CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

CO-ORDINATION COMPOUNDS

Level I Exercise I

1. Ligand in a metal carbonyl complex is

A. CO_2

B. CO

C. $CoCl_2$

D. $C_2O_4^{2-}$

Answer: B

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2. In complex compounds the metal atom acts as a

A. Lewis acid

B. Lewis base

C. Bronsted acid

D. Bronsted base

Answer: A

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3. A ligand should contain

A. odd electrons

B. even number of electrons

C. lone pair of electrons to donate

D. vacant orbital to accept the lone pair

Answer: C

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4. The oxidation state of Iron is $\left[Fe(CN)_6\right]^{-3}$ ion

A. $+1$

B. $+2$

C. $+3$

D. zero

Answer: C

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5. The primary valency of 'Fe' in the complex $K_4\left[Fe(CN)_6\right]$ is

A. 2

B. 3

C. 6

D. 4

Answer: A

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6. In which of the following compounds Iron has zero oxidation state

A. $Fe(CO)_5$

B. Fe_2O_3

C. FeO

D. Fe_3O_4

Answer: A

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7. The hybridisation of metal ion in square planar complexes in

A. dsp^2

B. sp^3d

C. d^3sp^3

D. sp^3

Answer: A

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8. The charge on Cobalt in $\left[Co(CN)_6\right]^{3-}$ is

A. -3

B. $+3$

C. -6

D. $+6$

Answer: B

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9. The hybridisation of Iron in $K_4\left[Fe(CN)_6\right]$ is

A. dsp^2

B. sp^3

C. d^2sp^3

D. d^2sp^2

Answer: C

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10. A bidentale ligand is

A. pyridine

B. thiocyanate

C. ethylene diammine

D. water

Answer: C

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11. Which of the following is a polynuclear compound

A. $\left[Co(NH_3)_4Cl_2\right]Cl$

B. $NaFe\left[Fe(CN)_6\right]$

C. $\left[Cr(H_2O)_5Cl\right]Cl_2$

D. $\left[Co_2(NH_3)_6(OH)_3\right]Cl_3$

Answer: D

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12. One mole of the complex $Co(NH_3)_5Cl_3$ gives 3 moles o f ions on dissolution in water. One mole of he same complex reacts with two moles of $AgNO_3$ solution to yield two moles of AgCl(s). The structure of the complex is

A. $[Co(NH_3)_5Cl]Cl_2$

B. $[Co(NH_3)_3Cl_3].2NH_3$

C. $[Co(NH_3)_4Cl_2].\ Cl.\ NH_3$

D. $[Co(NH_3)_6]Cl_3$

Answer: A

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

A. The number of ligands around a metal ion bonded by sigma bonds

B. the number of only anionic ligands bonded to the metal ion

C. the number of ligands around a metal ion bonded by sigma and pi-bonds both

D. the number of ligands around a metal ion bonded by pi-bonds

Answer: A

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14. In the IUPAC version, the ligand $OH^{\,-}$ is named as

A. hydroxide

B. hydroxyl

C. hydroxo

D. ol

Answer: B

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15. The formula of 'nitrosyl' group

A. NO

B. NO^{+}

C. NO^{-}

D. ONO

Answer: B

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16. Name of oxalate in IUPAC version changes to

A. Oxalite

B. Oxalato

C. Oxalito

D. Oxalide

Answer: A

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17. (A) : Structure of $\left[Co(NH_3)_6\right]^{+3}$ ion is octahedral

(R) : The coordination number of the metal ion is 6

A. Both (A) and R are true and R is the correct explanation of (A)

B. Both (A) and R are true and R is not the correct explanation of (A)

C. (A) is true but R is false

D. (A) is false but R is true

Answer: A

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18. Metal-Isothiocyanato' is indicated by its chemical symbol as

A. M-NCS

B. M-SCN

C. M-CNS

D. M-CSN

Answer: C

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19. $[PtBrCl(NO_2)(NH_3)]$ I on ionisation gives the ion

A. Cl^-

B. Br^-

C. I^-

D. NO_2

Answer: D

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20. A racemic mixture has a net rotation

A. to right of original plane

B. to left of original plane

C. to right or left of original plane

D. zero

Answer: D

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21. Optical isomers differ in

A. chemical properties

B. molecular formulae

C. physical properties

D. optical properties

Answer: D

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22.

IUPAC Name	Formulae of ligand
(i)Bromo	$(A)CO$
(ii)Carbonyl	$(B)C_6H_5COO^-$
(iii)Benzoato	$(C)H_2O$
(iv)Aquo	$(D)Br^-$

The correct match is

A. $\begin{array}{cccc} i & ii & iii & iv \\ D & A & B & C \end{array}$

B. $\begin{array}{cccc} i & ii & iii & iv \\ D & B & A & C \end{array}$

C. $\begin{array}{cccc} i & ii & iii & iv \\ D & A & C & B \end{array}$

D. $\begin{array}{cccc} i & ii & iii & iv \\ D & C & A & B \end{array}$

Answer: A

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23. Fac and mer isomerism is associated with the general formula

A. MA_3X_3

B. $M(AA)_3$

C. MABCD

D. $M(AA')_3$

Answer: A

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24. Which of the following is an example of ambidentate ligand

A. CO

B. CN^-

C. H_2O

D. SO_4^{2-}

Answer: B

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25.

LIST-I	LIST-II
(A)Haber's process	$(1)Cu$
(B)Contact process	$(2)V_2O_5$
(C)Hydrogenation of oils	$(3)Pt$
(D)Ostwald's process	$(4)Fe$
	$(5)Ni$

The correct match is

A. $\begin{array}{cccc} A & B & C & D \\ 4 & 3 & 5 & 1 \end{array}$

B. $\begin{array}{cccc} A & B & C & D \\ 4 & 2 & 3 & 5 \end{array}$

C. $\begin{array}{cccc} A & B & C & D \\ 4 & 2 & 5 & 3 \end{array}$

D. $\begin{array}{cccc} A & B & C & D \\ 3 & 1 & 5 & 2 \end{array}$

Answer: C

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26. Coordination isomerism is exhibited by

A. $[CrH_2O)_6]Cl_3$

B. $[Cr(NH_3)_6][Co(CN)_6]$

C. $[Cr(en)_2]NO_2$

D. $[Ni(NH_3)_6][BF_4]_2$

Answer: B

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27. Which is not amphoteric

A. Al^{+3}

B. Cr^{+3}

C. Fe^{+3}

D. Zn^{+2}

Answer: C

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28. Which of the following has maximum number of unpaired d-electrons

A. Zn

B. Fe^{+2}

C. Ni^{+3}

D. Cu^{+1}

Answer: B

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29. Human haemoglobin is made up of

A. 4 haeme units and one globular protein

B. 4 haeme units and four globular protein

C. 2 haeme units and one globular protein

D. 4 haeme units and two globular protein

Answer: A

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30. Globular protein in haemoglobin is made up of

A. two polypeptide chains

B. four polypeptide chains

C. one polypeptide chain

D. eight polypeptide chains

Answer: B

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31. Geometry of orbitals around the transition metal ion in haem of haemoglobin is

A. square planar arrangement

B. tetrahedral arrangement

C. plane trigonal arragement

D. octahedral arrangement

Answer: D

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32. The number of moles of KI required to prepare one mole of $K_2[HgI_4]$ is

A. 4

B. 3

C. 2

D. 1

Answer: A

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33. The protein part of the Haemoglobin and non protein part of Haemoglobin are coordinated through

A. N of the pyrrole

B. N-of the Histidine

C. N of 2,3-dimethyl Benzimidazole

D. N of the 5,6-dimethyl Benzimidazole

Answer: B

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34. In metallurgy the metal used to displace silver from its cyano complex is

A. Zn

B. Au

C. F_2

D. Cl_2

Answer: A

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35. Which of the following releases metal slowly which gives uniform coating in electroplating

A. Metal salts

B. Double salts

C. Complex salts

D. Alums

Answer: C

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36. The metal present in chlorophyll is

A. Fe

B. Mg

C. Co

D. Zn

Answer: B

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37. Number of dative bonds around Mg^{2+} ion in chlorophyll is

A. 2

B. 3

C. 4

D. 6

Answer: A

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Level I Exercise Ii

1. The primary valency of the central transition metal ion in a complex compound $\left(Cr(NH_3)_4Cl_2\right]Cl$

A. 3

B. 2

C. 1

D. 0

Answer: A

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2. The number of ions given by $\left[CO(NH_3)_3Cl_3\right]$ in aqueous solution is

A. 1

B. 2

C. 3

D. zero

Answer: D

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3. The primary and secondary valencies of the central metal ion in the complex $\left[Co(NH_3)_6\right]Cl_3$ respectively are

A. 6 and 2

B. 6 and 6

C. 3 and 3

D. 3 and 6

Answer: D

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4. The complex compound which does not give precipitate with $AgNO_3$ solution is

A. $\left[Co(NH_3)_5Cl\right]Cl_2$

B. $\left[Co(NH_3)_6\right]Cl_3$

C. $\left[Co(NH_3)_4Cl_2\right]Cl$

D. $\left[Co(NH_3)_3Cl_3\right]$

Answer: D

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5. The oxidation state of Cr in $\left[Cr(NH_3)_4Cl_2\right]Cl$

A. $+3$

B. $+2$

C. $+1$

D. 0

Answer: A

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6. When 1. mole of $\left[Cr(NH_3)_4Cl_2\right]Cl$ is added to excess of $AgNO_3$ solution the weight of AgCl precipitated is

A. 143.5 g

B. 108 g

C. zero

D. 54 g

Answer: C

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7. The primary valency of Iron in $K_4\left[Fe(CN)_6\right]$ is satisfied by

A. Six CN^- ions

B. Two CN^- ions

C. Four K^+ ions

D. Two K^+ ions

Answer: B

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8. The secondary valency of Chromium in $\left[Cr(en)_3\right]Cl_3$ is

A. 6

B. 3

C. 2

D. 4

Answer: A

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9. Which of the following is wrong with respect to $\left[Co(NH_3)_5Cl\right]Cl_2$

A. central metal ion is Co and the ligands are NH_3 and Cl^+ ion

B. oxidation number of Co is +2

C. co-ordination number of Co is 6

D. the number of ions formed when 1 mole of the compound dissolves in water is 3 moles

Answer: B

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10. The deep blue complex produced by adding excess of Ammonia to $CuSO_4$ solution is

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

B. $\left[Cu(NH_3)_4\right]^{2+}$

C. $\left[Cu(NH_3)_6\right]^{2+}$

D. Cu^{2+}

Answer: B

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11. A complex in which central atom carries zero oxidation state is

A. $[Co(NH_3)_3Cl_3]$

B. $PtCl_4.2NH_3$

C. $Ni(CO)_4$

D. $Na_2[(Ni(CN)_4)]$

Answer: C

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12. $K_2SO_4.\ Al_2(SO_4)_3.24H_2O$ is

A. a complex salt

B. a double salt

C. a complex salt & double salt

D. a basic salt

Answer: B

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13. Number of dative bonds in the complex $CoCl_3.5NH_3$ is

A. 5

B. 6

C. 3

D. 4

Answer: B

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14. Stable complex based on EAN rule

(i) $K_4[Fe(CN)_6]$ (ii) $[Co(NH_3)_5Cl]Cl_2$

(iii) $[Ni(CO)_4]$ (iv) $K_3\left(Ni(CN)_4\right]$

A. ionly

B. i& ii only

C. I,ii & iii only

D. all

Answer: A

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15. IUPAC name of the complex, $Ni(CO)_4$ is

A. tetracarbonylNickel (II)

B. tetracarbonylNickel (O)

C. tetracarbonylNickelate (II)

D. tetracarbonylNickelate (O)

Answer: B

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16. Potassium hexachloroplatinate (IV) is given with the chemical formula

A. $Pt_2[K(Cl)_6]$

B. $K[Pt(Cl)_6]$

C. $K_2[Pt(Cl)_6]$

D. $K_4[Pt(Cl)_6]$

Answer: B

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17. IUPAC name of $K_3[Al(C_2O_4)_3]$

A. potassium alumino oxalte

B. potassium trioxalato aluminate (III)

C. potassium aluminium oxalate (III)

D. potassium trioxalato aluminate (VI)

Answer: C

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

A. Lithiumaluminiumhydride

B. Lithiumtetrahydridoaluminate[III]

C. Tetrahydridealuminiumlithionate

D. Aluminiumlithiumhydride

Answer: A

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19. The neutral complex, diamminedibromodichloroplatinum(IV) is best represented as

A. $\left[Pt(NH_3)_2Br_2Cl_2\right]$

B. $\left[PtCl_2Br_2(NH_3)_2\right.$

C. $\left[PtBr_2Cl_2(NH_3)_2\right]$

D. $\left[Pt(NH_3)_2Cl_2Br_2\right]$

Answer: A

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20. IUPAC name of `[Fe(CN)_(6)]^(4-) is

A. ferrocyanide

B. hexacyanoferrate (III)

C. ferricyanide

D. hexacyanoferrate (III)

Answer: B

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21. When $AgNO_3$ solution is added in execss to 1lit. $CoCl_3, XNH_3$ solution, one mode of AgCl is formed,. What is the or x?

A. 1

B. 2

C. 3

D. 4

Answer: D

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22.

Complex	Type
$(A) CoCl_3.3NH_3$	(i) Anionic complex
$(B) Na_2ZnCl_4$	(ii) Cationic complex
$(C) PtCl_4.5NH_3$	(iii) Neutral complex

The correct match is

A. A - ii, B-iii, C-i

B. A-iii, B-, C-ii

C. A-ii, B-i, C-iii

D. A-iii, B-ii, C-i

Answer: B

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23. (A) : IUPAC name of $\left[Co(H_2O)_4Cl_2\right]Cl.2H_2O$ is tetraaquadichlorocobalt(III) chloride.

(R) : Water of crystallisation is represented by Arabic numerical before its name

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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24. (A): IUPAC name of [Pt Br (en)] Cl, is dibromobis (1, 2-ethane diamine) platinum (IV) chloride.

