

BASIC EXERCISE

COORDINATION COMPOUNDS AND TERMINOLOGY

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

Ans. (1)

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

Ans. (4)

3. Select bidentate or didentate ligand from the following .

- (1) CO (2) SCN^- (3) CH_3COO^- (4) $\text{C}_2\text{O}_4^{2-}$

Ans. (4)

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

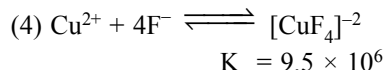
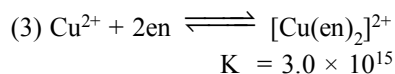
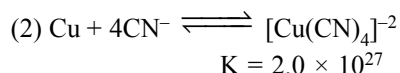
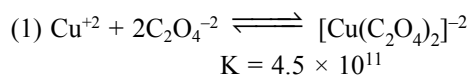
Ans. (2)

5. The CN and ON of X in the compound $[\text{X}(\text{SO}_4)(\text{NH}_3)_5]$ will be :-

- (1) 10 and 3 (2) 1 and 6 (3) 6 and 4 (4) 6 and 2

Ans. (4)

6. From the stability constant K (Hypothetical values) given below, predict which is strongest ligand:-



Ans. (2)

7. 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

Ans. (3)

8. The oxidation state of iron in $\text{Na}_4[\text{Fe}(\text{CN})_5(\text{NOS})]$ is

- (1) +1 (2) +2 (3) +3 (4) zero

Ans. (2)

9. Incorrect statement about DMG :-

- (1) It is tetradenate ligand (2) Chelating ligand
 (3) Dioxime of diacetyl (4) In gravimetric determination of Ni is used

Ans. (1)

IUPAC-NOMENCLATURE

10. Which of the following is cationic complex

- (1) Tetracarbonyl nickel (0) (2) Hexachloroplatinate (III) ion
(3) Hexaquaairon (III) ion (4) Tetraiodomercurate (II) ion

Ans. (3)

11. $K_3[Fe(CN)_6]$ is :-

- (a) Potassium hexacyano ferrate (II) (b) Potassium hexacyano ferrate (III)
(c) Potassium ferri-cyanide (d) Hexa cyano 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)

Ans. (2)

12. Give the IUPAC name of the complex compound $[Co(NH_3)_4(H_2O)Br](NO_3)_2$.

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

Ans. (4)

13. 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

Ans. (2)

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

- (1) $[Co(NO_2)_2(en)_2Cl_2]^+$ (2) $[CoCl(NO_2)_2(en)_2]^+$
(3) $[Co(NO_2)Cl(en)_2]^+$ (4) $[Co(en)Cl_2(NO_2)_2]^-$

Ans. (3)

15. Which of the following statement is incorrect about $[Fe(H_2O)_5NO]SO_4$:-

- (1) It gives brown ring test for nitrates (2) Oxidation state of Fe is +1
(3) It exhibits geometrical isomerism (4) Charge on NO is +1

Ans. (3)

16. The correct IUPAC name of the complex $Fe(C_5H_5)_2$ is

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

Ans. (2)

17. The correct name of $[Pt(NH_3)_4Cl_2][PtCl_4]$ 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)

Ans. (1)

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

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

Ans. (1)

19. 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)

Ans. (1)

20. 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

Ans. (1)

21. IUPAC name of $\text{K}_2[\text{OsCl}_5\text{N}]$ will be
 (1) Potassium pentachloroazido osmate (VIII)
 (2) Potassium pentachloroazido osmate (VI)
 (3) Potassium pentachloro nitrido osmate (VI)
 (4) Potassium nitro osmate (III)

Ans. (3)

WERNER'S THEORY & EAN

22. Which of the following has least conductivity in aqueous solution.
 (1) $\text{Co}(\text{NH}_3)_4\text{Cl}_3$ (2) $\text{Co}(\text{NH}_3)_3\text{Cl}_3$ (3) $\text{Co}(\text{NH}_3)_5\text{Cl}_3$ (4) $\text{Co}(\text{NH}_3)_6\text{Cl}_3$

Ans. (3)

23. 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

Ans. (2)

24. 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

Ans. (2)

25. 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

Ans. (3)

26. 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) $\text{PtCl}_4 \cdot 3\text{NH}_3$

Ans. (4)

27. In the metal carbonyls of general formula $\text{M}(\text{CO})_x$ (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

Ans. (2)

28. A compound has the empirical formula $\text{CoCl}_3 \cdot 5\text{NH}_3$. 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) $[\text{Co}(\text{NH}_3)_5\text{Cl}_2]\text{Cl}$ (2) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (3) $[\text{Co}(\text{NH}_3)_5\text{Cl}_3]$ (4) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl} \cdot \text{NH}_3$

Ans. (2)

29. Which of the following pair the EAN of central metal atom is not same ?
 (1) $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{Fe}(\text{NH}_3)_6]^{3+}$ (2) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ and $[\text{Cr}(\text{CN})_6]^{3-}$
 (3) $[\text{FeF}_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{3-}$ (4) $[\text{Ni}(\text{CO})_4]$ and $[\text{Ni}(\text{CN})_4]^{2-}$

Ans. (4)

HYBRIDISATION, COLOUR, MAGNETIC AND OTHER PROPERTIES

30. 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

Ans. (3)

31. The shape of the complex $[\text{Ag}(\text{NH}_3)_2]^+$ is :
 (1) Octahedral (2) Square planar (3) Tetrahedral (4) Linear

Ans. (4)

32. Hexafluoroferrate (III) ion is an outer orbital complex. The number of unpaired electrons are
 (1) 1 (2) 5 (3) 4 (4) Unpredictable

Ans. (2)

33. The shape of $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ is :
 (1) Square planar (2) Pyramidal (3) Octahedral (4) Tetrahedral

Ans. (1)

34. Among the following ions, which one has the highest paramagnetism ?
 (1) $[\text{FeF}_6]^{3-}$ (2) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (3) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$

Ans. (1)

35. In the complex ion ML_6^{n+} , M^{n+} has five d-electrons and L is weak field ligand. According to crystal field theory, the magnetic properties of the complex ion correspond to how many unpaired electrons
 (1) 0 (2) 5 (3) 2 (4) 3

Ans. (2)

36. 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) $[\text{Co}(\text{H}_2\text{O})_6]^{+3}$

Ans. (2)

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

Ans. (1)

38. The magnetic property and the shape of $[\text{Cr}(\text{NH}_3)_6]^{3+}$ complex ions are :
 (1) Paramagnetic, Octahedral (2) Diamagnetic, square planer
 (3) Paramagnetic, tetrahedral (4) None of the above

Ans. (1)

39. Amongst the following ions which one has the highest paramagnetism
 (1) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (2) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ (3) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Zn}(\text{H}_2\text{O})_6]^{2+}$

Ans. (2)

40. Which of the following complexes is an inner orbital complex ?
 (1) $[\text{CoF}_6]^{3-}$ (2) $[\text{FeF}_6]^{3-}$ (3) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

Ans. (3)

41. 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

Ans. (2)

42. 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)
Ans. (4)
43. The wrong statement is :-
 (1) Halide ligands forms high spin complex
 (2) Strong ligands form low spin complex
 (3) $[\text{FeF}_6]^{3-}$ is inner orbital complex
 (4) $[\text{NiCl}_4]^{2-}$ is outer orbital complex
Ans. (3)
44. What is Incorrect for $\text{K}_4[\text{Fe}(\text{CN})_6]$
 (1) O.N of Iron is +2 (2) It exhibit diamagnetic character
 (3) It exhibit paramagnetic character (4) It involved d^2sp^3 hybridisation
Ans. (3)
45. In which of the following molecules, central atom used orbitals of different quantum number in the hybridisation :-
 (1) $[\text{Fe}(\text{CO})_5]$ (2) IF_7 (3) $\text{Ni}(\text{CO})_4$ (4) XeO_4
Ans. (1)
46. What are the geometric shape and the oxidation number of the copper atom, respectively, for the complex ion, $[\text{Cu}(\text{NH}_3)_4(\text{OH}_2)_2]^{2+}$?
 (1) Tetrahedral; + 2 (2) Square planar; - 2 (3) Linear; + 3 (4) Octahedral; + 2
Ans. (4)
47. For 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
Ans. (2)
48. 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) $[\text{Ni}(\text{CN})_4]^{2-}$
Ans. (2)
49. 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 $0.6 \Delta_0$
Ans. (2)
50. 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) $t_{2g}^0 t_g^4$ (4) $t_{2g}^2 e_g^2$
Ans. (2)

51. 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)
A. $[\text{CrF}_6]^{4-}$	i. One
B. $[\text{MnF}_6]^{4-}$	ii. Two
C. $[\text{Cr}(\text{CN})_6]^{4-}$	iii. Three
D. $[\text{Mn}(\text{CN})_6]^{4-}$	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

Ans. (3)

52. Which of the following complexes are paramagnetic in nature :-

$[\text{Fe}(\text{CN})_6]^{3-}$	$[\text{Fe}(\text{CN})_6]^{4-}$	$[\text{CoF}_6]^{3-}$	$\text{Ni}(\text{CO})_4$
I	II	III	IV

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

Ans. (3)

53. Among the complex ions given below which is/are outer-orbital complex :

$[\text{Co}(\text{CN})_6]^{3-}$	$[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$	$[\text{FeF}_6]^{3-}$	$[\text{CoF}_6]^{3-}$
I	II	III	IV

