5 CHAPTER

COORDINATION COMPOUND

EXERCISE-1

[SINGLE CORRECT CHOICE TYPE]

Introduction

Q.1 Which of the following complex will give white precipitate with barium chloride solution –

(A) $[Cr(NH_3)_5Cl]SO_4$ (B) $[Cr(NH_3)_5SO_4]Cl$

(C) $[Co(NH_3)_6]Br_3$ (D) $[Co(NH_3)_4Br_2]Cl$

Q.2 Aqueous solution of $FeSO_4$ gives tests for both Fe^{2+} and SO_4^{2-} but after addition of excess of KCN, solution ceases to give test for Fe^{2+}. This is due to the formation of

(A) the double salt $FeSO_4.2KCN.6H_2O$ (B) $Fe(CN)_3$

(C) the complex ion $[Fe(CN)_6]^{4-}$ (D) the complex ion $[Fe(CN)_6]^{3-}$

Q.3 Potassium ferrocyanide is a

(A) Normal salt (B) Mixed salt (C) Double salt (D) Complex salt

Q.4 Aq. solution of carnallite, shows the properties of

(A) K^+, Mg^{2+}, Cl^- (B) K^+, Mg^{++}, SO_4^{2-} (C) K^+, Mg^{2+}, CO_3^{2-} (D) K^+, Mg^{2+}, Cl^-, Br^-

Q.5 An aqueous solution of potash alum gives

(A) Two types of ions (B) Only one type of ion

(C) Four types of ions (D) Three types of ions

Classification of ligands

Q.6 Which of the following represents the monodentate monoanion ligand ?

(A) Carbonato (B) Ammonia (C) Nitrito (D) Oxalato

Q.7 The donor atoms in EDTA are –

(A) Two N and Two O (B) Two N and four O

(C) Four N and Two O (D) Three N and three O

Q.8 Which of the following ligands is not a chelating agent –

(A) EDTA (B) ethylenediamine (C) Oxalate (D) Pyridine

Q.9 All ligands are –

(A) Lewis acid (B) Lewis base (C) Neutral (D) Reducing agent

Q.10 In SCN ligand if N is attached to central metal atom or ion, the name of ligand is –

(A) Thiocyanato-N (B) Cyanato-N (C) Thiocyanato-S (D) Cyanato-S

Q.11 Which of the following species cannot be a ligand –

(i) NH_4^+ (ii) NO^+ (iii) $C_5H_5\ddot{N}$

(A) i only (B) i & ii only (C) i & iii only (D) i, ii & iii only

Q.12 Glycinato ligand is –

(A) a Chelating ligand (B) Bidentate ligand

(C) Having two donor sites N and O^- (D) All of these

Q.13 Triphenyl phosphine is –

(A) Neutral and monodentate ligand (B) Neutral and tridentate ligand

(C) Uninegative and unidentate ligand (D) Trinegative and tridentate ligand

Q.14 The total number of Ligands attached to the central metal ion through coordinate bond is called –

(A) Valency of the metal ion (B) Oxidation state of the metal ion

(C) Coordination number of metal ion (D) Ionisable valency of metal

Q.15 Diethylene triamine is

(A) Chelating agent (B) Symmetrical ligand (C) Tridentate ligand (D) All of these

Q.16 Which of the following is not chelating agent?

(A) Hydrazine (B) Oxalato (C) Glycinato (D) Ethylene diamine

Q.17 Which of the following species is not expected to be a ligand

(A) NO^+ (B) NH_4^+ (C) $NH_2–NH_3^+$ (D) NO_2^+

Q.18 The number of donor sites in dimethyl glyoximate, glycinato, diethylene triamine and EDTA are respectively

(A) 2, 2, 3 and 4 (B) 2, 2, 3 and 6 (C) 2, 2, 2 and 6 (D) 2, 3, 3 and 6

Q.19 $[EDTA]^{4-}$ is a
(A) Monodentate ligand (B) Bidentate ligand
(C) Tetra dentate ligand (D) Hexadentate ligand

Q.20 Bidentate ligand is
(A) pyridine (B) acetylacetonate (C) SCN^- (D) Triethylenetetraamine

Q.21 According to Lewis theory the ligands are
(A) Acidic in nature (B) Basic in nature
(C) Neither acidic nor basic (D) Some are acidic and others are basic

Q.22 Denticity of $[HEDTA]^{3-}$
(A) 3 (B) 4 (C) 5 (D) 6

Q.23 The ion or molecule which forms a complex compound with transition metal ion is called
(A) Acid (B) Ligand (C) Complex ion (D) No special name

Q.24 Among the following which are ambidentate ligands
(i) NO_2^- (ii) NO_3^- (iii) $EDTA^{4-}$
(iv) SCN^- (v) $H_2NCH_2CH_2NH_2$
(A) (i) and (ii) (B) (iii) and (iv) (C) (i) and (iv) (D) (iii) and (vi)

Q.25 The ligand $N(CH_2CH_2NH_2)_3$ is
(A) Tridentate (B) Pentadentate (C) Tetradentate (D) Bidentate

Q.26 **Statement-1 :** Charge on the complex of ferric ion with $EDTA^{4-}$ is minus one.
Statement-2 : EDTA is a hexadentate ligand.
(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1
(B) Statement-1 is true, Statement-2 is true and Statement-2 is NOT the correct explanation for Statement-1
(C) Statement-1 is true, Statement-2 is false
(D) Statement-1 is false, Statement-2 is true

Q.27 **Statement-1 :** $NH_2–NH_2$ is not a chelating ligand.
Statement-2 : A chelating ligand must posses two or more lone pair at such a distance that it may form strain free ring with metal ion.
(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1
(B) Statement-1 is true, Statement-2 is true and Statement-2 is NOT the correct explanation for Statement-1
(C) Statement-1 is true, Statement-2 is false
(D) Statement-1 is false, Statement-2 is true

Oxidation State and Co-ordination Number

Q.28 The co-ordination number and oxidation number of 'x' in the following compound $[x(SO_4)(NH_3)_5]Cl$ will be:

(A) 10 & 3 (B) 2 & 6 (C) 6 & 3 (D) 6 & 4

Q.29 The oxidation state of Fe in brown ring complex $[Fe(H_2O)_5NO]SO_4$ is :

(A) + 1 (B) + 2 (C) + 3 (D) + 4

Q.30 Consider :

	Complex	**Coordination number**
(A)	$[CuCl_2]^-$	(i) 6
(B)	$Ni(CO)_4$	(ii) 5
(C)	$[PtCl_6]^{4-}$	(iii) 4
(D)	$[Ni(NH_3)_6]^{2+}$	(iv) 2

Proper matching is :

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

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

Q.31 How many $EDTA^{4-}$ ligands are required to make an octahedral complex with a Ca^{2+} ion ?

(A) Six (B) Three (C) One (D) Two

Q.32 The oxidation number and coordination number of chromium in the following complex is $[Cr(C_2O_4)_2(NH_3)_2]^{-1}$

(A) O.N. = + 4, C.N. = 4 (B) O.N. = +3, C.N. = 4

(C) O.N. = – 1, C.N. = 4 (D) O.N. = + 3, C.N. = 6

Q.33 In which of the following complexes the nickel metal is in highest oxidation state:

(A) $Ni(CO)_4$ (B) $[Cr(NH_3)_6]_2[NiF_6]_3$

(C) $[Ni(NH_3)_6(BF_4)_2$ (D) $K_4[Ni(CN)_6]$

Q.34 The co-ordination number of cobalt in the complex $[Co(en)_2Br_2]Cl_2$ is

(A) 2 (B) 6 (C) 5 (D) 4

Q.35 Which of the following complexes show six coordination number

(A) $[Zn(CN)_4]^{2-}$ (B) $[Cr(en)_3]^{3+}$ (C) $[Cu(trien)]^{++}$ (D) $[Ni(dmg)_2]$

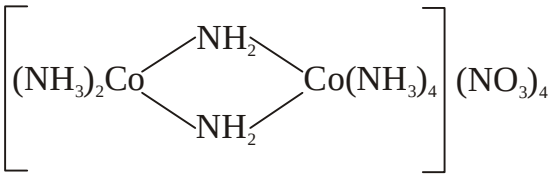
Q.36 The coordination number of central metal atom/ion in a complex is determined by
(A) number of ligands around metal ion bonded by sigma bonds
(B) number of ligands around metal ion bonded by pi-bonds
(C) Number of co-ordinate bonds metal atom/ion has accepted from ligands
(D) The number of only anionic ligands bonded to the metal ion

Q.37 In complexes of d-block cations the highest possible coordination number is
(A) 6 (B) 5 (C) 4 (D) 8

Q.38 Complex compound having central metal atom in zero oxidation state.
(A) $[Cu(NH_3)_4]SO_4$ (B) $[Pt(NH_3)_2Cl_2]$ (C) $K_4[Ni(CN)_4]$ (D) $K_3[Fe(CN)_6]$

Q.39 The oxidation state of Mo in its oxo-complex species $[Mo_2O_4(C_2H_4)_2(H_2O)_2]^{2-}$ is :
(A) + 2 (B) + 3 (C) + 4 (D) + 5

Q.40 The oxidation state of cobalt in



(A) 2 (B) 3 (C) 4 (D) 6

Effective Atomic Number (E.A.N)

Q.41 Which of the following metal carbonyl does not exist as monomer ?
(A) $Cr(CO)_6$ (B) $Mn(CO)_5$ (C) $Ni(CO)_4$ (D) $Fe(CO)_5$

Q.42 According to EAN rule, how many CO groups should be attached to Fe ?
(A) 4 (B) 5 (C) 6 (D) 8

Q.43 In $[Cr(CO)_6]$ how many CO groups can be replaced by NO:
(A) all the 6 CO groups are replaced by 6 NO groups
(B) all the 4 CO groups are replaced by 6 NO groups
(C) all the 2 CO groups are replaced by 3 NO groups
(D) all the 6 CO groups are replaced by 4 NO groups

Q.44 In the complex $Fe(CO)_x$, the value of x is, if it follows sidwick EAN rule :
(A) 3 (B) 4 (C) 5 (D) 6

Q.45 Effective atomic number of Fe in $[Fe(CO)_4]^-$ is :
(A) 34 (B) 35 (C) 36 (D) 37

Q.46 The effective atomic number of Cr (atomic number 24) in $[Cr(NH_3)_6]Cl_3$ is
(A) 35 (B) 27 (C) 33 (D) 36

Q.47 The complex compound in which central metal ion obeys EAN rule
(A) $K_4[Fe(CN)_6]$ (B) $K_3[Fe(CN)_6]$ (C) $[Cr(H_2O)_6]Cl_3$ (D) $[Cu(NH_3)_4]SO_4$

Q.48 E.A.N of metal ion in following complex is found to be equal to atomic number of krypton:
(A) $[Pd(NH_3)]_6Cl_4$ (B) $[Cr(NH_3)_5Cl]SO_4$ (C) $[Co(en)_3]Cl_3$ (D) $[Mn(CO)_2(NO)_2]$

Q.49 Which complex compound does not obey 18-electron rule or Sidgwick Rule
(A) $[V(CO)_6]$ (B) $[Fe(\pi\text{-}C_5H_5)_2]$ (C) $[Mn(CO)_5]^-$ (D) $[Cr(\pi\text{-}C_6H_6)_2]$

Q.50 $[Co(CO)_4]$ attains stability by its
(A) Oxidizing character (B) Reduction (C) Dimerization (D) All of these

Q.51 The value of x in $[Fe(CO)_2(NO)_x]$, is:
(A) 3 (B) 4 (C) 2 (D) 1

Q.52 EAN of the central metal in the complexes $K_2[Ni(CN)_4]$, $[Cu(NH_3)_4]SO_4$ and $K_2[PtCl_6]$ are respectively.
(A) 36, 35, 86 (B) 34, 35, 84 (C) 34, 35, 86 (D) 34, 36, 86

Q.53 Which of the following pair of complexes have the same EAN of the central metal atoms/ions?
(A) $[Cu(NH_3)_4]SO_4$ and $K_3[Fe(CN)_6]$
(B) $K_4[Fe(CN)_6]$ and $[Co(NH_3)_6]Cl_3$
(C) $K_3[Cr(C_2O_4)_3]$ and $[Cr(NH_3)_6]Cl(NO_2)_2$
(D) All

Q.54 The values of 'x' in complexes $H_x[Co(CO)_4]$, $[Fe(CO)_x \,.\, (\pi\text{-}C_5H_5)]^+$ are respectively
(A) 1, 1 (B) 2, 3 (C) 3, 1 (D) 1, 3

Q.55 The EAN of metal atoms in $Fe(CO)_2(NO)_2$ and $Co_2(CO)_8$ respectively are

(A) 34, 35 (B) 34, 36 (C) 36, 36 (D) 36, 35

Q.56 Following Sidgwick's rule of EAN, correct formula of $Co_2(CO)_x$ will be

(A) $Co_2(CO)_4$ (B) $Co_2(CO)_3$ (C) $CO_2(CO)_8$ (D) $CO_2(CO)_{10}$

Q.57 **Statement–1:** $[V(CO)_6]$ can not act as oxidising agent.

Statement–2: It can be reduced by reducing agent.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement-2 is true and Statement-2 is NOT the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.58 **Statement–1:** In $Mn_2(CO)_{10}$ molecule, there are total 70 electrons in both Mn atoms.

