

INORGANIC CHEMISTRY

ENTHUSIAST | LEADER | ACHIEVER



EXERCISE

Co-ordination Compounds

ENGLISH MEDIUM

EXERCISE-I (Conceptual Questions)

Build Up Your Understanding

TERMINOLOGY OF COORDINATION COMPOUND

1. In the complex ion $[\text{Fe}(\text{EDTA})]^-$ the coordination number and oxidation state of central metal ion is :-
 (1) C.N. = 6 O.N. = +3
 (2) C.N. = 1 O.N. = -1
 (3) C.N. = 4 O.N. = +2
 (4) C.N. = 3 O.N. = +3

CC0001

2. The coordination number and oxidation number of the central metal ion in the complex $[\text{Pt}(\text{en})_2]^{+2}$ is :-
 (1) C.N. = 2, O.N. = +2
 (2) C.N. = 6, O.N. = +4
 (3) C.N. = 4, O.N. = +4
 (4) C.N. = 4, O.N. = +2

CC0002

3. Select bidentate or didentate ligand from the following.
 (1) CO (2) SCN^-
 (3) CH_3COO^- (4) $\text{C}_2\text{O}_4^{2-}$

CC0003

4. The oxidation and coordination number of Pt in $[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]^-$ is respectively :-
 (1) + 1, 3 (2) + 2, 4
 (3) + 3, 6 (4) + 2, 5

CC0004

5. The CN and ON of X in the complex compound $[\text{X}(\text{SO}_4)(\text{NH}_3)_5]$ will be respectively :-
 (1) 10 and +3 (2) 1 and +6
 (3) 6 and +4 (4) 6 and +2

CC0005

6. What is the oxidation number of Fe in $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]^{2+}$ ion?
 (1) +2 (2) +3
 (3) +1 (4) 0

CC0006

7. Which one is a heteroleptic complex ?
 (1) Ferrocene (2) Chromocene
 (3) Prussian blue (4) Zeise's salt

CC0231

8. Select the set representing correct statements only.
 (I) A coordination entity constitutes a central metal atom or ion bonded to a fixed number of ions or molecules.
 (II) Ligand having two different or similar donor atoms in the complex is called bidentate ligand.
 (III) All bidentate ligands are chelating ligands.
 (IV) Ni^{+2} , Co^{+3} and Fe^{+3} are acting as Lewis acids in $[\text{NiCl}_2(\text{H}_2\text{O})_4]$, $[\text{CoCl}(\text{NH}_3)_5]^{+2}$ and $[\text{Fe}(\text{CN})_6]^{-3}$.

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

CC0232

9. Oxidation number of Cobalt in $\text{K}[\text{Co}(\text{CO})_4]$ is :-
 (1) +1 (2) -1 (3) 0 (4) +2

CC0233

10. Which of the following species is not expected to be ligand :-
 (1) NO (2) NH_4^+
 (3) $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$ (4) CO

CC0234

11. Identify the statement which is not correct :-
 (1) Coordination compounds are mainly known for transition metals.
 (2) Coordination number and oxidation state of central metal atom in a complex is same.
 (3) Ligand donates at least one electron pair to CMA
 (4) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ is a heteroleptic complex.

CC0235

12. Which of the following ligands will not show chelation?
 (1) EDTA (2) DMG
 (3) Ethane-1, 2 diamine (4) SCN^-

CC0236

IUPAC - NOMENCLATURE

13. $\text{K}_3[\text{Fe}(\text{CN})_6]$ is :-
 (a) Potassium hexacyano ferrate (II)
 (b) Potassium hexacyano ferrate (III)
 (c) Potassium ferri-cyanide
 (d) Hexacyano ferrate (III) potassium

Correct answer is :-

- (1) Only (a) and (b) (2) Only (b) and (c)
 (3) Only (a) and (c) (4) Only (b) and (d)

CC0009

14. Give the IUPAC name of the complex compound $[\text{Co}(\text{NH}_3)_4(\text{H}_2\text{O})\text{Br}](\text{NO}_3)_2$.

- (1) Bromoaquatetraamine Cobalt (III) nitrate
- (2) Bromoaquatetraaminocobalt (III) nitrate
- (3) Bromoaquatetraammine cobaltate (III) nitrate
- (4) Tetraammineaquabromido cobalt (III) nitrate

CC0010

15. Which of the following complex is anion :-

- (1) Fluoro pentaammine cobalt(III)
- (2) Trioxalato ferrate(III)
- (3) Penta Carbonyl iron(0)
- (4) Dichloro diammine platinum(II)

CC0011

16. The chloro-bis (ethylenediamine) nitro cobalt (III) ion is :-

- (1) $[\text{Co}(\text{NO}_2)_2(\text{en})_2\text{Cl}_2]^+$
- (2) $[\text{CoCl}(\text{NO}_2)_2(\text{en})_2]^+$
- (3) $[\text{CoCl}(\text{en})_2\text{NO}_2]^+$
- (4) $[\text{Co}(\text{en})\text{Cl}_2(\text{NO}_2)_2]^-$

CC0012

17. Which of the following complexes is not a chelate

- (1) bis (dimethylglyoximate) nickel(II)
- (2) Potassium ethylenediaminetetrathiocyanato chromate(III)
- (3) Tetrammine dichlorocobalt(III) nitrate
- (4) Trans-diglycinatoplatinum(II)

CC0013

18. The correct IUPAC name of the complex $[\text{Fe}(\eta^5\text{-C}_5\text{H}_5)_2]$ is

- (1) Cyclopentadienyl iron (II)
- (2) Bis (cyclopentadienyl) iron (II)
- (3) Dicyclopentadienyl ferrate (II)
- (4) Ferrocene

CC0014

19. The correct name of $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2][\text{PtCl}_4]$ is :-

- (1) Tetraammine dichloro platinum (IV) tetrachloro platinate (II)
- (2) Dichloro tetra ammine platinum (IV) tetrachloro platinate (II)
- (3) Tetrachloro platinum (II) tetraammine platinate(IV)
- (4) Tetrachloro platinum (II) dichloro tetraamine platinate (IV)

CC0015

20. The IUPAC name of $\text{K}_2[\text{Cr}(\text{CN})_2\text{O}_2(\text{O})_2(\text{NH}_3)]$ is:-

- (1) Potassiumamminedicyano dioxoperoxochromate(VI)
- (2) Potassiumamminecyanoperoxodioxo chromium (VI)
- (3) Potassiumamminecyanoperoxodioxo chromium (VI)
- (4) Potassiumamminecyanoperoxodioxo chromate (IV)

CC0016

21. The IUPAC name for $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ is :-

- (1) Hexaammine cobalt (III) hexacyanochromate (III)
- (2) Hexacyanochromium cobalt hexaammine (VI)
- (3) Hexaammine cobalt (III) hexacyanochromium (VI)
- (4) Hexacyanochromium (III) hexaammine cobalt (III)

CC0017

22. The IUPAC name for $[\text{Co}(\text{NCS})(\text{NH}_3)_5]\text{Cl}_2$ is :-

- (1) Pentaammine (thiocyanato-N) cobalt (III) chloride
- (2) Pentaammine (thiocyanato-S) cobalt (III) chloride
- (3) Pentaammine (isothiocyanato-N,S)cobalt (III) chloride
- (4) Pentaammine (mercapto-N) cobalt (III) chloride

CC0018

23. Which rule is incorrect regarding IUPAC nomenclature of complex ions ?

- (1) Cation is named first and then anion is named
- (2) In the coordination sphere, the ligands are named alphabetically.
- (3) Positively charged ligands have suffix-ate.
- (4) More than one same type of ligands are indicated by di, tri, tetra etc.