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

Ans. (1)

54. In which of following pairs of species the number of unpaired electrons are same :-

- (1) $[\text{CoF}_6]^{3-}$, $[\text{FeF}_6]^{3-}$ (2) $[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{Fe}(\text{CN})_6]^{4-}$
 (3) $[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{Ni}(\text{CN})_4]^{2-}$ (4) $[\text{CoF}_6]^{3-}$, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$

Ans. (4)

55. $\text{CuCl}_2 + \text{K}_4[\text{Fe}(\text{CN})_6] \rightarrow \text{Chocolate brown ppt(X)}$

Select the correct statement for (X) :

- (1) Its IUPAC name is copper (I) hexacyanoferrate (II)
 (2) It reacts with excess potassium cyanide forming an another soluble complex which has tetrahedral geometry.
 (3) It has 'spin only' magnetic moment equal to $\sqrt{36}$ B.M.
 (4) B and C both

Ans. (2)

56. Which of the following complexes are low spin and diamagnetic ?

- (a) $\text{K}_4[\text{Os}(\text{CN})_6]$ (b) $[\text{Mo}(\text{CO})_6]$ (c) $[\text{Mn}(\text{CN})_6]^{4-}$

Select the correct answer using the codes given below :

- (1) a, b and c (2) a and b only (3) a and c only (4) b and c only

Ans. (2)

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

- (1) It is paramagnetic and high spin complex
- (2) It is diamagnetic and high spin complex
- (3) It is diamagnetic and low spin complex
- (4) It is paramagnetic and low spin complex

Ans. (3)

58. Which is true for $[\text{Ni}(\text{en})_2]^{2+}$, $Z(\text{Ni}) = 28$?

- (1) paramagnetism, dsp^2 , square planar, C.N. of Ni = 2
- (2) diamagnetic, dsp^2 , square planar, C.N. of Ni = 4
- (3) diamagnetic, sp^3 , tetrahedral, C.N. of Ni = 4
- (4) paramagnetism, sp^3 , tetrahedral, C.N. of Ni = 4

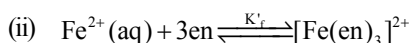
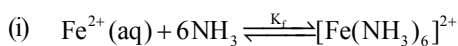
Ans. (2)

59. 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

Ans. (1)

60. 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

Ans. (2)

61. 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) $[\text{Co}(\text{NH}_3)_4(\text{en})]^{+3}$

Ans. (3)

62. What will be the theoretical value of 'spin only' magnetic moment when $\text{Fe}(\text{SCN})_3$ reacts with a solution containing F^- ions to yield a complex ?

- (1) 2.83 B.M. (2) 3.87 B.M. (3) 5.92 B.M. (4) 1.73 B.M.

Ans. (3)

63. S_1 : A solution of $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$ is green but a solution of $[\text{Ni}(\text{CN})_4]^{2-}$ is colourless.

S_2 : Energy difference between d levels (i.e. Δ) for H_2O complex is in the visible region and that for the cyano complex is in the UV region.

- (1) Both statements are correct and S_2 is the correct answer of S_1 .
- (2) Both statements are correct and S_2 is not the correct answer of S_1 .
- (3) S_1 is correct and S_2 is incorrect.
- (4) S_2 is false and S_1 is correct.

Ans. (1)

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

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

Ans. (4)

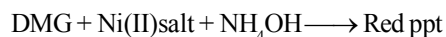
65. Match List-I (Complex ions) with List-II (CFSE) and select the correct answer using the codes given below the lists :

Column-I		Column-II
(P) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$		1. $0.6 \Delta_0$
(Q) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$		2. $0.4 \Delta_0$
(R) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$		3. 0
(S) $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$		4. $1.2 \Delta_0$

	P	Q	R	S
(1)	3	1	2	4
(2)	1	1	3	4
(3)	4	3	2	1
(4)	None of these			

Ans. (1)

66. It is an experiment fact that :



Which of the following is wrong about this red ppt :

- (1) It is a non-ionic complex
- (2) It involves intra molecular H-bonding
- (3) Ni(II) is sp^3 hybridised
- (4) It is a diamagnetic complex

Ans. (3)

67. Wilkinson's catalyst react with H_2 to form an octahedral complex in which Rh($Z = 45$) has the following electronic configuration in the ligand field $t_{2g}^{2,2,2}, e_g^{0,0}$. Then which of the following is correct about this new complex

- (1) It is paramagnetic
- (2) Its IUPAC name is chlorodihydridotris (triphenylphosphine) rhodium (III)
- (3) Hybridisation of Rh(I) is $d^2\text{sp}^3$
- (4) None of these

Ans. (2)

ISOMERISM

68. 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) None |

Ans. (1)

69. The two compounds sulphato penta-ammine cobalt (III) bromide and sulphato penta-ammine cobalt (III) chloride represent :

- | | |
|-----------------------------|--------------------------|
| (1) Linkage isomerism | (2) Ionisation isomerism |
| (3) Co-ordination isomerism | (4) No isomerism |

Ans. (4)

70. Which of the following set of isomerism is wrong :

- | | |
|---|---|
| (1) $\text{Cis-}[\text{Co}(\text{gly})_2\text{Cl}_2]^-$ – optical isomerism | (2) $[\text{Zn}(\text{NH}_3)_3\text{Cl}]^+$ – Geometrical isomerism |
| (3) $[\text{Fe}(\text{H}_2\text{O})_6]\text{Cl}_3$ – Hydrate isomerism | (4) $[\text{Co}(\text{en})_2(\text{NCS})_2]\text{Cl}$ – Linkage isomerism |

Ans. (2)

71. The kind of isomerism exhibited by $[\text{Rh}(\text{en})_2\text{Cl}_2][\text{Rh}(\text{en})\text{Cl}_4]$ and $[\text{Rh}(\text{en})_3][\text{RhCl}_6]$ is
 (1) Linkage (2) Co-ordination (3) Ligand (4) Ionisation

Ans. (2)

72. 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) $[\text{Pt}(\text{H}_2\text{O})(\text{NH}_3)\text{BrCl}]$

Ans. (3)

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

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

Ans. (2)

74. Which of the following complexes will show optical isomerism ?

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

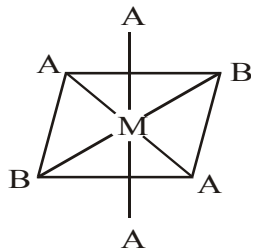
Ans. (4)

75. The compound $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_3$ and $[\text{Cr}(\text{H}_2\text{O})_4\text{Cl}_2]\text{Cl} \cdot 2\text{H}_2\text{O}$ represent

- (1) Linkage isomerism (2) Hydration isomerism (3) Ligand isomerism (4) None of these

Ans. (2)

76. The isomer -



can be marked as -

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

Ans. (4)

77. A Planar Complex (Mabcd) gives :-

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

Ans. (4)

78. Which of the following types of isomers can $[\text{Ag}(\text{NH}_3)_2]^+[\text{Ag}(\text{CN})_2]^-$ form :-

- (i) Coordination isomers (ii) Geometric isomers (iii) Optical isomers
 (1) (i) only (2) (i) & (ii) (3) (iii) only (4) None of these

Ans. (4)

79. 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) $\text{PtCl}_4 \cdot 2\text{NH}_3$

Ans. (3)

80. $\text{Cis}[\text{Pt}(\text{en})_2\text{Cl}_2]\text{Br}_2 \cdot 2\text{H}_2\text{O}$ and $\text{trans}[\text{Pd}(\text{en})_2\text{Br}_2]\text{Cl}_2 \cdot 2\text{H}_2\text{O}$ are :

- (1) Ionisation isomer
 (2) Geometrical isomer
 (3) Hydrate isomer
 (4) None of these

Ans. (4)

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

- (1) $[\text{M}(\text{CN})_6]^\pm$ (2) $[\text{M}(\text{en})(\text{CN})_4]^\pm$ (3) $[\text{M}(\text{en})_2(\text{CN})_2]^\pm$ (4) $[\text{M}(\text{en})_3]^\pm$

Ans. (3)

82. 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) $[\text{Pt}(\text{gly})_2]$

Ans. (3)

83. Select the correct statement :

- (1) Potassium ferrocyanide and potyassium ferricyanide can be differentiated by measuring the solid state magnetic moment.
(2) The complex $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ can be differentiated by adding aqueous solution of barium chloride.
(3) The complex $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Br}$ and $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{Cl}$ can be differentiated by adding aqueous solution of silver nitrate.
(4) All of these

Ans. (4)

84. 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) $[\text{Pt}(\text{NH}_3)_3(\text{Br})]$

Ans. (4)

85. The pair of molecules that exhibit geometrical isomerism are

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

Ans. (1)

ORGANOMETALLIC COMPOUNDS

86. Which of the following is π -acid ligand

- (1) NH_3 (2) CO (3) gly. (4) ethylene diamine

Ans. (2)

87. 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) All are correct

Ans. (2)

88. Compounds which contain one or more metal carbon bonds are called :

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

Ans. (4)

89. Which one of the following is used as a heterogeneous catalyst ?

- (1) Wilkinson's catalyst (2) Tetraethyl lead (3) Zeigler Natta catalyst (4) Grignard's reagent

Ans. (3)

90. 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.

