



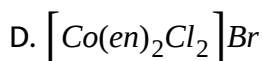
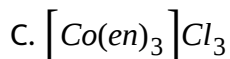
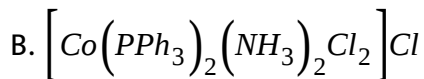
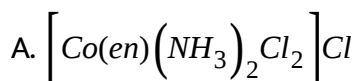
CHEMISTRY

PHYSICAL, INORGANIC, AND ORGANIC CHEMISTRY

COORDINATION COMPOUNDS

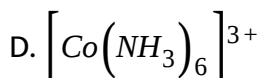
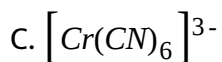
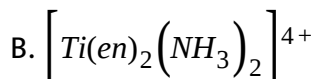
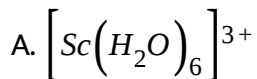
INORGANIC CHEMISTRY (COORDINATION COMPOUNDS)

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



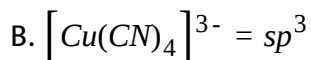
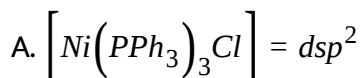
Answer: 4

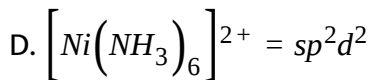
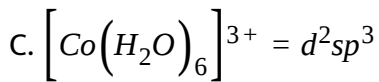
2. Which of the following complex ions is expected to absorb visible light?



Answer: 3

3. Which of the following complexes are not correctly matched with the hybridisation of their central metal ions ?

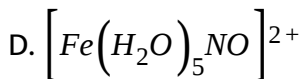
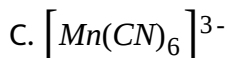
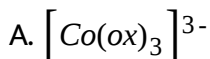




Answer: C

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4. Which of the following is an outer orbital complex according to valence bond theory ?



Answer: D

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5. Match list I with list II and select the correct answer :

List (I)

(Equiv. conductance at infinite dilution)

(A)229

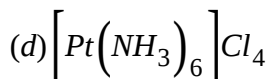
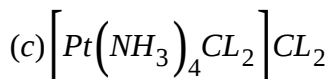
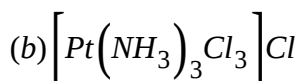
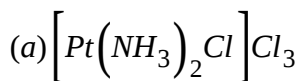
(B)97

(C)404

(D)523

List(II)

(Formula)



The code :

A. $\begin{matrix} A & B & C & D \\ (1) & c & a & b & d \end{matrix}$

B. $\begin{matrix} A & B & C & D \\ (2) & a & c & d & b \end{matrix}$

C. $\begin{matrix} A & B & C & D \\ (3) & a & d & c & b \end{matrix}$

D. $\begin{matrix} A & B & C & D \\ (4) & c & b & a & d \end{matrix}$

Answer: D



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6. The IUPAC name for $K_2[Cr^{VI}NH_3(CN)_2O_2(O_2)]$ is

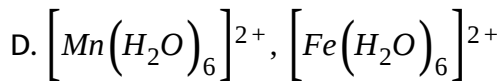
- A. potassium amminedicyanide -C - dioxidoperoxideochromate (VI)
- B. potassium amminedicyanatotetraoxychromium(III)
- C. potassium amminedicyanochromate (IV)
- D. potassium aminocyanodiperoxochromate (VI)

Answer: 1

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7. The pair in which both species have the same magnetic moment (spin only) value is :

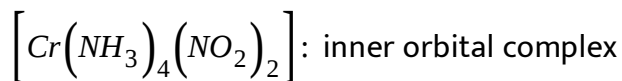
- A. $[Cr(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$
- B. $[Cr(NH_3)_6]^{3+}$, $[Fe(H_2O)_6]^{2+}$
- C. $[Co(NH_3)_6]^{2+}$, $[Cr(NH_3)_6]^{3+}$



Answer: C

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8. Consider the following complex :



The oxidation number, number of d - electrons, number of unpaired d - electrons on the irrelaetion and number of isomers are respectively.

A. 3, 3, 3, 2

B. 2, 4, 0, 6

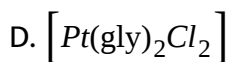
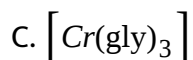
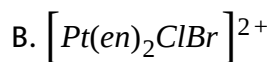
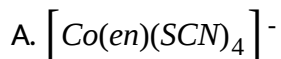
C. 2, 4, 2, 6

D. 2, 4, 4, 4

Answer: C

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9. Which of the following compounds / complex ions would not show geometrical isomerism?



Answer: 1

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10. Which of the following is not an ambidentate ligand ?



D. NO_2^-

Answer: 3

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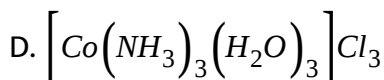
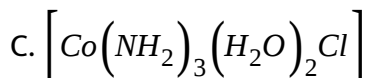
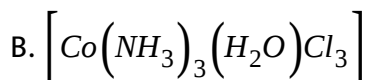
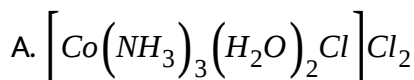
11. The coordination number of a central metal atom in a complex is determined by:

- A. the number of only anionic ligands bonded to metal ion
- B. the number of ligands around a metal ion bonded by pi bonds
- C. the number of only neutral ligands around a metal ion bonded by sigma bonds
- D. the number of sigma bonds between the ligands and the central atom/ ion i.e. the number of ligand donor atoms to which the metal is directly attached.

Answer: D

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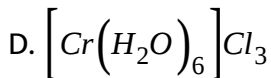
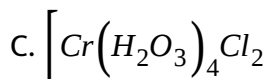
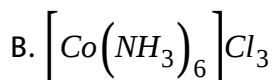
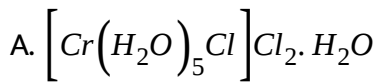
12. The hypothetical complex triamminediaquachloridocobalt(III) chloride can be represented as :



Answer: 1

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13. One mole of complex compound $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ gives 3 moles of ions on dissolution in water. One mole of same complex reacts with two moles of AgNO_3 to yield two moles of $\text{AgCl}(s)$. The complex is:

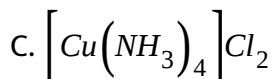
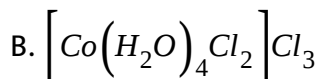
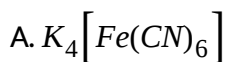


Answer: 4



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14. Which of the following will exhibit maximum ionic conductivity ?



Answer: A



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15. EAN rule is followed by $K_4Fe(CN)_6$ complex .

A. 36

B. 34

C. 38

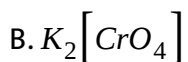
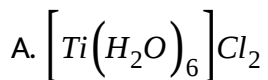
D. 40

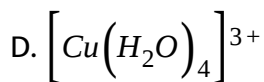
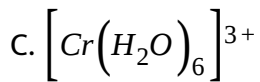
Answer: 1



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16. Which of the following species has no 'd' electrons in the central metal atom is ?

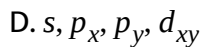
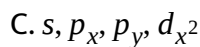
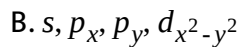
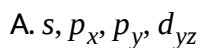




Answer: 2

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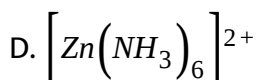
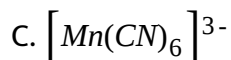
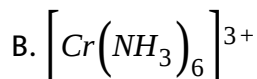
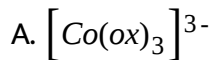
17. A square planar complex is formed by hybridization of which atomic orbitals?



Answer: B

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18. Which of the following is an outer orbital complex according to valence bond theory ?

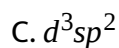
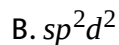
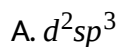


Answer: 4



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19. In $[Ni(H_2O)_6]^{2+}$, the hybridisation of central metal ion is :

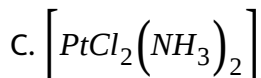
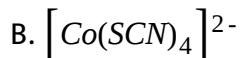
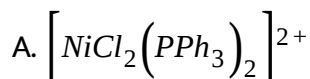


D. dsp^3

Answer: B

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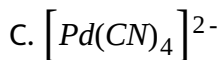
20. Which of the following species has square planar geometry ?



Answer: 3

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21. The species having tetrahedral shape is

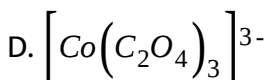
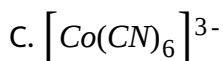
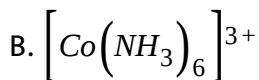
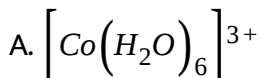


Answer: 4



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22. In which of the following coordination entities, the magnitude of Δ_0 [CFSE in octahedral field] will be maximum ?

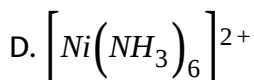
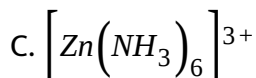
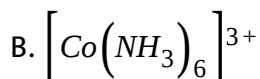
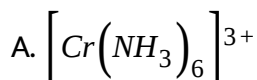


Answer: 3



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23. Which one of the following amino complexes would show the highest value of paramagnetic behaviour ?

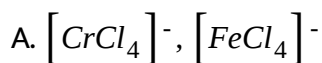


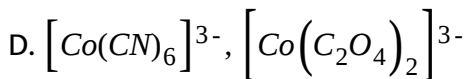
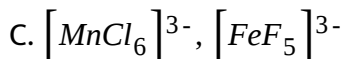
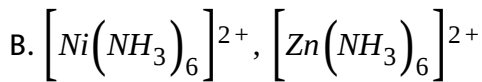
Answer: A



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24. The pair in which both species have same (spin only) magnetic moment is :

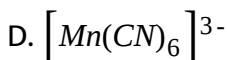
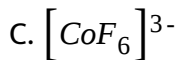
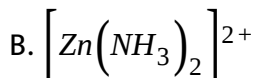
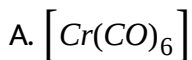




Answer: D

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25. Which of the following complexes is inner orbital complex and paramagnetic ?



Answer: 4

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26. $[Co(NO_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ are examples of which of the following type of isomerism ?

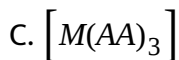
- A. Linkage
- B. Geometrical
- C. Ionization
- D. Optical isomerism

Answer: C

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27. Facial-meridional isomers is associated with which one of the following complex (M = central metal) .

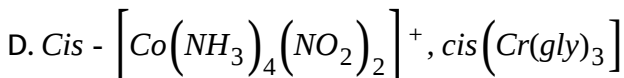
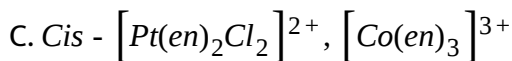
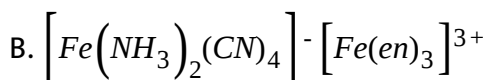
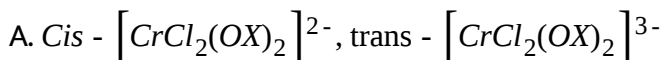
- A. $[M(AA)_2]$
- B. $[MA_3B_3]$



Answer: 2

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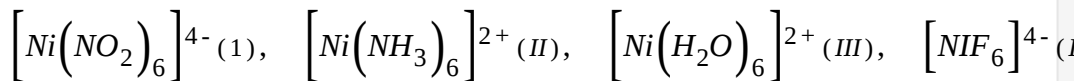
28. In which of the following pairs both the complexes show optical isomerism?



Answer: C

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29. The correct order for the wavelengths of absorption in the visible region for the following :



A. $IV > III > II > I$

B. $I > II > III > IV$

C. $III > IV > II > I$

D. $II > III > I > IV$

Answer: 1

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30. Select the incorrect statement ?

A. Ag^+ ions with an excess of a solution containing CN^- ions form a complex having coordination number two.

B. $\text{PtCl}_3(\eta^2 - \text{C}_2\text{H}_4)$, an organometallic compound is σ and π bonded.

C. Vitamin B_{12} is a coordination compound of cobalt.

D. $RhCl(PPh_3)_3$, a Wilkinson catalyst has sp^3 hybridisation and is used for the hydrogenation of alkenes.

Answer: D

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31. Given the molecular of the hexacoordinated complexes is :

(1) $CoCl_3.6NH_3$ (2) $CoCl_3.5NH_3$ (3) $CoCl_3.4NH_3$

If the number of co-ordinated NH_3 molecules in (1), (2) and (3) respectively are (6), (5) and (4) , the primary valency in (1), (2) and (3) are

:

A. 6, 5, 4

B. 3, 2, 1

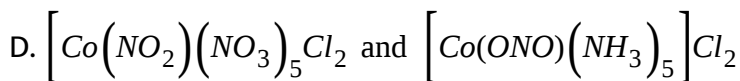
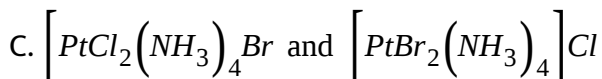
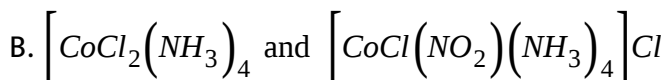
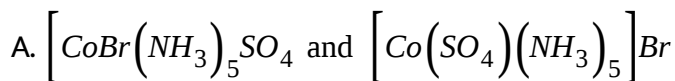
C. 0, 1, 2

D. 3, 3, 3

Answer: 4

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



Answer: 1

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33. The hybridisation of $\left[NiCl_2(PPh_3)_2 \right]$ and $\left[NiCl_2(PMe_3)_2 \right]$ are respectively (consider PPh_3 a bulkier ligand than Pme_3):

A. sp^3 and dsp^2

B. sp^3 and sp^3

C. dsp^2 and dsp^2

D. dsp^2 and sp^3

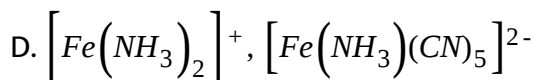
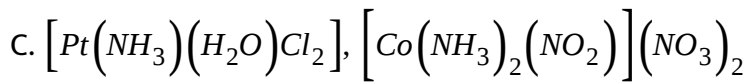
Answer: 1

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34. In which of the following pairs both the complexes show geometrical isomerism?

A. $\left[Cr(en)_2Cl_2 \right]^+$, $\left[Cr(en)_3 \right]^{3+}$

B. $\left[Co(NH_3)_4Cl_2 \right]^+$, $\left[Co(en)_2Cl_2 \right]^+$



Answer: 2

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35. How many total ionization isomers of the complex



A. 2

B. 3

C. 4

D. 1

Answer: B

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36. Which of the following statements is incorrect ?

- A. Both $\left[Ti(H_2O)_6 \right] Cl_3$ and $\left[Ni(H_2O)_6 \right] Cl_2$ are coloured solutions.
- B. Removal of water from $\left[Ti(H_2O)_6 \right] Cl_3$ on heating renders it colourless
- C. The metal carbon bond carbonyls possess both s and p character
- D. The $M - C\pi$ bond in metal carbonyl is formed by the donation of a pair of electrons from the carbon monoxide into a vacant orbital of the metal.

Answer: 4

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

A. 1.158Å

B. 1.128Å

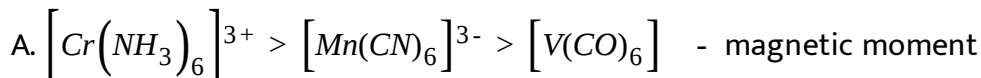
C. 1.178Å

D. 1.118Å

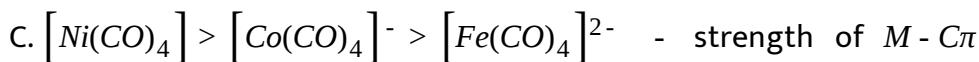
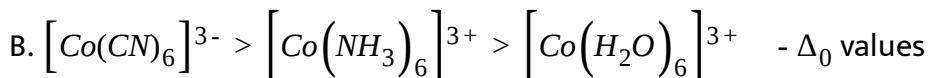
Answer: 1

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38. Which of the following orders is incorrect for the properties indicated against each ?



(spin only values in B.M.)



bond.

D. $[Fe(CN)_6]^{3-} < [Co(CN)_6]^{4-} < [Ni(NH_3)_6]^{2+}$ - effective atomic number of metal ion.

Answer: C

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39. Choose the correct option for the complex $[PtCl_2(en)_2]^{2+}$.

A. Platinum is in +2 oxidation state

B. Racemic mixture is obtained on mixing mirror images of its trans form in 1:1 molar ratio.

C. It has two five membered chelating rings.

D. (2) and (3) both

Answer: 3

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40. How many geometrical isomers and stereoisomers are possible for $[Pt(NO_2)(NH_3)(NH_2OH)(Py)]^+$ and $[Pt(BRr)(Cl)(I)(NO_2)(Py)]$ respectively ?

- A. 3 and 15
- B. 3 and 30
- C. 4 and 15
- D. 4 and 30

Answer: 2

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41. 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: 1

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42. 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: 3

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43. $[Fe(H_2O)_6]^{2+}$ 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: 3



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44. The two compounds pentaamminesulphatocobalt (III) and pentaamminesulphatocobalt (III) chloride represent :

- A. Linkage isomerism
- B. Ionization isomerism
- C. Coordination isomerism

D. No isomerism

Answer: 4

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45. 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 and IV

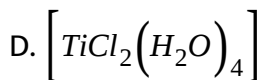
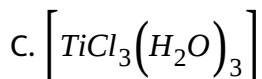
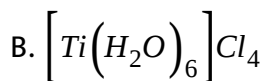
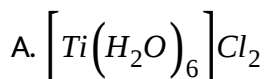
C. II, III and IV

D. I, II, III and IV

Answer: 2

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46. 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: 2

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1. Give the order of chelating effect of following ligands.

(i) $C_2O_4^{2-}$ (ii) EDTA (iii) dien

A. $iii > ii > i$

B. $i > ii > iii$

C. $ii > iii > i$

D. $i > iii > ii$

Answer: C



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2. Write the structural formula corresponding to each of the following

IUPAC names :

(a) potassium tetracyanidozincate (II)

(b) tetracarbonyl nickel (0)

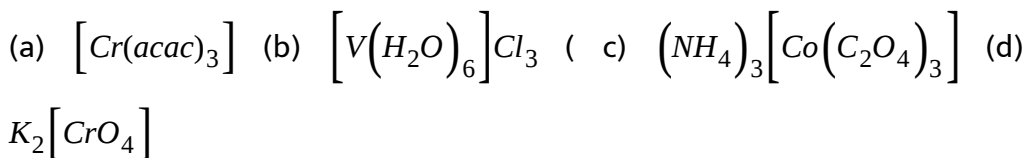
(c) potassium tetracyanonickelate (0)

(d) potassium tris (oxalato) aluminate (III)



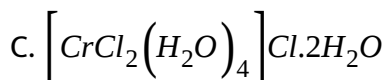
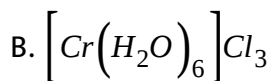
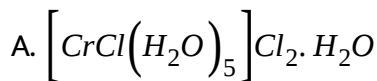
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3. Write the IUPAC name of the following :



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4. A solution containing 0.319 g of complex $CrCl_3 \cdot 6H_2O$ was passed through cation exchanger and the solution given out was neutralised by 28.5 ml of 0.125 M NaOH. The correct formula of the complex will be: [molecular weight of complex = 266.5]

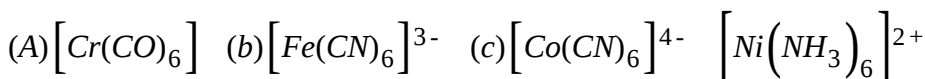


D. All are correct

Answer: B

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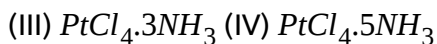
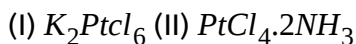
5. Calculate the effective atomic number of the metal atoms in the following complexes / complex ions.



[Cr=24, Fe=26, Co=27 and Ni=28 as atomic numbers]

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6. Consider the following complexes:



Their electrical conductances in an aqueous solution are:

A. 256,0,97,404

B. 404,0,97,256

C. 256,97,0,404

D. 404,97,256,0

Answer: A

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7. Explain the following:

(i) All the octahedral complexes of Ni^{2+} must be outer orbital complexes.

(ii) $[CoF_6]^{3-}$ is paramagnetic but $[Co(CN)_6]^{3-}$ is diamagnetic .

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8. You are given the following two complex X and Y which are isomer of each other , X is $Hg [Co(SCN)_4]$. It is further given that 'spin only' magnetic moment of X is found to be 3.78 B.M. and that of Y is 1.73 B.M. Then which of the following is correct ?

A. Anion of X will be tetrahedral and that of Y will be square planar

- B. Anion of X will be square planar but that of Y will be tetrahedral
- C. Both the anions will be tetrahedral
- D. Both the anions will be square planar

Answer: A

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9. All the following complexes show a decrease in their weights when placed in a magnetic balance. Then which of these has square planar geometry?

- A. $Ni(CO)_4$
- B. $K[AgF_4]$
- C. $Na_2[Zn(CN)_4]$
- D. None of these

Answer: B



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10. It is non experimental fact that $Cs_2[CuCl_4]$ is orange coloured but $(NH_4)_2[CuCl_4]$ is yellow. It is further known that total paramagnetic moment of a unpaired electron is due to spin as well as due to nature of orbital , 'd' orbital contributing more than 's' or 'p'. Thus the total paramagnetic moment of orange compound is found to be more than that of yellow compound. Then which of the following is correct?

- A. Anion of orange compound is tetrahedral and that of yellow is square planar
- B. Anion of orange compound is square planar and that of yellow is tetrahedral
- C. Both the anions are tetrahedral
- D. Both the anions are square planar.

Answer: A



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11. It is an experimental fact that : $DMG + Ni(II)salt + NH_4OH \rightarrow$ Red precipitate

Which of the following is wrong about this red precipitate ?

- A. It is non-ionic complex.
- B. It involves intra molecular H-bonding.
- C. $Ni(II)$ is sp^3 hybridised.
- D. It is a diamagnetic complex.

Answer: C

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12. The correct order for the CFSE (numerical value) for the following complexes is :

Complex	P	Q	R	S
Formula	$[CoF_6]^{3-}$	$[Co(CN)_6]^{3-}$	$[Co(NH_3)_6]^{3+}$	$[Co(H_2O)_6]^{3+}$

A. $P > Q > R > S$

B. $Q > R > S > P$

C. $S > R > P > Q$

D. $R > Q > P > S$

Answer: B

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13. Which of the following statement is not correct ?