CC0023

WERNER'S THEORY & EAN

24. Which of the following has least conductivity in aqueous solution.

- (1) $\text{CoCl}_3 \cdot 4\text{NH}_3$
- (2) $\text{CoCl}_3 \cdot 3\text{NH}_3$
- (3) $\text{CoCl}_3 \cdot 5\text{NH}_3$
- (4) $\text{CoCl}_3 \cdot 6\text{NH}_3$

CC0020

25. If EAN of a central metal ion X^{+2} in a complex is 34. and atomic number of X is 28. The number of monodentate ligands present in complex are:-

- (1) 3
- (2) 4
- (3) 6
- (4) 2

CC0021

26. The EAN of cobalt in the complex ion $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ is :-

- (1) 27
- (2) 36
- (3) 33
- (4) 35

CC0022

27. The effective atomic number of Cr (atomic no. 24) in $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ is

- (1) 35
- (2) 27
- (3) 33
- (4) 36

CC0023

28. Which gives only 25% mole of AgCl , when reacts with AgNO_3 :-

- (1) $\text{PtCl}_2 \cdot 4\text{NH}_3$
- (2) $\text{PtCl}_4 \cdot 5\text{NH}_3$
- (3) $\text{PtCl}_4 \cdot 4\text{NH}_3$
- (4) $\text{PtCl}_4 \cdot 3\text{NH}_3$

CC0024

29. In the metal carbonyls of general formula $M(CO)_x$ (Which follows EAN rule) if M is Ni, Fe and Cr the value of x will be respectively:-
 (1) 6, 5, 6 (2) 4, 5, 6 (3) 4, 4, 5 (4) 4, 6, 6

CC0025

30. A compound has the empirical formula $CoCl_3 \cdot 5NH_3$. When an aqueous solution of this compound is mixed with excess silver nitrate, 2 mol of AgCl precipitate per mol of compound. On reaction with excess HCl, no NH_4^+ is detected. Hence it is

- (1) $Co(NH_3)_5Cl_2Cl$ (2) $[Co(NH_3)_5Cl]Cl_2$
 (3) $[Co(NH_3)_5Cl_3]$ (4) $[Co(NH_3)_4Cl_2]Cl \cdot NH_3$

CC0026

31. Which is incorrect regarding Werner theory :-

- (1) Co-ordination compounds metals show two types of valency.
 (2) Primary valency is satisfied by negative ions.
 (3) Secondary valency is satisfied by only neutral molecules.
 (4) Secondary valency is responsible for geometry of complex.

CC00238

32. Number of electrolytes in the complex $CoCl_3 \cdot 5NH_3$

- (1) 3 (2) 2 (3) 4 (4) 5

CC00239

VALENCE BOND THEORY

33. Which of the following compound is paramagnetic
 (1) Tetracyanonickelate (II) ion
 (2) Tetraamminezinc (II) ion
 (3) Hexaamine chromium (III) ion
 (4) Diammine silver (I) ion

CC00028

34. The shape of the complex $[Ag(NH_3)_2]^+$ is :

- (1) Octahedral (2) Square planar
 (3) Tetrahedral (4) Linear

CC00029

35. Hexafluoroferrate(III) ion is an outer orbital complex. The number of unpaired electrons are

- (1) 1 (2) 5 (3) 4 (4) 3

CC00030

36. The shape of $[Cu(NH_3)_4]SO_4$ is :

- (1) Square planar (2) Pyramidal
 (3) Octahedral (4) Tetrahedral

CC00031

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

- (1) $[FeF_6]^{3-}$ (2) $[Fe(H_2O)_6]^{2+}$
 (3) $[Cu(H_2O)_6]^{2+}$ (4) $[Zn(H_2O)_6]^{2+}$

CC00032

38. In the complex ion ML_6^{n+} , M^{n+} has five d-electrons and L is weak ligand then the magnetic properties of the complex ion correspond to how many unpaired electrons

- (1) 0 (2) 5 (3) 2 (4) 3

CC00033

39. A magnetic moment of 1.73 BM will be shown by one among of the following compounds .

- (1) $[Cu(NH_3)_4]^{2+}$ (2) $[Ni(CN)_4]^{2-}$
 (3) $TiCl_4$ (4) $[CoCl_6]^{3-}$

CC00034

40. The magnetic property and the shape of $[Cr(NH_3)_6]^{3+}$ complex ions are :

- (1) Paramagnetic, Octahedral
 (2) Diamagnetic, square planar
 (3) Paramagnetic, tetrahedral
 (4) None of the above

CC00035

41. Amongst the following ions which one is high spin complex.

- (1) $[Cr(NH_3)_6]^{2+}$ (2) $[Fe(H_2O)_6]^{3+}$
 (3) $[Cu(H_2O)_4]^{1+}$ (4) $[Zn(H_2O)_6]^{2+}$

CC00036

42. Which of the following complexes is an inner orbital complex ?

- (1) $[CoF_6]^{3-}$ (2) $[FeF_6]^{3-}$
 (3) $[Cr(NH_3)_6]^{3+}$ (4) $[Fe(H_2O)_6]^{2+}$

CC00037

43. What is Incorrect for $K_4[Fe(CN)_6]$

- (1) O.N of Iron is +2
 (2) It exhibit diamagnetic character
 (3) It exhibit paramagnetic character
 (4) It involves d^2sp^3 hybridisation

CC00039

44. In which of the following molecules, central atom used orbitals of different principle quantum number in the hybridisation :-

- (1) $[Fe(CO)_5]$ (2) $[Zn(NH_3)_6]^{+2}$
 (3) $[Ni(CO)_4]$ (4) $[Ni(NH_3)_6]^{+2}$

CC00040

45. What are the geometric shape and the oxidation number of the copper atom, respectively, for the complex ion, $[Cu(NH_3)_4(OH)_2]^{2+}$?

- (1) Tetrahedral; + 2
 (2) Square planar; - 2
 (3) Linear; + 3
 (4) Octahedral; + 2

CC00041

- 46.** For $[\text{FeF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$ magnetic moment of the fluoride complex is expected to be :-
 (1) The same as the magnetic moment of the cyanide complex
 (2) Larger than the magnetic moment of the cyanide complex because there are more unpaired electrons in the fluoride complex
 (3) Smaller than the magnetic moment of the cyanide complex because there are more unpaired electrons in the fluoride complex
 (4) Larger than the magnetic moment of the cyanide complex because there are fewer unpaired electrons in the fluoride complex

CC0042

- 47.** Which of the following contains one unpaired electron in the 4p orbitals :-
 (1) $[\text{Cu}(\text{NH}_3)_2]^+$ (2) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
 (3) $[\text{Cu}(\text{CN})_4]^{3-}$ (4) $[\text{Ni}(\text{CN})_4]^{2-}$

CC0043

- 48.** How many unpaired electrons are present in the Brown Ring complex $[\text{Fe}(\text{H}_2\text{O})_5(\text{NO})]\text{SO}_4$
 (1) 4 (2) 3 (3) 0 (4) 5

CC0045

- 49.** Which of the following statements about $[\text{Cr}(\text{CO})_6]$ is correct ?
 (1) It is paramagnetic and inner orbital complex
 (2) It is diamagnetic and inner orbital complex
 (3) It is diamagnetic and outer orbital complex
 (4) It is paramagnetic and outer orbital complex

CC0046

- 50.** Which is true for complex $[\text{Ni}(\text{en})_2]^{2+}$?
 (1) paramagnetism, dsp^2 , square planar, C.N. of Ni = 2
 (2) diamagnetism, dsp^2 , square planar, C.N. of Ni = 4
 (3) diamagnetism, sp^3 , tetrahedral, C.N. of Ni = 4
 (4) paramagnetism, sp^3 , tetrahedral, C.N. of Ni = 4

CC0047

- 51.** Arrange the following in order of decreasing number of unpaired electrons :
 I : $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ II : $[\text{Fe}(\text{CN})_6]^{3-}$
 III : $[\text{Fe}(\text{CN})_6]^{4-}$ IV : $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$
 (1) IV, I, II, III (2) I, II, III, IV
 (3) III, II, I, IV (4) II, III, I, IV

CC0048

- 52.** Spin magnetic moment of $[\text{MnBr}_4]^{2-}$ is 5.9 BM its geometry would be :-
 (1) Square planer (2) Tetrahedral
 (3) Square pyramidal (4) Octahedral

CC0240

- 53.** The hybridisation in $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
 (1) sp^3d^2 (2) sp^3d^3
 (3) dsp^3 (4) d^2sp^3

CC0241

- 54.** Which complex is diamagnetic ?
 (1) $[\text{MnO}_4]^-$ (2) $[\text{Co}(\text{NH}_3)_6]^{+2}$
 (3) $[\text{Fe}(\text{CN})_6]^{3-}$ (4) $[\text{Cr}(\text{H}_2\text{O})_6]^{+3}$

