

Questions

Q. 1 Give IUPAC name for the following :

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|--|--|
| (i) $[\text{Ti}(\text{H}_2\text{O})_6]^{+3}$ | (ii) $[\text{CoCl}(\text{H}_2\text{O})_2(\text{NH}_3)_3]^{+2}$ |
| (iii) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ | (iv) $[\text{Cr}(\text{en})_3][\text{Ni}(\text{CN})_6]$ |
| (v) $\text{Na}[\text{Ag}(\text{CN})_2]$ | (vi) $[\text{Co}(\text{H}_2\text{O})_6][\text{Co}(\text{CN})_6]$ |
| (vii) $\text{Cu}(\text{acac})_2$ | (viii) $[\text{Pt}(\text{NH}_3)_4\text{ClNO}_2]\text{SO}_4$ |
| (ix) $[\text{CrCl}(\text{H}_2\text{O})(\text{en})_2]\text{Cl}_2$ | |

Q. 2 What is polydentate ligand ? Explain different types of polydentate ligands with illustrations.

Q. 3 In the coordination compound $[\text{Co}(\text{en})(\text{dien})\text{Cl}]\text{Cl}_2$.

- (i) The coordination number of cobalt is _____
- (ii) The oxidation state of cobalt is _____
- (iii) The dentate character of different ligands are _____
- (iv) Ionic charge on complex cation is _____
- (v) The number of non-coordinated chlorine is _____

[Similarly for $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$ or other coordination compounds]

Q. 4 What are polydentate ligands ? Give one example of each type.

Q. 5 Give the systematic formula for the following :

- (i) Hexachloroplatinic (iv) acid
- (ii) Bromotetraamine cobalt
- (iii) Bis (acetyl acetonato) copper (II)
- (iv) Dichloro argentate (I) ion.
- (v) Hexamine chromium (III) nitrate (Ans. $[\text{Cr}(\text{NH}_3)_6](\text{NO}_3)_3$)
- (vi) Chloronitritotetramine platinum (iv) sulphate (Ans.) $[\text{Pt}(\text{NH}_3)_4\text{NO}_2\text{Cl}]\text{SO}_4$
- (vii) Ammonium tetrathiocyanatodiammine chromate (III)

(Ans.) $\text{NH}_4[\text{Cr}(\text{NH}_3)_2(\text{NCS})_4]$

Q. 6 Give IUPAC name for the following. Also classify the above complexes as an anionic, cationic and ionic.

- (i) $[\text{Cr}(\text{en})_3]_2(\text{SO}_4)_3$
- (ii) $[\text{CoCl}(\text{H}_2\text{O})_2(\text{NH}_3)_2]^{+2}$
- (iii) $\left[(\text{C}_5\text{H}_5) \text{Co} \text{Fe} \begin{array}{c} \diagup \text{Co} \diagdown \\ \diagdown \text{Co} \diagup \end{array} \text{Fe} \text{Co} (\text{C}_5\text{H}_5) \right]$

- (iv) $(\text{NH}_4)_3 [\text{Cr} (\text{NCS})_6]$
- (v) $[\text{Co} \text{Br} (\text{H}_2\text{O}) (\text{NH}_3)_4]^{+3}$
- (vi) $[\text{CoCl}_3 (\text{NH}_3)_3]$
- (vii) $\text{Na} [\text{SbCl}_5 (\text{C}_6\text{H}_5)]$
- (viii) $\text{H}_3 [\text{CoCl}_6]$
- (ix) $[\text{Co} (\text{H}_2\text{O})_6]$
- (x) $[\text{Co} (\text{CN})_6]$
- (xi) $[(\text{NH}_3)_5 \text{CrOH}-\text{Cr} (\text{NH}_3)_5] \text{Cl}_5$

Ans. : μ -hydroxobis (pentaamine) chromium (III) chloride

- (xii) $[\text{Co} (\text{NH}_3)_4 (\text{OH}) (\text{H}_2\text{O})] \text{Br}_2$

Q.7 What are polydentate ligand ? How are they classify ? Explain different types of ligands giving examples.

Q.8 Give the name and structure for the following abbreviations. Also showing their potential coordinating atoms. Also clasify the above abbrevlated ligands showing the coordinating atoms.

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|---|--------------|--|
| (i) $(\text{dmg})^-$ | (ii) nta | (iii) en |
| (iv) $(\text{acac})^-$ | (v) dipy | (vi) $(\text{ox})^{-2}$ |
| (vii) pn | (viii) i-bn | (ix) $(\text{oxin})^-$ or $(\text{oxinate})^-$ |
| (x) $(\text{gly})^-$ | (xi) o-phen | (xii) diars or D |
| (xiii) $(\text{Big})^-$ | (xiv) dien | (xv) tetramine |
| (xvi) terpy | (xvii) trien | (xviii) $(\text{NTA})^{-3}$ |
| (ixi) $(\text{EDTA})^{-4}$ or Y^{-4} | | |

Q. 9 Just sketch the possible geometries of complexes having coordination number six or coordination No. 4.

Q.10 Discuss in detail about geometry of complexes having coordination number six.

Q.11. Give rules for the nomenclature of various coordination compounds. (or Q. 15.)

Q.12. Give rules for naming of the various kinds of ligands.

Q.13. On the basis of the nature of complexes, classify complexes and give at least two illustrations of each. Also give IUPAC name of each illustration.

Q.14. Discuss the naming of ambidentate ligands.

Q.15. Discuss the naming of the central metal ion and mononuclear complexes giving two illustration of each class. Also give IUPAC name of . h.