(a) $[Ni(H_2O)_6]^{2+}$ and $[Ni(NH_3)_6]^{2+}$ have same value of CFSE

(b) $[Ni(H_2O)_6]^{2+}$ and $[Ni(NH_3)_6]^{2+}$ have same value of magnetic moment

A. Only a

B. Only b

C. Both a and b

D. None of these

Answer: A

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14. Statement-1: $[Co^{II}(NH_3)_6]^{2+}$ is not readily oxidized to $[Co^{III}(NH_3)_6]^{3+}$ when air is bubbled through it.

Statement-2: Crystal field stabilization energy of $Co(+III)$ with a d^6 configuration is higher than for $Co(+III)$ with a d^7 arrangement.

A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1

B. Statement-1 is true, statement-2 is true, statement-2 is NOT a correct explanation for statement-1

C. Statement-1 is true, statement-2 is false

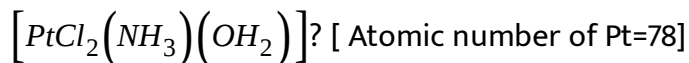
D. Statement-1 is false, statement-2 is true.

Answer: D



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15. Which of the following is true about the complex



- (i) It will have two geometrical isomeric forms, cis and trans.
- (ii) The hybridisation state of Pt(II) is sp^3 .
- (iii) It is a square planar complex. (iv) It is a diamagnetic complex.
- (v) It can show hydrate isomerism. (vi) It is a tetrahedral complex.

A. (i),(iii),(iv)

B. (ii),(iv),(v)

C. (ii),(v),(vi)

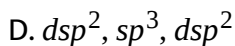
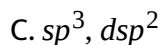
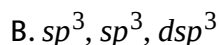
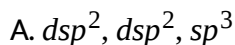
D. (i),(v),(vi)

Answer: A



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16. Among $[\text{Ni}(\text{CN})_4]^{4-}$, $[\text{Ni}(\text{PPh}_3)_3\text{Br}]$ and $[\text{Ni}(\text{dmg})_2]$ species, the hybridisation state of the Ni-atoms are respectively:



Answer: B



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17. For the reaction $\text{Ni}^{2+} + 4\text{NH}_3 \rightleftharpoons [\text{Ni}(\text{NH}_3)_4]^{2+}$, at equilibrium, if the solution contain $1.65 \times 10^{-4}\%$ of nickel in the free state, and the concentration of NH_3 at equilibrium is 0.5 M. Then the instability constant of the complex will be approximately equal to :

A. 1.0×10^{-5}

B. 1.5×10^{-16}

C. 1.0×10^{-7}

D. 1.5×10^{-17}

Answer: C

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18. In metal carbonyls the metal carbon bond length is found to be less than the expected bond length. Explain why ?

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19. π -bonding is not involved in :

A. ferrocene

B. dibenzenechromium

C. Zeise's salt

D. Grignard's reagent

Answer: D



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20. Wilkinson's catalyst contains:

A. rhodium

B. iron

C. aluminium

D. cobalt

Answer: A

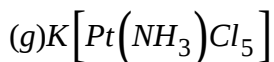
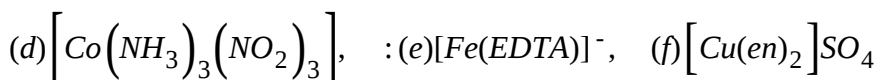
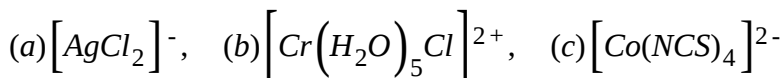


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1. K_2SO_4 solution mixed with $Cr_2(SO_4)_3$ solution in 1:1 molar ratio gives the test of Cr^{3+} ion but $CuSO_4$ solution mixed with aqueous ammonia in 1:4 molar ratio does not give the test of Cu^{2+} ion. Explain why?

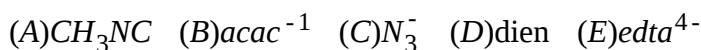
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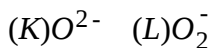
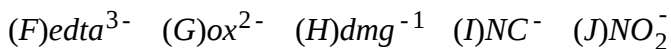
2. What is the coordination number and the oxidation state of the metal in each of the following complexes ?



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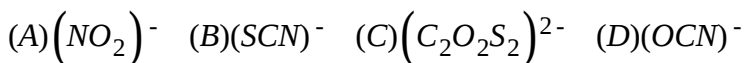
3. Write the name of the following ligands and classify their denticity





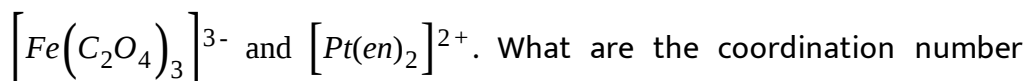
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4. Predict the different ligating sites by drawing structures in the following ligands.

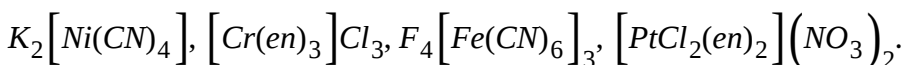


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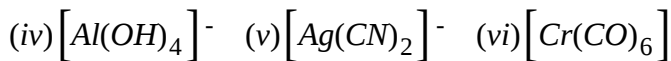
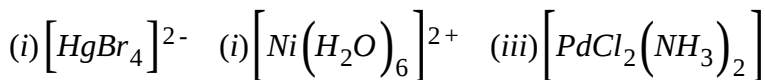
5. (a) Determine the denticity of the ligands in complexes



(b) Designate the coordination entities and counter ions in the coordination compounds.



(c) Identify the Lewis acid and Lewis base components of the following complexes.



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Exercise Part-I: Subjective Question Section (B)

1. Name the following compounds

(a)	$[Co(NH_3)_6]Cl_3$	Prepared in 1798 by B.M. Tassaert and considered to be first complex salt prepared.
(b)	$[Rh(NH_3)_5]I_2$	A yellow colored complex obtained by heating $[Rh(NH_3)_5(H_2O)]I_3$ above $100^\circ C$.
(c)	$[Fe(CO)_5]$	A highly toxic volatile liquid.
(d)	$[Fe(C_2O_4)_2]^{2-}$	The ion formed when Fe_2O_3 rust is dissolved in oxalic acid, $H_2C_2O_4$.
(e)	$[Cu(NH_3)_4]SO_4$	A deep blue compound obtained when $CuSO_4$ is treated with excess of NH_3 .
(f)	$Na[Cr(OH)_4]$	The compound formed when $Cr(OH)_3$ precipitate is dissolved in excess of $NaOH$.
(g)	$[Co(gly)_3]$	A complex that contains the anion of amino acid, glycine.
(h)	$[Fe(H_2O)_5(SCN)]^{2+}$	The red complex ion formed in the qualitative analysis test of Fe^{3+} ion.
(i)	$K_2[HgI_4]$	Alkaline solution of this complex is called Nessler's Reagent .
(j)	$Co[Hg(SCN)_4]$	Deep blue crystalline precipitate obtained in qualitative detection of Hg^{2+} .
(k)	$Fe_4[Fe(CN)_6]_3$	Prussian blue , deep blue colored complex obtained in detection of Fe^{2+} .
(l)	$K_3[Co(NO_2)_6]$	Potassium cobaltinitrite or Fischer salt yellow precipitate obtained in detection of Co^{2+} .

(m)	$[Ni(dmg)_2]$	Rosy red precipitate obtained in detection of Ni^{2+} ions.
(n)	$K_2[PtCl_6]$	Yellow precipitate obtained in detection of potassium ions.
(o)	$Na_2[Fe(CN)_5NO]$	Sodium nitroprusside used for detection of sulphide ions/sulphur.
(p)	$[Fe(H_2O)_5(NO')]SO_4$	Brown ring complex, obtained in detection of Fe^{+1} ions.
(q)	$[Cu(CN)_4]^{2-}$	Colourless stable soluble complex obtained in detection of Cu^{2+} on adding excess of KCN solution.
(r)	$(NH_4)_2[PtCl_6]$	Only few compounds of ammonium ions are precipitate this is one of these, a yellow precipitate.

2. Name the following compounds

- | | | | |
|-----|--|-----|--|
| (a) | $[\text{CoBr}(\text{en})_2(\text{ONO})] \cdot$ | (b) | $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{ONO})_6]$ |
| (c) | $[\text{Co}(\text{NH}_3)_6(\text{CO}_3)]\text{Cl}$ | (d) | $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2][\text{PtCl}_4]$ |
| (e) | $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$ | (f) | $[(\text{NH}_3)_5\text{Co}-\text{NH}_2-\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})]\text{Cl}_5$ |
| (g) | $[\text{Cr}(\text{CO})_5(\text{PPPh}_3)]$ | (h) | $[(\text{CO})_5\text{Mn}-\text{Mn}(\text{CO})_5]$ |
| (i) | $\text{Cr}(\eta^6-\text{C}_6\text{H}_6)_2$ | (j) | $[\text{Co}(\text{NH}_3)_4(\text{OH}_2)_2][\text{BF}_4]_3$ |
| (k) | $\text{Ba}[\text{Zr}(\text{OH})_2(\text{ONO})_2(\text{ox})]$ | (l) | $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{C}_2\text{O}_4)_3]$ |

3. Write down the formulae of the following compounds

(a)	Tetraamminezinc(II) Nitrate	The compound formed when zinc nitrate is treated with an excess of ammonia
(b)	Tetracarbonylnickel(0)	The first metal carbonyl(prepared in 1888) and an important compound in the industrial refining of nickel metal
(c)	Potassium amminetrichloridoplatinate(II)	A compound that contains a square planar anion
(d)	Dicyanidoaurate(I) ion	An ion important in the extraction of gold from its ores
(e)	Sodium hexafluoroaluminate(III)	Called cryolite, used in the electrolytic refining of aluminium
(f)	Diamminesilver(I) ion	Ion formed when AgCl is dissolved in excess of ammonia

4. Write down the formulae of the following compounds

(a)	diamminetriaquahydroxidochromium (III) nitrate
(b)	tetrakis(pyridine)platinum(II) tetraphenylborate(III)
(c)	dibromidotetracarbonyliron (II)
(d)	ammonium diamminetetrakis(isothiocyanato)chromate(III).
(e)	pentaamminedinitrogenruthenium(II) chloride
(f)	barium dihydroxidodinitrito-O-oxalatozirconate(IV)
(g)	tetrapyridineplatinum(II) tetrachloridonickelate(II)

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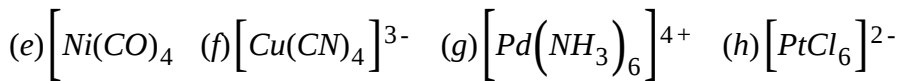
Exercise Part-I: Subjective Question Section (C)

1. 1 g of complex $\left[Cr(H_2O)_5Cl\right]Cl_2 \cdot H_2O$ was passed through a cation exchanger to produce HCl. The acid liberated was diluted to 1 litre. What will be the molarity of acid solution [Molecular weight of complex=266.5]?

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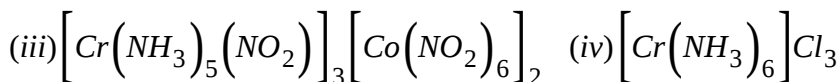
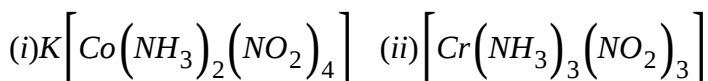
2. Calculate the EAN of central atom in the following complexes

(a) $[Cr(CO)_6]$ (b) $[Fe(CN)_6]^{4-}$ (c) $[Fe(CO)_5]$ (d) $[Co(NH_3)_6]^{3+}$



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3. Arrange the following compounds in order of increasing molar conductivity .



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Exercise Part-I: Subjective Question Section (D)

1. A metal complex having composition $Cr(NH_3)_4Cl_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia, whereas B gives a yellow precipitate soluble in concentrated ammonia.

(i) Write the formulae of A and B.

(ii) State hybridisation of chromium in each.

(iii) Calculate their magnetic moments for each (spin-only value).

(iv) Calculate the EAN for both.

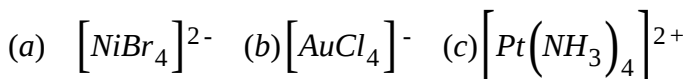
(v) Will they conduct electricity or not.

(vi) Write the formula of the complexes formed when the precipitates dissolve in aqueous ammonia & the concentrated ammonia respectively.



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2. Predict the hybridisation and geometry of the following complexes.



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Exercise Part-I: Subjective Question Section (E)

1. For the complex $K_2[Cr(NO)(NH_3)(CN)_4]$, $\mu = 1.73BM$.

(i) Write IUPAC name.

(ii) What will be structure ?

(iii) How many unpaired electrons are present in the central metal ion ?

(iv) Is it paramagnetic or diamagnetic ?

(v) Calculate the EAN of the complex.

(vi) What will be the hybridisation of the complex.

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2. Predict the hybridisation and geometry of the following complexes.

(a) $[Fe(CN)_6]^{3-}$ (b) $[MnBr_4]^{2-}$ (c) $[Fe(H_2O)_6]^{2+}$ (d) $[Co(SCN)_4]^{2-}$

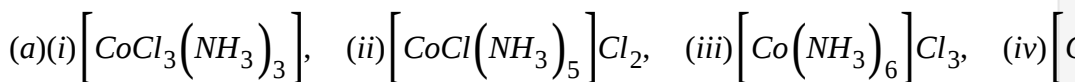
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3. $[Co(NH_3)_6]^{3+}$ & $[CoF_6]^{3-}$ both are complexes of Co(III), but $[Co(NH_3)_6]^{3+}$ is diamagnetic while $[Co(F_6)]^{3-}$ is paramagnetic with

$\mu = 4.90\text{BM}$. Explain.

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4. Arrange the following in increasing order as directed.



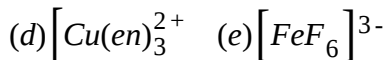
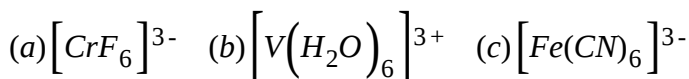
- Molar conductance

(b) C, N, O, F (halogen)-tendency of σ donation.

(c) Br^- , S^{2-} , NO_2^- , CO, CN^- , NH_3 , NO^+ (-)-strength of ligands.

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5. For each of the following complexes, draw a crystal field energy-level diagram, assign the electrons to orbitals, and predict the number of unpaired electrons:



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Exercise Part-I: Subjective Question Section (F)

1. Cobalt (II) is stable in aqueous solution but in the presence of complexing reagents (strong field ligands) it is readily oxidised. Why ?

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2. The value of Δ_0 for $\left[Ti(H_2O)_6 \right]^{3+}$ is found to be 240 kJ mol^{-1} then predict the colour of the complex using the following table .

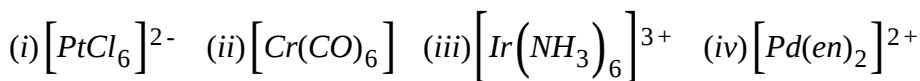
$$\left(h = 6 \times 10^{-34} \text{ J - sec}, N_A = 6 \times 10^{23} \text{ c} = 3 \times 10^8 \text{ m/sec} \right)$$

Absorbed light	λ (nm) (absorbed)	Colour exhibited
Blue	435 – 480	Yellow
green-blue	480 – 490	Orange
blue-green	490 – 500	Red
green	500 – 560	purple
yellow-green	560 – 580	violet
Yellow	580 – 595	blue
Red	605 – 700	blue green

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3. (a) $\left[Ti(H_2O)_6 \right]^{3+}$ absorbs light of wavelength 5000\AA . Name one ligand which would form a titanium (III) complex absorbing light to lower wavelength than 5000\AA and one ligand which would form a complex absorbing light of wavelength higher than 5000\AA .

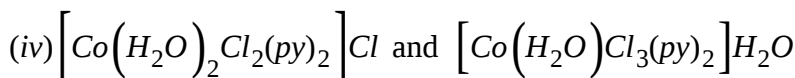
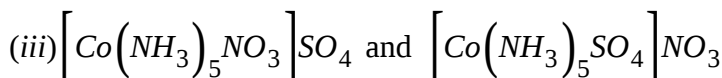
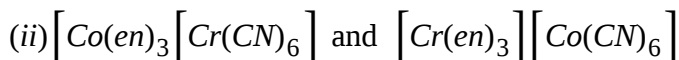
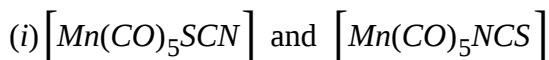
(b) Calculate the magnetic moments (spin only) of the following complexes



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Exercise Part-I: Subjective Question Section (G)

1. What type of isomers are the following :



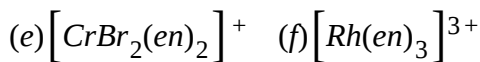
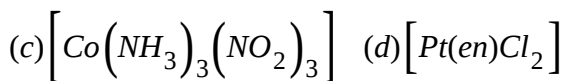
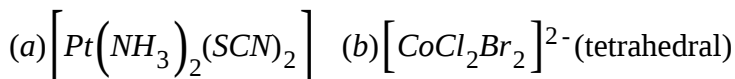
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2. (a) Draw all possible constitutional isomers of the compound $Ru(NH_3)_5(NO_2)Cl$. Label the isomers as linkage isomers or ionization isomers.

(b) There are six possible isomers for a square planar palladium (II) complex that contains two NH_3 and two SCN^- ligands. Sketch the structure of all six, and label them according to the classification.

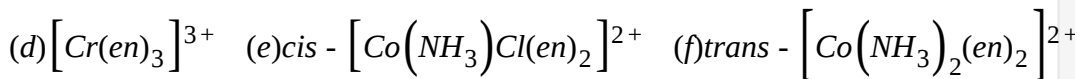
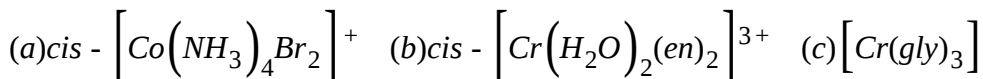
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3. How many geometrical isomers are possible for each of the following complexes ?



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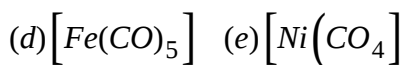
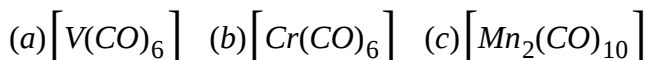
4. Which of the following complexes can exist as enantiomers? Draw their structures



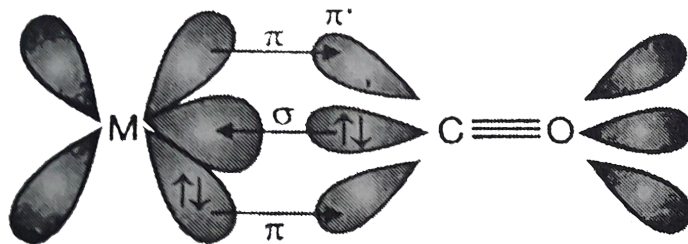
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Exercise Part-I: Subjective Question Section (H)

1. Draw the structures of the following metal carbonyls



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2.

The figure represents the synergic bonding interaction in metal carbonyl complex. On the basis of the explain the following:

(i) Strength of Metal-ligand bond

(ii) Bond order of CO in carbonyl complex as compared to bond order in carbon monoxide.

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Exercise Part-II: Section (A)

1. Ethylene diamine is an example of a ligand:

A. monodentate

B. bidentate

C. tridentate

D. hexadentate

Answer: B

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2. The donor sites of $(EDTA)^{4-}$ are ?

A. O atoms only

B. N atom only

C. Two N atoms and four O atoms

D. Three N atoms and three O atoms.

Answer: C

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3. Some salts although containing two different metallic elements give test for one of them in solution Such salts are :

- A. complex salt
- B. double salts
- C. normal salt
- D. none

Answer: A



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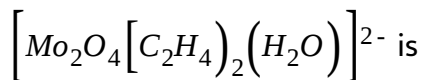
4. Ligands are :

- A. Lewis acids
- B. Lewis bases
- C. neutral
- D. none

Answer: B

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5. The oxidation state of mo in its oxido-complex - complex species



A. +2

B. +3

C. +4

D. +5

Answer: B

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6. Co-ordination number of platinum in $\left[Pt \left(NH_3 \right)_4 Cl_2 \right]^{2+}$ ion is :

A. 4

B. 2

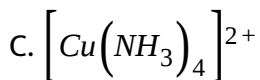
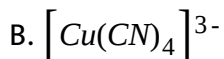
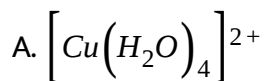
C. 8

D. 6

Answer: D

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7. Which of the following is copper (I) compound ?



D. All of these

Answer: B

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8. In the complex $[CoCl_2(en)_2]Br$, the co-ordination number and oxidation state of cobalt are :

A. 6 and +3

B. 3 and +3

C. 4 and +2

D. 6 and +1

Answer: A



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9. What is the charge on the complex $[Cr(C_2O_4)_2(H_2O)_2]$ formed by Cr(III) ?

A. +3

B. +1

C. +2

D. -1

Answer: D



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Exercise Part-II: Section (B)

1. A complex cation is formed by Pt(in some oxidation state) with ligands (in proper number so that coordination number of Pt becomes six).

Which of the following can be its correct IUPAC name ?

A. Diammineethylenediaminedithiocyanato-S-platinum (II) ion

B. Diammineethylenediaminedithiocyanato-S-platinate (IV) ion

C. Diammineethylenediaminedithiocyanato-S-platinum (IV) ion

D. Diamminebis (ethylenediamine) dithiocyanate -S- platinum (IV) ion

Answer: C



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2. Which of the following names is impossible ?