Statement–2: $Mn_2(CO)_{10}$ molecule acts as oxidising agent.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true. Statement-2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

IUPAC Nomenclature

Q.59 The number of ions formed, when bis (ethane-1,2-diamine) copper (II) sulphate is dissolved in water will be

(A) 1 (B) 2 (C) 3 (D) 4

Q.60 A complex cation is formed by Pt (in some oxidation state) with ligands (in proper number so that coordination number of Pt becomes six). Which of the following can be its correct IUPAC name :

(A) Diammineethylenediaminedithiocyanato-S-platinum (II) ion

(B) Diammineethylenediaminedithiocyanato-S-platinate (IV) ion

(C) Diammineethylenediaminedithiocyanato-S-platinum (IV) ion

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

Q.61 Trioxalatoaluminate(III) and tetrafluoro-borate(III) ions are:

(A) $[Al(C_2O_4)_3]$, $[BF_4]^{3-}$ (B) $[Al(C_2O_4)_3]^{3+}$, $[BF_4]^{3+}$

(C) $[Al(C_2O_4)_3]^{3-}$, $[BF_4]^{-}$ (D) $[Al(C_2O_4)_3]^{2-}$, $[BF_4]^{2-}$

Q.62 The correct IUPAC name of the complex $Fe(C_5H_5)_2$ is –

(A) Cyclopentadienyl iron (II)
(B) Bis (cyclopentadienyl) iron (II)
(C) Dicyclopentadien ferrate (II)
(D) Ferrocene

Q.63 The IUPAC name of $Fe(CO)_5$ is –

(A) Pentacarbonyl ferrate (0)
(B) Pentacarbonyl Ferrate (III)
(C) Pentacarbonyl Iron (0)
(D) Pentacarbonyl Iron (II)

Q.64 $K_3[Fe(CN)_6]$ is –

(i) Potassium hexacynoferrous (III)
(ii) Potassium hexacynoferrate (III)
(iii) Potassium ferricyanide
(iv) Hexa cyno ferrate (III) potassium

Correct answer is –

(A) Only (i) and (ii)
(B) Only (ii) and (iii)
(C) Only (i) and (iii)
(D) Only (ii) and (iv)

Q.65 IUPAC name of $[Pt(NH_3)_3(Br)(NO_2)Cl]Cl$ is –

(A) Triamminechloridobromidonitroplatinum (IV) chloride
(B) Triamminebromidonitrochloroplatinum (IV) chloride
(C) Triamminebromidochloridonitroplatinum (IV) chloride
(D) Triamminenitrochloridobromoplatinum (IV) chloride

Q.66 The correct name of $[Pt(NH_3)_4Cl_2]\,[PtCl_4]$ is –

(A) Tetraammine dichloro platinum (IV) tetrachloroplatinate (II)
(B) Dichloro tetra ammine platinium (IV) tetrachloro platinate (II)
(C) Tetrachloro platinum (II) tetraammine platinate (IV)
(D) Tetrachloro platinum (II) dichloro tetraamine platinate (IV)

Q.67 The chloro-bis (ethylenediamine) nitro cobalt (III) ion is –

(A) $[Co\,(NO_2)_2\,(en)_2\,Cl_2]^+$
(B) $[CoCl\,(NO_2)_2\,(en)_2\,]^+$
(C) $[Co\,(NO_2)\,Cl\,(en)_2]^+$
(D) $[Co\,(en)Cl_2\,(NO_2)_2\,]^-$

Q.68 The formula of the complex hydridotrimethoxoborate (III) ion is :

(A) $[BH(OCH_3)_3]^{2-}$ (B) $[BH_2(OCH_3)_3]^{2-}$ (C) $[BH(OCH_3)_3]^-$ (D) $[BH(OCH_3)]^+$

Q.69 The IUPAC name of $[Co(NH_3)_6]\,[Cr(C_2O_4)_3]$ is

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

Q.70 IUPAC name of $[Pt(NH_3)_3(Br)(NO_2)Cl]Cl$ is

(A) Triamminechlorobromonitroplatinum(IV) chloride.

(B) Triamminebromonitrochloroplatinum(IV) chloride.

(C) Triamminebromochloronitroplatinum(IV) chloride.

(D) Triamminenitrochlorobromoplatinum(IV) chloride.

Q.71 The IUPAC name of $[Ni(NH_3)_4]\ [NiCl_4]$ is

(A) Tetrachloronickel(II) tetraamminenickel(II)

(B) Tetraamminenickel(II) tetrachloronickel(II)

(C) Tetraamminenickel(II) tetrachloronickelate(II)

(D) Tetraaminenickel(II) tetrachloridonickelate(IV)

Q.72 The formula of sodium nitroprusside is

(A) $Na_4[Fe(CN)_5(NOS)]$ (B) $Na_2[Fe(CN)_5(NO)]$

(C) $[Fe(H_2O)_5(NO)]SO_4$ (D) $Fe_4[Fe(CN)_6]_3$

Q.73 The oxidation number of chromium in Triamminechloridooxalatochromate ion is

(A) II (B) IV (C) V (D) III

Q.74 IUPAC nomenclature of sodium nitroprusside is

(A) Sodium pentacyanonitrosylferrate (III)

(B) Sodium pentacyanidonitrosylliumferrate (II)

(C) Sodium petacyanidonitrosylliumferrate (III)

(D) Sodium pentacyanonitrosylferrate (II)

Q.75 The formula of potassium dicyanobis(oxalato)nickelate(II) is

(A) $K_4[Ni(CN)_2(Ox)_2]$ (B) $K[Ni(CN)_2(Ox)_2]$

(C) $K_3[Ni(CN)_2(Ox)_2]$ (D) $K_2[Ni(CN)_2(Ox)_2]$

Q.76 The IUPAC name of $K_2[Cr(NH_3)(CN)_2(O)_2(O_2)]$ is

(A) Potassium amminedicyanodioxidoperoxochromate(VI)

(B) Potassium amminedicyanoperoxooxidochromium(VI)

(C) Potassium amminedicyanoperoxooxochromium(VI)

(D) Potassium amminedicyanodiperoxodioxochromate(IV)

Q.77 The IUPAC name of the red coloured complex $[Fe(C_4H_7O_2N_2)_2]$ obtained from the reaction of Fe^{2+} and dimethyl glyoxime

(A) bis(dimethylglyoxime) ferrate (II) (B) bis(dimethylglyoximato) iron (II)

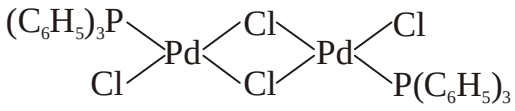
(C) bis(2, 3-butanedioldioximato) iron (II) (D) bis(2, 3-butanedionedioximato) iron (I)

Q.78 The IUPAC name for the coordination compound $Ba[BrF_4]_2$ is

(A) Barium tetrafluorobromate (V) (B) Barium tetrafluorobromate (III)

(C) Barium bis(tetrafluorobromate(III)) (D) none of these

Q.79 IUPAC name of



(A) Chlorotriphenylphosphinepalladium(II) di-μ-chloridochlorotriphenylphosphinepalladium(II)

(B) Chlorotriphenylphosphinepalladium(III) di-μ-chloridochlorotriphenylphosphinepalladium(II)

(C) Triphenylphosphinechloropalladium(II) di-μ-chloridotriphenylphosphinechloropalladium(III)

(D) Triphenylphosphinechloropalladium(III) di-μ-chloridotriphenylposphinechloropalladium(III)

Q.80 The hypothetical complex chloro diaquatriammine cobalt (III) chloride can be represented as :

(A) $[CoCl(NH_3)_3(H_2O)_2]Cl_2$ (B) $[Co(NH_3)_3(H_2O)Cl_3]$

(C) $[Co(NH_2)_3(H_2O)_2Cl]$ (D) $[Co(NH_3)_3(H_2O)_3]Cl_3$

Werner's Theory

Q.81 In a complex, the correct statement is :

(A) primary valency is ionisable (B) primary valency is non-ionisable

(C) secondary valency is ionisable (D) All of these

Q.82 The molecular formula of various hexacoordinate complexes are given as below.

(1) $CrCl_3.6NH_3$ (2) $CrCl_3.5NH_3$ (3) $CrCl_3.4NH_3$

If the number of NH_3 ligands attached to central metal ion respectively are 6, 5 and 4, then the primary valencies in (1), (2) and (3) respectively are :

(A) 3, 3, 3 (B) 0, 1, 2 (C) 3, 2, 1 (D) 6, 5, 4

Q.83 Which of the following has minimum molar electrical conductivity ?

(A) $CoCl_3.6NH_3$ (B) $CoCl_3.5NH_3$ (C) $CoCl_3.4NH_3$ (D) $CoCl_3.3NH_3$

Q.84 When $AgNO_3$ is added to a solution of $Co(NH_3)_5Cl_3$, the precipitate of AgCl shows two ionisable chloride ions. This means –

(A) Two chlorine atom satisfy primary valency and one chlorine atom satisfies primary valency as well as secondary valency.

(B) One chlorine atom satisfies primary valency.

(C) Two chlorine atoms satisfy secondary valency.

(D) Three chlorine atoms satisfy secondary valency.

Q.85 Which isomer of $CrCl_3.6H_2O$ is dark green in colour and forms one mole of AgCl with excess of $AgNO_3$ solution –

(A) $[Cr(H_2O)_6]Cl_3$ (B) $[Cr(H_2O)_5Cl]Cl_2.H_2O$

(C) $[Cr(H_2O)_4Cl_2]Cl.2H_2O$ (D) $[Cr(H_2O)_3Cl_3].3H_2O$

Q.86 Give the correct increasing order of electrical conductivity of aqueous solutions of following complex entities –

I. $[Pt(NH_3)_6]Cl_4$ II. $[Cr(NH_3)_6]Cl_3$ III. $[Co(NH_3)_4Cl_2]Cl$ IV. $K_2[PtCl_6]$

(A) III < IV < II < I (B) IV < II < III < I (C) II < I < IV < III (D) I < II < IV < III

Q.87 Which of the following is most likely formula of platinum complex, if $\frac{1}{4}$ of total chlorine of the compound is precipitated by adding $AgNO_3$ to its aqueous solution –

(A) $PtCl_4.6H_2O$ (B) $PtCl_4.5H_2O$ (C) $PtCl_4.2H_2O$ (D) $PtCl_4.3H_2O$

Q.88 The fraction of chlorine precipitated by $AgNO_3$ solution from $[Co(NH_3)_5Cl]Cl_2$ is –

(A) 1/2 (B) 2/3 (C) 1/3 (D) 1/4

Q.89 The number of ions formed when Tetraamminecopper(II) sulphate is dissolved in water is

(A) 1 (B) 2 (C) 4 (D) Zero

Q.90 For complexes: (I) $CoC1_3.6NH_3$(II) $CoCl_3.5NH_3$ (III) $CoCl_3.4NH_3$ primary valency in I, II & III are respectively:

(A) 6, 5,4 (B) 3, 2, 1 (C) 0, 1, 2 (D) 3, 3, 3

Q.91 Which one of the following has highest molar conductivity

(A) Diamminedichloroplatinum(II) (B) Tetraamminedichlorocobalt(III) chloride

(C) Potassium hexacyanoferrate(II) (D) Hexaaquachromium(III) bromide

Q.92 Which of the following will not give precipitate with $AgNO_3$?
(A) $CoCl_3.3NH_3$ (B) $CoCl_3.4NH_3$ (C) $CoC1_3.5NH_3$ (D) $CoCl_3.6NH_3$

Q.93 How many moles of AgCl would be obtained, when 100 ml of 0.1 M $CoCl_3(NH_3)_5$ is treated with excess of $AgNO_3$?
(A) 0.01 (B) 0.02 (C) 0.03 (D) none of these

Q.94 0.001 mol of $Co(NH_3)_5(NO_3)(SO_4)$ was passed through a cation exchanger and the acid coming out of it required 20 ml of 0.1 M NaOH for neutralisation. Hence, the complex is
(A) $[CoSO_4(NH_3)_5]NO_3$ (B) $[CoNO_3(NH_3)_5]SO_4$
(C) $[Co(NH_3)_5]SO_4NO_3$ (D) None of these

Q.95 Consider the following statements:
According to Werner's theory.
(1) Ligands are connected to the metal ion by covalent bonds.
(2) Secondary valencies are directional
(3) Secondary valencies are non-ionisable
(4) Secondary valencies are satisfied by either neutral or negative ions
Of these statements:
(A) 2, 3 & 4 are correct (B) 2 & 3 are correct
(C) 1 & 3 are correct (D) 1, 2 & 4 are correct

Q.96 Cobalt (III) chloride forms several octahedral ecomplexes with ammonia. Which of the following will **not** give test for chloride ions with silver nitrate at 25ºC ?
(A) $CoCl_3.4NH_3$ (B) $CoCl_3.5NH_3$ (C) $CoCl_3.6NH_3$ (D) $CoCl_3.3NH_3$

Valence Bond Theory (V.B.T.)

Q.97 Hexafluorocobaltate(III) ion is found to be high spin complex, the hybridisation ~~state~~ of cobalt is –
(A) d^2sp^3 (B) sp^3 (C) sp^3d (D) sp^3d^2

Q.98 The number of unpaired electrons calculated in $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ are :
(A) 4 and 4 (B) 0 and 2 (C) 2 and 4 (D) 0 and 4

Q.99 The complex ions $[Fe(CN)_6]^{3-}$ and $[Fe(CN)_6]^{4-}$
(A) Are both octahedral and paramagnetic
(B) Are both octahedral and diamagnetic
(C) Have same structure but different magnetic character
(D) Have different structures but same magnetic character

Q.100 A complex of certain metal has the magnetic moment of 4.91 BM whereas another complex of the same metal with same oxidation state has zero magnetic moment. The metal ion could be

(A) Co^{2+} (B) Mn^{2+} (C) Fe^{2+} (D) Fe^{3+}

Q.101 Point out the correct statements amongst the following

(A) $[Cu(CN)_4]^{3-}$ has tetrahedral geometry and dsp^2 hybridization

(B) $[Ni(CN)_6]^{4-}$ is octahedral and Ni has d^2sp^3 hybridization

(C) $[ZnBr_4]^{2-}$ is tetrahedral and diamagnetic

(D) $[Cr(NH_3)_6]^{3+}$ has octahedral geometry and sp^3d^2 hybridization

Q.102 Which complex has square planar structure ?

(A) $Ni(CO)_4$ (B) $[NiCl_4]^{2-}$ (C) $[Ni(H_2O)_6]^{2+}$ (D) $[Cu(NH_3)_4]^{2+}$

Q.103 Complexes with CN^- ligands are :

(A) High spin complexes

(B) Usually low spin complexes

(C) High spin complex with diamagnetic behaviour

(D) Always diamagnetic in nature

Q.104 Which order is correct in spectrochemical series of ligands –

(A) $Cl^- < F^- < C_2O_4^{2-} < NO_2^- < CN^-$ (B) $CN^- < C_2O_4^{2-} < Cl^- > NO_2^- < F^-$

(C) $C_2O_4^{2-} < F^- < Cl^- > NO_2^- < CN^-$ (D) $F^- < Cl^- < NO_2^- < CN^- < C_2O_4^{2-}$

Q.105 Cu^{++} and Au^{3+} resemble in formation of co-ordination compound

(A) C.N. = 2, linear (B) C.N. = 4, tetrahedron

(C) C.N. = 4, square planar (D) None of these

Q.106 Which of the following complexes doesn't have d^2sp^3 hybridisation?