CC0242

CFT, COLOUR OF THE COMPLEX AND STABILITY

- 55.** Which one of these ions absorbs energy from visible spectrum :-

- (1) $[\text{Cu}(\text{NH}_3)_4]^+$ (2) $[\text{Cu}(\text{NH}_3)_4]^{+2}$
 (3) $[\text{Zn}(\text{H}_2\text{O})_6]^{+2}$ (4) $[\text{CdCl}_4]^{-2}$

CC0049

- 56.** In the complex $[\text{Ni}(\text{H}_2\text{O})_2(\text{NH}_3)_4]^{+2}$ the magnetic moment (μ) of Ni is :-

- (1) Zero (2) 2.83 BM
 (3) 1.73 BM (4) 3.87 BM

CC0050

- 57.** Which of the following system has maximum number of unpaired electrons :-

- (1) d^5 (Octahedral, low spin)
 (2) d^8 (Tetrahedral)
 (3) d^6 (Octahedral, low spin)
 (4) d^3 (Octahedral)

CC0051

- 58.** In an octahedral crystal field, the t_{2g} orbitals are

- (1) Raised in energy by $0.4 \Delta_0$
 (2) Lowered in energy by $0.4 \Delta_0$
 (3) Raised in energy by $0.6 \Delta_0$
 (4) Lowered in energy by $0.6 \Delta_0$

CC0052

- 59.** If $\Delta_0 < P$, the correct electronic configuration for d^4 system will be :-

- (1) $t_{2g}^4 e_g^0$ (2) $t_{2g}^3 e_g^1$
 (3) $t_{2g}^0 e_g^4$ (4) $t_{2g}^2 e_g^2$

CC0053

60. Match List-I (Complex ions) with List-II (Number of Unpaired Electrons) and select the correct answer using the codes given below the lists :-

List -I (Complex ions)	List II (Number of Unpaired Electrons)
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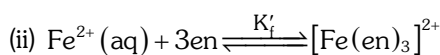
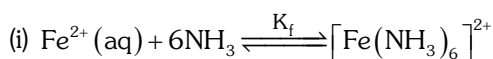
- A. $[\text{CrF}_6]^{4-}$
 B. $[\text{MnF}_6]^{4-}$
 C. $[\text{Cr}(\text{CN})_6]^{4-}$
 D. $[\text{Mn}(\text{CN})_6]^{4-}$

- i. One
 ii. Two
 iii. Three
 iv. Four
 v. Five

Code :	A	B	C	D
(1)	iv	i	ii	v
(2)	ii	v	iii	i
(3)	iv	v	ii	i
(4)	ii	i	iii	v

CC0054

61. Consider the following complex formation reactions and comment on their formation constant value



- (1) $K_f > K'_f$ (2) $K_f < K'_f$
 (3) $K_f = K'_f$ (4) can not be compared

CC0055

62. Select most stable complex :-

- (1) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ (2) $[\text{Co}(\text{NH}_3)_2(\text{en})_2]^{3+}$
 (3) $[\text{Co}(\text{en})_3]^{3+}$ (4) $[\text{Co}(\text{NH}_3)_4(\text{en})]^{3+}$

CC0056

63. Red color of gem stone ruby is due to impurities of:-

- (1) Al_2O_3 (2) Cr^{+3}
 (3) Al^{+3} ions (4) All of these

CC0059

ISOMERISM

64. A square planar complex is cis platin $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ shows :

- (1) Geometrical isomerism (2) Optical isomerism
 (3) Linkage isomerism (4) Ionisation isomerism

CC0060

65. The two compounds sulphato penta-ammine cobalt (III) bromide and penta-amminebromo cobalt (III) sulphate represent :

- (1) Linkage isomerism
 (2) Ionisation isomerism
 (3) Co-ordination isomerism
 (4) Hydrate isomerism

CC0061

66. Which of the following complex can not exhibit geometrical isomerism :-

- (1) $[\text{Pt}(\text{NH}_3)_2\text{ClNO}_2]$ (2) $[\text{Pt}(\text{gly})_2]$
 (3) $[\text{Cu}(\text{en})_2]^{+2}$ (4) $[\text{Pt}(\text{H}_2\text{O})(\text{NH}_3)\text{BrCl}]$

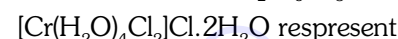
CC0062

67. Which one of the following compounds will exhibit linkage isomerism :-

- (1) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ (2) $[\text{Co}(\text{NH}_3)_3\text{NO}_2]\text{Cl}_2$
 (3) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ (4) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$

CC0063

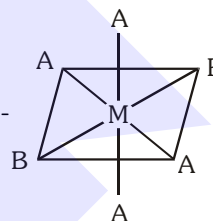
68. The compound $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and



- (1) Linkage isomerism (2) Hydrate isomerism
 (3) Ligand isomerism (4) Ionisation isomerism

CC0066

69. Compound -



can be marked as -

- (1) Cis form (2) Leavo form
 (3) Dextro form (4) Trans form

CC0067

70. A Planar Complex $[\text{Mabcd}]$ gives :-

- (1) Two Optical isomer
 (2) Two geometrical isomer
 (3) Three optical isomer
 (4) Three geometrical isomers

CC0068

71. No. of geometrical isomers expected for octahedral complex $[\text{Mabcdef}]$ is :-

- (1) Zero (2) 30 (3) 15 (4) 9

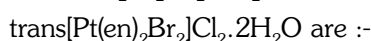
CC0069

72. Which of the following complex produce ppt with AgNO_3 and exist in two geometrical isomeric form

- (1) $\text{PtCl}_2 \cdot 4\text{NH}_3$ (2) $\text{PtCl}_2 \cdot 3\text{NH}_3$
 (3) $\text{PtCl}_4 \cdot 4\text{NH}_3$ (4) $\text{PtCl}_4 \cdot 2\text{NH}_3$

CC0070

73. $\text{Cis}[\text{Pt}(\text{en})_2\text{Br}_2]\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ and



- (1) Ionisation isomer (2) Geometrical isomer
 (3) Hydrate isomer (4) Optical isomers

CC0071

74. Which of the following octahedral complex have maximum stereoisomers :-

- (1) $[\text{Fe}(\text{CN})_6]^{4-}$ (2) $[\text{Co}(\text{en})(\text{CN})_4]^{-1}$
(3) $[\text{Co}(\text{en})_2(\text{Cl})_2]^+$ (4) $[\text{Co}(\text{en})_3]^{+3}$

CC0072

75. Which of the following complex does not show geometrical isomerism ?

- (1) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ (2) $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$
(3) $[\text{Cr}(\text{en})_3]^{3+}$ (4) $[\text{Pt}(\text{gly})_2]$

CC0073

76. Which of the following complex compounds does not exhibits geometrical isomerism ?

- (1) $[\text{PtCl}_2(\text{NH}_3)_2]$ (2) $[\text{PdCl}_2\text{BrI}]$
(3) $[\text{Pt}(\text{NH}_3)(\text{py})(\text{Cl})(\text{Br})]$ (4) $[\text{Pt}(\text{NH}_3)_3(\text{Br})]$

CC0075

77. The pair of molecules that exhibit geometrical isomerism are

- (1) $[\text{Cr}(\text{NH}_3)_4\text{Cl}_2]^+$ and $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$
(2) $[\text{Cr}(\text{NH}_3)_5\text{Cl}]^{2+}$ and $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$
(3) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ and $[\text{Co}(\text{NH}_3)_6]^{3+}$
(4) All of the above show geometric isomerism

CC0076

78. Complex $[\text{Co}(\text{NH}_3)_3(\text{NO}_2)_3]$ show which isomerism:-

- (1) Ionisation and linkage
(2) Linkage and geometrical
(3) Geometrical and ligand
(4) Coordination and linkage

CC0243

79. Which of the following represents incorrect match?

- (1) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)](\text{NO}_3)_2$: Linkage isomerism
(2) $[\text{Pt}(\text{NH}_3)(\text{H}_2\text{O})\text{Cl}_2]$: Geometrical isomerism
(3) $\text{K}[\text{Cr}(\text{H}_2\text{O})_2(\text{C}_2\text{O}_4)_2]$: Geometrical and optical
(4) $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2\text{H}_2\text{O}$: Hydrate and linkage isomerism

CC0244

80. $\text{CrCl}_3 \cdot 6\text{H}_2\text{O}$ show 3 different coloured compounds due to :-

- (1) Ionisation isomerism
(2) Coordination isomerism
(3) Optical isomerism
(4) Hydrate isomerism

CC0245

ORGANOMETALLIC COMPOUNDS

81. Which of the following is π -acid ligand

- (1) NH_3 (2) CO
(3) glycinate (4) ethylene diamine

CC0077

82. Which of the following statement is/are wrong:-

- (a) Al_4C_3 is an organometallic compound
(b) Metal carbonyls are organometallic compounds
(c) TEL is π bonded organometallic compound
(d) Frankland reagent is σ -bonded organometallic compound

The answer is:-

- (1) c and d (2) a and c
(3) a and b (4) b & d

CC0078

83. Compounds which contain direct metal carbon bonds are called :

- (1) Organic compound (2) Complex compound
(3) Metal carbides (4) OMC compounds.

