CHEMISTRY

BOOKS - S DINESH & CO CHEMISTRY (HINGLISH)

CO-ORDINATION COMPOUNDS

MULIPLE CHOICE QUESTIONS

1. Which of the following represents hexadentate ligand ?

A. 2, 2 bipyridyl

B. DMG

C. ethylenediamine

D. None of these

Answer: D

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2. Which of the following represents chelating ligand ?

A. Cl^{-}

B. DMG

C. OH^{-}

D. $H_2\ddot{O}:$

Answer: B

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3. en is an example of a

A. monodentate

B. bidentate ligand

C. tridentate ligand

D. hexadentate ligand

Answer: B

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4. A group of atoms can function as a ligand only when :

A. It is a small molecule

B. It is capable of acting as donor of electron pair

C. It is a negatively charged ion

D. It is positively charged ion

Answer: B

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5. The co-ordination number of Cr in $\left[Cr\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3$ is

A. 3

B. 4

C. 6

D. 2

Answer: C

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6. The oxidation number of Fe in $K_4\left[Fe(CN)_6\right]$ is

A. 3

B. 2

C. 0

D. 1

Answer: B

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7. Which of the following is most likely structure of $CrO_3.6H_2O$ if $1/3$ of total chlorine of the compound is precipitated by adding $AgNO_3$ to its aqueous solution ?

A. $CrCl_3.6H_2O$

B. $\left[Cr(H_2O)_3Cl_3\right](H_2O)_3$

C. $\left[CrCl_2(H_2O)_4\right]Cl.2H_2O$

D. $\left[CrCl.(H_2O)_5\right]Cl_2.H_2O$

Answer: C

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8. The coordination number of a central ion may be obtained from

A. The number of ionic bond formed with the surrounding ions.

B. The number of co-ordinate bonds formed with the surrounding atoms.

C. The number of ions of opposite charge immediately surrounding the specific ion.

D. None of the above

Answer: B

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9. The co-ordination number and oxidation number of X in the following compound $\left[X(SO_4)(NH_3)_5\right]Cl$ will be

A. 10 and 3

B. $2 \text{ and } 6$

C. $6 \text{ and } 3$

D. $6 \text{ and } 4$

Answer: C

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10. Which of the following complex will give white ppt. with $BaCl_2$ solution ?

A. $\left[Cr(NH_3)_5SO_4\right]Cl$

B. $\left[Co(NH_3)_4Cl_2\right]NO_2$

C. $\left[Cr(NH_3)_5Cl\right]SO_4$

D. Both A and C

Answer: C

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11. It which of the following compounds the oxidation state of the nickel atom is zero

A. $KNiCl_3$

B. $Ni(PF_3)_4$

C. $[Ni(NH_3)_6]Cl_2$

D. $Ni(CO)_4$

Answer: D

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12. What is the co-ordination number of chromium in $[Cr(NH_3)_2(H_2O)_2]Cl_3$?

A. 3

B. 4

C. 5

D. 6

Answer: B

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13. How many ions are produced from $\left[Co\left(NH_3\right)_6\right]Cl_3$ in solution ?

A. 6

B. 4

C. 3

D. 2

Answer: B

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14. Which of the following is non-ionizabla ?

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

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

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

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

Answer: A

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15. Which of the following pair contains complex salt and double salt respectively?

A. $FeSO_4, K_4\left[Fe(CN)_6\right]$

B. $\left[Cu\left(NH_3\right)_4\right]SO_4, FeSO_4.7H_2O$

C. $\left[Cu\left(NH_3\right)_4\right]SO_4, K_2SO_4. Al_2\left(SO_4\right)_3.24H_2O$

D. $MgSO_4.7H_2O, CuSO_4$

Answer: C

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16. In which of the following compounds the metal is in the lowest oxidation state

A. $\left[Co\left(NH_3\right)_5Br\right]_2SO_4$

B. $Fe_3\left[Fe(CN)_6\right]_2$

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

D. $K\left[PtCl_3\left(C_2H_4\right)\right]$

Answer: C

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17. The effective atomic number of Fe in $Fe(CO)_5$ is

A. 26

B. 34

C. 36

D. 54

Answer: C

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18. Effective atomic number of Fe in the complex $K_4\left[Fe(CN)_6\right]$ is

A. 24

B. 12

C. 36

D. 18

Answer: C

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19. Number of electrons gained by Pd (for coordination) in $\left[PdCl_4\right]^{2-}$ is

A. 4

B. 8

C. 10

D. zero

Answer: B

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20. The oxidation number of Ag in Tollen's reagent is

A. 0

B. $+1$

C. $+2$

D. $+1.5$

Answer: B

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

A. $Ni(CO)_4$

B. K_2NiF_6

C. $\left[Ni\left(NH_3\right)_6\right]\left(BF_4\right)_2$

D. $K_4\left[Ni(CN)_6\right]$

Answer: B

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22. The oxidation state of Fe in $Fe(CO)_5$ is

A. -1

B. $+2$

C. $+3$

D. None of these

Answer: D

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23. $KCl.\ MgCl_2.6H_2O$ is a

A. mixed salt

B. double salt

C. basic salt

D. complex salt

Answer: B

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24. What is not true about a ligand

A. It can act as Lewis base

B. It can be monodentate or multidentate

C. A monodentate ligand cannot be chelating ligand

D. A multidentate ligand cannot cause chelation.

Answer: D

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25. Which of the following can be termed as mixed complex ?

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

B. $[Cu(NH)_4]SO_4$

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

D. K_2FeSO_4

Answer: C

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26. Which is false about glycenato ion ?

A. It formula is $H_2N - CH_2 - COO^-$

B. It is a symmetrical bidentate ligand

C. It is chelating ligand

D. It is unsymmetrical bidentate ligand

Answer: B

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27. How many ions per molecule should be produced in the solution when potash alum in dissolved in large excess of water ?

A. 4

B. 8

C. 6

D. 10

Answer: B

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28. Which of the following ligand gives chelate complexes ?

A. SCN^{-}

B. $C_2O_4^{2-}$

C. Pyridine

D. $NH_2 - NH_2$

Answer: B

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29. In the complex $\left[Pt(py)_4\right]\left[PtCl_4\right]$, the oxidation numbers of Pt atom in former and latter part of the compund are respectively

A. 0 and 0

B. $+4$ and $+2$

C. $+2$ and $+2$

D. 0 and $+4$

Answer: C

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30. In the formation of complex entity, the central metal atom/ion acts as :

A. Lewis base

B. Bronsted base

C. Lewis acid

D. Bronsted acid

Answer: C

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31. Which of the following complex has same oxidation state of the central metall atom in the cationic and anionic part ?

A. $\left[Pt(py)_4\right]\left[PtCl_4\right]$

B. $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_6\right]$

C. $\left[Pt\left(NH_3\right)_4Cl_2\right]\left[PtCl_4\right]$

D. $K_4\left[Ni(CN)_6\right]$

Answer: A

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32. How many H-bonds are present in the complex entity formed by Ni^{2+} and dimethylglyoximato ligands ?

A. 2

B. 3

C. 4

D. None

Answer: A

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33. Which of the following is a negative ligand ?

A. thiocarbonyl

B. carbonyl

C. cyclopentadienyl

D. nitrosyl .

Answer: C

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34. IUPAC name of $Na_3\left[CoCl\left(NO_2\right)_5\right]$ is

A. chloronitrodis (ethylendiamine) cobaltic (III) chloride

B. chloronitrobis(ethylendiamine) cobalt (II) chloride

C. chlorodis (ethylediamine)nitrocobalt(III)choride

D. bis(ethylenediamine)chloronitrocobalt(III) chloride.

Answer: C

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35. The compound $\left[CoCl_3I\left(C_5H_5N\right)_2\right]Br$ will show the chemical test for which of the following ions? .

A. Br^-

B. Cl^-

C. I^-

D. Br^- as well as Cl^-

Answer: A

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36. The correct $IUPAC$ name of $\left[Mn_3(CO)_{12}\right]$ is .

A. dodecarbonylmanganate(0)

B. dodecarbonylmanganic(II)

C. dodecarbonyltrimanganese(0)

D. manganicdodecarbonyl(0).

Answer: C

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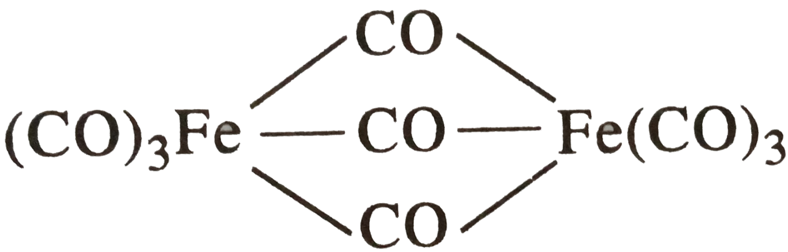
37. The correct name fo



A. tri-μ-carbonylbis(tricarbonyl)iron(0)

B. hexacarbonyliron(III)μ-tricarbonylferrate(0)

C. tricarbonyliron(0)μ-tricarbonyliron(0)tricarbonyl

D. non-carbonyl iron.

Answer: A

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38. The correct IUPAC name of $Fe\left(C_5H_5\right)_2$ is

A. cyclopentadienyliron(II)

B. bis(cyclopentadienyl)iron(II)

C. dicyclopentadienylferrate(II)

D. ferrocene

Answer: B

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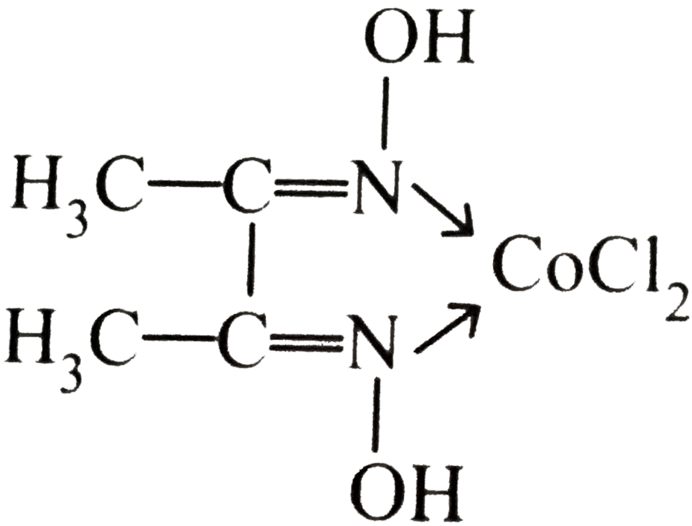
39. The correct *IUPAC* name of the complex



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A. dichlorodimethylglyoximatocobalt(II)

B. bis(dimethylglyoxime)dichlorcobalt(II)

C. dimethylglyoximecobalt(II) chloride

D. dicholorodimethylglyoxime-N,N-cobalt(II).

Answer: A

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40. The complex $Hg\left[Co(CNS)_4\right]$ is correctly named as

A. mercury tetrathiocyanatocobaltate(II)

B. mercury cobaltatetrasulphocyano(II)

C. mercury tetrasulphocyanidecobaltate(II)

D. mercury sulphocyanatocobalt(II).

Answer: A

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41. In sodium tetrafluorooxochromate (â€¦.), $Na_3\left[Cr(O)F_4\right]$ the left out place should be filled with which of the following Roman unmeral?

A. VI

B. III

C. IV

D. None of these

Answer: B

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42. The correct IUPAC name of $K_2[Zn(OH)_4]$ is

A. potassium tetrahydroxyzinc(II)

B. potassium tetrahydroxozincate(II)

C. potassium tetrahydroxizincate(IV)

D. potassium hydroxozinc(II)

Answer: B

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43. Lithium tetrahydridoaluminate is correctly represented as

A. $Al[LiH_4]$

B. $Al_2[LiH_4]_3$

C. $Li[AlH_4]$

D. $Li[AlH_4]_2$

Answer: C

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44. The correct name of the compound $[Cu(NH_3)_4](NO_3)_2$, according to IUPAC system is

A. cuprammonium nitrate

B. tetraamminecopper(II) dimitrate

C. tetraamminecopper (II)nitrate

D. tetraamminecopper (II) dinitrate.

Answer: C

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45. The value of 'X' in $KAl(SO_4)x.12H_2O$ is-

A. aluminiumpotassium sulphate-12 water

B. potassiumaluminium(III) sulphate-12 water

C. potassiumaluminate(III) sulphate hydrate

D. aluminium(III)potassium sulphate hydrate-12

Answer: B

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46. The IUPAC name of $\left[Ni(CO)_4\right]$ is

A. tetracarbonylnickel(I)

B. tetracarbonylnickel(0)

C. tetracarbonylnickel(II)

D. tetracarbonylnickel(III)

Answer: B

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47. The correct IUPAC name of $AlCl_3.4(Et. OH)$ is

A. aluminium(II) chloride-4-ethanol

B. aluminium(III) chloride-4-ethanol

C. aluminium(IV) chloride-4-hydroxyethane

D. aluminium chloride-4-ethanol

Answer: B

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48. IUPAC name of complex $K_3\left[Al\left(C_2O_4\right)_3\right]$ is

A. potassium aluminooxalate

B. potassium alumino(III)oxalate

C. potassium trioxalatoaluminate

D. potassium tripxalatoaluminate(III)

Answer: D

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49. In octaamine -μ-dihydroxodiiron(III)sulphate, the number of bridging ligands is:

A. 2

B. 1

C. 3

D. None

Answer: A

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50. The correct $IUPAC$ name of $\left[Mn_3(CO)_{12}\right]$ is .

A. magneticdodecylcarbonyl(0)

B. dodecarbonylmanganate(0)

C. dodecarbonylmangemic(II)

D. dodecacarbonyltrimanganese(0)

Answer: D

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51. The $IUPAC$ name of the complex having formula

$\left[(CO)_3Fe(CO)_3Fe(CO)_3\right]$ is .

A. monocarbonylferrate(0)

B. tricarbonyliron(0)-μ-tricarbonyliron(0)

C. tri-μ-carbonylbis-{tricarbonyliron(0)}

D. hexacarbonyl-μ-tricarbonyliron(III).

Answer: C

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52. Sodium pentacyanoitrosylferrate(II) is also called

A. sodium cobaltnitrite

B. sodium nitroprusside

C. sodium ferrocyanide

D. sodium sulphocyanide

Answer: B

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53. What is the name of the complex $\left[Al(OH)_2\left(H_2O\right)_4\right]SO_4$?

A. bis(tetrahydroxo)dioxaaminate(III)sulphate

B. dihydroxotetrahydridealuminium(III)sulphate

C. tetraaquodihydroxoaluminium(III)sulphate

D. tetraaquodihydroxyaluminium(IV)sulphate.

Answer: C

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

A. linkage isomerism

B. ionisation isomerism

C. co-ordination isomerism

D. No isomerism

Answer: D

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55. Which one of the following will be able to show geometrical isomerism ?

A. MA_3B (Square planer)

B. MA_2B_2 (Tetrahedral)

C. MABCD (Square planer)

D. MABCD (Tetrahedral).

Answer: C

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56. The type of isomerism shown by $\left[Co(en)_2(NCS)_2\right]Cl$ and $\left[Co(en)_2(NCS)Cl\right]NCS$ is:

A. co-ordination

B. ionisation

C. linkage

D. all the above

Answer: B

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57. The following isomers refer to $\left[\left\{\left(C_6H_5\right)_3P\right\}_2 Pd(SCN)_2\right]$ and $\left[\left\{\left(C_6H_5\right)_3P\right\}_2 Pd(NCS)_2\right]$

A. Linkage isomersm

B. Co-ordination isomerism

C. Ionisation isomerism

D. Geometrical isomerism

Answer: A

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58. Which of the following compound would exhibit co-ordination isomerism?

A. $\left[Cr\left(H_2O\right)_6\right]Cl_3$

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

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

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

Answer: B

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59. The kind of isomerism exhibited by $\left[Rh(en)_2Cl_2\right]\left[Ir(en)Cl_4\right]$ and $\left[Ir(en)_3\right]\left[RhCl_6\right]$ is

A. Linkage isomerism

B. Ionisation isomerism

C. co-ordination isomerism

D. Position isomerism.

Answer: C

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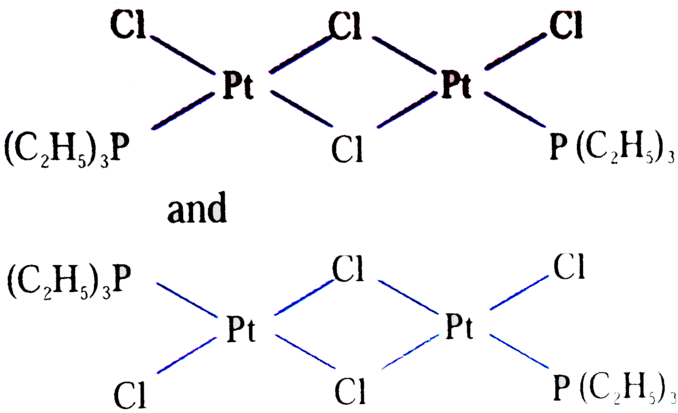
60. The Complexes given below show:



A. optical isomerism

B. co-ordination isomerism

C. geometrical isomerism

D. bridged isomerism.

Answer: C

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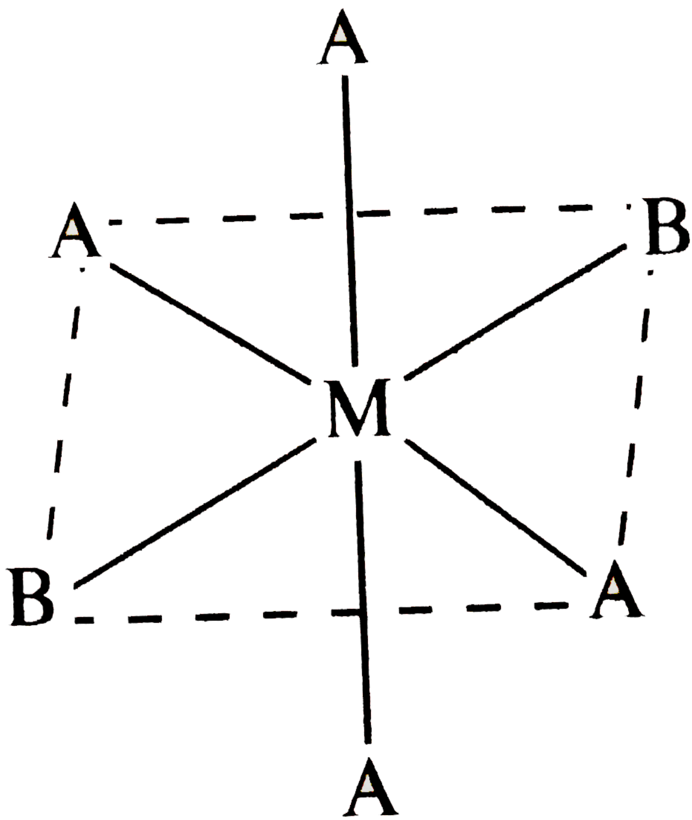
61. The isomer can be marked as



A. dextro isomer

B. laevo isomer

C. cis isomer

D. trans isomer

Answer: D

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62. The compounds $\left[Cr\left(H_2O\right)_6\right]Cl_3$ and $\left[Cr\left(H_2O\right)_4Cl_2\right]Cl.2H_2O$ represent

A. Linkage isomerism

B. Hydrate isomerism

C. Ligand isomerism

D. None of these

Answer: B

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63. Which isomerism is exhibited by

$$\left[Co\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3?$$

A. Linkage isomerism

B. cis-trans isomerism

C. Co-ordination isomerism

D. None of these

Answer: B

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64. Fac, mer isomerism is associated with which of the following general formula ?