(R): (en) represents ethylenediamine and it is a ligand where prefix di- is already included in its designation.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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25. (A) : $\left[Co_2(OH)_3(NH_3)_6\right]Cl_3$ is an example of polynuclear complex compound

(R) : Compound in which the number of central metal atoms is more than one is called polynuclear compound

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: A

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26. The IUPAC name of the coordination compound $K_3\left[Fe(CN)_6\right]$

A. Potassium hexacyanoferrate(II)

B. Potassium hexacyanoferrate (III)

C. Potassium hexacyanoiron (II)

D. Tropotassium hexacyano iron (II)

Answer: B

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27. The IUPAC name of the complex $\left[Co(NO_2)(NH_3)_5\right]Cl_2$ is

A. pentaamminenitrito-N-cobalt(III) chloride.

B. nitrito-N-pentaamminecobalt(III) chloride

C. nitrito-N-pentaamminecobalt(II) chloride

D. pentaamminenitrito-N-cobalt(II) chloride Isomerism :

Answer: A

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28. Example showing ionisation isomerism

A. $\left[Co(NO_3)(NH_3)_5SO_4\&\left[Co(SO_4)(NH_3)_5\right]NO_3\right.$

B. $\left[Co(NH_3)_4Cl_2\right]Cl\&\left[CO(NH_3)_5Cl\right]Cl_2$

C. $\left[Cr(H_2O)_5Cl\right]Cl_2.\ H_2O\&\left[Cr(H_2O)_4Cl_2\right]Cl.2H_2O$

D. $\left[Pt(NH_3)_4\right][PtCl_4]\&\left[Pt(NH_3)_3Cl_2\right][PtCl_4]$

Answer: A

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29. When two ligands of the same type occupy opposite positions to each other in a coordination polyhydron, the isomer is called

A. trans-

B. cis-

C. fac-

D. mer-

Answer: A

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30. Geometrical isomerism in square planar complexes is given by

A. Ma_4 type complex

B. $Ma(3)b$ type complex

C. Ma_2b_2 type complex

D. Mb_4 type complex

Answer: C

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31. Both geometrical and optical isomerisms are shown by

A. $\left[Pt(NH_3)_2Cl_2\right]$

B. $\left[Pt(NH_3)_4Cl_2\right]$

C. $Pt\left[(en)_2Cl_2\right]$

D. $\left[Pt(en)_3\right]$

Answer: C

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32. (A): A cis-isomer has a net dipole moment zero.

(R): A cis-isomers has two ligands of the same type occupying adjacent positions.

A. Both (A) and (R) are true and (R) is the correct explanation of (A)

B. Both (A) and (R) are true and (R) is not the correct explanation of (A)

C. (A) is true but (R) is false

D. (A) is false but (R) is true

Answer: D

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33. Optical isomerism is exhibited by a complex with

A. coordination number 4, with a bidentate ligand

B. coordination number 4, with two bidentate ligands

C. coordination number 6, with a bidentate ligand

D. coordination number 6, with three tridentate ligands

Answer: C

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34. Ligands with which linkage isomerism is possible

A) NO_2 B) CN^- C) SCN^-

A. A only

B. A & B

C. B & C

D. A,B & C

Answer: D

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35. Optical isomers have

A) property of chirality

B) almost identical chemical properties

C) almost identical physical properties

D) similar rotation of plane polarised light

A. A,B,C are correct

B. B,C,D are correct

C. A,C,D are correct

D. A,B,D are correct

Answer: A

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36. Identify the correct statements among the following

I) Cr in first series of d-block has highest oxidation state.

II) Colour of MnO_4^- is due to charge transfer phenomenon.

III) Zn can show variable oxidation state.

IV) Ferromagnetism disappears in the solution of Fe

A. All

B. I & II only

C. II & IV and

D. II & III only

Answer: C

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37. What is wrong about the following pair of compounds? $\left[Cr(H_2O)_6\right]Cl_3$ and $\left[Cr(H_2O)_5Cl\right]Cl_2.\ H_2O$

A. They are hydration isomers

B. They have different colours

C. Their 0.1M aqueous solutions have same molar conductivity

D. They have different IUPAC name

Answer: C

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38. Geometrical isomerism in square planar complexes is given by

A. Tetrahedral complex

B. Square planar complex

C. Tined complexes

D. planar triangle complexes

Answer: B

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39. Which of the following compound shows optical isomerism?

A. $[Cu(NH_3)_4]^{2+}$

B. $[Zn(Cl)_4]^{2-}$

C. $[Cr(C_2O_4)_3]^{2-}$

D. $[Co(CN)_6]^{3-}$

Answer: C

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40. M-L bonds in carbonyl compounds posses

A. only σ character

B. only π character

C. both σ and π chracter

D. none of the above

Answer: C

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41. IUPAC name of $K_3\left[Fe(CN)_6\right]$ is (Ker CET)

A. potassiumhexacyanoferrate (II)

B. Potassiumhexacyanoferrate (III)

C. hexacyanoferrate (III)

D. potassiumferricyanide

Answer: B

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42. $K_4\left[Fe(CN)_6\right]$ is a

A. double salt

B. complex compound

C. neutral molecule

D. none of these

Answer: B

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43. The oxidation number of Pt in $[Pt(C_2H_4)Cl_3]^-$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: B

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44. The effective atomic number of Cr in $[Cr(NH_3)_6]Cl_3$ is

A. 35

B. 27

C. 33

D. 36

Answer: C

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45. Discuss the nature of bonding and magnetic behaviour in the $\left[FeF_6\right]^{3-}$ Co-ordination entities on the basis of valence bond theory.

A. 6.92 BM

B. 5.92 BM

C. 7.62 BM

D. 3.14 BM

Answer: B

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46. Give evidence that $\left[Co(NH_3)_5Cl\right]SO_4$ and $\left[Co(NH_3)_5SO_4\right]Cl$ are ionization isomers.

A. Ionization

B. Ligand

C. Co-ordination

D. Hydrate

Answer: A

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47. Which one of the following pairs of complexes has the effective atomic number equal to 36 for the transition element ?

A. $[Co(NH_3)_6]Cl_3 : K_3[Fe(CN_6)]$

B. $[Co(NH_3)_6]Cl_3 : [Co(Co)_4]$

C. $[Fe(CO)_5], K_4[Fe(CN)_6]$

D. $[Fe(CO)_5], K_3[Fe(CN)_6]$

Answer: C

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48. The carboxylic acid group attached to porphyrin of heme in blood is

A. $HCOO^-$

B. $-CH_2-COO^-$

C. $-C_2H_4-COO^-$

D. $-C_3H_6-COO^-$

Answer: C

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49. Tetrapyrrole structure has

A. Pyrrole rings

B. Methylene linkage

C. Both 1 and 2

D. None of the above

Answer: C

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50. The formation of HbO_2 is

A. Oxidation

B. Reduction

C. Oxygenation

D. Disproportion action

Answer: C

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51. $\left[Fe(H_2O)_6\right]^{2+}$ is

A. Pale green complex

B. Blue coloured complex

C. Red coloured complex

D. Violet coloured complex

Answer: A

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52. I) Chlorophyll is a magnesium porphyrin complex

II) Mg atom forms two covalent bonds and two dative bonds in chlorophyll

A. both are wrong

B. both are correct

C. only I is correct

D. only II is wrong

Answer: B

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Level Ii Lecture Sheet Exercise I Single One Or More Than One Correct Answers

1. Which statement is incorrect :

A. $\left[Fe(CO)_5\right]$ reacts with $Br_2. Cl_2$

B. Carbonyl complexes are usually formed with transition metals

C. All transition metals form monometallic carbonyls

D. The decomposition of $\left[Ni(CO)_4\right]$ to give Ni is used in the extraction of Ni by Mond's process.

Answer: C

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2. Which of the following cannot ionise

A. $\left[Co(NH_3)_3Cl_3\right]$

B. $\left[Co(NH_3)_4Cl_2\right]Cl$

C. $\left[Co(NH_3)_5Cl_3\right]Cl_2$

D. $\left[Co(NH_3)_6\right]Cl_2$

Answer: A

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3. In test of NO_3^- in the dark brown ring complex is formed, which is true of this complex

A. The colour is due to charge transfer spectra

B. Iron and NO both have +1 charge

C. The complex species can be represented as $\left[Fe^1(H_2O)_5NO\right]^{2+}$

D. No on heating

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

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4. What is/are the coordination number(s) of Au in the complexes formed by Au ?

A. 6

B. 4

C. 5

D. 2

Answer: B

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5. The ligand which gives chaelate complexes is:

A. SCN^-

B. $NH_2 - \overset{+}{N}H_3$

C. EDTA

D. $C_2O_4^{2-}$

Answer: C::D

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6. Which of the following is(are) true about metal - ligands complex :

A. Larger the ligand, the more stable is the metal-ligand complex

B. Highly charged ligand forms stronger bonds

C. Larger the permanent dipole moment of ligand, the more stable is the bond

D. Greater the ionisation potential of central metal, the stronger the bond

Answer: B::C

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7. Which ion isare) not paramagnetic :

A. $\left[Ni(NH_3)_6\right]^{2+}$

B. $\left[Ni(Co)_4\right]$

C. $\left[Co(NH_3)_6\right]^{3+}$

D. $\left[Ni(CN)_4\right]^{2+}$

Answer: B::C::D

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8. Which of the following isare) considered as an organometallic compound :

A. Zeise's salt

B. Ferrocene

C. cis-platin

D. Grignard reagent

Answer: A::B::D

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9. Which is true in the case of $\left[Ni(CO)_4\right]$ complex :

A. Hybridisation of Ni is sp^3

B. Tetrahedral shape of the molecule

C. Diamagnetic

D. None of these

Answer: A::B::C

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10. Which of the following cations form an amine complex with excess of ammonia:

A. Ag^{+}

B. Cu^{2+}

C. Cd^{2+}

D. Na^{+}

Answer: A::B::C

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11. $Fe_2(CO)_9$ is diamagnetic. Which of the following reasons is correct :

A. Presence of one CO as bridge group

B. Presence of monodentate ligand

C. Metal - metal (Fe-Fe) bond in molecule

D. Resonance hybridisation of CO

Answer: A::B::D

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12. A bidentale ligand is

A. Polydentate nature

B. Two or more donor centres

C. The tendency to get itself attached to two metal ions

D. None of these

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

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13. The complex $[Hgl_3]^-$

A. is trigonal planar

B. has sp^2-hybridization

C. is paramagnetic

D. none of these

Answer: A::B::C

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14. $K_4[Fe(CN)_6]$ is used in the identification of:

A. Fe^{2+} ions

B. Fe^{3+} ions

C. Cu^{2+} ions

D. Cd^{2+} ions

Answer: A::B::C

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15. The oxidation number of metal atom is (are)zero in :

A. $\left[Ni(CO)_4\right]$

B. $\left[Fe_2(CO)_5\right]$

C. $Na\left[Co(CO)_4\right]$

D. $\left[CuCl_4\right]^{2-}$

Answer: A::B

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16. Which is not correctly matched ?

A.

Complex compounds	IUPAC name
$K[CrF_4O]$	Potassium tetrafluorooxo chromate(V)

B.

Complex compounds	IUPAC name
$Na\left[BH(OCH_3)_3\right]$	Sodium hydrido trimethoxy borate (III)

C.

Complex compounds	IUPAC name
$\left[Be(CH_3 - CO - CH - CO - C_6H_5)_2\right]^0$	Bis (benzoylacetonato b

D.

Complex compounds	IUPAC name
$H[AuCl_4]$	Hydrogen tetrachloro aurate (III)

Answer: B::C

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17. The complex ion $\left[Cu(NH_3)_4\right]^{2+}$ has :

A. The tetrahedral configuration & one unpaired electron

B. Square planar configuration & one unpaired electron

C. Square planar & two unpaired electron

D. all

Answer: B::D

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18. Which of the following statements is/are true ?

A. In ferrocyanide ion, the effective atomic number is 36

B. Chelating ligands are atleast bidentate ligand

C. $\left[CrCl_2(CN)_2(NH_3)_2\right]$ and $\left[CrCl_3(NH_3)_3\right]$ both have d^2sp^3 hybridisation

D. all

Answer: D

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

A. The oxidation state of iron in sodium nitro prusside $Na_2\left[Fe(CN)_5(NO)\right]$ is +II

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

C. both a & b

D. Fe is d^2sp^3 hybridised

Answer: A::B

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20. The d-orbitals involved in sp^3d^2 or d^2sp^3 hybridisation of the central metal ion are :

A. $d_{x^2-y^2}\&d_{z^2}$

B. $d_{xy}\&d_{z^2}$

C. $d_{yz}\&d_{x^2-y^2}$

D. d_{z^2} only

Answer: A

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21. Coordination number of Cr is 6. A complete entity with $C_2O_4^{-2}$, en superoxide as ligands is $\left[Cr(C_2O_4)_x(en)_y(O_2)_z\right]^+$. The ratio of x: y : z is

A. $1:1:2$

B. $1:1:1$

C. $1:2:3$

D. $2:1:1$

Answer: A

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

A. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the magnetic properties

B. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the geometry

C. The complex $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in primary valencies of nickel

D. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the state of hydridisation of nicket

Answer: A::B::D

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23. For $[Fe(CN)_6]^{4-}$. $[Ni(CN)_4]^{2-}$ and $[Ni(CO)_4]$. Correct statement

A. all have identical geometry

B. $[Ni(CO)_4]$ is para magnetic

C. all are dia magnetic

D. $[Fe(CN)_6]^{4-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic

Answer: C

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24. Which have octahedral shape $\left(d^{2}sp^{3}\right)$ hybridisation of central atom :

A. $\left[Cr\left(NH_{3}\right)_{6}\right]^{+}$

B. $\left[Fe(CN)_{6}\right]^{3-}$

C. $\left[Cu\left(NH_{3}\right)_{6}\right]^{+}$

D. None of these

Answer: A::B

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25. Which possesses tetrahedral shape $\left(sp^{3}\right.$- hybridisation of central atom):

A. $\left[Zn\left(NH_{3}\right)_{4}\right]^{2+}$

B. $\left[Ni(CO)_{4}\right]$

C. $\left[Cu(NH_3)_4\right]^{2+}$

D. None of these

Answer: A::B

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26. Which of the following complexes is a chelate ?