Q.16. Discuss the naming of the negative ligand (or neutral ligands or positive ligands or bridging ligands of polynuclear complexes)

Q.17. Find out simple cation and complex anion (or complex cation and simple anion) from the following ionic complex compounds. Also give their IUPAC name.

- (i) $K_2 [Pt^{IV} Cl_6]$
- (ii) $NH_4 [Cr^{III} (SNC)_4] (NH_3)_2$
- (iii) $[Pt^{II} (py)_4] [Pt^{II} Cl_4]$
- (iv) $[Co^{III} (NH_3)_6][Cr^{III} (C_2O_4)_3]$
- (v) $[Pt^{IV} (NH_3)_4 Br_2] Br_2$
- (vi) $[Fe^{III} (H_2O)_4] [(C_2O_4)_2 SO_4]$

Q.18 Just sketch the possible geometries of complexes having coordination number (C.N.) 2, 3, 4, 5 and 6. Also give name of each geometry and indicate its bond angle.

Q.19 The shape of complexes having C.N. = 2 is and its bond angle is

Q.20 Classify the following complexes on the basis of coordination number. Also mention their geometry,

- | | |
|--------------------------------------|--------------------------------|
| (i) $Cu(CN)_2^-$ | (ii) $Cu(NH_3)_2^+$ |
| (iii) $Ag(CN)_2^-$ | (iv) $Hg(NH_3)_2^{+2}$ |
| (v) H_3O^+ | (vi) $[Ni (Co)_4]^0$ |
| (vii) $FeCl_4^-$ | (viii) $[Ni (dmg)_2]^0$ |
| (ix) $[Pt (NH_3)_4]^{+2}$ | (x) $AuCl_4^-$ |
| (xi) $[Mn (CO)_5]$ | (ix) $[Cu (dipy)_2 I]$ |
| (xi) $Fe (CO)_5$ | (xii) $NiBr_3 [(C_2H_5)_3P]_2$ |
| (xiii) $[Cu (NH_3)_4 (H_2O)_2]^{+2}$ | (xiv) $[Vo (acac)]$ |
| (xv) $[Cu(en)_2]^{+2}$ | (xvi) $[Cu(Cl)_5]^{-3}$ |
| (xvii) $[Cr (H_2O)_5 Cl]^{+2}$ | (xiii) $Au(CN)_2^-$ |

Q. 21 What are chelates ? Give classification and uses of chelates.

Q. 22 Discuss the classification of chelates on the basis of type of linkages present in it. Also give at least one illustration of each type of chelates.

Q. 23 Define with illustratin :

- (a) chelation (b) chelate effect (c) coordination compound (d) Simple salt
- (e) molecular (addition) compound (f) Lattice compounds (double salt) (g) Complex ion (h) Ligand (i) Coordination number (j) Coordinating atom
- (k) Coordination sphere (First sphere of attraction) (l) polynuclear complex (Bridging complexes) (m) Chelate compound (metal chelate) (n) sequestration (o) Ambidentate ligand (p) Ligancy (or C. N.)

- Q. 24 Describe the uses of chelates.
- Q. 25 Discuss the importance of chelation in coordination compounds.
- Q. 26 Give the formula of : Mohr's salt, potash alum, potassium ferrocyanide, potassium ferricyanide.
- Q. 27 Give the dissociation into of following salt into its ions when they dissolved in water.
- Mohr's salt
 - potash alum
 - potassium ferrocyanide
- Q. 28 Give difference between :
- Double salt (lattice compound) and coordination compound.
- Q. 29 Which of the following ligands having vacant type orbitals ?
- H_2O
 - NH_3
 - F
 - CO
 - NO
 - CN
 - unsaturated organic compound.
 - iso cyanides
 - α -dipyridyl
 - o-phenanthroline.
- Q. 30 Which of the following ligands having π bonding electrons.
- ethylene
 - benzene
 - α -dipyridyl
 - o-phenanthroline
 - cyclopentadienyl ion.
- Q. 31 Classify the following into coordination compound and molecular compound.
- $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ (Mohr's salt)
 - potash alum
 - $K_4[Fe(CN)_6]$
 - $Fe(CN)_2$
 - KCN
- Q. 32 How does hard water is effectively softened ?
- Q. 33 Give the general names of complexing agent used to reduce the hardness of water.
- Q. 34 What is sequestration ?
- Q. 35 Match the following.

Column-A	Column-B	Column-A	Column-B
chelation	Linear	Bridge complex	one metal ion
Covalent bond	Cupferron	Chelate compo.	Two metal ion
Coordinate bond	acidic group	EDTA	hexadentate
Refinement of metals	Same metal ion	CrO_4^{2-}	Tetrahedral
C. N. = 2	Coordinating group	Trifluoro acetylacetone	Zr and Hf

Q. 36 Fill up the blank :

- (i) In symmetrical bidentate ligands, the two coordinating atoms are the while in unsymmetrical bidentate ligands, the two coordinating atoms are the.....
- (ii) metal ion present in chelate compounds.
- (iii) The covalent bonds are formed by the group.
- (iv) The coordinate bonds are formed by thegroup.
- (v) Chelate compounds having central metal ion.
- (vi) polynuclear complex (bridged complex) have atleast central metal ions.
- (v) Coordination number of "en" is
- (vi) organic solvent has been used for separation of Zr and Hf metals.
- (vii) has been used for the refinement of many metals by solvent extraction.
- (viii) The compound having C.N. 2 has geometry and it possesses ligand repulsion.
- (ix) The geometry of $[\text{Ni}(\text{dmg})_2]^0$ complex is
- (x) $[\text{Co}^{\text{III}}(\text{NH}_3)_5\text{SO}_4]^+$ and $[\text{Co}^{\text{III}}(\text{en})_2\text{SO}_4]^+$ complexes are exhibit and absorption bands of S-O vibrations. They also showing character of SO_4^{-2} ion.