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

Q.107 Hybridization of metal ion in $[Ni(H_2O)_6]^{2+}$ complex is

(A) d^3sp^2 (B) sp^3d^2 (C) sp^3 (D) dsp^2

Q.108 Which of the following complex has a square planar geometry ?

(A) $[Ag(NH_3)_2]^+$ (B) $[Cu(en)_2]^{2+}$ (C) $[MnCl_4]^{2-}$ (D) $Ni(CO)_4$

Q.109 Among the following, the species having square planar geometry/shape

(i) XeF_4 (ii) SF_4 (iii) $[NiCl_4]^{2-}$ (iv) $[PdCl_4]^{2-}$

(A) (i) and (iv) (B) (i) and (ii) (C) (ii) and (iii) (D) (iii) and (iv)

Q.110 Hybridization of Cr in chromium hexacarbonyl is

(A) sp^3d^2 (B) dsp^2 (C) d^2sp^3 (D) d^3sp^2

Q.111 The species having tetrahedral shape is

(A) $[Cu(en)_2]^{2+}$ (B) $[Ni(CN)_4]^{2-}$ (C) $[AgF_4]^-$ (D) $[Cu(CN)_4]^{3-}$

Q.112 Which of the following molecules is not tetrahedral

(A) $[Ni(en)_2]^{2+}$ (B) $[Ni(CO)_4]$ (C) $[Zn(NH_3)_4]^{2+}$ (D) $[NiCl_4]^{2-}$

Q.113 In $Fe(CO)_5$, sigma bond between Fe and CO results by the overlap between filled sp hybrid orbital of C -atom of CO molecule and which hybrid orbitals of Fe :

(A) d^2sp^3 (B) sp^3 (C) $d_{x^2-y^2}sp^3$ (D) $d_{z^2}sp^3$

Q.114 For the correct assignment of electronic configuration of a complex, the valence bond theory often requires the measurement of

(A) molar conductance (B) optical activity

(C) magnetic moment (D) dipole moment

Q.115 The hybridisation and unpaired electrons in $[Fe(H_2O)_6]^{2+}$ ion are:

(A) sp^3d^2; 4 (B) d^2sp^3, 3 (C) d^2sp^3, 4 (D) sp^3d^2, 2

Q.116 The hybridisation of Co in $[Co(H_2O)_6]^{3+}$ is

(A) d^2sp^3 (B) dsp^2 (C) sp^3 (D) sp^3d^2

Q.117 Which of the following statements about $Fe(CO)_5$ is correct?

(A) It is paramagnetic and high spin complex (B) It is diamagnetic and high spin complex

(C) It is diamagnetic and low spin complex (D) It is paramagnetic and low spin complex

Q.118 Which of the following statements is not true?

(A) $[MnCl_4]^{2-}$ ion has tetrahedral geometry and is paramagnetic

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

(C) $[CuCl_4]^{2-}$ has square planar geometry and is paramagnetic

(D) $[NiBr_2(Ph_3P)_3]$ has trigonal bipyramidal geometry and two unpaired electron

Q.119 Which of the following is not expected to show paramagnetism?

(A) $[Fe(NH_3)_6]^{2+}$ (B) $Ni(CO)_4$ (C) $[Cr(en)_3]^{2+}$ (D) $[Cu(NH_3)_4]^{2+}$

Q.120 Considering H_2O as a weak field ligand, the number of unpaired electrons in $[Mn(H_2O)_6]^{2+}$ will be : (Atomic no. of Mn = 25)

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

Q.121 The d-electron configuration of Cr^{2+}, Mn^{2+}, Fe^{2+} and Ni^{2+} are $3d^4$, $3d^5$, $3d^6$ and $3d^8$ respectively, which one of the following aqua-complex will exhibit the minimum paramagnetic behaviour ?

(A) $[Cr(H_2O)_6]^{2+}$ (B) $[Mn(H_2O)_6]^{+2}$ (C) $[Fe(H_2O)_6]^{2+}$ (D) $[Ni(H_2O)_6]^{2+}$

Q.122 A magnetic moment of 1.73 BM will be shown by one among the following :

(A) $[Ni(CN)_4]^{2-}$ (B) $TiCl_4$ (C) $[CoCl_6]^{4-}$ (D) $[Cu(NH_3)_4]^{2+}$

Q.123 CN^- is strong field ligand. This is due to the fact that

(A) it carries negative charge

(B) it is a pseudohalide

(C) it can accept electrons from metal species

(D) it forms high spin complexes with metal specis

Q.124 Which pair of ion form homoleptic octahedral complex with H_2O having low spin and high spin respectively?

(A) Fe^{2+}, Fe^{3+} (B) Co^{2+}, Co^{3+}

(C) Fe^{3+}, Fe^{2+} (D) Co^{3+}, Co^{2+}

Q.125 **Statement–1 :** $[Ni(CN)_4]^{2-}$ is a diamagnetic complex

Statement–2 : Compound is low spin complex.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.126 **Statement–1 :** $K_3[Fe(CN)_6]$ is a low spin complex.

Statement–2 : Fe^{3+} ion in this complex undergoes sp^3d^2 hybridization.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Crystal Field Theory (C.F.T.)

Q.127 The strongest field ligand in the following is

(A) CN^- (B) NH_3 (C) OH^- (D) SCN^-

Q.128 Among the following, which one has higher CFSE?

(A) $[Zn(NH_3)_4]^{2+}$ (B) $[Zn(OH)_4]^{2-}$ (C) $[Zn(CN)_4]^{2-}$ (D) $[Zn(H_2O)_4]^{2+}$

Q.129 The purple colour of $[Ti(H_2O)_6]^{3+}$ in aqueous solution is due to :

(A) d-d transition of unpaired d-electron (B) charge transfer spectrum

(C) intermolecular vibration (D) polarisation of cation.

Q.130 Which of the following statements is correct with respect to the crystal field theory ?

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

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

(C) The ligands are point charges which are either ions or neutral molecules.

(D) All of these

Q.131 All the following complex ions are found to be paramagnetic :

P : $[FeF_6]^{3-}$; Q : $[CoF_6]^{3-}$

R : $[V(H_2O)_6]^{3+}$; S : $[Ti(H_2O)_6]^{3+}$

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

Q.132 For the $t_{2g}^6\ e_g^2$ system, the value of magnetic moment (μ) is –

(A) 2.83 B.M. (B) 1.73 B.M. (C) 3.87 B.M. (D) 4.92 B.M.

Q.133 Which of the following electronic arrangement gives the highest value of the magnetic moment in case of octahedral complex ?

(A) d^6, strong field (B) d^7, high spin

(C) d^4, weak field (D) d^2, strong field

Q.134 In which of the following coordination entities, the magnitude of Δ_0 will be maximum? :

(A) $[Co(CN)_6]^{3-}$ (B) $[Co(C_2O_4)_3]^{3-}$ (C) $[Co(H_2O)_6]^{3+}$ (D) $[Co(NH_3)_6]^{3+}$

Q.135 The crystal field stabilization energy (CFSE) is the highest for

(A) $[CoF_4]^{2-}$ (B) $[Co(SCN)_4]^{2-}$ (C) $[Co(dmg)_2]^{3+}$ (D) $[CoCl_4]^{2-}$

Q.136 Crystal field stabilization energy for low spin d^4 octahedral complex is

(A) $-0.6\ \Delta_0$ (B) $-1.8\ \Delta_0$ (C) $-1.6\ \Delta_0 + P$ (D) $-1.2\ \Delta_0$

Q.137 The most stable ion is

(A) $[Fe(py)_6]^{3+}$ (B) $[FeF_6]^{3-}$ (C) $[Fe(CN)_6]^{3-}$ (D) $[Fe(H_2O)_6]^{3+}$

Q.138 Which of the following factors tends to increase the stability of metal ion complexes

(A) Higher ionic radius of the metal ion

(B) Higher charge/size ratio of the metal ion

(C) Lower ionisation potential of the metal ion

(D) Lower basicity of the ligand

Q.139 Which one of the following statement is incorrect ?

(A) Greater the formation constant (K_f) of a complex ion, greater is its stability.

(B) Greater the positive charge on the central metal ion, greater is the stability of the complex

(C) Greater is electron pair donating ability of the ligand, lesser is the stability of the complex.

(D) Chelate complexes have high stability constants.

Q.140 Select the correct statement about brown ring complex ion $[Fe(H_2O)_5(NO)]^{2+}$.

(A) Colour change is due to charge transfer

(B) It has iron in +1 oxidation state and nitrosyl as NO^+

(C) It has magnetic moment of 3.87 BM confirming three unpaired electrons in Fe

(D) All the above are correct statements.

Q.141 The value of Δ_0 for complex ion $[CoCl_6]^{4-}$ is 18000 cm^{-1}. Then the value of Δ_t for $[CoCl_4]^{2-}$ complex ion will be

(A) 18000 cm^{-1} (B) 16000 cm^{-1} (C) 8000 cm^{-1} (D) 2000 cm^{-1}

Q.142 The spin only magnetic moment value (in Bohr magneton units) of $Cr(CO)_6$ is

(A) 0 (B) 2.84 (C) 4.90 (D) 5.92

Q.143 The correct distribution of 3d electrons in chromium for the complex $[Cr(CN)_6]^{3-}$

(A) $3d^1_{xy}, 3d^1_{yz}, 3d^1_{xz}$ (B) $3d^{\uparrow\downarrow}_{xy}, 3d^{\uparrow}_{yz}, 3d^0_{zx}$

(C) $3d^1_{x^2-y^2}, 3d^1_{z^2}, 3d^1_{xz}$ (D) $3d^1_{xy}, 3d^1_{x^2-y^2}, 3d^1_{yz}$

Q.144 Among the following complexes, which has magnetic moment of 5.9 BM

(A) $Ni(CO)_4$ (B) $[Fe(H_2O)_6]^{2+}$ (C) $[Co(NH_3)_6]^{3+}$ (D) $[MnBr_4]^{2-}$

Q.145 Which of the following complex ion absorb visible light

(A) $[Sc(H_2O)_3(NH_3)_3]^{3+}$ (B) $[Ti(en)_2(NH_3)_2]^{4+}$

(C) $[Cr(NH_3)_6]^{3+}$ (D) $[Zn(NH_3)_6]^{2+}$

Q.146 Which of the following is diamagnetic in nature

(A) Co^{3+} octahedral complex with weak field ligands

(B) Co^{3+} octahedral complex with strong field ligands

(C) Co^{2+} in tetrahedral complex

(D) Co^{2+} in square planar complex

Q.147 Among the following, the compound that is both paramagnetic and coloured is

(A) $K_2Cr_2O_7$ (B) $(NH_4)_2[TiCl_6]$ (C) $VOSO_4$ (D) $K_3[Cu(CN)_4]$

Q.148 Prussian blue is formed when

(A) Ferrous sulphate cambines with $K_4[Fe(CN)_6]$

(B) Ferric sulphate combines with $K_4[Fe(CN)_6]$

(C) Ferrous ammonium sulphate combines with $K_3[Fe(CN)_6]$

(D) $FeCl_3$ combines with $K_3[Fe(CN)_6]$

Q.149 Octahedral complex of Ni(II) will be always

(A) inner orbital

(B) outer orbital

(C) inner or outer orbital depending upon the strong or weak field ligand

(D) none of these

Q.150 Mn^{2+} forms a complex with Br^- ion. The magnetic moment of the complex is 5.92 B.M. What could not be the probable formula and geometry of the complex?

(A) $[MnBr_6]^{4-}$, octahedral (B) $[MnBr_4]^{2-}$, square planar

(C) $[MnBr_4]^{2-}$, tetrahedral (D) $[MnBr_5]^{3-}$, trigonal bipyramidal

Q.151 A complex of certain metal has the magnetic moment of 4.91 BM whereas another complex of the same metal with same oxidation state has zero magnetic moment. The metal ion could be

(A) Co^{2+} (B) Mn^{2+} (C) Fe^{2+} (D) Fe^{3+}

Q.152 The complex having highest Δ value

(A) $[Ni(en)_3]^{2+}$ (B) $[Ni(CN)_4]^{2-}$ (C) $[NiCl_4]^{2-}$ (D) $[Ni(NH_3)_6]^{2+}$

Q.153 The colour of light absorbed by an aqueous solution of $CuSO_4$ is

(A) Red (B) blue-green (C) yellow (D) violet

Q.154 d-orbital configuration of complex $[FeF_6]^{3-}$

(A) $t_{2g}^3e_g^2$ (B) t_{2g}^5 (C) $t_{2g}^2e_g^3$ (D) e_g^5

Q.155 An ion M^{2+}, forms the complexes $[M(H_2O)_6]^{2+}$, $[M(en)_3]^{2+}$ and $[MBr_6]^{4-}$, match the complex with the appropriate colour.

(A) Green, Blue and Red (B) Blue, Red and Green

(C) Green, Red and Blue (D) Red, Blue and Green

Q.156 Colourless complex is :

(A) $[TiF_6]^{2-}$ (B) $[CoF_6]^{3-}$ (C) $[NiCl_4]^{2-}$ (D) $[Fe(CO)_5]$

Q.157 The correct order for the wavelength of absorption in the visible region is

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

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

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

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

Q.158 Which of the following coordination entities should be expected to absorb light of lowest frequency ?