A. Potassium tetrfluoridooxidochromate (VI)

B. Barium tetrafluoridochromate (II)

C. Dichlorobis (urea) copper (II)

D. All are impossible

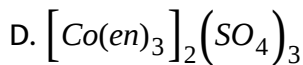
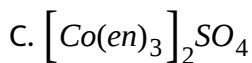
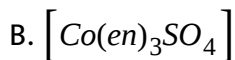
Answer: A



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3. The formula of complex tris (ethylenediamine) cobalt (III) sulphate is

A. $[Co(en)_2SO_4]$



Answer: D

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4. The correct IUPAC name of the compound $[Co(NH_3)_4Cl(ONO)]Cl$ is :

A. Tetraamminechloridonitrito-N-cobalt(III) chloride

B. Chloridonitrito-O-tetraamminecobalt(II) chloride

C. Dichloridonitrito-O-tetraamminecobalt(III)

D. Tetraamminechloridonitrito-O-cobalt(III) chloride

Answer: D

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5. The hypothetical complex triamminediaquachloridocobalt(III) chloride can be represented as :

- A. $\left[\text{CoCl}(\text{NH}_3)_3(\text{H}_2\text{O})_2 \right]$
- B. $\left[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})\text{Cl}_3 \right]$
- C. $\left[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_2\text{Cl} \right]\text{Cl}_2$
- D. $\left[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_3 \right]\text{Cl}_3$

Answer: C



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Exercise Part-II: Section (C)

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

A. 4

B. 8

C. 5

D. 6

Answer: C



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2. The EAN of platinum in potassium hexachloridoplatinate (IV) is (Atomic number of Pt=78)

A. 90

B. 86

C. 76

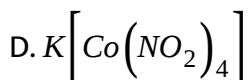
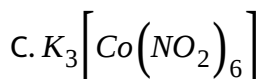
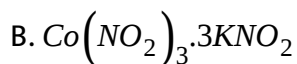
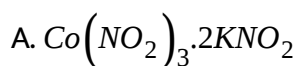
D. 88

Answer: B



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3. A compound is made by mixing cobalt (III) nitrite and potassium nitrite solutions in the ratio of 1:3. The aqueous solution of the compound showed 4 particles per molecules whereas molar conductivity reveals the presence of six electrical charges. The formula of the compound is :

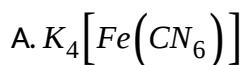


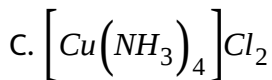
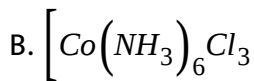
Answer: C



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4. Which of the following will exhibit maximum ionic conductivity ?

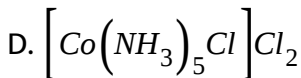
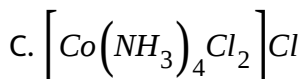
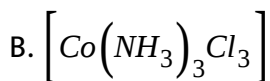
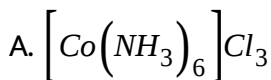




Answer: A

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5. Which of the following shows maximum molar conductance ?



Answer: A

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6. The complex $\left[Cr(H_2O)_4Br_2\right]Cl$ gives the test for :

A. Br^-

B. Cl^-

C. Cr^{3+}

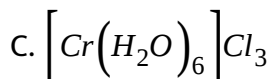
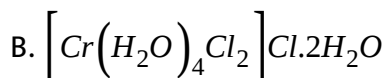
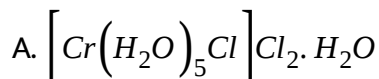
D. Br^- and Cl^- both

Answer: B



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7. Which of the following complexes will be dehydrated to relatively minimum extent by conc. H_2SO_4 under identical condition .



D. all of these

Answer: C

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8. On adding $AgNO_3$ solution to a solution of $\left[Pt(NH_3)_3Cl_3\right]Cl$, the percentage of total chloride ion precipitated is

A. 100

B. 75

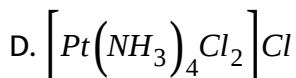
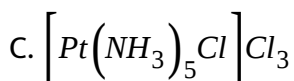
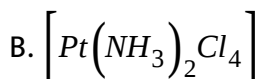
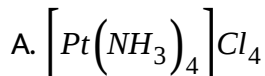
C. 50

D. 25

Answer: D

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



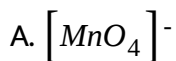
Answer: C

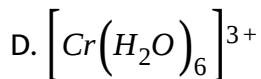
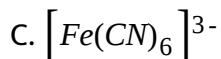
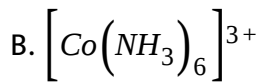


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Exercise Part-II: Section (D)

1. The complex ion which has no 'd' electrons in the central metal atom is :





Answer: A

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2. For the correct assignment of electronic configuration of a complex, the valence bond theory often requires the measurement of

A. molar conductance

B. optical activity

C. magnetic moment

D. dipole moment

Answer: C

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3. The magnitude of crystal field stabilisation energy (CFSE of Δ_1) in tetrahedral complexes is considerably less than that in the octahedral field. Because

- A. There are only four ligands instead of six so the ligands field is only $\frac{2}{3}$ in tetrahedral complex
- B. The direction of the orbital does not coincide with the direction of the ligands. This reduces the crystal field stabilization energy (Δ) by further $\frac{2}{3}$
- C. Both point (A) and (B) are correct
- D. Both point (A) and (B) are wrong.

Answer: C



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4. Which of the following factors does tends to increase the stability of metal ion complexes ?

- A. Higher ionic radius of the metal ion
- B. Higher charge / size ratio of the metal ion
- C. Lower ionisation potential of the metal ion
- D. Lower basicity of the ligands.

Answer: B

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5. The crystal field splitting energy for octahedral complex (Δ_0) and that for tetrahedral complex (Δ_1) are related as :

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

B. $\Delta_t = 0.5\Delta_0$

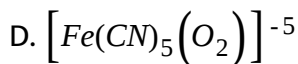
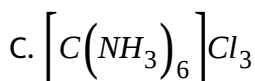
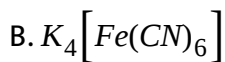
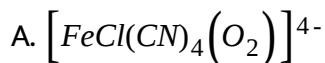
C. $\Delta_t = 0.33\Delta_0$

$$D. \Delta t = \frac{9}{4} \Delta_0$$

Answer: A

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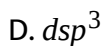
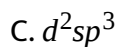
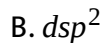
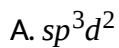
6. All the metal ions contain $t_{2g}^6 e_g^0$ configuration. Which of the following complex will be paramagnetic ?



Answer: A

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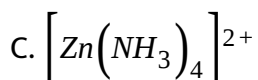
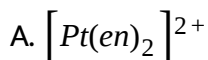
1. Chromium hexacarbonyl is an octahedral compound involving :



Answer: C

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2. Which of the following molecules is not tetrahedral ?



Answer: A

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3. The complex $\left[Pt(NH_3)_4\right]^{2+}$ has Structure :

A. square planar

B. tetrahedral

C. pyramidal

D. pentagonal

Answer: A

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4. Match Column-I with Column-II and select the correct answer with respect to hybridisation using the codes given below .

	Column - I (Complex)		Column - II (Hybridisation)
(I)	$[\text{AuF}_4]^-$	(p)	dsp^2 hybridisation
(II)	$[\text{Cu}(\text{CN})_4]^{3-}$	(q)	sp^3 hybridisation
(III)	$[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$	(r)	sp^3d^2 hybridisation
(IV)	$[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]^{2+}$	(s)	d^2sp^3 hybridisation

- A. (I) (II) (III) (IV)
 q p r s
- B. (I) (II) (III) (IV)
 p q s r
- C. (I) (II) (III) (IV)
 p q r s
- D. (I) (II) (III) (IV)
 q p s r

Answer: B

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5. The hybridisation and unpaired electrons in $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ ion are :

A. $sp^3d^2, 4$

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

C. $d^2sp^3, 4$

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

Answer: A



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6. The number of unpaired electrons in d^6 , low spin, octahedral complex is :

A. 4

B. 2

C. 1

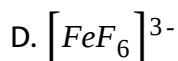
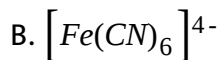
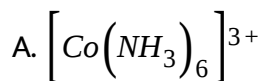
D. 0

Answer: D



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7. Which of the following is a high spin complex ?

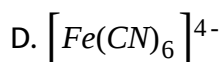
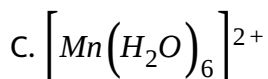
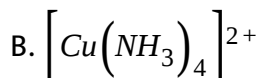
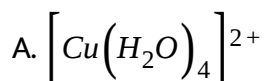


Answer: D



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8. Which has maximum paramagnetic nature ?



Answer: C

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9. The number of unpaired electrons present in complex ion $[FeF_6]^{3-}$ is:

A. 5

B. 4

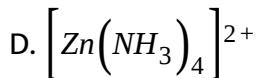
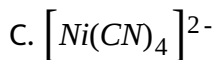
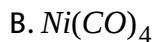
C. 6

D. 0

Answer: A

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10. Which of the following complexes has a geometry different from others ?



Answer: C

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11. Select the correct statement

A. Complex ion $[\text{MoCl}_6]^{3-}$ is paramagnetic

B. Complex ion $[\text{Co}(\text{en})_3]^{3+}$ is diamagnetic

C. Both (A) and (B) are correct

D. None of correct

Answer: C

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12. Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $NiCl_4^{2-}$:

A. $Ni(CO)_4$ and $NiCl_4^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic .

B. $NiCl_4^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic

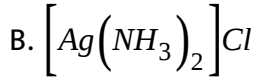
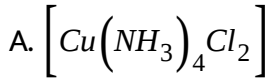
C. $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $NiCl_4^{2-}$ is paramagnetic

D. $Ni(CO)_4$ is diamagnetic and $NiCl_4^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic.

Answer: C

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1. The compound which does not show paramagnetism is



C. NO

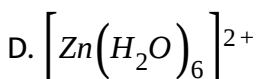
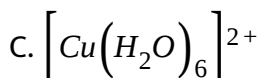
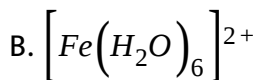
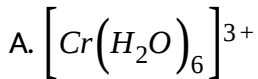
D. NO_2

Answer: B



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2. Among the following ions, which one has the highest paramagnetism ?



Answer: B

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Exercise Part-II: Section (G)

1. The complexes $\left[Pt(NH_3)_4\right]\left[PtCl_6\right]$ and $\left[Pt(NH_3)_4Cl_2\right]\left[PtCl_4\right]$ are :

- A. linkage isomers
- B. optical isomers
- C. co-ordination isomers
- D. ionisation isomers

Answer: C

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2. $\left[Co(NH_3)_5NO_2\right]Cl_2$ and $\left[Co(NH_3)_5ONO\right]Cl_2$ are related to each other as :

- A. geometrical isomers
- B. linkage isomers
- C. coordination isomers
- D. ionisation isomers

Answer: B



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3. The number of geometrical isomers of $\left[Co(NH_3)_3(NO_3)_3\right]$ is

- A. 0
- B. 2
- C. 3

D. 4

Answer: B

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4. Geometrical isomerism is found in coordination compounds having coordination number:

A. 2

B. 3

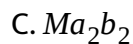
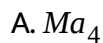
C. 4 (tetrahedral)

D. 6

Answer: D

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

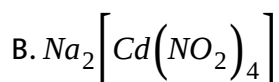
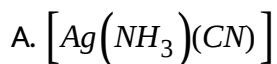


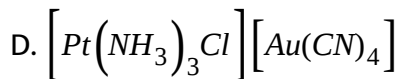
Answer: C



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6. Geometrical isomerism can be shown by



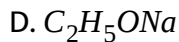
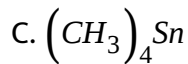
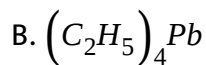


Answer: C

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Exercise Part-II: Section (H)

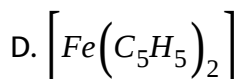
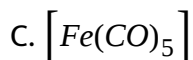
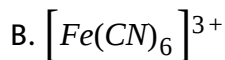
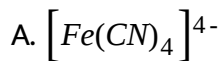
1. Which one is not an organometallic compound ?



Answer: D

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2. Formula of ferrocene is :



Answer: D

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Exercise Part-III: Match the column

1. Match the following columns

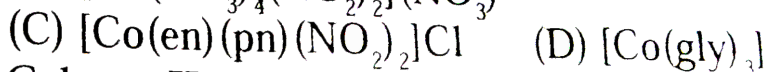
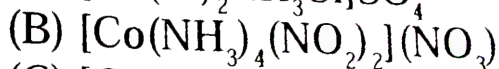
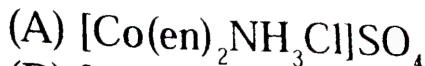
Column-I		Column-II	
(A)	$[Fe(en)_3]^{3+}$	(p)	d^2sp^3 hybridisation of central metal
(B)	$[Co(ox)_3]^{3-}$	(q)	sp^3d^2 hybridisation of central metal
(C)	$[Cr(CN)_6]^{3-}$	(r)	paramagnetic
(D)	$[NiCl_6]^{4-}$	(s)	diamagnetic
		(t)	metal ion has +3 oxidation state



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2. Select the correct option (s) for the coordination compounds and their respectively isomeric forms.

Column-I



Column-II

(p) Optical isomer (q) Geometrical isomer

(r) Ionization isomer (s) Linkage isomer



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Exercise-2 Part-I: Only one option correct Type

1. A complex anion is formed by Osmium (in some oxidation state) with ligands (in proper number so that coordination number of osmium becomes six). Which of the following can be its correct IUPAC name ?

A. pentachloridonitridoosmium(VI)

B. pentachloridonitridoosmate(VI)

C. azidopentachloridoosmate(VI)

D. None of these

Answer: B

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2. The EAN of metal atoms in $\left[Fe(CO)_2(NO^+)^2\right]$ and $Co_2(CO)_8$ respectively are :

A. 34,35

B. 34,36

C. 36,36

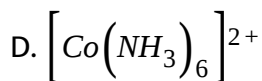
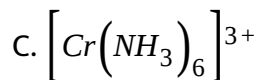
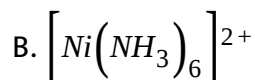
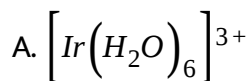
D. 36,35

Answer: C



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3. Which of the following is inner orbital complex as well as diamagnetic in nature ?



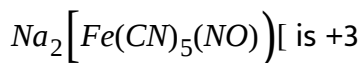
Answer: A



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4. Which of the following statement is correct ?

A. The oxidation state of iron in sodium nitro prusside



B. $[Ag(NH_3)_2]^+$ is linear in shape

C. In $[Fe(H_2O)_6]^{3+}$, Fe is d^2sp^3 hybridized

D. In $Ni(CO)_4$, the oxidation state of Ni is 1

Answer: B

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5. The complex $K_4[Zn(CN)_4(O_2)_2]$ is oxidised into $K_2[Zn(CN)_4(O_2)_2]$,

then which of the following is correct ?

A. Zn(II) is oxidised into Zn(IV)

B. Paramagnetic moment decrease

C. O - O bond length increases

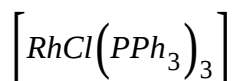
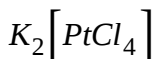
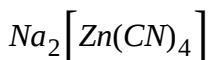
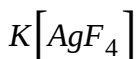
D. Paramagnetic moment increases.

Answer: D



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6. All the following complexes show decrease in their weights when placed in a magnetic balance then the group of complexes having tetrahedral geometry is :



A. II,III,V

B. I,II,III

C. I,III,IV

D. none of these

Answer: D

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7. The complex $\left[Fe(H_2O)_6NO\right]^{2+}$ is formed in the brown ring test for nitrates when freshly prepared $FeSO_4$ solution is added to aqueous solution of NO_3^- ions followed by addition of conc. H_2SO_4 . Select correct statement about this complex.

- A. Hybridisation of iron is sp^3d^2
- B. Iron has +1 oxidation state.
- C. It has magnetic moment of 3.87 B.M. confirming three unpaired electrons in Fe.
- D. All the above are correct statement.

Answer: D

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8. Which of the following statement is not correct ?

A. $TiCl_4$ is a colourless compound.

B. $[Cr(NH_3)_6]Cl_3$ is a coloured compound.

C. $K_3[VF_6]$ is a colourless compound.

D. $[Cu(NCCH_3)_4][BF_4]$ is a colourless compound.

Answer: C



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9. Amongst $[TiE_6]^{2-}$, $[CoF_6]^{3-}$, Cu_2Cl_2 and $[NiCl_4]^{2-}$ [Atomic no.

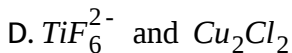
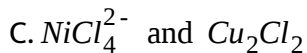
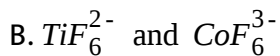
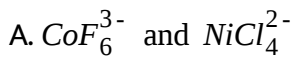
$Ti = 22$, $Co = 27$, $Cu = 29$, $Ni = 28$] the colourless species are :

(A) $[TiF_6]^{2-}$ and $[Cu_2Cl_2]$

(B) Cu_2Cl_2 and $[NiCl_4]^{2-}$

(C) $[TiF_6]^{2-}$ and $[CoF_6]^{3-}$

(D) $[CoF_6]^{3-}$ and $[NiCl_4]^{2-}$



Answer: D

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10. The number of geometrical isomers for octahedral $[\text{CoCl}_4(\text{NH}_3)_2]^-$, square planar $[\text{AuBr}_2\text{Cl}_2]^-$ and $[\text{PtCl}_2(\text{en})]$ are

A. 4,2

B. 2,2

C. 3,2

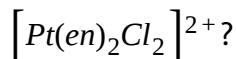
D. 2,3

Answer: B



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11. Which of the following statements is not true about the complex ion



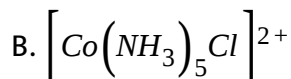
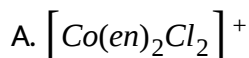
- A. It has two geometrical isomers - cis and trans
- B. Both the cis and trans isomers display optical activity.
- C. Only the cis isomer displays optical activity
- D. Only the cis isomer has non-superimposable mirror image.

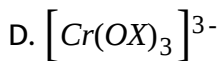
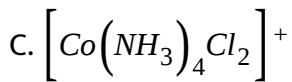
Answer: B



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12. Both geometrical and optical isomerism are shown by

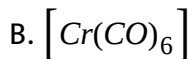
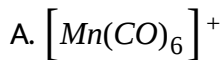




Answer: A

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13. Among the following , metal carbonyls, the C-O bond is strongest :



Answer: A

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Exercise-2 Part-II: Single and double value integer Type

1. Sum of denticity of following ligands are

Glycinaty ion, Oxalate ion, o-phenathroline, 2,2-bipyridyl, diethylenetriamine, ethylenediamine

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2. How many total sodium ions are present in one formula unit of sodium ethane-1,2-diaminetetraacetatochromate (II) and sodium hexanitrito cobaltate (III) ?

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3. A blue colour complex is obtained in the analysis of Fe^{+3} having formula $Fe_4 [Fe(CN)_6]_3$

Let a= oxidation number of Iron in the coordination sphere

b= no. of secondary valencies of central iron ion.

c = Effective atomic number of Iron in the coordination sphere.

Then find the value of $(c+a-2b)$

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4. Co-ordination number of Cr in $CrCl_3 \cdot 5H_2O$ is six. The volume of 0.1 N $AgNO_3$ needed to ppt. the chlorine in outer sphere in 200 ml of 0.01 M solution of the possible complexes is/are:

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5. Ni^{+2} form a complex ion in water having the formula $[Ni(H_2O)_6]^{+2}$.

How many of the following statements are true for the complex ion?

(i) The complex is octahedral in shape (ii) The complex is diamagnetic in nature .

(iii) Ni^{+2} has incompletely filled 3d subshell. (iv). Secondary valency of Ni^{+2} is 6

(v) All the bonds (metal-ligand) are perpendicular to each other. (vi) All

the 3d orbitals of Ni^{+2} are degenerate

(vii) Total spin of the complex is 1. (viii) The hybridisation of Ni^{+2} is d^2sp^3

(ix) The complex is more stable than $[Ni(en)_3]^{+2}$ (x) Effective atomic number of Ni^{+2} is 36.

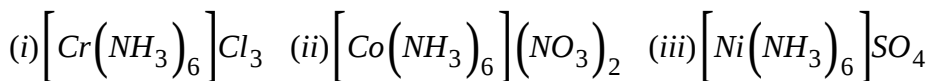
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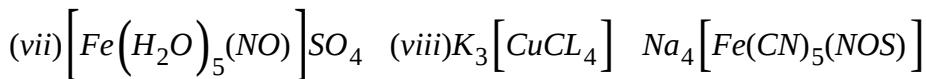
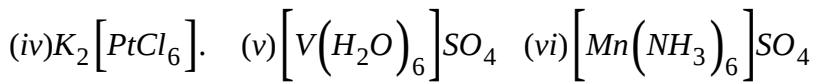
6. How many of the following is correctly matched complex ?

	Complex	Oxidation no. on central metal	Electronic configuration
(a)	$K_3[Co(C_2O_4)_3]$	+3	t_{2g}^5
(b)	$(NH_4)_2[CoF_4]$	+2	$t_{2g}^5 e_g^2$
(c)	Cis - $[Cr(en)_2Cl_2]Cl$	+3	$t_{2g}^3 e_g^0$
(d)	$[Mn(H_2O)_6]SO_4$	+2	$t_{2g}^3 e_g^2$

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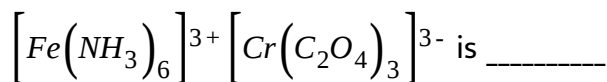
7. Total number of paramagnetic complexes which are inner orbital complexes :





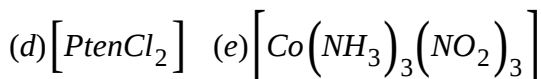
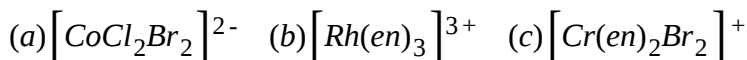
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8. The number of coordination isomers possible for



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9. Find the sum of number of geometrical isomers for following complexes.

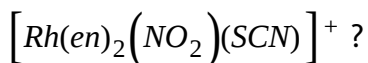


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10. What is the sum of bond order of Fe-C bond and C-O bond in $Fe(CO)_5$?

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11. How many isomeric forms are possible for the octahedral complex.



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Exercise-2 Part-III: One of More than One Options Correct Type

1. Which of the following statement(s) are incorrect ?

A. Those additional compounds which lose their identity in solution are called double salts.

B. In $K_3[Fe(CN)_6]Fe^{2+}$ and CN^- ions can give quantitative identification test.

C. $[KAl(SO)_4 \cdot (2).12H_2O]$ is a coordination compound

D. All acids are lewis acids and σ donors.

Answer: B::C::D

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2. The 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. dimerization

D. none

Answer: B::C

3. Select the correct statement

- A. Potassium ferrocyanide and potassium ferricyanide can be differentiated by measuring the solid state magnetic moment.
- B. The complex $[Co(NH_3)_3(5)Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ can be differentiated by adding aqueous solution of barium chloride
- C. The complex $[Co(NH_3)_3(5)Cl]Br$ and $[Co(NH_3)_5Br]Cl$ can be differentiated by adding aqueous solution of silver nitrate .
- D. the complex $[Co(NH_3)_6Cl_3]$ and $[Co(NH_3)_5Cl]Cl_2$ can be differentiated by measuring molar conductance.