A. $M(AA)_2$

B. $M(AA)_3$

C. MABCD

D. MA_3X_3.

Answer: D

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65. The tetrhedral complex, bis(benzoylacetonato)beryllium(II) will show

A. geometrical isomerism

B. optical isomerism

C. structural isomerism

D. No isomerism.

Answer: B

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66. One among the following complex ions will not show optical activity

A. $\left[Pt(Br)(Cl)(I)\left(NO_2\right)\left(C_5H_5N\right)\left(NH_3\right)\right]^-$

B. cis - $\left[Co(en)_2Cl_2\right]^+$

C. $\left[Co(en)\left(NH_3\right)_2Cl_2\right]^+$

D. $\left[Cr\left(NH_3\right)_4Cl_2\right]^+$

Answer: D

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67. Of the following complex which one will show co-ordination isomerism ?

A. $\left[Cr\left(NH_3\right)_6\right]\left[Co(en)_3\right]$

B. $\left[Cr\left(NH_3\right)_6\right]Cl_2$

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

D. $\left[Cr(en)_2Cl_2\right]^+$

Answer: A

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68. The planar complex Mabcd gives

A. Two optical isomers

B. Two geometrical isomers

C. Three optical isomers

D. Three geometrical isomers.

Answer: D

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69. Which of the following complexes can form d and l isomers ?

A. $\left[Co\left(NH_3\right)_4Cl_3\right]^+$

B. $\left[Co\left(NH_3\right)_2Cl_3\right]$

C. trans-$\left[Co(en)_2Cl_2\right]$

D. cis-$\left[Co(en)_2Cl_2\right]^+$

Answer: D

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70. Out of the following which will not show geometrical isomerism ?

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

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

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

D. $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

Answer: B

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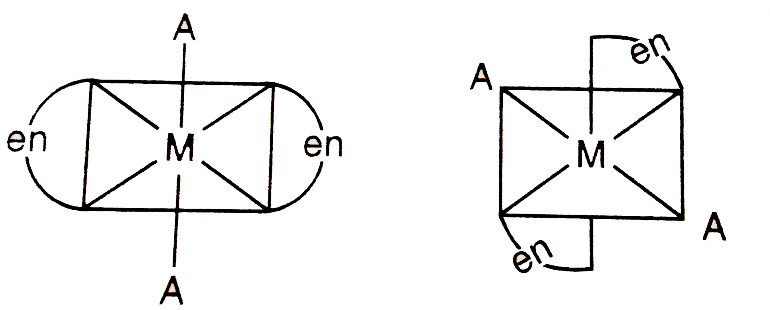
71. The two complexes given given below are



A. Geometrical isomers

B. Position isomers

C. Optical isomers

D. Identical

Answer: D

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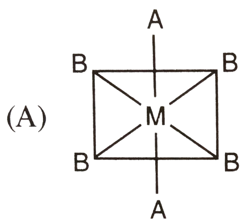
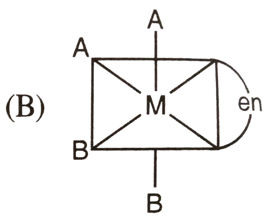
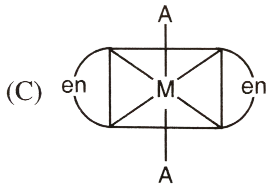
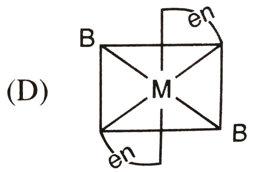
72. The phenomenon of optical activity will be shown by:

A. 

B. 

C. 

D. 

Answer: B

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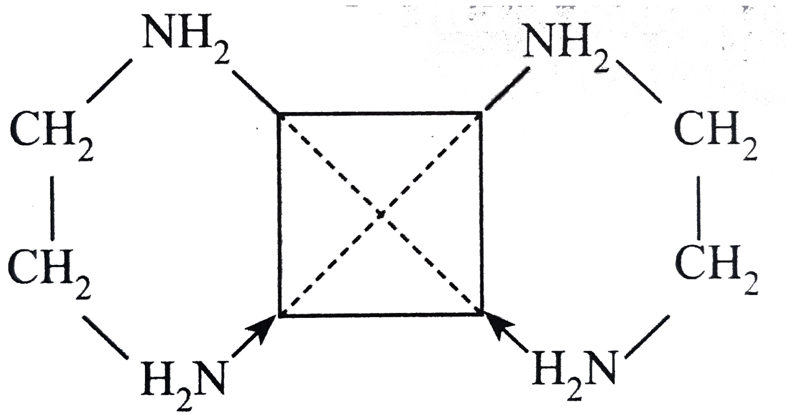
73. A square planar complex represented as:



A. Geomtrical isomerism

B. optical isomerism

C. Linkage isomerism

D. No isomerism

Answer: D

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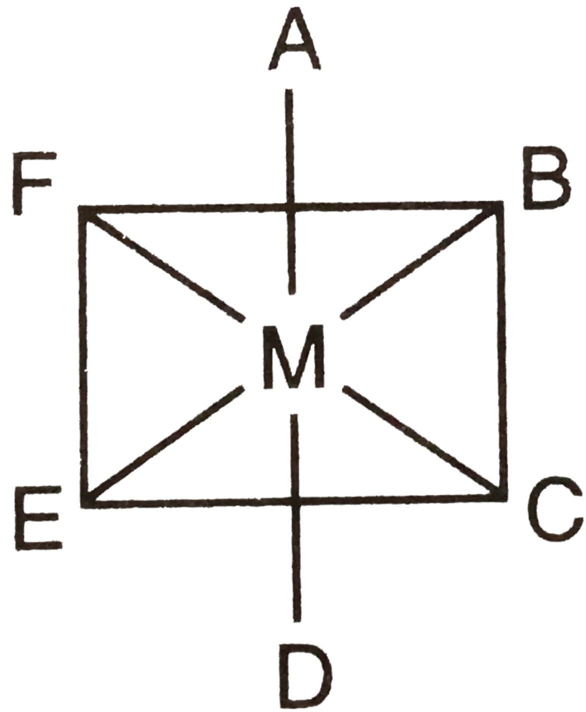
74. The complex show below can exhibit



A. Optical isomerism only

B. Geometrical isomerism only

C. Both optical and geometrical isomerism

D. No isomerism.

Answer: C

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75. Aqueous solution of nickel sulphate on treating with pyridine and then adding a solution of sodium nitrite gives derk blue crystals of

A. $\left[Ni(py)_4\right]SO_4$

B. $\left[Ni(py)_2\left(NO_2\right)_2\right]$

C. $\left[Ni(py)_4\left(NO_2\right)_2\right]$

D. $\left[Ni(py)_3\left(NO_2\right)_2SO_4\right]$

Answer: C

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76. Which of the following cations does not form complex with ammonia?

A. Ag^{+}

B. Cu^{2+}

C. Cd^{2+}

D. Na^{+}

Answer: D

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77. When ammonia is added to green aqueous solution of nickel (II) sulphate, the colour of the solution changes to the violet. This is caused by

A. nickel ion undergoing a change in oxidation state

B. ammonia molecules replacing water molecules surrounding nickel

C. change in co-ordination number of nickel

D. change in pH value of the solution.

Answer: B

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78. A complex of platinum, ammonia and chloride produces four ions per molecule in the solution. The structure consistent with the observation is:

A. $\left[Pt\left(NH_3\right)_6Cl_4\right.$

B. $\left[Pt\left(NH_3\right)_2Cl_4\right]$

C. $\left[Pt\left(NH_3\right)_5Cl\right]Cl_3$

D. $\left[Pt\left(NH_3\right)_4Cl_2\right]Cl_2$

Answer: C

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79. Blue solution of $CuSO_4$ becomes darker when treated with ammonia because

A. Ammonia molecule replaces water molecule in solution

B. Ammonia is stronger ligand than water

C. Ammonia is highly soluble in water

D. None of the above.

Answer: B

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80. According to Werner's theory, the secondary valencies of the central metal atom correspond to its

A. oxidation state

B. co-ordination number

C. any of the (A) or (B)

D. neither of the two.

Answer: B

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81. K_3CoF_6 is high spin complex. What is the hybrid state of Co atom in the complex ?

A. sp^3d

B. sp^3d^2

C. d^2sp^3

D. dsp^2

Answer: B

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82. Hexafluorocbaltate(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

Answer: D

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83. Tetraaminecopper (II) ion is a square planar complex with one unpaired electron. According to valence bond theory the hybrid state of copper should be

A. sp^3

B. sp^2

C. dsp^2

D. None of above.

Answer: C

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84. CuCl is sparingly soluble in water but it dissolves in KCl solution due to the formation of

A. $K_2\left[CuCl_4\right]$

B. $K_2[CuCl_4]$

C. $K[CuCl_2]$

D. None of the above.

Answer: A

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85. Hexafluorocbaltate (III) ion is an outer orbital complex. The number of unpaired electrons present in it is

A. 1

B. 5

C. 4

D. unpredictable.

Answer: B

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86. Which of the following system has maximum number of the unpaired electrons in an inner octahedral complex?

A. d^4

B. d^9

C. d^7

D. d^5

Answer: A

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87. Which of the following complex species involves d^2sp^3 hybridisation?

A. $\left[CoF_6\right]^{3-}$

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

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

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

Answer: C

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88. A complex involving dsp^2 hybridisation has

A. square planar geometry

B. a tetrahedral geometry

C. an octahedral geometry

D. trigonal planar geometry

Answer: A

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89. An octahedral complex is formed when hybrid orbitals of the following type are involved

A. sp^3

B. dsp^2

C. sp^3d^2

D. sp^3d

Answer: C

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

A. the tetrahedral configuration with one unpaired electron configuration

B. square planar configuration with one unpaired electrons

C. tetrahedral configuration with all electrons paired

D. square planar configuration will all electrous paired.

Answer: B

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91. Which of the following square planar complexes will form two geometrical isomers?

A. MA_4

B. MA_3B

C. MA_2B_2

D. MAB_3

Answer: C

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92. In the complex $Fe(CO)_x$, the value of x is

A. 3

B. 4

C. 5

D. 6

Answer: C

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93. Which among the following complexes has square pyramidal geometry ?

A. tatracarbonylnickel(0)

B. hexaamminecobalt(II) nitrate

C. pentacarbonyliron(0)

D. bis(acetylacetonato)oxovanadium(IV).

Answer: D

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94. Which of the following is paramagnetic?

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

B. $K_3[Fe(CN)_6]$

C. $Ni(CO)_4$

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

Answer: B

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95. The hybridisation of nickel in tetracarbonyl nickel is

A. dsp^2

B. sp^3

C. sp^3d

D. sp^3d^2

Answer: B

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96. In the conplex $\left[Ni(H_2O)_2(NH_3)_4\right]^{2+}$ the number of unpaired electrons is

A. 0

B. 1

C. 3

D. 2

Answer: D

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97. According to Werner's theory, the primary valencies of the central metal atom

A. are satisfied by negative ions

B. are satisfied by negative ions or neutral molecule

C. decide the geometry of the complex

D. are equal to its coordination number.

Answer: A

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98. Which of the following cations does not form complex with ammonia?

A. Al^{3+}

B. Ag^{+}

C. Cu^{2+}

D. Cd^{2+}

Answer: A

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99. Which of the following pairs contains only tetrahedral complexes ?

A. $[ZnCl_4]^{2-}$ and $[MnCl_4]^{2-}$

B. $[Zn(NH_3)_4]^{2+}$ and $[Cu(NH_3)_4]^{2+}$

C. $[MnCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$

D. $\left[ZnCl_4\right]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$

Answer: A

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100. The EAN of Ni in $\left[Ni(CN)_4\right]^{2-}$ is

A. 34

B. 35

C. 36

D. 28

Answer: A

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101. $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is a square planar complex.The number of unpaired electrons and hybrid state of copper are respectively

A. 4, dsp^2

B. 1, sp^2

C. 1, dsp^2

D. 4s, sp^3

Answer: C

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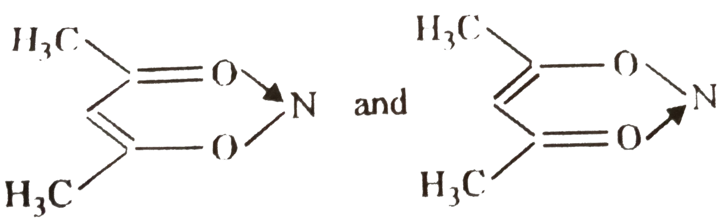
102. The compounds shown below are



A. Linkage isomers

B. Resonating forms

C. Tautomers

D. Coordination isomers

Answer: B

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103. Which of the following complexes involves d^2sp^3 hybridization ?

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

B. $[Co(NH_3)_6]^{2+}$

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

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

Answer: C

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104. Which of the following hybrid state is associated with low spin complex?

A. sp^3

B. sp^3d^2

C. d^2sp^3

D. sp^3d

Answer: C

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105. Hexafluorocobaltate (III) ion is a high spin complex. The hybrid state of cobalt is

A. d^2sp^3

B. sp^3d^2

C. dsp^2

D. sp^3d

Answer: B

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106. Which of the following is correct value of n in $Cr(CO)_n$?

A. 2

B. 4

C. 6

D. Unpredictable.

Answer: C

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107. Which statement about coordination number of a cation is true ?

A. Metal ions exhibit only a single characteristic coordination number

B. The coordination number is equal to the number of ligands bonded to the metal atom

C. The coordination is determined solely by the number of empty d-orbitals in the atom

D. C.N. is equal to the number of coordinate bonds between metal cation and ligands.

Answer: D

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108. In the complex $PtCl_4.3NH_3$ the number of ionisabel chlorines is

A. Four

B. Two

C. One

D. Three

Answer: C

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109. Which of the following metals from polynuclear complex ?

A. Na

B. Mg

C. Mn

D. All

Answer: C

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110. The correct formula of Zeise's salt is

A. $\left[PyCl_3.\ C_2H_6\right]^- K^+$

B. $\left[PtCl_2.\ \left(C_2H_2\right)_2\right]^- K^+$

C. $K^+\left[PtCl_3.\ C_2H_4\right]^-$

D. $\left[PtCl_3.\ C_6H_6\right]^- K^+$

Answer: C

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111. Which of the following is not an example of organometallic compound?

A. trimethylboron

B. trimethylaluminium

C. trimethoxytitanium chloride

D. tetracarbonylnickel

Answer: C

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112. One among the following is not an organometallic compound

A. trimethylboron

B. trimethylorthoborate

C. diethylmagnesium

D. butylethylmercury.

Answer: B

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113. Wilkinson's catalyt is

A. $TiCl_4$ and $Al(C_2H_5)_3$

B. $[(C_6H_5)_3P]_3RhCl$

C. $TiCl_4$ and $(C_6H_5)_3P$

D. $Al(C_2H_5)_3$, $TiCl_4$ and $(C_6H_5)_3P$

Answer: B

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114. Hypo is used in photography because of its

A. a strong oxidising agent

B. a strong reducing agent

C. a strong complexing agent n

D. None of the above.

Answer: C

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115. From the stability constant (hypothetical vlues) , given below, predict which is the most stable complex ?

A. $Cu^{2+} + 4NH_3 \Leftrightarrow \left[Cu\left(NH_3\right)_4\right]^{2+}$

$K = 4.5 \times 10^{11}$

B. $Cu^{2+} + 4CN \Leftrightarrow \left[Cu(CN)_4\right]^{2-}$

$K = 2.0 \times 10^{27}$

C. $Cu^{2+} + 2en \Leftrightarrow \left[Cu(en)_2\right]^{2+}$

$K = 3.0 \times 10^{15}$

D. $Cu^{2+} + 4H_2O \Leftrightarrow \left[Cu\left(H_2O\right)_4\right]^{2+}$

$K = 9.5 \times 10^8$

Answer: D

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116. Organometallic compound used in the purification of its metals is

A. $Ni(CO)_4$

B. $Pb\left(C_2H_5\right)_4$

C. $Li - C_4H_9$

D. $Na_2\left[Ni(CN)_4\right]$

Answer: A

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117. Hardness of water is estimated by simple tirtration with

A. Conductivity method

B. EDTA method

C. Titrimetric method

D. Distillation method.

Answer: B

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118. Ferrocene is

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

B. $Fe\left(\eta^2 - C_5H_5\right)_2$

C. $Cr\left(\eta^5 - C_5H_5\right)_5$

D. $Os\left(\eta^5 - C_5H_5\right)_2$

Answer: A

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119. The incorrect among the following is

A. pyridine is a monodentate ligand

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

C. organometallic compounds contain at least one metal-carbon bond

D. The oxidation state of nickel in $\left[Ni(CO)_4\right]$ is zero.

Answer: B

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120. A reagent used for identifying nickel ion is:

A. Potassium ferrocyanide

B. Phenolphthalein

C. Dimethylglyoxime

D. Neutral ferric chloride

Answer: C

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121. Ziegler-Natta catalyst is

A. Solution of $SnCl_4 +$ trialkylaluminium

B. Solution of $TiCl_4 +$ trialkylaluminium

C. Solution of $TiCl_4 +$ trialkylchromium

D. Solution of $SnCl_4 +$ Tollen's reagent.

Answer: B

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122. If NH_4OH is added to the $\left[PtCl_4\right]^{2-}$ ion, the complex formed represents

A. zero dipole

B. finite dipole

C. infinite dipole

D. All of the above.

Answer: B

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123. The complex $CoCl_3, 3NH_3$ ionizes to give

A. $2Cl^-$ ion

B. $1Cl^-$ ion

C. $3Cl^-$ ion

D. $0Cl^-$ ion.

Answer: D

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124. The complex in which the number of unpaired electrons is zero is

A. $\left[TiF_6\right]^{3-}$

B. $\left[CoF_6\right]^{3-}$

C. V_2O_5

D. None of the above.

Answer: C

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125. The colour of $\left[Ti\left(H_2O\right)_6\right]^{3+}$ is due to

A. Transfer of an electron from one Ti to another

B. Presence of water molecule

C. Excitation of electrons from$d \rightarrow d$

D. Intra molecular vibration.

Answer: C

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126. Magnus's green salt has the formula

A. $\left[Pt\left(NH_3\right)_4\right]^{2+}\left[PtCl_4\right]^{2-}$

B. $K_2Pt(CN)_6$

C. $\left[PtCl_4\right]^{2+}$

D. $\left[Cu\left(NH_3\right)_4\right]^{2+}\left[PtCl_4\right]^{2-}$

Answer: A

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127. Which of the following will not give the chemical tast for iron in aqueous solution ?