Ans. (2)

91. Synergic bonding involves :-

- (1) The transference of electrons from ligands to metal
 (2) The transference of electrons from filled metal orbitals to anti-bonding orbitals of ligands
 (3) Both the above
 (4) None of these

Ans. (2)

92. OMC form during purification of a metal is :-

- (1) $\text{Ni}(\text{CO})_4$ (2) $\text{Pb}(\text{C}_2\text{H}_5)_4$ (3) $\text{Li}-\text{C}_4\text{H}_9$ (4) $\text{Na}_2[\text{Ni}(\text{CN})_4]$

Ans. (1)

93. 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) $\text{Ni}(\text{CO})_4$

Ans. (3)

APPLICATION OF COORDINATION CHEMISTRY

94. The brown ring test for nitrites and nitrates is due to the formation of a complex ion with formula :-

- (1) $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}^+]^{2+}$ (2) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (3) $[\text{Fe}(\text{H}_2\text{O})(\text{NO})_5]^{2-}$ (4) $[\text{Fe}(\text{NO})(\text{CN})_5]^{2+}$

Ans. (1)

95. In a ferric salt on adding KCN a prussian blue is obtained which is :-

- (1) $\text{K}_3[\text{Fe}(\text{CN})_6]$ (2) $\text{Fe}_3[\text{Fe}(\text{CN})_6]_4$ (3) $\text{FeSO}_4[\text{Fe}(\text{CN})_6]$ (4) $\text{Fe}_4[\text{Fe}(\text{CN})_6]_3$

Ans. (4)

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

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

Ans. (3)

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

- (1) Ag_2SO_3 (2) $\text{Ag}_2\text{S}_2\text{O}_3$ (3) $[\text{Ag}(\text{S}_2\text{O}_3)]^-$ (4) $[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$

Ans. (4)

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

- (1) $\text{PtCl}_4 + \text{KCl} \rightarrow$ (2) $\text{AgCl} + \text{NH}_3 \rightarrow$
 (3) $\text{AgBr} + \text{Na}_2\text{S}_2\text{O}_3 \rightarrow$ (4) $\text{HgI}_2 + \text{KI} \rightarrow$

Ans. (4)

99. $\text{K}_4[\text{Fe}(\text{CN})_6]$ reacts with FeCl_3 to form :-

- (1) $\text{K}_3\text{Fe}(\text{CN})_6$ (2) $\text{K}_4[\text{Fe}(\text{CN})_3\text{Cl}_3]$ (3) $\text{K}_3[\text{Fe}(\text{CN})_5\text{Cl}]$ (4) $\text{KFe}[\text{Fe}(\text{CN})_6]$

Ans. (4)

100. Match List I with List II and select the correct answer using the codes given below the lists :-

List I	List II
A. Muscle contraction	i. Zinc
B. Blue-green algae	ii. Cobalt
C. Carboxypeptidase	iii. Calcium
D. Cyanocobalamin	iv. Molybdenum

Code :

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

Ans. (4)

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

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

Ans. (3)

102. Extraction of metals of other processes is through the complex formation :-

I : cyanide process

II : Mond's process

III : Photographic fixing process

Complexes formed in these methods are

I	II	III
(1) $[\text{Ag}(\text{NH}_3)_2]\text{Cl}$	$\text{Ni}(\text{CO})_4$	$[\text{Ag}(\text{CN})_2]^-$
(2) $[\text{Cd}(\text{CN})_4]^{2-}$	$\text{Ni}(\text{CO})_4$	$[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$
(3) $[\text{Ag}(\text{CN})_2]^-$	$\text{Ni}(\text{CO})_4$	$[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$
(4) $[\text{Ag}(\text{CN})_2]^-$	$[\text{Ag}(\text{S}_2\text{O}_3)_2]^{3-}$	$\text{Ni}(\text{CO})_4$

Ans. (3)

103. 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

Ans. (4)

ANALYTICAL EXERCISE

1. Which of the following is not a double salt but is a complex salt –
 (A) $\text{KCl} \cdot \text{MgCl}_2 \cdot 6\text{H}_2\text{O}$ (B) $\text{FeSO}_4 \cdot (\text{NH}_4)_2\text{SO}_4 \cdot 6\text{H}_2\text{O}$
 (C) $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ (D) $4\text{KCN} \cdot \text{Fe}(\text{CN})_2$
 Ans. (D)
2. The complex that violates the EAN rule –
 (A) Potassium ferrocyanide (B) Potassium ferricyanide
 (C) Tetra carbonyl Nickel (0) (D) Cobalt (III) hexammine chloride
 Ans. (B)
3. The solution of the complex $[\text{Cu}(\text{NH}_3)_4]\text{SO}_4$ in water –
 (A) Will give the tests of Cu^{2+} ions (B) Will give the tests of NH_3
 (C) Will give the tests of SO_4^{2-} (D) Will not give the tests of any of the above species
 Ans. (C)
4. The donor atoms in EDTA^{4-} 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
 Ans. (B)
5. The co-ordination number of Cr in the complex ion $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$ is –
 (A) Zero (B) 3
 (C) 6 (D) None of these
 Ans. (C)
6. Match List I and List II and select the correct answer using the codes given below the lists :
 List I (Equivalent conductance) List II (Formula)
 (1) 229 (i) $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$
 (2) 97 (ii) $[\text{Pt}(\text{NH}_3)_3\text{Cl}_3]\text{Cl}$
 (3) 404 (iii) $[\text{Pt}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}_2$
 (4) 523 (iv) $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$
 Code :

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

 Ans. (D)
7. Coordination number and oxidation number of Cr in $\text{K}_3[\text{Cr}(\text{C}_2\text{O}_4)_3]$ are, respectively –
 (A) 4 and +2 (B) 6 and +3
 (C) 3 and +3 (D) 3 and 0
 Ans. (B)
8. The formula of the complex tris (ethylene diamine) cobalt(III) sulphate is –
 (A) $[\text{Co}(\text{en})_2]\text{SO}_4$ (B) $[\text{Co}(\text{en})_3]\text{SO}_4$
 (C) $[\text{Co}(\text{en})_3]\text{SO}_4$ (D) $[\text{Co}(\text{en})_3]_2(\text{SO}_4)_3$
 Ans. (D)
9. The IUPAC name of $[\text{CoCl}(\text{NO}_2)(\text{en})_2]\text{Cl}$ is –
 (A) Chloronitrobis(ethylenediammine)cobalt(III)chloride
 (B) Chloronitrobis(ethylenediammine)cobalt (II)chloride
 (C) Chlorobis(ethylenediammine)nitrocobalt(III)chloride
 (D) Bis(ethylenediammine)chloronitrocobalt(III)chloride
 Ans. (C)

10. IUPAC name of $[\text{Pt}(\text{NH}_3)_3(\text{Br})(\text{NO}_2)\text{Cl}]\text{Cl}$ is –
 (A) Triamminechlorobromonitroplatinum (IV) chloride
 (B) Triamminebromonitrochloroplatinum (IV) chloride
 (C) Triamminebromochloronitroplatinum (IV) chloride
 (D) Triamminenitrochlorobromoplatinum (IV) chloride
 Ans. (C)
11. $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ are isomers –
 (A) Linkage (B) Geometrical
 (C) Ionization (D) Optical
 Ans. (C)
12. 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
 Ans. (C)
13. The complex ion $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)^{2+}]$ and $[\text{Co}(\text{NH}_3)_5(\text{ONO})]^{2+}$ are called –
 (A) Ionization isomers (B) Linkage isomers
 (C) Coordination isomers (D) Hydrate isomers
 Ans. (B)
14. Which would exhibit co-ordination isomerism –
 (A) $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ (B) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$
 (C) $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ (D) $[\text{Cr}(\text{en})_2\text{Cl}_2]^+$
 Ans. (A)
15. In nitroprusside ion the iron and NO exist as Fe^{II} and NO^+ rather than Fe^{III} and NO. These forms can be differentiated by –
 (A) Estimating the concentration of iron
 (B) Measuring the concentration of CN^-
 (C) Measuring the solid state magnetic moment
 (D) Thermally decomposing the compound
 Ans. (C)
16. Out of the following which will not show geometrical isomerism –
 (A) $[\text{Pt}(\text{NH}_3)_2(\text{H}_2\text{O})_2]^{+2}$ (B) $[\text{Cr}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$
 (C) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ (D) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$
 Ans. (B)
17. Which of the following statement is incorrect about $[\text{Fe}(\text{H}_2\text{O})_5\text{NO}]\text{SO}_4$ –
 (A) It gives brown ring test for nitrates
 (B) Oxidation state of Fe is +1
 (C) It exhibits geometrical isomerism
 (D) Charge on NO is +1
 Ans. (C)
18. Which of the following is not optically active –
 (A) $[\text{Co}(\text{en})_3]^{3+}$ (B) $[\text{Cr}(\text{ox})_3]^{3-}$
 (C) $\text{cis}-[\text{CoCl}_2(\text{en})_2]^+$ (D) $\text{trans}-[\text{CoCl}_2(\text{en})_2]^+$
 Ans. (D)