A. bis (dimethylglyoximato) nickel (II)

B. potassium ethylene diamine tetrathiocyanato chromate(III)

C. tetrammine carbonatocobalt (III) nitrate

D. trans - diglycinatoplatinum (II)

Answer: A::B::D

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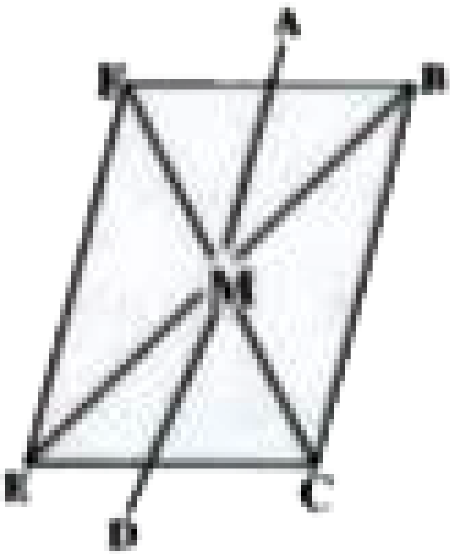
27. A complex shown below can exhibit :



A. Optical isomerism only

B. Geometrical isomerism only

C. both

D. None of these

Answer: C

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28. Which of the following compounds can exhibit geometrical isomerism?

A. $\left[Cr(H_2O)_6\right]Cl_2$

B. $\left[Cr(NH_3)_6\right]\left[Co(CN)_6\right]$

C. $\left[Cr(en)_2\right]NO_2$

D. $\left[Cr(H_2O)_5\right]Cl_3$

Answer: B

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29. Which of the following isomerisms are exhibited by $\left[Cr(NH_3)_2(OH)_2Cl_2\right]$ is

A. Geometrical

B. Optical

C. both

D. Co-ordinational

Answer: C

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30. Which of the following statements is not true about the complex ion $[CrCl(NO_2)(en)_2]^+$?

A. It has two geometrical isomers cis and trans.

B. cis and transforms are not diastereomers to each other

C. Only the cis isomer displays optical activity

D. It has three optically active isomers : d, 1 and reso forms.

Answer: B::D

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31. Which of the following statement(s) is/are incorrect?

A. In $\left[CoBrCl(en)_2\right]^+$ geometrical isomerism exists, while optical isomerism does not exist

B. IUPAC name of $K_2\left[Cr(CN)_2O_2(O_2)(H_2O)\right]$ is Potassium aquadicyanosuperoxo peroxo chromate(III)

C. There are 3 geometrical and 15 stereoisomers possible for $\left[Pt(NO_2)(NH_3)(NH_2OH)(py)\right]^+$ and $\left[PtBrClI(NO_2)(NH_3)(py)\right]$ respectively

D. cis and transforms are not diastereomers to each other.

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

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32. Which of the following statements is/are true ?

A. The π bond between metal and carbonyl carbon reduces the bond order of C-O bond from triple bond in CO toward double bond.

B. The pair of compounds $\left[Cr(H_2O)_6\right]Cl_3$ and $\left[CrCl_3(H_2O)_3\right].3H_2O$ show hydrate isomerism

C. d_z^2orbital of central metal atom/ion is used in dsp^2 hybridisation

D. Facial and meridional isomers associated with $[Ma_3b_3]^{n\pm}$ type complex compound, both are optically inactive.

Answer: A::B::D

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33. Which of the following statement is true about the complex $\left[CrCl_3(OH)_2(NH_3)\right]^{2-}$ ion?

A. It has three geometrical isomers

B. Only one space isomer is optically active and remaining are inactive

C. There are total four space isomers

D. The magnetic moment of complex ion is 3.89 BM

Answer: A::D

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34. Which of the following pairs show coordination isomerism ?

A. $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$

B.

$[Co(NH_3)_3(H_2O)_2Cl]Br$ and $[Co(NH_3)_3(H_2O)Cl.\,Br]Br.\,H_2O$

C. $[Pt(NH_3)_4Cl_2]Br_2$ and $[Pt(NH_3)_4Br_2]Cl_2$

D. $[Co(NH_3)_6][Cr(C_2O_4)_3]$ and $[Cr(NH_3)_6][Co(C_2O_4)_3]$

Answer: A::D

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35. A metal comples having composition $Cr(NH_3)_4CI_2Br$ 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, where as B gives a plae yellow precipitate soluble in concentrated ammonia. The hybridisation of Cr in A and magnetic momentum in B are respectively

A. $d^2sp^3, 2.8BM$

B. $sp^3d^2, 3.8MB$

C. $d^2s^3, 3.8BM$

D. $sp^3d^2, 2.8BM$

Answer: B

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36. In poly nuclear metal carbonyls, the hybridisation of 'C' in terminal carbonyl is 'sp' where as that in bridged carbonyl is $'sp'^2$

II) In all mono nuclear metal carbonyl, the carbonyls are non bridged

III) $Fe(CO)_5$ is diamagnetic and Fe' is dsp^3 hybridised

IV) Metal carbonyls are more stable due to more nucleophilic nature of carbon monoxide The correct statements are

A. I, II, III

B. I,III, IV

C. II,III, IV

D. I, II, III are IV

Answer: A

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37. Which is high spin complex :

A. $CoCl_6^{3-}$

B. FeF_6^{3-}

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

D. $\left[Ni(CN)_4\right]^{2-}$

Answer: A::B

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38. A d-block element forms octahedral complex but its magnetic moment remains same either in strong field or in weak field ligand. Which of the following is/are correct ?

A. Element always forms colourless compound

B. Number of electrons in t_{2_g} orbitals are higher than in e_g orbitals

C. It can have either d^3 or d^8 configuration

D. It can have either d^7 or d^8 configuration

Answer: B::C

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39. For which of the following d^n configuration of octahedral complex(es), cannot exist in both high spin and low spin forms?

A. d^3

B. d^5

C. d^6

D. d^8

Answer: B::D

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40. Select the correct statement

A. Chelation effect is maximum for five and six membered rings

B. Greater the charge on the central metal cation, greater the value of Δ (CFSE)

C. In complex ion $[CoF_6]^{3-}$, F^- is a weak field ligand, so that $\Delta_{oct} < P$ (Pairing energy) and it is low spin complex

D. $\left[CoCl_2(NH_3)_2(en)\right]^+$ comples ion will have four different isomers.

Answer: A::B::D

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41. Which one of the following statement (s) is/are false ?

A. Weak ligand like F^-, Cl^- and OH^- usually form low spin complexes

B. Strong ligands like CN^- and NO_2^-, generally form high spin complexes

C. $[FeF_6]^{3-}$ is high spin complexes

D. $\left[Ni(CO)_4\right]$ is high spin complex

Answer: A::B::D

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Level Ii Lecture Sheet Exercise Ii Linked Comprehension Type Questions Passage I

1. Valence bond theory successfully explains the magnetic behaviour of complexes. The substances which contains unpaired electrons are paramagnetic and paramagnetic character increases as the number of unpaired electrons increases. Magnetic moment of a complex can be determined experimentally and by using formula $\sqrt{n(n+2)}$ and we can determine the number of unpaired electrons in it. This information is important in writing electronic structure of complex which in turn also useful in deciding the geometry of complex.

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

$$\underset{(I)}{\left[Ni(CN)_4\right]^{2-}} \qquad \underset{(II)}{\left[NiCl_4\right]^{2-}} \qquad \underset{(II)}{Ni(CO)_4} \qquad \underset{(IV)}{\left[Ni(H_2O)_6\right]^{2+}}$$

A. I only

B. II and IV only

C. II, III and IV

D. II and IV

Answer: D

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2. Valence bond theory successfully explains the magnetic behaviour of complexes. The substances which contains unpaired electrons are paramagnetic and paramagnetic character increases as the number of unpaired electrons increases. Magnetic moment of a complex can be determined experimentally and by using formula $\sqrt{n(n+2)}$ and we can determine the number of unpaired electrons in it. This information is important in writing electronic structure of complex which in turn also useful in deciding the geometry of complex.

The magnetic moment of complexes given below are in the order :

$Ni(CO)_4$	$\left[Mn(CN)_6\right]$
(I)	(II)
$\left[Cr(NH_3)_6\right]^{3+}$	$\left[CoF_6\right]^{3+}$
(I)	(II)

A. $I > II > III > IV$

B. $I < II < III < IV$

C. $IV > II > I > III$

D. $IV < II < I < III$

Answer: B

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3. Valence bond theory successfully explains the magnetic behaviour of complexes. The substances which contains unpaired electrons are paramagnetic and paramagnetic character increases as the number of unpaired electrons increases. Magnetic moment of a complex can be determined experimentally and by using formula $\sqrt{n(n+2)}$ and we can determine the number of unpaired electrons in it. This information is important in writing electronic structure of complex which in turn also useful in deciding the geometry of complex.

Which of the following are diamagnetic ?

1) $K_4[Fe(CN)_6]$ 2) $K_3[Cr(CN)_6]$ 3) $K_3[Co(CN)_6]$ 4) $K_2[Ni(CN)_4]$

A. 1, 2,& 4

B. 1, 3 & 4

C. 2 & 3

D. 1 & 4

Answer: B

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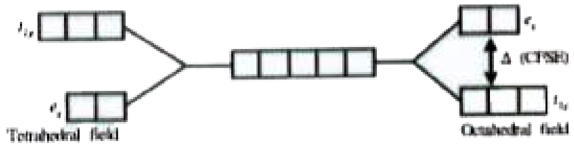
Level Ii Lecture Sheet Exercise Ii Linked Comprehension Type Questions Passage Ii

1. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two sets $t_{2g}\left(d_{xy}, d_{yz}, d_{xz}\right)$ and $e_g\left(d_{z^2}, d_{x^2-y^3}\right)$ are either stabilized or destabilized depending upon the nature of magnetic field. It can be expressed diagramatically as : Value of CFS depends upon nature of ligand and a spectro-chemical series has been made experiment-ally, for tetrahedral complexes Δ_i is about 4/9 times to Δ_0 (CFSE for octahedral complexes).



The energy lies in visible region and i.e., why electronic transition $t_{2_g} \Leftrightarrow e_g$ are responsible for colour. Such transitions are not possible with d^0 and d^{10} configuration.

The value of CFSE (Δ_a) for complexes given below follow the order:

$\left[Co(NH_3)_6\right]^{3+}$ $\left[Rh(NH_3)_6\right]^{3+}$ $\left[Ir(NH_3)_6\right]^{3+}$
(I) (II) (III)

A. $I < II < III$

B. $I > II > III$

C. $I < II > III$

D. I=II=III

Answer: A

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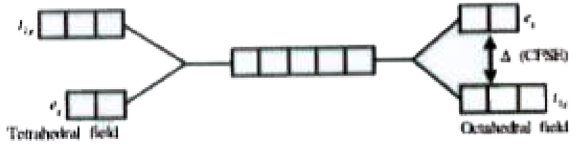
2. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two sets $t_{2g}(d_{xy}, d_{yz}, d_{xz})$ and $e_g(d_{z^2}, d_{x^2-y^3})$ are either stabilized or destabilized depending upon the nature of magnetic field. It can be expressed diagramatically as : Value of CFS depends upon nature of ligand and a spectro-chemical series has been made experiment-ally, for tetrahedral complexes Δ_i is about 4/9 times to Δ_0 (CFSE for octahedral complexes).



The energy lies in visible region and i.e., why electronic transition $t_{2_g} \Leftrightarrow e_g$ are responsible for colour. Such transitions are not possible with d^0 and d^{10} configuration.

Cr^{3+} form four complexes with four different ligands which are $\left[Cr(Cl)_6\right]^{3-}$, $\left[Cr(H_2O)_6\right]^{3+}$, $\left[Cr(NH_3)_6\right]^{3+}$ and $\left[Cr(CN)_6\right]^{3-}$. The order of CFSE (Δ_a) in these complexes is :

A.

$$\left[Cr(Cl)_6\right]^{3-} = \left[Cr(H_2O)_6\right]^{3+} = \left[Cr(NH_3)_6\right]^{3+} = \left[Cr(CN)_6\right]^{3-}$$

B.

$$\left[Cr(Cl)_6\right]^{3-} < \left[Cr(H_2O)_6\right]^{3+} < \left[Cr(NH_3)_6\right]^{3+} < \left[Cr(CN)_6\right]^{3-}$$

C.

$$\left[Cr(Cl)_6\right]^{3-} > \left[Cr(H_2O)_6\right]^{3+} > \left[Cr(NH_3)_6\right]^{3+} > \left[Cr(CN)_6\right]^{3-}$$

D.

$$\left[Cr(Cl)_6\right]^{3-} < \left[Cr(H_2O)_6\right]^{3+} = \left[Cr(NH_3)_6\right]^{3+} < \left[Cr(CN)_6\right]^{3-}$$

Answer: B

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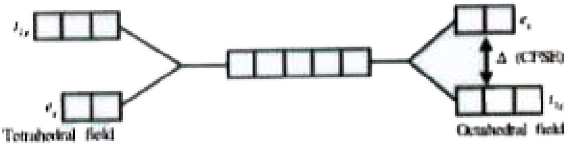
3. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two sets $t_{2g}\left(d_{xy}, d_{yz}, d_{xz}\right)$ and $e_g\left(d_{z^2}, d_{x^2-y^3}\right)$ are either stabilized or destabilized depending upon the nature of magnetic field. It can be expressed diagramatically as : Value of CFS depends upon nature of ligand and a spectro-chemical series has been made experiment-ally, for tetrahedral complexes Δ_i is about 4/9 times to Δ_0 (CFSE for octahedral complexes).



The energy lies in visible region and i.e., why electronic transition $t_{2_g} \Leftrightarrow e_g$ are responsible for colour. Such transitions are not possible with d^0 and d^{10} configuration.

For an octahedral complex, which of the following d'-electron configuration will give maximum CFSE?