A. $K_2Fe_2SO_4.24H_2O$

B. $\left(NH_4\right)_2SO_4.\ FeSO_4.6H_2O$

C. $K_3\left[FeF_6\right]$

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

Answer: C

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128. In which of the follwing pair the EAN of central metal atom is not same ?

A. $\left[Fe(CN)_6\right]^{3-}$ and $\left[Fe(CN)_6\right]^{4-}$

B. $[Cr(NH+)3))_6]^{3+}$ and $\left[Cr(CN)_6\right]^{3-}$

C. $\left[FeF_6\right]^{3-}$ and $\left[Fe(CN)_6\right]^{3-}$

D. $\left[Ni(CO)_4\right]$ and $\left[Ni\left(NH_3\right)_4\right]$

Answer: A

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129. Name the metal M which is extracted on the basis of following reactions :

$4M + 8CN^- + 2H_2O + O_2 \rightarrow 4\left[M(CN)_2\right]^- + 4OH^-$

$2\left[M(CN)_2\right]^- + Zn \rightarrow \left[Zn(CN)_4\right]^{2-} + 2M$

A. Nickel

B. Silver

C. Copper

D. Mercury

Answer: B

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130. From the following given co-ordination compounds find the odd one out

$\left[Ag\left(NH_3\right)_2\right]^+, \left[AgCl_2\right]^-, \left[Ag\left(CN_2\right]^-, \left[Ag(CN)_4\right]^{2-}$

A. $\left[Ag\left(NH_3\right)_2\right]^+$

B. $\left[AgCl_2\right]^-$

C. $\left[Ag(CN)_2\right]^-$

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

Answer: D

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131. E.D.T.A. is generally a

A. monodentate ligand

B. bidentate ligand

C. tetradentatc ligand

D. hexadentate ligand

Answer: D

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132. $Fe_2(CO)_9$ is diamagnetic. Which of the following reasons is correct?

A. Presence of one CO as bridge group

B. Presence of monodentate ligand

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

D. Resonance hybridization of CO.

Answer: C

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133. The compounds $\left[Co\left(NO_2\right)\left(NH_3\right)_5\right]Cl_2$ and $\left[Co(ONO)\left(NH_3\right)_5\right]Cl_2$ are examples of

A. Geometrical isomers

B. Linkage isomers

C. Ligand isomers

D. Ionisation isomers

Answer: B

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134. A complex MA_3X_3. Where A and X are unidentate ligands may give

A. two geometrical isomers

B. three geometrical isomers

C. two geometrical isomers which can be resolved into a pair of enantiomers

D. two geometrical isomers one of which can be resolved into a pair of enantiomers .

Answer: A

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REVISION QUESTIONS

1. Which of the following ligands is a bidentate?

A. EDTA

B. Ethylenediamine

C. Acetate

D. Pyridine

Answer: B

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2. The green pigment present in plants , chlorophyll contains the metal

A. Al

B. Fe

C. Mg

D. Ca

Answer: C

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3. The effective atomic number of Cr(at. No. 24) in $\left[Cr\left(NH_3\right)_6\right]Cl_3$ is

A. 35

B. 27

C. 33

D. 36

Answer: C

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4. In which there is outer orbital hyridisation

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

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

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

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

Answer: D

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5. The oxidation number of Pt in $\left[Pt\left(C_2H_4\right)Cl_3\right)]^{\ominus}$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: B

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6. Ligands in a complex salt are:

A. anions ilnked by coordinate bonds to a central metal atom or ion

B. cations linked by coordinate bonds to a central metal or ion

C. molecules linked by coordinate bonds to a central metal or ion

D. ions or molecules linked by coordinate bond to a central atom or ion .

Answer: D

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7. A group of atoms can function as a ligand only when :

A. It is a small molecule

B. It has an unshared electron pair

C. It is a negatively charged ion

D. It is a positively charged ion.

Answer: B

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8. A solution of potassium ferrocyanide would contain â€¦.ions

A. 2

B. 3

C. 4

D. 5

Answer: D

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9. The coordination number of copper in cuprammonium sulphate is

A. 2

B. 3

C. 4

D. 6

Answer: C

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10. $K_4[Fe(CH)_6]$ is called

A. potassium hexacyanoferrate (II)

B. potassium ferricyanide

C. potassium hexacyanoferrate(III)

D. prussian blue.

Answer: A

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11. The complex $CoCl_3, 3NH_3$ ionizes to give

A. $2Cl^-$ ions

B. $1Cl^-$ ion

C. $3Cl^-$ ions

D. $NoCl^-$ ion

Answer: D

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12. AgCl dissolves in NH_4OH due to the formation of

A. $\left[Ag\left(NH_4\right)_2\right]Cl$

B. $\left[Ag\left(NH_4\right)_3\right]Cl$

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

D. $\left[Ag\left(NH_3\right)_2\right]OH.$

Answer: C

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13. In any ferric salt on adding potassinum ferrocyanide, a prussian blue colour is obtanied, which is mainly due to the formation of

A. $K_3[Fe(CN)_6]$

B. $Kfe[Fe(CN)_6]$

C. $FeSO_4.\ Fe(CN)_6$

D. $Fe_4[Fe(CN)_6]_3.$

Answer: B

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14. The formula of carnallite is

A. Simple salt

B. Douboe salt

C. Alum

D. Coordination compound

Answer: B

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15. The formula of sodium nitroprusside is

A. $Na_4\left[Fe(CN)_5NOS\right]$

B. $Na_2\left[Fe(CN)_5NO\right]$

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

D. $Na_2\left[Fe(CN)_6NO_2\right]$.

Answer: B

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16. Which complex has square planer structure ?

A. $Ni(CO)_4$

B. $\left[NiCl_4\right]^{2-}$

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

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

Answer: D

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17. Structural isomers are the isomers that have the same molecular formula, that differ in the bonding patterns and atomic organization. Structural isomerism is subdivided as Ionization Isomerism, hydrate isomerism and linkage isomerism.

Ionisaton isomers occur because of the formation of different ions in a solution

Ionization isomers are coordination compounds that have 2 different ligands swapped between the inner and the outer coordination spheres. In the special case when one of these ligands is a water molecule, the isomerism is called hydrate isomerism

Linkage isomers are two or more coordination compounds in which the donor atom of at least one of the ligands is different (i.e., the connectivity between atoms is different).

$\left[Co\left(NH_3\right)_5Br\right]SO_4$ and $\left[Co\left(NH_3\right)_5SO_4\right]Br$ are examples of which of the following type of isomerism ?

A. Linkage

B. Geometrical

C. Ionisation

D. Optical.

Answer: C

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18. Structural isomers are the isomers that have the same molecular formula, that differ in the bonding patterns and atomic organization. Structural isomerism is subdivided as Ionization Isomerism, hydrate isomerism and linkage isomerism.

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Linkage isomers are two or more coordination compounds in which the donor atom of at least one of the ligands is different (i.e., the connectivity between atoms is different).

$\left[Co\left(NH_3\right)_6\right]\left[Cl_2NO_2\right.$ and $\left[CO\left(NH_3\right)_4Cl\left(NO_2\right)Cl\right.$ exhibit which type of isomersim ?

A. Geometrical

B. Optical

C. Linkage

D. Ionisation

Answer: D

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19. Which of the following complex will show geometrical as well as opitcal isomerism?

(en= ethylendiamine)

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

B. $\left[Pt\left(NH_3\right)Cl_4\right]$

C. $\left[Pt(en)_3\right]^{4+}$

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

Answer: D

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20. Which of the following is odd one out ?

A. Potassium ferricyanide

B. ferrous ammonium sulphate

C. potassium ferrocyanide

D. tetraamminecopper(II) sulphate.

Answer: B

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21. The formula of dichlorobis (urea) copper (II) is

A. $\left[Cu\left\{O=C\left(NH_2\right)_2\right\}_2\right]Cl_2$

B. $\left[CuCl_2\left\{O=C\left(NH_2\right)_2\right\}_2\right]$

C. $\left[Cu\left\{O=C\left(NH_2\right)_2\right\}Cl\right]Cl$

D. $\left[CuCl_2\left\{O = C\left(NH_2\right)_2\right\}H_2\right]$

Answer: B

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22. Which of the following is organo-metallic compound ?

A. $Ti\left(C_2H_4\right)_4$

B. $Ti\left(OC_2H_5\right)_4$

C. $Ti\left(OCOCH_3\right)_4$

D. $Ti\left(OC_6H_5\right)_4$

Answer: A

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23. The oxidation state of Fe in brown complex $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: A

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24. In the compound lithium tetrahydridoaluminate, the ligand is

A. A^{+}

B. H

C. H^{-}

D. None of these

Answer: C

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25. In which of the following coordinate compounds the central metal atom obeys the EAN rule.

A. All

B. $K_3[Fe(CN)_6]$

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

D. $[Cu(NH_3)_4]SO_4$

Answer: C

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26. Which of the following is paramagnetic?

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

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

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

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

Answer: C

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27. Which of the following has square planar structure ?

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

B. $\left[NiCl_4\right]^{2+}$

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

D. `All of these.

Answer: C

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28. The unpaired electrons in $Ni(CO)_4$ are

A. Zero

B. One

C. Three

D. Four.

Answer: A

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29. Which of the following compounds is not coloured ?

A. $Na2[CuCl_4]$

B. $Na_2[CdCl_4]$

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

D. $K_3[Fe(CN)_6]$

Answer: B

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

A. 2

B. 3

C. 4

D. 0

Answer: A

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31. Which is paramagnetic ?

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

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

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

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

Answer: A

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32. Which is not a π bonded complex

A. Zeise's salt

B. Ferrocene

C. Dibenzene chromium

D. Tetraethy lead.

Answer: D

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33. The total number possible isomers for the complex compound $\left[Cu^{II}\left(NH_3\right)_4\left[Pt^{II}CI_4\right]\right.$ are

A. 3

B. 6

C. 5

D. 4

Answer: D

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34. A coordination compound of cobalt has the molecular, formula containing five ammonia molecules, one nitro group and two chlorine atoms for onew cobalt atom. One mole of this compounds three ions in an aqueous solution. On reacting this solution with excess of $AgNO_3$ solution, we get two moles of AgCl precipitate. The ionic formula for this complex would be

A. $\left[Co\left(NH_3\right)_4NO_2Cl\right]\left[\left(NH_3\right)Cl\right]$

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

C. $\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]Cl_2$

D. $\left[Co\left(NH_3\right)\right]_5.\left[\left(NO_2\right)_2Cl_2\right].$

Answer: C

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35. Which of the following species represent the example of dsp^2-hybridisation ?

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

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

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

D. $\left[FeF_6\right]^{3-}$

Answer: B

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36. Which of the following complexes will have four isomers ?

A. $\left[Co(en)\left(NH_3\right)_2Cl_2\right]Cl$

B. $\left[Co\left(PPh_3\right)_2\left(NH_3\right)_2Cl_2\right]Cl$

C. $\left[Co(en)_3\right]Cl_3$

D. $\left[Co(en)_2Cl_2\right]Cl.$

Answer: A

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37. The correct structure of $Fe(CO)_5$ is (Z= 26 for Fe)

A. Octahedral

B. Tetrahdral

C. Square pyramidal

D. Trigonal pyramidal

Answer: C

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38. Chemical formula for in iron(III) hexacyanoferrate(II) is

A. $Fe^{3} \wedge + \left[Fe(CN)_6\right]^{4} \wedge$ -

B. $Fe_3\left[Fe(CN)_6\right]$

C. $Fe_3\left[Fe(CN)_6\right]_4$

D. $Fe_4\left[Fe(CN)_6\right]^3$

Answer: D

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39. The shape of $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is

A. tetrahedral

B. square planar

C. pyramidal

D. octahedral

Answer: B

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40. The EAN of iron in $\left[Fe(CN)_6\right]^{3-}$ is

A. 34

B. 36

C. 37

D. 35

Answer: D

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41. $CuSO_4$ dissolves in NH_3 due to formation of

A. $Cu(OH)_2$

B. $\left[Cu\left(NH_3\right)_4\right]SO_4$

C. $\left[Cu\left(NH_3\right)_4(OH)_2\right]$

D. CuO.

Answer: B

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42. Which one of the following is an example of octahedral complex ?

A. $\left[FeF_6\right]^{3-}$

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

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

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

Answer: A

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

A. double salt

B. complex compound

C. neutral molecule

D. none of thes .

Answer: B

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44. Which of the following is paramagnetic?

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

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

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

D. $\left[CoF_6\right]^{3-}$

Answer: D

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45. Magnesium is an important component of which biomolecule occuring extensively in living world?

A. Haemoglobin

B. Chlorophyll

C. Florigen

D. ATP

Answer: B

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46. The valency of Cr in the complex $\left[Cr\left(H_2O\right)_4Cl_2\right]^+$

A. 1

B. 3

C. 5

D. 6

Answer: B

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47. Which of the following is expected to be a paramagnetic complex?

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

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

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

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

Answer: A

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48. IUPAC name of $Na_3\left[Co\left(NO_2\right)_6\right]$ is

A. sodium cobaltnitrite

B. sodium hexanitritocobaltate(III)

C. sodium hexanitrocobalt(III)

D. sodium hexanitrocobaltate(III)

Answer: D

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49. According to the postulates of Werner for cooedination compounds

A. Primary valency is ionizable

B. Secondary valency is ionizable

C. Primary and secondary valencies are nonionizable

D. Only primary valency is non-ionizable.

Answer: A

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50. Correct formula of the complex formed in the brown ring test for nitrates is

A. $FeSO_4 . NO$

B. $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$

C. $\left[Fe\left(H_2O\right)_5NO\right]^{+}$

D. $\left[Fe\left(H_2O\right)_5NO\right]^{3+}$

Answer: B

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51. AgCl is soluble in NH_4OH solution. The solubility is due to the formation of

A. AgOH

B. Ag_2O

C. $\left[Ag\left(NH_3\right)_2\right]^+$

D. NH_4Cl

Answer: C

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52. The number of isomers exhibited by $\left[Cr\left(NH_3\right)_3Cl_3\right]$ is

A. 2

B. 3

C. 4

D. 5

Answer: A

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53. For the square planar complex [M(a) (b) (c) (d)] (where M = central meatal and a, b, c and d are monodentate ligands), the number of possible geometrical isomers are

A. 1

B. 2

C. 3

D. 4

Answer: C

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54. Which of the following will exhibit optocal isomerism ?

A. $\left[Cr(en)\left(H_2O\right)_4\right]^{3+}$

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

C. trans-$\left[Cr(en)\left(Cl_2\right)\left(NH_{3\,-}\,(2)\right]^+$

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

Answer: B

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55. In Zeigler-Natta polymerisation of ethylene, the active species is

A. $AlCl_3$

B. Et_3Al

C. CH_2CH_2

D. Ti^{III}

Answer: D

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56. Some salts although containing two different metallic elements give test for one of them in solution. Such salts are:

A. Complex salts

B. Double salts

C. Normal salts

D. None .

Answer: A

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57. Which of the following will give maximum number of isomer ?

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

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

C. $\left[Ni\left(C_2O_4\right)(en)_2\right]$

D. $\left[Cr(SCN)_2\left(NH_3\right)_4\right]^{2+}$

Answer: D

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58. Coordination number of Ni in $\left[Ni\left(C_2O_4\right)_3\right]^{4-}$ is:

A. 3

B. 6

C. 4

D. 5

Answer: B

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59. Which of the following organometallic compound is σ and π-bonded?

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

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

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

D. $Al\left(CH_3\right)_3$

Answer: C

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60. Which statement is incorrect ?

A. $Ni(CO)_4$- Tetrahedral, paramagnetic

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

C. $Ni(CO)_4$-Tetrahedral, diamagnetic

D. $\left[NiCl_4\right]^{2-}$ - Tetrahedral. Paramagnetic.

Answer: A

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61. Which of the following will exhibit maximum ionic conductivity?

A. $K_4\left[Fe(CN)_6\right]$

B. $\left[Co\left(NH_3\right)_6Cl_3\right.$

C. $\left[Cu\left(NH_3\right)_4\right]Cl_2$

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

Answer: A

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62. EAN of iron in $K_4\left[Fe(CN)_6\right]$ is

A. 1

B. 2

C. 3

D. 4

Answer: B

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63. The compounds $\left[PtCl_2\left(CH_3\right)_4\right]Br_2$ and $\left[PtBr_2\left(NH_3\right)_4\right]Cl_2$ constitutes a pair of

A. Coordination isomers

B. Linkage isomers

C. Ionization isomers

D. Hydrate isomers

Answer: C

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64. The coordination number of Fe (II) in oxyhaemoglobin is

A. 6

B. 4

C. 8

D. 10

Answer: A

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65. In $\left[Co\left(NH_3\right)_6\right]Cl_3$,the number of covalent bonds is

A. 3

B. 6

C. 9

D. 18

Answer: D

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66. Which of the following compounds exhibits linkage isomerism?

A. $\left[Co(en)_3\right]Cl_3$

B. $\left[Co\left(NH_3\right)_6\right]\left[Cr(en)_3\right]$

C. $\left[Co(en)_2NO_2Cl\right]Br$

D. $\left[Co\left(NH_3\right)_5Cl\right]Br_2$

Answer: C

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67. The oxidation number of cobalt in $K\left[Co(CO)_4\right]$ is

A. $+1$

B. - 1

C. $+3$

D. - 3

Answer: C

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68. The IUPAC name of $K_3\left[Ir\left(C_2O_4\right)_3\right]$ is

A. potassium trioxalatoiridium(III)

B. potassium trioxalatoiridate(III)

C. potassium tris(oxalato)iridium(III)

D. potassium tris(oxalto)iridate(III)

Answer: B

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69. Chemical formula for in iron(III) hexacyanoferrate(II) is

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

B. $Fe_3\left[Fe(CN)_6\right]$

C. $Fe_3\left[Fe(CN)_6\right]_4$

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

Answer: B

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70. The effective atomic number of iron in $\left[Fe(CN)_6\right]^{3-}$ is

A. 34

B. 36

C. 37

D. 35

Answer: D

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71. The geometry of the compound $\left[Pt\left(NH_3\right)_2Cl_2\right]$ is

A. Square planar

B. Pyramidal

C. Tetrahedral

D. octahedral

Answer: A

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72. Which of the following cannot show linkage isomerism?