(A) $[Cr(en)_3]^{3+}$ (B) $[CrCl_6]^{3-}$ (C) $[Cr(NH_3)_6]^{3+}$ (D) $[Cr(CN)_6]^{3-}$

Q.159 Correct increasing order for the wavelength of absorption in the visible region for the complexes of Co^{3+} is :

(A) $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(H_2O)_6]^{3+}$

(B) $[Co(H_2O)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(NH_3)_6]^{3+}$

(C) $[Co(H_2O)_6]^{3+}$, $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$

(D) $[Co(NH_3)_6]^{3+}$, $[Co(en)_3]^{3+}$, $[Co(H_2O)_6]^{3+}$

Q.160 **Statement-1:** Complex compound $[Ni(en)_3]Cl_2$ has lower stability than $[Ni(NH_3)_6]Cl_2$

Statement-2 : In $[Ni(en)_3]Cl_2$, geometry around Ni^{2+} is octahedral.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement-2 is true and Statement-2 is NOT the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.161 **Statement-1 :** Δ_0 increases in the order of $[Cr(Cl_6)]^{3-} < [Cr(CN)_6]^{3-} < [Cr(C_2O_4)_3]^{3-}$

Statement-2 : Stronger the ligand field, higher will be Δ_0 value.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement-2 is true and Statement-2 is NOT the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.162 **Statement–1 :** Potassium ferrocyanide is diamagnetic where as potassium ferricyanide is paramagnetic.

Statement–2 : Crystal field splitting in ferrocyanide ion is lesser than that of ferricyanide ion.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.163 **Statement–1 :** In octahedral geometry of ligands d-orbitals of a metal cation split into two sets of orbitals t_{2g} and eg.

Statement–2 : Splitting of d-orbitals occurs only in the case of strong field ligands.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.164 **Statement–1 :** $[Ti(H_2O_6]^{3+}$ is coloured while $[Sc(H_2O)_6]^{3+}$ is colourless

Statement–2 : d-d transition is not possible in $[Sc(H_2O)^{3+}$ due to having no d-electron, while possible for Ti^{3+} having d^1 configuration.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Structural Isomerism

Q.165 In coordination compounds, the hydrate isomers differ –

(A) In the number of water molecules of hydration only

(B) In the number of water molecules only present as ligands

(C) Both (A) and (B)

(D) In their coordination number of the metal atom

Q.166 Which of the following is pair of ionization isomers ?

(A) $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$

(B) $[Cr(H_2O)_5Cl]Cl_2.H_2O$ and $[Cr(H_2O)_4.Cl_2]Cl.2H_2O$

(C) $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6]\ [Co(CN)_6]$

(D) cis-$[Pt(NH_3)_2Cl_2]$ and trans-$[Pt(NH_3)_2Cl_2]$

Q.167 Which would exhibit co-ordination isomerism –

(A) $[Cr(NH_3)_6][Co\ (CN)_6]$ (B) $[Co(en)_2Cl_2]^+$

(C) $[Cr(NH_3)_6]Cl_3$ (D) $[Cr(en)_2Cl_2]^+$

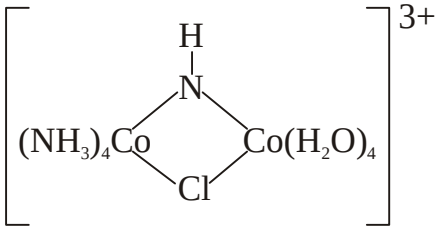
Q.168 $[Pd(C_6H_5)_2\ (SCN)_2]$ and $[Pd(C_6H_5)_2(NCS)_2]$ are:

(A) Linkage isomers (B) Co-ordination isomers

(C) Ionisation isomers (D) Geometrical isomers

Q.169 Which will exhibit co-ordination isomerism

(A) $[Cr(NH_3)_6]\ [Co(CN)_6]$ (B) $[Co(en)_2\ Cl_2]Br$

(C) 

(D) $[Ir(NO_2)_3(H_2O)_3]$

Q.170 Coordination isomerism is caused by the interchange of ligands between the

(A) Cis and Trans configuration

(B) Complex cation and complex anion in a complex salt

(C) Co-ordination sphere and simple counter ion

(D) Low oxidation and higher oxidation state of metal cation

Q.171 The pair of complex compounds $[Cr(H_2O)_6]Cl_3$ and $[Cr(H_2O)_5Cl]Cl_2 \cdot H_2O$ are

(A) Linkage isomers (B) Ionisation isomers

(C) Coordination isomers (D) Hydrate isomers

Q.172 The ionization isomer of $[Cr(H_2O)_4Cl(NO_2)]Cl$ is

(A) $[Cr(H_2O)_4(NO_2)]Cl_2$ (B) $[Cr(H_2O)_4Cl_2]NO_2$

(C) $[Cr(H_2O)_4Cl(ONO)]Cl$ (D) $[Cr(H_2O)_3Cl_2(NO_2)]H_2O$

Q.173 The total number of possible structural isomers for the complex compound $[Cu(NH_3)_4][PtCl_4]$ are

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

Q.174 Type of isomerism exhibited by $[Cr(NCS)(NH_3)_5][ZnCl_4]$

(A) Coordination isomerism (B) Linkage isomerism

(C) Ionization isomerism (D) Both coordination and linkage isomerism

Q.175 Type of isomerism exhibited by $[Ir(OCN)_3(H_2O)_3]$

(A) Hydrate isomerism (B) Linkage isomerism

(C) Polymerization isomerism (D) Both (B) and (C)

Q.176 Other than the X-ray diffractions, how could be the following pairs of isomers be distinguished from one another by

$[Cr(NH_3)_6][Cr(NO_2)_6]$ and $[Cr(NO_2)_2(NH_3)_4][Cr(NO_2)_4(NH_3)_2]$

(A) electrolysis of an aqueous solution (B) measurement of molar conductance

(C) measuring magnetic moments (D) measurement of optical activity

Q.177 How the isomerism complexes $[Co(NH_3)_6][Cr(NO_2)_6]$ and $[Cr(NH_3)_6][Co(NO_2)_6]$ can be distinguished from one another by

(A) measurement of molar conductance (B) measurement magnetic moments

(C) electrolysis of their aqueous solutions (D) measurement of optical activity

Q.178 Which of the following cannot show linkage isomerism?

(A) SO_3^{2-} (B) SCN^- (C) $S_2O_3^{2-}$ (D) SO_4^{2-}

Q.179 The complexes $[Co(NH_3)_6][Cr(C_2O_4)_3]$ and $[Cr(NH_3)_6][Co(C_2O_4)_3]$ will have which type of isomerism

(A) Linkage isomerism (B) Geometrical isomerism

(C) Coordination isomerism (D) Ionisation isomerism

Q.180 Which of the following will give maximum number of structural isomers ?

(A) $[Co(NH_3)_4Cl_2]$ (B) $[Ni\ (en)(NH_3)_4]^{2+}$

(C) $[Ni(C_2O_4)(en)_2]^{2-}$ (D) $[Cr(SCN)_2(NH_3)_4]^{+}$

Q.181 The complexes $[Co(NH_3)_6]\ [Cr(CN)_6]$ and $[Cr(NH_3)_6]\ [Co(CN)_6]$ are the examples of which type of isomerism?

(A) Linkage isomerism (B) Ionization isomerism

(C) Coordination isomerism (D) Geometrical isomerism

Q.182 Complexes $[Co\ (SO_4)(NH_3)_5]Br$ and $[CoBr(NH_3)_5]SO_4$ can be distinguished by

(A) conductance measurement (B) using $BaCl_2$

(C) using $AgNO_3$ (D) all

Q.183 **Statement-1 :** The complex $[Cr(SCN)(NH_3)_5]Cl_2$ is linkage isomer of $[Cr(NCS)(NH_3)_5)]Cl_2$.

Statement-2 : SCN^- is an ambident ligand.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.184 **Statement-1 :** Coordination isomerism can occur when both cation and anion are complex ions.

Statement-2 : Co-ordination isomers may exhibit geometrical isomerism.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

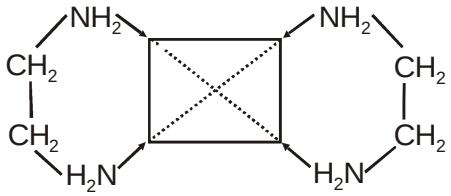
(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Stereo Isomerism

Q.185 A square planar complex represented as it will show which isomerism –



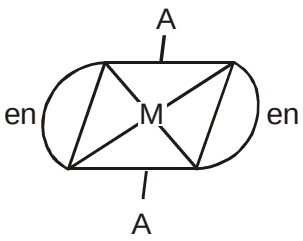
(A) Geometrical isomerism (B) Optical isomerism
(C) Linkage isomerism (D) None of these

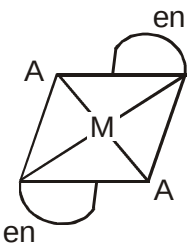
Q.186 Geometrical isomerism in coordination compounds is exhibited by –
(A) Square planar and tetrahedral complexes
(B) Square planar and octahedral complexes
(C) Tetrahedral and octahedral complexes
(D) Square planar, tetrahedral and octahedral complexes

Q.187 $[Co(en)_3]^{3+}$ ion is expected to show
(A) two optically active isomers: d and *l* forms
(B) three optically active isomers: d, *l* and meso forms
(C) four optically active isomers: cis, d and *l* isomers and trans d and *l* isomers
(D) No optical isomerism but can show cis-trans isomerism

Q.188 Cis-trans-isomerism is found in square planar complexes of the molecular formula (a and b are monodentate ligands) –
(A) Ma_4 (B) Ma_3b (C) Ma_2b_2 (D) Mab_3

Q.189 The complexes given below are –





(A) Geometrical isomers (B) Position isomers
(C) Optical isomers (D) Identical

Q.190 Theoritically the No. of geometrical isomers expected for octahedral complex [Mabcdef] is –

(A) Zero (B) 30 (C) 15 (D) 9

Q.191 $[Co(NH_3)_4(NO_2)_2]Cl$ exhibits

(A) Linkage isomerism, ionisation isomerism and optical isomerism

(B) Linkage isomerism, geometrical isomerism and optical isomerism

(C) Linkage isomerism, ionisation isomerism and geometrical isomerism

(D) Ionisation isomerism, geometrical isomerism and optical isomerism

Q.192 On treatment of $[Ni(NH_3)_4]^{2+}$ with concentrated HCl, two compounds **I** and **II** having the same formula, $[NiCl_2(NH_3)_2]$ are obtained, **I** can be converted into **II** by boiling with dilute HCl. A solution of **I** reacts with oxalic acid to form $[Ni(C_2O_4)(NH_3)_2]$ wheras **II** does not react. Point out the correct statement of 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

Q.193 The difference in colour is not due to

(A) Linkage isomerism (B) Geometrical isomerism

(C) Optical isomerism (D) Hydrate isomerism

Q.194 The number of possible isomers of square planar complex [M(abcd)] are :

(A) 4 (B) 3 (C) 0 (D) 1

Q.195 $[Co(NH_3)_4Cl_2]^+$ exhibits

(A) Geometrical isomerism (B) Optical isomerism

(C) Ionisation isomerism (D) No isomerism

Q.196 Which one of the following will not show geometrical isomerism

(A) $[Cr(NH_3)_4Cl_2]Cl$ (B) $[Co(en)_2Cl_2]Cl$

(C) $[Co(NH_3)_5(NO_2)]Cl_2$ (D) $[Pt(NH_3)_2Cl_2]$

Q.197 Total number of optical isomers in $[Co(en)_2Cl_2]^+$ is

(A) 2 (B) 3 (C) 4 (D) 6

Q.198 Which of the following complex will show geometrical as well as optical isomerism

(A) $[Pt(NH_3)_2Cl_2]$ (B) $[Pt(NH_3)_2Cl_4]$

(C) $[Pt(en)_3]^{4+}$ (D) $[Pt(en)_2Cl_2]^{2+}$

Q.199 Which of the following coordination compounds would exhibit optical activity

(A) trans-dicyanobis (ethylenediamine) chromium (III) chloride

(B) tris-(ethylenediamine) cobalt (III) bromide

(C) pentaamminenitrocobalt (III) chloride

(D) diamminedichloroplatinum (II)

Q.200 Which of the following does not have optical isomer

(A) $[Co(NH_3)_3Cl_3$ (B) $[Co(en)_3]Cl_3$ (C) $[Co(en)_2Cl_2]$ Cl (D) $[Co(en)\ (NH_3)_2Cl_2]Cl$

Q.201 Which of the following has only one pair of enantiomers

(A) $[CoBr(SCN)_2(H_2O)_3]$ (B) $[Cr(NH_3)_6][Co(CN)_6]$

(C) $[CrCl_2(NH_3)_2(H_2O)_2]^+$ (D) $[IrBr_2(CN)(NO_2)(H_2O)(py)]^-$

Q.202 The number of possible isomers of an octahedral complex $[Co(C_2O_4)_2(NH_3)_2]^-$ is

(A) 1 (B) 2 (C) 3 (D) 4

Q.203 Which of the following complex does not show geometrical isomerism

(A) $[IrCl_2(NH_3)_4]^+$ (B) $[Fe(NH_3)_2(CN)_4]^-$ (C) $[Cr(Ox)_3]^{3-}$ (D) $[Co(NH_3)_3(NO_2)_3]$

Q.204 For the given complex $[CoCl_2(en)\ (NH_3)_2]^+$, the number of geometrical isomers, the number of optically active isomers and total number of stereoisomers are

(A) 3, 2 and 4 (B) 2, 2 and 4 (C) 3, 1 and 4 (D) 3, 2 and 3

Q.205 The existence of two different coloured complexes with the composition of $[Co(NH_3)_4Cl_2]^-$ is due to

(A) Ionization isomerism (B) Linkage isomerism

(C) Geometrical isomerism (D) Coordination isomerism

Q.206 Which one of the following complexes is not expected to exhibit isomerism

(A) $[Ni(NH_3)_4\ (H_2O)_2]^{2+}$ (B) $[Pt(NH_3)_2Cl_2]$

(C) $[Ni(en)Cl_2]$ (D) $[Ni(en)_3]^{2+}$

Q.207 The number of geometrical isomers of the complex $[Co(NO_2)_3(NH_3)_3]$ is

(A) 2 (B) 4 (C) 3 (D) 0

Q.208 Which of the following statements is incorrect?