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

4. s-1: $[MnCl_6]^{3-}$, $[FeF_6]^{3-}$ and $[CoF_6]^{-3}$ are paramagnetic having four, five and four unpaired electrons respectively.

S-2: Valence bond theory gives a quantitative interpretation of the thermodynamic stabilities of coordination compounds.

S-3: The crystal field splitting Δ_o depends upon the field produced by the ligand and charge on the metal ion.

A. TTT

B. TFT

C. FTF

D. TFF

Answer: B



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5. Which of the following is/are correctly matched ?

A. $[Ni(CO)_4]$ - dsp^2 and diamagnetic

B. $[Ni(en)_3](NO_2)_2$ - sp^3d^2 and two unpaired electrons.

C. $[V(NH_3)_6]Cl_3$ - sp^3d^2 and two unpaired electrons.

D. $[Mn(NO^+)_3(CO)]$ - sp^3 and diamagnetic.

Answer: B::D

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6. Which of the following statement(s) is /are correct with respect to the crystal field theory ?

A. It considers only the metal ion d-orbitals and gives no consideration at all to other metal orbitals.

B. It cannot account for the π bonding in complexes .

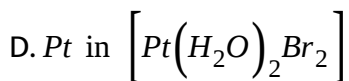
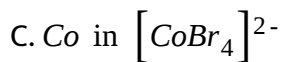
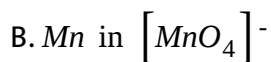
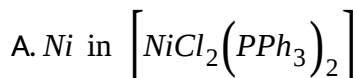
C. The ligands are point charge which are either ions or neutral molecules

D. The magnetic properties can be explained in term of splitting of d-orbital in different crystal field.

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

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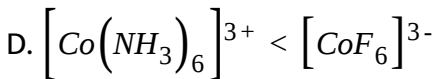
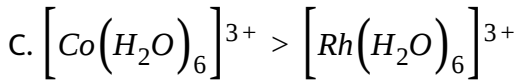
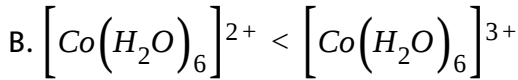
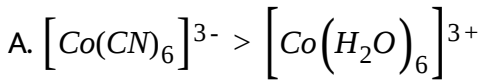
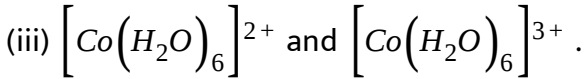
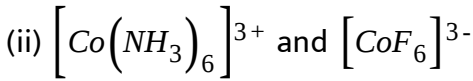
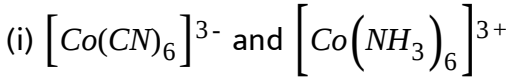
7. Spin only' magnetic moment of Ni in $[Ni(dmg)_2]$ is same as that found in:



Answer: B::D

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8. Which complex of the following pairs has the larger value of Δ_0

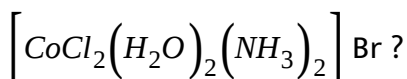


Answer: A::B



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9. Which of the following isomerism is/are shown by the complex



A. Ionization

B. Linkage

C. Geometrical

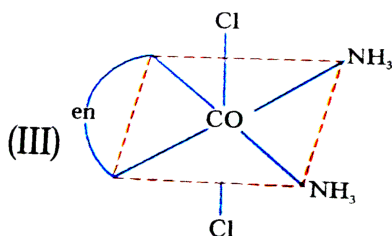
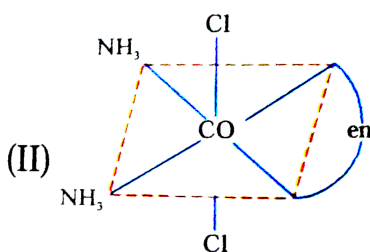
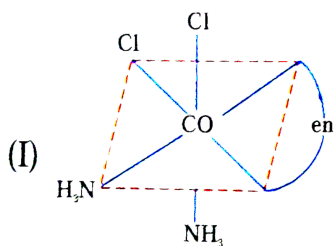
D. optical

Answer: A::C::D

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10. Three arrangements are shown for the complex $[Co(en)(NH_3)_2Cl_2]^+$

pick up the wrong statement.



A. I and II are geometrical isomers

B. II and III are optical isomers

C. I and III are optical isomers

D. II and III are geometrical isomers.

Answer: B::C::D

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11. Consider the following complexes

$[V(CO)_6]^-$, $[Cr(CO)_6]$ and $[Mn(CO)_6]^+$. Then incorrect statement (s)

about metal carbonyls is / are

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

B. C-O' bond order is less in the cation than in anion

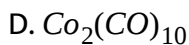
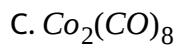
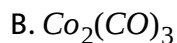
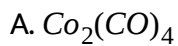
C. C-O' bond longer in the cation than in anion or neutral carbonyl.

D. M-C' bond order is higher in the cation than in anionic or neutral carbonyl.

Answer: B::C::D

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12. Following Sidwick's rule of EAN, $Co(CO)_x$ will be :



Answer: C

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1. In coordination chemistry there are a variety of methods applied to find out the structure of complexes. One method involves treating the complex with known reagents and from the nature of reaction, the formula of the complex can be predicted. An isomer of the complex $Co(en)_2(H_2O)Cl_2Br$, on reaction with concentrated H_2SO_4 (dehydrating agent) it suffers loss in weight and on reaction with $AgNO_3$ solution it gives a white precipitate which is soluble in $NH_3(aq)$.

The correct formula of the complex is :

- A. $[CoClBr(en)_2]H_2O$
- B. $[CoCl(en)_2(H_2O)]BrCl$
- C. $[CoBr(en)_2(H_2O)]Cl_2$
- D. $[CoBrCl(en)_2]Cl \cdot H_2O$

Answer: D

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2. In coordination chemistry there are a variety of methods applied to find out the structure of complexes. One method involves treating the complex with known reagents and from the nature of reaction, the formula of the complex can be predicted. An isomer of the complex $\text{Co(en)}_2(\text{H}_2\text{O})\text{Cl}_2\text{Br}$, on reaction with concentrated H_2SO_4 (dehydrating agent) it suffers loss in weight and on reaction with AgNO_3 solution it gives a white precipitate which is soluble in $\text{NH}_3(\text{aq})$.

If all the ligands in the coordination sphere of the above complex be replaced by F^- , then the magnetic moment of the complex ion (due to spin only) will be :

- A. 2.8 BM
- B. 5.9 BM
- C. 4.9 BM
- D. 1.73 BM

Answer: C

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3. In coordination chemistry there are a variety of methods applied to find out the structure of complexes. One method involves treating the complex with known reagents and from the nature of reaction, the formula of the complex can be predicted. An isomer of the complex $Co(en)_2(H_2O)Cl_2Br$, on reaction with concentrated H_2SO_4 (dehydrating agent) it suffers loss in weight and on reaction with $AgNO_3$ solution it gives a white precipitate which is soluble in $NH_3(aq)$.

Similarly if all the ligands in the coordination sphere be replaced by CO_2^- , then the magnetic moment of the complex ion (due to spin only) will be

:

- A. 1.73 BM
- B. 0.0 BM
- C. 4.9 BM
- D. 5.9 BM

Answer: B



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4. In coordination chemistry there are a variety of methods applied to find out the structure of complexes. One method involves treating the complex with known reagents and from the nature of reaction, the formula of the complex can be predicted. An isomer of the complex $Co(en)_2(H_2O)Cl_2Br$, on reaction with concentrated H_2SO_4 (dehydrating agent) it suffers loss in weight and on reaction with $AgNO_3$ solution it gives a white precipitate which is soluble in $NH_3(aq)$.

If one mole of original complex is treated with excess $Pb(NO_3)_2$ solution, then the number of moles of white precipitate (of $PbCl_2$) formed will be :

- A. 0.5
- B. 1.0
- C. 0.0
- D. 3.0

Answer: A



5. In coordination chemistry there are a variety of methods applied to find out the structure of complexes. One method involves treating the complex with known reagents and from the nature of reaction, the formula of the complex can be predicted. An isomer of the complex $Co(en)_2(H_2O)Cl_2Br$, on reaction with concentrated H_2SO_4 (dehydrating agent) it suffers loss in weight and on reaction with $AgNO_3$ solution it gives a white precipitate which is soluble in $NH_3(aq)$.

The number of geometrical isomers of the formula of the above original complex are (including the complex) :

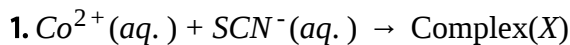
- A. 2
- B. 3
- C. 4
- D. 1

Answer: A





Exercise-2 Part-IV: Comprehension -2



The coordination number of cobalt and nickel in complexes X and Y are four.

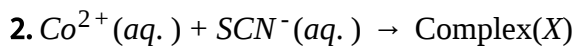
The IUPAC name of the complexes (X) and (Y) are respectively :

- A. tetrathiocyanoato-S-cobalt(II) and bis(dimethylglyoximate) nickel (II).
- B. tetrathiocyanoato-S-cobaltate(II) and bis(dimethylglyoximate) nickel (II).
- C. tetrathiocyanoato-S-cobaltate(II) and bis(dimethylglyoximate) nickelate (II).

D. tetrathiocyanato-S-cobaltate(III) and bis(dimethylglyoximate) nickel (II).

Answer: B

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The coordination number of cobalt and nickel in complexes X and Y are four.

The geometry of complexes (X) and (Y) are respectively :

A. tetrahedral and square planar.

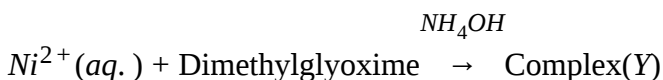
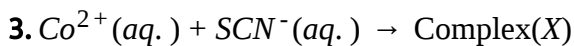
B. both tetrahedral

C. square planar and tetrahedral

D. both square planar.

Answer: A

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The coordination number of cobalt and nickel in complexes X and Y are four.

Select the correct statement for the complexes (X) and (Y) .

- A. (X) is paramagnetic with two unpaired electrons.
- B. (Y) is diamagnetic and shows intermolecular H-bonding .
- C. (X) is paramagnetic with three unpaired electrons and (Y) is diamagnetic
- D. (X) and (Y) both are diamagnetic.

Answer: C

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Exercise-2 Part-IV: Comprehension -3

1. Matching the information given in the three columns of the following table.

Let us consider following columns		
Column 1	Column 2	Column 3
μ (in B.M.)	Hybridisation state	No. of geometrical isomers
(I) $\mu = 2.83$ B.M.	(i) sp^3	(P) 2
(II) $\mu = 5.93$ B.M.	(ii) sp^2d^2	(Q) 3
(III) $\mu = 3.88$ B.M.	(iii) d^2sp^3	(R) 4
(IV) $\mu = 0$ B.M.	(iv) dsp^2	(S) 5

[Note: Atomic Number of Cr=24,V=23,Pt=78]

About $\left(CrCl_3(NH_3)_3 \right)$ which of following combination is correct ?

- A. (III),(iii),P
- B. (II),(iv),Q
- C. (IV),(i), R
- D. (I),(ii),S

Answer: A



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Exercise-2 Part-IV: Comprehension -4

1. Matching the information given in the three columns of the following table.

Let us consider following columns		
Column 1	Column 2	Column 3
μ (in B.M.)	Hybridisation state	No. of geometrical isomers
(I) $\mu = 2.83$ B.M.	(i) sp^3	(P) 2
(II) $\mu = 5.93$ B.M.	(ii) sp^3d^2	(Q) 3
(III) $\mu = 3.88$ B.M.	(iii) d^2sp^3	(R) 4
(IV) $\mu = 0$ B.M.	(iv) dsp^2	(S) 5

[Note: Atomic Number of Cr=24,V=23,Pt=78]

Correct combination for $\left[VCl_2(NO_2)_2(NH_3)_2 \right]^-$

- A. (II),(i),P
- B. (I),(iii),S
- C. (III),(ii),R
- D. (IV),(iv),Q

Answer: B

Exercise-2 Part-IV: Comprehension -5

1. Matching the information given in the three columns of the following table.

Let us consider following columns		
Column 1	Column 2	Column 3
μ (in B.M.)	Hybridisation state	No. of geometrical isomers
(I) $\mu = 2.83$ B.M.	(i) sp^3	(P) 2
(II) $\mu = 5.93$ B.M.	(ii) sp^3d^2	(Q) 3
(III) $\mu = 3.88$ B.M.	(iii) d^2sp^3	(R) 4
(IV) $\mu = 0$ B.M.	(iv) dsp^2	(S) 5

[Note: Atomic Number of Cr=24, V=23, Pt=78]

Correct combination for $[PtCl_2(NH_3)_2]$ is :

- A. (II),(iii),Q
- B. (I),(iv),S
- C. (IV),(iv),P
- D. (III),(ii),R

Answer: C

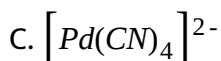
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Exercise-3 Part-I: JEE(Advance) /IIT-JEE Problem

1. A green complex, $K_2[Cr(NO)(NH_3)(CN)_4]$ is paramagnetic and has $\mu_{eff} = 1.73BM$. Write the IUPAC name of the complex and draw the structure of anion and find out the the hybridisation of metal ion.

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2. The species having tetrahedral shape is :



Answer: D



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

is :

A. $\sqrt{3}$

B. $\sqrt{8}$

C. $\sqrt{12}$

D. $\sqrt{24}$

Answer: C



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4. When diemethyl glyoxime is added to the aqueous solution of nickel (II) chloride in presence of dilute ammonia solution, a bright red coloured precipitate is obtained .

(a) Draw the structure of bright red substance .

(b) Write the oxidation state of nickel in the substance and hybridisation.

(c) State whether the substance is paramagnetic or diamagnetic.

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5. 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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6. The bond length in CO is 1.128 Å. What will be the bond length of CO in $Fe(CO)_5$?

A. 1.158 Å

B. 1.128 Å

C. 1.178 Å

D. 1.118 Å

Answer: A



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7. $NiCl_2 \xrightarrow{KCN}$ complex A

$NiCl_2 \xrightarrow{KCl}$ excess complex B

A & B complexes have the co-ordination number 4.

The hybridisation of both complexes are :

A. dsp^2

B. sp^2 & dsp^2

C. dsp^2 & sp^3

D. both sp^3

Answer: C



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8. $NiCl_2 \xrightarrow{KCN}$ complex A

$NiCl_2 \xrightarrow{KCl}$ excess complex B

A & B complexes have the co-ordination number 4.

What are the magnetic nature of 'A' & 'B' ?

A. Both diamagnetic

B. A is diamagnetic & 'B' is paramagnetic with one unpaired electrons.

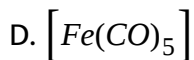
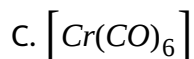
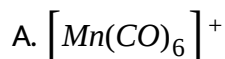
C. A is diamagnetic & 'B' is paramagnetic with two unpaired electrons.

D. Both are paramagnetic

Answer: C

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9. Among the following metal carbonyls , the C-O bond order is lowest in :



Answer: B

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10. Match the complexes in Column-I with their properties listed in

Column-II

	Column-I		Column-II
(A)	$[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})_2]\text{Cl}_2$	(p)	Geometrical isomers
(B)	$[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$	(q)	Paramagnetic
(C)	$[\text{Co}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}$	(r)	Diamagnetic
(D)	$[\text{Ni}(\text{H}_2\text{O})_6]\text{Cl}_2$	(s)	Metal ion with +2 oxidation state



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11. The IUPAC name of $[\text{Ni}(\text{NH}_3)_4][\text{NiCl}_4]$ is

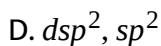
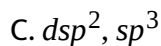
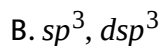
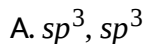
- A. Tetrachloronickel (II) tetraamminenickel(II)
- B. Tetraamminenickel(II) tetrachloronickel(II)
- C. Tetraamminenickel(II) tetrachloronickelate(II)
- D. Tetraamminenickel(II) tetrachloronickelate(0)

Answer: C



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12. Both $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ are diamagnetic. The hybridisation of nickel in these complexes, respectively are :



Answer: B



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13. Statement-1: The geometrical isomers of the complex $[M(NH_4)_4Cl_2]$ are optically inactive, and

Statement-2: Both geometrical isomers of the complex $[M(NH_3)_4Cl_2]$ possess axis of symmetry.

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-1
- B. Statement-1 is true, statement-2 is true, statement-2 is NOT a correct explanation for statement-1
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true.

Answer: B

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14. Statement I $\left[Fe(H_2O)_5NO \right] SO_4$ is paramagnetic

Statement II The Fe in $\left[Fe(H_2O)_5NO \right] SO_4$ has three unpaired electrons .

- A. Statement-1 is true, statement-2 is true, statement-2 is a correct explanation for statement-2

- B. Statement-1 is true, statement-2 is true, statement-2 is NOT a correct explanation for statement-2
- C. Statement-1 is true, statement-2 is false
- D. Statement-1 is false, statement-2 is true.

Answer: A

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15. The compound (s) the exhibit(s) geometrical isomerism is (are) :

- A. $[Pt(en)Cl_2]$
- B. $[Pt(en)_2]Cl_2$
- C. $[Pt(en)_2Cl_2]Cl_2$
- D. $[Pt(NH_3)_2Cl_2]$

Answer: C::D

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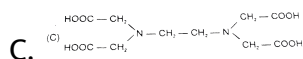
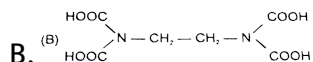
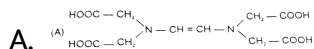
16. The spin only magnetic moment value (in Bohr magneton units) of $Cr(CO)_6$ is :

- A. 0
- B. 2.84
- C. 4.90
- D. 5.92

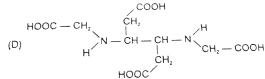
Answer: A

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17. The correct structure of ethylenediamineteraacetic acid (*EDTA*) is .



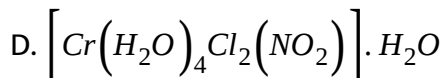
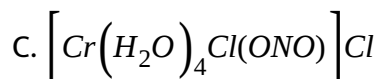
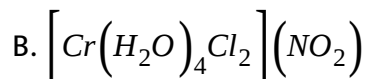
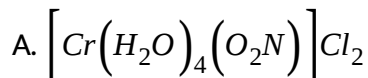
D.



Answer: C

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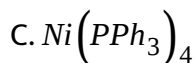
18. The ionisation isomer of $\left[Cr(H_2O)_4Cl(NO_2)\right]Cl$



Answer: B

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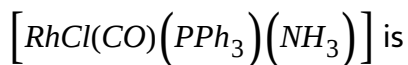
19. The complex showing a spin -magnetic moment of $2.82BM$ is .



Answer: B

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20. Total number of geometrical isomers for the complex



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21. Geometrical shapes of the complex formed by the reaction of Ni^{2+} with Cl^{\ominus} , CN^{\ominus} and H_2O are :

- A. octahedral, tetrahedral and square planar
- B. tetrahedral, square planar and octahedral
- C. square planar, tetrahedral and octahedral
- D. octahedral, square planar and octahedral

Answer: B



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22. Among the following complexes : $K_3[Fe(CN)_6]$, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(ox)_3]$, $[Ni(H_2O)_6]Cl_2$, $K_2[Pt(CN)_4]$ and $[Zn(H_2O)_6(NO_3)_2]$

The diamagnetic are .

- A. K,L,M,N

B. K,N,O,P

C. L,M,O,P

D. L,M,N,O

Answer: C

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23. The volume (in mL) of $0.1M AgNO_3$ required for complete precipitation of chloride ions present in $30mL$ of $0.01M$ solution of $[Cr(H_2O)_5Cl]Cl_2$, as silver chloride is close to:

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24. As per IUPAC nomenclature, the name of the complex

$[Co(H_2O)_4(NH_3)_2]Cl_3$ is

A. Tetraaquadiaminecobalt(III) chloride

B. Tetraaquadiammincobalt(III) chloride

C. Diaminetetraaquacobalt (III) chloride

D. Diamminetetraaquacobalt (III) chloride

Answer: D

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25. $\left[\text{NiCl}_2 \left\{ \text{P}(\text{C}_2\text{H}_5)_2(\text{C}_6\text{H}_5) \right\}_2 \right]$ exhibits temperature dependent magnetic behaviour. The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are:

A. tetrahedral and tetrahedral

B. square planar and square planar

C. tetrahedral and square planar

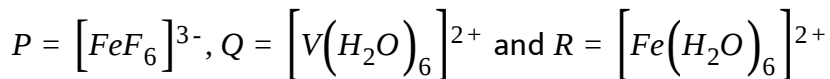
D. square planar and tetrahedral

Answer: C



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26. Consider the following complexes ion P , Q and R



The correct order of the complex ions, according to their spin only magnetic moment values (in BM) is .

A. $R < Q < P$

B. $Q < R < P$

C. $R < P < Q$

D. $Q < P < R$

Answer: B



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27. The pair of coordination complex exhibiting the same kind of isomerism is .

- A. $\left[Cr(NH_3)_5Cl\right]Cl_2$ and $\left[Cr(NH_3)_4Cl_2\right]Cl$
- B. $\left[Co(NH_3)_4Cl_2\right]^+$ and $\left[Pt(NH_3)_2(H_2O)Cl\right]^+$
- C. $\left[CoBr_2Cl_2\right]^{2-}$ and $\left[PtBr_2Cl_2\right]^{2-}$
- D. $\left[Pt(NH_3)_3(NO_3)\right]Cl$ and $\left[Pt(NH_3)_3Cl\right]Br$

Answer: B::D



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28. $EDTA^{4-}$ is ethylenediamine tetraacetate ion The total number of $N - CO - O$ bond angles in $[Co(EDTA)]^{-1}$ complex ion is .



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29. A list of species having the formula of XZ_4 is given below
 XeF_4 , SF_4 , SiF_4 , BF_4^- , BrF_4^- , $[Cu(NH_3)_4]^{2+}$, $[FeCl_4]^{2-}$, $[CoCl_4]^{2-}$ and
 $[PtCl_4]^{2-}$

Defining shape on the basis of the locatiion of X and Z atoms, the total number of species having a square planar shape is

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30. Match each coordination compounds in List-I with an appropriate pair of characteristics from List-II and select the correct answer using the code given below the lists.