A. NO_2^-

B. SCN^-

C. CN^-

D. NH_3

Answer: D

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

A. potassium hexacyanoferrate (II)

B. potassium hexacyanoferrate(III)

C. hexacyanoferrate(III)

D. potassium ferricyanide

Answer: B

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74. The shape of cuprammonium ion is

A. Octahedral

B. Tetrahdral

C. Trigonal

D. Square planar

Answer: D

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75. Which of the following species represent the example of dsp^2-hybridisation ?

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

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

C. $\left[Ag(CN)_2\right]^{-}$

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

Answer: B

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76. Consider the following complex $\left[Co\left(NH_3\right)_5CO_3\right]ClO_4$

The coordination number, oxidation number number of d-electrons and number of unpaired d-electrons on the metal are respectively

A. 6, 3, 6, 0

B. 7, 2, 7, 1

C. 7, 1, 6, 4

D. 6, 2, 7, 3

Answer: A

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77. In $\left[Co\left(C_2O_4\right)_3\right]^{3-}$, the isomerism shown is .

A. Ligand

B. Optical

C. Geometrical

D. Ionization

Answer: B

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78. In the complex $\left[Fe\left(H_2O\right)_6\right]^{3+}$ $\left[Fe(CN)_6\right]^{3-}$ $\left[Fe\left(C_2O_4\right)_3\right]^{3-}$ and $\left[FeCl_6\right]^{3-}$, that complex that has highest stability is

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

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

C. $\left[Fe\left(C_2O_4\right)_3\right]^{3-}$

D. $\left[FeCl_6\right]^{3-}$

Answer: C

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79. The colour of $CoCl_3.5NH_3.\,H_2O$ is

A. Orange yellow

B. Orange

C. Green

D. Violet

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80. Atomic numbers of Cr and Fe are respectively 24 and 26. Which of the following is paramagnetic with the spin of the electron?

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

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

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

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

Answer: D

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81. The hypothetical complex triamminediaquachloridocobalt(III) chloride can be represented as :

A. $\left[CoCl\left(NH_3\right)_3\left(H_2O\right)_2\right]Cl_2$

B. $\left[Co\left(NH_3\right)_3\left(H_2O\right)Cl_3\right]$

C. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_2Cl\right]$

D. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3$.

Answer: A

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82. In the silver plating of copper, $K\left[Ag(CN)_2\right]$ is used instead of $AgNO_3$. The reason is

A. A thin layer of Ag is formed on Cu

B. More voltage is required

C. Ag^+ ions are completely removed form solution

D. Less availability of Ag^+ ions, as Cu cannot displace Ag from $\left[Ag(CN)_2\right]^-$ ion.

Answer: D

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83. Both geometrical and optical isomerism are shown by

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

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

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

D. $\left[Cr(ox)_3\right]^{3-}$

Answer: A

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84. The catalyst used for olefin polymerisation is

A. Ziegler-Natta catalyst

B. Wilkinson's catalyst

C. Pd-catalyst

D. Zeise's salt catalyst

Answer: A

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85. An example for a double salt is

A. Cuprammonium sulphate

B. Mohr's salt

C. Potassium ferricyanide

D. Cobalthexammine chloride.

Answer: B

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86. When $AgNO_3$ is added to a solution of $Co\left(NH_3\right)_5Cl_3$, the precipitate of AgCl shows two ionizable chloride ions. This means :

A. Two chlorine atoms satisfy primary valency and one secondary valency

B. One chlorine atom satisfies primary as well as secondary valency

C. Three chlorine atoms satisfy primary valency

D. Three chlorine atoms satisfy secondary valency.

Answer: A

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87. The oxidation number of Fe in $K_4[Fe(CN))(6)\Big]$ is

A. $+2$

B. $+6$

C. $+3$

D. $+4$

Answer: A

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88. Which one of the following will not show geometrical isomerism?

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

B. $\left[Cu(en)_2Cl_2\right]Cl$

C. $\left[Co\left(NH_3\right)_5NO_2\right]Cl_2$

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

Answer: C

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89. According to Lewis the ligands are

A. Acidic in nature

B. Basic in nature

C. Neither acidic nor basic

D. Some are acidic and others are basic.

Answer: B

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90. The most satble complex among the following is

A. $K_3\left[Al\left(C_2O_4\right)_3\right]$

B. $\left[Pt(en)_2\right]Cl_2$

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

D. $K_2[Ni(EDTA)]$

Answer: D

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91. A similarity between optical and geometrical isomerism is that

A. Each gives equal number of isomers for given compound

B. It in a compound one is present then so is the other

C. Both are included in stereoisomerism

D. They have no similarity

Answer: C

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

A. s, px, py, d_{yz}

B. $s, px, py, d_{x}^{2} - y^{2}$

C. s, px, py, d_{z}^{2}

D. s, px, py, d_{xy}

Answer: B

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93. The type of isomerism present in intro pentaamine-chromium(III) chloride is:

A. Optical

B. Linkage

C. Ionization

D. Polymerization

Answer: B

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94. Which of the following compounds is square planar and does not have any unpaired electron ?

A. $Ni(CO)_4$

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

C. $\left[NiCl_4\right]^{2-}$

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

Answer: D

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95. Which of the following hydrate is diamagnetic ?

A. $\left[Mn\left(H_2O_6\right)\right]^{2+}$

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

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

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

Answer: C

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96. The geometry of $Ni\left(CO_4\right)$ and $Ni\left(PPh_3\right)_2Cl_2$ are

A. both square planar

B. tetrahedral and square planar

C. both tetrahedral

D. square planar and tetrahedral .

Answer: C

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97. Hybridization of Fe in $K_3Fe(CN)_6$ is

A. sp^3

B. dsp^3

C. sp^3d^2

D. d^2sp^3

Answer: D

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98. One mole of complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of same complex reacts with two moles of $AgNO_3$ to yield two moles of $AgCl(s)$. The complex is:

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

B. $\left[Co(NH_3)_3Cl_3\right].2NH_3$

C. $\left[Co(NH_3)_4Cl_2\right]Cl.2NH_3$

D. $\left[Co(NH_3)_4Cl\right]Cl_2.\ NH_3.$

Answer: A

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99. Ammonia forms the complex $\left[Cu(NH_3)_4\right]^{2+}$ with copper ions in alkaline solution but not in acid solution. The reasons for it is:

A. In acidic solution hydration protects Cu^{2+} ion

B. In acidic solution proton coordinates with ammonia molecules to form NH_4^+ ions and NH_3 molecules are not available

C. In alkaline solutions insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali.

D. Copper hydroxide is amphorteric substance.

Answer: D

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100. Which one of following octahedral complexes will not show geometrical isomerism ?

A. $M[A_2B_2]$

B. $M[A_3B_3]$

C. $[MA_4B_2]$

D. $[MA_5B]$

Answer: D

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101. The number of unpaired electrons in the complex ion $\left[CoF_6\right]^{3-}$ is (Atomic no. of $Co = 27$)

A. 2

B. 3

C. 4

D. 0

Answer: C

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102. According to IUPAC nomenclature sodium nitroprusside is named as

A. sodium numtroprusside

B. sodium nitroferrocyanide

C. sodium pentacyanonsylferrate (III)

D. sodium pentacyanonitrosoniumferrate (II).

Answer: D

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103. In the coordination compound, $K_4\left[Ni(CN)_4\right]$ oxidation state of nickel is

A. - 1

B. 0

C. $+1$

D. $+2$

Answer: B

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104. The complex used as an anticancer agent is

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

B. cis-$\left[PtCl_2\left(NH_3\right)_2\right]$

C. cis-$K_2\left[PtCl_2Br_2\right]$

D. $Na_2\left[CoCl_4\right]$

Answer: B

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105. The correct name of the compound $\left[Cu\left(NH_3\right)_4\right]\left(NO_3\right)_2$, according to IUPAC system is

A. cuprammonium nitrate

B. tetramminecopper(II) nitrate

C. tatraaminecopper(II) nitrate

D. tetraamminecopper(II) dinitrite

Answer: B

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106. Which of the following complex species does not involve inner orbital hybridisation ?

A. $\left[CoF_6\right]^{3-}$

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

C. $\left[Fe\left(CN_6\right)\right]^{3-}$

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

Answer: A

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107. Which of the following statements is incorrect ?

A. In $K_3\left[Fe(CN)_6\right]$ the ligand has satisfied only the secondary valency of ferric ion .

B. In $K_3\left[Fe(CN)_6\right.$, the ligand has satisfied both primary and secondary valencies of ferric ion

C. In $K_4\left[Fe(CN)_6\right]$ the ligand has satisfied both primary and secondary valencies of ferrous ion.

D. In $\left[Cu\left(NH_3\right)_4\right]SO_4$ the ligand has satisfied only the secondary valency of copper.

Answer: A

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108. Which one of the following complexes? [Atomic numbers, Mn=25, Fe = 26, Co = 27, Ni = 28]

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

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

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

D. $[Ni)NH_3)_6]^{2+}$

Answer: D

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

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

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

C. the number of ligands aronud a metal ion bonded sigma and pi-bonds

D. the number of only anionic ligands bonded to the motal ion.

Answer: A

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110. CN^- is a strong field ligand. This is due to the fact that

A. it carries negative charge

B. it is pseudo-halide

C. it can accept electrons from metal species

D. it forms high spin complexes with metal species.

Answer: B

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

A. three

B. five

C. two

D. four.

Answer: B

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112. Which of the following is not considered as an organometallic compounds ? .

A. Cisplatin

B. Ferrocene

C. Zeise's salt

D. Grignard regent

Answer: A

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113. Which of the following does not have optical isomer?

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

B. $\left[Co(En)_2Cl_3\right]$

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

D. $\left[CO(en)\left(NH_3\right)_2Cl_2\right]Cl.$

Answer: A

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114. Pentaamminenitrocobalt (III) cation possesses the property of

A. Physisorption

B. Verstile reducing agent

C. Chirality

D. Linkage isomerism .

Answer: D

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115. The anion $\left[Co\left(C_2O_4\right)_3\right]^{3-}$ involves hybridization

A. sp^3d^2

B. d^2sp^3

C. sp^2d^3

D. d^3sp^2

Answer: A

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116. Match the list I and II and pick the correct matching from the codes given below

List - I (complex)	List - II (Structure and magneticmoment)
a) $\left[Ag(CN)_2\right]^-$	1) square planar and 1.73 BM
b) $\left[Cu(CN)_4\right]^{3-}$	2) Linear and zero
c) $\left[Cu(CN)_6\right]^{4-}$	3) Octahedral and zero
d) $\left[Cu(NH_3)_4\right]^{2+}$	4) tetrahedral and zero
e) $\left[Fe(CN)_6\right]^{4-}$	5) octrahedral and 1.73 BM

A. a-2, b-4, c-5, d-1, e-3

B. a-5, b-4, c-1, d-3, e-2

C. a-1, b-3, c-4, d-2, e-5

D. a-4, b-5, c-2, d-1, e-1

Answer: A

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117. The number for chloride ion/s produced by complex tetraamminechloroplatinm(IV) chloride in an aqueous solution is

A. Four

B. two

C. one

D. three

Answer: D

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118. The prussian blue colour obtained during the test of nitrogen by lassaigne's test is due to the formation of:

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

B. CaCN

C. $Fe_3\left[Fe(CN)_6\right]_4$

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

Answer: D

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119. The oxidation state of Cr in $\left[Cr\left(NH_3\right)_4Cl_2\right]^+$ is:

A. $+3$

B. $+2$

C. $+1$

D. 0

Answer: A

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120. $\left[Fe\left(NO_2\right)_3Cl_3\right]$ and $\left[Fe(O-NO)_3Cl_3\right]$ show

A. linkage isomerism

B. Geometrical isomerism

C. Optical isomerism

D. None of these .

Answer: A

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121. In which of the following complex ion, the central metal ions is in a state of sp^3d^2 hybridization ?

A. $\left[CoF_6\right]^{3-}$

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

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

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

Answer: A

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122. Which of the following has highest molar conductivity

A. diaminedichloroplatinum (II)

B. tetraaminedichlorocobalt (III) chloride

C. potassiumhexacyanoferrate(II)

D. hexaaquachromium (III) chloride

Answer: C

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123. Match List-I (Complexes) with List-II (Hybridization) of central atom and select the correct answer using the codes given below the lists:

	List - I		*List - II*
A	$Ni(CO)_4$	1.	sp^3
B	$[Ni(CN)_4]^{2-}$	2.	dsp^2
C	$[Fe(CN)_6]^{4-}$	3.	sp^3d^2
D	$[MnF_6]^{4-}$	4.	d^2sp^3

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iv)

D. (i), (ii) and (iv)

Answer: C

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124. When excess of ammonia is added to $CuSO_4$ solution, the deep blue coloured complex is formed. Complex is

A. tetrahedral and paramagnetic

B. tetrahedral and diamagnetic

C. square planar and diamagnetic

D. square planar and paramagnetic

Answer: D

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125. Among the following complexes which has magnetic moment of 5.9 BM

A. $Ni(CO)_4$

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

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

D. $\left[MnBr_4\right]^{2-}$

Answer: D

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126. The formula of sodium nitroprusside is

A. $Na_2\left[Fe(CN)_3NO\right]$

B. $Na_3\left[Fe(CN)_5ONO\right]$

C. $Na_2\left[Fe(CN)_5NO\right]$

D. $Na_4\left[Fe(CN)_4NO\right]$

Answer: C

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127. For μ isomerism is associated with which one of the following complex ? (M = central metal)

A. $\left[M(AA)_2\right]$

B. $\left[MA_3B_3\right]$

C. $\left[M(AA)_3\right]$

D. [MABCD]

Answer: B

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128. The increasing order of the crystal field splitting power of some common ligands is

A. $H_2O < OH^- < Cl^- < F^- < CN^-$

B. $H_2O < Cl^- < OH^- < CN^- < F^-$

C. $CN^{-} < H_2O < OH^{-} < F^{-} < Ci^{-}$

D. $Cl^{-} < F^{-} < OH^{-} < H_2O < CN^{-}$

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129. Which of the following is a tridentate ligand?

A. NO_2^{-}

B. oxalate ion

C. glycinate ion

D. dien

Answer: D

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130. Which of the following statements is not correct ?

A. The complex $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ different in the state of hybridization of nickel

B. The compexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ different in the magnetic properities

C. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ different in geometry

D. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4^{2-}]$ different in the primary valencies of nickel

Answer: D

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131. Both Co^{3+} and Pt^{4+} have a coordination number of six. Which of the following pair of complexes will show approximately the same electrical conductance for their 0.001 M aqueous solution ?

A. $CoCl_3 4NH_3$ and $Pt.4NH_3$

B. $CoCl_3 3NH_3$ and $PtCl_4.5NH_3$

C. $CoCl_3 6Nh_3$ and $PtCl_4.\ 5NH_3$

D. $CoCl_3 6NH_3$ and $PtCl_4.3NH_2$

Answer: C

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132. The ligand NO is named as

A. Nitrosonium

B. Nitronium

C. Nitrosyl

D. Nitro

Answer: C

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133. $2:4$ dinitrophenylhybrazine is an example for

A. tridentate ligand

B. monodentete ligand

C. polydentate ligand

D. didentate ligand

Answer: B

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134. Wht will be the theoretical value of magnetic moment (μ) when CN^{-} ligands join Fe^{3+} ion to yield complex

A. 2.83 BM

B. 3.87 BM

C. 5.92 BM

D. 1.73 BM

Answer: D

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135. Sodium nitroprusside reacts with sulphide ion to give a purple colour due to the formation of

A. $\left[Fe(CN)_5NO\right]^{2-}$

B. $\left[Fe(NO)_5CN\right]^{-}$

C. $\left[Fe(CN)_5NOS\right]^{4-}$

D. $\left[Fe(CN)_5NOS\right]^{3-}$

Answer: C

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136. Among the following, the compound that is both paramagnetic and coloured is :-

A. $K_2Cr_2O_7$

B. $\left(NH_4\right)_2\left[TiCl_6\right]$

C. $VOSO_4$

D. $K_3\left[Cu(CO)_4\right]$

Answer: B

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137. Prussian blue is obtained by mixing together aqueous solution of Fe^{3+} salt with

A. Ferricyanide

B. Ferrocyanide

C. Hydeogen cyanide

D. Sodium cyanide.

Answer: B

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138. The two isomers X and Y with the formula $Cr(H_2O)_5ClBr$ were taken for experiment on depression in freezing point. It was found that one mole of X gave depression corresponding to 2 moles of particles and one mole of Y gave depression to 3 moles of particles. The structural formulae of X and Y raspectively are

A. $\left[Cr\left(H_2O\right)_5Cl\right]Br_2, \left[Cr\left(H_2O\right)_2Br_2\right]Cl.\,H_2O$

B. $\left[Cr\left(H_2O\right)_5Cl\right]Br_2, \left[Cr\left(H_2O\right)_3ClBr\right]H_2O$

C. $\left[Cr\left(H_2O\right)_5Br\right]BrCl, \left[Cr\left(H_2O\right)_4ClBr\right]H_2O$

D. $\left[Cr\left(H_2O\right)_4Br_2\right]Cl.\,H_2O, \left[Cr\left(H_2O\right)_5Cl\right]Br_2$

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139. The primary and secondary valencies of chromium in the complex ion, dichlotodioxalatochromoium (III), are respectrively

A. 3, 4

B. 4, 3

C. 3, 6

D. 6, 3

Answer: C

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140. In the brown ring test, the brown colour of the ring is due to

A. a mixture of NO and NO_2

B. nitroferrous sulphate

C. ferrous nitrate

D. ferric nitrate

Answer: B

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141. A ligand may be regarded as

A. Lewis base

B. Bronsted acid

C. Lewis acid

D. Bronsted base

Answer: A

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142. Hybridization shape and magnetic moment of $K_3\left[Co\left(CO_3\right)_3\right]$ is

A. d^2sp^3, octahedral , 4.9 BM

B. sp^3d^2 , octahedral , 4.9BM

C. dsp^2, square planar octahedral , 4.9BM

D. sp^3, tetrahedral, 4.9 BM

Answer: B

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143. Geometry, hybridisation and magnetic moment of the ions $\left[Ni(CN)_4\right]^{2-}$, $\left[MnBr_4\right]^{2-}$ and $\left[FeF_6\right]^{3-}$ are .

