is colourless.

Reason: d-d transition is not possible in  $\left[ \text{Sc}(\text{H}_2\text{O})_6 \right]^{3+}$ .

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: B**



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4. Assertion: Acidified  $[Cu(NH_3)_4]^{2+}$  and  $[Cu(H_2O)_4]^{2+}$  both react with  $K_4[Fe(CN)_6]$  to give brown ppt.

Reason: both complexes are blue in colour of little different shade.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: D**

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5. Assertion:  $[Fe(EDTA)]^-$  complex is octahedral in shape.

Reason: EDTA is a hexadentate ligand and undergoing  $sp^3d^2$

hybridisation.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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6. STATEMENT-1: Tetrahedral complexes with chiral structure exhibit optical isomerism .

and

STATEMENT-2: They lack plane of symmetry .

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: C**



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7. Assertion: Oxidation state of Fe in  $Fe(CO)_5$  is zero.

Reason: Synergic bonding takes place in this metal carbonyl complex.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: D**

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**8.** Assertion: Zeise's salt is a  $\pi$ -bonded organometallic compound.

Reason: Zeise's salt contain  $C_2H_4$  molecules as one of the ligand.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: C**

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9. Assertion:  $\left[ \text{CoCl}_3(\text{NH}_3)_3 \right]$  does not give white precipitate with  $\text{AgNO}_3$  solution.

Reason:  $\left[ \text{CoCl}_3(\text{NH}_3)_3 \right]$  complex is optically inactive.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

Answer: D



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10. Assertion: Transition metal ion forming octahedral complexes undergo  $sp^3d^2$  or  $d^2sp^3$  hybridisation.

Reason: Strong field ligands force the unpaired electrons of central metal ion to pair up causing  $d^2sp^3$  hybridisation whereas weak field ligands do not affect electronic configuration of the metal ion undergoes in  $sp^3d^2$  hybridisation.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion



**Answer: C**



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11. Assertion: Complex ion  $[Co(NH_3)_6]^{2+}$  is readily oxidized to  $[Co(NH_3)_6]^{3+}$

Reason: Unpaired electron in complex ion  $[Co(NH_3)_6]^{2+}$  is present in 4p orbital.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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**12.** Assertion: Hydrazine is a neutral ligand.

Reason: It has two N as donor atoms and behaves as a chelating ligand.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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13. Reason: Complex anion  $[Re_2Cl_8]^{2-}$  has one  $\delta$ -bond, one sigma and one  $\pi$ -bond.

Reason:  $d_{z^2}$  orbital can never form  $\delta$ -bond.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: B**



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14. Assertion: In  $N_2$  Molecule, any N-atom can coordinate with central atom/ion.

Reason:  $N_2$  molecule can also act as ambidentate ligand.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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**15. Assertion:** In  $N_2H_4$ , any one N-atom can coordination with central metal cation in a coordination compound.

Reason:  $N_2H_4$  can also act as ambidentate ligand.

- A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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16. Assertion:  $[Ti(H_2O)_6]^{4+}$  is coloured while  $[Sc(H_2O)_6]^{3+}$  is colourless.

Reason: d-d transition is not possible in  $[Sc(H_2O)_6]^{3+}$ .

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: B**

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17. Assertion: Acidified  $[Cu(NH_3)_4]^{2+}$  and  $[Cu(H_2O)_4]^{2+}$  both react with  $K_4[Fe(CN)_6]$  to give brown ppt.

Reason: both complexes are blue in colour of little different shade.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: D**

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**18.** Assertion:  $[Fe(EDTA)]^-$  complex is octahedral in shape.

Reason: EDTA is a hexadentate ligand and undergoing  $sp^3d^2$  hybridisation.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**



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**19.** Assertion: Tetrahedral complexes with chiral structure exhibit optical isomerism.

Reason: They lack plane of symmetry.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: C**



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20. Assertion: Oxidation state of Fe in  $Fe(CO)_5$  is zero.

Reason: Synergic bonding takes place in this metal carbonyl complex.

- A. If assertion is true but the reason is false
- B. If assertion is false but reason is true
- C. If both assertion and reason are true and the reason is the correct explanation of assertion
- D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: D**

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21. Assertion: Zeise's salt is a  $\pi$ -bonded organometallic compound.

Reason: Zeise's salt contain  $C_2H_4$  molecules as one of the ligand.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: C**



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22. Assertion:  $\left[CoCl_3(NH_3)_3\right]$  does not give white precipitate with  $AgNO_3$  solution.

Reason:  $\left[CoCl_3(NH_3)_3\right]$  complex is optically inactive.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: D**

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**23.** Assertion: Transition metal ion forming octahedral complexes undergo  $sp^3d^2$  or  $d^2sp^3$  hybridisation.