{en= $H_2NCH_2CH_2NH_2$: atomic numbers : $Ti = 22$, $Cr = 24$, $Cp = 27$, $Pt = 78$

}

	List-I		List-II
P.	$[Cr(NH_3)_4Cl_2]Cl$	1.	Paramagnetic and exhibits ionisation isomerism
Q.	$[Ti(H_2O)_2Cl](NO_3)_2$	2.	Diamagnetic and exhibits <i>cis-trans</i> isomerism
R.	$[Pt(en)(NH_3)Cl]NO_3$	3.	Paramagnetic and exhibits <i>cis-trans</i> isomerism
S.	$[Co(NH_3)_4(NO_3)_2]NO_3$	4.	Diamagnetic and exhibits ionisation isomerism

A. $\begin{matrix} P & Q & R & S \\ 4 & 2 & 3 & 1 \end{matrix}$

B. $\begin{matrix} P & Q & R & S \\ 3 & 1 & 4 & 2 \end{matrix}$

- | | | | | |
|----|---|---|---|---|
| | P | Q | R | S |
| C. | 2 | 1 | 3 | 4 |
| | P | Q | R | S |
| D. | 1 | 3 | 4 | 2 |

Answer: B

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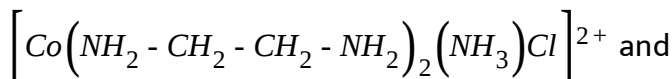
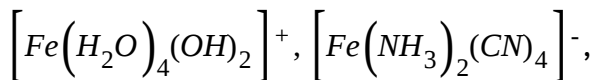
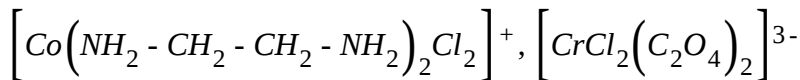
31. For the octahedral complexes of Fe^{3+} in SCN^- (thiocyanato-S) and in CN^- ligands environment, the difference between the spin-only magnetic moments in Bohr magnetons (when approximated to the nearest integer) is : [Atomic number of Fe=26]

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32. In the complex acetyl bromidodicarbonylbis (triethylphosphine) iron (II), the number of $Fe - C$ bond (s) is

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33. Among the complex ions,



that show(s) cis-trans isomerism is



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34. Among $[\text{Ni}(\text{CO})_4]$, $[\text{NiCl}_4]^{2-}$, $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$, $\text{Na}_3[\text{CoF}_6]$, Na_2O_2

and CsO_2 , the total number of paramagnetic compounds is

A. 2

B. 3

C. 4

D. 5

Answer: B



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35. The possible number of geometrical isomers for the complex

$[CoL_2Cl_2]^-$ ($L = H_2NCH_2CH_2O^-$) is (are)....



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36. The geometries of the ammonia complexes of Ni^{2+} , Pt^{2+} and Zn^{2+} , respectively, are

- A. octahedral, square planar and tetrahedral
- B. square planar, octahedral and tetrahedral
- C. tetrahedral , square planar and octahedral
- D. octahedral , tetrahedral and square planar

Answer: A



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37. Addition of excess aqueous ammonia to a pink coloured aqueous solution of $MCl_2 \cdot 6H_2O(X)$ and NH_4Cl gives an octahedral complex Y in the presence of air. In aqueous solution, complex Y behaves as 1:3 electrolyte. The reaction of X with excess HCl at room temperature results in the formation of a blue coloured complex Z. The calculated spin only magnetic moment of X and Z is 3.87 BM, whereas it is zero of complex Y. Among the following options, which statement(s) is (are) correct ?

- A. The hybridization of the central metal ion in Y is d^2sp^3
- B. Addition of silver nitrate of Y gives only two equivalents of silver chloride
- C. When X and Z in equilibrium at $0^\circ C$, the colour of the solution is pink
- D. Z is a tetrahedral complex.

Answer: A::C::D



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38. The correct statement (s) regarding the binary transition metal carbonyl compounds is (are)

(Atomic numbers: Fe = 26, Ni = 28)

A. Total number of valence shell electrons at metal centre in

$Fe(CO)_5$ or $Ni(CO)_4$ is 6

B. These are predominantly low spin in the nature

C. Metal- carbon bond strengthens when the oxidation state of the metal is lowered

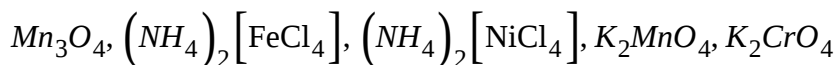
D. The carbonyl C-O bond weakens when the oxidation state of the metal is increased

Answer: B::C



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39. Among the species given below, the total number of diamagnetic species is _____. H atom, NO_2 monomer, O_2^- (superoxide), dimeric sulphur in vapour phase,



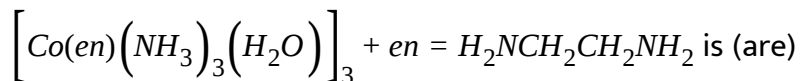
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40. The ammonia prepared by treating ammonium sulphate with calcium hydroxide is completely used by $NiCl_2 \cdot 6H_2O$ to form a stable coordination compound. Assume that both the reactions are 100% complete. If 1584 g of ammonium sulphate and 952 g of $NiCl_2 \cdot 6H_2O$ are used in the preparation, the combined weight (in grams) of gypsum and the nickel-ammonia coordination compound thus produced is ____.

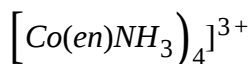
(Atomic weights in $g\ mol^{-1}$: H = 1, N = 14, O = 16, S = 32, Cl = 35.5, Ca = 40, Ni = 59)

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41. The correct option(s) regarding the complex



- A. It has two geometrical isomers
- B. It will have three geometrical isomers if bidentate 'en' is replaced by two cyanide ligands
- C. It is paramagnetic
- D. It absorbs light at longer wavelength as compared to



Answer: A::B::D



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42. Match each set of hybrid orbitals from LIST-I with complex(es) given in LIST-II.

LIST-I

P. dsp^2

Q. sp^3

R. sp^3d^2

S. d^2sp^3

LIST-II

1. $[FeF_6]^{4-}$

2. $[Ti(H_2O)_3Cl_3]$

3. $[Cr(NH_3)_6]^{3+}$

4. $[FeCl_4]^{2-}$

5. $Ni(CO)_4$

6. $[Ni(CN)_4]^{2-}$

A. $P \rightarrow 5, Q \rightarrow 4, 6: R \rightarrow 2, 3, S \rightarrow 1$

B. $P \rightarrow 5, 6, Q \rightarrow 4: R \rightarrow 3, S \rightarrow 1, 2$

C. $P \rightarrow 6, Q \rightarrow 4, 5: R \rightarrow 1, S \rightarrow 2, 3$

D. $P \rightarrow 4, 6, Q \rightarrow 5, 6: R \rightarrow 1, 2, S \rightarrow 3$

Answer: C



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Exercise-3 Part-I: JEE(Advance) /IIT-JEE Problem (Comprehenion)

KCN

1. $NiCl_2 \rightarrow$ complex A

KCl

$NiCl_2 \rightarrow$ excess complex B

A & B complexes have the co-ordination number 4.

The IUPAC name of complexes 'A' & 'B' are respectively :

A. Potassium tetracyanonickelate(II) and Potassium

tetrachloronickelate(II)

B. Potassium tetracyanonickel(II) and Potassium tetrachloronickel(II)

C. Potassium cyanonickelate(II) and Potassium chloronickelate(II)

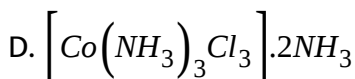
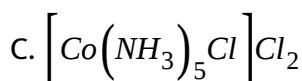
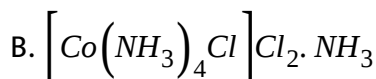
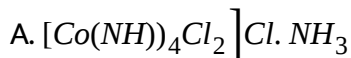
D. Potassium cyanonickel(II) and Potassium chloronickel(II)

Answer: A



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



Answer: C



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2. 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 $Cu(OH)_2$ is precipitated which is soluble in excess of alkali.

B. copper hydroxide is amphoteric.

C. in acidic solution hydration protects Cu^{2+} ions.

D. in acidic solution protons coordinates with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available.

Answer: D



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3. The oxidation state of nickel in $K_4Ni(CN)_4$ is:

A. -1

B. 0

C. +1

D. +2

Answer: B

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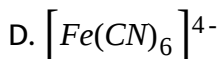
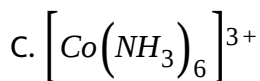
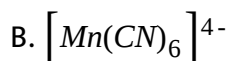
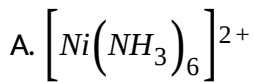
4. The coordination number of a central metal atom in a complex is determined by:

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

Answer: D

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



Answer: A



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6. 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 contain zinc.

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

C. Cyanocobalmin is B_{12} and contain cobalt.

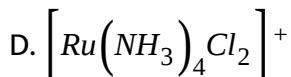
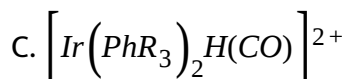
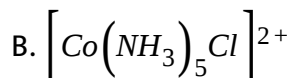
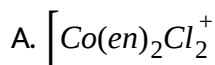
D. Chlorophyll are green pigments in plants and contain calcium.

Answer: D



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

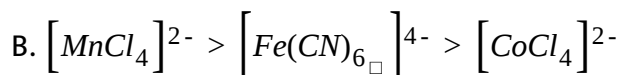
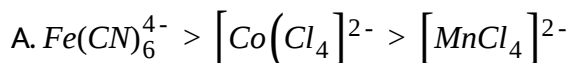


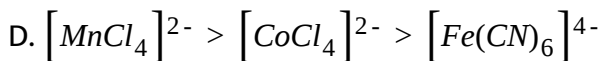
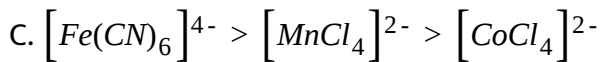
Answer: A



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





Answer: D

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9. The oxidation state of *Cr* in $[Cr(NH_3)_4Cl_2]^+$ is:

A. 0

B. +1

C. +2

D. +3

Answer: D

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10. IUPAC name of $K_3[Fe(CN)_6]$ is

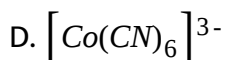
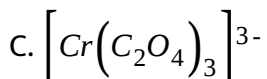
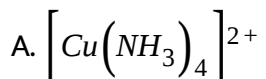
- A. Potassium hexacyanoferrate(II)
- B. Potassium hexacyanoferrate(III)
- C. Potassium hexacyanoiron(II)
- D. Tripotassium hexacyanoiron(II)

Answer: B



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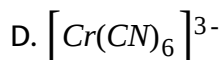
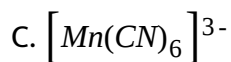
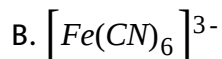
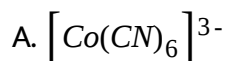
11. Which of the following will show optical isomerism? .



Answer: C

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



Answer: A

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13. 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^4 (in weak field ligands)

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

D. d^5 (in strong field ligands)

Answer: A



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14. Nickel ($Z = 28$) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively:

A. one, tetrahedral

B. two, tetrahedral

C. one, square planar

D. two, square planar

Answer: B

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15. IUPAC name $\left[Co(NH_3)_5(NO_2)\right]Cl_2$ is

- A. Nitrito-N-pentaamminecobalt(III)chloride
- B. Nitrito-N-pentaamminecobalt(II) chloride
- C. Pentaamminenitrito-N-cobalt(II)chloride
- D. Pentaamminenitrito-N-cobalt (III) chloride

Answer: D

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

- A. π -character only

B. both σ and π characters

C. ionic character only

D. σ - character only

Answer: B

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

A. Six

B. Three

C. One

D. Two

Answer: C

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18. The spin-only magnetic moment [in units of Bohr magneton, (μ_B of Ni^{2+})] in aqueous solution would be (atomic number of $Ni = 28$)

A. 2.84

B. 4.8

C. 0

D. 1.73

Answer: A



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

($Co = 27$, $Ni = 28$, $Fe = 26$, $Pt = 78$)





Answer: B

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20. The coordination number and the oxidation state of the element 'E' in the complex $[E(en)_2(C_2O_4)]NO_2$ (where *en* is ethylenediamine) are, respectively

A. 4 and 2

B. 4 and 3

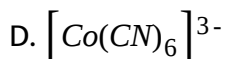
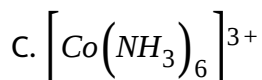
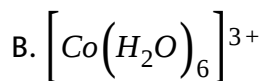
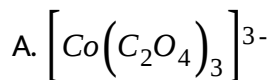
C. 6 and 3

D. 6 and 2

Answer: C

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21. In which of the following octahedral complexes of Co (at. no. 27), will the magnitude of Δ_o be the highest?

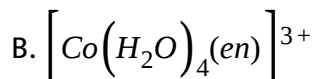
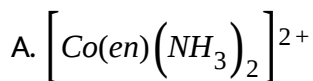


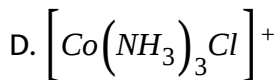
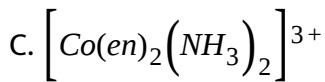
Answer: D



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22. Which of the following has an optical isomer?

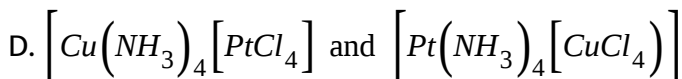
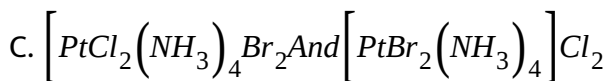
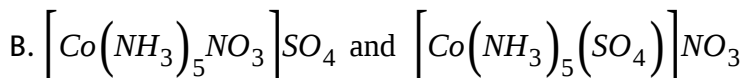
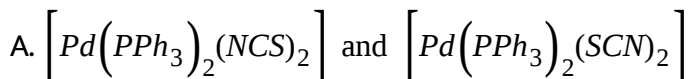




Answer: C

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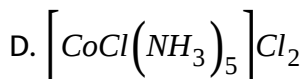
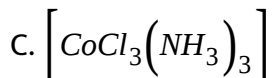
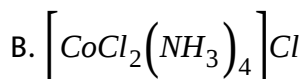
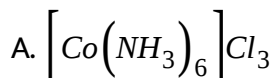
23. Which of the following pairs represents linkage isomers ?



Answer: A

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24. A solution containing 2.675 g of $\text{CoCl}_3 \cdot 6\text{NH}_3$ (molar mass = 267.5 g mol^{-1}) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of AgNO_3 to give 4.73 g of AgCl (molar mass = 143.5 g mol^{-1}). The formula of the complex is (At. mass of Ag = 108 u)

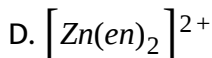
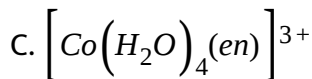
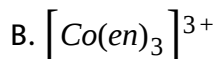
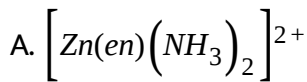


Answer: A

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25. Which one of the following has an optical isomer ?

(en=ethylenediamine)



Answer: B



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26. Which of the following facts about the complex $\left[\text{Cr}(\text{NH}_3)_6 \right] \text{Cl}_3$ is wrong ?

A. The complex involves d^2sp^3 hybridisation and is octahedral in shape.

B. The complex is paramagnetic

C. The complex is an outer orbital complex

D. The complex gives white precipitate with silver nitrate solution.

Answer: C

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27. The magnetic moment (spin only) of $[NiCl_4]^{2-}$ is

A. 1.82 BM

B. 5.46BM

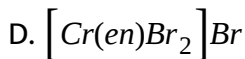
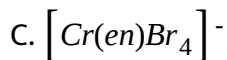
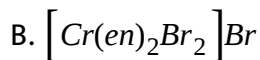
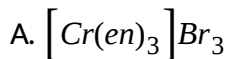
C. 2.82 BM

D. 1.41 BM

Answer: C

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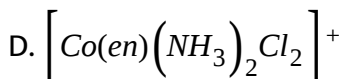
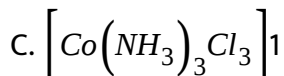
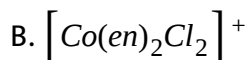
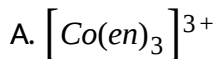
28. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide ?



Answer: B

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



Answer: C



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30. The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1, L_2, L_3 and L_4 absorb wavelength in the region of red, green, yellow and blue, respectively. The increasing order of ligand strength of the four ligands is :

A. $L_4 < L_3 < L_2 < L_1$

B. $L_1 < L_3 < L_2 < L_4$

C. $L_3 < L_2 < L_4 < L_1$

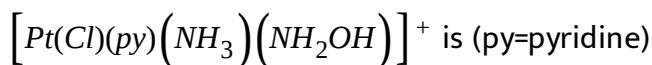
D. $L_1 < L_2 < L_4 < L_3$

Answer: B



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31. The number of geometric isomers that can exist for square planar



A. 2

B. 3

C. 4

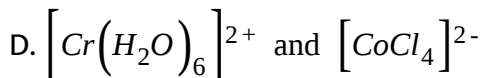
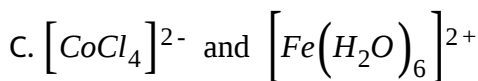
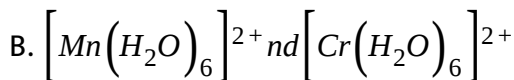
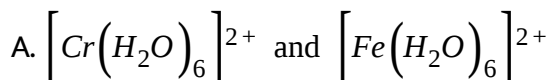
D. 6

Answer: B

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32. The pair having the same magnetic moment is

[at. No. $Cr = 24$, $Mn = 25$, $Fe = 26$ and $Co = 27$]

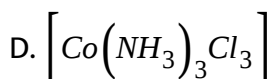
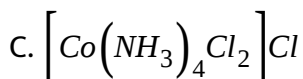
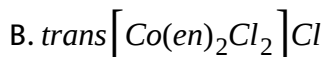
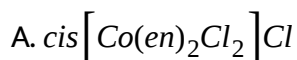


Answer: A

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33. Which of the following complexes shows optical isomerism ?

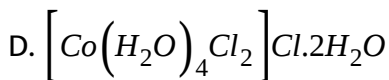
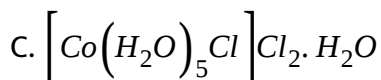
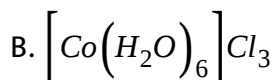
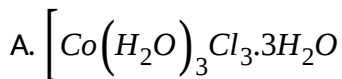
(en=ethylenediamine)



Answer: A

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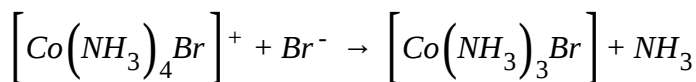
34. On treatment of 100mL of 0.1 M solution of $CoCl_3 \cdot 6H_2O$ with excess $AgNO_3$, 1.2×10^{22} ions are precipitated. The complex is :



Answer: D

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35. Consider the following reaction and statements:



- (I) Two isomers are produced if the reactant complex ion is a cis-isomer.
- (II) Two isomers are produced if the reactant complex ion is a trans-isomer.
- (III) Only one isomers is produced if the reactant complex ion is a trans-isomer.
- (IV) Only one isomers is produced if the reactant complex ion is a cis-

isomer.

The correct statements are :

A. (III) and (IV)

B. (II) and (IV)

C. (I) and (III)

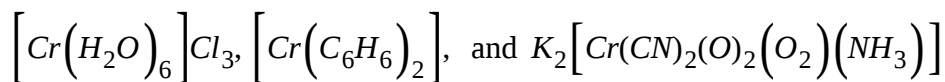
D. (I) and (III)

Answer: D



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36. The oxidation state of Cr in



respectively are :

A. +3, 0 and +6

B. +3, 0 and +4

C. +3, + 4 and + 6

D. +3, + 2 and + 4

Answer: A



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Exercise-3 Online Exam

1. An octahedral complex of Co^{3+} is diamagnetic . The hybridisation involved in the formation of the complex is :

A. sp^3d^2

B. dsp^2

C. d^2sp^3

D. sp^3d

Answer: C



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2. The correct statement about the magnetic properties of

$[Fe(CN)_6]^{3-}$ and $[FeF_6]^{3-}$ is : (Z=26)

A. both the paramagnetic

B. both are diamagnetic

C. $[Fe(CN)_6]^{3-}$ is diamagnetic, $[FeF_6]^{3-}$ is paramagnetic

D. $[Fe(CN)_6]^{3-}$ is paramagnetic, $[FeF_6]^{3-}$ is diamagnetic

Answer: A



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3. Which of the following name formula combinations is not correct ?

Formula Name

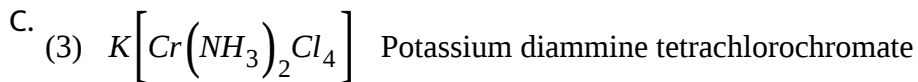
A. (1) $K_2[Pt(CN)_4]$ Potassium tetracyanoplatinate(II)

Formula Name

B. (2) $[Mn(CN)_5]^{2-}$ Pentacyanomagnate(II) ion

Formula

Name



D.

Formula

Name

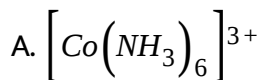


Answer: B



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4. Consider the coordination compound , $\left[Co(NH_3)_6\right]Cl_3$. In the formation of the complex, the species which acts as the Lewis acid is :



Answer: C

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5. Among the following species the one which causes the highest $CFSE, \Delta_0$ as a ligands is :

A. CN^-

B. NH_3

C. F^-

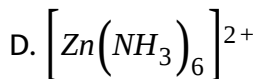
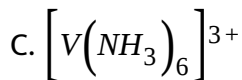
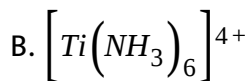
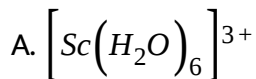
D. CO

Answer: D

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6. Which of the following complexes will mostly likely absorb visible light ?

(At nos. Sc=21,Ti=22,V=23,Zn=30)



Answer: C



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7. An octahedral complex with molecular composition $M.5\text{NH}_3.Cl.SO_4$ has two isomers. A and B. The solution A gives a white precipitation with AgNO_3 solution and the solution of B gives white precipitate with BaCl_2 solution. The type of isomerism exhibited by the complex is :

A. linkage isomers

B. ionisation isomerism

C. coordination isomers

D. Geometrical isomerism

Answer: B

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8. Nickel ($Z=28$) combines with a uninegative monodentate ligands to form a diamagnetic complex $[NiL_4]^{2-}$. The hybridisation involved and the number of unpaired electrons present in the complex are respectively:

A. sp^3 , two

B. dsp^2 , zero

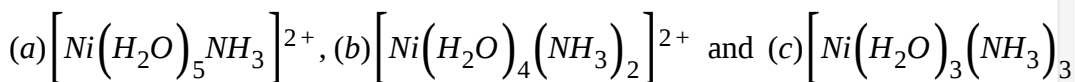
C. dsp^2 , one

D. sp^3 , zero

Answer: B

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9. The correct statement on the isomerism associated with the following complex ions ,



is :

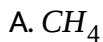
- A. (a) and (b) show only geometrical isomerism
- B. (b) and (c) show geometrical and optical isomerism
- C. (b) and (c) show only geometrical isomerism
- D. (a) and (b) show geometrical and optical isomerism

Answer: C



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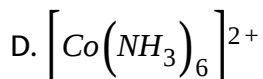
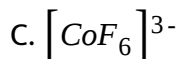
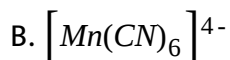
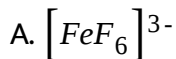
10. Which molecule/ion among the following cannot act as a ligand in complex compounds ?