A. High spin $d^6(-0.4)$

B. Low spin $d^4(-1.6)$

C. Low spin $d^5(-2.0)$

D. High spin $d^7(-0.8)$

Answer: C

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Level Ii Lecture Sheet Exercise Ii Linked Comprehension Type Questions Passage Iii

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

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

i) $K[Co(NO_2)_4(NH_3)_2]$ ii) $[Cr(ONO)_3(NH_3)_3]$

iii) $[Cr(NO_2)(NH_3)_5]_3[Co(NO_2)_6]_2$ iv) $Mg[Cr(NO_2)_5(NH_3)]$

A. $ii < i < iv < iii$

B. $i < ii < iii < iv$

C. $ii < i < iii < iv$

D. $iv < iii < ii < i$

Answer: A

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

The oxidation number, coordination number and magnetic moment in the following complex $Na_3\left[Cr(CN)_6\right]$ is :

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

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

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

D. 0,= +3, CN. = 6, MM. = $\sqrt{12}BM$

Answer: A

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

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

A. $[NiCl_4]^{2-}$, $\left[Ni(CN)_4\right]^{2-}$

B. $[CoF_6]^{3-}$, $\left[Co(NH_3)_6\right]^{3+}$

C. $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{2-}$

D. $\left[Cu(NH_3)_4\right]^{+}$, $\left[Ni(NH_3)_4\right]^{2+}$

Answer: B

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Level Ii Lecture Sheet Exercise Ii Linked Comprehension Type Questions Passage Iv

1. The central metal ion in the complex makes available a number of empty orbitals for the formation of co-ordinate bonds with suitable ligands. The inner d-orbitals or outer d-orbitals are involved. The empty hybrid orbitals of metal ion overlap with the filled orbitals of ligand to from metal ligand co-ordinate bonds. For co-ordination number 6 octahedral geometry and $sp^3, d^2 \text{ or } d^2sp^2$ hybridisation involved and for cordiantion number 4 tetrahedral geometry, square planar geometry and $sp^3. dsp^2$ hybridisation involved.

Hybridisation present in $\left[Cr(NH_3)_6\right]^{+3}$

A. sp^3d^2

B. sp^3

C. d^2sp^3

D. dsp^2

Answer: C

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2. The central metal ion in the complex makes available a number of empty orbitals for the formation of co-ordinate bonds with suitable ligands. The inner d-orbitals or outer d-orbitals are involved. The empty hybrid orbitals of metal ion overlap with the filled orbitals of ligand to from metal ligand co-ordinate bonds. For co-ordination number 6 octahedral geometry and $sp^3, d^2 \text{ or } d^2sp^2$ hybridisation involved and for cordiantion number 4 tetrahedral geometry, square planar geometry and $sp^3 . dsp^2$ hybridisation involved.

Type of complex formed in $\left[Fe(H_2O)_6\right]^{+3}$ ion

A. inner orbital complex

B. outer orbital complex

C. both a and b

D. none

Answer: B

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3. The central metal ion in the complex makes available a number of empty orbitals for the formation of co-ordinate bonds with suitable ligands. The inner d-orbitals or outer d-orbitals are involved. The empty hybrid orbitals of metal ion overlap with the filled orbitals of ligand to from metal ligand co-ordinate bonds. For co-ordination number 6 octahedral geometry and sp^3, d^2 or d^2sp^2 hybridisation involved and for cordiantion number 4 tetrahedral geometry, square planar geometry and $sp^3. dsp^2$ hybridisation involved.

Geometry of $[Ni(CN)_4]^{-2}$ ion is

A. tetrahedral

B. Octahedral

C. square planar

D. none.

Answer: C

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Level Ii Lecture Sheet Exercise Ii Linked Comprehension Type Questions Passage V

1. The stability of complex ion depend upon charge, size electronegativity of metal ion. Greater the charge of metal ion greater would be the stability. As size of metal ion decreases stability of metal ion increases complex ion more stable if chelating ligand present.

$Fe^{+3} + 6CN^{-} \Leftrightarrow \left[Fe(CN)_6\right]^{-3}, K_1$

$Fe^{+2} + 6CN^{-} \Leftrightarrow \left[Fe(CN)_6\right]^{-4}, K_2$: the value of K_1 and K_2 are

A. $1.8 \times 10^6, 1.2 \times 10^{31}$

B. $1.8 \times 10^6, 1.8 \times 10^6$

C. $1.2 \times 10^{31}, 1.2 \times 10^{31}$

D. $1.2 \times 10^{31}, 1.8 \times 10^6$

Answer: D

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2. The stability of complex ion depend upon charge, size electronegativity of metal ion. Greater the charge of metal ion greater would be the stability. As size of metal ion decreases stability of metal ion increases complex ion more stable if chelating ligand present.

Which is most correct order of stability

A. $Zn^{+2} > Cu^{+2} > Ni^{+2} > Co^{+2} > Fe^{+2} > Mn^{+2}$

B. $Zn^{+2} < Cu^{+2} < Ni^{+2} < Co^{+2} < Fe^{+2} < Mn^{+2}$

C. $Zn^{+2} = Cu^{+2} > Ni^{+2} > Co^{+2} > Fe^{+2} > Mn^{+2}$

D. $Zn^{+2} > Cu^{+2} > Ni^{+2} = Co^{+2} > Fe^{+2} > Mn^{+2}$

Answer: A

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3. The stability of complex ion depend upon charge, size electronegativity of metal ion. Greater the charge of metal ion greater would be the stability. As size of metal ion decreases stability of metal ion increases complex ion more stable if chelating ligand present.

Which increases stability of complex ion

A. greater charge on metal ion

B. less size of metal ion

C. chelating ligand

D. all the above

Answer: D

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Level Ii Lecture Sheet Exercise Ii Linked Comprehension Type Questions Passage Vi

1. The d-orbitals participating in hybridisation of metal atom may be from the n & (n-1) shell. This depends on the nature of metal and nature of ligand. The complexes involving the inner d-level (inner orbital complexes) results when the ligand is a powerful (or) strong ligand results in a diamagnetic (or) low spin complexes. A weak ligand usually results in the formation of outer orbital complex (or) high spin complex.

The hybridisation of Cu in $\left[CuCl_4\right]^{2-}$ & $\left[Cu(NH_3)_4\right]^{2+}$ are respectivly

A. dsp^2, dsp^2

B. sp^3, dsp^2

C. sp^3, sp^3

D. dsp^2, sp^3

Answer: B

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2. The d-orbitals participating in hybridisation of metal atom may be from the n & (n-1) shell. This depends on the nature of metal and nature of ligand. The complexes involving the inner d-level (inner orbital complexes) results when the ligand is a powerful (or) strong ligand results in a diamagnetic (or) low spin complexes. A weak ligand usually results in the formation of outer orbital complex (or) high spin complex.

Number of unpaired electrons present in $\left[Fe(CN)_6\right]^{4-} \& \left[Fe(H_2O)_6\right]^{2+}$ are respectively.

A. 4,4

B. 0,0

C. 0,4

D. 2,4

Answer: C

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3. The d-orbitals participating in hybridisation of metal atom may be from the n & (n-1) shell. This depends on the nature of metal and nature of ligand. The complexes involving the inner d-level (inner orbital complexes) results when the ligand is a powerful (or) strong ligand results in a diamagnetic (or) low spin complexes. A weak ligand usually results in the formation of outer orbital complex (or) high spin complex.

Among the following sets, the one having the same geometry and same magnetic property for both complexes is

A. $[Mn(CN)_6]^{3-} \& [MnF_e]^{3-}$

B. $[Co(CN)_6]^{3-} \& [CoF_6]^{3-}$

C. $[Fe(CN)_6]^{4-} \& [Fe(H_2O)_6]^{2+}$

D. $[Cr(CN)_6]^{3-} \& [Cr(NH_3)_6]$

Answer: D

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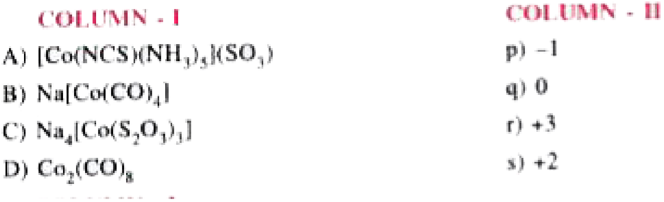
Level Ii Exercise Iii Match The Following Questions

1. Match Column-I (Compounds) with Column - II (Oxidation states of Co) and select the correct answer using the codes given below the Columns



COLUMN - I	COLUMN - II
A) $[Co(NCS)(NH_3)_5](SO_3)$	p) -1
B) $Na[Co(CO)_4]$	q) 0
C) $Na_4[Co(S_2O_3)_3]$	r) $+3$
D) $Co_2(CO)_8$	s) $+2$

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2. Match Column-I (Compounds) with Column - II (Oxidation states of Co) and select the correct answer using the codes given below the Columns

COLUMN - I	COLUMN - II
A) EDTA	p) diamagnetic
B) $Ni(CO)_4$	q) Bidentate
C) low spin complex	r) Hexa dentate
D) Glycine	s) $K_4[Fe(CN)_6]$

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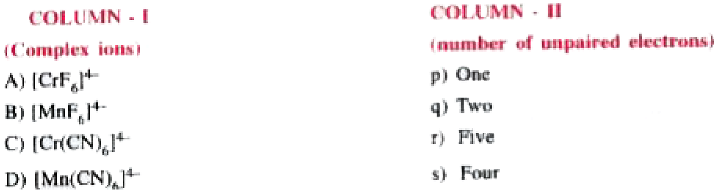
3. Match Column-I (Complex ions) with Column-II (Number of unpaired electrons) and select the correct answer using the codes given below the Columns :



COLUMN - I (Complex ions)	COLUMN - II (number of unpaired electrons)
A) $[CrF_6]^{4-}$	p) One
B) $[MnF_6]^{4-}$	q) Two
C) $[Cr(CN)_6]^{4-}$	r) Five
D) $[Mn(CN)_6]^{4-}$	s) Four

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4. Match Column - 1 (Complexes) with Column - II (Hybridization of central atom and select the correct answer using the codes given below the Columns :

COLUMN - I	COLUMN - II
A) $Ni(CO)_4$	p) sp^3
B) $[Ni(CN)_4]^{2-}$	q) dsp^2
C) $[Fe(CN)_6]^{4-}$	r) sp^3d^2
D) $[MnF_6]^{4-}$	s) d^2sp^3

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5. Match Column with Column-II and select the correct answer using the codes given below the Columns.

COLUMN - I (Complex)	COLUMN - II (Geometry)
A) $[Ni(CN)_4]^{2-}$	p) Tetrahedral
B) $[ZnCl_4]^{2-}$	q) Tetragonal
C) $[Co(en)_3]^{3+}$	r) Square planar
D) $[Cu(NO_2)_6]^{4-}$	s) Octahedral

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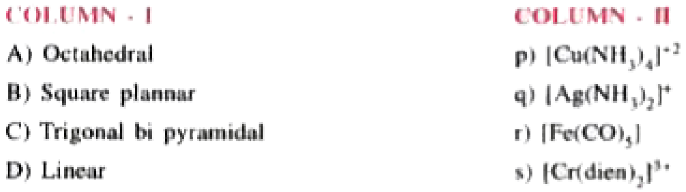
6. Match Column with Column-II and select the correct answer using the codes given below the Columns.



COLUMN - I	COLUMN - II
A) Octahedral	p) $[Cu(NH_3)_4]^{+2}$
B) Square plannar	q) $[Ag(NH_3)_2]^{+}$
C) Trigonal bi pyramidal	r) $[Fe(CO)_5]$
D) Linear	s) $[Cr(dien)_2]^{3+}$

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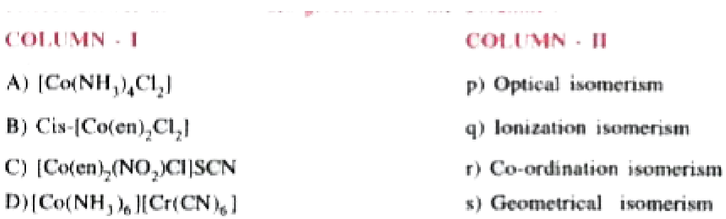
7. Match Column (Co-ordination compounds) with Column-II (Type of isomerism) and select the correct answer using the codes given below the Columns :



COLUMN - I	COLUMN - II
A) $[Co(NH_3)_4Cl_2]$	p) Optical isomerism
B) Cis-$[Co(en)_2Cl_2]$	q) Ionization isomerism
C) $[Co(en)_2(NO_2)Cl]SCN$	r) Co-ordination isomerism
D) $[Co(NH_3)_6][Cr(CN)_6]$	s) Geometrical isomerism

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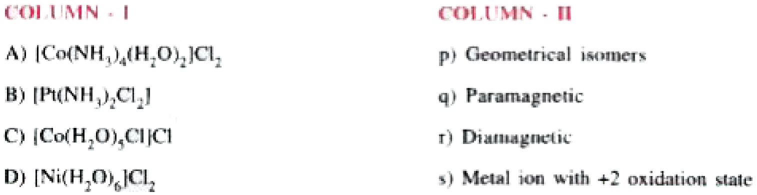
8. Match the complexes in Column - I with their properties listed in Column - II. Indicate your answer by darkening the appropriate bubbles of the 4×4 matrix given in the ORS.



COLUMN - I	COLUMN - II
A) $[Co(NH_3)_4(H_2O)_2]Cl_2$	p) Geometrical isomers
B) $[Pt(NH_3)_2Cl_2]$	q) Paramagnetic
C) $[Co(H_2O)_5Cl]Cl$	r) Diamagnetic
D) $[Ni(H_2O)_6]Cl_2$	s) Metal ion with +2 oxidation state

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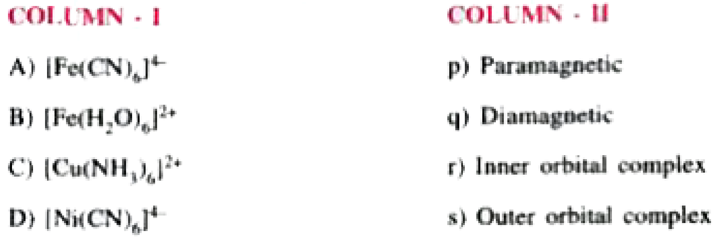
9. Match the complexes in Column - I with their properties listed in Column - II.



COLUMN - I	COLUMN - II
A) $[Fe(CN)_6]^{4-}$	p) Paramagnetic
B) $[Fe(H_2O)_6]^{2+}$	q) Diamagnetic
C) $[Cu(NH_3)_6]^{2+}$	r) Inner orbital complex
D) $[Ni(CN)_6]^{4-}$	s) Outer orbital complex

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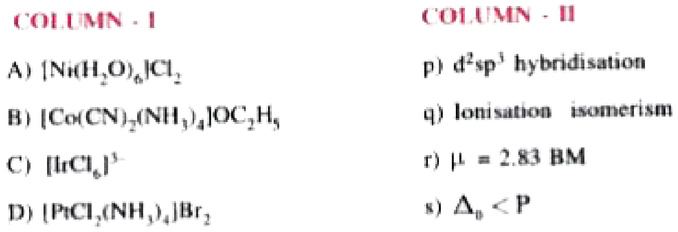
10. Match the complexes in Column - I with their properties listed in Column - II.