A. Tetrahedral , square planar, octahedral $sp^3, dsp^3, sp^2d^2, 5.9, 0, 4.9$

B. Tetrahedral, square planar, octahedral $dsp^2, sp^3, sp^3d^2, 0, 5.9, 4.9$

C. Square planar , tetrahedral , octahedral $dsp^2, sp^3, d^2sp^3, 5.9, 4.9, 0$

D. Square planar, tetrahedral, octahedral $dap^2, sp^3, sp^3d^2, 0, 5.9, 4.9$

Answer: D

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144. The reaction $\left[Fe(CN)_6\right]^{3-} \rightarrow \left[FeF_6\right]^{3-}$ takes place with

A. Decrease in magnetic moment

B. Increase in magnetic moment

C. Decrease in coordination number

D. Increase in coordination number.

Answer: B

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145. Which of the following can exhibit geometrical isomerism

A. $\left[MnBr_4\right]^{2-}$

B. $\left[Pt\left(NH_3\right)_3Cl\right]^{-}$

C. $\left[PtCl_2P\left(C_2H_5\right)_3\right]_2$

D. $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$

Answer: C

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146. The number of unpaired electrons calsulated in $\left[Co\left(NH_3\right)_3\right]^{3+}$ and $\left|CoF_6\right|^{3-}$ are

A. 4 and 4

B. 0 and 2

C. 2 and 4

D. 0 and 4

Answer: D

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147. When SCN^{-} is oxided to an aqueous solution is

A. $\left|Fe\left(OH_2\right)_2(SCN)^2\right|^{2+}$

B. $\left|Fe\left(OH_2\right)_5(SCN)\right|^{2+}$

C. $\left|Fe\left(OH_2\right)_8(SCN)\right|^{2+}$

D. $\left|Fe\left(OH_2\right)_2(SCN)\right|^{6+}$

Answer: B

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148. Which complex compound possesses sp^3d^2 hybridization

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

B. $\left|FeCl_6\right|^{3-}$

C. $Fe\left(NH_3\right)_6|^{3+}$

D. $\left|Fe(CN)_6\right|^{3-}$

Answer: C

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149. The complex, $\left[Pt(py)\left(NH_3\right)BrCl\right]$ will have how many geometrical isomers?

A. 0

B. 2

C. 3

D. 4

Answer: C

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150. The complexes $\left[Co\left(NH_3\right)_6\right]\left[C(CN)_6\right]$ and $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$ are the examples of which type of isomerism ?

A. Coordination isomerism

B. Geometrical isomerism

C. Linkage isomerism

D. Ioniziation isomerism

Answer: A

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151. Of the following complex ions, which is diamagnetic in natures?

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

B. $\left[CoF_6\right]^{3-}$

C. $\left[NiCl_4\right]^{2-}$

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

Answer: D

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152. Geometrical shapes of the complex formed by the reaction of Ni^{2+} with Cl^{Θ}, CN^{Θ} and H_2O are :

A. octahedral, tetrahedral and square planar

B. tetrahdral , square planar and octahedral

C. square planar, tetrahedral and octahedral

D. octahedral , square planar and octahedral

Answer: C

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153. Among the following complexes : $K_3[Fe(CN)_6]$, $[Co(NH_3)_6]Cl_3$, $Na_3[Co(ox)_3]$, $[Ni(H_2O)_6]Cl_2$, $K_2[Pt(CN)_4]$ and $[Zn(H_2O)_6(NO_3)_2]$

The diamagnetic are .

A. K, L, M, N

B. K, M, O, P

C. L, M, O, P

D. L, M, N, O

Answer: C

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154. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide?

A. $\left[Cr(en)_3\right]Br_3$

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

C. $\left[Cr(en)Br_4\right]^-$

D. $\left[Cr(en)Br_2\right]Br$

Answer: B

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155. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour ?

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

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

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

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

Answer: D

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156. $\left[NiCl_2\left\{P\left(C_2H_5\right)_2\left(C_6H_5\right)\right\}_2\right]$ exhibits temperature dependent magnetic behaviour. The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are:

A. tetrhedral and tetrahedral

B. square planar and square planar

C. tetrahedral and square planar

D. square planar and tetrahedral .

Answer: C

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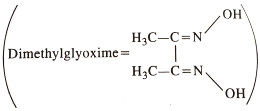
157. Red precipitae is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal $Ni(II)$. Which of the following statement is not true?

A. Red complex has a square planar geometry

B. Complex has symmetrical H-bonding

C. Red complex has a tatrahedral geometry

D. Dimethylglyoxime functions as bindentate ligand



Answer: C

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158. Low spin complex of d^6-cation in an octahedral field will have the following energy:

A. $\frac{-12}{5}\Delta_0 - P$

B. $\frac{-12}{5}\Delta_0 + 3P$

C. $\frac{-2}{5}\Delta_0 - P$

D. $\frac{-2}{5}\Delta_0 + P$

Answer: A

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159. The know oxidation states for both V and Co are

A. $+2, \ +3, \ +4, \ +5,$

B. $+2, \ +3, \ +4, \ +5, \ +6$

C. $+2, \ +3, \ +4$

D. $+2, \ +3$

Answer: C

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160. The expression for effective magnetic moment $\left(\mu_{eff}\right)$ is

A. $\mu_{eff} = \sqrt{n(n+2)} \quad B.M.$

B. $\mu_{eff} = \sqrt{2(n+2)} \quad B.M.$

C. $\mu_{eff} = \sqrt{n(2n+2)} \quad B.M.$

D. $\mu_{eff} = \sqrt{n(n+1)} \quad B.M.$

Answer: A

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161. In $\left[Ni\left(H_2O\right)_6\right]^{2+}$, the hybridisation of central metal ion is :

A. d^2sp^3

B. sp^3d^2

C. sp^3

D. dsp^2

Answer: B

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162. The complex showing a spin -magnetic momnet of $2.82BM$ is .

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

B. $\left[NiCl_4\right]^{2-}$

C. $\left[Ni\left(PPh_3\right)_4\right]$

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

Answer: B

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163. Anmongst the following ions which one has the highest magnetic moment value ?

(At.no. : Co= 27, Ni = 28)

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

B. $\left[CoF_6\right]^{3-}$

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

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

Answer: B

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164. A group of atoms can function as a ligand only when :

A. It is a small molecule

B. It has an unshared electron pair

C. It is a negatively charged ion

D. It is a positively charged ion.

Answer: B

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165. Amongst $\left[NiCl_4\right]^{2-}$, $\left[Ni\left(H_2O\right)_6\right]^{2+}$, $\left[Ni\left(PPh_3\right)_2Cl_2\right]$, $\left[Ni(CO)_4\right]$ and [Ni(CN)^(2-)` the paramagnetic species are

A. $\left[NiCl_4\right]^{2-}$, $\left[Ni\left(H_2O\right)_6\right]^{2+}$, $\left[Ni\left(PPh_3\right)_2Cl_2\right]$

B. $\left[Ni(CO)_4\right]$, $\left[Ni\left(PPh_3\right)_2Cl_2\right]$, $\left[NiCl_4\right]^{2-}$

C. $\left[Ni(CN)_4\right]^{2-}$, $\left[Ni\left(H_2O\right)_6\right](2+)$, $\left[NiCl_4\right]^{2-}$

D. $\left[Ni\left(PPh_3\right)_2Cl_2\right]$, $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{2-}$

Answer: A

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SELECTED STRAIGHT OBJECTIVE TYPE MCQS

1. Which of the following involves sp^3-hybridisation and are tetrahedral ?

A. $Ni(CO)_4$

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

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

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

Answer: A::C::D

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2. Which of the following involves dsp^2-hybridisation and are square planar ?

A. $\left[Cu(CN)_4\right]^{3-}$

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

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

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

Answer: B::C::D

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3. Which of the following are orter orbital octahedral complexes ?

A. $\left[FeF_6\right]^{3-}$

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

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

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

Answer: A::D

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4. Which of the following are diamagnetic ?

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

B. $Cu(CN)_4]^{3-}$

C. $\left[NiCl_4\right]^{2-}$

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

Answer: A::B

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5. Which of the following are paramagnetic?

A. $\left[NiCl_4\right]^{2-}$

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

C. $\left[MnCl_4\right]^{2-}$

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

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

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

A. O.S. of Fe is $+1$

B. C.N. of Fe is 6

C. Charge on NO is $+1$

D. O.S. of Fe is $+2$

Answer: A::B::C

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7. Select the complexes in which iron is in $+2$ oxidation state ?

A. $K_3[Fe(CN)_6]$

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

C. $Na[Fe(CN)_5NO]$

D. $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$

Answer: C::D

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8. $K_4\left[Fe(CN)_6\right]$ is used for detection of

A. Fe^{+} ions

B. Fe^{3+} ions

C. Zn^{2+} ions

D. Cu^{2+} ions.

Answer: B::C::D

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9. $K_3\left[Fe(CN)_6\right]$ is used for the detection of

A. Fe^{2+}

B. Fe^{3+}

C. Cd^{2+}

D. Cu^{2+}

Answer: A::B

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10. A ligand can be

A. a neutral molecule with lone pair of electrons

B. a neutral atom with lone pair of electrons

C. a negative ion with lone pair of electrons

D. a positive ion with lone pair of electrons.

Answer: A::C::D

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11. The oxidation state of Fe in brown complex $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: B

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12. Amongst $Ni(CO)_4$, $\left[Ni(CN)_4\right]^{2-}$ and $\left[NiCl_4\right]^{2-}$

A. $\left[Ni(CO)_4\right]$ and $\left[NiCl_4\right]^{2-}$ are diamagnetic and $\left[Ni(CN)_4\right]^{2-}$ is paramagnetic

B. $\left[NiCl_4\right]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic and $\left[Ni(CO)_4\right]$ is paramagnetic

C. $\left[Ni(CO)_4\right]$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic and $\left[NiCl_4\right]^{2-}$ is paramagnetic

D. $\left[Ni(CO)_4\right]$ is diamagnetic and $\left[NiCl_4\right]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ are paramagnetic .

Answer: C

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13. The compound which does not show paramagnetism is

A. $\left[Cu\left(NH_3\right)_4\right]Cl_2$

B. $\left[Ag\left(NH_3\right)_2\right]Cl$

C. NO

D. NO_2

Answer: B

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14. The number of d-electrons in $\left[Cr\left(H_2O\right)_6\right]^{3+}$ [At. No. of Cr = 24] is

A. 2

B. 3

C. 4

D. 5

Answer: B

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

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

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

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

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

Answer: B

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16. Which of the following is an organometallic compound ?

A. Lithium methoxide

B. Lithium acetate

C. Lithium dimethylamide

D. Methyl lithium.

Answer: D

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17. 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 monent

D. thermally decomposing the compound.

Answer: C

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18. The geometry of $Ni\left(CO_4\right)$ and $Ni\left(PPh_3\right)_2Cl_2$ are

A. both square planar

B. tatrahedral and square planar

C. both tetrahedral

D. square planar and tetrahedral .

Answer: C

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19. The pair having the same magnetic moment is

[at. No. $Cr = 24, Mn = 25, Fe = 26 \text{ and } Co = 27$]

A. $\left[MnO_4\right]^-$

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

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

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

Answer: A

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20. The correct order of hybridisation of the central atom in the following species NH_3, $\left[PtCl_4\right]^{2-}$, PCl_5 and BCl_3 is

(At. No. Pt = 78)

A. dsp^2, dsp^3, sp^3 and sp^3

B. sp^3, dsp^2, dsp^3, sp^2

C. sp^2, dsp^2, dsp^3, sp^2

D. dsp^2, sp^2, sp^3, dsp^3

Answer: B

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21. A mixture x containing 0.02 mol of $\left[Co\left(NH_3\right)_5SO_4\right]Br$ and 0.02 mol of $\left[Co\left(NH_3\right)_5Br\right]SO_4$ was prepared in $2L$ of solution.

$1L$ of mixture $X +$ excess $AgNO_3 \rightarrow Y$

$1L$ of mixture $X +$ excess $BaCl_2 \rightarrow Z$

The number of moles of Y and Z are

A. $0.01, 0.01$

B. $0.02, 0.01$

C. $0.01, 0.02$

D. $0.02, 0.02$

Answer: A

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22. In the process of extraction of gold.

Roasted gold ore $+ CN^- + H_2O \xrightarrow{O_2} [X] + OH^-$

$[X] + Zn \rightarrow [Y] + Au$

Identify the complexes $[X]$ and $[Y]$.

A. $Au(CN)_2]^-, \left[Zn(CN)_4\right]^{2-}$

B. $\left[Au(CN)_4\right]^{3-}, \left[Zn(CN)_4\right]^{2-}$

C. $\left[Au(CN)_2\right]^{2-}, \left[Zn(CN)_6\right]^{4-}$

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

Answer: A

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23. The pair of the compounds in which both the metals are in the highest possible oxidation state is

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

B. CrO_2Cl_2, MnO_4^{-}

C. TiO_3, MnO_2

D. $\left[Co(CN)_6\right]^{3-}, MnO_2$

Answer: B

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24. The species having tetrahedral shape is

A. $\left[PdCl_4\right]^{2-}$

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

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

D. $\left[NiCl_4\right]^{2-}$

Answer: D

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25. Which kind of isomerism is shown by $Co\left(NH_3\right)_4Br_2Cl$?

A. Geometrical and ionization

B. Geometrical and optical

C. Optical and ionization

D. Geometrical only

Answer: A

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26. In which of the following pairs both the complexes do not show optical isomerism?

A. $cis\left[Cr\left(C_2O_4\right)_2Cl_2\right]^{3-}$, cis $\left[Co. Co\left(NH_3\right)_4Cl_2\right]$

B. $\left[Co(en)_3\right]Cl_3$, cis $\left[Co(en)_2Cl_2\right]Cl$

C. $[PtCl(dien)]Cl, \left[NiCl_2Br_2\right]$

D. $\left[Co\left(NO_3\right)_3\left(NH_3\right)_3\right]$ cis $\left[Pt(en)_2Cl_2\right]$.

Answer: B

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27. The diamagnetic species is

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

B. $\left[NiCl_4\right]^{2-}$

C. $\left[CoCl_4\right]^{2-}$

D. $\left[CoF_6\right]^{2-}$

Answer: A

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

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

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

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

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

Answer: A

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29. Which of the following compounds show optical isomerism?

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

B. $\left[ZnCl_4\right]^{2-}$

C. $\left[Cr\left(C_2O_4\right)_3\right]^{3-}$

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

Answer: C

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30. Which one of the cyano complexes would exhibit the lowest value of para magnetic behaviour ?

(At. No. Cr = 24, Mn = 25, Fe = 26, Co = 27)

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

B. $\left|Mn(CN)_6\right|^{3-}$

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

D. $\left|Co(CN)_6\right|^{3-}$

Answer: D

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31. Which of the following is an inner orbital complex as well as diamagnetic in behaviour

[Atomic numbers Zn = 30, Cr = 24, Co = 27, Ni = 28.]

A. $\left|Zn\left(NH_3\right)_6\right|^2$

B. $\left|Ni\left(NH_3\right)_6\right|^{2+}$

C. $\left|Cr\left(NH_3\right)_6\right|^{3+}$

D. $\left|Co\left(NH_3\right)_6\right|^{3+}$

Answer: D

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

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

B. Cis $\left[Co(En)_2Cl_2\right]$

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

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

Answer: B

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33. IUPAC name $\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]Cl_2$ is

A. pentaaminenitrito-N-cobalt II chloride

B. pentaaminenitrito-N-cobalt (III) chloride

C. nitrito-N-pentaaminecobalt III chloride

D. nitrito-N-pentaaminecobalt II chloride.

Answer: B

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34. Nickel $(Z = 28)$ combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $\left[NiX_4\right]^{2-}$. The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively:

A. one , square planar

B. two, square planar

C. one, tetrahedral

D. two, terahedral.

Answer: D

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35. In $Fe(CO)_5$, the Fe - C bond possesses:

A. ionic character

B. σ character

C. π-charcter and

D. both σ and π bonds

Answer: D

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

A. one

B. two

C. six

D. three

Answer: A

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37. $\left[Cr\left(H_2O\right)_6\right]Cl_3$ (at no. of Cr = 24) has a magnetic moment of $3.83B.M.$ The correct distribution of $3d$ electrons the chromium of the complex.

A. $3d' xy, 3dyz', 3dxz'$

B. $3d' xy, 3dyz', 3d' z^2$

C. $3d' \left(x^2 - y^2\right), 3d' z^2, 3d' xz$

D. $3d' xy, 3d' \left(x^2 - y^2\right), 3d' yz.$

Answer: A

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38. $\left[Co\left(NH_3\right)_4\left(NO_2\right)_2\right]CI$ exhibits

A. ionization isomerism, geometrical isomerism and optical isomerism

B. linkage isomerism, geometrical isomerism and optical isomerism

C. linkage isomerism, ionization isomerism ane geometrical isomersim

D. linkage isomerism, ionization isomerism ane geometrical isomerism.

Answer: D

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39. Copper sulphate dissolves in excess of KCN to give

A. $|Cu(CN)_4|^{2-}$

B. $Cu(CN)_2$

C. CuCN

D. $\left|Cu(CN)_4\right|^{3-}$

Answer: D

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40. The pair in which both species have same magnetic moment (spin only value) is .

A. $\left|Cr\left(H_2O\right)\right|^{2+}, \left|CoCl_4\right|^{2-}$

B. $\left|Cr\left(H_2O\right)_6\right|^{2+}, \left|Fe(OH)_6\right|^{2+}$

C. $\left[Mn\left(H_2O\right)_6\right]^{2+}, \left|Cr\left(H_2O\right)_6\right|^{2+}$

D. $\left|CoCl_4\right|^{2-}, \left|Fe\left(H_2O\right)_6\right|^{2+}$

Answer: B

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41. The number of possible of an octahedral complex $\left[Co\left(C_2O_4\right)_2\left(NH_3\right)_2\right]^-$ is

A. 1

B. 2

C. 3

D. 4

Answer: C

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42. Among the following , the species having square planar geometry for central atoms are

(i) XeF_4

(ii) SF_4

(ii) $\left|NiCl_4\right|^{2-}$

(iv) $\left|PtCl_4\right|^{2}$

A. (i) and (iv)

B. (i) and (ii)

C. (ii) and (iii)

D. (iii) and (iv)

Answer: A

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43. $Ag^{+} + \Leftrightarrow \ | Ag\left(NH_3\right)_2|^{+}, k_1 = 6.8 \times 10^{-3}$

$\left[Ag\left(NH_3\right)\right]^{+} + NH_3 \Leftrightarrow \ | Ag\left(NH_3\right)_2|, k_2 = 1.6 \times 10^{-3}$

Then the formation constant or $|Ag\left(NH_3\right)_2|^{+}$ is

A. 1.08×10^{-7}

B. 1.08×10^{-5}

C. 1.08×10^{-9}

D. none of these

Answer: B

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44. If the bond length of CO bond in carbon monoxide is $1.128 Å$, then what is the value of CO bond length in $Fe(CO)_5$?

A. $1.15Ã…$

B. $1.128Ã…$

C. $1.72Ã…$

D. $1.118Ã…$

Answer: A

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45. The d electron congfiguration 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 folowing aqua complexes will exhibit the minimum paramagnetic behaviour ?