Q.37 Calculate charge on each of the following complex ion.

- (1) $[\text{Mn}^{\text{IV}}\text{F}_6]$ $1 \times 4 + 6(-1) = -2$ $\therefore [\text{MnF}_6]^{2-}$
- (2) $[\text{Cr}^{\text{III}}(\text{NH}_3)_2(\text{SO}_3)_2]$ $1 \times 3 + 2 \times 0 + 2(-2) = -1$ $\therefore [\text{Cr}(\text{NH}_3)_2(\text{SO}_3)_2]^-$
- (3) $[\text{Co}^{\text{III}}(\text{H}_2\text{O})_5\text{Cl}]$ $1 \times 3 + 5(0) + 1 \times (-1) = 2$ $\therefore [\text{Co}(\text{H}_2\text{O})_5\text{Cl}]^{2+}$
- (4) $[\text{Cu}^{\text{II}}(\text{NH}_3)_4]$ $1 \times 2 + 4(0) = 2$ $\therefore [\text{Cu}(\text{NH}_3)_4]^{2+}$
- (5) $[\text{Pt}^{\text{IV}}(\text{NH}_3)_4\text{Cl}(\text{NO}_2)]$ $1 \times 4 + 4(0) + 1(-1) + 1(-1) = +2$ $[\text{Pt}(\text{NH}_3)_4\text{Cl}(\text{NO}_2)]^{2+}$

Q. 38 Write a note on structure, stability and applications of chelates.**Q. 39 Choose the correct options for the following :**

- (1) The bond that is formed between the metal ion of the transition element and neutral molecules or anions in complex compounds is called :
 - (a) metallic bond
 - (b) covalent bond
 - (c) Ionic bond
 - (d) coordinante bond.
- (2). According to Werner's theory a metal hastypes of valencies :
 - (a) four
 - (b) one
 - (c) three
 - (d) two
- (3) Primary valency of a central metal ion in a complex is satisfied by :

- (a) Ligand (b) Free radical (c) Anion (d) cation
- (4) Potassium ferricyanide is an example of :
(a) Simple salt (b) manganometallic compound
(c) Double salt (d) complex salt.
- (5) During the formation of complex compounds, ligands can act as :
(a) Lewis acid (b) Arrhenius acid
(c) Arrhenius base (d) Lewis base
- (6) During the formation of complex compounds, metal can act as :
(a) Lewis base (b) Arrhenius acid
(c) Arrhenius base (d) Lewis acid
- (7) Identify Lewis base from $K_4[Fe(CN)_6]$
(a) K^+ (b) Fe^{+2} (c) Fe^{+3} (d) CN^-
- (8) Identify Lewis acid from $K_4[Fe(CN)_6]$
(a) K^+ (b) Fe^{+3} (c) CN^- (d) Fe^{+2}
- (9) Secondary valencies of metal are satisfied by :
(a) Anion (b) cation (c) free radical (d) Ligand
- (10) The bond between transition metal ion and the ligands held by secondary valencies is called :
(a) Ionic bond (b) Covalent bond
(c) metallic bond (d) coordinate covalent bond.
- (11) The is shown by square bracket [] in the formula of the complex compound :
(a) complex salt (b) complex compound
(c) Double salt (d) complex ion
- (11) A Complex having a ring structure formed between a polydentate ligand and metal ion is referred to as a :
(a) Monodentate ligand (b) polydentate ligand
(c) None of the above (d) chelate
- (12) The electrical charge of edta is :
(a) -2 (b) -1 (c) -3 (d) -4
- (13) Complexes containing two or more different kinds of ligands are called
(a) polynuclear complex (b) Tridentate ligand
(c) Hexadentate ligand (d) Mixed - ligand
- (14) Complexes which contain two or more central metal ions are called :
(a) Mixed ligand (b) Tridentate ligand

- (c) Hexadentate ligand (d) polynuclear complex
- (15) Which of the following compound is not a coordination compound ?
 (a) $K_3 [Ce (CN)_6]$ (b) $Na Fe Cl_4$
 (c) $Fe (H_2O)_6 Cl_3$ (d) $Fe SO_4 (NH_4)_2 SO_4$
- (16) Which of the following geometries are possible with coordination number 4.
 (a) Tetrahedral (b) Square planar
 (c) octahedral (d) Both (a) and (b)
- (17) Identify the ligand from $K_2[Ni(en)_4]$
 (a) K (b) Ni (c) CN^- (d) None
- (18) The co-ordination number of cobalt in $[Co(en)_2 Cl_2] Cl$ is :
 (a) 5 (b) 3 (c) 4 (d) 6
- (19) The valency of y in the complex $[Ni (CN)_4]^y$ is :
 (a) 0 (b) +2 (c) 4 (d) -2
- (20) The oxidation state of iron in $K_3[Fe(CN)_6]$ is
 (a) +1 (b) +2 (c) +4 (d) +3
- (21) The IUPAC name of $[Ni(CO)_4]$ is :
 (a) Tetra carbonyl nicketate (II) (b) Tetra carbonyl nicketate (0)
 (c) Tetra carbonyl nicketate (II) (d) Tetra carbonyl nicket (0)
- (22) The number of halide ions in $[Mn(NH_3)_3 Cl_2 Br] Cl$ is :
 (a) 3 (b) 4 (c) 2 (d) 1
- (23) The coordination number of Mn in $[Mn(en)_3]Cl_3$ is :
 (a) 2 (b) 4 (c) 2 (d) 6
- (24) The coordination number of Cr in $NH_4 [Cr(H_2O)_2 Cl_4]$ is
 (a) 3 (b) 4 (c) 2 (d) 6
- (25) Which of the following represents a chelating ligand ?
 (a) H_2O (b) NH_3 (c) OH^- (d) edta
- (26) In which of the following complex, nickel metal is in highest oxidation state ?
 (a) $[Ni (CO)_4]$ (b) $K_2 [NiF_6]$ (c) $K_4 [Ni(CN)_6]$ (d) $[Ni (NH_3)_6]Cl_3$
- (27) The correct name of the compound $[Cu(NH_3)_4](NO_3)_2$ according to IUPAC system is
 (a) Cuprammonium nitrate (b) Tetrammine copper (III) dinitrate
 (c) Tetramine copper (III) dinitrate (d) Tetraamine copper (II) nitrate
- (28) Which of the following is non-ionizable ?
 (a) $[Co (NH_3)_4 Cl_2] Cl$ (b) None