COLUMN - I	COLUMN - II
A) $[Ni(H_2O)_6]Cl_2$	p) d^2sp^3 hybridisation
B) $[Co(CN)_2(NH_3)_4]OC_2H_5$	q) Ionisation isomerism
C) $[IrCl_6]^{3-}$	r) $\mu = 2.83$ BM
D) $[PtCl_2(NH_3)_4]Br_2$	s) $\Delta_0 < P$

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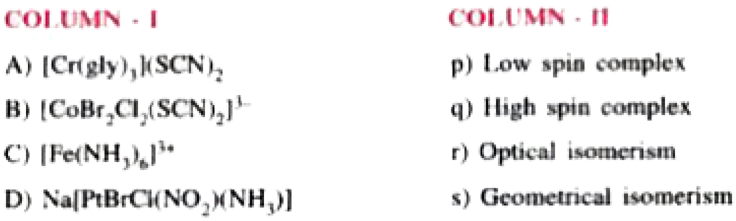
11. Match the complexes in Column - I with their properties listed in Column - II. Indicate your answer by darkening the appropriate bubbles of the 4 x 4 matrix given in the ORS.



COLUMN - I	COLUMN - II
A) $[Cr(gly)_3](SCN)_2$	p) Low spin complex
B) $[CoBr_2Cl_2(SCN)_2]^{3-}$	q) High spin complex
C) $[Fe(NH_3)_6]^{3+}$	r) Optical isomerism
D) $Na[PtBrCl(NO_2)(NH_3)]$	s) Geometrical isomerism

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12. The primary valency of the central transition metal ion in a complex compound $(Cr(NH_3)_4Cl_2]Cl$

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

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Level Ii Exercise Iv Integer Answer Type Questions

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

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2. What is the co-ordination number of Cr in $K_3\left[Cr(\text{ox})_3\right]$?

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3. The number of chloride ions which would be precipitated, when $CrCl_3.4NH_3$ is treated with silver nitrate solution

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4. Geomerical isomerism is found in co-ordination compounds having minimum co-ordination number.

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5. The number of unpaired electrons in d^7, low spin, octahedral complex is

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

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7. The number of unpaired electron in the complex ion $\left[CoF_6\right]^{3-}$ is

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8. The possible number of optical isomers in $\left[Co(en)_2Cl_2\right]^+$ are

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Practice Sheet 1 Single Or More Than One Option Questions General

1. The pair in which both species have iron is

A. Nitrogenase, cytochromes

B. Carboxypeptidase, haemoglobin

C. haemoglobin, nitrogenase

D. haemoglobin, cytochromes

Answer: D

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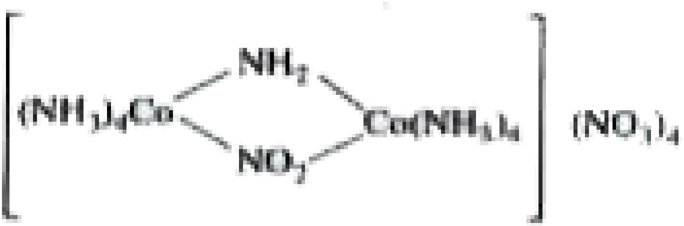

2. IUPAC name of the above compound is

A. Tetraamminecobalt(III) $-\mu$- amido $-\mu-$ nitrotetraammine cobalt(II) nitrate

B. Same cobalt (III) nitrate

C. μ- amido $-\mu-$ nitrobis tetraamine cobalt (III) nitrate

D. Both a and c

Answer: D

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3. Mixture 'X' containing 0.02 mole of $\left[Co(NH_3)_5SO_4\right]Br$ and 0.02 mole of $\left[Co(NH_3)_5Br\right]SO_4$ was dissolved in water to get 2 lit of solution.

If 1 lit of X+ execss $AgNO_3 \rightarrow Y$ mole of ppt. and

1 lit of X+ excess $BaCl_2 \rightarrow Z$ mole of ppt. Number of mole of Y and Z are

A. 0.01, 0.01

B. 0.02, 0.01

C. 0.01, 0.02

D. 0.02, 0.02

Answer: A

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4. Which of the following act as a ligand but does not have any lone pair of electrons ?

A. NH_3

B. C_2H_4

C. en

D. NO^+

Answer: B

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5. The number of CO ligands that can be attached to Fe(Z=26) on the basis of EAN theory are

A. 5

B. 6

C. 10

D. 12

Answer: A

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6. Ferrous sulphate forms Turn bull's blue with

A. KCN

B. NH_4SCN

C. $K_3\left[Fe(CN)_6\right]$

D. $K_4[Fe(CN_6)]$

Answer: C

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7. A complex cation is formed by ppt in some oxidation state) with ligands (in proper number so that CN of ppt becomes six). Which of the following can be its correct IUPAC name?

A. Diammine ethylene diamine dithiocyanato-s-platinum (II)

B. Diammine ethylene diamine dithiocyanato-s-platinum (IV) ion

C. Diammine ethylene diamine dithiocyanato-s-platinum (III) ion

D. Diamminebis (ethylene diamine) dithiocyanato-s-platinum (IV) ion

Answer: B

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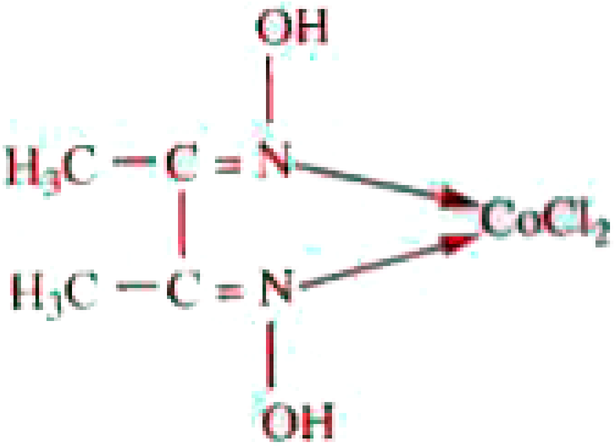
8. The correct IUPAC name of the complex is



A. a. dichlorido dimethylglyoximato cobalt (II)

B. b. bis (dimethylglyoxime) dichlorocobalt (II)

C. c. dimethyl glyoxime cobalt (II) chloride

D. d. dichloro dimethyl glyoxime-N, N-cobalt(II)

Answer: D

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9. Incerasing order of EAN of the metals in $\left[Ni(CN)_4\right]^{2-}$, $\left[Fe(CN)_6\right]^{3-}$ and $\left[Cu(CN)_4\right]^{3-}$ is

A. $\left[Ni(CN)_4\right]^{2-} < \left[Fe(CN)_6\right]^{3-} < \left[Cu(CN)_4\right]^{3-}$

B. $\left[Ni(CN)_4\right]^{2-} < \left[Fe(CN)_6\right]^{3-} = \left[Cu(CN)_4\right]^{3-}$

C. $\left[Ni(CN)_4\right]^{2-} < \left[Cu(CN)_4\right]^{3-} < \left[Fe(CN)_6\right]^{3-}$

D. $\left[Cu(CN)_4\right]^{2-} < \left[Fe(CN)_6\right]^{3-} < \left[Ni(CN)_4\right]^{2-}$

Answer: A

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10. 0.1M solution of which of the following compounds will have the lowest freezing point ?

A. $FeSO_4.\,(NH_4)_2SO_4.6H_2O$

B. $\left[Co(Cl)(NH_3)_5\right]Cl_2$

C. $K_3\left[Fe(CN)_6\right]$

D. $[CrCl_2(NH_3)]Cl$

Answer: A

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11. Among the following the chelate complexes are

A. Bis (dimethyl glyoximate) nickel (II)

B. Potassium ethylenediaminetetracyanato chromate (III)

C. Tetrammine dicyanato coball (III) nitrate

D. Trans-diglycinato palladium (II)

Answer: A::B::D

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12. In which of the following the central atom is present in its highest oxidation state?

A. $\left[Fe(CN)_6\right]^{-4}$

B. $[NiCl_4]^{2-}$

C. $\left[Cr(H_2O)_6\right]^{3+}$

D. $\left[Se(H_2O)_6\right]^{+3}$

Answer: D

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13. Given chemical formula and name, which are correctly matched ?

A. $K[Pt(NH_3)Cl_5]$ - Potassium amminepentachloroplatinate (IV)

B. $\left[Ag(CN)_2\right]^{-}$ - dicyanoargentate (I) ion

C. $K_3\left[Cr(C_2O_4)_3\right]$ - Potassium trioxalato chromate (III)

D. $Na_2[Ni(EDTA)]$ - Sodium ethylene diamine tetracetato nickel (I)

Answer: A::B::C

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14. The compounds that gives white precipitates with $AgNO_3$.

A. $[Co(NH_3)_6]Cl_3$

B. $[Co(NH_3)_3Cl_3]$

C. $K_2[Pt(en)_2Cl_2]$

D. $[Fe(en)_3]Cl_3$

Answer: A::D

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15. Iron cannot form complexes with ammonia because

A. In alkaline solution, iron salts are precipitated as their hydroxides which are insoluble in excess of alkali

B. In acid solutions, NH_3 cannot form complex because of protonation it changes to NH_4^+ ion which have no donar site.

C. In the presence of ammonia, iron nitrides are formed

D. In solution aqua complexes of iron salts are produced which protects the ions of iron.

Answer: A::B

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16. In complexes of gold, the coordination number of gold may be

A. 6

B. 4

C. 5

D. 2

Answer: B::D

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Practice Sheet 1 Linked Comprehension Type Questions Passage 1

1. A complex compound of cobalt contains five NH_3 molecules. One nitro group and two chloride ions for one Co atom. One mole of this compound produces three mole ions in aq. solution. On reacting with excess of $AgNO_3$ solution, two moles of AgCl get precipitated.

IUPAC name of the complex compound is

A. pentaammine nitrito-N-cobalt (III) chloride

B. pentaaminenitrito-N-cobalt (III) chloride

C. pentaamminenitrito-N-cobalt (III) chloride

D. pentamine chlorido cobalt (II) nitrite

Answer: C

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2. A complex compound of cobalt contains five NH_3 molecules. One nitro group and two chloride ions for one Co atom. One mole of this compound produces three mole ions in aq. solution. On reacting with excess of $AgNO_3$ solution, two moles of AgCl get precipitated.

The formula of the complex compound is

A. $[Co(NH_3)_4NO_2Cl](NH_3)Cl$

B. $[Co(NH_3)_5Cl]Cl(NO_2)$

C. $[Co(NH_3)_5(NO_2)Cl_2$

D. $[Co(NH_3)_5][(NO)_2Cl_2]$

Answer: C

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3. A complex compound of cobalt contains five NH_3 molecules. One nitro group and two chloride ions for one Co atom. One mole of this compound produces three mole ions in aq. solution. On reacting with excess of $AgNO_3$ solution, two moles of AgCl get precipitated.

EAN, of central atom of the complex is

A. 35

B. 36

C. 37

D. 54

Answer: B

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Practice Sheet 1 Linked Comprehension Type Questions Passage Ii

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

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

i) $K\left[Co(NO_2)_4(NH_3)_2\right]$ ii) $\left[Cr(ONO)_3(NH_3)_3\right]$

iii) $\left[Cr(NO_2)(NH_3)_5\right]_3\left[Co(NO_2)_6\right]_2$ iv) $Mg\left[Cr(NO_2)_5(NH_3)\right]$

A. $ii < iv < i < iii$

B. $i < ii < iii < iv$

C. $ii < i < iii < iv$

D. $iv < iii < ii < i$

Answer: A

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2. Complex compounds are molecular compounds which retain their identities even when dissolved in water. They donot give all the simple ions in solution but instead finish complex ions. The structure, magnetic property, colour and electrical properties of complex are explained by various theories

The Ox.No, CN and magnetic moment in the following complex is $\left[Cr(C_2O_4)_2(NH_3)_2\right]^-$

A. $+3, 6\sqrt{15}BM$

B. $-1, 6\sqrt{15}BM$

C. $+3, 6\sqrt{3}BM$

D. $+3, 6\sqrt{12}BM$

Answer: A

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

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

A. $[NiCl_4]^{-2}$, $\left[Ni(CN)_4\right]^{-2}$

B. $[CoF_6]^{-3}$, $\left[Co(NH_3)_6\right]^{+3}$

C. $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{-2}$

D. $\left[Cu(NH_3)_4\right]^{+}$, $\left[Ni(NH_3)_4\right]^{+2}$

Answer: B

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Practice Sheet 1 Match The Following Questions

1. Match the following columns

COLUMN - I	COLUMN - II
A) Ferrocene	p) Iron
B) $Mn_2(CO)_{10}$	q) Cobalt
C) Vitamin B_{12}	r) Metal-Metal bonding
D) Heame	s) Sandwich structure

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2. Match the following columns

COLUMN - I EAN	COLUMN - II Complex
A) 33	p) $[Cu(NH_3)_4]SO_4$
B) 34	q) $K_4[Fe(CN)_6]$
C) 35	r) $K_3[Cr(C_2O_4)_3]$
D) 36	s) $K_2[Ni(CN)_4]$

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Practice Sheet 1 Integer Answer Type Questions

1. Number of dative bonds in the complex $CoCl_3.5NH_3$ is

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2. The value of x in the complex $H_xCo(CO)_4$ on the basis of EAN rule is

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3. No. of ions produced by dissolving $PtCl_4.2NH_3$ in aqueous media is

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4. The EAN of a metal carbonyl, $M(CO)_x$ is 36. The atomic number of metal is 24. The value of x is

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5. The sum of coordination No. and oxidation number of M in the complex $[M(NH_3)_5SO_4]Cl$ is

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6. Maximum number of dative bonds that can be formed by EDTA

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Practice Sheet 2 Single Or More Than One Option Questions Isomerism

1. The complex, $[Co(NH_3)_4Cl_2]^+$ is known to exist in two different coloured forms. This is due to

A. ionisation isomerism

B. optical isomerism

C. geometrical isomerism

D. linkage isomerism

Answer: C

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2. Theoritically, the number of geometrcal isomers expected for octehedral complex, [Mabedef] is

A. 0

B. 15

C. 12

D. 30

Answer: B

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3. Both geometrical and optical isomerisms are shown by

A. $\left[Co(en)_2Cl_2\right]^+$

B. $\left[Co(NH_3)_5Cl\right]^{2+}$

C. $\left[Co(NH_3)_4Cl_2\right]^+$

D. $[Cr(Ox_3)]^{3-}$

Answer: A

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4. Which one of the following exhibit chirality?