CC0079

84. Which one of the following is a π bonded OMC ?

- (1) Wilkinson's catalyst (2) Tetraethyl lead
(3) Zeise's salt (4) Grignard's reagent

CC0080

85. Which of the following statement is true

- (1) FeCO_3 and Fe_3C are organometallic compounds.
(2) In ferrocene ligand is cyclopentadienyl.
(3) $\text{Pb}(\text{C}_2\text{H}_5)_4$ is π -bonded OMC
(4) In zeise salt central metal is sp^3 hybridised.

CC0081

86. Which of the following is not an organo metallic compound :-

- (1) $(\text{C}_2\text{H}_5)_2\text{Zn}$ (2) $\text{CH}_3\text{B}(\text{OCH}_3)_2$
(3) $\text{B}(\text{OCH}_3)_3$ (4) $\text{Ni}(\text{CO})_4$

CC0084

87. Number of metal-metal bonds in $[\text{Co}_2(\text{CO})_8]$ will be :-

- (1) 0 (2) 3 (3) 2 (4) 1

CC0246

APPLICATION OF COORDINATION CHEMISTRY

88. In a ferric salt on adding $K_4[Fe(CN)_6]$ a prussian blue is obtained which is :-

- (1) $K_3[Fe(CN)_6]$ (2) $Fe_3[Fe(CN)_6]_4$
(3) $FeSO_4[Fe(CN)_6]$ (4) $Fe_4[Fe(CN)_6]_3$

CC0086

89. Hypo is used in photography because it is :-

- (1) A reducing agent
(2) An oxidising agent
(3) A Complexing agent
(4) Photo sensitive Compound

CC0087

90. The solubility of AgBr in hypo solution is due to the formation of :-

- (1) Ag_2SO_3 (2) $Ag_2S_2O_3$
(3) $[Ag(S_2O_3)]^-$ (4) $[Ag(S_2O_3)_2]^{3-}$

CC0088

91. Which of the following is related to Nessler's reagent?

- (1) $PtCl_4 + KCl \rightarrow$ (2) $AgCl + NH_3 \rightarrow$
(3) $AgBr + Na_2S_2O_3 \rightarrow$ (4) $HgI_2 + KI \rightarrow$

CC0089

92. $K_4[Fe(CN)_6]$ reacts with $FeCl_3$ to form :-

- (1) $K_3[Fe(CN)_6]$ (2) $K_4[Fe(CN)_3Cl_3]$
(3) $K_3[Fe(CN)_5Cl]$ (4) $KFe[Fe(CN)_6]$

CC0090

93. A reagent used for identifying nickel ion is :-

- (1) Potassium ferrocyanide
(2) Phenolphthalein
(3) Dimethyl glyoxime
(4) EDTA

CC0091

94. Which one of the following statement is false for nickel-dimethylglyoximate complex ?

- (1) The stability of complex is only due to the presence of intra-molecular hydrogen bonding
(2) The complex is stable, only because dimethyl glyoxime ligand is a stronger ligand
(3) The complex is stable as it has five membered chelate rings as well as intra molecular hydrogen bonding
(4) (1) and (2) both

C0092

EXERCISE-I (Conceptual Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	1	4	4	2	4	3	4	1	2	2	2	4	2	4	2
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	3	3	2	1	1	1	1	3	2	2	2	3	4	2	2
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	3	1	3	4	2	1	1	2	1	1	2	3	3	1	4
Que.	46	47	48	49	50	51	52	53	54	55	56	57	58	59	60
Ans.	2	2	2	2	2	1	2	4	1	2	2	4	2	2	3
Que.	61	62	63	64	65	66	67	68	69	70	71	72	73	74	75
Ans.	2	3	2	1	2	3	2	2	4	4	3	3	2	3	3
Que.	76	77	78	79	80	81	82	83	84	85	86	87	88	89	90
Ans.	4	1	2	4	4	2	2	4	3	2	3	4	4	3	4
Que.	91	92	93	94											
Ans.	4	4	3	4											

EXERCISE-II (Previous Year Questions)

AIPMT 2006

- Copper sulphate dissolves in excess of KCN to give
 (1) $\text{Cu}(\text{CN})_2$ (2) CuCN
 (3) $[\text{Cu}(\text{CN})_4]^{3-}$ (4) $[\text{Cu}(\text{CN})_4]^{2-}$
CC0096
- $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)_2]\text{Cl}$ exhibits
 (1) linkage isomerism, geometrical isomerism and optical isomerism
 (2) linkage isomerism, ionization isomerism and optical isomerism
 (3) linkage isomerism, ionization isomerism and geometrical isomerism
 (4) ionization isomerism, geometrical isomerism and optical isomerism
CC0097

AIPMT 2007

- Which of the following will give a pair of enantiomers
 (1) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ (2) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$
 (3) $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_6]$ (4) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_2$
CC0103
- The d electron configurations 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 complexes will exhibit the minimum paramagnetic behaviour
 (1) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (2) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
 (3) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$
CC0104

AIPMT 2008

- Which of the following complexes exhibits the highest paramagnetic behaviour? Where gly = glycine, en = ethylenediamine and bpy = bipyridyl (At. No. Ti = 22, V = 23, Fe = 26, Co = 27)
 (1) $[\text{Co}(\text{OX})_2(\text{H}_2\text{O})_2]^-$ (2) $[\text{Ti}(\text{NH}_3)_6]^{3+}$
 (3) $[\text{V}(\text{gly})_2(\text{OH})_2(\text{NH}_3)_2]^+$ (4) $[\text{Fe}(\text{en})(\text{bpy})(\text{NH}_3)_2]^{2+}$
CC0105
- In which of the following coordination entities the magnitude of Δ_o (CFSE in octahedral field) will be maximum?
 (1) $[\text{Co}(\text{CN})_6]^{3-}$ (2) $[\text{Co}(\text{C}_2\text{O}_4)_3]^{3-}$
 (3) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$ (4) $[\text{Co}(\text{NH}_3)_6]^{3+}$
CC0106

AIPMT 2009

- Which of the following complex ions is expected to absorb visible light?
 (1) $[\text{Zn}(\text{NH}_3)_6]^{2+}$ (2) $[\text{Sc}(\text{H}_2\text{O})_3(\text{NH}_3)_3]^{3+}$
 (3) $[\text{Ti}(\text{en})_2(\text{NH}_3)_2]^{4+}$ (4) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
CC0107

AIPMT/NEET

- Out of TiF_6^{2-} , CoF_6^{3-} , Cu_2Cl_2 and NiCl_4^{2-} colourless species are :
 (1) CoF_6^{3-} and NiCl_4^{2-} (2) TiF_6^{2-} and CoF_6^{2-}
 (3) Cu_2Cl_2 and NiCl_4^{2-} (4) TiF_6^{2-} and Cu_2Cl_2
CC0108
- Which of the following does not show optical isomerism?
 (1) $[\text{Co}(\text{en})_3]^{3+}$ (2) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
 (3) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]^0$ (4) $[\text{Co}(\text{en})\text{Cl}_2(\text{NH}_3)_2]^+$
CC0109
- Which one of the following complexes is **not** expected to exhibit isomerism :-
 (1) $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ (2) $[\text{NiCl}_4]^{2-}$
 (3) $[\text{Ni}(\text{en})_3]^{2+}$ (4) $[\text{Ni}(\text{NH}_3)_4(\text{H}_2\text{O})_2]^{2+}$
CC0110