Answer: A

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11. Which of the following complex ions has electrons that are symmetrically filled in both t_{2g} and e_g orbitals?



Answer: A



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12. Identify the correct trend given below : (Atomic no : Ti=22, Cr=24 and Mo=42)

A.

$$\Delta_0 \text{ of } [Cr(H_2O)_6]^{2+} < [Mo(H_2O)_6]^{2+} \text{ and } \Delta_0 \text{ of } [Ti(H_2O)_6]^{+3} < [Ti(H_2O)_6]^{+2}$$

B.

$$\Delta_0 \text{ of } [Cr(H_2O)_6]^{2+} > [Mo(H_2O)_6]^{2+} \text{ and } \Delta_0 \text{ of } [Ti(H_2O)_6]^{+3} > [Ti(H_2O)_6]^{+2}$$

C.

$$\Delta_0 \text{ of } [Cr(H_2O)_6]^{2+} > [Mo(H_2O)_6]^{2+} \text{ and } \Delta_0 \text{ of } [Ti(H_2O)_6]^{+3} < [Ti(H_2O)_6]^{+2}$$

D.

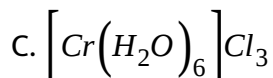
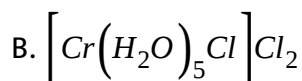
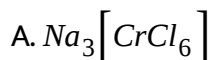
$$\Delta_0 \text{ of } [Cr(H_2O)_6]^{2+} < [Mo(H_2O)_6]^{2+} \text{ and } \Delta_0 \text{ of } [Ti(H_2O)_6]^{+3} > [Ti(H_2O)_6]^{+2}$$

Answer: D



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13. Which one of the following complexes will consume more equivalent of aqueous solution of $Ag(NO_3)$?

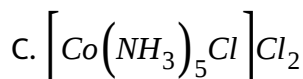
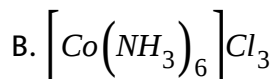
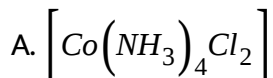


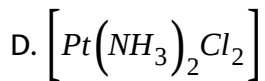
Answer: C



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14. Which of the following is an example of homoleptic complex ?



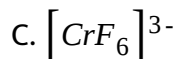


Answer: B



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15. sp^3d^2 hybridization is not displayed by :



Answer: A



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16. $[Co_2(CO)_8]$ displays :

- A. one Co-Co bond , two terminal CO and four bridging CO
- B. one Co-Co bond , six terminal CO and two bridging CO
- C. no Co-Co bond , four terminal CO and four bridging CO
- D. one Co-Co bond , six terminal CO and four bridging CO

Answer: B

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17. The correct combination is :

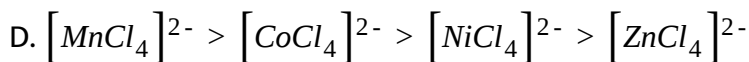
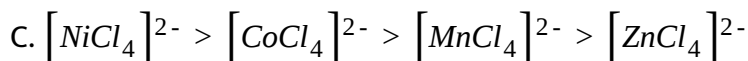
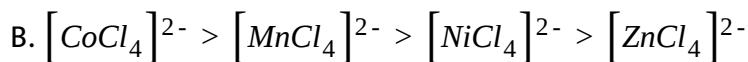
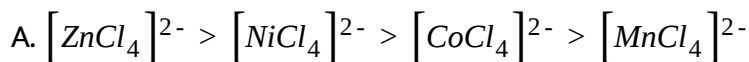
- A. $[NiCl_4]^{2-}$ -square - planar, $[Ni(CN)_4]^{2-}$ -paramagnetic
- B. $[Ni(CN)_4]^{2-}$ -tetrahedral, $[Ni(CO)_4]$ - paramagnetic
- C. $[NiCl_4]^{2-}$ - paramagnetic, $[Ni(CO)_4]$ - tetrahedral
- D. $[NiCl_4]^{2-}$ -diamagnetic , $[Ni(CO)_4]$ -square-planar

Answer: C

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18. The correct order of spin-only magnetic moments among the following is :

(Atomic number : Mn=25,Co=27,Ni=28,Zn=30)

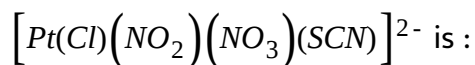


Answer: D



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19. The total number of possible isomers of square-planar



A. 8

B. 12

C. 16

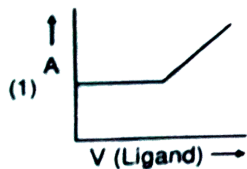
D. 24

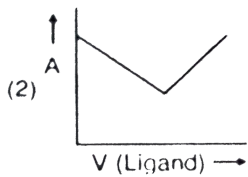
Answer: B

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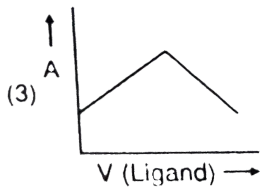
20. In a complexometric titration of metal ion with ligand

$M(\text{Metal ion}) + L(\text{Ligand}) \rightarrow C(\text{Complex})$ end point is estimated spectrophotometrically (through light absorption). If 'M' and 'C' do not absorb light and only 'L' absorbs, then the titration plot between absorbed light(A) versus volume of ligand 'L' (V) would look like :

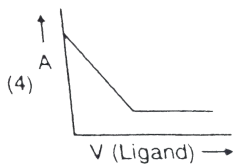




B.



C.



D.

Answer: A

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21. In Wilkinson's catalyst, the hybridization of central metal ion and its shape are respectively :

A. sp^3d , trigonal bipyramidal

B. d^2sp^3 , octahedral

C. dsp^2 , square planar

D. sp^3 , tetrahedral

Answer: C

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22. Which of the following complexes will show geometrical isomerism ?

A. Potassium tris(oxalato) chromate (III)

B. Pentaachlorochromium(III)chloride

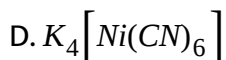
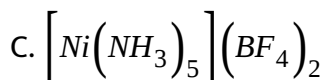
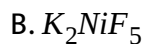
C. Aquachlorobis(ethylenediamine)cobalt(II) chloride

D. Potassium amminetrichloroplatinate(II)

Answer: C

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1. In which of the following complexes the nickel metal is in highest oxidation state:



Answer: B



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2. The EAN of platinum in potassium hexachloroplatinate (IV) is:

A. 46

B. 86

C. 36

D. 84

Answer: B

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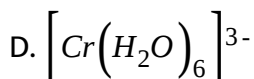
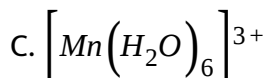
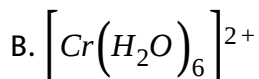
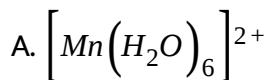
3. The IUPAC name of $K_2[Cr(CN)_2O_2(O)_2(NH_3)]$ is :

- A. Potassium amminedicyanodioxoperoxochromate(VI)
- B. Potassium amminecyanoperoxodioxochromate(VI)
- C. Potassium amminedicyanoperoxooxochromate(VI)
- D. Potassium amminecyanodiperoxodioxochromate(VI)

Answer: A

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

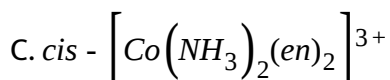
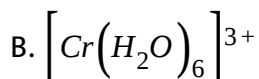
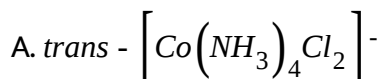


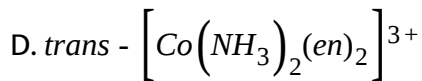
Answer: D



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5. Which complex is likely to show optical activity :

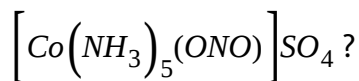




Answer: C

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6. Which kind of isomerism is shown by the complex



1. Ionisation isomerism 2. Linkage isomerism

3. Geometrical isomerism 4. Optical isomerism.

A. 1,2,3 and 4 are correct

B. 1,3 and 4 are correctly only

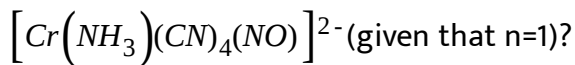
C. 1 and 2 are correct only

D. 2,3 and 4 are correct only

Answer: C

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7. Which of the following statements is correct for complex



A. It is d^2sp^3 hybridised.

B. The chromium is in +1 oxidation state

C. It is heteroleptic complex and its aqueous solution is coloured

D. All of these

Answer: D

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8. S-1: $\left[Cr(NH_3)_6\right]^{3+}$ is a inner orbital complex with

S-2: The complex formed by joining the CN ligands to Fe^{3+} ion has theoretical value for 'spin only' magnetic moment equal to 1.73 B.M.

S-3: $Na_2S + Na_2\left[Fe(CN)_5NO\right] \rightarrow Na_4\left[Fe(CN)_5NOS\right]$, In reactant and product the oxidation states of iron are same

A. FTF

B. TTF

C. TTT

D. FFF

Answer: C

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9. Which of the following statement is false ?

A. Complex of Pt(+II) and Au(+III) are square planar -including those with weak field ligands such as halide ions.

B. In tetrahedral complex, the t_{2g} orbitals are nearer to the direction of the ligands.

C. For d^0 , d^5 and d^{10} arrangement the CFSE is zero in both octahedral and tetrahedral complexes with weak field ligand

D. None

Answer: D

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10. If excess of $AgNO_3$ solution is added to 100mL of a 0.024 M solution of dichlorobis (ethylenediamine) cobalt (III) chloride . How many mole of AgCl be precipitated ?

A. 0.0012

B. 0.0016

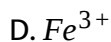
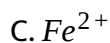
C. 0.0024

D. 0.0048

Answer: C

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11. A complex of certain metal has the magnetic moment of 4.91 BM whereas another complex of the same metal with same oxidation state has zero magnetic moment. The metal ion could be :

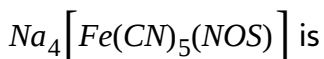


Answer: C



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12. Oxidation number of Fe in violet coloured complex



A. 0

B. 2

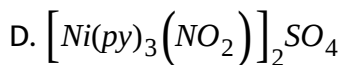
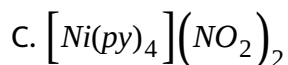
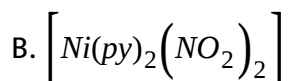
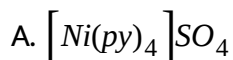
C. 3

D. 4

Answer: B

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13. Aqueous solution of nickel sulphate on treating with pyridine and then adding a solution of sodium nitrite gives dark blue crystals of :



Answer: C

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14. The IUPAC name of $\left[Co(NH_3)_6\right]\left[Cr(C_2O_4)_3\right]$ is :

- A. Hexaamminecobalt(III) tris(oxalato)chromate(III)
- B. Hexaamminecobalt(III) tris(oxalato)chromium(III)
- C. Hexaamminecobalt(II) tris(oxalato)chromium(III)
- D. Hexaamminecobalt(III)trioxalatechromium(III)

Answer: A



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15. In the compound lithiumtetrahydroaluminate, the ligands is :

- A. H^+
- B. H
- C. H^-
- D. none of these

Answer: C

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16. The oxidation number of Co in the complex ion



is :

A. +2

B. +3

C. +4

D. +6

Answer: B

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17. The magnitude of crystal field stabilisation energy (CFSE of Δ_1) in tetrahedral complexes is considerably less than that in the octahedral field. Because

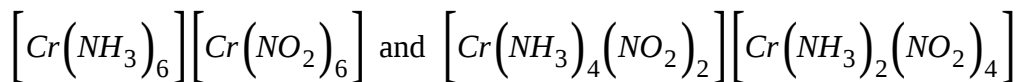
- A. There are only four ligands instead of six so the ligand field is only $2/3$ in tetrahedral complex
- B. The direction of the orbital does not coincide with the direction of the ligands. This reduces the crystal field stabilization energy (Δ) by further $2/3$
- C. Both point (A) and (B) are correct
- D. Both point (A) and (B) are wrong.

Answer: C



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18. Other than the X-ray difference , how could be the following pairs of isomers be distinguished from one another by :



- A. cryoscopic method
- B. measurement of molar conductance
- C. measuring magnetic moment
- D. observing their colours.

Answer: B



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19. $\left[Fe(en)_2(H_2O)_2\right]^{2+} + en \rightarrow \text{complex}(X)$. The correct statement about the complex (X) is

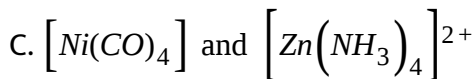
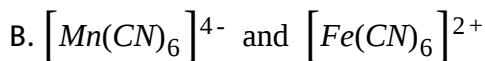
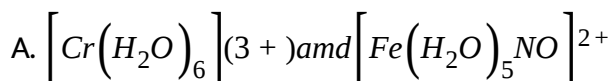
- A. it is low spin complex

- B. it is diamagnetic
- C. it shows geometrical isomerism
- D. (1) and (2) both.

Answer: D

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20. Which of the following pairs will show the same magnetic moment ('spin only') ?



D. All of these

Answer: D

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21. What will be the 'spin only' magnetic moment of the complex formed when $\text{Fe}(\text{SCN})_3$ reacts with solution containing excess F^- ?

- A. 2.83 BM
- B. 3.87 BM
- C. 5.92 BM
- D. 1.73 BM

Answer: C



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22. Which of the following statement about $\text{Fe}(\text{CO})_5$ is correct ?

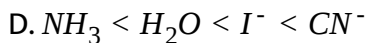
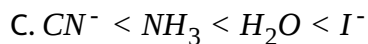
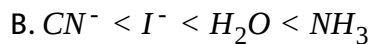
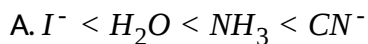
- A. It is paramagnetic and high spin complex
- B. It is diamagnetic and high spin complex
- C. It is diamagnetic and low spin complex

D. It is paramagnetic and low spin complex

Answer: C

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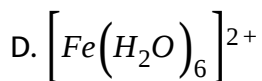
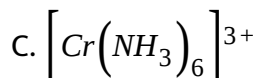
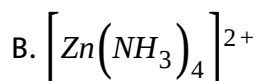
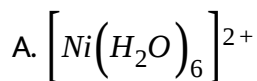
23. The crystal field -splitting for Cr^{3+} ion in octahedral field changes for ligands I^- , H_2O , NH_3 , CN^- and the increasing order is :



Answer: A

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

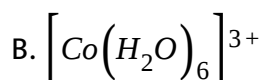
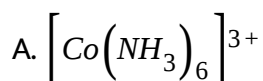


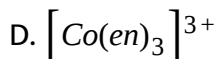
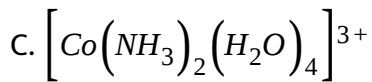
Answer: B



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25. Of the following complex ions, the one that probably has the largest overall formation constant, K_f is





Answer: D

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26. The correct structure of $Fe(CO)_5$ is ?

A. Hexaamminecobalt(III) tris(oxalato)chromate(III)

B. tetrahedral

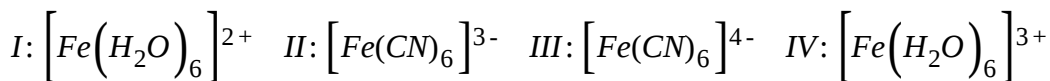
C. square pyramidal

D. trigonal bipyramidal

Answer: D

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27. Arrange the following in order of decreasing number of unpaired electrons. :



A. IV,I,II,III

B. I,II,III,IV

C. III,II,I,IV

D. II,III,I,IV

Answer: A



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28. Match List-I (Complexes) with List-II (Hybridization) of central atom and select the correct answer using the codes given below the lists :

	List-I		List-II
A	$Ni(CO)_4$	1.	sp^3
B	$[Ni(CN)_4]^{2-}$	2.	dsp^2
C	$[Fe(CN)_6]^{4-}$	3.	sp^3d^2
D	$[MnF_6]^{4-}$	4.	d^2sp^3

- A. $\begin{matrix} A & B & C & D \\ 1 & 3 & 2 & 4 \end{matrix}$
- B. $\begin{matrix} A & B & C & D \\ 5 & 2 & 4 & 3 \end{matrix}$
- C. $\begin{matrix} A & B & C & D \\ 5 & 3 & 2 & 4 \end{matrix}$
- D. $\begin{matrix} A & B & C & D \\ 1 & 2 & 4 & 3 \end{matrix}$

Answer: D

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29. Which of the following complexes ionization isomerism ?

- A. $[Cr(NH_3)_6]Cl_3$
- B. $[Cr(en)_2]Cl_2$
- C. $[Cr(en)_3]Cl_3$
- D. $[Co(NH_3)_5Br]SO_4$

Answer: D

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30. Coordination number of Ni in $\left[Ni(C_2O_4)_3 \right]^{4-}$ is :

- A. 3
- B. 6
- C. 4
- D. 2

Answer: B



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Additional Problem for Self Practice (APSP) Part-II

1. The angle between the bonding orbitals of a molecule AX_3 with zero dipole moment is

A. 120°

B. 109°

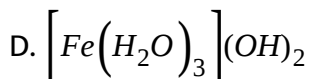
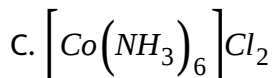
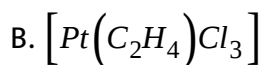
C. 104°

D. 180°

Answer: A

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2. In which of the following compounds, the oxidation number of the started transition metal is zero.



Answer: A



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3. Ligands contains :

- A. lone pair of electrons
- B. incomplete octet
- C. unpaired electrons
- D. shared pair of electrons.

Answer: A



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4. e_g orbitals include

- A. d_{xy} and d_{yz}
- B. d_{yz} and d_{xz}
- C. d_{yz} and d_{xz}

D. $d_{x_2-y_2}$ and d_{z_2}

Answer: D

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5. 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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6. 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

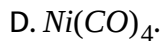
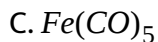
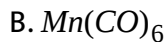
- A. 800 nm
- B. 580 nm
- C. 620 nm
- D. 320 nm

Answer: D

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7. The least stable metal carbonyl as per the bonding considerations should be

- A. $Cr(CO)_6$



Answer: B

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8. A coordination complex of type MX_2Y_2 [M=metal ion, X,Y=monodentata ligands], can have either a tetrahedral of a square planar geometry. The maximum number of possible isomers in these two cases are respectively

A. 0 and 2

B. 2 and 1

C. 1 and 3

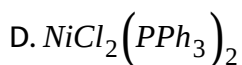
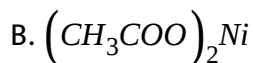
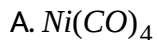
D. 3 and 2

Answer: A



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9. The compound in which nickel has the lower oxidation states is :



Answer: A



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10. IUPAC name of complex $K_3[Al(C_2O_4)_3]$ is

A. potassium trioxalatoaluminate (III)

B. potassium aluminiumoxalate

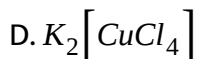
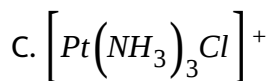
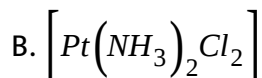
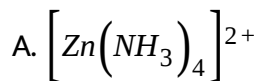
C. potassium trioxalatealuminium(II)

D. potassium trioxalatealuminium(III)

Answer: A

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11. Geometric isomers would be expected for which of the following compounds



Answer: B

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12. Co-ordination compounds $\left[Pt(NH_3)_3(NCS)\right]$ and $\left[Pt(NH_3)_2Cl_2\right]Cl$ are example of Isomerism

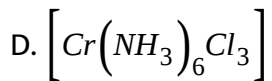
- A. co-ordination isomerism
- B. linkage isomers
- C. optical isomerism
- D. hydrate isomerism

Answer: B

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13. The highest molar conductivity will be exhibited by the complex .

- A. $\left[Cr(NH_3)_6\right]Cl_3$
- B. $\left[Cr(NH_3)_6Cl\right]Cl_2$
- C. $\left[Cr(NH_3)_6Cl_2\right]Cl$



Answer: A



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14. How many isomers are possible for the complex $\left[Co(en)_2Cl_2\right]$
(en=ethylene diamine)

A. 4

B. 2

C. 6

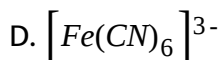
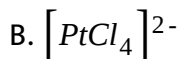
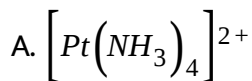
D. 3

Answer: D



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15. Which of the following complex ions does satisfy the effective atomic number (EAN) rule?

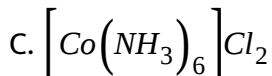
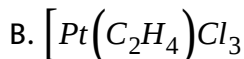


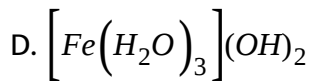
Answer: C



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16. In which of the following compounds, the oxidation number of the started transition metal is zero.





Answer: A

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17. $[NiCl_4]^{2-}$ is paramagnetic and therefore its geometry is :

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

Answer: C

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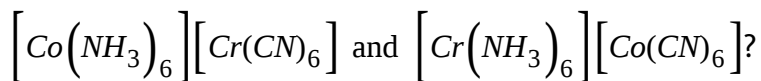
18. dsp^2 hybridization represent

- A. octahedral geometry
- B. square-planar geometry
- C. trigonal-bipyramidal geometry
- D. square-pyramidal geometry

Answer: B

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19. Which isomerism is exhibited by



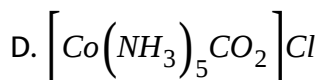
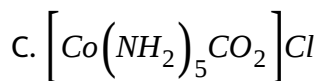
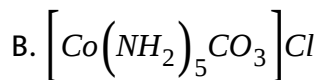
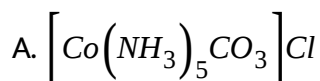
- A. Ionization
- B. Linkage
- C. Coordination
- D. Polymerization.