A. $[Cr(OX_3)]^{3-}$

B. $Cis-[PtCl_2(en)]$

C. $Cis-\left[RhCl_2(NH_3)_2\right]^{-1}$

D. Mer- $\left[Co(NO_2)_3(\text{trien})\right]$

Answer: A

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5. For the emperical formula $Pt(NH_3)_2Cl_2$, the no. of possible coordination isomers would be (ON of pt is +2 in all all isomeric forms)

A. 1

B. 2

C. 3

D. 4

Answer: B

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6. Which of the following can show optical isomerism

A. $FeSO_4.7H_2O$

B. $K_3\left[Cr(C_2O_4)_3\right]$

C. $K_3\left[Fe(CN)_6\right]$

D. $\left[Cr(H_2O)_6Cl_3$

Answer: B

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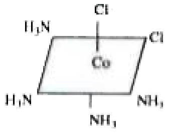
7. Consider the following arrangements of the octahedral complex ion $\left[Co(NH_3)_4Cl_2\right]^+$



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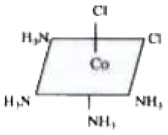
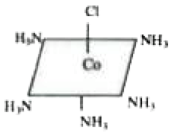
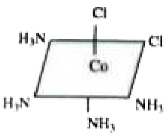


(II)



(III)



(IV)

which of the following statements is incorrect regarding these structure.

A. I, II are enantiomers

B. II, III are trans and Cis isomers respectively

C. III, IV are trans and Cis isomers respectively

D. II, IV have identical structure

Answer: A

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8. The tris (Ethylene diamine) Cobalt (III) cation $\left[Co(en)_3\right]^{3+}$ can have

A. Three stereo isomers, all chiral and optically active

B. Two chiral stereo isomers (enantiomers)

C. Three stereo isomers all chiral

D. Two stereo isomers both achiral

Answer: B

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9. The number of linkage isomers for the compound $K_2[Cu(CN)_2(NCS)_2]$ are

A. 4

B. 6

C. 16

D. 9

Answer: A

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10. Which of the following isomerism is not exhibited by $[Cr(NH_3)_2(H_2O)_2Cl_2]Cl$

A. Ionisation

B. Geometrical

C. Hydrate

D. Optical

Answer: A

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11. The following complexes which can form same no. of geometrical isomers are

A. $[CoCl_2Br_2]^{-2}$

B. $\left[Rh(en)_3\right]^{3+}$

C. $\left[Cr(en)_2Br_2\right]$

D. $[Pt(en)Cl_2]$

Answer: A::C::D

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12. The compound that exhibit geometrical isomerism is

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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13. Which of the following statement is false.

A. In $[PtCl_2(NH_3)_4]^{+2}$ complex ion, the cis-form is optically inactive

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

C. In $[\text{Mabed}]^{n\pm}$ letrahedral complexes, optical isomerism cannot be observed

D. In $[\text{Mabed}]^{n\pm}$ square planar complexes, optical isomerism can be observed

Answer: A::C::D

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14. Which of the following statement is true about the complex $\left[CrCl_3(OH)_2(NH_3)\right]^{-2}$ ion ?

A. It has 3 geometrical isomers

B. Only one space isomer is optically active and remaining are inactive

C. There are total four space isomers

D. The magnetic moment of complex ion is 3.89 BM

Answer: A::D

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15. Which of the following are coordination isomers of $\left[Co(NH_3)_6\right]\left[Cr(CN)_6\right]$

A. $\left[Cr(NH_3)_6\right]\left[Co(CN)_6\right]$

B. $\left[Cr(NH_3)_4(CN)_2\right]\left[Co(CN)_4(NH_3)_2\right]$

C. $\left[Cr(NH_3)_3(CN)_3\right]\left[Co(NH_3)_3(CN)_3\right]$

D. none

Answer: A::B

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16. Regarding tetraamminedithiocyanato-S cobalt tris (oxalato) Cobaltate (III) the correct statements are

A. Formula of complex in $\left[Co(SCN)_2(NH_3)_3(CN)_3\right]$

B. It is a chelating complex and show linkage isomerism

C. It shows optical isomerism

D. It shows geometrical isomerism

Answer: B::C::D

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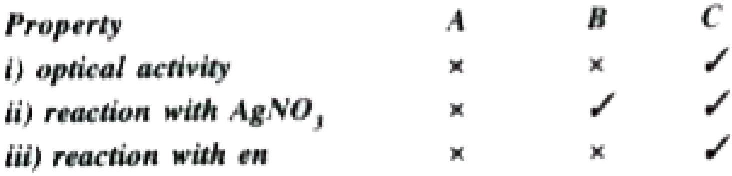
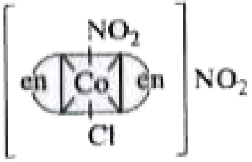
Practice Sheet 2 Linked Comprehension Type Questions Passage 1

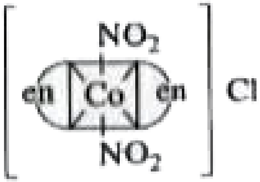
1. A compound $\left[Co(en)_2(NO_2)_2\right]Cl$ exists in different isomeirc forms with their characterstic properties as given below

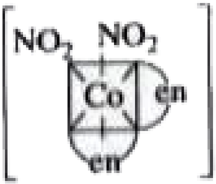


Property	A	B	C
i) optical activity	×	×	✓
ii) reaction with $AgNO_3$	×	✓	✓
iii) reaction with en	×	×	✓

Structure of 'A' is

A. 

B. 

C. 

D. none

Answer: A

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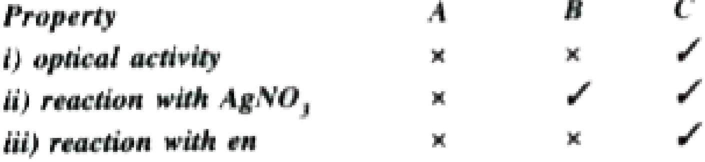
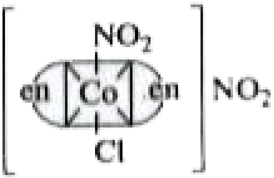
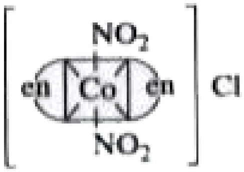
2. A compound $[Co(en)_2(NO_2)_2]Cl$ exists in different isomeirc forms with their characterstic properties as given below

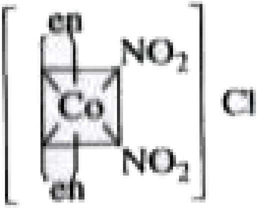


Property	A	B	C
i) optical activity	×	×	✓
ii) reaction with $AgNO_3$	×	✓	✓
iii) reaction with en	×	×	✓

Structure of 'B' is

A. 

B. 

C. 

D. none

Answer: B

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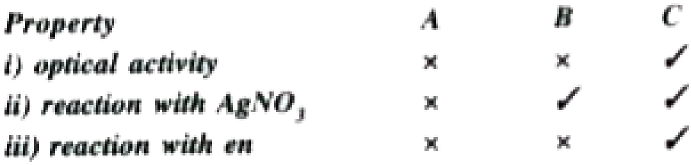
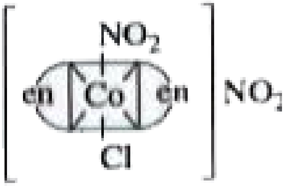
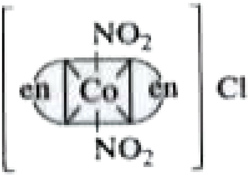
3. A compound $\left[Co(en)_2(NO_2)_2\right]Cl$ exists in different isomeirc forms with their characterstic properties as given below

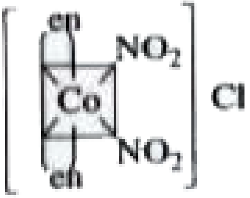


Property	*A*	*B*	*C*
i) optical activity	×	×	✓
ii) reaction with $AgNO_3$	×	✓	✓
iii) reaction with en	×	×	✓

Structure of 'C'

A.


B.


C.


D. none

Answer: C

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Practice Sheet 2 Linked Comprehension Type Questions Passage Ii

1. Complex compounds can exhibit isomerism like structural and stereo. The complexes containing coordination No. 1, 2, 3 cannot exhibit geometrical isomerism. Geometrical and optical isomerism is common in the complex having coordination number 4 and 6 Ma,b, shows facial and meridonial isomerism.

Number of geometrical isomers posible for complex $[Pt(NH_3)(Py)(Cl)(Br)]$ is

A. 2

B. 3

C. 1

D. 4

Answer: B

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2. Complex compounds can exhibit isomerism like structural and stereo. The complexes containing coordination No. 1, 2, 3 cannot exhibit geometrical isomerism. Geometrical and optical isomerism is common in the complex having coordination number 4 and 6 Ma,b, shows facial and meridonial isomerism.

$\left[Co(NH_3)_5(NO_2)\right]Cl_2$ and $\left[Co(NH_3)_5ONO\right]Cl_2$ are

A. linkage isomers

B. ionisation isomers

C. coordinate isomers

D. geometrical isomers

Answer: A

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3. Complex compounds can exhibit isomerism like structural and stereo. The complexes containing coordination No. 1, 2, 3 cannot exhibit geometrical isomerism. Geometrical and optical isomerism is common in the complex having coordination number 4 and 6 Ma,b, shows facial and meridonial isomerism.

The two compounds pentam mine sulphato cobalt(III) bromide and Pentaammine sulphato cobalt (III) chloride represent

A. linkage isomerism

B. ionisation isomerism

C. coordination isomerism

D. no isomerism

Answer: D

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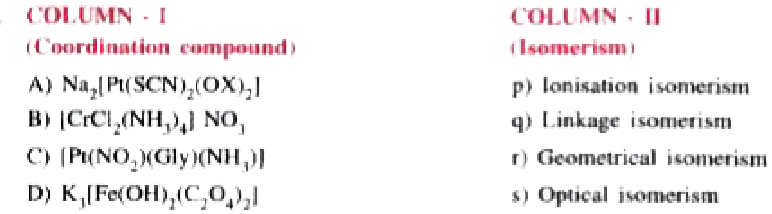
Practice Sheet 2 Match The Following Questions

1. Match the following columns



COLUMN - I (Coordination compound)	COLUMN - II (Isomerism)
A) $Na_2[Pt(SCN)_2(OX)_2]$	p) Ionisation isomerism
B) $[CrCl_2(NH_3)_4]\ NO_3$	q) Linkage isomerism
C) $[Pt(NO_2)(Gly)(NH_3)]$	r) Geometrical isomerism
D) $K_3[Fe(OH)_2(C_2O_4)_2]$	s) Optical isomerism

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2. Match the following columns

COLUMN - I	COLUMN - II
A) $Pt[(NH_2)_3Cl_2]$	p) Ionisation isomerism
B) $[Co(en)_3]^{3-}$	q) Geometrical isomerism
C) $[Co(NH_3)_3(NO_2)_3]$	r) Optical isomerism
D) $[Co(NH_3)_5Br]Cl$	s) Facial-meridonial isomerism

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3. The number of isomers possible for square planar complex $K_2[PdClBr_2SCN]$ are

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4. Number of isomers possible for $\left[Co(en)_2Cl(NO_2)\right]Cl$ are

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5. Find out maximum number of geometrical isomers theoritically possible for an actaheral complex of formula $\left[Pt(en)(NH_3)_2Cl_2(en)^+\right]$ are

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6. No. of isomers of $\left[Co(NH_3)_2Cl_2(en)\right]^+$ are

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7. No. of geometrical isomers of $\left[RhCl(CO)(PPh_3)(NH_3)\right.$ are

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8. The possible no. of coordination isomers of $\left[Cr(NH_3)_6\right]\left[Co(CN)_6\right]$ is

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Practice Sheet 3 Single Or More Than One Option Questions

1. The coordination number and oxidation number of 'x' in the following, Compound $\left[x(NH_3)_5(SO_4)\right]Cl$ will be

A. 10 and 3

B. 2 and 6

C. 6 and 3

D. 6 and 4

Answer: C

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2. The ligand called π-acid is

A. Co

B. NH_3

C. $C_2O_4^-$

D. ethylene diamine

Answer: A

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3. In $Fe(CO)_5$, Fe-C bond possess

A. π- character only

B. $sigmma$ character only

C. ionic character only

D. both $sigmma$ and π character

Answer: D

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4. The hybridisation of central metal ion and shape of Wilkinson's catalyst is

A. dsp^2, square planar

B. sp^3, tetrahedral

C. d^2sp^3, octahedral

D. dp^3d, trigonal bipyramidal

Answer: A

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5. Which of the following has dodechahedral geometry

A. $[ReH_9]^{2-}$

B. $[ZF_7]^{3-}$

C. $[Mo(CN)_8]^{4+}$

D. $[UF_8)]^{3-}$

Answer: C

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6. Which of the following organometallic compound in $sigmma$ and π bonded

A. $\left[Fe(\eta^5 - C_5H_5)_2\right.$

B. $[PtCl_3(\eta^2 - C_2H_4)]$

C. $[Co(CO)_5NH_3]^{2+}$

D. $Al(CH_3)_3$

Answer: C

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7. All the following complex ions are found to be paramagnetic

$P = [FeF_6]^{3-}$ $Q = [CoF_6]^{3-}$ $R = \left[V(H_2O)_6\right]^{3+}$ $S = \left[T:(H_2O)_6\right]^{3+}$

The correct order of their paramagnetic moment (spin only) is

A. $P > Q > R > S$

B. $P < Q < R < S$

C. P=Q=R=S

D. $P > R > Q > S$

Answer: A

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8. Which of the following statements in most likely to be incorrect

A. $Ti(NO_3)_4$ is a colourless compound

B. $\left[Cu(NC.\,CH_3)_4\right]^{2+}$ is a colourless compound

C. $\left[Cr(NH_3)_6\right]^{3+}3Cl^-$ is a coloured compound

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

Answer: D

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9. What will be the theoritical value of spin only magnetic moment when $Fe(SCN)_3$ reacts with a solution containing F ion to yield a complex

A. 2.83 BM

B. 3.87 BM

C. 5.92 BM

D. 1.73 BM

Answer: C

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10. Among the following, the species with tetrahedral geometry ?