AIPMT 2010

- Which of the following complex ion is not expected to absorb visible light?
 (1) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ (2) $[\text{Ni}(\text{CN})_4]^{2-}$
 (3) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
CC0111
- The existence of two different coloured complexes with the composition of $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ is due to:-
 (1) Ionization isomerism
 (2) Linkage isomerism
 (3) Geometrical isomerism
 (4) Coordination isomerism
CC0112
- Crystal field stabilization energy for high spin d^4 octahedral complex is :-
 (1) $-0.6 \Delta_o$ (2) $-1.8 \Delta_o$
 (3) $-1.6 \Delta_o + P$ (4) $-1.2 \Delta_o$
CC0113

AIPMT Pre. 2011

- Of the following complex ions, which is diamagnetic in nature?
 (1) $[\text{NiCl}_4]^{2-}$ (2) $[\text{Ni}(\text{CN})_4]^{2-}$
 (3) $[\text{CuCl}_4]^{2-}$ (4) $[\text{CoF}_6]^{3-}$
CC0116
- The complex $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ and $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ are the examples of which type of isomerism?
 (1) Linkage isomerism
 (2) Ionization isomerism
 (3) Coordination isomersim
 (4) Geometrical isomerism
CC0117

16. The complex $[\text{Pt}(\text{Py})(\text{NH}_3)\text{BrCl}]$ will have how many geometrical isomers ?
 (1) 3 (2) 4 (3) 0 (4) 2

CC0118

AIPMT Mains 2011

17. Which of the following carbonyls will have the strongest C–O bond ?
 (1) $[\text{Fe}(\text{CO})_5]$ (2) $[\text{Mn}(\text{CO})_6]^+$
 (3) $[\text{Cr}(\text{CO})_6]$ (4) $[\text{V}(\text{CO})_6]^+$

CC0119

18. Which of the following complex compounds will exhibit highest paramagnetic behaviour :-
 (At. No. Ti = 22, Cr = 24, Co = 27, Zn = 30)
 (1) $[\text{Zn}(\text{NH}_3)_6]^{2+}$ (2) $[\text{Ti}(\text{NH}_3)_6]^{3+}$
 (3) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Co}(\text{NH}_3)_6]^{3+}$

CC0120

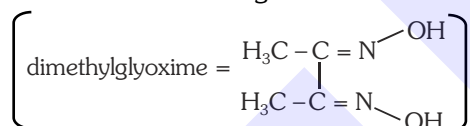
AIPMT Pre. 2012

19. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour?
 (1) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (2) $[\text{Co}(\text{NH}_3)_6]^{3+}$
 (3) $[\text{Ni}(\text{NH}_3)_6]^{2+}$ (4) $[\text{Zn}(\text{NH}_3)_6]^{2+}$

CC0123

AIPMT Mains 2012

20. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal Ni(II). Which of the following statements is not true ?



- (1) Red complex has a tetrahedral geometry.
 (2) Dimethylglyoxime functions as bidentate ligand.
 (3) Red complex has a square planar geometry.
 (4) Complex has symmetrical H-bonding.

CC0124

21. Low spin complex of d^6 -cation in an octahedral field will have the following energy :-
 (Δ_0 = Crystal field splitting energy in an octahedral field, P = Electron pairing energy)

- (1) $\frac{-2}{5} \Delta_0 + 2P$ (2) $\frac{-2}{5} \Delta_0 + P$
 (3) $\frac{-12}{5} \Delta_0 + P$ (4) $\frac{-12}{5} \Delta_0 + 3P$

CC0125

NEET-UG 2013

22. A magnetic moment of 1.73 BM will be shown by one among the following :-
 (1) $[\text{CoCl}_6]^{4-}$ (2) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
 (3) $[\text{Ni}(\text{CN})_4]^{2-}$ (4) TiCl_4

CC0126

AIPMT 2014

23. Which of the following complexes is used to be as an anticancer agent?
 (1) $\text{mer-}[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ (2) $\text{cis-}[\text{PtCl}_2(\text{NH}_3)_2]$
 (3) $\text{cis-}[\text{K}_2[\text{PtCl}_2\text{Br}_2]]$ (4) Na_2CoCl_4

CC0127

AIPMT 2015

24. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not give test of chloride ions with silver nitrate at 25°C?
 (1) $\text{CoCl}_3 \cdot 4\text{NH}_3$ (2) $\text{CoCl}_3 \cdot 5\text{NH}_3$
 (3) $\text{CoCl}_3 \cdot 6\text{NH}_3$ (4) $\text{CoCl}_3 \cdot 3\text{NH}_3$

CC0130

25. Which of these statements about $[\text{Co}(\text{CN})_6]^{3-}$ is true:-
 (1) $[\text{Co}(\text{CN})_6]^{3-}$ has four unpaired electrons and will be in a low-spin configuration.
 (2) $[\text{Co}(\text{CN})_6]^{3-}$ has four unpaired electrons and will be in a high spin configuration.
 (3) $[\text{Co}(\text{CN})_6]^{3-}$ has no unpaired electrons and will be in a high-spin configuration.
 (4) $[\text{Co}(\text{CN})_6]^{3-}$ has no unpaired electrons and will be in a low-spin configuration.

CC0131

Re-AIPMT 2015

26. The name of complex ion, $[\text{Fe}(\text{CN})_6]^{3-}$ is :-
 (1) Tricyanoferrate (III) ion
 (2) Hexacyanidoferrate (III) ion
 (3) Hexacyanoiron (III) ion
 (4) Hexacyanito ferrate (III) ion

CC0132

27. The hybridization involved in complex $[\text{Ni}(\text{CN})_4]^{2-}$ is (At.No. Ni = 28)
 (1) d^2sp^2 (2) d^2sp^3 (3) dsp^2 (4) sp^3

CC0133

28. The sum of coordination number and oxidation number of the metal M in the complex $[\text{M}(\text{en})_2(\text{C}_2\text{O}_4)]\text{Cl}$ (where en is ethylenediamine) is:-
 (1) 7 (2) 8 (3) 9 (4) 6

CC0134

29. Number of possible isomers for the complex $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ will be : (en = ethylenediamine)
 (1) 3 (2) 4 (3) 2 (4) 1

CC0135

NEET-I 2016

30. Which of the following has longest C–O bond length? (Free C–O bond length in CO is 1.128 Å).
 (1) $\text{Ni}(\text{CO})_4$ (2) $[\text{Co}(\text{CO})_4]^\ominus$
 (3) $[\text{Fe}(\text{CO})_4]^{2-}$ (4) $[\text{Mn}(\text{CO})_6]^+$

CC0138

NEET-II 2016

- 31.** The correct increasing order of trans-effect of the following species is :
 (1) $\text{Br}^- > \text{CN}^- > \text{NH}_3 > \text{C}_6\text{H}_5^-$
 (2) $\text{CN}^- > \text{Br}^- > \text{C}_6\text{H}_5^- > \text{NH}_3$
 (3) $\text{NH}_3 > \text{CN}^- > \text{Br}^- > \text{C}_6\text{H}_5^-$
 (4) $\text{CN}^- > \text{C}_6\text{H}_5^- > \text{Br}^- > \text{NH}_3$
CC0139
- 32.** Jahn-Teller effect **not** observed in high spin complexes of :-
 (1) d^4 (2) d^9 (3) d^7 (4) d^8
CC0140

NEET(UG) 2017

- 33.** An example of a sigma bonded organometallic compound is :
 (1) Grignard's reagent (2) Ferrocene
 (3) Cobaltocene (4) Ruthenocene
CC0147
- 34.** Pick out the correct statement with respect to $[\text{Mn}(\text{CN})_6]^{3-}$:-
 (1) It is sp^3d^2 hybridised and tetrahedral
 (2) It is d^2sp^3 hybridised and octahedral
 (3) It is dsp^2 hybridised and square planar
 (4) It is sp^3d^2 hybridised and octahedral
CC0148
- 35.** Correct increasing order for the wavelengths of absorption in the visible region the complexes of Co^{3+} is :-
 (1) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$
 (2) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{en})_3]^{3+}$
 (3) $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
 (4) $[\text{Co}(\text{en})_3]^{3+}$, $[\text{Co}(\text{NH}_3)_6]^{3+}$, $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
CC0149