- (c) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (d) $\text{Co}(\text{NH}_3)_3\text{Cl}_3$
- (29) Which is the central metal ion in $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$?
 (a) Fe^{2+} (b) H_2O (c) None (d) Fe^{3+}
- (30) All legands are :
 (a) Lewis acid (b) Neutral (c) None (d) Low base
- (31) In $\text{K}_3[\text{Fe}(\text{CN})_6]$ the anion bonded by primary valency is :
 (a) $[\text{Fe}(\text{CN})_6]^{4-}$ (b) 6CN^- (c) $[\text{Fe}(\text{CN})_6]^{3-}$ (d) CN^-
- (32) The secondary valency of metal ion in a $\text{NH}_4[\text{Cr}(\text{H}_2\text{O})_2\text{Cl}_4]^+$ ion is :
 (a) 3 (b) -3 (c) 0 (d) 6
- (33) Which of the following is a chelate ?
 (a) $\text{K}_3[\text{Fe}(\text{CN})_6]$ (b) $\text{K}[\text{MnO}_4]$
 (c) $[\text{Ag}(\text{NH}_3)_2]\text{OH}$ (d) $[\text{CrCl}_2(\text{en})_2]\text{NO}_3$
- (34) The oxidation number of Fe in the complex $[\text{Fe}(\text{CO})_5]$ is :
 (a) A (b) 2 (c) 5 (d) zero
- (35) The correct name for the complex $\text{K}_3[\text{Fe}(\text{C}_2\text{O}_4)_3]$ is :
 (a) Potassium ferric oxalate
 (b) Potassium iron (III) trioxalate
 (c) Potassium trioxalato iron (III)
 (d) Potassium trioxalato ferrate (III)
- (36) The correct name for the complex $[\text{Pt}(\text{NH}_3)_2\text{Cl}_4]$ is :
 (a) Platinum diamminetetrachlorate
 (b) Tetrachlorodiammine platinate (III)
 (c) Platinum tetrachloridediammine
 (d) Tetrachlorodiammine platinum (IV)
- (37) What is the oxidation number of Co in $[\text{Co}(\text{NH}_3)_4\text{Cl}(\text{NO}_2)]$?
 (a) +3 (b) +5 (c) +4 (d) +2
- (38) IUPAC name of $\text{Na}_3[\text{Co}(\text{NO}_2)_6]$ is :
 (a) Sodium cobaltnitrite (b) Sodium hexanitrito cobaltate (II)
 (c) Sodium hexanitro cobalt (III) (d) Sodium hexanitrito cobaltate (III)
- (39) The oxidation number of platinum in $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$ is :
 (a) 2 (b) 3 (c) 6 (d) 4
- (40) Coordination number of Ni in $[\text{Ni}(\text{C}_2\text{O}_4)_3]^{4-}$
 (a) 3 (b) 4 (c) 5 (d) 6
- (41) Give the oxidation number of Fe in $[\text{Fe}(\text{NH}_3)_2\text{CO}_4]\text{SO}_4$

- (a) +1 (b) +3 (c) +4 (d) +2
- (42) How many coordination sites are in ptn ?
(a) 1 (b) 2 (c) 6 (d) 3
- (43) Which of the following is hexadentate ligand ?
(a) en (b) ptn (c) None (d) edta
- (44) What is the charge of edta ?
(a) -1 (b) -2 (c) -3 (d) -4
- (45) What is the coordination number of Co^{2+} in $\text{K}_2[\text{CoCl}_3]$ complex compound.
(a) 2 (b) 4 (c) 3 (d) 6
- (46) What is oxidation number of Co in $\text{K}_3[\text{Co}(\text{Cl})_6]$
(a) +6 (b) +2 (c) +4 (d) +3
- (47) Ptn is the type of ligand
(a) Bi-dentate (b) Tridentate anion
(c) Bi-dentate anion (d) Tridentate neutral
- (48) The name of the ring structure (cyclic) complex compound formed between metal ion and poly dentate irgand is
(a) Natural complex (b) simple complex
(c) Polynuclear complex (d) chelate
- (49) Which one of the following is the structural formula of potassion hexacyano ferrate (II).
(a) $\text{K}_3 [\text{Fe}(\text{CN})_6]$ (b) $\text{K}_3[\text{Fe}(\text{CN})_4 \text{Cl}_2]$
(c) $\text{K}_2 [\text{Fe} (\text{CN})_4]$ (d) $\text{K}_4 [\text{Fe}(\text{CN})_6]$
- (50) What is secondary valency (co-ordination number) of Cr metal ion in the complex $[\text{Cr} (\text{en})_2 \text{Cl}_2] \text{NO}_3$?
(a) 4 (b) 1 (c) 3 (d) 6
- (51) Mention the charge on $[\text{Cr}^{\text{III}} (\text{CO})_2 (\text{CN})_4]$ complex ion.
(a) +2 (b) +1 (c) 0 (d) -1
- (52) Mention the primary Valency (oxidation state) of Co in the complex $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$
(a) IIV (b) IV (c) 0 (d) III
- (53) What is the oxidation state of Fe in $[\text{Fe}(\text{NO}) (\text{CN})_5]^{2-}$ complex ion ?
(a) +6 (b) +2 (c) zero (d) + 3
- (54) What is the number of chlorine combined by secondary valency in $[\text{Fe}(\text{NH}_3)_4\text{Cl}_2] \text{Cl}$?