Answer: C



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20. The complex pentaamminecarbonatocobalt(III) chlorides is :



Answer: A



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21. According to the Crystal Field Theory, the energy of d_{xy} orbital is lower than $d_{x^2-y^2}$ in an octahedral complex because

A. the d_{xy} orbital near the ligands

- B. the repulsion between the d_{xy} electrons and ligands electrons is less than that between $d_{x^2-y^2}$ and ligands electrons.
- C. the repulsion between the d_{xy} electrons and ligands electrons is more than that between $d_{x^2-y^2}$ and ligands electrons.
- D. the $d_{x^2-y^2}$ orbital is away the ligands.

Answer: B



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22. The orbitals of iron involved in the hybridization in $Fe(CO)_5$ are

- A. s, p_x, p_y, p_z and $d_{x^2-y^2}$
- B. s, p_x, p_y, p_z^2 and $d_{x^2-y^2}$
- C. s, p_x, p_y, p_z and d_{z^2}
- D. s, p_x, p_z, p_{xy} and $d_{x^2-y^2}$

Answer: C



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23. The crystal field stabilization energy (CFSE) in $[Co(SCN)_6]^{3-}$ is :

A. $-2.4\Delta_0$

B. $-1.8\Delta_0$

C. $-4\Delta_0$

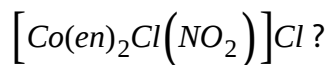
D. $0\Delta_0$

Answer: C



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24. How many isomers are possible for a compound with formula,



A. 2

B. 4

C. 6

D. 8

Answer: C



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25. Metal carbonyls have the metal ions in zero or unusually lower oxidation states. This is because :

A. carbonyl ligands is reducing in nature.

B. carbonyl is a highly electron rich ligands.

C. carbonyl is a strongly σ -bonding ligand.

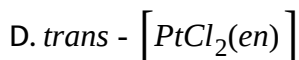
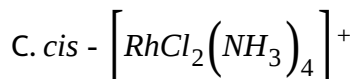
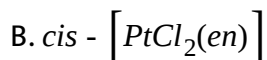
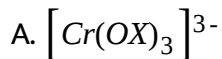
D. carbonyl is a strongly π -acidic ligand.

Answer: D



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26. Among the following, the chiral complex is :

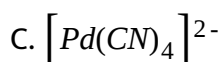


Answer: A



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27. The species having tetrahedral shape is



Answer: D

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

A. Geometrical and ionization

B. Optical and ionization

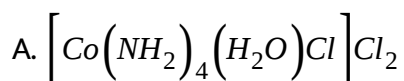
C. Geometrical and optical

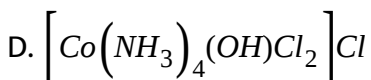
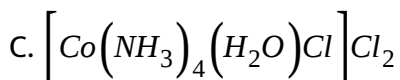
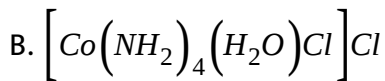
D. Geometrical only

Answer: A

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29. The formula of tetraammineaquachlorocobalt(III) chloride is :





Answer: C

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30. The oxidation number and co-ordination number of chromium in complex ion $\left[\text{Cr}(\text{C}_2\text{O}_4)_2(\text{H}_2\text{O})_2 \right]^-$ are

A. 3,6

B. 2,6

C. 2,8

D. 3,8

Answer: A

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31. The complex that exhibits Co-ordination isomerism is

- A. $[Cr(NCS)(H_2O)_5]^{2+}$
- B. $[Cr(NH_3)_6]Cl_3$
- C. $[Cr(NH_3)_6][Co(CN)_6]$
- D. $[CoCl_2(NH_3)_4]Cl \cdot H_2O$

Answer: C



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32. The strong field ligand is "

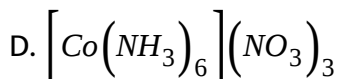
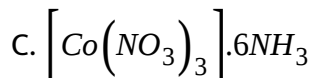
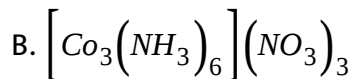
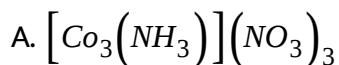
- A. SCN^-
- B. NO_2^-
- C. I^-

D. S^{2-}

Answer: B

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33. The correct formula for hexaamminecobalt(III) nitrate is



Answer: D

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34. The IUPAC name of complex $[Cu(en)_2(H_2O)_2]^{2+}$

- A. ethylene dimineCu(II) dihydrate
- B. diaquobis(ethylenediamine)copper(II)ion
- C. diaquobisdietyeamineCU(II)ion
- D. diaquobis(ethylenediamine)cuprate(II)

Answer: B

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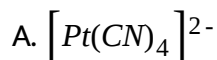
35. The electronic spectrum of $\left[Ni(H_2O)_6 \right]^{++}$ shows as band at $8500cm^{-1}$ due to d-d transition . $\left[Ph_4As \right]_2 \left[NiCl_4 \right]$ will have such a transition in cm^{-1} at

- A. 3778
- B. 8500
- C. 7250
- D. 850

Answer: A

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36. In the coordination compound $\text{Na}_2[\text{Pt}(\text{CN})_4]$ the Lewis acids is



Answer: C

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37. The 'd' orbitals will be split under square planar geometry into

A. two levels

B. three levels

C. four levels

D. five levels

Answer: C

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38. 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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39. The formula of the isothiocyanate is



Answer: B



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40. The bond order for a species with the configuration $\sigma_{1s}^2\sigma^*_{1s}2s^2\sigma^*_{2s}2s^2\sigma_{px}^1$ will be

A. 1

B. 1/2

C. zero

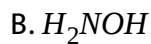
D. 3/2

Answer: B



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41. Which of the following compounds has the least tendency to form hydrogen bonds between molecules ?

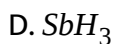
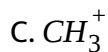
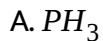


Answer: D



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42. The species in which the central atom uses sp^2 hybrid orbital in its bonding is:

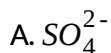


Answer: C



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43. In which of the following ion/molecules, the 'S' atom does not assume sp^3 hybridization ?



D. S_8

Answer: A

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44. Which of the following contain maximum number of electrons in the antibonding molecular orbitals



Answer: B

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45. Lattice energy for an ionic compound is calculated by using

- A. Kirchoff's equation
- B. Markownikoff's rule
- C. Born Haber cycle
- D. Carnot cycle

Answer: B



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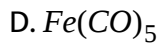
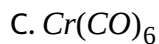
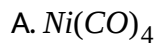
46. IUPAC name of $\left[Co(ONO)(NH_3)_5Cl_2\right]$ is

- A. pentamminenitrocobalt(II)chloride
- B. pentamminenitrosocobalt(III)chloride
- C. pentamminenitritocobalt(III)chloride
- D. pentammineoxo-nitrocobalt(III)chloride

Answer: B

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47. The metal carbonyl which is paramagnetic is



Answer: B

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48. High spin complexes having coordination number '6' are usually formed through

A. sp^3d^2 hybridisation

B. d^2sp^3 hybridisation

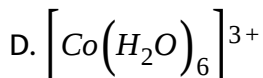
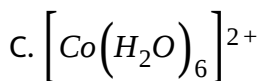
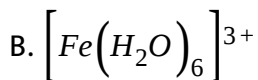
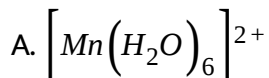
C. sp^3 hybridisation

D. sp^3d hybridisation

Answer: A

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



Answer: B

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50. When any solution passes through a cation exchange resin that is in acidic form, H ion of the resin is replaced by cations of the solution. A solution containing 0.319 g of an isomer with molecular formula $CrCl_3 \cdot 6H_2O$ is passed through a cation exchange resin in acidic form. The eluted solution requires 19 cm^3 of 0.125 N NaOH. The isomer is

- A. triaquachloro chromium (III) chloride trihydrate
- B. hexaaqua chromium (III) chloride
- C. pentaquachloro chromium (III) chloride monohydrate
- D. tetraaquadichloro chromium (III) chloride dihydrate.

Answer: C

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51. A person having osteoporosis is suffering from lead poisoning. Ethylene diamine tetra acetic acid (EDTA) is administered for this condition. The best form of EDTA to be used for such administration is -

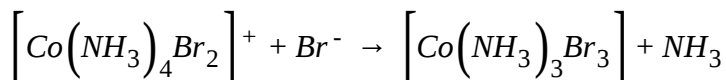
- A. EDTA
- B. tetrasodium salt
- C. disodium salt
- D. calcium dihydrogen salt

Answer: D



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52. Consider the following reaction and statements:



Two isomers are produced if the reactant complex ion is a cis-isomer

Two isomers are produced if the reactant complex ion is a trans-isomer

Only one isomer is produced if the reactant complex ion is a trans-isomer

Only one isomer is produced if the reactant complex ion is a cis – isomer

The correct statements are

A. I and II

B. III and IV

C. I and IV

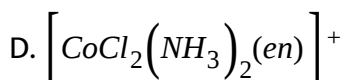
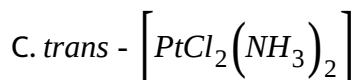
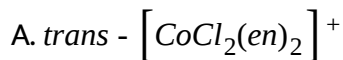
D. II and III

Answer: C



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53. The complex that shows optical activity is



Answer: B



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54. For $[FeF_6]^{3-}$ and $[CoF_6]^{3-}$, the statement that is correct is :

A. both are coloured

B. both are colourless

C. $[FeF_6]^{3-}$ is colored and $[CoF_6]^{3-}$ is colorless

D. $[FeF_6]^{3-}$ is colorless and $[CoF_6]^{3-}$ is colored

Answer: D



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55. Which of the following statements about ammonium cerium (IV)

nitrate, $(NH_4)_2[Ce(NO_3)_6]$ is false ?

- A. NO_3^- acts as a monodentate ligand
- B. The Ce atom has as coordination number of 12
- C. The shape of the complex ion is icosahedron
- D. The solution is used as oxidizing agent.

Answer: A

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56. Which one of the following reactions is correct ?

- A. $[\text{Fe}(\text{CO})_5] + 2\text{NO} \rightarrow [\text{Fe}(\text{CO})_2(\text{NO})_2] + 3\text{CO}$
- B. $[\text{Fe}(\text{CO})_5] + 2\text{NO} \rightarrow [\text{Fe}(\text{CO})_2(\text{NO})_2] + 2\text{CO}$
- C. $[\text{Fe}(\text{CO})_5] + 3\text{NO} \rightarrow [\text{Fe}(\text{CO})_2(\text{NO})_2] + 3\text{CO}$
- D. $[\text{Fe}(\text{CO})_5] + 3\text{NO} \rightarrow [\text{Fe}(\text{CO})_2(\text{NO})_2] + 2\text{CO}$

Answer: A

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57. How many isomers are possible for complex $[Co(ox)_2Cl_2]^+$?

A. 1

B. 3

C. 2

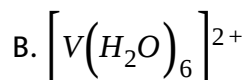
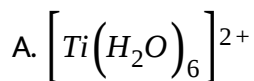
D. 4

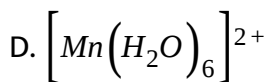
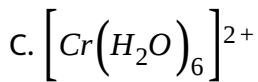
Answer: B



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58. In which of the following complexes the metal ion has the lowest ionic radius ?

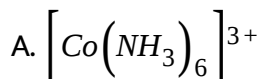




Answer: B

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59. Which of the complexes has the magnetic moment of 3.87 BM ?



Answer: C

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60. IUPAC name of complex ion $[CrCl_2(ox)_2]^{3-}$ is

- A. dichlorodioxalatochromium(III)
- B. dioxalatodichlorochromate(III)
- C. dichlorodioxalatochromate(III)
- D. bisoxalato-dichlorochromate (III)

Answer: C



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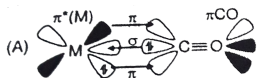
61. The type of isomerism that $Co(NH_3)_4Br_2Cl_2$ can exhibit is/are

- A. geometric and ionisation
- B. ionisation
- C. Optical and ionisation
- D. Optical, ionisation and geometric

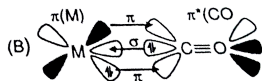
Answer: A

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62. Metal 'M' forms a carbonyl compound in which it is present in its lower valence state. Which of the following bonding is possible in this metal carbonyl ?



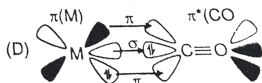
A.



B.



C.



D.

Answer: B

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63. An appropriate reagent for the conversion of 1-propanol to 1-propanal is

- A. acidified potassium dichromate
- B. alkaline potassium permanganate
- C. pyridinium chlorochromate
- D. acidified CrO_3

Answer: C



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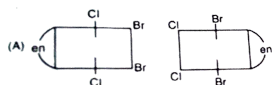
64. The complex ion that does not have d electrons in the metal atom is

- A. $[MnO_4]^-$
- B. $[Co(NH_3)_6]^{3+}$
- C. $[Fe(CN)_6]^{3-}$
- D. $[Cr(H_2O)_6]^{3+}$

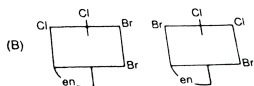
Answer: A

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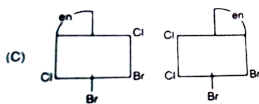
65. The complex ion $[M(en)Br_2I_2]^{-1}$, has two optical isomers. Their correct configurations are:



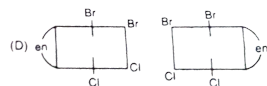
A.



B.



C.



D.

Answer: D

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66. The IUPAC name of the complex $[PT(en)(NH_3)(Cl)_2(ONO)] [Ag(CN)_2]$ is :

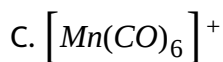
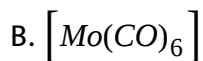
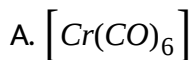
- A. monoamminedichlorido(ethane-1,2-diammine)nitritioplatinum(IV)dicyanoargentate(I)
- B. monoaminebischlorido (ethane-1,2-diammine)nitritioplinate(IV) dicyanoanosilver(I)
- C. monoaminebischlorido(ethane-1,2-diammine) nitritioplinate (IV) dicyanoargentate (I)
- D. monoamminebischlorido (ethane-1,2-diammine) nitritioplatinum(IV) dicyanoargentate (I)

Answer: D



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67. The C-O bond length is the shortest in:



Answer: C

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68. The spin-only magnetic moment of $[Fe(NH_3)_6]^{3+}$ and $[FeF_6]^{3-}$ (in units of BM) respectively are

A. 1.73 and 1.73

B. 5.92 and 1.73

C. 1.73 and 5.92

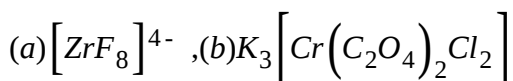
D. 5.92 and 5.92

Answer: C

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Additional Problem for Self Practice (APSP) Part-III Subjected Question

1. What is the coordination number and the oxidation state of the metal in each of the following complexes ?



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2. Write the name of the following ligands and classify their denticity

(a) o-phen (b) NOS^-

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3. Name the $K[PtCl_3(\eta^2-C_2H_4)]$ compound.

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4. Write down the formulae of the following compounds

(a) tetraamminecobalt(III)- μ -amido- μ -hydroxidobis(ethylenediamine) cobalt(III) chloride

(b) bis(η^5 -cyclopentadienyl) iron (II)

(c) tetraammineaquacobalt(III) - μ -cyanidotetramminebromidocobalt(III)

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5. Calculate the EAN of central atom in the following complexes

(a) $[Fe(CO)_2(NO)_2]$ (b) $[Fe(C_5H_5)_2]$

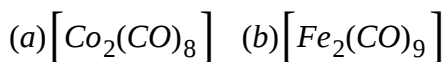
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6. Complete the following table (using concepts of VBT).

	Complex	Geometry	Hybridisation	Number of unpaired electrons(n)	Mag. moment
	CN = 2				
(a)	$[\text{Ag}(\text{NH}_3)_2]^+$			0	
(b)	$[\text{Cu}(\text{CN})_2]^-$	Linear			
(c)	$[\text{AuCl}_2]^-$				0
	CN = 4				
(d)	$[\text{PtCl}_2(\text{NH}_3)_2]$			0	
(e)	$[\text{Zn}(\text{CN})_4]^{2-}$			0	
(f)	$[\text{Cu}(\text{CN})_4]^{3-}$			0	
(g)	$[\text{MnBr}_4]^{2-}$			5	
(h)	$[\text{Cu}(\text{NH}_3)_4]^{2+}$	Square Planar			
(i)	$[\text{CoI}_4]^{2-}$			3	
	CN = 6				
(j)	$[\text{Mn}(\text{CN})_6]^{3-}$			2	
(k)	$[\text{Cr}(\text{NH}_3)_6]^{3+}$			3	
(l)	$[\text{Fe}(\text{CN})_6]^{3-}$			1	
(m)	$[\text{Ir}(\text{NH}_3)_6]^{3+}$			0	
(n)	$[\text{V}(\text{CO})_6]$			1	
(o)	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$			4	
(p)	$[\text{MnCl}_6]^{3-}$			4	

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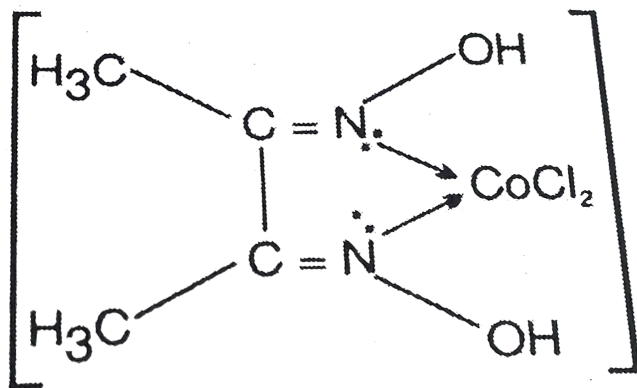
7. Draw the structures of the following metal carbonyls



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Additional Problem for Self Practice (APSP) Part-III Only one option correct type

1. The correct IUPAC name of the complex is :



- A. dichloridodimethylglyoximecobalt(II)
- B. Bis(dimethylglyoxime)ichloridocobalt(II)
- C. Dimethylglyoximecobalt(II) chloride
- D. Dichlorido (dimethylglyoximato)cobalt(II)

Answer: A

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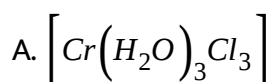
2. A co-ordination complex has the formula $PtCl_4 \cdot 2KCl$. Electrical conductance measurements indicate the presence of three ion in one formula unit. Treatment with $AgNO_3$ produces no precipitate of $AgCl$. What is the co-ordination number of Pt in this complex ?

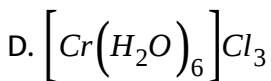
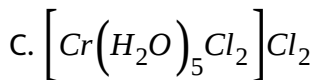
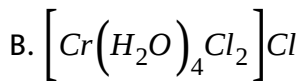
- A. 5
- B. 6
- C. 4
- D. 3

Answer: B

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3. Which of the following complexes produces three moles of silver chloride when its mole is treated with excess of silver nitrate ?





Answer: D



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4. The number of chloride ions which would be precipitated when one mole of the complex $PtCl_4 \cdot 4NH_3$ is treated with silver nitrate is : (here coordination number of platinum is 6).

A. four

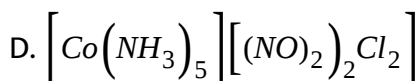
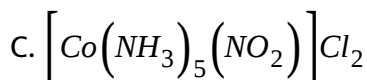
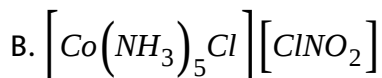
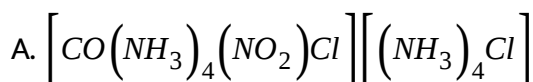
B. one

C. three

D. two

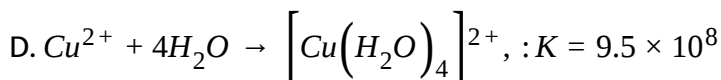
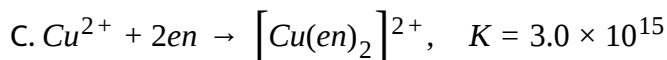
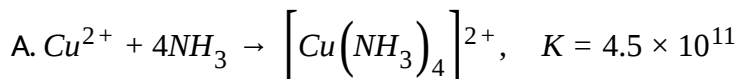
Answer: D

5. A coordination compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three moles of ions in an aqueous solution. The aqueous solution on treatment with an excess of $AgNO_3$ gives two moles of $AgCl$ as a precipitate. The formula of this complex would be



Answer: C

6. From the stability constant (hypothetical values), given below, predict which is the most stable complex?



Answer: B

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7. In Ziegler salt C=C bond length is :

Note: $\left\{ \begin{array}{l} \text{C} - \text{C} \text{ bond length in ethane is } 1.54 \text{ \AA} \\ \text{C} = \text{C} \text{ bond length in ethene is } 1.34 \text{ \AA} \\ \text{C} \equiv \text{C} \text{ bond length in ethyne is } 1.20 \text{ \AA} \end{array} \right\}$

A. 1.37 \AA

B. 1.19 \AA

C. 1.87\AA

D. 1.34\AA

Answer: A

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8. Which is not a π -bonded complex ?

A. Zeise's salt

B. Ferrocene

C. bis(benzene) chromium

D. Tetraethyl lead

Answer: D

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9. What is wrong about the compound $K\left[Pt\left(\eta^2 - C_2H_4\right)Cl_3\right]$?

- A. it is called Zeises's salt
- B. It is π bonded complex
- C. Oxidation number of Pt is +4
- D. Four ligands surround the platinum atom.

Answer: C

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10. Which of the following are bidentate monoanion ligands ?

(a) Dimethylglyoximate (b) Oxalate ion (c) Bis (ethane-1,2-diamine)

Select the correct answer using the codes given below :

- A. a only
- B. a and c only
- C. c only

D. b and c only

Answer: A

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11. Diethylenetriamine is :

- A. chelating agent
- B. tridentate neutral molecule
- C. tridentate monoanion
- D. (A) and (B) both

Answer: D

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12. In $K_4[Fe(CN)_6]$, Fe is in the form of

- A. An atom
- B. Neutral complex
- C. Cationic complex
- D. Anionic complex

Answer: D

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13. Complex ion $[FeN_3(O_2)(SCN)_4]^{4-}$ is named as : (coordination number of central metal ion in complex is six)

- A. azidosuperoxideotetrathiocyanato-S-ferrate(II)
- B. azidodioxigentetrathioxyanato-ferrate (III)
- C. azidoperoxidotetrathiocyanato-S-ferrate(II)
- D. azidodioxidotetrathioxyanato-S-ferrate (III)

Answer: A



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14. The IUPAC name for $K_2[Cr(CN)_2O_2(O)_2NH_3]$ is:

- A. potassium amminecyanoperoxodioxochromatic(V)
- B. potassium amminedicyanoperoxodioxochromium(VI)
- C. potassium amminecyanoperoxodioxochromium (VI)
- D. potassium amminedicyanodioxoperoxochromate (VI)

Answer: D



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15. Consider the following statements:

According to the Werner's theory.