Reason: Strong field ligands force the unpaired electrons of central metal ion to pair up causing  $d^2sp^3$  hybridisation whereas weak field ligands do not affect electronic configuration of the metal ion undergoes in  $sp^3d^2$  hybridisation.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: C**

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24. Assertion: Complex ion  $[Co(NH_3)_6]^{2+}$  is readily oxidized to  $[Co(NH_3)_6]^{3+}$

Reason: Unpaired electron in complex ion  $[Co(NH_3)_6]^{2+}$  is present in 4p orbital.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**

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**25.** Assertion: Hydrazine is a neutral ligand.

Reason: It has two N as donor atoms and behaves as a chelating ligand.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

**Answer: A**

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**26.** Reason: Complex anion  $[Re_2Cl_8]^{2-}$  has one  $\delta$ -bond, one sigma and one  $\pi$ -bond.

Reason:  $d_{z^2}$  orbital can never form  $\delta$ -bond.

A. If assertion is true but the reason is false

B. If assertion is false but reason is true

C. If both assertion and reason are true and the reason is the correct explanation of assertion

D. If both assertion and reason are true but reason is not the correct explanation of assertion

Answer: B

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## SUBJECTIVE PROBLEMS

1. Consider the following compounds with their regular geometries.

Compounds	Geometry
A	Square planar
B	Trigonal bipyramidal
C	Square pyramidal
D	Octahedral
E	Pentagonal bipyramidal

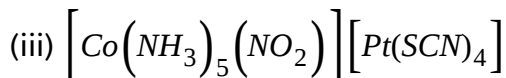
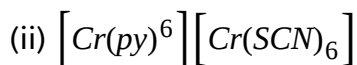
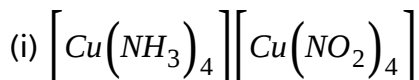
Calculate value of  $(x + y - z)^2$ , where x is total number of axial d-orbitals having zero nodal plane, y and z are total no. of non-axial and axial d-orbitals respectively each one having two nodal planes used in hybridisation of central atoms of compounds A to E.

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2. How many  $\pi$ -bonds are present in ferrocene?

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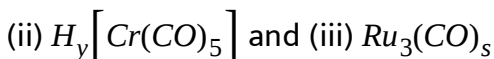
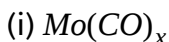
3. Consider the following complexes compounds



If  $x_1, x_2, x_3$  are more possible coordination isomers of given complex compounds respectively then calculate value of  $x_1^2 + x_2^2 + x_3^2$ .

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4. Consider the following carbonyl complex compounds.



Then calculate value of  $|x + y - s|$ .





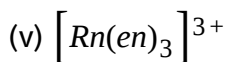
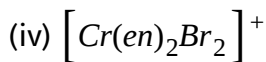
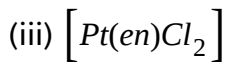
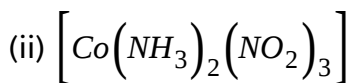
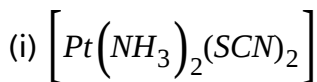
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5. If  $x$  and  $y$  are total number of electrons which are present in non-axial and axial set of d-orbitals respectively in Ni cation of  $[Ni(DMG)_2]$ , then calculate the value of  $\frac{2x^2}{y}$



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6. Consider the following complex compounds:



Then calculate sum of total number of geometrical isomers in all above complex compounds.

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7. Consider the following transformation:



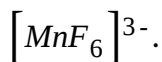
If both reactant and product follow EAN rule, then calculate value of  $x + z - y$  (where  $x, y$  and  $z$  are natural numbers).

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8. The oxidation state of Fe in brown complex  $[Fe(H_2O)_5NO]SO_4$  is

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9. Calculate |C.F.S.E| (mod value) is term of Dq. For complex ion



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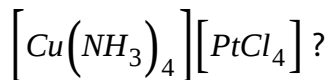
10. Total number of geometrical isomers of  $[CoBrClI(CN)(H_2O)(NH_3)]^-$  complex ion, in which all halides are in cis-position.

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11. What is CFSE of complex ion  $[FeF_6]^{4-}$  in terms of  $Dq$ ?

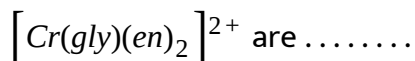
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12. How many more co-ordination isomers are possible of the compound



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13. Total number of space (stereo) isomers of complex ion





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14. A (Light pink colour complex)  $Pb_2 \frac{\emptyset}{d} il.$   $\xrightarrow{HNO_2}$   $\Delta HMnO_4$   $\xrightarrow{H_2S/H^+}$  A (Light pink colour complex).

Calculate CFSE value in light pink colour complex.



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15. How many electrons are present in  $t_{2g}$  set of d-orbitals of central metal cation in  $[Fe(H_2O)_5(NO)]SO_4$  brown ring complex?