19. The complex ions $[\text{Fe}(\text{CN})_6]^{3-}$ and $[\text{Fe}(\text{CN})_6]^{4-}$ –
 (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
 Ans. (C)
20. Hexafluorocobaltate(III) ion is found to be high spin complex, the probable hybrid state of cobalt in it is –
 (A) d^2sp^3 (B) sp^3
 (C) sp^3d (D) sp^3d^2
 Ans. (D)
21. If $\Delta_0 < P$, the correct electronic configuration for d^4 system will be –
 (A) $t_{2g}^4 e_g^0$ (B) $t_{2g}^3 e_g^1$
 (C) $t_{2g}^0 t_g^4$ (D) $t_{2g}^2 e_g^2$
 Ans. (B)
22. The crystal field splitting energy for octahedral Δ_0 and tetrahedral Δ_t complexes is related to –
 (A) $\Delta_t = \frac{4}{9}\Delta_0$ (B) $\Delta_t = \frac{1}{2}\Delta_0$
 (C) $\Delta_0 = 2\Delta_t$ (D) $\Delta_0 = \frac{4}{9}\Delta_t$
 Ans. (A)
23. The value of the ‘spin only’ magnetic moment for one of the following configuration is 2.84 BM. The correct one is :
 (A) d^5 (in strong ligand field) (B) d^2 (in weak as well as in strong fields)
 (C) d^2 (in weak ligand field only) (D) d^4 (in strong ligand field)
 Ans. (B)
24. The correct order for the wavelength of absorption in the visible region is –
 (A) $[\text{Ni}(\text{NO}_2)_6]^{4-} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
 (B) $[\text{Ni}(\text{NO}_2)_6]^{4-} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NH}_3)_6]^{2+}$
 (C) $[\text{Ni}(\text{H}_2\text{O})_6]^{4-} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$
 (D) $[\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$
 Ans. (A)
25. The spin magnetic moment of cobalt in $\text{Hg}[\text{Co}(\text{SCN})_4]$ is :
 (A) $\sqrt{3}$ (B) $\sqrt{8}$
 (C) $\sqrt{15}$ (D) $\sqrt{24}$
 Ans. (C)
26. In the complexes $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$, $[\text{Fe}(\text{CN})_6]^{3+}$, $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ and $[\text{FeCl}_6]^{3-}$, more stability is shown by –
 (A) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ (B) $[\text{Fe}(\text{CN})_6]^{3+}$
 (C) $[\text{Fe}(\text{C}_2\text{O}_4)_3]^{3-}$ (D) $[\text{FeCl}_6]^{3-}$
 Ans. (C)

27. Which of the following is a π -acid ligand –
 (A) NH_3 (B) CO
 (C) F^- (D) $\text{H}_2\text{N}-\text{CH}_2-\text{CH}_2-\text{NH}_2$
 Ans. (B)
28. Which of the following acts as a ligand but does not possess any unshared pair of electrons ?
 (A) C_2H_4 (B) NH_3
 (C) en (D) CN^-
 Ans. (A)
29. Which of the following organometallic compound is used as fungicide in plant protection –
 (A) $\text{C}_2\text{H}_5\text{HgCl}$ (B) $(\text{C}_2\text{H}_5)_2\text{Zn}$
 (C) $(\text{C}_2\text{H}_5)_4\text{Pb}$ (D) $(\text{C}_2\text{H}_5)_2\text{Cd}$
 Ans. (A)
30. When AgNO_3 is added to a solution of $\text{Co}(\text{NH}_3)_5\text{Cl}_3$, the precipitate of AgCl shows two ionisable chloride ions. This means –
 (A) Two chlorine atom satisfy primary velency and one secondary valency
 (B) One chlorine atom satisfies primary as wel as secondary valency
 (C) Three chlorine atoms satisfy primary valency
 (D) Three chlorine atoms satisfy secondary valency
 Ans. (A)
31. Which of the following is a double salt
 (A) Carnallite (B) Mohr's salt
 (C) Alum (D) All are correct
 Ans. (D)
32. In which pair of complex entities given below the EAN of metal atom/ion is same –
 (A) $[\text{Ni}(\text{en})_2]^{2+}$, $[\text{Sc}(\text{H}_2\text{O})_6]^{3+}$ (B) $[\text{Fe}(\text{CN})_6]^{3-}$, $[\text{Co}(\text{CN})_6]^{3-}$
 (C) $[\text{Ni}(\text{CO})_4]$, $[\text{Fe}(\text{CN})_6]^{4-}$ (D) $[\text{Ni}(\text{en})_2]^{2+}$, $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
 Ans. (C)
33. Which of the following is non ionisable ?
 (A) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]$ (B) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$
 (C) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (D) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$
 Ans. (A)
34. Glycinato ligand is –
 (A) $\text{CH}_2 \begin{matrix} \nearrow \text{NH}_2 \\ \searrow \text{COO}^- \end{matrix}$ (B) Bidentate ligand
 (C) Two donor sites N and O^- (D) All of these
 Ans. (D)
35. Co-ordination number of Fe in $\text{K}_3[\text{Fe}(\text{CN})_6]$ is :
 (A) 2 (B) 3
 (C) 4 (D) 6
 Ans. (D)

36. The co-ordination number of cobalt in $[\text{Co}(\text{en})_2\text{Br}_2]\text{Cl}_2$ is –
 (A) 2 (B) 4
 (C) 6 (D) 8
 Ans. (C)
37. The oxidation number of platinum in $[\text{Pt}(\text{NH}_3)_5\text{Cl}]\text{Cl}_3$ is –
 (A) 2 (B) 3
 (C) 4 (D) 6
 Ans. (C)
38. The chloro-bis (ethylenediamine) nitro cobalt (III) ion is –
 (A) $[\text{Co}(\text{NO}_2)_2(\text{en})_2\text{Cl}_2]^+$ (B) $[\text{CoCl}(\text{NO}_2)_2(\text{en})_2]^+$
 (C) $[\text{Co}(\text{NO}_2)\text{Cl}(\text{en})_2]^+$ (D) $[\text{Co}(\text{en})\text{Cl}_2(\text{NO}_2)_2]^-$
 Ans. (C)
39. The correct IUPAC name of the complex $\text{Fe}(\text{C}_5\text{H}_5)_2$ is –
 (A) Cyclopentadienyl iron (II) (B) Bis (cyclopentadienyl) iron (II)
 (C) Dicyclopentadienyl ferrate (II) (D) Ferrocene
 Ans. (B)
40. The IUPAC name for $[(\text{NH}_3)_5\text{Cr}-\text{OH}-\text{Cr}(\text{NH}_3)_5]^{+5}$ is :
 (A) μ -hydroxo-bis (pentaammine dichromium) (V+) ion
 (B) μ -hydroxo-bis (decaammine dichromium) (V+) ion
 (C) μ -hydroxo-bis (octaammine chromium) (V+) ion
 (D) μ -hydroxo-bis (pentaammine chromium) (III) ion
 Ans. (D)
41. A 2 litre solution (X) contain 0.02 mole of $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{Br}$ and 0.02 mole of $[\text{Co}(\text{NH}_3)_5\text{Br}]\text{SO}_4$. 1 litre of this solution is taken –
 $\text{X} + \text{AgNO}_3 (\text{excess}) \rightarrow \text{Y mole AgBr} \downarrow$
 $\text{X} + \text{BaCl}_2 (\text{excess}) \rightarrow \text{Z mole BaSO}_4 \downarrow$
 Valurs of Y and Z are –
 (A) 0.01, 0.02 (B) 0.02, 0.02
 (C) 0.02, 0.01 (D) 0.01, 0.01
 Ans. (D)
42. The total number of possible isomers of the complex compound $[\text{Cu}^{\text{II}}(\text{NH}_3)_4][\text{Pt}^{\text{III}}\text{Cl}_4]$ is
 (A) 3 (B) 6
 (C) 5 (D) 4
 Ans. (D)
43. Which of the following pairs represents linkage isomers ?
 (A) $[\text{Pd}(\text{PPh}_3)_2(\text{NCS})_2]$ and $[\text{Pd}(\text{PPh}_3)_2(\text{SCN})_2]$
 (B) $[\text{Co}(\text{NH}_3)_5\text{NO}_3]\text{SO}_4$ and $[\text{Co}(\text{NH}_3)_5\text{SO}_4]\text{NO}_3$
 (C) $[\text{PtCl}_2(\text{NH}_3)_4]\text{Br}_2$ and $[\text{PtBr}_2(\text{NH}_3)_4]\text{Cl}_2$
 (D) $[\text{Cu}(\text{NH}_3)_4][\text{PtCl}_4]$ and $[\text{Pt}(\text{NH}_3)_4][\text{CuCl}_4]$
 Ans. (A)

44. Co-ordination isomerism is caused interchange of ligand between the :

- (A) Complex cation and complex anion
- (B) Inner sphere and outer sphere
- (C) Low oxidation and higher oxidation states
- (D) cis and trans structure

Ans. (A)

45. Which statement is incorrect –

- (A) $\text{Ni}(\text{CO})_4$ – Tetrahedral, paramagnetic
- (B) $[\text{Ni}(\text{CN})_4]^{2-}$ – Square planar, diamagnetic
- (C) $\text{Ni}(\text{CO})_4$ – Tetrahedral, diamagnetic
- (D) $[\text{NiCl}_4]^{2-}$ – Tetrahedral, paramagnetic

Ans. (A)