NEET(UG) 2018

- 36.** The type of isomerism shown by the complex $[\text{CoCl}_2(\text{en})_2]$ is
 (1) Geometrical isomerism
 (2) Coordination isomerism
 (3) Ionization isomerism
 (4) Linkage isomerism
CC0151

- 37.** The geometry and magnetic behaviour of the complex $[\text{Ni}(\text{CO})_4]$ are
 (1) square planar geometry and diamagnetic
 (2) tetrahedral geometry and diamagnetic
 (3) square planar geometry and paramagnetic
 (4) tetrahedral geometry and paramagnetic
CC0152

- 38.** Iron carbonyl, $\text{Fe}(\text{CO})_5$ is
 (1) tetranuclear (2) mononuclear
 (3) trinuclear (4) dinuclear
CC0153

NEET(UG) 2019

- 39.** What is the **correct** electronic configuration of the central atom in $\text{K}_4[\text{Fe}(\text{CN})_6]$ based on crystal field theory ?
 (1) $t_{2g}^4 e_g^2$ (2) $t_{2g}^6 e_g^0$ (3) $e^3 t_2^3$ (4) $e^4 t_2^2$
CC0247

NEET(UG) 2019 (ODISHA)

- 40.** The Crystal Field Stabilisation Energy (CFSE) for $[\text{CoCl}_6]^{4-}$ is 18000 cm^{-1} . The CFSE for $[\text{CoCl}_4]^{2-}$ will be-
 (1) 6000 cm^{-1} (2) 16000 cm^{-1}
 (3) 18000 cm^{-1} (4) 8000 cm^{-1}
CC0248

NEET(UG) 2020

- 41.** Which of the following is the correct order of increasing field strength of ligands to form coordination compounds ?
 (1) $\text{CN}^- < \text{C}_2\text{O}_4^{2-} < \text{SCN}^- < \text{F}^-$
 (2) $\text{SCN}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$
 (3) $\text{SCN}^- < \text{F}^- < \text{CN}^- < \text{C}_2\text{O}_4^{2-}$
 (4) $\text{F}^- < \text{SCN}^- < \text{C}_2\text{O}_4^{2-} < \text{CN}^-$
CC0260
- 42.** Urea reacts with water to form A which will decompose to form B. B when passed through Cu^{2+} (aq), deep blue colour solution C is formed. What is the formula of C from the following ?
 (1) $\text{CuCO}_3 \cdot \text{Cu}(\text{OH})_2$ (2) CuSO_4
 (3) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ (4) $\text{Cu}(\text{OH})_2$
CC0261

NEET(UG) 2021

43. Ethylene diaminetetraacetate (EDTA) ion is:
- (1) Hexadentate ligand with four "O" and two "N" donor atoms
 - (2) Unidentate ligand
 - (3) Bidentate ligand with two "N" donor atoms
 - (4) Tridentate ligand with three "N" donor atoms

CC0262

44. Match List-I with List-II

List-I		List-II	
(a)	$[\text{Fe}(\text{CN})_6]^{3-}$	(i)	5.92 BM
(b)	$[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$	(ii)	0 BM
(c)	$[\text{Fe}(\text{CN})_6]^{4-}$	(iii)	4.90 BM
(d)	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	(iv)	1.73 BM

Choose the **correct** answer from the options given below

- (1) (a)-(iv), (b)-(ii), (c)-(i), (d)-(iii)
- (2) (a)-(ii), (b)-(iv), (c)-(iii), (d)-(i)
- (3) (a)-(i), (b)-(iii), (c)-(iv), (d)-(ii)
- (4) (a)-(iv), (b)-(i), (c)-(ii), (d)-(iii)

CC0263

NEET (UG) 2022

45. The IUPAC name of the complex -

$[\text{Ag}(\text{H}_2\text{O})_2][\text{Ag}(\text{CN})_2]$ is:

- (1) diaquasilver(II) dicyanidoargentate(II)
- (2) dicyanidosilver(I) diaquaargentate(I)
- (3) diaquasilver(I) dicyanidoargentate(I)
- (4) dicyanidosilver(II) diaquaargentate(II)

CC0264

46. The order of energy absorbed which is responsible for the color of complexes

- (A) $[\text{Ni}(\text{H}_2\text{O})_2(\text{en})_2]^{2+}$
- (B) $[\text{Ni}(\text{H}_2\text{O})_4(\text{en})]^{2+}$ and
- (C) $[\text{Ni}(\text{en})_3]^{2+}$

- (1) (C)>(B)>(A) (2) (C)>(A)>(B)
- (3) (B)>(A)>(C) (4) (A)>(B)>(C)

CC0265

NEET (UG) 2022 (Overseas)

47. The number of bridging carbonyl groups in $[\text{Co}_2(\text{CO})_8]$ and $[\text{Mn}_2(\text{CO})_{10}]$, respectively are
- (1) 2 and 2
 - (2) 2 and 4
 - (3) 0 and 2
 - (4) 2 and 0

CC0266

48. Which one of the following is the correct order of spin-only magnetic moment for the given complexes?

- (1) $[\text{Fe}(\text{CN})_6]^{3-} > [\text{Co}(\text{H}_2\text{O})_6]^{2+} > [\text{MnCl}_6]^{3-}$
- (2) $[\text{MnCl}_6]^{3-} > [\text{Fe}(\text{CN})_6]^{3-} > [\text{Co}(\text{H}_2\text{O})_6]^{2+}$
- (3) $[\text{MnCl}_6]^{3-} > [\text{Co}(\text{H}_2\text{O})_6]^{2+} > [\text{Fe}(\text{CN})_6]^{3-}$
- (4) $[\text{Co}(\text{H}_2\text{O})_6]^{2+} > [\text{MnCl}_6]^{3-} > [\text{Fe}(\text{CN})_6]^{3-}$

CC0267

Re-NEET (UG) 2022

49. Match List-I with List-II :

List-I (Complexes)	List-II (Types)
(a) $[\text{Co}(\text{NH}_3)_5\text{NO}_2]\text{Cl}_2$ and $[\text{Co}(\text{NH}_3)_5\text{ONO}]\text{Cl}_2$	(i) ionisation isomerism
(b) $[\text{Cr}(\text{NH}_3)_6] [\text{Co}(\text{CN})_6]$ and $[\text{Cr}(\text{CN})_6] [\text{Co}(\text{NH}_3)_6]$	(ii) coordination isomerism
(c) $[\text{Co}(\text{NH}_3)_5(\text{SO}_4)]\text{Br}$ and $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$	(iii) linkage isomerism
(d) $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and $[\text{Cr}(\text{H}_2\text{O})_5\text{Cl}]\text{Cl}_2 \cdot \text{H}_2\text{O}$	(iv) solvate isomerism

Choose the **correct answer** from the options given below :

- (1) (a)-(iii), (b)-(i), (c)-(ii), (d)-(iv)
- (2) (a)-(ii), (b)-(iii), (c)-(iv), (d)-(i)
- (3) (a)-(iii), (b)-(ii), (c)-(i), (d)-(iv)
- (4) (a)-(iv), (b)-(iii), (c)-(ii), (d)-(i)

CC0268

50. Given below are two statements : one is labelled as Assertion (A) and the other is labelled as Reason (R).

Assertion (A) :

The metal carbon bond in metal carbonyls possesses both σ and π character.

Reason (R) :

The ligand to metal bond is a π bond and metal to ligand bond is a σ bond.

In the light of the above statements, choose the most appropriate answer from the options given below :

- (1) Both (A) and (R) are correct and (R) is the correct explanation of (A)
- (2) Both (A) and (R) are correct but (R) is not the correct explanation of (A)
- (3) (A) is correct but (R) is not correct.
- (4) (A) is not correct but (R) is correct.