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16. A (Light pink colour complex)  $Pb_2 \frac{\emptyset}{d} il.$   $\xrightarrow{HNO_2}$   $\Delta HMnO_4$   $\xrightarrow{H_2S/H^+}$  A (Light pink colour complex).

Calculate CFSE value in light pink colour complex.



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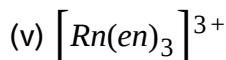
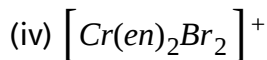
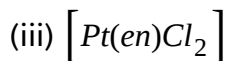
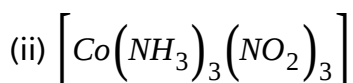
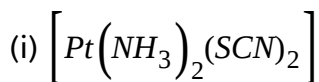
17. Calculate value of "x+y" if x is the total number of  $\sigma$  bonds and y is total number of  $\pi$  bonds in ligand EDTA and phenanthroline.

(EDTA Ethylene diamine tetraacetate, Phen=1,10-N,N-phenanthroline)



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18. Consider the following complex compounds:

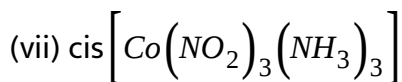
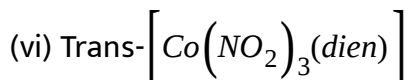
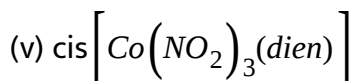
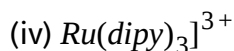
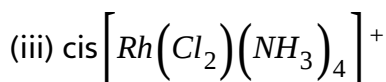
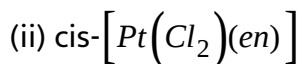
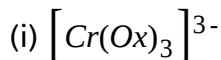


Then calculate sum of total number of geometrical isomers in all above complex compounds.



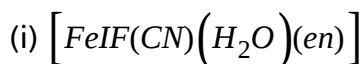
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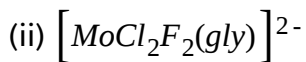
19. Total number of complexes among the following which are optically active?



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20. Consider the following complexes:





Then, calculate value of  $|x - y|$  (where  $x$  and  $y$  are total number of possible optically active isomers in (i) and (ii) complex respectively).

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21. Consider the following ligands  $NH_2^-$ ,  $acac$ ,  $OH^-$ ,  $Gly$ ,  $O_2^-$ ,  $Phen$ ,  $DMG$ ,  $NO_2^-$ ,  $CO_3^{2-}$ ,  $Cl^-$ ,  $CH_3COO^-$ ,  $en$ ,  $SO_4^{2-}$ . Then calculate value of "P+Q-R-S"

here

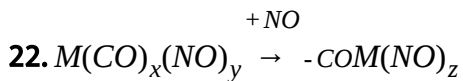
P: total number of ligands which act as bridging as well as monodentate only.

Q: Total number of flexidentate ligands.

R: Total number of bidentate ligands only

S: Total number of unsymmetrical bidentate ligands.

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Where EAN of metal (M) in both produce and reactant is same and it is 54. then calculate value of  $(x+y-z)$ . (where x,y and z are natural numbers and M belong to 6th group according to long form of periodic table)

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23. Consider the following compounds with their regular geometries.

Compounds	Geometry
A	Square planar
B	Trigonal bipyramidal
C	Square pyramidal
D	Octahedral
E	Pentagonal bipyramidal

Calculate value of  $(x + y - z)^2$ , where x is total number of axial d-orbitals having zero nodal plane, y and z are total no. of non-axial and axial d-orbitals respectively each one having two nodal planes used in hybridisation of central atoms of compounds A to E.

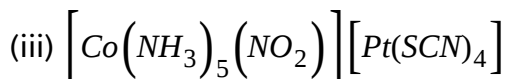
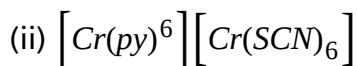
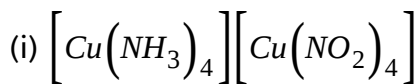
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24. How many  $\pi$ -bonds are present in ferrocene?

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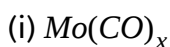
25. Consider the following complex compounds



If  $x_1, x_2, x_3$  are more possible coordination isomers of given complex compounds respectively then calculate value of  $x_1^2 + x_2^2 + x_3^2$ .

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26. Consider the following carbonyl complex compounds.



(ii)  $H_y[Cr(CO)_5]$  and (iii)  $Ru_3(CO)_5$

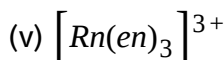
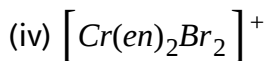
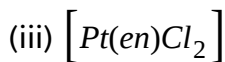
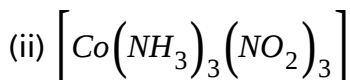
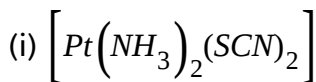
Then calculate value of  $|x + y - x|$ .