$(At. No. Cr = 24, Mn = 25, Fe = 26, Ni = 28)$

A. $\left|Cr\left(H_2O\right)_6\right|^{2+}$

B. $\left|Mn\left(H_2O\right)_6\right|^{2-}$

C. $\left|Fe\left(H_2O\right)_6\right|^{2+}$

D. $\left|Ni\left(H_2O\right)_6\right|^{2+}$

Answer: D

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46. Which of the following has a square planar geometry? .

A. $\left|PtCl_4\right|^{2-}$

B. $CoCl_4|^{2-}$

C. $|FeCl_4|^{2-}$

D. $|NiCl_4|^{2-}$

Answer: A

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47. Among the following metal carbonyls, the $C-O$ bond order is lowest in

A. $|Mn(CO)_6|^{+}$

B. $|Fe(CO)_5|$

C. $|Cr(CO)_6|$

D. $|V(CO)_6|^{-}$

Answer: D

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48. Which of the following will give a pair of enontiomorphs ?

$en = NH_2CH_2CH_2NH_2$

A. $\left|Pt\left(NH_3\right)_3\right|\left|PtCl_6\right|$

B. $\left|Co\left(NH_3\right)_4Cl_2\right|NO_2$

C. $\left|Cr\left(NH_3\right)_6\right|\left|Co(CN)_6\right|$

D. $\left|Co(en)_2Cl_2\right|Cl$

Answer: D

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49. The IUPAC name of $\left[Ni\left(NH_3\right)_4\right]\left[NiCl_4\right]$ is

A. Tetrachloronickel II-tetraaminenickel(II)

B. Tetraaminenickel (II)-tetrachloronickel(II)

C. Tetraaminenickel (II) tatrachloronickelate (II)

D. Tetrachloronickel (II)-tetraaminenickelate (O).

Answer: C

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50. Which of the following complexes exhibits the highest paramagnetic behaviour?

where gly=glycine, en=ethylenediamine and bipy =bipyridyl

(At. no. $Ti = 22, V = 23, Fe = 26, Co = 27$)

A. $\left|V(gly)_2(OH)_2\left(NH_3\right)_2\right|^{2+}$

B. $\left|Fe(en)(bpy)\left(NH_3\right)_2\right|^{3+}$

C. $\left|Co(OX)_2(OH)_2\right|^{2-}$

D. $\left|Ti\left(NH_3\right)_6\right|^{3+}$

Answer: C

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51. In which of the following coordination entities the magnitude of Δo (CFSE in ocetahedral field) will be maximum?

A. $\left|Co\left(H_2O\right)_6\right|^{3+}$

B. $\left|Co\left(NH_3\right)_6\right|^{3+}$

C. $\left|Co(CN)_6\right|^{3-}$

D. $\left|Co\left(C_2O_4\right)_3\right|^{3-}$

Answer: C

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52. The coordination number and the oxidation state of the element 'E' in the complex $\left[E(en)_2\left(C_2O_4\right)\right]NO_2$ (where (en) is ethylenediamine) are, respectively

A. 4 and 3

B. 6 and 3

C. 6 and 2

D. 4 and 2

Answer: B

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53. For the given complex $\left[CoCl_2(en)\left(N_3\right)_2\right]^+$, the number of geometrical iosmers, the number of optical isomers and total number of isomers of all type possible respectively are

A. 2, 2 and 4

B. 2 ,2 and 3

C. 2, 0 and 2

D. 0, 2 and 1

Answer: B

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54. The spin only magnetic moment value of $Cr(CO)_6$ is

A. zero

B. 2.84

C. 4.90

D. 5.92

Answer: A

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55. The magnitude of crystal field stabilization energy (CFSE or Δt) in tetrahedral complexes is considerably less than in octahedral field. This is because

A. There are four ligands instead of six so the ligand field is only 2/3 the size hence , the Δt is only 2//3 the size

B. The direction of the orbitals does not coincide with the direction fo the ligands . This reduces the crystal field stabilisation energy (Δt) by further 2/3

C. Both points (A) and (B) correct

D. Both points (A) and (B) are wrong .

Answer: C

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56. Which of the following complex ions is expected to absorb visible light?

A. $\left|Ti(en)_2\left(NH_3\right)_2\right|^{4+}$

B. $\left|Cr\left(NH_3\right)_6\right|^{3+}$

C. $\left|Zn\left(NH_3\right)_6\right|^{2+}$

D. $\left|Sc\left(H_2O\right)_3\left(NH_3\right)_3\right|^{3+}$

Answer: B

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57. When EDTA solution is added to `Mg^(2+) ion solution, then which of the statements is not true

A. Four coordinate sites of Mg^{2+} are occupied by EDTA and remaining two sites are occupied by water molecules

B. All six coordinate sites of Mg^{2+}

C. pH of the solution is decreased

D. Colourless $[Mg - EDTA]^{2-}$

Answer: A

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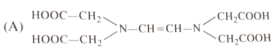
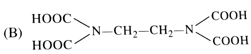
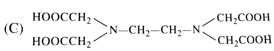
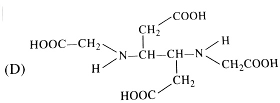
58. The correct structure of ethylenediamineteraacetic acid $(EDTA)$ is .

A. 

B. 

C. 

D. 

Answer: C

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59. Which one of the following complex is not expected to exhibit isomerism

A. $\left[Ni\left(NH_3\right)_4\left(H_2O\right)_2\right]^{2+}$

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

C. $\left[Ni\left(NH_3\right)_2Cl_2\right]$

D. $\left[Ni(en)_3\right]^{2+}$

Answer: C

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60. The existence of two different coloured comlexes with the composition $\left|Co\left(NH_3\right)_2Cl_2\right|^+$ is due to

A. Ionisation isomerism

B. Linkage isomerism

C. Geometrical isomerism

D. Co-ordination isomerism.

Answer: C

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61. Which of the following is wrongly matched?

A. $\left|Cu\left(NH_3\right)_4\right|^{2+}$ - Square planar

B. $Ni(CO)_4|$ - neutral ligand

C. $\left|Fe(CN)_6\right|^{3-}$ - sp^3d^2

D. $\left|Co(en)_3\right|^{3+}$ - follows EAN rule

Answer: C

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62. Which of the following complex has minimum magnitude of Δ^0 ?

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

B. $\left|Co\left(NH_3\right)_6\right|^{3+}$

C. $\left|CoCl_6\right|^{3-}$

D. $\left|Cr\left(H_2O\right)_6\right|^{3+}$

Answer: C

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

A. $-0.6\Delta_0$

B. $-1.8\Delta_0$

C. $-1.6\Delta_0 + P$

D. $-1.2\Delta_0$

Answer: A

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64. Which of the following is diamagnetic in nature ?

A. Co^{3+} , octahedral complex with weak field ligands

B. Co^{3+}, octahedral complex with strong field ligands

C. Co^{2+} in tetrahedral complex

D. Co^{2+} in a square planar complex.

Answer: B

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65. In $Fe(CO)_5$, the $Fe \leftarrow CO\sigma$ bond results by the overlap between filled sp hybrid orbital of C atom of CO molecule and vacant

A. d^2sp^3

B. sp^3

C. dsp^3

D. dsp^2 hybrid orbital of Fe .

Answer: C

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66. The ligand $N\left(CH_2CH_2NH_2\right)_3$ is

A. tridentate

B. pentadentate

C. tatradentate

D. bidentate

Answer: C

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67. Which one of the following has largest number of isomers?

A. $\left|Ru\left(NH_3\right)Cl_2\right|^+$

B. $\left|Co(en)_2Cl_2\right|^+$

C. $\left|Ir\left(PR_3\right)H(CO)\right|^{2+}$

D. $\left|Co\left(NH_3\right)_5Cl\right|^{2+}$

Answer: B

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68. Square planar complexes of the type MABXL (where A, B, X and L are unidentates) show

A. two cis and one trans isomer

B. two trans and one cis isomer

C. two cis and two trans isomer

D. one cis and one trans isomer.

Answer: A

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69. Which of the following complex ions has geometrical isomers?

A. $\left|Co(en)_3\right|^{3+}$

B. $\left|Ni\left(NH_3\right)_5Br\right|^{+}$

C. $\left|Co\left(NH_3\right)_2en_2\right|^{3+}$

D. $\left|Cr\left(NH_3\right)_4(en)\right|^{3+}$

Answer: C

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70. Which 0.01 mole of a cobalt complex is treated with excess silver nitralte solution4.305 g silver chloride is precipitated. The formula of the complex is

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

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

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

D. $\left[Co\left(NH_3\right)_4Cl_2\right]No_3$

Answer: C

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71. The correct statement with respect to the complexes $Ni(CO)_4$ and $\left|Ni(CN)_4\right|^{2-}$ is

A. nickel is in the same oxidation state in both

B. both have tetrahedral geometry

C. both have square planar geometry

D. have tetrahedral and square planar geometry respectively.

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72. The complex which has the highest magnetic moment among the following is

A. $\left|CoF_6\right|^{3-}$

B. $\left|Co\left(NH_3\right)_6\right|^{3+}$

C. $\left|Ni\left(NH_3\right)_4\right|^{2+}$

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

Answer: A

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73. Among $\left|Ni(CO)_4\right|$, $\left|Ni(CN)_4\right|^{2-}$, $\left|NiCl_4\right|^{2-}$ species, the hybridisation state at Ni atom are respectively

]Atomic number of Ni = 28]

A. sp^3, dsp^3, dsp^2

B. sp^3, dsp^2, sp^3

C. sp^3, sp^3, dsp^2

D. dsp^2, dsp^2, sp^3.

Answer: B

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74. Geometrical shapes of the complex formed by the reaction of Ni^{2+} with Cl^{Θ}, CN^{Θ} and H_2O are :

A. octahedral, tetrahedral, square planar

B. tetrahedral , square planar and octahedral

C. square planar, tetrahedral and octahedral

D. octahedral, square planar and octahedral

Answer: B

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75. Among the following complexes : $K_3\left[Fe(CN)_6\right]$, $\left[Co\left(NH_3\right)_6\right]Cl_3$, $Na_3\left[Co(ox)_3\right]$, $\left[Ni\left(H_2O\right)_6\right]Cl_2$, $K_2\left[Pt(CN)_4\right]$ and

$\left[Zn\left(H_2O\right)_6\left(NO_3\right)_2\right]$

The diamagnetic are .

A. K, L, M, N

B. K, M, O, P

C. L, M, O, P

D. L, M, N, O

Answer: C

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76. Which of the following facls about the complex $\left|Cr\left(NH_3\right)_6\right|Cl_3$ is wrong

A. The complex is paramagnetic

B. The complex is diamagnetic

C. The complex gives white precipitate with silver nitrate solution

D. The complex involves d^2sp^3 hybridisation and is octahedral in shape.

Answer: B

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77. Low spin complex of d^6-cation in an octahedral field will have the following energy:

A. $-\frac{2}{5}\Delta_0 + 2P$

B. $-\frac{2}{5}\Delta_0 + P$

C. $-\frac{12}{5}\Delta_0 + P$

D. $-\frac{12}{5}\Delta_0 + 3P$

Answer: D

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78. $\left[NiCl_2\left\{P\left(C_2H_5\right)_2\left(C_6H_5\right)\right\}_2\right]$ exhibits temperature dependent magnetic behaviour. The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are:

A. tetrhedral and tetrahedral

B. square planar and square planar

C. tetrahedral and square planar

D. square planar and tetrahedral .

Answer: C

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79. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour ?

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

B. $\left|Zn\left(NH_3\right)_6\right|^{2+}$

C. $|Cr\left(NH_3\right)_6^{3+}$

D. $\left|Co\left(NH_3\right)_6\right|^{3+}$

Answer: A

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80. As per IUPAC nomenclature, the name of the complex $\left[Co\left(H_2O\right)_4\left(NH_3\right)_2\right]Cl_3$ is

A. tetraaquadiamine cobalt(III) chloride

B. tetraaquadiammine cobalt(III) chloride

C. diamine tetraaqua cobalt(III) chloride

D. diammine tetraaqua cobalt(III) chloride.

Answer: D

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81. Which of the following complex species is not expected to exhibit optical isomerism ?

A. $\left|Co(en)\left(NH_3\right)_2Cl_2\right|^{2+}$

B. $\left|Co(en)_3\right|^{3+}$

C. $\left|Co(en)_2Cl_2\right|^{+}$

D. $\left|Co\left(NH_3\right)_3Cl_3\right|$

Answer: A

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82. An excess of $AgNO_3$ is added to $100mL$ of a $0.01M$ solution of dichlorotetraaquachromium(III) chloride The number of moles of $AgCI$ precipitated would be .

A. 0.001

B. 0.002

C. 0.003

D. 0.01

Answer: B

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83. Consider the follwing complexes ion P, Q and R

$P = \left[FeF_6\right]^{3-}$, $Q = \left[V\left(H_2O\right)_6\right]^{2+}$ and $R = \left[Fe\left(H_2O\right)_6\right]^{2+}$

The correct order of the complex ions, according to their spin only magnetic moment values (inBM) is .

A. $R < Q < P$

B. $Q < R < P$

C. $R < P < Q$

D. $Q < P < R$

Answer: B

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84. A magnetic moment of 1.73 B.M. will be shown by one among the following:

A. $\left|Cu\left(NH_3\right)_4\right|^{2+}$ - Square planar

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

C. $TiCl_4$

D. $\left|CoCl_6\right|^{4-}$

Answer: A

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COMPREHENNSION TYPE MCQS

1. A metal complex having the composition or $(NH_3)_4Cl_2Br$ has been isolated in two form A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia . The formula of the complex A is

A. $\left[Cr(NH_3)_4Br\right]Cl_2$

B. $\left[Cr(NH_3)_4BrCl\right]Cl$

C. $\left[Cr(NH_3)_4Cl_2\right]Br$

D. Both A and B are possible.

Answer: B

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2. A metal complex having the composition or $(NH_3)_4Cl_2Br$ has been isolated in two form A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia .The formule of the complex B is

A. $[Cr(NH_3)_4Br]Cl_2$

B. $[Cr(NH_3)_4ClBr]Cl$

C. $[Cr(NH_3)_4Cl_2]Br$

D. $[Cr(NH_3)_4]BrCl_2$

Answer: C

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3. A metal complex having the composition or $(NH_3)_4Cl_2Br$ has been isolated in two form A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia . The hybridization of Cr in the complexes A and B respectively is

A. d^2sp^3 and sp^3d^2

B. sp^3d^2 and d^2sp^3

C. sp^3d and dsp^3

D. d^2sp^3 and d^2sp^3

Answer: D

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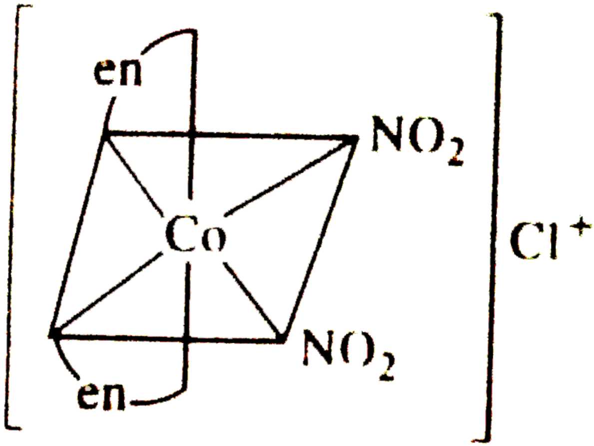
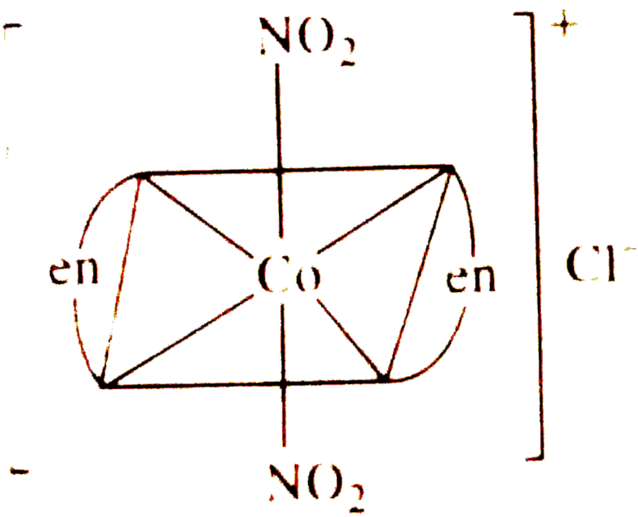
4. A compound $CO(en)_2NO_2Cl$ has been prepared in a number of isomeric form . One form undergoes no reaction with $AgNO_3$ or (en) and is optically inactive. A third form is optically acitve and reacts with both $AgNO_3$ and (en) complexes are

(A)

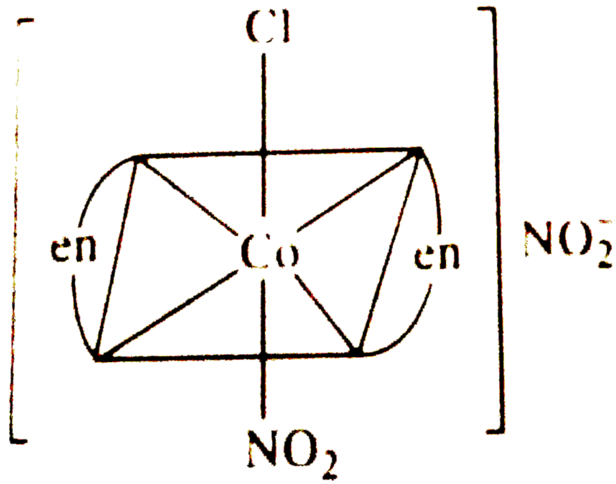


bis-bis (ethylenediamine) dinitrocobalt (III) chloride.

(B)



trans -bis (ethylyenediamine) dinitrocobalt (III) chloride.

(C) 

trans chloronitrobis (ethylendiamine)cobalt (III) nitrite.