- (a) 1 (b) 3 (c) 0 (d) 2
- (55) Which of the following is not an example of negative bidentate ligand ?
 (a) carbonato (b) oxalato
 (c) sulphato (d) ethylenediammine
- (56) Which of the following complex is potassium bis (oxalato) diammine cobaltate (III) ?
 (a) $K_2[Co(NH_3)_2(Ox)_2]$ (b) $K_4[(Co(NH_3)_2(OC)_2)]$
 (c) $K_3[Co(NH_3)_2(Ox)_2]$ (d) $K[Co(NH_3)_2(OX)_2]$
- (57) Which of the following ligands is a bidentate :
 (a) EDTA (b) Ammonia (c) Acetate (d) Ethylenediamine
- (58) Which of the following represents IUPAC name of $[Co(NH_3)_6]Cl_3$.
 (a) Cobalt (II) hexamine tetrachloride (b) Cobalt hexamine chloride
 (c) Hexamine cobalt chloride (d) Hexammine cobalt (III) chloride
- (59) The oxidation number of Pt in $[Pt(NH_3)_3Cl_3]^-$ is
 (a) +1 (b) +3 (c) +4 (d) +2
- (60) Coordination number and oxidation number of Cr in $K_3[Cr(C_2O_4)_3]$ are respectively ?
 (a) 4 and +2 (b) 3 and +3 (c) 3 and 0 (d) 6 and +3
- (61) Correct IUPAC name of $K_4[Fe(CN)_6]$ is :
 (a) Tetra potassium ferri cyanide (b) Potassium hexacyanide
 (c) Potassium ferro cyanide (d) Potassium hexacyanoferrate (II)
- (62) Oxidation Number of Cobalt in $K[Co(CO)_4]$ is :
 (a) +1 (b) +3 (c) -3 (d) -1
- (63) The name of the complex $[Pt(NH_3)_6]Cl_4$ is
 (a) Hexammine platinum (II) chloride
 (b) Tetrachloro hexamine platinum (IV)
 (c) Tetrachloro hexammine platinate (II)
 (d) Hexamine platinum (IV) chloride
- (64) What is the oxidation number of Co in $[Co(NH_3)_4Cl(NO_2)]$?
 (a) +1 (b) +5 (c) +4 (d) +2
- (65) Chemical formula for iron (III) hexacyanoferrate (II) is :
 (a) $Fe(CN)_6$ (b) $Fe_3[(CN)_6]$
 (c) $Fe_3[Fe(CN)_6]_4$ (d) $Fe_4[Fe(CN)_6]_3$
- (66) IUPAC name of $Na_3[Co(NO_2)_6]$ is
 (a) Sodium cobaltinitrite
 (b) sodium hexanitro cabatt (III)

- (c) sodium hexanitro cobaltate (III)
(d) sodium hexanitrito cobaltate (III)
- (67) The primary valency of iron in $[K_4 Fe(CN)_6]$ is :
(a) 1 (b) 3 (c) 4 (d) 2
- (68) Coordination number of Ni in $[Ni(C_2O_4)_3]^{-2}$
(a) 3 (b) 4 (c) 5 (d) 6
- (69) The primary valency of iron in $K_4 [Fe(CN)_6]$ is :
(a) 5 (b) 3 (c) 4 (d) 2
- (70) The oxidation number of cobalt in $K[Co (CN)_4]$
(a) +2 (b) -3 (c) -1 (d) +3
- (71) IUPAC name of $K_3 [Fe(CN)_6]$ is :
(a) Potassium hexacyanoferrate (II) (b) hexacyanoferrate (III)
(c) potassium ferricyanide (d) Potassium hexacyano ferrate (III)
- (72) The oxidation state of Fe in $K_4[Fe(CN)_6]$ is
(a) -2 (b) +4 (c) +6 (d) +2
- (73) The oxidation number of Cr in $[Cr (NH_3)_4 Cl_2]^+$ is :
(a) +2 (b) +1 (c) 0 (d) +3
- (74) Ammonia group in a coordination compound is named as
(a) Ammonia (b) Ammonium (c) Amine (d) Ammine
- (75) Identify monodentate ligand from the following ?
(a) edta (b) en (c) ptn (d) H_2O
- (76) A ligand which form a single coordinate covalent bond by donating one electron-pair to a metal ion is called a :
(a) Bidentate ligand (b) Tridentate ligand
(c) Polydentate ligand (d) monodentate ligand
- (77) What is the charge on pentacarbonyl iron (0) complex.
(a) one (b) five (c) three (d) zero
- (78) Which of the following cannot behave as ligand ?
(a) NH_3 (b) NO_3^- (c) H_2CO (d) CO_2
- (79) In complex compounds which type of bond is present ?
(a) Ionic bond (b) Covalent bond
(c) Metallic bond (d) coordinate covalent bond
- (80) Potassium ferricyandide is an example of :
(a) Double salt (b) simple salt
(c) None of these (d) complex salt