46. 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

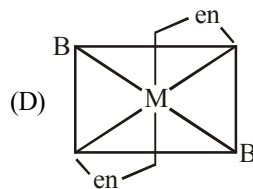
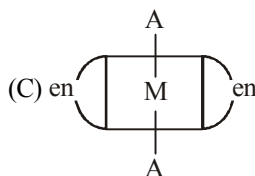
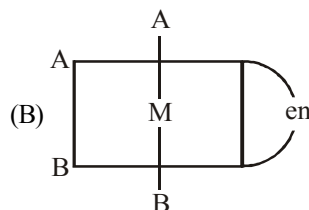
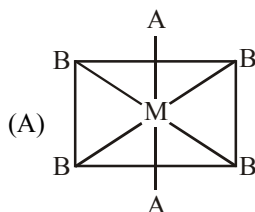
Ans. (C)

47. Theoretically the No. of geometrical isomers expected for octahedral complex $[\text{Mabcdef}]$ is –

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

Ans. (C)

48. The phenomenon of optical activity will be shown by –



Ans. (B)

49. Which of the following contains one unpaired electron in the 4p orbitals –

- (A) $[\text{Cu}(\text{NH}_3)_2]^+$
- (B) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
- (C) $[\text{Cu}(\text{CN})_4]^{3-}$
- (D) $[\text{Ni}(\text{CN})_4]^{2-}$

Ans. (B)

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

List-I

(Complex ions)

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

List-II

(No. of unpaired electrons)

- (i) One
 (ii) Two
 (iii) Three
 (iv) Four
 (v) Five

Code :

	1	2	3	4
(A)	(iv)	(i)	(ii)	(v)
(C)	(iv)	(v)	(ii)	(i)

	1	2	3	4
(B)	(ii)	(iv)	(iii)	(i)
(D)	(ii)	(i)	(iii)	(v)

Ans. (C)

51. In an octahedral crystal field, the t_{2g} orbitals are –

- (A) Raised in energy by $0.4 \Delta_0$ (B) Lowered in energy by $0.4 \Delta_0$
 (C) Raised in energy by $0.6 \Delta_0$ (D) Lowered in energy by $0.6 \Delta_0$

Ans. (B)

52. 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.

Ans. (A)

53. Which order is correct in spectrochemical series of ligands –

- (A) $\text{Cl}^- < \text{F}^- < \text{C}_2\text{O}_4^{2-} < \text{NO}_2^- < \text{CN}^-$
 (B) $\text{CN}^- < \text{C}_2\text{O}_4^{2-} < \text{Cl}^- > \text{NO}_2^- < \text{F}^-$
 (C) $\text{C}_2\text{O}_4^{2-} < \text{F}^- < \text{Cl}^- > \text{NO}_2^- < \text{CN}^-$
 (D) $\text{F}^- < \text{Cl}^- < \text{NO}_2^- < \text{CN}^- < \text{C}_2\text{O}_4^{2-}$

Ans. (A)

54. The metal present in chlorophyll, haemoglobin and vitamin B_{12} are respectively

- (A) Fe, Mg and Co (B) Mg, Fe and Co
 (C) Co, Mg and Fe (D) None of the above is correct.

Ans. (B)

55. Match List-I with List-II and select the correct answer using the codes given below the lists –

List-I

(Complex ions)

- a. $[\text{Fe}(\text{CN})_6]^{4-}$
 b. $[\text{Fe}(\text{CN})_6]^{3+}$
 c. $[\text{Cr}(\text{H}_2\text{O})_6]^{3+}$
 d. $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
 e. $[\text{FeF}_6]^{3-}$

List-II

(Magnetic Moment in Bohr Magnetons)

1. 1.73
 2. 5.93
 3. 0.00
 4. 2.83
 5. 3.88

Code :

	a	b	c	d	e
(A)	1	2	3	4	5
(C)	2	3	4	5	1

	a	b	c	d	e
(B)	3	1	5	4	2
(D)	4	5	1	2	3

Ans. (B)

56. Which one of the following statements is incorrect –
 (A) Greater the stability constant of a complex ion, greater is its stability
 (B) Greater the charge on the central metal ion, greater is the stability of the complex.
 (C) Greater is the basic character of the ligand, the greater is the stability of the complex
 (D) Chelate complexes have low stability constant.
 Ans. (D)
57. In metal carbonyls, there is –
 (A) No π bond between CO and metal atom
 (B) Only σ bond between metal atom and CO molecules
 (C) One σ and one π bond (back-donation) between metal atom and CO molecules
 (D) The metal-carbon bonds does not exist at all
 Ans. (C)
58. Ferrocene is an example of
 (A) Sandwiched complex
 (B) Pi-bonded complex
 (C) A complex in which all the five carbon atoms of cyclopentadiene anion are bonded to the metal
 (D) All of these
 Ans. (D)
59. A person suffering from lead poisoning should be fed with –
 (A) Hypo (B) Cis-platin
 (C) $[\text{Ca}(\text{EDTA})]^{2-}$ (D) DMG
 Ans. (C)
60. Give the correct increasing order of electrical conductivity of aqueous solution of following complex entities –
 I. $[\text{Pt}(\text{NH}_3)_6]\text{Cl}_4$ II. $[\text{Cr}(\text{NH}_3)_6]\text{Cl}_3$ III. $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{Cl}$ IV. $\text{K}_2[\text{PtCl}_6]$
 (A) III < IV < II < I (B) IV < II < III < I
 (C) II < I < IV < III (D) I < II < IV < III
 Ans. (A)

Previous Year Exercise

1. The correct order of the stoichiometries of AgCl formed when AgNO₃ in excess is treated with the complexes: CoCl₃.6NH₃, CoCl₃.5NH₃, CoCl₃.4NH₃ respectively is: [NEET-2017]

(1) 1 AgCl, 3 AgCl, 2 AgCl
 (3) 3 AgCl, 2 AgCl, 1 AgCl

(2) 3 AgCl, 1 AgCl, 2 AgCl
 (4) 2 AgCl, 3 AgCl, 1 AgCl

Ans. (3)
2. Correct increasing order for the wavelengths of absorption in the visible region for the complexes of Co³⁺ is: [NEET-2017]

(1) [Co(en)₃]³⁺, [Co(NH₃)₆]³⁺, [Co(H₂O)₆]³⁺
 (3) [Co(H₂O)₆]³⁺, [Co(NH₃)₆]³⁺, [Co(en)₃]³⁺

(2) [Co(H₂O)₆]³⁺, [Co(en)₃]³⁺, [Co(NH₃)₆]³⁺
 (4) [Co(NH₃)₆]³⁺, [Co(en)₃]³⁺, [Co(H₂O)₆]³⁺

Ans. (1)
3. Pick out the correct statement with respect [Mn(CN)₆]³⁻: [NEET-2017]

(1) It is sp³d² hybridised and octahedral
 (3) It is d²sp³ hybridised and octahedral

(2) It is sp³d² hybridised and tetrahedral
 (4) It is dsp² hybridised and square planar

Ans. (3)
4. The correct increasing order of trans-effect of the following species is [NEET-(Phase-2)-2016]

(1) NH₃ > CN⁻ > Br⁻ > C₆H₅⁻
 (3) Br⁻ > CN⁻ > NH₃ > C₆H₅⁻

(2) CN⁻ > C₆H₅⁻ > Br⁻ > NH₃
 (4) CN⁻ > Br⁻ > C₆H₅⁻ > NH₃

Ans. (2)
5. Which of the following has longest C – O bond length ? (Free C – O bond length CO is 1.128 Å) [NEET-2016]

(1) [Mn(CO)₆]⁺

(2) Ni(CO)₄

(3) [Co(CO)₄]⁻

(4) [Fe(CO)₄]²⁻

Ans. (4)
6. The name of complex ion, [Fe(CN)₆]³⁻ is [Re-AIPMT-2015]

(1) Tricyanoferrate (III) ion
 (3) Hexacyanoiron (III) ion

(2) Hexacyanidoferrate (III) ion
 (4) Hexacyanitoferrate (III) ion

Ans. (2)
7. The hybridization involved in complex [Ni(CN)₄]²⁻ is (At. No. Ni = 28) [Re-AIPMT-2015]

(1) d²sp²

(2) d²sp³

(3) dsp²

(4) sp³

Ans. (3)
8. The sum of coordination number and oxidation number of the metal M in the complex [M(en)₂(C₂O₄)]Cl (where en is ethylenediamine) is [Re-AIPMT-2015]

(1) 7

(2) 8

(3) 9

(4) 6

Ans. (3)
9. Number of possible isomers for the complex [Co(en)₂Cl₂]⁺Cl will be (en = ethylenediamine) [Re-AIPMT-2015]

(1) 3

(2) 4

(3) 2

(4) 1

Ans. (1)
10. Which of these statements about [Co(CN)₆]³⁻ is true ? [AIPMT-2015]

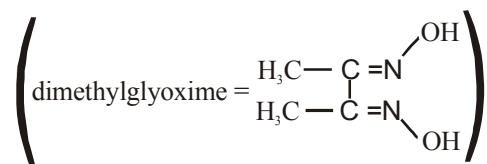
(1) [Co(CN)₆]³⁻ has no unpaired electrons and will be in a high-spin configuration
 (2) [Co(CN)₆]³⁻ has no unpaired electrons and will be in a low-spin configuration
 (3) [Co(CN)₆]³⁻ has four unpaired electrons and will be in a low-spin configuration
 (4) [Co(CN)₆]³⁻ has four unpaired electrons and will be in a high-spin configuration