CC0269

EXERCISE-II (Previous Year Questions)

ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	3	2	2	2	1	4	4	3	2	2	3	1	2	3
Que.	16	17	18	19	20	21	22	23	24	25	26	27	28	29	30
Ans.	1	2	3	3	1	4	2	2	4	4	2	3	3	1	3
Que.	31	32	33	34	35	36	37	38	39	40	41	42	43	44	45
Ans.	4	4	1	2	4	1	2	2	2	4	2	3	1	4	3
Que.	46	47	48	49	50										
Ans.	2	4	3	3	3										

EXERCISE-III (Analytical Questions)

Master Your Understanding

1. A complex compound of cobalt has molecular formula containing five NH_3 molecules, one nitro group and two chlorine atom for one cobalt atom. One mole of this compound produces three moles of ion in aqueous solution. On reaction with excess of AgNO_3 solution two moles of AgCl get precipitated. The Ionic formula of the compound is:-

- (1) $[\text{Co}(\text{NH}_3)_4 \text{NO}_2 \text{Cl}] \text{NH}_3 \text{Cl}$
 (2) $[\text{Co}(\text{NH}_3)_5 \text{Cl}] \text{ClNO}_2$
 (3) $[\text{Co}(\text{NH}_3)_5 \text{NO}_2] \text{Cl}_2$
 (4) $[\text{Co}(\text{NH}_3)_5 (\text{NO}_2) \text{Cl}] \text{Cl}$

CC0161

2. Which of the following react with AgCl ?

- (1) KCN (2) NH_4OH
 (3) $\text{Na}_2\text{S}_2\text{O}_3$ (4) All

CC0162

3. Which one of the following shows maximum paramagnetic character ?

- (1) $[\text{Fe}(\text{CN})_6]^{3-}$ (2) $[\text{Fe}(\text{CN})_6]^{4-}$
 (3) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ (4) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$

CC0163

4. Which statement is incorrect :-

- (1) $\text{Ni}(\text{CO})_4$ - Tetrahedral, paramagnetic
 (2) $[\text{Ni}(\text{CN})_4]^{2-}$ - Square planar, diamagnetic
 (3) $\text{Ni}(\text{CO})_4$ - Tetrahedral, diamagnetic
 (4) $[\text{NiCl}_4]^{2-}$ - Tetrahedral, paramagnetic

CC0164

5. Considering H_2O as a weak field ligand, the number of unpaired electrons in $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ will be (At. no. of Mn = 25) :-

- (1) Four (2) Three (3) Five (4) Two

CC0166

6. Which of the following coordination compounds would exhibit optical isomerism ?

- (1) tris(ethylenediamine) cobalt (III) bromide
 (2) pentaamminenitrocobalt (III) iodide
 (3) diamminedichloroplatinum (II)
 (4) trans-dicyanobis (ethylenediamine) chromium (III) chloride

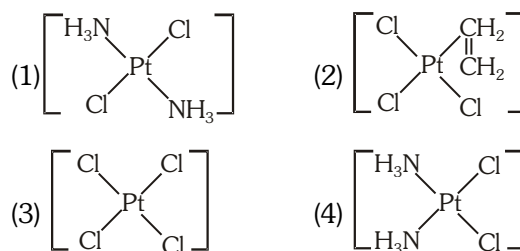
CC0167

7. Among $[\text{Ni}(\text{CO})_4]$, $[\text{Ni}(\text{CN})_4]^{2-}$, $[\text{NiCl}_4]^{2-}$ species, the hybridization states at the Ni atom are, respectively (At. no. of Ni = 28):-

- (1) dsp^2 , sp^3 , sp^3 (2) sp^3 , dsp^2 , dsp^2
 (3) sp^3 , dsp^2 , sp^3 (4) sp^3 , sp^3 , dsp^2

CC0168

8. Which of the following is considered to be an anticancer species ?



CC0169

9. Which of the following does not have a metal-carbon bond ?

- (1) $\text{Ni}(\text{CO})_4$ (2) $\text{Al}(\text{OC}_2\text{H}_5)_3$
 (3) $\text{C}_2\text{H}_5\text{MgBr}$ (4) $\text{K}[\text{Pt}(\text{C}_2\text{H}_4)\text{Cl}_3]$

CC0170

10. The correct order for the wavelength of absorption in the visible region is :

- (1) $[\text{Ni}(\text{NO}_2)_6]^{4-} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
 (2) $[\text{Ni}(\text{NO}_2)_6]^{4-} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NH}_3)_6]^{2+}$
 (3) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$
 (4) $[\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$

CC0172

11. The IUPAC name of the coordination compound $\text{K}_3[\text{Fe}(\text{CN})_6]$ is

- (1) potassium hexacyanoferrate (II)
 (2) potassium hexacyanoferrate (III)
 (3) potassium hexacyanoiron (II)
 (4) tripotassium hexacyanoiron (II)

CC0173

12. Which one of the following complexes would exhibit the lowest value of spin magnetic moment ?

- (1) $[\text{Cr}(\text{CN})_6]^{3-}$ (2) $[\text{Mn}(\text{CN})_6]^{3-}$
 (3) $[\text{Fe}(\text{CN})_6]^{3-}$ (4) $[\text{Co}(\text{CN})_6]^{3-}$

CC0174

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

- (1) s, p_x , p_y , d_{yz} (2) s, p_x , p_y , $d_{x^2-y^2}$
 (3) s, p_x , p_y , d_{z^2} (4) s, p_x , p_y , d_{xy}

CC0176

14. The most stable complex among the following is

- (1) $\text{K}_3[\text{Al}(\text{C}_2\text{O}_4)_3]$ (2) $[\text{Pt}(\text{en})_2]\text{Cl}_2$
 (3) $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$ (4) $\text{K}_2[\text{Ni}(\text{EDTA})]$

CC0177

15. Nickel ($Z=28$) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electron (s) in the nickel and geometry of this complex ion are, respectively.
 (1) one, square planar (2) two, square planar
 (3) one, tetrahedral (4) two, tetrahedral
CC0179
16. In $Fe(CO)_5$, the $Fe-C$ bond possesses
 (1) ionic character (2) σ - character only
 (3) π -character only (4) both σ & π character
CC0180
17. How many EDTA (ethylenediaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion?
 (1) One (2) Two (3) Six (4) Three
CC0181
18. The "spin-only" magnetic moment [in units of Bohr magneton, (μ_B)] of Ni^{2+} in aqueous solution would be (At. No. Ni= 28)
 (1) 0 (2) 1.73 (3) 2.84 (4) 4.90
CC0182
19. The coordination number of Ni^{+2} is = 4
 $NiCl_2 + KCN$ (Complex) \rightarrow A (Complex)
 $A + \text{Conc. HCl}$ (Maximum) \rightarrow B (Chloro complex)
 The IUPAC name of A and B are
 (1) potassium tetracyanonickelate(II), potassium tetrachloronickelate(II),
 (2) tetracyanopotassiumnickelate(II), tetrachloropotassiumnickelate (II),
 (3) tetracyanonickel (II), tetrachloronickel (II)
 (4) potassiumtetracyanonickel (II), potassiumtetrachloronickel (II).
CC0183
20. Which one of the following is tridentate ligand
 (1) NO_2^- (2) oxalate ion
 (3) glycinate ion (4) dien
CC0184
21. Both Co^{3+} and Pt^{4+} have a coordination number of six. Which of the following pairs of complexes will show approximately the same electrical conductance for their aqueous solutions
 (1) $CoCl_3 \cdot 4NH_3$ and $PtCl_4 \cdot 4NH_3$
 (2) $CoCl_3 \cdot 3NH_3$ and $PtCl_4 \cdot 5NH_3$
 (3) $CoCl_3 \cdot 6NH_3$ and $PtCl_4 \cdot 5NH_3$
 (4) $CoCl_3 \cdot 6NH_3$ and $PtCl_4 \cdot 3NH_3$
CC0185
22. Which of the following has a square planar geometry
 (1) $[PtCl_4]^{2-}$ (2) $[CoCl_4]^{2-}$
 (3) $[FeCl_4]^{2-}$ (4) $[NiCl_4]^{2-}$
CC0186
23. Hybridisation of Cr in $[Cr(NH_3)_6]^{+3}$ is
 (1) dsp^2 (2) dsp^3 (3) d^2sp^3 (4) sp^3d^2
CC0187
24. Hybridisation and shape of central metal atom of Wilkinson's catalyst is :-
 (1) dsp^2 , Square planar
 (2) sp^3 , Tetrahedral
 (3) sp^3d , Trigonal bipyramidal
 (4) sp^3d^2 , Octahedral
CC0188
25. Which of the following is not an organo metallic compound :-
 (1) $(C_2H_5)_2Zn$ (2) $CH_3B(OCH_3)_2$
 (3) $B(OCH_3)_3$ (4) $Ni(CO)_4$
CC0189
26. Among the ligands NH_3 , en, CN^- and CO the correct order of their increasing field strength, is:-
 (1) $CO < NH_3 < en < CN^-$
 (2) $NH_3 < en < CN^- < CO$
 (3) $CN^- < NH_3 < CO < en$
 (4) $en < CN^- < NH_3 < CO$
CC0191
27. Which one of the following complex ions has geometrical isomers?
 (1) $[Co(en)_3]^{3+}$ (2) $[Ni(NH_3)_5Br]^+$
 (3) $[Co(NH_3)_2(en)_2]^{3+}$ (4) $[Cr(NH_3)_4(en)]^{3+}$
CC0192
28. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide?
 (1) $[Cr(en)Br_2]Br$ (2) $[Cr(en)_3]Br_3$
 (3) $[Cr(en)_2Br_2]Br$ (4) $[Cr(en)Br_4]^-$
CC0193
29. The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1 , L_2 , L_3 and L_4 absorb wavelength in the region of red, green, yellow and blue, respectively. The increasing order of ligand strength of the four ligands is :
 (1) $L_3 < L_2 < L_4 < L_1$ (2) $L_1 < L_2 < L_4 < L_3$
 (3) $L_4 < L_3 < L_2 < L_1$ (4) $L_1 < L_3 < L_2 < L_4$
CC0194