- (1) Ligands are connected to the metal ions by ionic bonds.
- (2) Secondary valencies have directional properties

(3) Secondary valencies are non-ionisable

Of these statements :

A. 1,2 and 3 are correct

B. 2 and 3 are correct

C. 1 and 3 are correct

D. 1 and 2 are correct

Answer: B



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16. Which of the following is correct for both the following coordination compounds ?

(I) $CoCl_3 \cdot 6NH_3$ and (II) $PtCl_4 \cdot 5NH_3$

A. They give white precipitate with $AgNO_3$ solution.

B. They have different primary valencies for the central metal ions.

C. Both (A) and (B)

D. None of these

Answer: C



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17. In the complexes $[\text{SbF}_5]^{2-}$, sp^3d hybridisation is present.

Geometry of the complex is:

A. Square pyramidal

B. Square bipyramidal

C. Tetrahedral

D. square planar

Answer: A



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

A. $-0.6\Delta_0$

B. $-1.8\Delta_0$

C. $-1.6\Delta_0 + P$

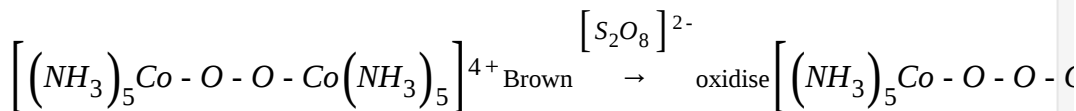
D. $-1.2\Delta_0$

Answer: A



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19.



The magnetic moment of green complex is 1.7 BM & for brown complexes magnetic moment is zero. (O-O) is same in all respect in both the complexes.

The O.S. of Co in brown complex & green complex respectively are-

- III III & IV III*
 A. brown green
- III II & III III*
 B. brown green
- III III & III II*
 C. brown green
- III IV & III III*
 D. brown green

Answer: A

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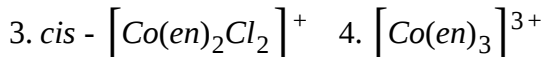
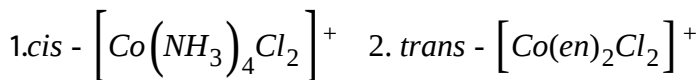
20. Which one of the following will be able to show cis-trans isomerism ?

- A. Ma_3b
- B. $M(AA)_2$
- C. $M(AB)(CD)$
- D. Ma_4

Answer: C

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21. Which of the compound show optical isomerism ?



Select the correct answer using the codes given below:

A. 1 and 2

B. 2 and 3

C. 3 and 4

D. 1,3 and 4

Answer: C



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Additional Problem for Self Practice (APSP) Part-III Match the column

1. Match the complexes in Column-I with characteristic(s)/ type of hybridisation listed in column-II

	Column – I		Column – II
(A)	$[\text{Co}(\text{en})_3]^{3+}$	(p)	sp^3d^2 hybridisation
(B)	$[\text{Co}(\text{ox})_3]^{3-}$	(q)	Diamagnetic
(C)	$[\text{Co}(\text{H}_2\text{O})_6]^{2+}$	(r)	d^2sp^3 hybridisation
(D)	$[\text{Co}(\text{NO}_2)_6]^{3-}$	(s)	Paramagnetic
		(t)	Chelate ligand

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Additional Problem for Self Practice (APSP) Part-III Single and double value integer type

1. What is the coordination number of metal in $[\text{M}(\text{trien})(\text{dipy})]^{\pm n}$?

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2. Out of the following. How many have correct IUPAC naming :-

(1) $[\text{Ni}(\text{CN})_4]^{2-}$ - Tetracyanonickel (II) ion

(2) $[\text{Pt}(\text{Py})_4][\text{PtCl}_4]$ - Tetrapyridine platinum (II) tetrachloride

platinate (II)

- (3) $[Ni(dmg)_2]$ - Bis(dimethylglyoimato) nikel (II)
- (4) $K_3[Fe(CN)_5NO]$ - Potassium pentacyanonitrosylferrate (II)
- (5) $[Fe(CO)_5]$ - Pentacyanocarbonyl Ferrate (O)
- (6) $K_2[HgI_4]$ - Potassium tetraiodidomercurate (II)
- (7) $[Pt(NH_3)_6]Cl_4$ Tetraammineplatinum (IV) tetrachlorido cuprate (II)
- (8) $[Cu(gly)_2]$ - Diglycinate copper (II)
- (9) $K_4[Fe(CN)_4]$ - Potassium hexacyanidoferrate (II)
- (10) $[Pt(NH_3)_6]Cl_4$ - Hexaammine platinum (IV) chloride.



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3. How many of the given complexes follow E.A.N rule ?

- (a) $[Fe(CO)_5]$ (b) $[Co_2(CO)_8]$ (c) $[Fe(C_5H_5)_2]$ (d) $K_3[Fe(CN)_6]$ (e) $[Fe(NO)_2_9CO)_2]$ (f) $[CoF_6]^{4-}$



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4. A name of neutral complex is :

Bis (acetyl acetanato) methylcyanidoethiocyanato-s-iron(Y)

The 'Y' is O.N. of metal then calculate sum of primary and secondary valency ?

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5. $Na_2 \left[Cr(NO)(NH_3)(C_2O_4)_2 \right]$, $u = \sqrt{3}BM$, Then total no. of electron in $d_{x^2-y^2}$ and d_{z^2} orbitals of metals:

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6. If CFSE increases by 30% and 40% respectively for Co^{3+} to Rh^{3+} to Ir^{3+} , then the total increase in CFSE for Ir^{3+} with respect to Co^{3+} is

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7. For the $[Cr(H_2O)_6]^{2+}$ ion, the mean pairing energy P is found to be 23500cm^{-1} . The magnitude of Δ_0 is 13900cm^{-1} . Calculate the C.F.S.E. (cm^{-1}) for this complex ion corresponding to high spin state (x) and low spin state (y). Write your answer as $\left(\frac{y-x}{100}\right)$.

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8. The possible number of stereoisomers for the formula $[Ma_2b_2cd]^{\pm n}$.

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9. A complex is prepared by mixing $CoCl_3$ & NH_3 0.1 M solution of the complex was found to freeze at $-0.372^\circ C$. Total geometrical isomers of complex are x. (Molar depression constant of water = $1.86^\circ C/m$) Report your answer by multiplying x with 6.

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10. Calculate total number of geometrical, optical and structural isomers in the compound. $\left[Rn(en)_2(NO_2)_2 \right]NO_3$

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11. What is the EAN value of $W(CO)_6$ carbonyl compounds ?

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Additional Problem for Self Practice (APSP) Part-III One or more than one option correct type

1. Which of the following pairs of name and formula of complexes is correct ?

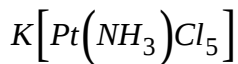
A. Tetramminecopper(II) sulphate..... $\left[Cu(NH_3)_4 \right]SO_4$

B. Diamminesilver(I) chloride $\left[Ag(NH_3)_2 \right]Cl$

C. Potassium hexacyanidoferrate(III)..... $K_4 \left[Fe(CN)_6 \right]$

D. Potassium

amminepentachloridoplatinate(IV).....

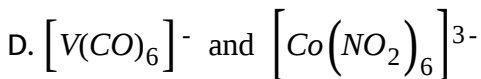
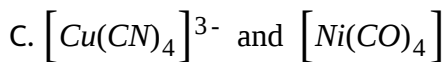
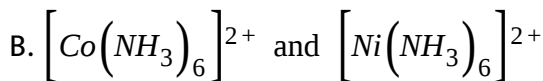
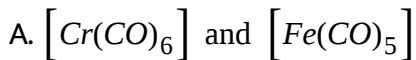


Answer: A::B::D



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2. In Which of the following pair fo complexes the central metal/ions do have same effective atomic number ?



Answer: A::C::D



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3. Which of the following statement is / are correct ?

- A. $Ni(CO)_4$ _____ Tetrahedral, paramagnetic
- B. $[Ni(CN)_4]^{2-}$ _____ Square planar, diamagnetic
- C. $Ni(dmg)_2$ _____ Square planar, diamagnetic
- D. $[NiCl_4]^{2-}$ _____ Tetrahedral, paramagnetic

Answer: B::C::D

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4. Which of the following statement(s) is / are correct ?

- A. $[Co(NH_3)_6]^{3+}$, $[Co(CN)_6]^{3-}$ and $[Co(NO_2)_6]^{3-}$ are diamagnetic involving d^2sp^3 hybridisation.
- B. $[Zn(NH_3)_4]^{2+}$, $[FeCl_4]^-$ and $[Ni(CO)_4]$ are diamagnetic involving sp^3 hybridisation.

C. The magnetic moment of $\left[Fe(H_2O)_6\right]^{3+}$ is 5.92 BM and that of

$\left[Fe(CN)_6\right]^{3-}$ is 1.73

D. The magnetic moment of $K_4[MnF_6]$ and $K_3[FeF_6]$ are same .

Answer: A::C::D

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5. Consider the following statements :

S_1 : Generally square planar complexes show geometrical isomerism but do not exhibit optical isomerism because they do not possess plane of symmetry .

$$S_2: \Delta_t = \frac{4}{9} \Delta_0$$

S_3 : In octahedral complexes each electron entering the t_{2g} orbitals stabilizes the complex ion by $0.4 \Delta_0$ and each electron entering the e_g orbital destabilizes the complex by an amount of $0.6 \Delta_0$

Select the correct statement from the codes given below.

A. S_1 and S_3 are correct

B. S_2 and S_3 are correct

C. S_1 is incorrect

D. S_2 and S_3 are incorrect

Answer: B::C

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6. Select the correct statement

A. $[Co(EDTA)]^-$ has two optical isomers.

B. $[Co(NH_3)_5(NO_2)]^{2+}$ show linkage isomerism

C. For $[Pt(NH_3)BrCl(NO_2)py]$, theoretically fifteen different geometrical isomers are possible .

D. $[Cr(H_2O)_4Cl_2]Cl_2 \cdot 2H_2O$ is an example of hydrate as well as ionisation isomerism.

Answer: A::B::C



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7. Which of the following are π -bonded organometallic compounds ?

A. ferrocene

B. Diethyl zinc

C. Ethylmagnesium iodide

D. Bis(benzene) chromium(0)

Answer: A::D



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Additional Problem for Self Practice (APSP) Part-III Comprehension.

1. Double salts are addition compounds which lose their identity in aqueous solution whereas complexes which are also addition compounds do not lose their identity in aqueous solution. The coordination compounds show isomerism and find applications in photography, qualitative analysis, metallurgy, water purification and in the treatment of various diseases .

Which of the following statment is incorrect ?

A. Alum is a double salt

B. EDTA salt of calcium is used in the treatment of lead poisoning.

C. Effective atomic number of the metal in complexes

$[Ni(CO)_4]$ and $[Fe(CN)_6]^{4-}$ is same.

D. Chloridotris (triphenylphosphine) rhodium (I) is effective

heterogeneous catalyst for hydrogenation of alkenes.

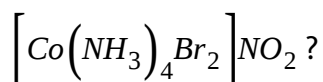
Answer: D



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2. Double salts are addition compounds which lose their identity in aqueous solution whereas complexes which are also addition compounds do not lose their identity in aqueous solution. The coordination compounds show isomerism and find applications in photography, qualitative analysis, metallurgy, water purification and in the treatment of various diseases .

Which of the following statement is true for the complex



- A. It shows ionisation, linkage and geometrical isomerism
- B. It does not show optical isomerism because its cis and trans forms each have at least one plane of symmetry.
- C. Its ionisation isomers cannot be differentiated by silver nitrate solution.
- D. (A) and (B) both

Answer: B



3. Double salts are addition compounds which lose their identity in aqueous solution whereas complexes which are also addition compounds do not lose their identity in aqueous solution. The coordination compounds show isomerism and find applications in photography, qualitative analysis, metallurgy, water purification and in the treatment of various diseases .

Choose the correct option if the complex $[PtCl_2(en)_2]^{2+}$.

- A. Platinum is in +2 oxidation state
- B. Racemic mixture is obtained on mixing mirror images of its trans form in 1:1 molar ratio.
- C. It has two five membered chelating rings.
- D. (B) and (C) both.

Answer: C



Additional Problem for Self Practice (APSP) Part-IV Practice Test -2 (Section-1)

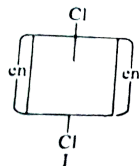
1. Given that the energy of the photons of different colours decreases in the order of VIBGYOR (Violet > Indigo > Blue > Green > Yellow > Red) and that if complex absorbs a photon of low energy then it shows colour of high energy photon. If an ion , M^{2+} , forms the complexes $[M(H_2O)_6]^{2+}$, $[MBr_6]^{4-}$, 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. $[MBr_6]^{4-}$ - blue, $[M(H_2O)_6]^{2+}$ green, $[M(en)_3]^{2+}$ red
- B. $[MBr_6]^{4-}$ - green, $[M(H_2O)_6]^{2+}$ blue, $[M(en)_3]^{2+}$ red
- C. $[MBr_6]^{4-}$ - green, $[M(H_2O)_6]^{2+}$ red, $[M(en)_3]^{2+}$ blue
- D. $[MBr_6]^{4-}$ - red, $[M(H_2O)_6]^{2+}$ green, $[M(en)_3]^{2+}$ blue

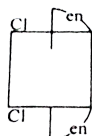
Answer: A

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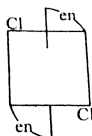
2. Which of the following pairs of structures shows geometrical isomerism ?



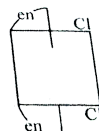
(A) I with III



(B) II with IV



(C) I with II



(D) none of these

A. I with III

B. II with IV

C. I with II

D. none of these

Answer: C

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3. 50 ml of 0.2 M solution of a compound with empirical formula $\text{CoCl}_3 \cdot 4\text{NH}_3$ on treatment with excess of $\text{AgNO}_3(\text{aq})$ yields 1.435 g of AgCl . Ammonia is not removed by treatment with concentrated H_2SO_4 . The formula of the compound is

- A. $\left[\text{Co}(\text{NH}_3)_4 \text{Cl} \right] \text{Cl}_2$
- B. $\left[\text{Co}(\text{NH}_3)_4 \text{Cl}_2 \right] \text{Cl}$
- C. $\left[\text{Co}(\text{NH}_3)_4 \right] \text{Cl}_3$
- D. $\left[\text{CoCl}_3(\text{NH}_3)_3 \right] \text{NH}_3$

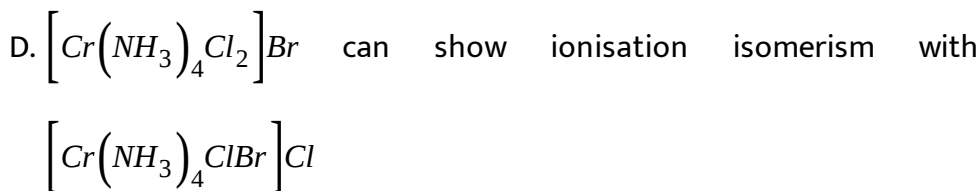
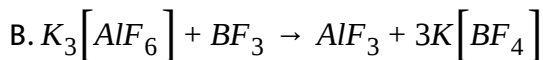
Answer: B

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4. Which of the following statement is incorrect ?

A. Potassium amminetetracyanonitrosoniumchromate(I) having

$\mu = 1.73\text{BM}$ has ds^2sp^3 hybridisation.



Answer: C

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5. Which of the following statements is not true ?

A. $MnCl_4^-$ ion has tetrahedral geometry and is paramagnetic .

B. $[Mn(CN)_6]^{2-}$ ion has octahedral geometry and is paramagnetic.

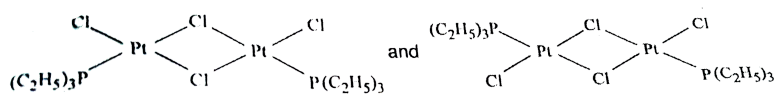
C. $[Cu(CN)_4]^{3-}$ has square planar geometry and is diamagnetic.

D. $[Ni(Ph_3P)_2Br_3]$ has trigonal bipyramidal geometry and is paramagnetic.

Answer: C

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6. The complexes given below show:



- A. optical isomerism
- B. co-ordination isomerism
- C. geometrical isomerism
- D. bridged isomerism.

Answer: C

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7. Which of the following statement is correct with respect to the metal carbonyls of I^{st} transition series ?

- A. As $M - C\pi$ bonding increasing, the C-O bond length increases.
- B. As positive charge on the central metal atom increases, the C-O bond length increases.
- C. As electron density on the central metal atom increases, the C-O bond length increases.
- D. (A) and (C) both.

Answer: D

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Additional Problem for Self Practice (APSP) Part-IV Practice Test -2 (Section-2)

1. Which of the following statement(s) is/are correct ?

A. *cis* - $\left[\text{Pt}(\text{NH}_3)_2\text{Cl}_2 \right]$ is used as an anticancer species.

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

C. In the silver electroplating of copper, $\text{K}[\text{Ag}(\text{CN})_2]$ is used in place of AgNO_3 .

D. CN^- ions show the reducing as well as complexing properties towards metal species.

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



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2. Which of the following is true for the complex $\text{Co}(\text{NO}_2)(\text{Cl})_2 \cdot 5\text{NH}_3$ (Co is in +III oxidation state) ?

A. It shows linkage isomerism

B. It show ionisation isomerism.

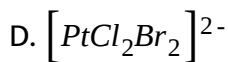
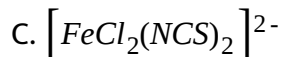
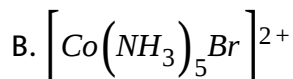
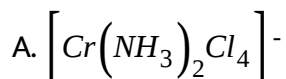
C. It is inner orbital complex

D. It is diamagnetic.

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

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3. Which of the following complexes can exist as diastereoisomer ?



Answer: A::D

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4. Tetrahedral complexes are generally favoured:

A. where the ligands are bulky

B. when the ligands are stronger

C. where the electronic configuration of the central metal is

d^0d^5 or d^{10} (with weak field ligands) as there is no CFSE.

D. when the central metal ion has pseudo noble gas electron

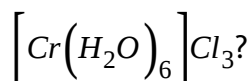
configuration ,i.e, $(n-1)d^{10}ns^0np^0$

Answer: A::C::D



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5. Which of the following statement is/are incorrect for the complex



A. It has a magnetic moment of 3.83 BM.

B. The distribution of 3d electrons in $3d_{xy}^1, 3d_{yz}^1, 3d_{zx}^1$

C. The ligand has satisfied both primary and secondary valencies of chromium.

D. It shows ionization as well as hydrate isomerism.

Answer: C::D

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**Additional Problem for Self Practice (APSP) Part-IV Practice Test -2 (Section-3)
(One Integer Value Correct Type)**

1. In the complex $Fe(CO)_x$, the value of x is :

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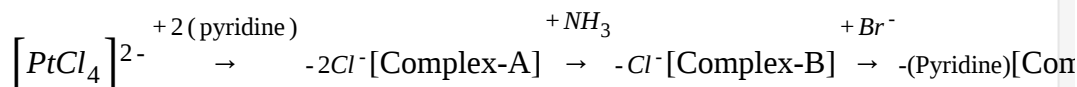
2. Count the no. of ions which can form low spin & high spin complexes when co-ordination no. 6 Co^{+3} , Ni^{2+} , Cr^{+3} , Fe^{+2} , Fe^{+3} , Cu^{+2} , Ti^{+3} , Co^{+2}

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3. The number of unpaired electrons present in $[NiF_6]^{2-}$ is

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4. The sum of stereoisomers of complex-A, complex-B and complex-C in following reaction is



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5. The number of d-electrons in $[Cr(H_2O)_6]^{3+}$ [atomic number of Cr =24] is :

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1. The magnetic moment for two complexes of empirical formula $Ni(NH_3)_4(NO_3)_2 \cdot 2H_2O$ is zero and 2.84 BM respectively. The second complex is not a neutral complex.

The number of water molecules of crystallization are respectively

A. zero, two

B. zero, zero

C. two, zero

D. two, two

Answer: C



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2. The magnetic moment for two complexes of empirical formula $Ni(NH_3)_4(NO_3)_2 \cdot 2H_2O$ is zero and 2.84 BM respectively. The second

complex is not a neutral complex.

The correct formula and geometry of the first complex is :

- A. $\left[\text{Ni}(\text{H}_2\text{O})_2(\text{NO}_3)_2 \right] \cdot 4\text{NH}_3$, tetrahedral
- B. $\left[\text{Ni}(\text{NH}_3)_4 \right] (\text{CO})_3 \cdot 2\text{H}_2\text{O}$, tetrahedral
- C. $\left[\text{Ni}(\text{NH}_3)_4 \right] (\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$, square planar
- D. $\left[\text{Ni}(\text{NH}_3)_4 \right] (\text{H}_2\text{O})_2 (\text{NO}_3)_2$, octahedral

Answer: C



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3. The magnetic moment for two complexes of empirical formula $\text{Ni}(\text{NH}_3)_4(\text{NO}_3)_2 \cdot 2\text{H}_2\text{O}$ is zero and 2.84 BM respectively. The second complex is not a neutral complex.

Which of the following statements are true for the second complex ?

- A. It has the EAN value of 36

B. It can show optical isomerism.

C. It cannot show geometrical isomerism.

D. It produces three-fold freezing point depression.

Answer: D



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**Additional Problem for Self Practice (APSP) Part-IV Practice Test -2 (Section-5)
(Matching Lift type)**

1. Column-I and Column-II contains four entries each. Entries of Column-I are to be matched with some entries of Column-II One or more than one entries of Column-I may have the matching with the same entries of Column-II.

	Column-I (Coordination compounds)		Column-II (Type of isomerism)
P.	$[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$	1.	Optical isomerism
Q.	$\text{cis-}[\text{Co}(\text{en})_3]\text{Cl}_2$	2.	Ionization isomerism
R.	$[\text{Co}(\text{en})_2(\text{NO}_2)\text{Cl}]\text{SCN}$	3.	Coordination isomerism
S.	$[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$	4.	Geometrical isomerism





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