A. $\left[Pd(CN)_4\right]^{2-}$

B. $\left[Ni(CN)_4\right]^{2-}$

C. $[PdCl_4]^{2-}$

D. $[NiCl_4]^{2-}$

Answer: D

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11. Which of the following statements are correct about stability of chelates ?

A. As the no. of rings in complex increases, stability of chelate also increases

B. A chelate having five memberd ring on more stable if it contains double bonds

C. A chelate having six memberd ring in more stable if it does not contain double bonds

D. Chelating ligands are atleast bidentate ligands

Answer: A::D

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12. Which of the following are paramagnetic

A. $[NiCl_4]^{2-}$

B. $\left[Ni(NH_3)_4\right]^{2+}$

C. $[MnCl_4]^{2-}$

D. $[CuCl_4]^{2-}$

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

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13. Which of the following statements about $Fe\left[(H_2O)_5NO\right]^{2-}$ are correct ?

A. O.S of Fe is +1

B. C.N. of Fe is 6

C. change of NO is +1

D. O.S. of Fe is +2

Answer: A::B::C

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

A. it is a low spin complex

B. it is diamagnetic

C. it shows geometrical isomerism

D. it does not exhibit any isomerism

Answer: A::B

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15. The correct statements among the following are.

A. The complexes $[NiCl_4)^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the magnetic propertic

B. The complexes $[NiCl_4]^{2-}$ and $Ni(CN)_4\Big]^{2-}$ differ in the geometry

C. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in primary valencies of nickel

D. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the state of hybridisation

Answer: A::B::D

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16. Among the following, the ions having same magnetic moment are

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

B. $[Sc(H_2O)_6]^{3+}$

C. VO^{2+}

D. $[Mn(H_2O)_6]^{3+}$

Answer: A::C

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Practice Sheet 3 Linked Comprehension Type Questions Passage 1

1. $\underset{(aq)}{C}o^{2+} + \underset{(aq)}{S}CN^{-} \rightarrow$ complex (a)

$\underset{(aq)}{N}i^{2+} + dmg \xrightarrow{NH4OH}$ complex (y)

The CN of Co, Ni in comp,exes (x) & (y) are four

The geometry of complex (x) & (y) are respectively

A. Tetrahedral & square planar

B. both tetrahedral

C. Square planar, tetrahedral

D. both square planar

Answer: B

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2. $\underset{(aq)}{C}o^{2+} + \underset{(aq)}{S}CN^{-} \rightarrow$ complex (a)

$\underset{(aq)}{N}i^{2+} + dmg \xrightarrow{NH4OH}$ complex (y)

The CN of Co, Ni in comp,exes (x) & (y) are four

Select the correct statements for the complexes 'x' and 'y'

A. ‘x' in paramagnetic with two unpaired e^-

B. y' is diamagnetic with intermolecular H-bonding

C. x' is paramagnetic with 3 unpaired e" and 'y' is diamagnetic

D. x' and 'y' both are diamagnetic

Answer: A

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3. $\underset{(aq)}{Co^{2+}} + \underset{(aq)}{SCN^-} \rightarrow$ complex (a)

$\underset{(aq)}{Ni^{2+}} + dmg \xrightarrow{NH4OH}$ complex (y)

The CN of Co, Ni in comp,exes (x) & (y) are four

The geometry of $[NiCl_4]^{-2}$ and $\left[NiPph_3)_2Cl_2\right]$ are

A. tetrahedral & square planar respectively

B. both tetrahedral

C. both square planar

D. square planar & tetrahedral respectively

Answer: B

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4. The magnetic moment of Ni^{+2} is $\sqrt{x}$, $'x'$ is

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Practice Sheet 3 Linked Comprehension Type Questions Passage Ii

1. V.B. Theory describes the bonding in terms of hybridised orbitals of central atom/ion. The theory mainly deals with the geometry (i.e. shape, magnetic properties)

$\left[Cu(NH_3)_4\right]^{+2}$ has hydridisation

A. sp^3

B. dsp^2

C. sp^2d

D. none

Answer: B

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2. V.B. Theory describes the bonding in terms of hybridised orbitals of central atom/ion. The theory mainly deals with the geometry (i.e. shape, magnetic properties)

Which complex has zero magnetic moment (spin only)

A. $(NiCl_4)^{-2}$

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

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

D. All

Answer: B

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3. V.B. Theory describes the bonding in terms of hybridised orbitals of central atom/ion. The theory mainly deals with the geometry (i.e. shape, magnetic properties)

Which of the following cyano complex would exhibit the lowest value of paramagnetic behaviour

A. $\left[Cr(CN)_6\right]^{-3}$

B. $\left[Co(CN)_6\right]^{-3}$

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

D. $\left[Mn(CN)_6\right]^{3-}$

Answer: B

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Practice Sheet 3 Match The Following Questions

1.

COLUMN-I	COLUMAN-II
(A)EDTA	(p)Monodeutate
(B)DMG	(q)Chelate ligand
$(C)en$	(r)Bidentate
$(D)CN^{-}$	(s)Hexadinatate

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2.

COLUMN-I	COLUMAN-II
$(A)\left[Ni(CO)_4\right]$	(p)Tetrahedral
$(B)\left[Fe(CO)_2(NO)_2\right]$	$(q)\pi -$ back bonding
$(C)\left[Ni(PF_3)_4\right]$	(r)diamagnetic
$(D)\left[Ni(PPh_3)_2Br_2\right]$	(s)one of the ligand is $3e^{-}$ donar

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Practice Sheet 3 Integer Answer Type Questions

1. Ni^{+2} ion forms a searlet red ppt with DMG. It is a .... Memberd ring.

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2. The CN of copper in complex formed by adding excess of NH_3 to $CuSO_4$ is

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3. The ratio of CN and OS of x in $\left[x(NH_3)_5SO_4\right]Cl$ is

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4. Cu^{+2} and and 'en gives a chelate complex. It is ... Membered

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5. The number of octahedral voids in a unit cell of cubic close packed structure is

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Practice Sheet 4 Single Or More Than One Option Questions C E T Stability Applications

1. Identify the incorrect statement

A. Δ_0 increasing order is $[CrCl_6]^{3-} < [Cr(NH_3)_6]^{3+} < [Cr(CN)6]^{3-}$

B. CFSE for $[Ti(H_2O)_6]^{3+}$ is $-0.4\Delta_0$

C. $[NiCl_4]^{2-}$ as well as $[Ni(CO)_4]$ are paramagnetic

D. The halide ions are arranged as $I^- < Br^- < Cl^- < F^-$ in the spectron chemical series

Answer: C

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2. The tetrahedral crystal field splitting is only .... of the octahedral splitting.

A. $1/2$

B. $2/9$

C. $4/9$

D. $5/9$

Answer: C

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3. Considering H_2O as a weak field ligand, the number of unpaired electrons in $\left[Mn(H_2O)_6\right]^{2+}$ will be (Atomic no of Mn=25)

A. 3

B. 5

C. 2

D. 4

Answer: B

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4. In which of the following complex, the metal ion In which of the following complex, the metal ion t_{2g}^{0}, e_{g}^{0}, configuration according to CFT

A. $[FeF_6]^{3-}$

B. $Fe(CN)_6]^{3-}$

C. $[Fe(CN)_6]^{2-}$

D. none

Answer: C

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5. Complex/complex ion 'x' is the most stable amongest following. Then 'x' must be

A. $Fe(CO)_5$

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

C. $\left[Fe(C_2O_4)_4\right]^{-3}$

D. $[Fe(H_2O_6)]^{+3}$

Answer: C

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6. From the stability constant (hypothetical value given below predict which is the strongest ligand

A. $Cu^{2+} + 4NH_3 \Leftrightarrow \left[Cu(NH_3)_4\right]^{2+}, K = 4.5 \times 10^{11}$

B. $Cu^{2+} + 4CN^- \Leftrightarrow \left[Cu(CN)4)\right]^{2-}, K = 2.0 \times 10^{27}$

C. $Cu^{2+} + 2en \Leftrightarrow \left[Cu(en)_4\right]^{2-}, K = 3 \times 10^{15}$

D. $Cu^{2+} + 4H_2O \Leftrightarrow \left[Cu(H_2O)_4\right]^{2+}, K = 9.5 \times 10^8$

Answer: B

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7. Which of the following statement is incorrect ?

A. The stability constant of $\left[Co(NH_3)_6\right]^{3+}$ is greater than that of $\left[Co(NH_3)_6\right]^{2+}$

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

C. The stability of halide complexes follows the order $I^- < \text{Por}^- < Cl^- < F^-$

D. The stability constant of $\left[Cu(NH_3)_4\right]^{2+}$ is greater than that of $\left[Cu(en)_2\right]^{2+}$

Answer: D

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

A. d^3

B. d^4

C. d^5

D. d^6

Answer: A

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9. Which of the following is arranged in order of increasing stability of the metal complexes ? (Oxidation states are given in parenthesis)

A. $Ag(I) < Pt(II) < Cr(III) < Co(III)$

B. $Co(III) < Cr(III) < Pt(II) < Ag(I)$

C. $Cr(III) < Pt(II) < Ag(I) < Co(III)$

D. $Pt(II) < Co(III) < Ag(I) < Cr(III)$

Answer: A

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10. Which of the following is low spin to strong field ligands?

A. $d_{xy}^2 d_{xz}^2 d_{yz}^1$

B. $d_{xy}^2 d_{yz}^1 d_{x^3 - y}^1 d_{z^2}^1$

C. $d_{xy}^2 d_{xz}^1 d_{yz}^1 d_{x^2 - y^2}^1$

D. $d_{xy}^1 d_{xz}^1 d_{yz}^1 d_{x^2 - y^2}^2$

Answer: A

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11. Identify the complexes which are expected to be coloured

A. $\left[Ti(NO_3)_4\right]$

B. $\left[Cu(NCCH_3)_4\right]^+ BF_4^-$

C. $\left[Cr(NH_3)_6\right]^{+3} 3Cl^-$

D. $K_3[VF_6]$

Answer: C::D

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12. Which of the following is a chelate ?

A. Cis-platin - a drug used in the treatment of cancer

B. Haemoglobin - a protein present in blood

C. Chlorophyll - a green plant pigment which acts as a photosensitiser in the synthesis of carbohydrates

D. Vitamin B_{12} - It is a cobalt (III) complex

Answer: B::C::D

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13. The following are octahedral and tetrahedtal complexes

$$\underset{I}{[Fe(H_2O)_6]} \qquad \underset{II}{[Cr(NH_3)]^{3+}} \qquad \underset{III}{[CoCl_4]^{2-}}$$

The wrong one is /are

A. All high spin d^5 complexes is octahedral system has CFSE = 0

B. Complex I is low spin d^5 octahedral complex

C. No. of unpaired electrons II and III are 3 each

D. All Cr(III) octahedral complexes are high spin complexed like II

Answer: B::D

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14. Co-ordination compounds have great importance in biological system in this content which of the following statemt is correct.

A. Carboxypeptidese A, is an enzyme and contains zinc

B. Haemoglobin is the red pigment of blood contains cobalt

C. Cyanocobalamine is B_{12} and contain cobalt

D. Chlorophylls are green pigments in plants contain calcium

Answer: A::C

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15. Which of the following are outer orbital octahedral complexes ?

A. $[FeF_6]^{3-}$

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

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

D. $\left[Fe(H_2O)_6\right]^{2+}$

Answer: A::D

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16. Select the correct statements among the following

A. Chelation effect is maximum for 5 and 6 membered rings

B. Greater the charge on the central metal cation greater the value of CFSE

C. In complex ion $[CoF_6]^{3-}$ ion is weak ligand so that $\Delta_0 < P$ and it is low spin complex

D. $\left[CoCl_2(NH_3)_2(en)\right]^{+}$ complex ion will have four different isomers

Answer: A::B::D

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Practice Sheet 4 Linked Comprehension Type Questions Passage I

1. In octahedral complexes having co-ordination number 6, the degeneracy of the d-orbitals of central atom is removed due to ligand electron metal electron repulsions. In the octahedral complex three orbitals have lower energy, t_{2g} set and two orbitals have higher energy, eg set. This phenomenon is formed as crystal field splitting and the energy seperation is denoted by Δ_0. Thus the energy of the two eg orbitals will increase by $(3/5)\Delta_0$ and that of the three t_{2g} will decrease by $(2/5)\Delta_0$. The erystal field splitling, Δ_0 depends upon the field produced by the ligand and charge on the metal ion. Some ligands are able to produce strong field and in these cases, the splitting will be large whereas other produce weak fields and consequently result in small splitting of d-orbitals.

In an octahedral crystal field, t_{2g} orbitals are

A. raised in energy by $0.4\Delta_0$

B. lowered in energy by $0.4\Delta_0$

C. raised in energy by $0.5\Delta_0$

D. lowered in energy by $0.6\Delta_0$

Answer: B

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2. In octahedral complexes having co-ordination number 6, the degeneracy of the d-orbitals of central atom is removed due to ligand electron metal electron repulsions. In the octahedral complex three orbitals have lower energy, t_{2g} set and two orbitals have higher energy, eg set. This phenomenon is formed as crystal field splitting and the energy seperation is denoted by Δ_0. Thus the energy of the two eg orbitals will increase by $(3/5)\Delta_0$ and that of the three t_{2g} will decrease by $(2/5)\Delta_0$. The erystal field splitling, Δ_0 depends upon the field produced by the ligand and charge on the metal ion. Some ligands are able to produce strong field and in these cases, the splitting will be large whereas other produce weak fields and consequently result in small splitting of d-orbitals.

If $\Delta_0 < P$, the correct electronic configuration of d^4 system will be

A. $t_{2g}^4 e_g^0$

B. $t_{2g}^3 e_g^1$

C. $t_{2g}^0 e_g^4$

D. $t_{2g}^2 e_g^2$

Answer: B

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3. In octahedral complexes having co-ordination number 6, the degeneracy of the d-orbitals of central atom is removed due to ligand electron metal electron repulsions. In the octahedral complex three orbitals have lower energy, t_{2g} set and two orbitals have higher energy, eg set. This phenomenon is formed as crystal field splitting and the energy seperation is denoted by Δ_0. Thus the energy of the two eg orbitals will increase by $(3/5)\Delta_0$ and that of the three t_{2g} will decrease by $(2/5)\Delta_0$. The erystal field splitling, Δ_0 depends upon the field produced by the ligand and charge on the metal ion. Some ligands are able to produce strong field and in these cases, the splitting will be large whereas other produce weak fields and consequently result in small splitting of d-orbitals.