(A) Geometrical isomerism is not exhibited by complexes having tetrahedral geometry

(B) Square planar complexes may show optical isomerism with ligands having chiral centre

(C) Octahedral complexes having two chelating ligands in perpendicular plane always exhibit optical isomerism

(D) Complex $[Pt(Gly)_2]$ does not show geometrical isomerism

Q.209 Which of the following complexes will show geometrical as well as optical isomerism?

(A) $[Zn(bcac)_2]$ (B) $[Pt(gly)_3]^+$ (C) $[CrBr_4(en)]^-$ (D) $[Ir(acac)_3]$

Q.210 A square planar complex can exhibit optical isomerism with ligand:

(A) gly (B) bcac (C) bn (D) dmg

Q.211 Which one of the following is expected to exhibit optical isomerism? (en = ethylenediamine)

(A) cis–$[Pt(NH_3)_2Cl_2]$ (B) trans–$[Co(en)_2Cl_2]^+$

(C) trans–$[Pt(NH_3)_2Cl_2]$ (D) cis–$[Co(en)_2Cl_2]^+$

Q.212 Which of the following will give a pair of enantiomers ?

(A) $[Pt(NH_3)_4][PtCl_6]$ (B) $[Co(NH_3)_4Cl_2]NO_2$

(C) $[Cr(NH_3)_6][Co(CN)_6]$ (D) $[Co(en)_2Cl_2]Cl$

Q.213 The complex, $[Pt(Py)(NH_3)BrCl]$ will have how many geometrical isomers ?

(A) 3 (B) 4 (C) 0 (D) 2

Q.214 **Statement-1 :** The geometrical isomer of the complex $[M(NH_3)_4Cl_2]$ are optically inactive.

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

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.215 **Statement-1:** Complexes of type $[MA_6]^{n\pm}$ and $[MA_5B]^{n\pm}$ do not show geometrical isomerism.

Statement-2: Geometrical isomerism is not exhibited by complexes of coordination number 6.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.216 **Statement-1 :** Cis-isomer of $[Co(en)_2Cl_2]^+$ shows optical activity.

Statement-2: Cis-isomer of $[Co(en)_2Cl_2]^+$ is a symmetric molecule.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Q.217 **Statement-1:** Complex compounds containing three symmetrical bidentate ligands exhibit optical activity.

Statement-2: Such octahedral complex have plane of symmetry.

(A) Statement-1 is true, Statement-2 is true and Statement-2 is correct explanation for Statement-1

(B) Statement-1 is true, Statement·2 is true and Statement-2 is **NOT** the correct explanation for Statement-1

(C) Statement-1 is true, Statement-2 is false

(D) Statement-1 is false, Statement-2 is true

Synergic bonding

Q.218 In which compound synergic bonding is present

(A) $[Ni(CO)_4]$ (B) $[Ni(NH_3)_4]^{2+}$ (C) $[Zn(OH)_4]^{2-}$ (D) $[FeF_6]^{3-}$

Q.219 Which of the following is not true for metal carbonyls ?

(A) The oxidation state of central metal in the carbonyls can be zero, negative or low positive

(B) $d\pi-p\pi$ back bonding from $M \rightarrow CO$ is present

(C) $d\pi-\pi^*MO$ back bonding is present from $M \rightarrow CO$

(D) bond order of CO decreases during $M \xrightarrow{\pi} CO$

Q.220 Which of the following is π -acid ligand

(A) NH_3 (B) CO (C) F^- (D) Ethylene diamine

Q.221 In the isoelectronic series of metal carbonyl, the CO bond strength is expected to increase in the order.

(A) $[Mn(CO)_6]^+ < [Cr(CO)_6] < [V(CO)_6]^-$ (B) $[V(CO)_6]^- < [Cr(CO)_6]^+ < [Mn(CO)_6]^+$

(C) $[V(CO)_6]^- < [Mn(CO)_6]^+ < [Cr(CO)_6]$ (D) $[Cr(CO)_6] < [Mn(CO)_6]^+ < [V(CO)_6]^-$

Q.222 In which complex, CO Bond order is minimum

(A) $Cr(CO)_6$ (B) $[Ni(CO)_4]$ (C) $[Fe(CO)_4]^{2-}$ (D) $[Co(CO)_4]^{-}$

Q.223 The metal which does not form polynuclear carbonyl is

(A) Mn (B) Co (C) Zn (D) Fe

Q.224 Which of the following has longest C–O bond length ? (Free C–O bond length in CO is 1.128Å)

(A) $[Mn(CO)_6]^{+}$ (B) $Ni(CO)_4$ (C) $[Co(CO)_4]^{\ominus}$ (D) $[Fe(CO)_4]^{2-}$

Q.225 **Assertion :** CO and CN^{-} are referred as π acid acid ligands.

Reason : In CO and CN^{-} vacant π^* type orbitals are present.

(A) If both Assertion and Reason are True and the Reason is a correct explanation of the Assertion.

(B) If both Assertion and Reason are True but Reason is not a correct explanation of the Assertion.

(C) If Assertion is True but the Reason is False

(D) If both Assertion and Reason are False.

Organometallic compounds

Q.226 Which amongst the following are organometallic compounds ?

1. $Al_2(CH_3)_6$ 2. $K[PtCl_3C_2H_2]$ 3. $N(CH_3)_3$

(A) 1 only (B) 3 only (C) 1 and 2 only (D) 1, 2 and 3

Q.227 CH_3MgI is an organometallic compound due to presence of

(A) Mg – I bond (B) C – I bond (C) C – Mg bond (D) C – H bond

Q.228 Which of the following is not considered as an organometallic compound

(A) Cis-platin (B) Ferrocene (C) Zeise's salt (D) Grignard reagent

Q.229 Which one is organometallic compound

(A) Lithium methoxide (B) tetracyanidonicklate (II) ion

(C) Lithium acetate (D) Methyl lithium

Q.230 Formula of ferrocene is:

(A) $[Fe(CN)_6]^{4-}$ (B) $[Fe(CN)_6]^{3+}$ (C) $[Fe(CO)_5]$ (D) $[Fe(C_5H_5)_2]$

Q.231 Ferrocene is an example of

(A) Sandwich complex

(B) π-bonded complex

(C) A complex in which all the five carbon atoms of cyclopentadienyl anion are in contact to the metal

(D) All of the above

Q.232 Which of the following is π–complex?

(A) Trimethyl aluminium (B) Ferrocene

(C) Diethyl zinc (D) Nickel carbonyl

Q.233 Among the following which is not the π-bonded organometallic compound?

(A) $K[PtCl_3(\eta^2 - C_2H_4)]$ (B) $Fe(\eta^5 - C_5H_5)_2$

(C) $Cr(\eta^6 - C_6H_6)_2$ (D) $(CH_3)_4Sn$

Applications

Q.234 Which metal is found in vitamin B_{12} ?

(A) Co (B) Pt (C) Fe (D) Mg

Q.235 Wilkionson's catalyst is used as a homogeneous catalyst in the hydrogenation of alkenes it contains

(A) Iron (B) Aluminium (C) Rhodium (D) Titanium

Q.236 Solution of $TiCl_4$ and trialkylaluminium used as a catalyst in polymerisation of olefins is called :

(A) Wilkinson's catalyst (B) Zeigler Natta catalyst

(C) Homogeneous catalyst (D) Grignard reagent

Q.237 Ligands used in anti-cancer drug called Cisplatin :

(A) NH_3, Cl^- (B) NH_3, H_2O (C) Cl^-, H_2O (D) NO_2^-, Cl^-

Q.238 Which reagent is used to estimate Ni^{++} ions gravimetrically:

(A) ethylene diamine (B) Dimethyl glyoxime [DMG] in basic medium

(C) NH_3 solution (D) Potassium ferrocyanide

Q.239 The disodium salt of ethylene diamine tetracetic acid can be used to estimate the following ion(s) in the aqueous solution

(A) Mg^{2+} ion (B) Ca^{2+} ion (C) Na^{+} ion (D) both Mg^{2+} and Ca^{2+}

Q.240 Ethylenediaminetetraacetic acid (EDTA) is the antidote for lead poisoning. It is administered in the form of

(A) free acid (B) sodium dihydrogen salt

(C) calcium dihydrogen salt (D) none of these

Q.241 Which of the following has magnesium ?

(A) Chlorophyll (B) Haemocyanin

(C) Carbonic anhydrase (D) Vitamin B_{12}

Q.242 In the silver palting of copper, $K[Ag(CN)_2]$ is used instead of $AgNO_3$. The reason is :

(A) a thin layer of Ag is formed on copper.

(B) more voltage is required.

(C) Ag^{+} ions are completely removed from the solution.

(D) less availability of Ag^{+} ions as Cu cannot displace Ag from $[Ag(CN)_2]^{-}$ ion.

Q.243 Among the following complexes the one which shows Zero crystal field stabilizations energy (CFSE)

(A) $[Mn(H_2O)_6]^{3+}$ (B) $[Fe(H_2O)_6]^{3+}$ (C) $[Co(H_2O)_6]^{2+}$ (D) $[Co(H_2O)_6]^{3+}$

Q.244 The correct increasing order of trans-effect of the following species is

(A) $CN^{-} > Br^{-} > C_6H_5^{-} > NH_3$ (B) $NH_3 > CN^{-} > Br^{-} > C_6H_5^{-}$

(C) $CN^{-} > C_6H_5^{-} > Br^{-} > NH_3$ (D) $Br^{-} > CN^{-} > NH_3 > C_6H_5^{-}$

Q.245 Jahn-Teller effect is not observed in high spin complexes of

(A) d^9 (B) d^7 (C) d^8 (D) d^4

Q.246 Dimethyl glyoxime forms a coloured water insoluble complex with

(A) Fe^{2+} (B) Ni^{++} (C) Co^{3+} (D) None of these

Q.247 Which of the following cation forms complex of coordination number two with excess of CN^{-}

(A) Cu^{2+} (B) Ag^{+} (C) Ni^{2+} (D) Fe^{2+}

Q.248 On addition of excess of aqueous KCN pale blue colour of $CuSO_4$ solution disappears it is due to formation of:

(A) $[Cu(CN)_4]^{2-}$ (B) $[Cu(CN)_4]^{3-}$ (C) $Cu(CN)_2$ (D) CuCN

Q.249 Oxidation number of Fe in violet coloured complex $Na_4[Fe(CN)_5(NOS)]$ sodium nitrosoprusside is:

(A) 0 (B) 2 (C) 3 (D) 4

Q.250 Which has yellow colour

(A) Potassium hexanitrito-Ocobaltate(III) (B) Potassium hexanitrito-Ncobaltate(II)

(C) Fischer's salt (D) All the above

EXERCISE-2

[MULTIPLE CORRECT CHOICE TYPE]

Q.1 Which of the following complexes have tetrahedral shape?

(A) $[Cu(NH_3)_4]^{2+}$ (B) $[Ni(CO)_4]$ (C) $[NiCl_4]^{2-}$ (D) $[Zn(NH_3)_4]^{2+}$

Q.2 Which of the following is/are inner orbital complex(es) as well as diamagnetic in nature.

(A) $[Ir(H_2O)_6]^{3+}$ (B) $[Ni(NH_3)_6]^{2+}$ (C) $[Cr(NH_3)_6]^{3+}$ (D) $[Co(NH_3)_6]^{3+}$

Q.3 Which of the following is/are correct about $[Cu(NH_3)_4]SO_4$

(A) It is a square planar complex.

(B) It is paramagnetic with one unpaired electron in the d-subshell

(C) It gives white ppt with $BaCl_2$

(D) Its molar conductivity is approximately equal to that of $[CrBr(NH_3)_5]SO_4$

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

(A) The oxidation state of iron in sodium nitro prusside $Na_2[Fe(CN)_5(NO)]$ is +2.

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

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

(D) In $Ni(CO)_4$, the oxidiation state of Ni is zero.

Q.5 **INCORRECT** order of stability of complex compound is:

(A) $[Fe(dmg)_2] > [Fe(en)_2]^{2+}$

(B) $[Co(en)_3]^{3+} > [Co(ox)_3]^{3-} > [Co(NH_3)_6]^{3+}$

(C) $[Co(ox)_3]^{3-} > [Co(acac)_3]$

(D) $[IrF_6]^{3-} > [RhF_6]^{3-} > [CoF_6]^{3-}$

Q.6 CFSE value of $[Fe(H_2O)_5](NO)]\ SO_4$ (Brown Ring Complex) is

(A) $-0.8\ \Delta_0$ (B) $-0.4\ \Delta_0$ (C) $-1.8\ \Delta_0$ (D) $-2.4\ \Delta_0$

Q.7 INCORRECT order of stability of complexes

(A) $[Cu(trien)]^{++}\ [Cu(en)_2]^{++}$ (B) $[Ni(ox)(NH_3)_2] > [Ni(acac)(NH_3)_2]^+$

(C) $[Ni(H_2O)_6]^{++} > [NiF_6]^{4-}$ (D) $[CoF_3(H_2O)_3] > [CoF_6]^{3-}$

Q.8 The value of crystal field energy (Δ_0) for $[Ti(H_2O)_6]^{3+}$ is 243 kJ mol^{-1}. The crystal field stabilization energy (CFSE) in this complex is: **(in kJ mol^{-1})**

(A) $\frac{3}{5} \times 243$ (B) $\frac{2}{5} \times 243$ (C) $3 \times \frac{2}{5} \times 243$ (D) 243

Q.9 Wavelength of absorption is minimum in the visible region for the complex ion.

(A) $[Cr(H_2O)_6]^{3+}$ (B) $[Cr(NH_3)_6]^{3+}$ (C) $[Cr(NO_2)_6]^{3-}$ (D) $[Cr(ONO)_6]^{3-}$

Q.10 In which of the following complex ion upaired electron is present in 4d orbital.

(A) $[Cu(NO_2)_5]^{3-}$ (B) $[Cu(NH_3)_4]^{2+}$ (C) $[Co(H_2O)_6]^{2+}$ (D) $[Fe(CO)_4]^{2-}$

Q.11 Which of the following statement is incorrect for $[Fe(H_2O)_5(NO)]SO_4$

(A) Oxidation state of iron is +1
(B) Coordination number of Fe is six
(C) Charge on NO ligand is +1
(D) It's brown colour is due to d-d-transition

Q.12 In which of the following complex ion, transference of electron occurs from 3d to 4p orbital

(A) $[Cu(H_2O_4)]^{2+}$ (B) $[Co(CN)_6]^{4-}$ (C) $[Co(H_2O)_6]^{2+}$ (D) $[Cu(py)_4]^{2+}$

Q.13 Consider the following complex ions and 'C–O' stretching bands/frequencies.