- (81) Secondary valencies of metal are satisfied by :
 (a) Anion (b) cation (c) none of these (d) ligand
- (82) Oxalate ion is a type of ligand
 (a) Monodentate (b) Tridentate (c) Hexadentate (d) Bidentate
- (83) Which is not a ligand from the following ?
 (a) Cl^- (b) CO_3^{2-} (c) NH_3 (d) Cl_2
- (84) Identify monodentate ligand from the following.
 (a) en (b) ptn (c) edta (d) H_2O
- (85) Which is the simple salt ?
 (a) $[\text{Cu}(\text{NH}_3)_4]^{+2}$ (b) $\text{C}_2\text{H}_5\text{NH}_2$
 (c) None of above (d) NaCl
- (86) Valency of "NO" ligand is _____.
 (a) + 1 (b) -1 (c) -2 (d) Neutral
- (87) Which one of the following is an example of an octahedral complex ?
 (a) $[\text{Ni}(\text{CN})_4]^{-2}$ (b) $[\text{Zn}(\text{NH}_3)_4]^{+2}$ (c) $[\text{Cu}(\text{NH}_3)_4]^{+2}$ (d) $[\text{FeF}_6]^{-3}$
- (88) Charge on Co ion in $[\text{Co}(\text{CN})_6]^{-3}$ is _____.
 (a) -6 (b) -3 (c) + 6 (d) +3
- (89) The number of unpaired electron in $\text{Ni}(\text{CO})_4$ is _____.
 (a) 1 (b) 3 (c) 4 (d) 0
- (90) Which of the following have square planer structure ?
 (a) $[\text{Ni}(\text{CO})_4]^{+2}$ (b) NiCl_2 (c) $\text{Ni}(\text{OH})_2$ (d) $[\text{Ni}(\text{CN})_4]^{+2}$
- (91) $[\text{EDTA}]^{-4}$ is a _____.
 (a) Monodentate ligand (b) Bidentate ligand
 (c) Quadridentate (d) Hexadentate ligand
- (92) From the given compounds, which one is the lattice compound ?
 (a) NaCl (b) NaKSO_4
 (c) $\text{K}_4[\text{Fe}(\text{CN})_6]$ (d) $\text{FeSO}_4(\text{NH}_4)_2 \cdot \text{SO}_4 \cdot 6\text{H}_2\text{O}$
- (93) Which one of the following is a bidentate ligand ?
 (a) Aquo (b) Carbonyl (c) Iodo (d) Carbonato
- (94) Ethylene diamine is a _____ ligand.
 (a) Monodentate (b) Polydentate (c) Tridentate (d) Bidentate
- (95) According to Werner's theory in a co-ordination compound central metal ion acquires how many valencies ?
 (a) 1 (b) 4 (c) 3 (d) 2

- (96) In a co-ordination compound primary valency of a central metal ion is satisfied by :
 (a) Ligand (b) Cation (c) Radical (d) Anion
- (97) Secondary valency of a metal ion in a co-ordination compound is satisfied by :
 (a) ion (b) Salt (c) Molecule (d) Ligand
- (98) Which of the following represents a chelating ligand ?
 (a) NH_3 (b) CH_3NH_2 (c) $\text{N}(\text{CH}_3)_2$ (d) edta,
- (99) Which of the following is a hexadentate ligand ?
 (a) en (b) ptn (c) acac (d) edta
- (100) What is the oxidation state of Fe ion in $[\text{Fe}(\text{NO})(\text{CN})_5]^{-2}$
 (a) 0 (b) +1 (c) +2 (d) +3
- (101) Mention the charge on complex $[\text{Cr}^{\text{III}}(\text{CO})_5(\text{CN})_4]$
 (a) 0 (b) +2 (c) +1 (d) -1

Q. 40 Answer the following :

- (1) In the co-ordination compound $[\text{Co}(\text{en})(\text{dien})\text{Cl}]\text{Cl}_2$

ANSWER

Chloro ethylenediammine diethylenetriammine cobalt
 (III) chloride

- The oxidation state of cobalt is +3
- The co-ordination number of cobalt is 6
- The dentate character of different ligands are en-bidentate
 Cl - monodentate
 dien - tridentate
- Ionic charge on complex cation is +2
- The number of non co-ordinated chlorine is 2

- (2) In the co-ordination compound $[\text{Ag}(\text{NH}_3)_2]^+$

Diammine silver (I) ion

- The oxidation of argenium (silver) is +1
- The co-ordination number of argenium (silver) is 2
- The dentate character of ligands is NH_3 monodentate
- Ionic charge on complex is +1

- (3) In the co-ordination compound $[\text{Co}(\text{NO}_2)_3(\text{NH}_3)_3]$

Trinitro triammine cobalt (III)

- The oxidation state of cobalt is +3
- The co-ordination number of cobalt is 6
- The dentate character of different ligands are NO_2 -monodentate

- 4 Ionic charge on complex is _____ NH_3 -monodentate
0
- (4) In the co-ordination compound $[\text{Ti}(\text{H}_2\text{O})_6]^{+3}$
Hexaaquo titanium (III) ion
- The oxidation state of Titanium is _____ + 3
 - The co-ordination number of Titanium is _____ 6
 - The dentate character of ligands is _____ H_2O -monodentate
 - Ionic charge on complex is _____ + 2.5
- (5) In the co-ordination compound $[\text{Cu}(\text{acac})_2]$
Bis acetylaceto copper (II)
- The oxidation state of cobalt is _____ +2
 - The co-ordination number of cobalt is _____ 4
 - The dentate character of different ligands are _____ Acac-monodentate
 - Ionic charge on complex is _____ 0
- (6) In the co-ordination compound $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$
Hexaammine cobalt (III) chloride
- The oxidation state of cobalt is _____ + 3
 - The co-ordination number of cobalt is _____ 6
 - The dentate character of ligand is _____ NH_3 -monodentate
 - Ionic charge on complex cation is _____ +3
 - The number of non co-ordinated chlorine is _____ 3
- (7) In the co-ordination compound $[\text{Cr}(\text{en})_3][\text{Ni}(\text{CN})_6]$
Tris {ethylenediammine} chromium (III)
Hexacyano nickelate (III)
- The oxidation state of chromium is _____ + 3
 - The oxidation state of nickel is _____ + 3
 - The co-ordination number of chromium is _____ 6
 - The co-ordination number of nickel is _____ 6
 - The dentate character of different ligands are _____ en-bidentate
CN - monodentate
 - Ionic charge on complex cation is _____ + 3
 - Ionic charge on complex anion is _____ -3
- (8) In the co-ordination compound $[\text{Pt}(\text{NH}_3)_4\text{ClNO}_2]\text{SO}_4$
Chloro nitro tetraammine platinum (IV) sulphate