30. Which of the following statements is/are correct?
- (1) $[\text{Ag}(\text{NH}_3)_2]^+$ is linear with sp hybridised Ag^+ ion.
 - (2) NiCl_4^{2-} has tetrahedral geometry.
 - (3) $[\text{Cu}(\text{NH}_3)_4]^{2+}$, $[\text{Pt}(\text{NH}_3)_4]^{2+}$ and $[\text{Ni}(\text{CN})_4]^{2-}$ have dsp^2 hybridisation of the metal ions.
 - (4) All the above

CC0195

31. Which of the following statements is not true about the complex ion $[\text{Pt}(\text{en})_2\text{Cl}_2]^{2+}$?
- (1) It has two geometrical isomers – cis and trans
 - (2) Both the cis and trans isomers display optical activity.
 - (3) Only the cis isomer displays optical activity.
 - (4) Only the cis isomer has non-superimposable mirror image.

CC0196

32. $[\text{Pt}(\text{NH}_3)(\text{NH}_2\text{OH})(\text{NO}_2)(\text{py})]^+$ will form how many optical isomers?
- (1) Zero
 - (2) 3
 - (3) 4
 - (4) 5

CC0198

33. All the metal ions contains $t_{2g}^6 e_g^0$ configurations. Which of the following complex will be paramagnetic?
- (1) $[\text{FeCl}(\text{CN})_4(\text{O}_2)]^{4-}$
 - (2) $\text{K}_4[\text{Fe}(\text{CN})_6]$
 - (3) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_3$
 - (4) $[\text{Fe}(\text{CN})_5(\text{O}_2)]^{5-}$

CC0200

34. Read the following statements :
- Geometrical isomerism is not observed in square planar complexes whereas optical isomerism may be observed.
 - Square planar complexes of the type Ma_2b_2 exhibit optical isomerism and two geometrical isomers.
 - Square planar complex of the type Mabcd , shows three isomers - two cis and one trans.
 - In $\text{fac-Co}[(\text{NH}_3)_3(\text{NO}_2)_3]$ the three identical ligands are present on the triangular face of the octahedral.

The option having incorrect statements is :

- (1) I, III & IV
- (2) I & II
- (3) II only
- (4) I, II, III & IV

CC0249

35. Choose the correct statement

- (1) The Complex ion does have plane of symmetry is always optically active.
- (2) In a coordination entity of the type $[\text{PtCl}_2(\text{en})_2]^{+2}$, only cis isomer shows optical activity
- (3) $\text{Cis}-(\text{CrCl}_2(\text{OX})_2)]^{-3}$ is optically inactive whereas $\text{trans} [\text{CrCl}_2(\text{OX})_2]$ is optically active.
- (4) Optical isomerism is shown by square planar complexes.

CC0250

36. Choose the correct set representing the given statements as true (T) or false (F).

- Coordination isomerism arises from the interchange of ligands between cationic and anionic entities present in a complex.
- Thiocyanate ligand is an ambidentate ligand.
- Ionisation isomerism arises when the counter ion in a complex salt is itself a potential ligand and can displace a ligand which can then becomes the counter ion.
- $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ do not exhibit coordination isomerism

- (1) FTTT
- (2) TTTT
- (3) TTTF
- (4) FTFT

CC0252

37. Select the incorrect statement

- (1) Coordination number and oxidation state of a metal means the same thing in a complex.
- (2) $[\text{Co}(\text{NH}_3)_6]^{+3}$, is a diamagnetic octahedral complex and an inner orbital complex.
- (3) $[\text{CoF}_6]^{-3}$ is called an outer orbital complex as it uses 4d orbitals in hybridisation.
- (4) $[\text{NiCl}_4]^{-2}$ & $[\text{Ni}(\text{CO})_4]$ both complexes are tetrahedral.

CC0253

38. Identify the incorrect one

- (1) The magnetic behaviour of metal ions having upto three electrons in the d orbitals in their coordination entities is independent on the nature of ligand.
- (2) Complex ions having d^4 , d^5 , d^6 & d^7 configuration with presence of SFL are low spin complexes.
- (3) Magnetic moment of coordination compounds is independent on nature of ligands.
- (4) $[\text{Mn}(\text{CN})_6]^{-3}$ has magnetic moment of two unpaired electrons whereas $[\text{MnCl}_6]^{-3}$ has four unpaired electrons.

CC0254

- 39.** Among the following statements the incorrect one
- (1) The crystal field theory is an electrostatic model which considers the metal ligand bond to be ionic.
 - (2) The five d-orbitals of an isolated gaseous metal atom/ion have same energy.
 - (3) The degeneracy of d-orbitals is lost if a spherically symmetrical field of negative charges surrounds the metal atom/ion.
 - (4) The pattern of splitting of d-orbitals depends upon the nature of the crystal field.

CC0255

- 40.** Incorrect statement among the following is :
- (1) If $\Delta_0 < P$ the fourth electron enters one of e_g orbitals giving the configuration $t_{2g}^3 e_g^1$.
 - (2) If $\Delta_0 > P$ the fourth electron enters one of t_{2g} orbitals giving the configuration $t_{2g}^4 e_g^0$.
 - (3) If $\Delta_0 > P$ then e^- configuration of metal ion d^6 will be represented as $t_{2g}^4 e_g^2$.
 - (4) All of the above

CC0256

- 41.** If the complex ion $[\text{Co}(\text{NH}_3)_5(\text{H}_2\text{O})]^{+3}$ absorbs blue-green radiation; then the colour of the radiation absorbed by $[\text{Co}(\text{NH}_3)_5(\text{Cl})]^{+2}$ will be :-
- (1) Blue
 - (2) Yellow
 - (3) Violet
 - (4) Indigo

CC0257

- 42.** Pick the set correctly representing the given statements as true (T) or false (F).

- On heating the violet colour of $[\text{Ti}(\text{H}_2\text{O})_6]\text{Cl}_3$ is disappeared.
- Red colour of ruby is due to incorporation of octahedral chromium (III) complexes into the alumina lattice.
- In emerald, Co^{+3} ions occupy octahedral sites in the mineral beryl ($\text{Be}_3\text{Al}_2\text{Si}_6\text{O}_{18}$)
- On substitution of water in $[\text{Ni}(\text{H}_2\text{O})_6]^{+2}$ by ethylenediammine (en) then spin magnetic moment is decreased.

- (1) TTFF
- (2) FTTF
- (3) TTTF
- (4) TFFT

CC0259
EXERCISE-III (Analytical Questions)
ANSWER KEY

Que.	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15
Ans.	3	4	3	1	3	1	3	4	2	1	2	4	2	4	4
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Ans.	4	1	3	1	4	3	1	3	1	3	2	3	3	4	4
Que.	31	32	33	34	35	36	37	38	39	40	41	42			
Ans.	2	1	1	2	2	3	1	3	3	3	2	1			