	Column-I	**Column-II**
	(Complex ions)	$\bar{\nu}_{CO}$ **(in cm^{-1})**
(P)	$[Ti(CO)_6]^{2-}$	(i) 2204
(Q)	$[V(CO)_6]^{-}$	(ii) 2100
(R)	$[Mn(CO)_6]^{+}$	(iii) 1859
(S)	$[Fe(CO)_6]^{2+}$	(iv) 1748

Then according to the given information the correct match is :

	(P)	**(Q)**	**(R)**	**(S)**		**(P)**	**(Q)**	**(R)**	**(S)**
(A)	(i)	(ii)	(iii)	(iv)	(B)	(iii)	(iv)	(i)	(ii)
(C)	(iv)	(iii)	(ii)	(i)	(D)	(i)	(iii)	(ii)	(iv)

Q.14 Which of the following are π-bonded organometallic compounds?

(A) Ferrocene
(B) $[Ni(\pi\text{-}C_5H_5)_2]$
(C) Ethylmagnesium iodide
(D) Dibenzene chromium

Q.15 The IR stretching frequencies of free CO, and CO in $[V(CO)_6]^{-}$, $[Cr(CO)_6]$ and $[Mn(CO)_6]^{+}$ are 2143 cm^{-1}, 1859 cm^{-1}, 2000 cm^{-1} and 2100 cm^{-1} respectively. Then INCORRECT statement(s) about metal carbonyls is/are

(A) 'C–O' bond is strongest in the cation and weakest in the anion.
(B) 'C–O'' bond order is less in the cation than in anion.
(C) 'C–O'' bond is longer in the cation than in anion or neutral carbonyl.
(D) 'M–C' bond order is higher in the cation than in anionic or neutral carbonyl.

Q.16 Which of the following properties is/are same in between $[Fe(CO)_2 (NO)_2]$ and $[Fe(\pi\text{-}C_5H_5)_2]$ complexes.

(A) Oxidation state of central metal atom/ion

(B) Effective atomic number

(C) All ligands exhibit synergic bonding

(D) Ligands show π-donor-π-acceptor behaviour in both complexes.

Q.17 Find IUPAC name of the hydrate isomer of $CrC1_3 \cdot 6H_2O$, which is having lowest electrical conductivity.

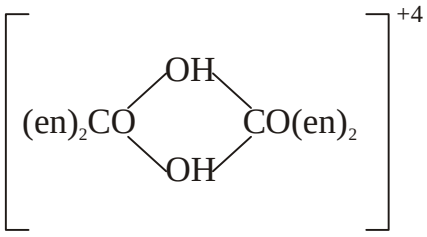
(A) Hexaaquachromium(III) chloride

(B) Tetraaquadichloridochromium(III) chloridedihydrate

(C) Pentaaquachloridochromium(III) chloridemonohydrate

(D) Triaquatrichloridochromium(III) trihydrate

Q.18 Choose the correct IUPAC name(s) of the given compound



(A) Bis(ethylenediamine)cobalt(lII)di-μ-hydroxidobis(ethylenediamine)cobalt(III) ion.

(B) Di-μ-hydroxidotetrakis(ethylenediamine)dicobalt(III) ion.

(C) Di-μ-hydroxidobis{bis(ethylenediamine)cobalt(III)}ion.

(D) Bis{μ-hydroxidobis(ethylenediamine)cobalt(III)} ion.

Q.19 Which of the following names is/are correct for the compound $Na[CoCl_2(NO_2)(\sigma\text{-}C_3H_5) (NH_3)_2]$

(A) Sodium allyldiamminedichloronitrito-N-cobaltate (III)

(B) Sodium diamminedichloroallylnitrito-N-cobaltate (III)

(C) Sodium diamminedichlorocyclopropylnitrito-N-cobaltate (III)

(D) Sodium diamminecyclopropylnitrito-N-dichlorocobaltate (III)

Q.20 Consider the following two statements

(i) Complex compound gives white ppt with $AgNO_3$ solution.

(ii) Complex compound exhibits geometrical isomerism.

Which complex compound is following both above given conditions.

(A) $CoCl_3 . 5NH_3 . H_2O$ (B) $CoCl_3 . 3NH_3$

(C) $PtCl_4 . 5NH_3$ (D) $PtCl_4 . 4NH_3$

Q.21 Which of the following will produce a white precipitate upon reacting with $AgNO_3$?

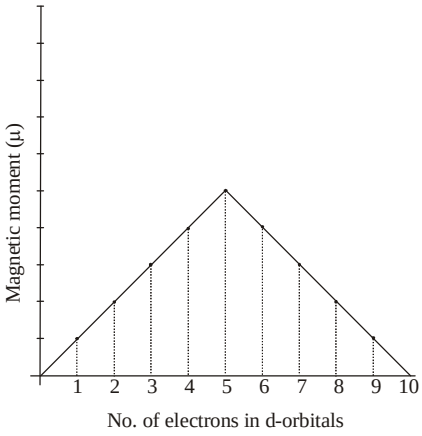
(A) $[Co(NH_3)_6]Cl_3$ (B) $[Co(NH_3)_3Cl_3]$

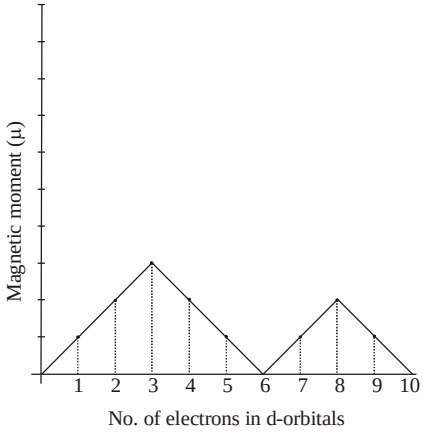
(C) $K_2[Pt(en)Cl_4]$ (D) $[Fe(en)_3]Cl_3$

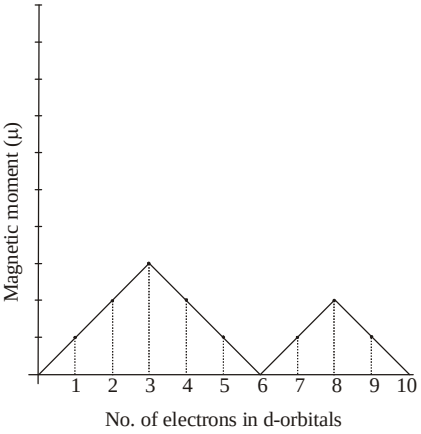
Q.22 Co-ordination number of Cr in $CrC1_3.5H_2O$ is six. The volume of 0.1 N $AgNO_3$ needed to ppt. the chlorine in outer sphere in 200 ml of 0.01 M solution of the complex is/are:

(A) 140 ml (B) 40 ml (C) 80 ml (D) 20 ml

Q.23 Select the correct graph between magnetic moment of complex compound and number of d-electrons with weak field ligand and strong field ligands respectively

(A) 

and


(B) 

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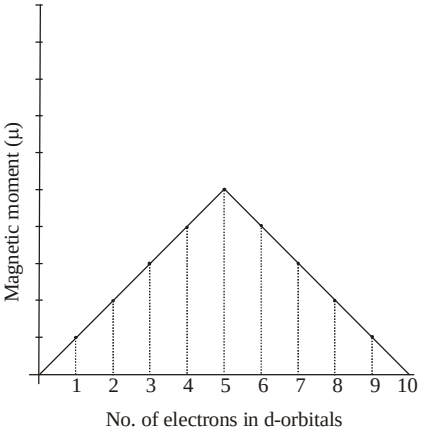
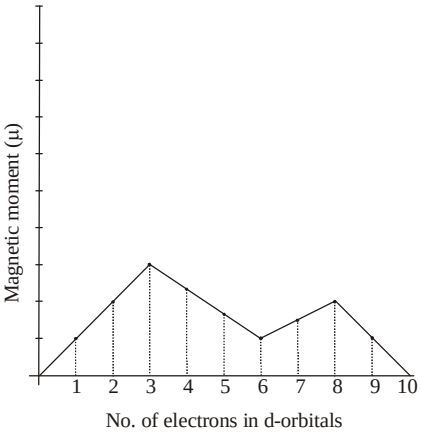


(C) 

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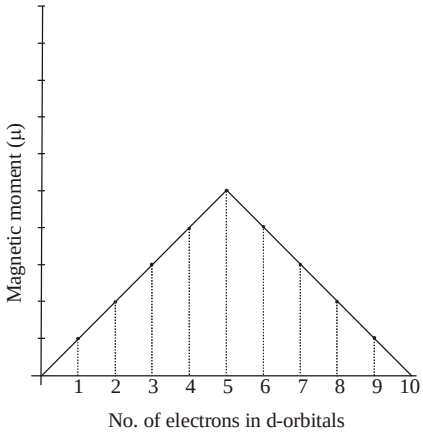
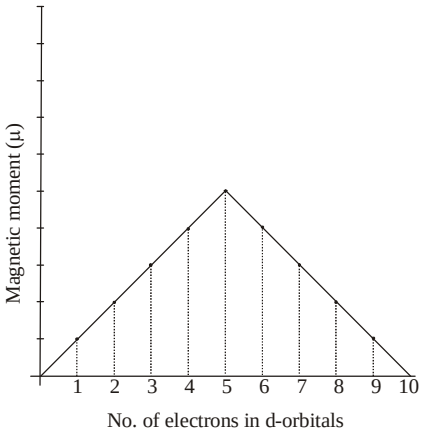
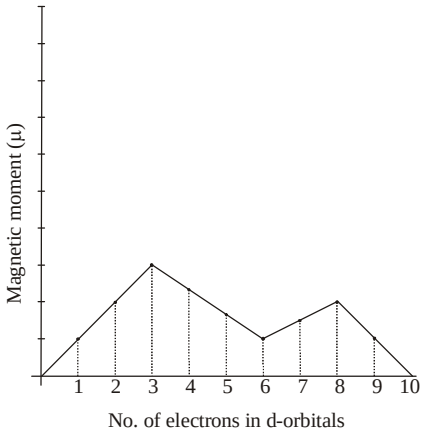


(D) 

and


Q.24 Which of the following statement is/are incorrect

(A) $[Pt(NO_3)_2(en)_2]^{2+}$ complex ion can show linkage isomerism

(B) $[Cr(CO_3)(NH_3)_4]Br$ can show ionization isomerism

(C) $FeCl_2.6H_2O$ can show hydrate isomerism

(D) $[FeCl_3(NH_3)_3]$ can exhibit structural isomerism

Q.25 The complex compound which can exhibit both structural and optical isomerism

(A) $[IrBr_2(en)_2]Br$ (B) $[Co(NO_2)_3(H_2O)_3]$

(C) $[Cr(NO_2)(SCN)(H_2O)(NH_3)_3]Br$ (D) $[Pt(acac)_3]Br$

Q.26 Which type of isomerism(s) are exhibited by complex $[CrCl_2(H_2O)_2(NH_3)_2]Br$

(I) Ionization isomerism (II) Hydrate isomerism

(III) Geometrical isomerism (IV) Optical isomerism

(A) I and II (B) II and IV (C) I, III and IV (D) I, II, III & IV

Q.27 How many isomers exist for $[Co(NH_3)_4Cl_2]^+$ and $[Co(en)_2Cl_2]^+$ complex ions, respectively

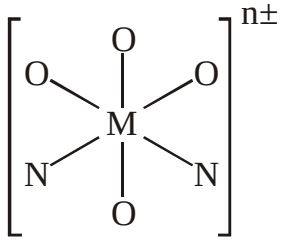
(A) 2 and 2 (B) 2 and 3 (C) 3 and 2 (D) 3 and 3

Q.28 Possible isomerism in complexes $[Co(NH_3)_3(NO_2)_3]$ and $[Co(NH_3)_5(NO_2)]Cl_2$ respectively are

(A) Linkage and optical (B) Geometrical and linkage

(C) Optical and ionisation (D) Linkage and geometrical

Q.29 Consider the following configuration arrangement between central metal atom/ion and donor site(s) of respective ligand:



Which of the following IUPAC name of complex ion is not satisfied with the given arrangement

(A) Ethylenediaminetetraacetatonickelate(II)ion

(B) Ethylenediaminebis(oxalato)chromate(III)ion

(C) Tetraaquaethylenediaminecobalt(III)ion

(D) Trans-(glycinato)bisoxalatoferrate(III)ion

Q.30 The complex ion having only two stereoisomers, is

(A) $[CoBr_2(en)_2]^+$ (B) $[Pt(Br)(CN)(NO_2)(NH_3)]^-$

(C) $[Zn(en)_2]^{++}$ (D) $[Cr(ox)_3]^{3-}$

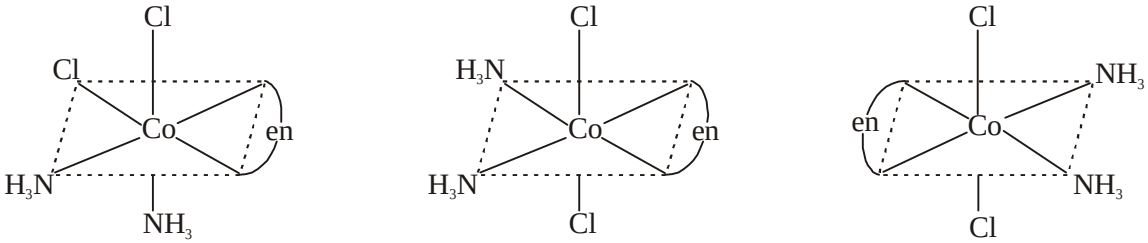
Q.31 Which of the following exhibit geometrical but not exhibit optical isomerism (M stands for a metal, and a and b are monodentate ligands)?