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27. If  $x$  and  $y$  are total number of electrons which are present in non-axial and axial set of d-orbitals respectively in Ni cation of  $[Ni(DMG)_2]$ , then calculate the value of  $\frac{2x^2}{y}$

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28. Consider the following complex compounds:





Then calculate sum of total number of geometrical isomers in all above complex compounds.

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29. Consider the following transformation:



If both reactant and product follow EAN rule, then calculate value of  $x + z - y$  (where  $x, y$  and  $z$  are natural numbers).

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30. Brown colour of the complex  $[Fe(H_2O)_5(NO)]SO_4$  is due to C. T. spectrum which causes momentary change in oxidation state. Find out oxidation state of Fe in this complex.

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31. Calculate |C.F.S.E| (mod value) is term of Dq. For complex ion  $[MnF_6]^{3-}$ .

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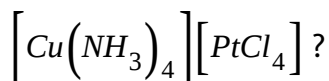
32. Total number of geometrical isomers of  $[CoBrClI(CN)(H_2O)(NH_3)]^-$  complex ion, in which all halides are in cis-position.

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33. What is CFSE of complex ion  $[FeF_6]^{4-}$  in terms of Dq?

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34. How many more co-ordination isomers are possible of the compound



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35. Total number of space (stereo) isomers of complex ion  $[Cr(gly)(en)_2]^{2+}$  are .....

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36. How many electrons are present in  $t_{2g}$  set of d-orbitals of central metal cation in  $[Fe(H_2O)_5(NO)]SO_4$  brown ring complex?

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37. A (Light pink colour complex)  $Pb_2 \frac{\emptyset}{d} il.$   $\xrightarrow{HNO_2}$   $\Delta HMnO_4$   $\xrightarrow{H_2S/H^+}$  A (Light pink colour complex).

Calculate CFSE value in light pink colour complex.

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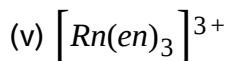
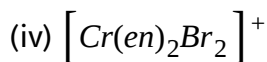
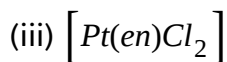
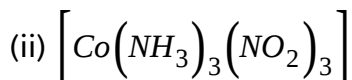
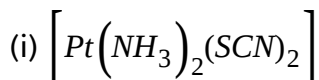
38. Calculate value of "x+y" if x is the total number of  $\sigma$  bonds and y is total number of  $\pi$  bonds in ligand EDTA and phenanthroline.

(EDTA Ethylene diamine tetraacetate, Phen=1,10-N,N-phenanthroline)



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39. Consider the following complex compounds:

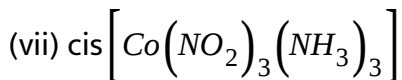
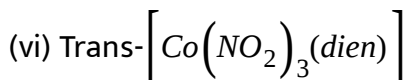
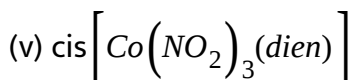
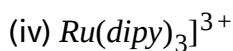
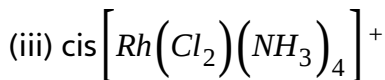
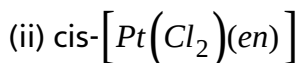
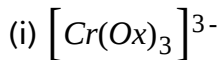


Then calculate sum of total number of geometrical isomers in all above complex compounds.



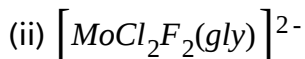
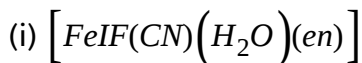
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40. Total number of complexes among the following which are optically active?



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41. Consider the following complexes:



Then, calculate value of  $|x - y|$  (where x and y are total number of possible optically active isomers in (i) and (ii) complex respectively).

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**42.** Consider the following ligands  $NH_2^-$ , acac,  $OH^-$ , Gly,  $O_2^-$ , Phen, DMG,  $NO_2^-$ ,  $CO_3^{2-}$ ,  $Cl^-$ ,  $CH_3COO^-$ , en,  $SO_4^{2-}$ . Then calculate value of "P+Q-R-S" here

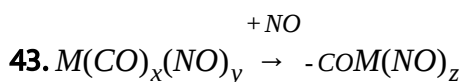
P: total number of ligands which act as bridging as well as monodentate only.

Q: Total number of flexidentate ligands.

R: Total number of bidentate ligands only

S: Total number of unsymmetrical bidentate ligands.

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Where EAN of metal (M) in both produce and reactant is same and it is



54. then calculate value of  $(x+y=z)$ . (where  $x,y$  and  $z$  are natural numbers and  $M$  belong to 6th group according to long form of periodic table)



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