First form of the complex is

A. A

B. B

C. C

D. none of these

Answer: C

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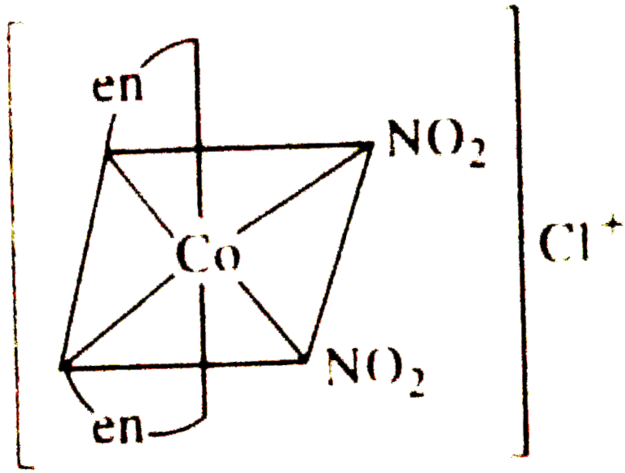
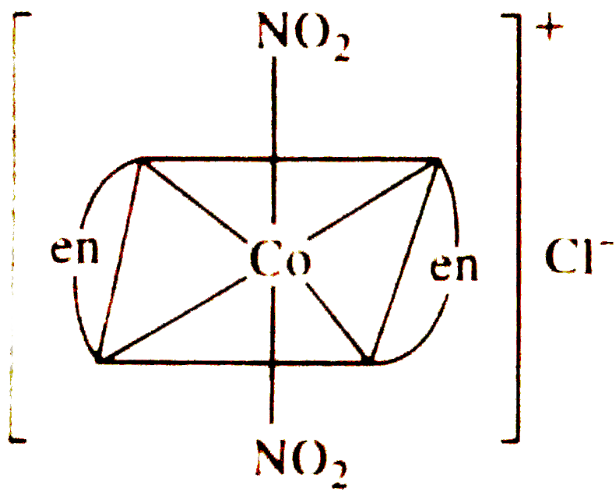
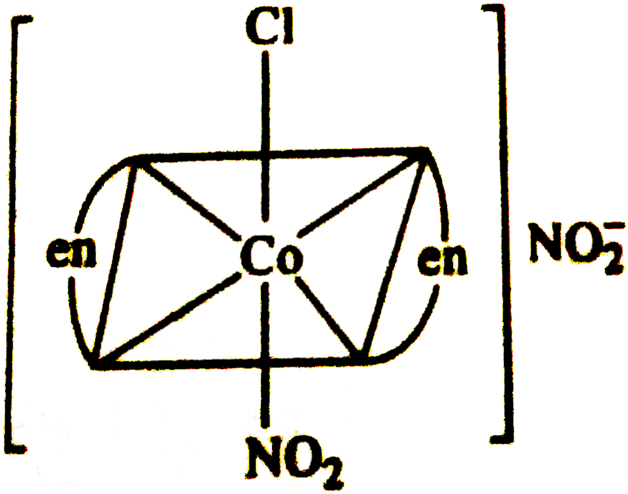
5. A compound $CO(en)_2NO_2Cl$ has been prepared in a number of isomeric form . One form undergoes no reaction with $AgNO_3$ or (en) and is optically inactive. A third form is optically acitve and reacts with both $AgNO_3$ and (en) complexes are

(A) 

bis-bis (ethylenediamine) dinitrocobalt (III) chloride.

(B) 

trans -bis (ethylyenediamine) dinitrocobalt (III) chloride.

(C) 

trans chloronitrobis (ethylendiamine)cobalt (III) nitrite.

One of the complexes starch iodide paper blue in acidic medium . This comples is

A. C

B. B

C. A

D. all of these .

Answer: A

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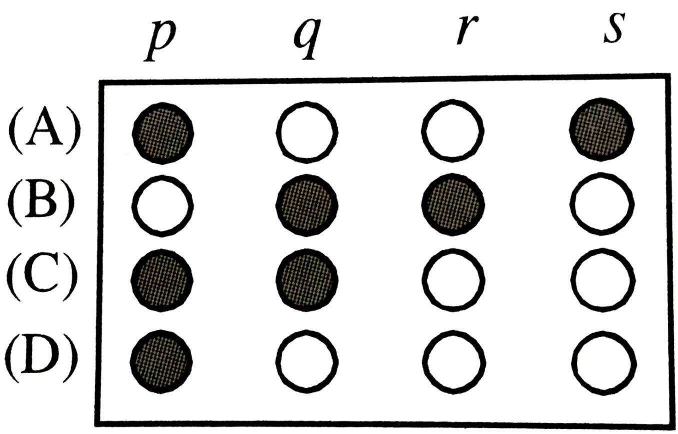
MATRIX MATCH TYPE MCQS

1. Here each question contains statements in two column which have to be matched statements in column I are labelled as A, B, C and D and the statements in column II are labelled as p,q,r and s. The answers are to be appropriately bubbled as illustrted in the following examples .

If the correct matches are A-p, A-s, B-q, B-r, C-p, C-q, and D-p then correctly bubbled 4xx4 matrix should look like the following.



Column I		Column II	
(A)	$\lvert Ni(CO)_4 \rvert$	(p)	square planar
(B)	$\lvert Ni(CN)_4 \rvert^{2-}$	(q)	Tetrahedral
(C)	$\lvert Cu(NH_3)_4 \rvert^{2+}$	(r)	Paramagnetic
(D)	$\lvert FeCl_4 \rvert^{2-}$	(s)	Diamagnetic

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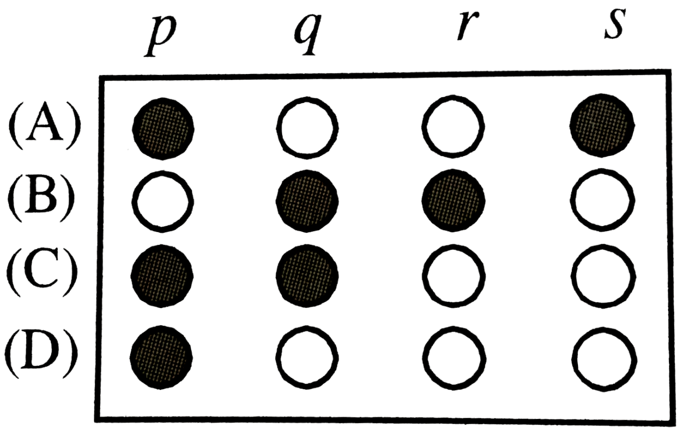
2. Here each question contains statements in two column which have to be matched statements in column I are labelled as A, B, C and D and the statements in column II are labelled as p,q,r and s. The answers are to be appropriately bubbled as illustrted in the following examples .

If the correct matches are A-p, A-s, B-q, B-r, C-p, C-q, and D-p then correctly bubbled 4xx4 matrix should look like the following.



	Column I		Column II
(A)	$\|Cr(H_2O)_2(C_2O_4)_2\|$	(p)	geometrical isomerism
(B)	$\|Co(en)_3\|^{3+}$	(q)	optical isomerism
(C)	$\|Co(NH_3)_5(NO_2)\|$	(r)	coordination number 6
(D)	$\|Pt(NH_2)(H_2O)Cl_2\|$	(s)	linkage isomerism

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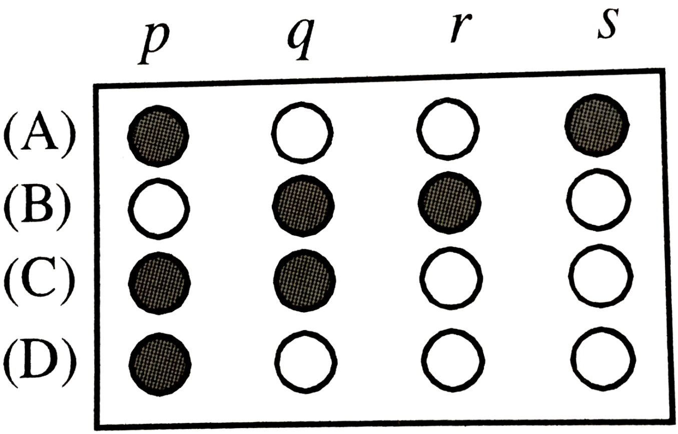
3. Here each question contains statements in two column which have to be matched statements in column I are labelled as A, B, C and D and the statements in column II are labelled as p,q,r and s. The answers are to be appropriately bubbled as illustrted in the following examples .

If the correct matches are A-p, A-s, B-q, B-r, C-p, C-q, and D-p then correctly bubbled 4xx4 matrix should look like the following.



Column I	Column II
(A) $:C\bar{N}:$	(s) unidentate ligand
(B) glycinate	(q) didentate ligand
(C) ethylenediamine	(r) Ambidentate ligand
(D) carbonate	(s) Chelating ligand.

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INTEGER TYPE QUESTIONS

1. The oxidation number of Mn in the product of alkaline oxidative fusion of MnO_2 is

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2. Fe^{2+} (Z = 26) has .... electrons in 3d orbitals

A. 6

B. 2

C. 1

D. 5

Answer: A

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3. Maximum oxidation state exhibited by manganese in its compounds is .....

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4. Number of oxygen atos between two chromium atoms in $Cr_2O_7^{2-}$ ion is .....

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5. Total number of geometrical isomers for the complex $\left[RhCl(CO)\left(PPh_3\right)\left(NH_3\right)\right]$ is

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REASON ASSERTION TYPE MCQS

1. Assertion: In aqueous solution Mohr' s salt gives $NH_4^{\oplus}, Fe^{2+}$ and SO_4^{2-}

Reason: Mohr' s salt is a double salt .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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2. Assertion: Coordination compounds are generally formed by transition metals

Reason: Transition metals generally have partly filled d-orbitals of the nth shell .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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3. Assertion: A sulphate ion is a bidentate ligand and can also act as monodentate in cartain complexes

Reason: Many a times multidentate ligands do have flexidentate character .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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4. Assertion: Optical isomerism is not shown by square planar complexes .

Reason :Square planar complexes do not possess chiral structures.

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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5. Assertion: Metal carbonyls can be called organometallics

Reason: Metal carbonyls don't contain metal carbon bond .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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6. Assertion: All square planar complex can exhibit geometrical isomerism

Reason: In square planar complexes,hybridisation is sp .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. Both A and R are false.

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7. Assertion: Chelates are relatively more stable than non-chelated complex

Reason: Complexes containing ligands which can be easily replaced by other ligands are called labile complexes .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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8. Assertion: The complex $\left[Co\left(NH_3\right)_3Cl_3\right]$ gives no precipitate with $AgNO_3$ solution

Reason: The given complex is non-ionisable .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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9. Assertion:EDTA froms an octahedral complex with metal ion

Reason: It has six donor atoms which coordinate simultaneously to the metal ion .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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10. Assertion: Glycinate ion is an example of monodentate ligand

Reason: It contains N as the only donor atom .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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11. Assertion: The number of unpaired electrons in $\left[Ni(CO)_4\right]$ is zero

Reason: In this compounds 4s-electrons of Ni atom enter the inner d-orbitals to facilitate the sp^3 hybridisation in Ni atom .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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12. Assertion: $Ni(CO)_4$ is tetrahedral in shape

Reason: Ni atom is in zero oxidation state and undergoes sp^3 -hybridisation .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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13. Assertion: No. of unpaired electrons present in $\left[Cu\left(NH_3\right)_2\right]^{\oplus}$ complex is zero

Reason: The complex is linear with sp-hybrisation .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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14. Assertion: The ligands nitro and nitrito are called ambidentate

Reason: These ligands give linkage isomers .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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15. Assertion: Total no. of isomers shown by $\left[Co(en)_2Cl_2\right]^{\oplus}$ complex ion is 3

Reason: $\left[Co(en)_2Cl_2\right]^{2+}$ complex ion has an octahedral geometry .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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16. Assertion :NF_3 is weaker ligand than $N\left(CH_3\right)_3$

Reason: NF_3 ionises to give F^{Θ} ions in aqueous solution .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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17. Assertion: $\left[Ni(en)_3\right]Cl_2$ has lower stability than $\left[Ni\left(NH_3\right)_6\right]Cl_2$

Reason: In $\left[Ni(en)_3\right]CI_2$ the geometry of Ni is trigonal bipyramidal .

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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18. Assertion : Potassium ferrocyanide is diamagnetic whereas potassium ferricyanide is paramagnetic.

Reason : Crystal field splitting in ferrocyanide ion is greater than that of ferricyanide ion.

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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19. Assertion : $\left[Cu\left(NO_2\right)_3\left(NH_3\right)_3\right]$ does not show optical

Reason : It has a phane of symmetry.

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

B. Both A and R are true but R is not a correct explanation A

C. A is true but R is false

D. A is false but R is trus

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ULTIMATE PREPARATORY PACKAGE

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

A. NH_3

B. C_2H_4

C. en

D. NO_+

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2. The oxidation state of iron in $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$ is

A. $+1$

B. $+2$

C. $+3$

D. - 1

Answer: A

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3. The hybridisation of central metel ion and shape of Wilkinson's catalyst is

A. dsp^2 squara planar

B. sp^3, tetrahedral

C. d^2sp^3 octahedral

D. sp^3d trigonal bipyramidal.

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4. Oxidation state of Fe in ferrocene is

A. $+1$

B. $+3$

C. $+2$

D. None of these.

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5. Chloroplatinic acid is

A. monobasic

B. dibasic

C. tribasic

D. tetrabasic.

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6. Which of the following is not optically active?

A. $\left[Co(ox)_3\right]^{3-}$

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

C. cis-$\left[CoCl_2(en)_2\right]^{+}$

D. trans-$\left[CoCl_2(en)_2\right]^{+}$

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7. Cobalt is present in

A. Vitamin B_1

B. Vitamin B_2

C. Vitamin B_6

D. Vitamin B_{12}

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8. Phthalocyanin blue, the blue pigment present in feathers of a peacock is a complex compound of

A. Copper

B. Cobalt

C. Nickel

D. None of these.

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9. Vitamin B_{12} is a red coloured compound . It is a complex of

A. Iron

B. Copper

C. Cobalt

D. Nickel.

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10. Which of the following will show geometric as well as optical isomerism ?

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

B. $\left[Pt\left(NH_3\right)_2Cl_4\right]$

C. $\left[Pt(en)_3\right]^{4+}$

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

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11. Which of the following is a π-acid ligand?

A. NH_3

B. CO

C. F^-

D. ethylenediamine.

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12. The number of CO ligands that can be attached to Fe(Z=26) on the basis of E.A.N. theory are

A. 5

B. 6

C. 10

D. 12

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13. The value of x in the complex $H_xCo(CO)_4$, on the basis of E.A.N. rule is (At. No. Co = 27)

A. 5

B. 1

C. 4

D. None of these.

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14. What is the oxidation state of Fe in introprusside ion ?

A. $+1$

B. $+2$

C. $+3$

D. None of these.

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BRAIN TEASERS - 22

1. In photography , $Na_2S_2O_3.5H_2O$ is used

A. in reduction of Ag metal from AgBr

B. for the conversion of AgBr into silver thiosulphate

C. for the conversion of AgBr into silver sulphate

D. for the conversion of AgBr into soluble thiosulphate complex.

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BRAIN TEASERS - 23

1. Turnbull's blue is a compound

A. $\overset{III}{KFe}\left[\overset{II}{Fe}(CN)_6\right]$

B. $\overset{II}{KFe}\left[\overset{III}{Fe}(CN)_6\right]$

$III \quad II$

C. $Na_2\left[Fe(CN)_5NO\right]$

$II \quad III$

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

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BRAIN TEASERS - 24

1. The possibe number of isomers for the complex $\left[MCl_2Br_2\right]SO_4$ is

A. 1

B. 2

C. 4

D. 5

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BRAIN TEASERS - 25

1. Tetahedral complex bis(benzylacetonato) beryllium (II) depicts

A. Geometrical isomerism

B. Optical isomerism

C. Ionisation isomerism

D. None of the above.

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BRAIN TEASERS - 26

1. Which of the following is not a double salt but is a complex salt ?

A. $KClMgCl_2.6H_2O$

B. $FeSO_4(NH_4)_2SO_4.6H_2O$

C. $K_2SO_4Al_2(SO_4)_3.24H_2O$

D. $4KCN.\ Fe(CN)_2.$

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BRAIN TEASERS - 27

1. Which of the following has a shape different from others ?

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

B. $Ni(CO)_4$

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

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

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BRAIN TEASERS - 28

1. Which of the following has dodecahedral geometry?

A. $\left[ReH_9\right]^{2-}$

B. $\left[ZrF_7\right]^{-}$

C. $\left[Mo(CN)_8\right]^{4-}$

D. $\left[UF_8\right]^{3-}$

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BRAIN TEASERS - 29

1. The tendency to form complexes is maximum for

A. Normal elements

B. Transition elements

C. Inner transition elements

D. Metal containing fully filled d-orbitals.

Answer: B

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BRAIN TEASERS - 30

1. Theortically possible number of isomers for $\left[Pt(py)\left(NH_3\right)\left(NO_2\right)(Cl)(Br)(I)\right]$ are

A. 3

B. 4

C. 8

D. 15

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BRAIN TEASERS - 31

1. A complex $PtCl_4.5NH_3$ shows a molar conductance of 402 $ohm^{-1}cm^2mol^{-1}$ in water and precipitate three mole of AgCl with $AgNO_3$. The formula of the complex is

A. $\left[Pt\left(NH_3\right)_6Cl_4\right.$

B. $\left[Pt\left(NH_3\right)_5Cl\right]Cl_3$

C. $\left[Pt\left(NH_3\right)_4Cl_2\right]Cl_2$

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

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BRAIN TEASERS - 32

1. An arrangement of various ligands in decreasing order of crystal field splitting tendency is know as

A. Nephelauxetic series

B. Spectrochemical series

C. Electrochemical series

D. Macrocylic effect.

Answer: B

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BRAIN TEASERS - 33

1. Number of unpaired electrons in d^4 low spin octahedral complex are

A. 1

B. 2

C. 3

D. zero

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BRAIN TEASERS - 34

1. In ferrocene, hybridisation state of iron is

A. sp^3d^2

B. d^2sp^3

C. dsp^3

D. sp^3d^3

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BRAIN TEASERS - 35

1. The fungicide 'cerresan' is

A. C_2H_5HgCl

B. $CuSO_4 +$ lime

C. Aldrin

D. Organo arsenic compound.

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BRAIN TEASERS - 36

1. Which one of the following metal carhonyls is prepared by the direct interaction of finely divided metal with CO ?

A. $V(CO)_6$

B. $Fe(CO)_5$

C. $Cr(CO)_6$

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

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BRAIN TEASERS - 37

1. Which of following is an example is an example of a sandwich compound ?

A. Ferrocene

B. Chromocene

C. Dibenzenechromium

D. all the above

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BRAIN TEASERS - 38

1. Alcoholic H_2PtCl_6 is also known as

A. Speier's catalyst

B. Brown's catalyst

C. Adam's catalyst

D. Lindlar's catalyst.

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BRAIN TEASERS - 39

1. Coordination number of Titanium in $\left[Ti\left(NO_3\right)_4\right]$ is

A. 4

B. 6

C. 2

D. 8

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BRAIN TEASERS - 40

1. The complex ' Ferroin' is a useful redox indicator . In this , the ligands is a

A. Bidentate ligand

B. Tridentate ligand

C. Tetradentate ligand

D. Monodentate ligand

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BRAIN TEASERS - 41

1. Total number of ions produced by Tollen's reagent on ionisation are

A. 2

B. 3

C. 0

D. 4

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BRAIN TEASERS - 42

1. Cyanocobalamin contains which element

A. Ca

B. Co

C. Mg

D. Zn.

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BRAIN TEASERS - 43

1. The IUPAC name of $\left[Co\left(NH_3\right)_4Br_2\right]_2\left[ZnCl_4\right]$ is

A. dibromotetraamminecobelt (III) tetrachlorozinc (II)

B. tetraamminedibromocobalt (III) tetrachlorozincate(II)

C. dibromotetraamminecobalt(III) tetrachlorozincate(III)

D. None of the above.

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BRAIN TEASERS - 44

1. Stability constant is more for the metal ion

A. Ni^{2+}

B. Co^{2+}

C. Mn^{2+}

D. Zn^{2+}

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BRAIN TEASERS - 45

1. Antidote for lead poisoning is

A. EDTA

B. White of an egg

C. Cisplatin

D. Nickel.

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BRAIN TEASERS - 46

1. The expected freezing point of 0.0100 m $\left[Co\left(NH_3\right)_5Cl\right]Cl_2$ is

A. $+0.0279\,^{\circ}$ C

B. -$0.0279\,^{\circ}$ C

C. $0.0186\ ^{\circ}$ C

D. $0.0558\ ^{\circ}$ C

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BRAIN TEASERS - 47

1. Berlin green is

A. $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_4\right]$

III

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

C. Cr_2O_3

III

D. $K_3\left[Co\left(NO_2\right)_6\right]$

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BRAIN TEASERS - 48

1. An example of π-acid ligand is

A. CO

B. NO

C. N_2

D. All of the above.

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BRAIN TEASERS - 49

1. Which of the following is a mixel salt ?

A. $CaOCl_2$

B. $CuSO_4.4NH_3$

C. $AgCl.2NH_3$

D. None of these.

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UNIT TEST - IG

1. Which of the following is not true for ligand metal complex ?

A. Highly charged ligand forms bond

B. Greate the ionzation potential of central metal, the stronger is the bond

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

D. Larger the ligand , the more stale is the metal ligand bond .

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2. The coordination number of a metal in coordination compound is

A. same as primary valency

B. sum of primary and secondary valencies

C. same as secondary valency

D. None of the above.

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

A. The number around a metal is bonded bt pi-bonds

B. The number of only anionic ligands bonded to the metal atom

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

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

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4. EDTA has coordination number

A. 3

B. 4

C. 5

D. 6

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5. Among the properties (A) reducing(B) oxidising (C) complexing the set of properties shown by CN^{Θ} ion towards metal species is .