(A) Ma_3b_2c (B) $M(AA)_3$ (C) $Ma_4(AA)$ (D) $M(AB)_2(AA)$

Q.32 Both geometrical and optical isomerism are shown by

(A) $[Co(en)_2Cl_2]^+$ (B) $[Co(NH_3)_5Cl]^{2+}$ (C) $[Co(NH_3)_4Cl_2]^+$ (D) $[Cr(Ox)_3]^{3-}$

Q.33 Three arrangements are shown for the complex $[Co(en)(NH_3)_2Cl_2]^+$. Pick up the wrong statement



(A) I and II are geometrical isomers (B) II and III are optical isomers

(C) I and III are optical isomers (D) II and III are geometrical isomers

Q.34 Which of the following compound(s) show(s) optical isomerism

(A) $[Pt(bn)_2]^{2+}$ (B) $[CrCl_2(en)_2]^+$

(C) $[Co(en)_3][CoF_6]$ (D) $[Zn(gly)_2]$

Q.35 Which of the following statements is not true about the complex ion $[CrCl(NO_2)(en)_2]^+$ (en = enthylene diamine)

(A) It has two geometrical isomers-cis and trans

(B) cis and trans forms are not diastereomers to each other

(C) Only the cis isomer displays optical activity

(D) It has three optically active isomers : d, *l* and meso forms

Q.36 Which of the following will have two stereoisomeric forms?

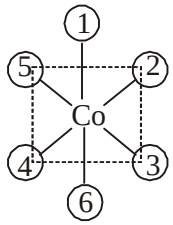
(A) $[Cr(NO_3)_3(NH_3)_3]$ (B) $K_3[Fe(C_2O_4)_3]$

(C) $[CoCl_2(en)_2]^+$ (D) $[CoBrCl(Ox)_2]^{3-}$

Q.37 Which of the following isomerisms is/are shown by the complex $[CoCl_2(OH)_2(NH_3)_2]Br$?

(A) Ionization (B) Linkage (C) Geometrical (D) Optical

Q.38 Consider the following representation for "Bromidochloridoethylenediamineglycinato cobaltate(III)" complex compound



Which of the following statement(s) is/are correct regarding given information

(A) If both halogen present in (1) and (3) position then compound should be optically active

(B) If both halogen present in (5) and (3) position then compound should be optically active

(C) If position (2), (6) and (5) occupy with 'N' atoms as donating site then it is a trans isomer.

(D) All possible geometrical isomers are optically active

Q.39 $\underset{\text{Brown}}{\left[(NH_3)_5Co-O-O-Co(NH_3)_5\right]^{+4}} \xrightarrow[\text{Oxidise}]{[S_2O_8]^{2-}} \underset{\text{Green}}{\left[(NH_3)_5Co-O-O-Co(NH_3)_5\right]^{+5}}$

The magnetic moment of green complex is 1.7 BM & for brown complexes magnetic moment is zero.

(O-O) is same in all respect in both the complexes.

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

(A) III III & IV III (B) III II & III III
brown green brown green

(B) III III & III II (D) III IV & III III
brown green brown green

Q.40 The complex $K_2[Zn(CN)_2(O_2)_2]$ is oxidised into $[Zn(CN)_2(O_2)_2]$, then which of the following is/are correct?

(A) Zn(II) is oxidised into Zn(IV) (B) Magnetic moment decreases

(C) O – O bond length increase (D) Magnetic moment increases

Q.41 $K_6[(CN)_5Co–O_2–Co(CN)_5] \xrightarrow{\text{Oxidizes}} K_5[(CN)_5\ Co–O_2–Co\ (CN)_5]$

(X) (Y)

In both the complexes oxidation state of Co cation is same

The B.E. of (O–O) in X & Y is-

(A) B.E. of (O – O) in Y < B.E. of (O – O) in X

(B) B.E. of (O – O) in X < B.E. of (O – O) in Y

(C) B.E. of (O – O) in X = B.E. of (O – O) in Y

(D) can't be compared

Q.42 What is oxidation state, magnetic moment and type of hybridisation of central metal cation in following complex. $[Os(ONO)\ (O)_2\ (O_2)\ (SCN)\ (H_2O)]OH$

(A) + 7, $\sqrt{3}$ B.M., d^2sp^3 hybridisation (B) + 8, 0 B.M., sp^3d^2 hybridisation

(C) + 8, 0 B.M., d^2sp^3 hybridisation (D) + 9, 0 B.M., d^2sp^3 hybridisation

Q.43 Which of the following statement(s) is (are) correct?

(A) Hexacyanidoferrate (II) ion has four unpaired electrons in 3d-orbital

(B) tetracyanidonickelate (II) ion is square planar

(C) IUPAC name of $[Zn(OH)_4]^{-2}$ ion is tetrahydroxidozinc(II) ion

(D) The coordination number of Cr in $[Cr(NH_3)_2\ (en)_2]^{+3}$ is 6

Q.44 Which of the following is/are paramagnetic

(A) $[Ru(H_2O)_6]^{3+}$ (B) $[Mn(CO)_5]^{-}$ (C) $[Fe(NH_3)_6]^{2+}$ (D) $Cr_2O_7^{2-}$

Q.45 Correct statement is

(A) $[Co(Ox)_3]^{3-}$ is more stable than $[Co(H_2O)_6]^{3+}$

(B) In $[Co(NH_3)_6]^{2+}$ and $[Cu(NH_3)_4]^{2+}$ unpaired e^- lies in valence d and p orbital respectively

(C) Colour due to charge transfer spectra is found to be more intense than d-d transition

(D) δ-bond is found between metals in polynuclear metal carbonyl compounds

Q.46 Select incorrect statement(s) for $[Cu(CN)_4]^{3-}$, $[Cd(CN)_4]^{2-}$ and $[Cu(NH_3)_4]^{2+}$ complex ion.

(A) Both $[Cd(CN)_4]^{2-}$ and $[Cu(NH_3)_4]^{2+}$ have square planar geometry

(B) $[Cu(NH_3)_4]^{2+}$ and $[Cd(CN)_4]^{2-}$ have equal no. of unpaired electron

(C) $[Cu(CN)_4]^{3-}$ and $[Cd(CN)_4]^{2-}$ can be separated from the mixture on passing H_2S gas

(D) All the three complexes have magnetic moment equal to zero

Q.47 Select the correct statement(s)

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

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

(C) $[Ni(CN)_4]^{4-}$ ion and $[Ni(CO)_4]$ are diamagnetic tetrahedral complexes

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

Q.48 Both complex compound pentamminethiocyanatocobalt(III) bromide and pentaamminebromidocobalt(II) thiocyanate represent

(A) Linkage isomerism (B) Ionization isomerism

(C) Coordination isomerism (D) NO isomerism

Q.49 Which of the following octahedral complex exhibits structural isomerism

(A) $[CrCl(gly)(en)(NH_3)]$ (B) $[Co(SO_4)(H_2O)_4]Br$

(C) $[Ir(O_2N)(ox)_2]^{2-}$ (D) $[RhBrH_2O(en)_2]SO_4$

[PARAGRAPH TYPE]

Paragraph for question nos. 50 to 52

$Ni(NH_3)_4(NO_3)_2.2H_2O$ molecule may have two unpaired electrons or zero unpaired electron and measurement of magnetic moment helps us to predict the geometry.

Q.50 If magnetic moment value is zero then the formula of the complex will be

(A) $[Ni(NH_3)_4](NO_3)_2 \cdot 2H_2O$

(B) $[Ni(NH_3)_2(H_2O)_2](NO_3)_2 \cdot 2NH_3$

(C) $[Ni(NH_3)_4(H_2O)_2](NO_3)_2$

(D) $[Ni(NO_3)_2(H_2O)_2] \cdot 4NH_3$

Q.51 If the magnetic moment value is $2\sqrt{2}$ and conducts electricity then the formula of the complex is

(A) $[Ni(NH_3)_4](NO_3)_2.2H_2O$

(B) $[Ni(NH_3)_2(H_2O)_2](NO_3)_2.2NH_3$

(C) $[Ni(NH_3)_4(H_2O)_2](NO_3)_2$

(D) $[Ni(NH_3)_4(NO_3)_2].2H_2O$

Q.52 The higher and lower value of magnetic moment of the given complex corresponds to the following geometries respectively.

(A) Octahedron and Tetrahedron

(B) Octahedron and square planar

(C) Square planar and Octahedron

(D) Octahedron and Octahedron

Paragraph for question nos. 53 to 54

No single theory of bonding of complex compound is sufficient to describe the bonding, magnetic property, colour, etc of a given complex.

Q.53 The tetrahedral complex which is diamagnetic but coloured-

(A) $[NiCl_4]^{2-}$ (B) $[CrO_4]^{2-}$ (C) $[MnO_4]^{2-}$ (D) $[Cd(CN)_4]^{2-}$

Q.54 The incorrect statement about $Ni(CO)_4$ is-

(A) The bond order of CO in the complex is less than bond order of CO molecule

(B) The complex is diamagnetic and dsp^2 hybridised

(C) The bond order of Ni–C bond is greater than one

(D) The complex cannot act as oxidising or reducing agent according to sidgwick EAN rule

Paragraph for question nos. 55 to 57

When a transition metal ion (usually) is involved in octahedral complex formation, the five degenerate d-orbitals split into two set of degenerate orbitals (3 + 2). Three degenerate orbitals of lower energy (d_{xy}, d_{yz}, d_{zx}) and a set of degenerate orbitals of higher energy ($d_{x^2-y^2}$ and d_{z^2}). The orbitals with lower energy are called t_{2g} orbitals and those with higher energy are called e_g orbitals.

In octahederal complexes, positive metal ion may be considered to be present at the centre and negative ligand at the corner of a regular octahedron. As lobes $d_{x^2-y^2}$ and d_{z^2} lie along the axes, i.e., along the ligand the repulsions are more and so high is the energy. The lobes of the remaining three d-orbitals lie between the axes i.e., between the ligands. The repulsion between them are less, so lesser the energy. In the octahedral complexes, if metal ion has electrons more than 3 then for pairing them, the options are

(i) Pairing may start with 4^{th} electron in t_{2g} orbitals.

(ii) Pairing may start normally with 6^{th} electrons when t_{2g} and e_g orbitals are singly filled.

Q.55 In which of the following configurations, hybridisation and magnetic moment of octahedral complexes are independent of nature of ligands.

(I) d^3 configuration of any metal cation

(II) d^6 configuration of III^{rd} transition series metal cation

(III) d^8 configuration of I^{st} transition series metal cation

(IV) d^7 configuration of any metal cation

Select the **correct** code :

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

Q.56 Which of the following electronic arrangement is/are possible for inner orbital octahedral complex.

(I) $t_{2g}^3 e_g^2$ (II) $t_{2g}^6 e_g^1$ (III) $t_{2g}^3 e_g^0$ (IV) $t_{2g}^4 e_g^2$

Select the correct code :

(A) I, IV (B) II, III (C) III only (D) III, IV

Q.57 Select incorrect match for the following complexes.

(A) $[IrF_6]^{3-}$ ($\Delta > P$) (B) $[Co(H_2O)_6]^{3+}$ ($\Delta < P$)

(C) $Fe(CO)_5$ ($\Delta > P$) (D) $[PdCl_2(SCN)_2]^{2-}$ ($\Delta > P$)

Paragraph for question nos. 58 to 60

The necessary and sufficient condition to exhibit optical activity, the configuration of the given complex should be assymmetric

Q.58 The complex that contains two space isomers is-

(A) $[Zn(acac)_2]$ (B) $[Ca(EDTA)]^{2-}$ (C) [Be(acac)(gly)] (D) $[CoBrCl(en)_2]^+$

Q.59 The complex which does not exhibit cis-trans isomerism but optically active-

(A) $[Zn(gly)_2]$ (B) $[Pt(gly)_2]$ (C) $[Ni(gly)_2]$ (D) $[Pd(gly)_2]$

Q.60 The complex in which six pair of enantiomers available form is optically active -

(A) $[CoBrCl(CN)(H_2O)(NH_3)_2]$ (B) $[Rh((CN)_2(gly)(H_2O)(NH_3)]$

(C) $[FeF_2(OH)_2(en)]^-$ (D) $[CrBr_2Cl(CN)(NH_3)_2]^-$

Paragraph for question nos. 61 to Q.63

The splitting of five degenerated d-orbitals of the metal ion into sets of orbitals having different energies is called crystal field splitting. The concept forms the basis of crystal field theory.