Ans. (2)

11. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not give test for chloride ions with silver nitrate at 25°C ? [AIPMT-2015]
 (1) $\text{CoCl}_3 \cdot 6\text{NH}_3$ (2) $\text{CoCl}_3 \cdot 3\text{NH}_3$ (3) $\text{CoCl}_3 \cdot 4\text{NH}_3$ (4) $\text{CoCl}_3 \cdot 5\text{NH}_3$
Ans. (2)
12. Magnetic moment 2.84 B.M. is given by (At nos. Ni = 28, Ti = 22, Cr = 24, Co = 27) [AIPMT-2015]
 (1) Co^{2+} (2) Ni^{2+} (3) Ti^{3+} (4) Cr^{2+}
Ans. (2)
13. Colour of Ruby is due to presence of Cr_2O_3 in Al_2O_3 the reason of colour property [AIIMS 2015]
 (1) charge transfer of O^{2-} to Al^{+3}
 (2) charge transfer of O^{2-} to Cr^{3+}
 (3) charge transfer of O^- to Cr^{3+}
 (4) d-d transition in Cr^{+3}
Ans. (4)
14. Electronic configuration of Co in a octahedral complex is $t_2g^6 e_g^0$ with a ligand L, than L is [AIIMS 2015]
 (1) SCN^- (2) oxalate (3) F^- (4) Cl^-
Ans. (2)
15. Which of the following compound has minimum coordination number :- [AIIMS 2014]
 (1) $\text{Co}_2(\text{CO})_8$ (2) $\text{Mn}_2(\text{CO})_{10}$ (3) $[\text{Co}(\text{NH}_3)_5\text{Cl}]\text{Cl}_2$ (4) $[\text{Co}(\text{NH}_3)_4\text{Cl}]$
Ans. (4)
16. Which of the following compound show both linkage & ionisation isomerism :- [AIIMS 2014]
 (1) $[\text{Co}(\text{NH}_3)_5\text{NO}_2](\text{NO}_2)$ (2) $[\text{Co}(\text{NO}_2)(\text{Py})_2(\text{NH}_3)_2]\text{NO}_2$
 (3) $[\text{Co}(\text{NH}_3)_6]\text{Cl}_2$ (4) $[\text{Co}(\text{NO}_2)\text{Br}(\text{NH}_3)_4]\text{Cl}$
Ans. (4)
17. Among the following complexes the one which shows zero crystal field stabilization energy (CFSE) is [AIPMT-2014]
 (1) $[\text{Mn}(\text{H}_2\text{O})_6]^{3+}$ (2) $[\text{Fe}(\text{H}_2\text{O})_6]^{3+}$ (3) $[\text{Co}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Co}(\text{H}_2\text{O})_6]^{3+}$
Ans. (2)
18. Which of the following complexes is used to be as an anticancer agent ? [AIPMT-2014]
 (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
Ans. (2)
19. A magnetic moment of 1.73 BM will be shown by one among the following [NEET-2013]
 (1) $[\text{Ni}(\text{CN})_4]^{2-}$ (2) TiCl_4 (3) $[\text{CoCl}_6]^{4-}$ (4) $[\text{Cu}(\text{NH}_3)_4]^{2+}$
Ans. (4)
20. An excess of AgNO_3 is added to 100mL of a 0.01M solution of dichlorotetraaquachromium(III) chloride. The number of moles of AgCl precipitated would be [NEET-2013]
 (1) 0.002 (2) 0.003 (3) 0.01 (4) 0.001
Ans. (4)
21. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour ? [AIPMT (Prelims) –2012]
 (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) $[\text{Zn}(\text{NH}_3)_6]^{2+}$
Ans. (3)

22. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammonical Ni(II). Which of the following statements is not true ? [AIPMT Mains–2012]

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



Ans. (3)

23. 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) [AIPMT Mains–2012]

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

Ans. (2)

24. The complex, $[\text{Pt}(\text{Py})(\text{NH}_3)\text{BrCl}]$ will have how many geometrical isomers ? [AIPMT (Prelims)–2011]

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

Ans. (2)

25. The complexes $[\text{Co}(\text{NH}_3)_6][\text{Cr}(\text{CN})_6]$ and $[\text{Cr}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ are the examples of which type of isomerism ?

[AIPMT (Prelims)–2011]

- (1) Geometrical isomerism (2) Linkage isomerism
(3) Ionization isomerism (4) Coordination isomerism

Ans. (4)

26. The d-electron configurations of Cr^{2+} , Mn^{2+} , Fe^{2+} and Co^{2+} are d^4 , d^5 , d^6 and d^7 respectively. Which one of the following will exhibit minimum paramagnetic behaviour ? (At. Nos. Cr = 24, Mn = 25, Fe = 26, Co = 27)

[AIPMT (Prelims)–2011]

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

Ans. (4)

27. Of the following complex ions, which is diamagnetic in nature ? [AIPMT (Prelims)–2011]

- (1) $[\text{CoF}_6]^{3-}$ (2) $[\text{NiCl}_4]^{2-}$ (3) $[\text{Ni}(\text{CN})_4]^{2-}$ (4) $[\text{CuCl}_4]^{2-}$

Ans. (3)

28. Which of the following complex compounds will exhibit highest paramagnetic behaviour ? (At. no. Ti = 22, Cr = 24, Co = 27, Zn = 30) [AIPMT (Prelims)–2011]

- (1) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (2) $[\text{Zn}(\text{NH}_3)_6]^{2+}$ (3) $[\text{Ti}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Cr}(\text{NH}_3)_6]^{3+}$

Ans. (4)

29. Which of the following carbonyls will have the strongest C – O bond ? [AIPMT (Mains)–2011]

- (1) $\text{V}(\text{CO})_6^-$ (2) $\text{Fe}(\text{CO})_5$ (3) $\text{Mn}(\text{CO})_6^+$ (4) $\text{Cr}(\text{CO})_6$

Ans. (3)

30. The wave length of light absorbed is highest in:

[AIIMS–2011]

- (1) $[\text{Co}(\text{NH}_3)_5\text{Cl}]^{2+}$ (2) $[\text{Co}(\text{NH}_3)_5\text{H}_2\text{O}]^{3+}$ (3) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Co}(\text{en})_3]^{3+}$

Ans. (1)

31. Which of the following is diamagnetic:

[AIIMS–2011]

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

Ans. (3)

32. Which of the following complex ion is not expected to adsorb visible light ?

[AIPMT (Prelims) –2010]

- (1) $[\text{Ni}(\text{CN})_4]^{2-}$ (2) $[\text{Cr}(\text{NH}_3)_6]^{+3}$ (3) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$

Ans. (1)

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

[AIPMT (Prelims) –2010]

- (1) $-1.8 \Delta_0$ (2) $-1.6 \Delta_0 + P$ (3) $-1.2 \Delta_0$ (4) $-0.6 \Delta_0$

Ans. (4)

34. The existence of two different coloured complexes with the composition of $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]^+$ is due to

[AIPMT (Prelims) –2010]

- (1) Linkage isomerism (2) Geometrical isomerism
(3) Coordination isomerism (4) Ionization isomerism

Ans. (2)

35. Which one of the following complexes is not expected to exhibit isomerism ?

[AIPMT (Mains) –2010]

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

Ans. (3)

36. In which of the following compound C–O bond length is maximum :-

[AIIMS–2010]

- (1) $[\text{Fe}(\text{CO})_5]^-$ (2) $[\text{Ni}(\text{CO})_4]$ (3) $[\text{Cr}(\text{CO})_6]$ (4) $[\text{Mn}(\text{CO})_5]^+$

Ans. (1)

37. Out of TiF_6^{2-} , CoF_6^{3-} , Cu_2Cl_2 and NiCl_4^{2-} (Z of Ti = 22, Co = 27, Cu = 29, Ni = 28) the colourless species are (Atomic number Ti = 22, V = 23, Cr = 24, Mn = 25)

[AIPMT (Prelims) –2009]

- (1) Cu_2Cl_2 and NiCl_4^{2-} (2) TiF_6^{2-} and Cu_2Cl_2 (3) CoF_6^{3-} and NiCl_4^{2-} (4) TiF_6^{2-} and CoF_6^{3-}

Ans. (2)

38. Which of the following does not show optical isomerism ?

[AIPMT (Prelims) –2009]

- (1) $[\text{Co}(\text{NH}_3)_3\text{Cl}_3]^0$ (2) $[\text{Co}(\text{en})\text{Cl}_2(\text{NH}_3)_2]^+$
(3) $[\text{Co}(\text{en})_3]^{3+}$ (4) $[\text{Co}(\text{en})_2\text{Cl}_2]^+$ (en = ethylenediamine)

Ans. (1)

39. Which of the following complex ions is expected to absorb visible light ? (At. No. Zn = 30, Sc = 21, Ti = 22, Cr = 24)

[AIPMT (Prelims) –2009]

- (1) $[\text{Ti}(\text{en})_2(\text{NH}_3)_2]^{4+}$ (2) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (3) $[\text{Zn}(\text{NH}_3)_6]^{2+}$ (4) $[\text{Sc}(\text{H}_2\text{O})_3(\text{NH}_3)_3]^{3+}$

Ans. (2)

40. Which of the following complexes exhibits the highest paramagnetic behaviour ? (Where gly = glycine, en = ethylenediamine and bpy = bipyridyl moieties). (At. number Ti = 22, V = 23, Fe = 26, Co = 27)

[AIPMT (Prelims) –2008]

- (1) $[\text{Ti}(\text{NH}_3)_6]^{3+}$ (2) $[\text{V}(\text{gly})_2(\text{OH})_2(\text{NH}_3)_2]^+$
(3) $[\text{Fe}(\text{en})(\text{bpy})(\text{NH}_3)_2]^{2+}$ (4) $[\text{Co}(\text{ox})_2(\text{OH})_2]^-$

Ans. (4)

41. In which of the following coordination entities the magnitude of Δ_0 (CFSE in octahedral field) will be maximum (at. no. Co = 27) ?