Predict the order of Δ_0 for the following compound

i) $\left[Fe(H_2O)_6\right]^{+2}$ ii) $\left[Fe(CN)2(H_2O)_4\right.$ iii) $\left[Fe(CN)_4(H_2O)_2\right]^{2-}$

A. $\Delta_0(i) < \Delta_0(ii) < \Delta_0(iii)$

B. $\Delta_0(ii) < \Delta^0(i) < \Delta_0(iii)$

C. $\Delta_0(iii) < \Delta_0(ii) < \Delta_0(i)$

D. $\Delta_0(ii) < \Delta_0(iii) < \Delta_0(i)$

Answer: A

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Practice Sheet 4 Linked Comprehension Type Questions Passage Ii

1. The following ionisation constants are determind in 3 seperate experiments.

(I) $\left[Ag(S_2O_3)_3\right]^5 \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{3-} + S_2O_3^{-2}$

$K_1 = 2.0 \times 10^{-5} moldm^{-3}$

(II) $\left[Ag(S_2O_3)_2\right]^{3-} \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{-} + S_2O_3^{-2}$

$K_2 = 3.3 \times 10^{-5} moldm^{-3}$

(III) $[Ag(S_2O_3)]^{-} \Leftrightarrow Ag^{+} + S_2O_3^{2-}$

$K_3 = 1.5 \times 10^{-9} moldm^{-3}$

Which of the following is the most stable

A. $[Ag(S_2O_3)]^{5-}$

B. $\left[Ag(S_2O_3)_2\right]^{3-}$

C. $[Ag(S_2O_3)]^{-}$

D. $S_2O_3^{-2}$

Answer: A

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2. The following ionisation constants are determind in 3 seperate experiments.

(I) $\left[Ag(S_2O_3)_3\right]^5 \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{3-} + S_2O_3^{-2}$

$K_1 = 2.0 \times 10^{-5} moldm^{-3}$

(II) $\left[Ag(S_2O_3)_2\right]^{3-} \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{-} + S_2O_3^{-2}$

$K_2 = 3.3 \times 10^{-5} moldm^{-3}$

(III) $\left[Ag(S_2O_3)\right]^{-} \Leftrightarrow Ag^{+} + S_2O_3^{2-}$

$K_3 = 1.5 \times 10^{-9} moldm^{-3}$

In which of the equilibrium system, the concentration of $S_2O_3^{-2}$ is maximum.

A. I

B. II

C. III

D. same conc in all

Answer: A

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3. The following ionisation constants are determind in 3 seperate experiments.

(I) $\left[Ag(S_2O_3)_3\right]^5 \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{3-} + S_2O_3^{-2}$

$K_1 = 2.0 \times 10^{-5} moldm^{-3}$

(II) $\left[Ag(S_2O_3)_2\right]^{3-} \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{-} + S_2O_3^{-2}$

$K_2 = 3.3 \times 10^{-5} moldm^{-3}$

(III) $\left[Ag(S_2O_3)\right]^{-} \Leftrightarrow Ag^{+} + S_2O_3^{2-}$

$K_3 = 1.5 \times 10^{-9} moldm^{-3}$

The complex formation constant for the reaction

$Ag + 2S_2O_3^{-2} \Leftrightarrow \left[Ag(S_2O_3)_2\right]^{3-}$

A. 3.3×10^{-5}

B. 1.5×10^{-9}

C. 4.95×10^{-14}

D. 2×10^{13}

Answer: B

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Practice Sheet 4 Match The Following Questions

1.

COLUMN-I	COLUMN-II
(A)Muscle contraction	$(p)Zn$
(B)Blue-green algae	$(q)Co$
(C)Carboxypeptidase	$(r)Ca$
(D)Cyanocobalanine	$(s)MO$

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2.

COLUMN-I	COLUMN-II
$(A)\left[Mn(H_2O)_6\right]^{2+}$	(p)Paramagnetic
$(B)\left[Mn(CN)_6\right]^{3+}$	(q)Diamagnetic
$(C)\left[Co(NH_2)_6\right]^{3+}$	(r)High spin complex (or) outer orbital complex
$(D)\left[Ni(NH_3)_6\right]^{2+}$	(s)Low spin complex (or) inner orbital complex

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Practice Sheet 4 Integer Answer Type Questions

1. The CFSE for $[CoCl_6]^{4-}$ is $18000cm^{-1}$. The Δ for $[CoCl_4]^{2-}$ will be $Xx10^3cm^{-1}$. What is the value of X

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2. The difference in the number of coulombic exchange pairs for high spin and low spin d^5 ion in an octahedral complex according to crystal field theory is

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3. Coordination number of Fe in Haemoglobin is

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4. For the complex MC_2 stepwise formation constants for $M+L \Leftrightarrow ML \quad ML+L \Leftrightarrow ML_2$ are 4 and 3 respectively. Overall stability constant is xy. The value of x+y is

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5. No. of unpaired e^{-} in $K[(Ag(CN)_2]$ is

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6. No. of ions produced by dissolving $PtCl_4.2NH_3$ in aqueous media is

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Practice Sheet 5 Single Or More Than One Option Questions Miscellaneous

1. The ligands in anticancer drug "eis-platin" are

A. NH_3, Cl

B. NH_3, H_2O

C. Cl, H_2O

D. NO, Cl

Answer:

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2. Acc. to V.B. Theory, the following complexes will have same geometry.

A. $\left[Ni(CN)_4\right]^{2-}$

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

C. $[FeF_6]^{3-}$

D. $\left[Cr(NH_3)_6\right]^{3+}$

Answer:

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3. Pentaammine nitrocobalt(III) cation possesses the property of

A. physiorption

B. verstile reducing agent

C. chirality

D. linkage isomerism

Answer:

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4. A complex $PtCI_4.5NH_3$ shows a molar conductance of $402ohm^{-1}cm^{-2}mol^{-1}$ in water and precipitate 3 mole of AgCl with $AgNO_3$. The formula of the complex is

A. $[Pt(NH_3)_6]Cl_4$

B. $[Pt(NH_3)_5Cl]Cl_3$

C. $[Pt(NH_3)_4Cl_2]Cl_2$

D. $[Pt(NH_3)_3Cl_3]Cl$

Answer:

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5. Select the correct statement(s) for the compound $K_2[Cr(NO^+)(NH_3)(CN)_4]$

A. Its IUPAC name is potassium amminetetracyanidonitrosoniumchromate (I)

B. Its spin only magnetic moment is $\sqrt{8BM}$

C. Its hybridisation is d^2sp^3

D. It show geometrical isomerism

Answer:

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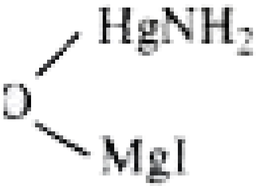
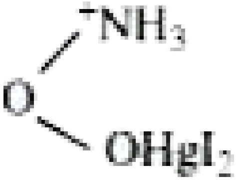
6. Ammonia reacts with Nessler's reagent to a brown ppt known as Millon's base. This base is believed to have the structure

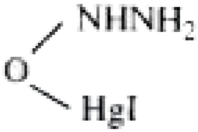


A.

B.



C.



D.

Answer:

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7. All of the following complex show decrease in their weight when placed in magnetic balance then the group of complexes having tetrahedral geometry is

I) $Ni(CO)_4$ II) $K[AgF_4]$ III) $Na_2[Zn(CN)_4]$

IV) $K_2[Pt(Cl_4]$ V) $[RhCl(pph_3)_3]$

A. II, III, IV

B. I, II, III

C. I, III, IV

D. None

Answer:

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8. What is hybridiation of metal involved in a diamagnetic sodium nitroprussaide ?

A. sp^3

B. dsp^2

C. d^2sp^3

D. sp^3d^2

Answer:

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9. On treatment of $\left[Ni(NH_3)_4\right]^{+2}$ with conc.HC/ two compounds I and II having the same formula $\left[Ni(NH_3)_2Cl_2\right]$ are obtained, I can be converted into II by boiling with dil.HCI. A solution of I reacts with oxalic acid to form $\left[Ni(NH_3)_2(C_2O_4)\right]$ where as II does not react. Point out the correct statement from the following

A. I cis, II trans, both tetrahedral

B. I cis, II trans both square planar

C. I trans, II cis, both tetrahedral

D. I trans, II cis both square planar

Answer:

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10. Amongst $I = \left[Co(Ox)_3\right]^{3-}, II = \left[CoF_6\right]^{3-}, III = \left[Co(NH_3)_6\right]^{+3}$

A. I, II are para, and III is dia

B. I, III are para, and II is dia

C. I, III are dia, and II in para

D. II, III are para, and I is dia

Answer:

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11. In the following pair find the pair in which first compound do not form complex with NH_3 and second give coloured complex with NH_3

A. $CoCl_2, ZnSO_4$

B. $Agl, CuSO_4$

C. $NiCl_2, CuSO_4$

D. $Cd(NO_3)_2, ZnSO_4$

Answer:

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12. Amongst the following ions which has the highest paramagnetism?

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

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

C. $[Cu(H_2O)_6]^{2+}$

D. $[Zn(H_2O)_6]^{2+}$

Answer:

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13. Which of the following isomerism in exhibited by $\left[Co(NH_3)_2(H_2O)Cl_2\right]$Cl

A. Ionisation

B. Geometrical

C. Hydrate

D. Optical

Answer:

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14. Which of the following is correct statement?

A. In metal carbonyl d_{e-o} increases compared to that of CO molecule

B. The pairs of compounds $\left[Cr(H_2O)_6\right]Cl_3$ and $\left[CrCl_3(H_2O)_3\right].3H_2O$ show hydrate isomerison

C. d_z^2 orbital of central atom/ion is used in dsp^2 hybridisation

D. Fac-mer isomers asscoiated with Ma_3, b_3 type compoud both optically active

Answer:

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15. The complex(es) which is /are blue in colour

A. $Fe_4\left[Fe(CN)_6\right]_3$

B. $Zn_2\left[Fe(CN)_6\right]$

C. $Cu_2\left[Fe(CN)_6\right]$

D. $Fe_3[Fe(CN)_6]_2$

Answer:

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16. In test of NO_3^- in the dark brown ring complex is formed, which is true of this complex

A. Colour in due to charge transfer phenomenon

B. Fe and NO both have +1 charge

C. The complex species can be represented as $[Fe^1(H_2O)_5NO]^{2+}$

D. Fe has +2 oxistate and NO is neutral

Answer:

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Practice Sheet 5 Linked Comprehension Type Questions Passage 1

1. On the basis of stability of complex extity in the solution, complexes may be of two types, perfect, imperfect complexes, the stabilies depends upon the extent of dissociation which in turn depends on the strength of M-L band. The dissociation of complex may be expressed $[ML_xP^+ \Leftrightarrow My^+ + xL$ and eq. constant of this dissociation equilibrium is called instability constant. The stability of complex depends are EAN, charge on central atom, basic nature chelation, nature of metal ion and ligand acc. to HSAB principle

The EAN of Co in $Co(CO)_4$ is 35. Hence it is less stable. It attains stability by

A. Oxidation of Co

B. Reduction of Co

C. Dimerisation

D. Tetramerisation

Answer:

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2. On the basis of stability of complex extity in the solution, complexes may be of two types, perfect, imperfect complexes, the stabilies depends upon the extent of dissociation which in turn depends on the strength of M-L band. The dissociation of complex may be expressed $[ML_xP^+ \Leftrightarrow My^+ + xL$ and eq. constant of this dissociation equilibrium is called instability constant. The stability of complex depends are EAN, charge on central atom, basic nature chelation, nature of metal ion and ligand acc. to HSAB principle Which of the following does not follow EAN rule?

A. $Fe(CO)_5$

B. $V(CO)_6$

C. $K_4[Fe(CN)_6]$

D. $Mn_2(CO)_{10}$

Answer:

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3. On the basis of stability of complex extity in the solution, complexes may be of two types, perfect, imperfect complexes, the stabilies depends upon the extent of dissociation which in turn depends on the strength of M-L band. The dissociation of complex may be expressed $\left[ML_xP^+ \Leftrightarrow My^+ + xL\right.$ and eq. constant of this dissociation equilibrium is called instability constant. The stability of complex depends are EAN, charge on central atom, basic nature chelation, nature of metal ion and ligand acc. to HSAB principle

Which complex in most stable ?

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

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

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

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

Answer:

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1. The CN of $Ni^{+2} = 4$

$NiCl_2 + KCN_{\text{excess}} \rightarrow A$ (cyano complex)

$NiCl_2 + conc.\ KCl_{(\text{excess})} \rightarrow B$ (Chloro complex)

The IUPAC name of A and B are

A. Potassium tetracyano nickelate (II), Potassium tetrachloro nickelate(II)

B. Tetracyano potassium nickelate(II), Tetrachloro potassium nickelate (II)

C. Tetracyano nickel (II), Tetrachloro nickel (II)

D. Potassium tetracyano nickel (II), Potassium tetracholoro nickel (II)

Answer:

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2. The CN of $Ni^{+2} = 4$

$NiCl_2 + KCN_{\text{excess}} \rightarrow A$ (cyano complex)

$NiCl_2 + conc.\ KCl_{(\text{excess})} \rightarrow B$ (Chloro complex)

Predict the magnetic nature of A and B

A. Both the diamagnetic

B. Both are paramagnetic

C. A is diamagnetic and B is para magnetic with 1 unpaired e^{-}

D. A is diamagnetic and B in para magnetic with 2 unpaired e^{-}

Answer:

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3. The CN of $Ni^{+2} = 4$

$NiCl_2 + KCN_{\text{excess}} \rightarrow A$ (cyano complex)

$NiCl_2 + conc.\ KCl_{(\text{excess})} \rightarrow B$ (Chloro complex)

The hybridisation of A and B are

A. dsp^2, sp^{3l}

B. sp^3, sp^3

C. dsp^2, dsp^2

D. sp^3d^2 both

Answer:

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