1. The oxidation state of platinum is _____ + 4
 2. The co-ordination number of platinum is _____ 6
 3. The dentate character of different ligands are _____
 NH_3 -monodentate
 Cl -monodentate
 NO_2 -monodentate
 4. Ionic charge on complex cation is _____ +2
 5. The number of non co-ordinated sulphate is _____ 1
- (9) In the co-ordination compound $\text{Na} [\text{Ag} (\text{CN})_2]$
 Sodium dicyano argenate (I)
1. The oxidation state of argenium (silver) is _____ + 1
 2. The co-ordination number of argenium (silver) is _____ 2
 3. The dentate character of ligands is _____ CN -monodentate
 4. Ionic charge on complex anion is _____ -1
 5. Ionic charge on simple cation Na is _____ +1
- (10) In the co-ordination compound $[\text{Co}(\text{H}_2\text{O})_6] [\text{Co}(\text{CN})_6]$
 Hexaaquo cobalt (III) Hexacyano cobaltate (III)
1. The oxidation state of cobalt in complex cation is _____ +3
 2. The oxidation state of cobalt in complex anion is _____ +3
 3. The co-ordination number of cobalt in complex cation is _____ 6
 4. The co-ordination number of cobalt in complex anion is _____ 6
 5. The dentate character of different ligands are _____
 H_2O -monodentate
 CN -monodentate
 6. Ionic charge on complex cation is _____ + 3
 7. Ionic charge on complex anion is _____ -3
- (11) In the co-ordination compound $[\text{Cr} \text{Cl} (\text{H}_2\text{O}) (\text{en})_2]\text{Cl}_2$
 Chloro aquo bis {ethylenediammine} chromium (III) chloride
1. The oxidation state of chromium is _____ + 3
 2. The co-ordination number of chromium is _____ 6
 3. The dentate character of different ligands are _____
 Cl -monodentate
 H_2O -monodentate
 en -bidentate
 4. Ionic charge on complex cation is _____ +2
- (12) In the Tris co-ordination compound $[\text{Cr}(\text{en})_3]_2 (\text{SO}_4)_3$
 Tris {ethylenediammine} chromium (III) sulphate

1. The oxidation state of chromium is _____ + 6
 2. The co-ordination number of chromium is _____ 6
 3. The dentate character of ligands is en-bidentate
 4. Ionic charge on complex cation is _____ + 6
 5. Ionic charge on simple anion is _____ - 2
 6. The number of non co-ordinated sulphate is _____ 3
- (13) In the co-ordination compound $[\text{CoCl}_2 (\text{H}_2\text{O})_2 (\text{NH}_3)_2]$
Dichloro diammine diaquo cobalt (III) ion
1. The oxidation state of cobalt is _____ + 3
 2. The co-ordination number of cobalt is _____ 6
 3. The dentate character of different ligands are _____
Cl-monodentate
 H_2O - monodentate
 NH_3 - monodentate
: +1
 4. Ionic charge on complex is _____
- (14) In the co-ordination compound $(\text{NH}_4)_3 [\text{Cr} (\text{NCS})_6]$
Ammonium hexaisothiocyanato chromate (III)
1. The oxidation state of chromium is _____ + 3
 2. The co-ordination number of chromium is _____ 6
 3. The dentate character of different ligands are _____ NCS-monodentate
 4. Ionic charge on simple cation is _____ + 1
 5. Ionic charge on complex anion is _____ +3
- (15) In the co-ordination compound $[\text{CoBr}(\text{H}_2\text{O})(\text{NH}_3)_4]^{+2}$
Bromo tetraammine aquo cobalt (III) ion
1. The oxidation state of cobalt is _____ + 3
 2. The co-ordination number of cobalt is _____ 6
 3. The dentate character of different ligands are _____
Br-monodentate
 H_2O -monodentate
 NH_3 -monodentate
+2
 4. Ionic charge on complex is _____
- (16) In the co-ordination compound $[\text{CoCl}_3 (\text{NH}_3)_3]$
Trichloro triammine cobalt (III)
1. The oxidation state of cobalt is _____ +3
 2. The co-ordination number of cobalt is _____ 6
 3. The dentate character of different ligands are _____
Cl-monodentate
 NH_3 -monodentate
0
 4. Ionic charge on complex is _____
- (17) In the co-ordination compound $\text{Na}(\text{SbCl}_5 (\text{C}_6\text{H}_5))$
Sodium pentachloro phenyl antimonate