[AIPMT(Prelims)-2008]

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

Ans. (4)

42. Which one of the following aqua complexes will exhibit the minimum paramagnetic behaviour ?
Atomic number Cr = 24, Mn = 25, Fe = 26, Ni = 28) [AIPMT(Prelims)-2007]
(1) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (2) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}$ (3) $[\text{Fe}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{Ni}(\text{H}_2\text{O})_6]^{2+}$
Ans. (4)
43. Which of the following will give a pair of enantiomorphs ? [AIPMT(Prelims)-2007]
(1) $[\text{Pt}(\text{NH}_3)_4][\text{PtCl}_6]$ (2) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]\text{NO}_2$
(3) $[\text{Co}(\text{NH}_3)_6][\text{Co}(\text{CN})_6]$ (4) $[\text{Co}(\text{en})_2\text{Cl}_2]\text{Cl}$ (en = $\text{NH}_2\text{CH}_2\text{CH}_2\text{NH}_2$)
Ans. (4)
44. $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)_2]\text{Cl}$ exhibits [AIPMT(Prelims)-2006]
(1) Linkage isomerism, ionization isomerism and optical isomerism
(2) Linkage isomerism, ionization isomerism and geometrical isomerism
(3) Ionization isomerism, geometrical isomerism and optical isomerism
(4) Linkage isomerism, geometrical isomerism and optical isomerism
Ans. (2)
45. $[\text{Cr}(\text{H}_2\text{O})_6]\text{Cl}_2$ (at. no. of Cr = 24) has a magnetic moment of 3.83 BM, the correct distribution of 3d electrons in the chromium of the complex is [AIPMT(Prelims)-2006]
(1) $3d_{x^2-y^2}^1, 3d_{z^2}^1, 3d_{xz}^1$ (2) $3d_{xy}^1, 3d_{x^2-y^2}^1, 3d_{yz}^1$ (3) $3d_{xy}^1, 3d_{zy}^1, 3d_{xz}^1$ (4) $3d_{xy}^1, 3d_{yz}^1, 3d_{z^2}^1$
Ans. (3)
46. The pair in which both species have same magnetic moment (spin only value) is – [AIIMS-2006]
(1) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}, [\text{CoCl}_4]^{2-}$ (2) $[\text{Cr}(\text{H}_2\text{O})_6]^{2+}, [\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
(3) $[\text{Mn}(\text{H}_2\text{O})_6]^{2+}, [\text{Cr}(\text{H}_2\text{O})_6]^{2+}$ (4) $[\text{CoCl}_4]^{2-}, [\text{Fe}(\text{H}_2\text{O})_6]^{2+}$
Ans. (2)
47. The pair in which both species have iron is – [AIIMS-2006]
(1) Nitrogenase, cytochromes (2) Carboxypeptidase, haemoglobin
(3) Haemocyanin, nitrogenase (4) Haemoglobin, cytochromes
Ans. (4)
48. The number of possible isomers of an octahedral complex $[\text{Co}(\text{C}_2\text{O}_4)_2(\text{NH}_3)_2]^-$ is – [AIIMS-2006]
(1) 1 (2) 2 (3) 3 (4) 4
Ans. (3)
49. The ligands in anti cancer drug cisplatin are [AIIMS-2006]
(1) NH_3, Cl (2) $\text{NH}_3, \text{H}_2\text{O}$ (3) $\text{Cl}, \text{H}_2\text{O}$ (4) NO, Cl
Ans. (1)
50. Given below, catalyst and corresponding process/reaction are matched. The mismatch is – [AIIMS-2006]
(1) $[\text{RhCl}(\text{PPh}_3)_2]$: Hydrogenation (2) $\text{TiCl}_4 + \text{Al}(\text{C}_2\text{H}_5)_3$: Polymerization
(3) V_2O_5 : Haber-Bosch process (4) Nickel: Hydrogentaion
Ans. (3)
51. Among the following the species having square planar geometry for central atom are [AIIMS-2006]
(i) XeF_4 (ii) SF_4 (iii) $[\text{NiCl}_4]^{2-}$ (iv) $[\text{PdCl}_4]^{2-}$
(1) (i) and (iv) (2) (i) and (ii) (3) (ii) and (iii) (4) (iii) and (iv)
Ans. (1)

52. Which one of the following is an inner orbital complex as well as diamagnetic in behaviour ?
Atomic number Zn = 30, Cr = 24, Co = 27, Ni = 28) [AIPMT(Prelims)-2005]
(1) $[\text{Zn}(\text{NH}_3)_6]^{2+}$ (2) $[\text{Cr}(\text{NH}_3)_6]^{3+}$ (3) $[\text{Co}(\text{NH}_3)_6]^{3+}$ (4) $[\text{Ni}(\text{NH}_3)_6]^{2+}$
Ans. (3)
53. Which one of the following is expected to exhibit optical isomerism ? (en = ethylenediamine) [AIPMT(Prelims)-2005]
(1) cis- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ (2) trans- $[\text{Co}(\text{en})_2\text{Cl}_2]$ (3) trans- $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ (4) cis- $[\text{Co}(\text{en})_2\text{Cl}_2]$
Ans. (2)
54. The correct order for the wavelength of absorption in the visible region is : [AIIMS-2005]
(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) $[\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+} < [\text{Ni}(\text{NO}_2)_6]^{4-}$
Ans. (1)
55. The oxidation state of chromium in the final product formed by the reaction between KI and acidified potassium dichromate solution is [AIIMS-2005]
(1) +4 (2) +6 (3) +2 (4) +3
Ans. (4)
56. The IUPAC name of the coordination compound $\text{K}_3[\text{Fe}(\text{CN})_6]$ is [AIIMS-2005]
(1) potassium hexacyanoferrate (II) (2) potassium hexacyanoferrate (III)
(3) potassium hexacyanoiron (II) (4) tripotassium hexacyanoiron (II)
Ans. (2)
57. Which of the following compounds shows optical isomerism ? [AIIMS-2005]
(1) $[\text{Cu}(\text{NH}_3)_4]^{2+}$ (2) $[\text{ZnCl}_4]^{2-}$ (3) $[\text{Cr}(\text{C}_2\text{O}_4)_3]^{3-}$ (4) $[\text{Co}(\text{CN})_6]^{3-}$
Ans. (3)
58. Which one of the following cyano complexes would exhibit the lowest value of paramagnetic behaviour ? [AIIMS-2005]
(1) $[\text{Cr}(\text{CN})_6]^{3-}$ (2) $[\text{Mn}(\text{CN})_6]^{3-}$ (3) $[\text{Fe}(\text{CN})_6]^{3-}$ (4) $[\text{Co}(\text{CN})_6]^{3-}$
Ans. (4)
59. The value of the 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is [AIIMS-2005]
(1) d^4 (in strong ligand field) (2) d^4 (in weak ligand field)
(3) d^3 (in weak as well as in strong fields) (4) d^5 (in strong ligand field)
Ans. (1)

Question asked prior to Medical Ent. Exams. 2005

60. 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) $[\text{Cu}(\text{H}_2\text{O})_6]^{2+}$
Ans. (3)
61. A co-ordination complex compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three mole ions in an aqueous solution on reacting this solution with excess of AgNO_3 solution, we get two moles of AgCl as precipitate. The ionic formula for this complex would be
(1) $[\text{Co}(\text{NH}_3)_5(\text{NO}_2)]\text{Cl}_2$ (2) $[\text{Co}(\text{NH}_3)_5\text{Cl}][\text{Cl}(\text{NO}_2)]$
(3) $[\text{Co}(\text{NH}_3)_4(\text{NO}_2)\text{Cl}](\text{NH}_2)\text{Cl}$ (4) $[\text{Co}(\text{NH}_3)_5][(\text{NO}_2)_2\text{Cl}_2]$
Ans. (1)