Q.61 The expected spin-only magnetic moments of $K_3[Co(CN)_6]$ and $K_4[MnF_6]$ respectively are

(A) 1.73 and 1.73 BM (B) 1.73 and 5.92 BM

(C) 0.0 and 1.73 BM (D) 0.0 and 5.92 BM

Q.62 Which of the following complex has its CFSE = – 4 Dq

(A) $Cr(CO)_6$ (B) $[Cr(NH_3)_6]^{3+}$ (C) $[FeF_6]^{4-}$ (D) $[Ni(Py)_6]^{2+}$

Q.63 The complex exhibits lowest energy absorption band is

(A) $[NiCl]_4]^{2-}$ (B) $Ni(CO)_4$ (C) $[Ni(CN)_4]^{2-}$ (D) $[Ni(H_2O)_6]^{2+}$

[MATCH TYPE]

Q.64

	Column-I (Complexes)		Column-II (C.N.)
(A)	$[Co(en)_3]^{2+}$	(P)	6
(B)	$[Ca(EDTA)]^{2-}$	(Q)	4
(C)	$[Ni(CO)_4]$	(R)	2
(D)	$[Ag(NH_3)_2]Cl$	(S)	5

Q.65

	Colum-I(Complexes)		Column-II(E.A.N.)
(A)	$[Fe(CO)_4]^{2-}$	(P)	34
(B)	$[Co(NH_3)_5Cl]Cl_2$	(Q)	35
(C)	$K_2[Ni(CN)_4]$	(R)	36
(D)	$[Cu(NH_3)_4]^{2+}$	(S)	37

Q.66

	Column-I		Column-II
(A)	$[Cu(NH_3)_4]SO_4$	(P)	dsp^2
(B)	$[Pt(NH_3)_2Cl_2]$	(Q)	Octahedral
(C)	$K_4[Fe(CN)_6]$	(R)	sp^3d^2
(D)	$[Fe(H_2O)_6]Cl_3$	(S)	square planar

Q.67

	Column-I		Column-II
(A)	$[Fe(NH_3)_6]^{2+}$	(P)	d^2sp^3
(B)	$[NiF_6]^{2-}$	(Q)	sp^3d^2
(C)	$[Co(H_2O)_6]^{3+}$	(R)	diamagnetic
(D)	$[Pt(Cl_2)(NH_3)_4]Cl_2$	(S)	paramagnetic
		(T)	outer orbital complex

Q.68

	Column-I		Column-II
(A)	$[MnCl_6]^{2-}$	(P)	One unpaired electron
(B)	$[Fe(CN)_6]^{3-}$	(Q)	d^2sp^3
(C)	$[CoF_6]^{3-}$	(R)	sp^3d^2
(D)	$[Fe(H_2O)_6]^{2+}$	(S)	Four unpaired electrons

Q.69

	Column-I		**Column-II**
(A)	$[Cu(NH_3)_4]^{2+}$	(P)	Low spin complex
(B)	$[CuCl_4]^{2-}$	(Q)	Magnetic moment = 1.73 B.M.
(C)	$K_2[Cr(CN)_4(NH_3)(NO^+)]$	(R)	Metal oxidation state +2
(D)	$K_4[Co(NO_2)_6]$	(S)	During hybridisation d-orbital electron is transfered to higher energy orbital

Q.70

	Column-I		**Column-II**
(A)	$[Ma_2bcde]^{n\pm}$	(P)	Only 1 cis isomer w.r.t all ligands
(B)	$[Ma_2b_2c_2]^{n\pm}$	(Q)	4 geometrical isomers
(C)	$[M(AB)c_2d_2]^{n\pm}$	(R)	5 stereo (space) isomers
		(S)	3 trans isomers

(where AB $\rightarrow$ Unsym, bidentate ligands, a, b, c, d & e $\rightarrow$ monodentate ligands)

Q.71

	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)	μ = 2.83 B.M.
(D)	$[PtCl_2(NH_3)_4]Br_2$		$_0$ < P

Q.72

	Column-I (Complexes)		**Column-II (Stereoproperties)**
(A)	$[CoCl_3(NH_3)_3]$	(P)	Show facial isomer
(B)	$[Cr(ox)_3]^{3-}$	(Q)	Cis form is optically active
(C)	$[CrCl_2(ox)_2]$	(R)	Trans form is optically inactive
(D)	$[RhCl_3(Py)_3]$	(S)	Show meridional form
		(T)	Two optically active isomer

Q.73

	Column-I		**Column-II**
(A)	Only four stereoisomer	(P)	$[M(AB)_3]^{n\pm}$
(B)	Four optically active isomer	(Q)	$[M(AA)a_2b_2]^{n\pm}$
(C)	Double the number of geometrical isomer compared to any other complex given in column-II	(R)	$[M\ a_2b_2cd]^{n\pm}$
		(S)	$[Ma_3bcd]^{n\pm}$

[INTEGER TYPE]

Q.74 Total number of ligands which can act as didentate/polydentate ligands with same donor atoms/sites.
DMG, en, Phen, Gly, acac, SO_4^{2-}, $S_2O_3^{2-}$, pyridine, PPh_3

Q.75 If an octahedral complex ion $[M(AA)_xa_y]^{\pm n}$ does not show optical isomerism, then find out value of $|x - y|^2$.
(Where AA is symmetrical bidentate ligand and 'a' is neutral monodentate ligand and x and y are natural number)

Q.76 Find the value of X ÷ Y for complex $[CoBr_2(CN)(NO_2)(H_2O)(NH_3)]$
where : X = Number of compound when both Br^- at cis position.
Y = Number of compound when both Br^- are at trans position.

Q.77 Consider the following complexes.
(i) $[Cr(EDTA)]^-$ (ii) $[Ru(en)_3]^{2+}$
(iii) $[Pt(gly)Cl_2]^-$ (iv) Cis-$[Cr(Cl)_2(ox)_2]^{3-}$
(v) trans-$[Pt(en)(NH_3)_2(py)_2]^{4+}$
Then find out the value of expression $|p \times q|^2$.
p = Total number of optically active complexes
q = Total number of optically inactive complexes

Q.78 If CFSE value of complex ion $[FeF_6]^{4-}$ in terms of Dq. is X, then find |X|.

Q.79 What are the values of m + n in the anionic species $[Ti(CO)_m]^{n-}$, if it is following sidwick EAN rule and having octahedral shape.

Q.80 Write the sum of Geometrical isomers of $[Pt(H_2N - CH(CH_3) - COO^-)_2]$ complex and stereo isomers of $[Pt(gly)_3]^+$ complex.

Q.81 From Meridional and facial isomer of $[Ma_3b_3]^{n\pm}$ on replacement of only one 'a' by 'b', the number of isomer of the product obtained are _____ and _____ respectively.
[If answer is 2 and 5 represent as 25]

Q.82 Predict the number of unpaired electrons in a tetrahedral d^6 ion and in a square planar d^7 ion.
Note : If answer is 1 and 2 represent as 12.

Q.83 The number of optically active isomer for $[Pt(NH_3)_2(F)(Cl)(Br)(I)]°$ is _____.

Q.84 Find the number of t_{2g} and e_g electrons in $[NiF_6]^{2-}$.
[If ans. is 4 & 2 then represent as 42]

Q.85 Total possible stereoisomer for the molecule $[Ma_2bcde]^{n\pm}$ (where a,b,c,d,e are simple monodentate ligand having no chiral centre). is-

Q.86 Number of pair of enantiomer of $[Ma_2b_2cd]$ is _____.

Q.87 Find the number of unpaired electrons in t_{2g}-set of d-orbitals in $[Co(H_2O)_3F_3]$ complex.

Q.88 How many pairs of enantiomers of [M(AA)(BC)de] are possible.

Q.89 Find the total number of isomer of $[Be(gly)_2]$.

Q.90 The total number of possible geometrical isomer for $[Ma_3b_3]^{n\pm}$ is _____.

Q.91 How many geometrical isomer(s) is / are formed by $[Ma_2bcde]$

Q.92 Find the E.A.N. value of Fe in $K_4[Fe(CN)_6]$.

Q.93 The number of geometrical isomer for $[PdCl_3Br(SCN)(NO_2)]^{2-}$ is '_____'.

Q.94 Calculate E.A.N. value of $K[PtCl_3(C_2H_4)]$.

Q.95 The number of ions furnished per molecule of the complex $[Cr(NH_3)_6]Cl_3$ is / are

Q.96 If Hund's rule violet then how many unpaired electrons are present in $[Cr(H_2O)_6]^{3+}$

Q.97 When one 'a' is replaced by 'b' in $[M(AA)a_2bc]^{n\pm}$ type of complex, then total number of geometrical isomer is increased by _____.

Q.98 Find the number of unpaired electron in the t_{2g} set of d-orbital in the $[Mn(H_2O)_6]^{2+}$.

Q.99 How many unpaired electron(s) is / are present in t_2g orbitals of $[Mn(NH_3)_6]^{2+}$.

Q.100 Find out the total number of stereoisomer possible for $[Cr(C_2O_4)(en)(NO_2)Cl]^-$.

Q.101 Find the Effective atomic number of $[Fe(CO)_2(\pi\text{–}C_5H_5)Cl]$.

Q.102 Find the number of unpaired electrons in t_{2g}-set of d-orbitals in $K_3[Co(ox)_3]$ complex.

[ANSWER KEY]

EXERCISE-1

Q.1	A	Q.2	C	Q.3	D	Q.4	A	Q.5	D
Q.6	C	Q.7	B	Q.8	D	Q.9	B	Q.10	A
Q.11	A	Q.12	D	Q.13	A	Q.14	C	Q.15	D
Q.16	A	Q.17	B	Q.18	B	Q.19	D	Q.20	B
Q.21	B	Q.22	C	Q.23	B	Q.24	C	Q.25	C
Q.26	B	Q.27	A	Q.28	C	Q.29	A	Q.30	C
Q.31	C	Q.32	D	Q.33	B	Q.34	B	Q.35	B
Q.36	C	Q.37	D	Q.38	C	Q.39	B	Q.40	B
Q.41	B	Q.42	B	Q.43	D	Q.44	C	Q.45	B
Q.46	C	Q.47	A	Q.48	C	Q.49	A	Q.50	D
Q.51	C	Q.52	C	Q.53	D	Q.54	D	Q.55	C
Q.56	C	Q.57	D	Q.58	C	Q.59	B	Q.60	C
Q.61	C	Q.62	B	Q.63	C	Q.64	B	Q.65	C
Q.66	A	Q.67	C	Q.68	C	Q.69	A	Q.70	C
Q.71	C	Q.72	B	Q.73	A	Q.74	B	Q.75	A
Q.76	A	Q.77	B	Q.78	B	Q.79	A	Q.80	A
Q.81	A	Q.82	A	Q.83	D	Q.84	A	Q.85	C
Q.86	A	Q.87	D	Q.88	B	Q.89	B	Q.90	D
Q.91	C	Q.92	A	Q.93	B	Q.94	B	Q.95	A
Q.96	D	Q.97	D	Q.98	D	Q.99	C	Q.100	C
Q.101	C	Q.102	D	Q.103	B	Q.104	A	Q.105	C
Q.106	D	Q.107	B	Q.108	B	Q.109	A	Q.110	C
Q.111	D	Q.112	A	Q.113	D	Q.114	C	Q.115	A
Q.116	A	Q.117	C	Q.118	C	Q.119	B	Q.120	B
Q.121	D	Q.122	D	Q.123	B	Q.124	D	Q.125	B
Q.126	C	Q.127	A	Q.128	C	Q.129	A	Q.130	D
Q.131	A	Q.132	A	Q.133	C	Q.134	A	Q.135	C
Q.136	C	Q.137	C	Q.138	B	Q.139	C	Q.140	D
Q.141	C	Q.142	A	Q.143	A	Q.144	D	Q.145	C
Q.146	B	Q.147	C	Q.148	B	Q.149	B	Q.150	B
Q.151	C	Q.152	B	Q.153	A	Q.154	A	Q.155	B
Q.156	A	Q.157	A	Q.158	B	Q.159	A	Q.160	D
Q.161	D	Q.162	B	Q.163	C	Q.164	A	Q.165	C
Q.166	A	Q.167	A	Q.168	A	Q.169	A	Q.170	B

Q.171 D	Q.172 B	Q.173 B	Q.174 D	Q.175 D
Q.176 B	Q.177 C	Q.178 D	Q.179 C	Q.180 D
Q.181 C	Q.182 D	Q.183 A	Q.184 B	Q.185 D
Q.186 B	Q.187 A	Q.188 C	Q.189 D	Q.190 C
Q.191 C	Q.192 B	Q.193 C	Q.194 B	Q.195 A
Q.196 C	Q.197 B	Q.198 D	Q.199 B	Q.200 A
Q.201 C	Q.202 C	Q.203 C	Q.204 A	Q.205 C
Q.206 C	Q.207 A	Q.208 D	Q.209 B	Q.210 C
Q.211 D	Q.212 D	Q.213 A	Q.214 B	Q.215 C
Q.216 C	Q.217 C	Q.218 A	Q.219 B	Q.220 B
Q.221 B	Q.222 C	Q.223 C	Q.224 D	Q.225 A
Q.226 C	Q.227 C	Q.228 A	Q.229 D	Q.230 D
Q.231 D	Q.232 B	Q.233 D	Q.234 A	Q.235 C
Q.236 B	Q.237 A	Q.238 B	Q.239 D	Q.240 C
Q.241 A	Q.242 D	Q.243 B	Q.244 C	Q.245 C
Q.246 B	Q.247 B	Q.248 B	Q.249 B	Q.250 C

EXERCISE-2

Q.1	BCD	Q.2	AD	Q.3	ACD	Q.4	ABD	Q.5	C
Q.6	A	Q.7	B	Q.8	B	Q.9	C	Q.10	A
Q.11	D	Q.12	D	Q.13	C	Q.14	ABD	Q.15	BCD
Q.16	BC	Q.17	B	Q.18	ABCD	Q.19	AC	Q.20	D
Q.21	AD	Q.22	BD	Q.23	A	Q.24	ABD	Q.25	C
Q.26	C	Q.27	B	Q.28	B	Q.29	D	Q.30	D
Q.31	A	Q.32	A	Q.33	BD	Q.34	ABCD	Q.35	BD
Q.36	AB	Q.37	ACD	Q.38	ABD	Q.39	A	Q.40	D
Q.41	B	Q.42	C	Q.43	BD	Q.44	AC	Q.45	ABCD
Q.46	A	Q.47	BCD	Q.48	D	Q.49	D	Q.50	A
Q.51	C	Q.52	B	Q.53	B	Q.54	B	Q.55	D
Q.56	B	Q.57	B	Q.58	B	Q.59	A	Q.60	A
Q.61	D	Q.62	C	Q.63	A				
Q.64	A – P; B – P; C – Q; D – R			Q.65	A – R; B – R; C – P; D – Q				
Q.66	A – P,S; B – P,S; C – Q; D – Q,R			Q.67	A – Q,S,T; B – P,R; C – P,R; D – P,R				
Q.68	A – Q; B – P,Q; C – R,S; D – R,S			Q.69	A – Q,R,S; B – Q,R; C – P,Q; D – P,Q,R,S				
Q.70	A – S; B – P; C – Q;			Q.71	A – R,S; B – P,Q; C – P; D – P,Q				
Q.72	A – PRS; B – T ;C–QRT; D–PRS			Q.73	A – P, Q; B – P, R; C – R,S				
						Q.74	6	Q.75	9
Q.76	4	Q.77	81	Q.78	4	Q.79	0008	Q.80	0008
Q.81	21	Q.82	0041	Q.83	12	Q.84	60	Q.85	0015
Q.86	0002	Q.87	0002	Q.88	5	Q.89	2	Q.90	0002
Q.91	9	Q.92	36	Q.93	4	Q.94	84	Q.95	4
Q.96	1	Q.97	0	Q.98	3	Q.99	3	Q.100	5
Q.101	36	Q.102	0						