1. The oxidation state of antimony is _____ + 4
 2. The co-ordination number of antimony is _____ 6
 3. The dentate character of different ligands are _____ Cl-monodentate
C₆H₅-monodentate
 4. Ionic charge on simple cation is _____ +1
 5. Ionic charge on complex auion is _____ -1
- (18) In the co-ordination compound H₃ [CoCl₆]
Hydrogen hexachloro cobaltate (III) OR
Hexachloro cobaltic (III) acid
1. The oxidation state of cobalt is _____ + 3
 2. The co-ordination number of cobalt is _____ 6
 3. The dentate character of ligands is _____ Cl-monodentate
 4. Ionic charge on simple cation is _____ +1
 5. Ionic charge on complex anion is _____ -3
- (19) In the co-ordination compound [Co(H₂O)]⁺³
Hexaaquo cobalt (III) ion
1. The oxidation state of cobalt is _____ + 3
 2. The co-ordination number of cobalt is _____ 6
 3. The dentate character of ligands is _____ H₂O-monodentate
 4. Ionic charge on complex is _____ +3
- (20) In the co-ordination compound [Co (CN)₆]⁻³
Hexacyano cobaltate (III) ion
1. The oxidation state of cobalt is _____ + 3
 2. The coordination number of cobalt is _____ 6
 3. The dentate character of ligands is _____ CN-monodentate
 4. Ionic charge on complex is _____ -3
- (21) In the co-ordination compound [(NH₃)₅ Cr OH Cr (NH₃)₅] Cl₅
μ-Hydroxo bis {pentaammine chromium (III)}chloride
1. The oxidation state of chromium is _____ + 3
 2. The co-ordination number of chromium is _____ 6
 3. The dented character of different ligands are _____ OH- monodentate
NH₃ - monodentate
OH-Hydroxo
 4. The bridge ligand in co-ordination compound is _____

5. Ionic charge on complex anion is _____
6. Ionic charge on simple anion is _____ +5
7. The number of iron co-ordinated chlorine is _____ -1
- (22) In the co-ordination compound $[\text{Co}(\text{NH}_3)_4(\text{OH})(\text{H}_2\text{O})]\text{Br}_2$ 5
Hydroxo tetraammine aquo cobalt (III) bromide
1. The oxidation state of cobalt is _____ + 3
2. The co-ordination number of cobalt is _____ 6
3. The dentate character of different ligands are _____
OH- monodentate
H₂O- monodentate
NH₃ - monodentate
4. Ionic charge on complex cation is _____ + 2
5. Ionic charge on simple anion is _____ -1
6. The number of non co-ordinated bromine is _____ 2
- (23) In the co-ordination compound $(\text{Co Br H}_2\text{O}(\text{NH}_3)_4)(\text{NO}_3)_2$
Bromo aquo tetramine cobalt (III) nitrate
1. The oxidation state of cobalt is _____ + 3
2. The co-ordination number of cobalt is _____ 6
3. The dentate character of different ligands are _____
Br-monodentate
H₂O-monodentate
NH₃-monodentate
4. Ionic charge on complex cation is _____ + 2
5. Ionic charge on simple anion is _____ -1
6. The number of non co - ordinated nitrate is _____ 2
- (24) In the co-ordination compound $[\text{Cr}(\text{NH}_3)_6](\text{NO}_3)_3$
Hexammine chromium (III) nitrate
1. The oxidation state of chromium is _____ + 3
2. The co-ordination number of chromium is _____ 6
3. The dentate character of ligands is _____ NH₃-monodentate
4. Ionic charge on complex cation is _____ +3
5. Ionic charge on simple anion is _____ -1
6. The number of non co-ordinated nitrate is _____ 2
- (25) In the co-ordination compound $[\text{Pt Cl}(\text{ONO})(\text{NH}_3)_4]\text{SO}_4$

Chloro nitrito tetraammine platinum (IV) sulphate

1. The oxidation state of platinum is _____ + 4
 2. The co-ordination number of platinum is _____ 6
 3. The dentate character of different ligands are _____
Cl- monodentate
ONO- monodentate
NH₃ - monodentate
 4. Ionic charge on complex cation is _____ +2
 5. Ionic charge on simple anion is - _____ -2
 6. The number of non co-ordinated sulphate is _____ 1
- (26) In the co-ordination compound $\text{NH}_4 [\text{Cr} (\text{SCN})_4 (\text{NH}_3)_2]$
Ammonium tetrathiocyanato diammine chromate (III)
1. The oxidation state of chromium is _____ + 3
 2. The co-ordination number of chromium is _____ 6
 3. The dentate character of different ligands are _____
SCN- monodentate
NH₃ - monodentate
 4. Ionic charge on simple cation is _____ + 1
 5. Ionic charge on complex anion is _____ -1
- (27) In the co-ordination compound $\text{H}_2 [\text{Pt} \text{Cl}_6]$
Hexachloroplatinic (IV) acid
1. The oxidation state of Platinum is _____ + 4
 2. The co-ordination number of Platinum is _____ 6
 3. The dentate character of ligands is _____ Cl-monodentate
 4. Ionic charge on simple cation is _____ +1
 5. Ionic charge on complex anion is _____ -2
- (28) In the co-ordination compound $[\text{AgCl}_2]^-$
Dichloro argentate (I) ion
1. The oxidation state of argenium (silver) is _____ + 1
 2. The co-ordination number of argenium (silver) is _____ 2
 3. The dentate character of ligands is _____ Cl-monodentate
 4. Ionic charge on complex is _____ -1

Q. 41 Answer the following :

1. Give the rules for nomenclature of various co-ordination compounds.
2. The shape of the complexes having C.N. = 2 is _____ and its bond angle is _____
3. Discuss the importance of chelation in co-ordination compounds.
4. Give the formula of Mohr's salt, Potash alum, Potassium Ferro cyanide, Potassium ferricyanide.
5. Give the dissociation into ions when they dissolved in water, (i) Mohr' salt (ii) Potash alum (iii) Potassium ferrocyanide