62. IUPAC name of $[\text{Pt}(\text{NH}_3)_3(\text{Br})(\text{NO}_2)\text{Cl}]\text{Cl}$ is
 (1) Triamminebromochloronitroplatinum (IV) chloride
 (2) Triamminebromonitrochloroplatinum (IV) chloride
 (3) Triamminechlorobromonitroplatinum (IV) chloride
 (4) Triamminenitrochlorobromoplatinum (IV) chloride
Ans. (1)
63. Shape of $\text{Fe}(\text{CO})_5$ is
 (1) Octahedral (2) Square planar (3) Trigonal bipyramidal (4) Square pyramidal
Ans. (3)
64. Which of the following will give maximum number of isomers ?
 (1) $[\text{Co}(\text{NH}_3)_4\text{Cl}_2]$ (2) $[\text{Ni}(\text{en})(\text{NH}_3)_4]^{2+}$ (3) $[\text{Ni}(\text{C}_2\text{O}_4)(\text{en})_2]^{2-}$ (4) $[\text{Cr}(\text{SCN})_2(\text{NH}_3)_4]^+$
Ans. (4)
65. Coordination number of Ni in $[\text{Ni}(\text{C}_2\text{O}_4)_3]^{4-}$ is
 (1) 3 (2) 6 (3) 4 (4) 2
Ans. (2)
66. Which of the following organometallic compounds is σ and π bonded ?
 (1) $[\text{Fe}(\eta^5 - \text{C}_5\text{H}_5)_2]$ (2) $\text{K}[\text{PtCl}_3(\eta^2 - \text{C}_2\text{H}_4)]$ (3) $\text{Co}[(\text{CO})_5\text{NH}_3]^{2+}$ (4) $\text{Fe}(\text{CH}_3)_3$
Ans. (3)
67. 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) $[\text{Ni}(\text{Cl})_4]^{2-}$ – tetrahedral, diamagnetic
Ans. (1)
68. Atomic number of Cr and Fe are respectively 24 and 26, which of the following is paramagnetic
 (1) $[\text{Cr}(\text{CO})_6]$ (2) $[\text{Fe}(\text{CO})_5]$ (3) $[\text{Fe}(\text{CN})_6]^{4-}$ (4) $[\text{Cr}(\text{NH}_3)_6]^{3+}$
Ans. (4)
69. The hypothetical complex triamminediaquachloridocobalt (III) chloride can be represented as
 (1) $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_2\text{Cl}]\text{Cl}_2$ (2) $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})\text{Cl}_3]$
 (3) $[\text{Co}(\text{NH}_2)_3(\text{H}_2\text{O})_2\text{Cl}]$ (4) $[\text{Co}(\text{NH}_3)_3(\text{H}_2\text{O})_3]\text{Cl}_3$
Ans. (1)
70. According to IUPAC nomenclature sodium nitroprusside is named as
 (1) Sodium nitroferrocyanide (2) Sodium nitroferrocyanide
 (3) Sodium pentacyanonitrosyl ferrate (II) (4) Sodium pentacyanonitrosyl ferrate (III)
Ans. (3)
71. The number of unpaired electrons in the complex ion $[\text{CoF}_6]^{3-}$ is (Atomic no. : $\text{Co} = 27$)
 (1) 2 (2) 3 (3) 4 (4) Zero
Ans. (3)

72. The anion of acetylacetone (acac) forms $\text{Co}(\text{acac})_3$ chelate with Co^{3+} . The rings of the chelate are
 (1) Three membered (2) Five membered (3) Four membered (4) Six membered

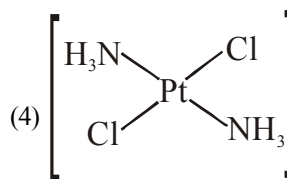
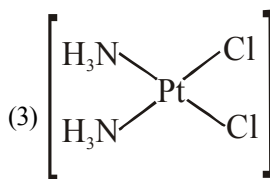
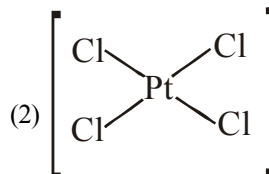
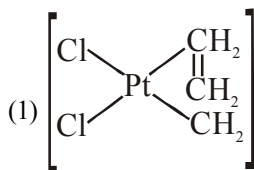
Ans. (4)

73. Which one of the following octahedral complexes will not show geometrical isomerism? (A and B are monodentate ligands)

- (1) $[\text{MA}_2\text{B}_4]$ (2) $[\text{MA}_3\text{B}_3]$ (3) $[\text{MA}_4\text{B}_2]$ (4) $[\text{MA}_5\text{B}]$

Ans. (4)

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



Ans. (3)

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

- (1) Pentaamminenitrocobalt (III) iodide
 (2) Diamminedichloroplatinum (II) chloride
 (3) Trans dicyanobis (ethylenediamine) chromium (III)
 (4) Tris-(ethylenediamine) cobalt (III) bromide

Ans. (4)

76. 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 (Atomic number of Ni = 28)

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

Ans. (2)

77. 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 (atomic number of Mn = 25)

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

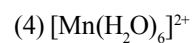
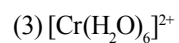
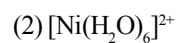
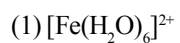
Ans. (2)

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

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

Ans. (1)

79. 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 complexes will exhibit the maximum paramagnetic behaviour ? (At. No. Cr = 24, Mn = 25, Fe = 26, Ni = 28)



Ans. (4)

ASSERTION & REASON QUESTIONS (ALLEN)

These questions consist of two statements each, printed as *Assertion* and *Reason*. While answering these Questions you are required to choose any one of the following four responses.

- A. If both *Assertion* & *Reason* are True & the *Reason* is a correct explanation of the *Assertion*.
- B. If both *Assertion* & *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* & *Reason* are False.

1. **Assertion** : $\text{K}_2\text{SO}_4 \cdot \text{Al}_2(\text{SO}_4)_3 \cdot 24\text{H}_2\text{O}$ is a complex compound.

Reason : It ionises to give a complex ion.

Ans. (D)

2. **Assertion** : In the complex $\text{K}_2[\text{PtCl}_6]$, C.N. of Pt is 6.

Reason : In the complex six coordinate bonds are formed between Pt and chloro ligands.

Ans. (A)

3. **Assertion** : Tetrahedral complex do not exhibit geometrical isomerism.

Reason : In tetrahedral complex all the four positions are identical.

Ans. (A)

4. **Assertion** : $[\text{Fe}(\text{CO})_5]$ is inner orbital complex.

Reason : In the given complex oxidation state of Iron is zero.

Ans. (B)

5. **Assertion** : $[\text{Fe}(\text{CN})_6]^{-3}$ is paramagnetic in nature.

Reason : $[\text{Fe}(\text{CN})_6]^{-3}$ is low spin complex.

Ans. (B)

6. **Assertion** : Hexachloroplatinate is a complex anion

Reason : Complex has negatively charged ligands

Ans. (B)

7. **Assertion** : $[\text{Ni}(\text{CN})_4]^{-2}$ has zero unpaired electron while that of $[\text{NiCl}_4]^{-2}$ has two unpaired e^-

Reason : $[\text{Ni}(\text{CN})_4]^{-2}$ has strong crystal field while $[\text{NiCl}_4]^{-2}$ has weak crystal field

Ans. (A)

8. **Assertion** : Cis - $[\text{Fe}(\text{en})_2 \text{Cl}_2]^+$ can form racemic mixture.

Reason : Cis - $[\text{Fe}(\text{en})_2 \text{Cl}_2]^+$ is square planar complex .

Ans. (C)

9. **Assertion** : Square planar complex Ma_2b_2 has two optical isomers

Reason : Mirror image of Ma_2b_2 is non super imposable

Ans. (D)

10. **Assertion** : AgI is coloured while AgF is colourless.
Reason : Unpaired e^- is present in AgI
Ans. (C)
11. **Assertion** : $[\text{CoF}_6]^{3-}$ is high spin complex.
Reason : F^- is strong field ligand.
Ans. (C)
12. **Assertion** : Ferrocene is π -bonded organometallic compound.
Reason : Ferrocene is a sandwich compound.
Ans. (B)
13. **Assertion** : Solution of Na_2CrO_4 in water is intensely coloured.
Reason : Ox. state of Cr in Na_2CrO_4 is +6.
Ans. (B)
14. **Assertion** : Potassium ferrocyanide is diamagnetic whereas potassium ferricyanide is paramagnetic.
Reason : Crystal field splitting in ferrocyanide ion is greater than that of ferricyanide ion.
Ans. (C)
15. **Assertion** : $[\text{Co}^{\text{III}}(\text{gly})_3]$ is called inner-metallic complex because,
Reason : Both the coordination number and charge of the cation are satisfied simultaneously by ligands.
Ans. (2)
16. **Assertion** : All tetrahedral complexes are mainly high spin and the low spin configurations are rarely observed.
Reason : Δ_t is always much smaller even with stronger field ligands and it is never energetically favourable to pair up the electrons.
Ans. (1)
17. **Assertion** : NH_2NH_2 although possesses two electron pairs for donation but not acts as a chelating agent.
Reason : The coordination by NH_2NH_2 leads to a three member highly unstable strained ring.
Ans. (1)
18. **Assertion** : The correct order for the wave length of absorption in the visible region is ;

$$[\text{Ni}(\text{NO}_2)_6]^{4+} < [\text{Ni}(\text{NH}_3)_6]^{2+} < [\text{Ni}(\text{H}_2\text{O})_6]^{2+}$$
Reason : The stability of different complexes depends on the strength of the ligand field of the various ligands.
Ans. (2)
19. **Assertion** : The 'spin only' magnetic moment of a green complex, potassium amminetetraamminechromate(III) is 1.73 BM.
Reason : To have two d-orbitals empty for d^2sp^3 hybridisation, the pairing of electrons take place leaving behind one unpaired electron as CN^- is a stronger ligand.
Ans. (1)
20. **Assertion** : Pentaamminethiocyanato-N-chromium(III) tetrachloridozincate(II) is a coloured compound and is an example of ionisation isomerism.
Reason : The compound is paramagnetic and therefore, d-d transition is possible.
Ans. (4)