A. b, c

B. a, b, c

C. c, a

D. a, b

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6. Ligans in complex compounds

A. Donate electron pair

B. Accept electron pair

C. Neither accept electron pair nor donate

D. all the above

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7. Ammonia forms the complex $\left[Cu\left(NH_3\right)_4\right]^{2+}$ with copper ions in alkaline solution but not in acid solution. The reasons for it is:

A. In acidic solution hydration protects copper ions

B. In alkaline solution insoluble `Cu(OH)_(2) is precipitated with excess of an alkali

C. Copper hydroxide is an amphoteric substance

D. In acidic solution protons coordinate with ammonia molecules are not variable.

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8. An aqueous solution of potassium gives

A. two types of ions

B. three types of ions

C. four types of ions

D. only one type of ion.

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9. The correct name of $\left|Pt\left(NH_3\right)_4Cl_2\right|\left|PtCl_4\right|$ is

A. tetrachloroplatinum (II) dichlorotetraamine platinate

B. dichlorotetraamineplatinum (IV) tetrachloro platinate (II)

C. tetraaminedichloroplatinum (IV) tetrachloro platinate (II)

D. tetrachloroplatinum (II) tetramineplatinate (IV)

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10. IUPAC name of $K_4\left|Fe(CN)_6\right|$ is

A. Potassium ferricyanide

B. potassium hexacyanoferrate(II)

C. tetrapotassium hexacyanoferrate

D. potassium hexacyanoferrate.

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11. IUPAC name of $\left|Co(ONO)\left(NH_3\right)_5Cl_2\right|$ is

A. pentaarminenitrocobalt (II) chloride

B. pentaaminenitrosocobalt (III) chloride

C. pentaaminenitritocobalt (III) chloride

D. pentaamineoxonitrocobalt (III) chloride.

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12. Which of the following is a wrong statement?

A. $Ni(CO)_4$ has zero oxidation number for Ni

B. $Ni(CO)_4$ has oxidation number of $+4$ for Ni

C. Ni is a metal

D. CO is gas.

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13. The IUPAC name of $K_2\left[Cr(CN)_2O_2\left(O_2\right)\right]NH_3$

A. Potassiumammine dicyandioxoperoxo chromate (IV)

B. Potassiumamminecyanoperoxodioxo chromate (IV)

C. Potassiumamminecyanoperoxodioxo chromium (IV)

D. Potassiumamminecyanoperoxodioxo chromium (V).

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14. Coordination isomerism is caused by interchange of ligands 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 .

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15. Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$

A. $Ni(CO)_4$ and $|NiCl_4|^{2-}$ are diamagnetic and $|Ni(CN)_4|^{2-}$ is paramagnetic

B. $Ni(CN)_4$ and $|NiCl_4|^{2-}$ are diamagnetic and $Ni(CN)_4$ is paramagnetic

C. $Ni(CO)_4$ and $\left|Ni(CN)_4\right|^{2-}$ are diamagnetic and $\left|NiCl_4\right|^{2-}$ paramagnetic

D. $\left|NiCl_4\right|^{2-}$ and $| Ni(CN)_4^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic.

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16. The type of isomerism present in intro pentaamine-chromium(III) chloride is:

A. optical

B. linkage

C. polymerisation

D. Ionization

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17. The complexes $\left|Co\left(NH_3\right)_6\right|\left|Cr\left(C_2O_4\right)_3\right|$ and $\left|Cr\left(NH_3\right)_6\right|\left|Co\left(CrO_4\right)_3\right|$ are

A. geometrical isomerism

B. ionization isomerism

C. coordination isomerism

D. linkage isomerism.

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18. $\left|Pt\left(NH_3\right)_4Cl_2\right|Br_2$ and $\left|Pt\left(NH_3\right)_4Br_2\right|Cl_2$ ion are related

A. optical isomers

B. ilnkage isomers

C. coordinate isomers

D. ionization isomers .

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19. What is the magnetic moment of $K_3\left|FeF_6\right|$?

A. 3.87 BM

B. 4.89 BM

C. 5.91 BM

D. 6.92 BM

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20. The geometry of $Ni\left(CO_4\right)$ and $Ni\left(PPh_3\right)_2Cl_2$ are

A. square planar and tetrahedral respectively

B. both are tetrahedrl

C. tetrahedral and square planar respectively

D. both are square planar.

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21. The value of 'spin only' magnetic moment for one of the following configuration is $2.84B.M.$ The correct one is:

A. d^4 (in weak ligand field)

B. d^4 (in strong ligand field)

C. d^3 (in weak as well as in strong field)

D. d^5 (in strong ligand)

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22. Silver sulphide dissolved in a solution of sodium cyanide to coupled

A. $Na_2[Ag(CN)_2]$

B. $Na \mid Ag(CN)_2 \mid$

C. $Na_3 \mid Ag(CN)_4 \mid$

D. $Na_5 \mid Ag(CN)_6 \mid$

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23. The coordination number and oxidation state of Cr in $K_3\left[Cr\left(C_2O_4\right)_3\right]$ an respectively

A. 6 and $+3$

B. 3 and 0

C. 4 and $+2$

D. 3 and $+3$

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24. In $\left|Ni\left(NH_3\right)_4\right|SO_4$, the valancy and coordination number of Ni will be respctively

A. 3 and 6

B. 4 and 4

C. 4 and 2

D. 2 and 4

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25. Which kind of isomerism is exhibited by octahedral $\left[Co\left(NH_3\right)_4Br_2\right]CI$? .

A. Geometrical and ionization

B. Geometrical only

C. Geometrical and optical

D. Optical and ionization.

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26. An aqueous solution of $COCL_2$ on addition of excess of concentrated HCl turns blue due to formation of

A. $\left|CoCl_4\right|^{2-}$

B. $\left|Co\left(H_2O\right)_2Cl_4\right|^{2-}$

C. $\left|Co\left(H_2O\right)_2 2Cl_4\right|^{2-}$

D. $\left|Co\left(H_2O\right)_4Cl_2\right|$

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27. In the process of extraction of gold.

Roasted gold ore $+CN^- + H_2O \xrightarrow{O_2} [X] + OH^-$

$[X] + Zn \rightarrow [Y] + Au$

Identify the complexes $[X]$ and $[Y]$.

A. $X = \left|An(CN)_4\right|^{3-}, Y = \left|Zn(CN)_4\right|^{2-}$

B. $X = \left|Au(CN)_2\right|^-$, Y = $\left|Zn(CN)_6\right|^{4-}$

C. $X = \left|Au(CN)_4\right|^-$, Y =$Zn(CN)_4|^{2-}$

D. $X = \left|Au(CN)_2\right|^-$, Y_(2) = $\left|Zn(CN)_4\right|^{2-}$

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Examples

1. Calculate the EAN of the metal in the following complexes and compare it with the atomic number of nearest noble gas.

(i) $\left[AuCl_2\right]^{-1}$

(ii) $Fe\left(C_2O_4\right)_3]^{3-}$

(iii) $\left[Cr\left(H_2O\right)_4NH_3\right]^{2+}$

(iv) $\left[Zn(OH)_4\right]^{2-}$

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2. Write the formulas of the following co-ordination compounds

i) tetramminediaquacobalt (III) chloride

ii) tris (ethane-1,2-diamine) chromium (iii) chloride

iii) potassium tetracyanonickelate (ii)

iii) potassium tetracyanonickelate (ii)

(iv) amminebromidochloridonitritoplatinate (II)

v) dichloridobis(ethane-1, 2-diamine) platinum (IV) nitrate

vi) iron (III) hexacyanoferrate (ii)

vii) tris(ethane-1,2-diamine) chromium (III) chloride

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3. Calculate the oxidation state of central metal atom in

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

(ii) $K_4\left[Fe(CN)_6\right]$

(iii) $\left[Co\left(NO_2\right)_2(py)_2\left(NH_3\right)_2\right]NO_3$

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4. When aqueous KCN is added to a solution of $CuSO_4$, a whitie precipitate solube in RCN is formed. But no precipate to formed when H_2S gas is bubbled through this solution. Explain.

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5. Indicate the type of isomerism exhibited by the following complexes and draw the structures for these isomers:

(i) $K\left[Cr\left(H_2O\right)_2\left(C_2O_4\right)_2\right.$

(ii) $\left[Co(en)_3\right]Cl_3$

(iii) $\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]\left(NO_3\right)_2$

(iv) $\left[Pt\left(NH_3\right)\left(H_2O\right)Cl_2\right]$

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6. On treatment of 100 mL of 0.1 M solution of $COCl_3.6H_2O$ with excess of $AgNO_3$, 1.2×10^{22} ions are precipitated. The complex is

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7. A complex compound of Cu^{3+} with molecular formula $CoCl_x. yH_2O$ gives a total of 3 ions on dissolving in water. To satisy both the primary and secondary valencies in the complex , the number of Cl^- ions required is :

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8. For the complex $\left[Fe(en)_2Cl_2\right]Cl$ (en = ethylene diamine) , identify

(i) the oxidation number of iron ,

(ii) the hybrid orbitals and the shape of the complex,

(iii) the magnetic behaviour of the complex ,

(iv) the number of geometrical isomers ,

(v) whether there is an optical isomer also , and

(vi) name of the complex . (At. no. of Fe = 26)

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9. Write the $IUPAC$ nomenclature of the given complex along with its hybridisation and structure

$K_2\left[Cr(NO)\left(NH_3\right)(CN)_4\right], \mu = 1.73. BM$.

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10. Write the state of hybridisation, the shape and the magnetic behaviour of the following complexes.

(i) $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

(ii) $\left[Co(en)_3\right]Cl_3$

(iii) $K_2\left[Ni(CN)_4\right]$

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NCERT in text question

1. Wrtie the formulas for the following coordination compounds:

(i). Tetraamminediaquacobalt(III) chloride.

(ii). Potassium tetracyanidonichelate(II).

(iii). Tris(ethane-1,2-diamine) chromium(III) chloride.

(iv) Amminebromidochloridonitrito-N-Platinate(II).

(v). Dichlororidobis (ethane-1,2-diamine) platinum(IV) nitrate.

(vi). Iron(III) hexacyanidoferrate(II).

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2. Write the IUPAC names of the following coordination compounds :

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

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

(iii) $K_3[Fe(CN)_6]$

(iv) $K_3[Fe(C_2O_4)_3]$

(v) $K_2[PdCl_4]$

(vi) $[Pt(NH_3)_2Cl(NH_2CH_3)]Cl$

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3. Indicate the type of isomerism exhibited by the following complexes and draw the structures for these isomers:

(i) $K[Cr(H_2O)_2(C_2O_4)_2$

(ii) $[Co(en)_3]Cl_3$

(iii) $[Co(NH_3)_5(NO_2)](NO_3)_2$

(iv) $[Pt(NH_3)(H_2O)Cl_2]$

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4. Give evidence to show that $\left[Co\left(NH_3\right)_5Ci\right]SO_4$ and $\left[Co\left(NH_3\right)_5SO_4\right]Cl$ exist as ionisation isomers.

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5. Explain on the basis of valence bond theory that $\left[Ni(CN)_4\right]^{2-}$ ion iwth square planar structure is diamagnetic and $\left[NiCl_4\right]^{2-}$ ion iwth tetrahedral geometry is paramagnetic.

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6. $\left[NiCl_4\right]^{2-}$ is paramagnetic while $\left[Ni(CO)_4\right]$ is diamagnetic though both are tetrahedral. Why?

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7. $\left[Fe\left(H_2O\right)_6\right]^{3+}$ is strongly paramagnetic whereas $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic. Explain.

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8. Explain $\left[Co\left(NH_3\right)_6\right]^{3+}$ is an inner orbital complex whereas $\left[Ni\left(NH_3\right)_6\right]^{2+}$ is an outer orbital complex.

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9. Predict the number of unpaired electrons in the square planar $\left[Pt(CN)_4\right]^{2-}$ ion.

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10. The hexaquo manganese(II) ion contains five unpaired electrons, while the hexacyanoion contains only one unpaired electron. Explain using the crystal field theory.

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11. Calculate the overall complex dissociation equilibrium constant for the $\left[Cu\left(NH_3\right)_4\right]^{2+}$ ion, given that β_4 for this complex is 2.1×10^{13}

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NCERT exercise

1. Explain bonding in coordination compounds in terms of werners postulates .

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2. $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution is $1:1$ molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous ammonia in $1:4$ molar ratio does not give the test of Cu^{2+} ion. Explain why?

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3. Explain with two examples each of the following: coordination entity, ligand, coordination number, coordination polyhedron, homoleptic and heteroleptic

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4. What is meant by unidentate and ambidentate ligands? Give two examples for each.

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5. Specify the oxidation numbers of metals in the following co-ordination entites :

(a) $\left[Co\left(H_2O\right)(CN)\left(en_2\right)\right]^{2+}$ (b) $\left[PtCI_4\right]^{2-}$

(c) $\left[Cr\left(NH_3\right)_3CI_3\right]$ (D) $\left[CoBr_2(en)_2\right]^{+}$

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

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6. Using $IUPAC$ norms write the fomulas for the following

(i). Tetrahydroxozincate(II).

(ii). Potassium tetrachloridopalladate(II).

(iii). Diamminedlchloridoplatinum(II).

(iv). Potassium tetracyanidonickelate(II).

(v). Pentaamminenitrito-O-Cobalt(III).

(vi). Hexaamminecobalt(III) sulphate

(vii). Potassium tri(oxalato)chromate(III).

(viii). Hexaammlneplatinum(IV)

(ix). Tetrabromidocuprate(II).

(x). Pentaamminenitrito-N-cobalt(III).

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7. Using IUPAC norms write the systematic names of the following :

(a) $\left[Co\left(NH_3\right)_6\right]CI_3$ (b) $\left[Co\left(NH_3\right)_4CI\left(NO_2\right)\right]CI$

(c) $\left[Ni\left(NH_3\right)_6\right]CL_2$ (d) $\left[Pt\left(NH_3\right)_2CI\left(NH_2CH_3\right)\right]CI$

(e) $\left[Mn\left(H_2O\right)_6\right]^{2+}$ (f) $\left[NiCl_4\right]^{2-}$

(g) $\left[Co(en)_3\right]^{3+}$ (h) $\left[Ti\left(H_2O\right)_6\right]^{3+}$

(i) $Ni(CO)_4$.

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8. List various types of isomerism possible for coordination compounds, giving an example of each.

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9. how many geometrical isomers are posssible in the following coordination entitles ?

(a) $\left[Cr\left(C_2O_4\right)_3\right]^{3-}(b)\left[Co\left(NH_3\right)_3CL_3\right]$

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10. Draw the structures of optical isomers of:

(i). $\left[Cr\left(C_2O_4\right)_3\right]^{3-}$

(ii). $\left[PtCl_2(en)_2\right]^{2+}$

(iii). $\left[Cr\left(NH_3\right)_2Cl_2(en)\right]^{\oplus}$

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11. Draw all the isomers (geometrical and optical) of:

(i) $\left[CoCl_2(en)_2\right]^+$

(ii) $\left[Co\left(NH_3\right)Cl(en)_2\right]^{2+}$

(iii) $\left[Co\left(NH_3\right)_2Cl_2(en)\right]^+$

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12. Write all the geometrical isomers of $\left[Pt\left(NH_3\right)(Br)(Cl)(py)\right]$ and how many of these will exhibit optical isomers?

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13. Aqueous copper sulphate solution (blue in colour) gives:

(i). A green precipitate with aqueous potassium fluoride and (ii). A bright green solution with aqueous potassium chloride. Explain these experimental results.

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14. What is the coordination entity formed when excess of aqueous KCN is added to an aqueous solution of copper sulphate? Why is it that no precipitate of copper sulphide is obtained when H_2S (g) is passed through this solution?

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15. Discuss the nature of bonding in the following co-ordination complexes on the basis of valence bond theory :

(a) $\left[Fe(CN)_6\right]^{4-}$ (b) $\left[FeF_6\right]^{3-}$

(c) $\left[Co\left(C_2O_4\right)_3\right]^{3-}$ (d) $\left[CoF_6\right]^{3-}$

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16. Draw figure to show the splitting of d orbitals in an octahedral crystal field.

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17. What is spectrochemical series? Explain the difference between a weak field ligand and a strong field ligand.

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18. What is crystal field splitting energy? How does the magnitude of $\triangle_0$ decide the actual configuration of d orbitals in a coordination entity?

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19. $\left[Cr\left(NH_3\right)_6\right]^{3+}$ is paramagnetic while $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic. Explain why?

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20. A solution of $\left[Ni\left(H_2O\right)_6\right]^{2+}$ is green but a solution of $\left[Ni(CN)_4\right]^{2-}$ is colourless Explain.

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21. $\left[Fe(CN)_6\right]^{4-}$ and $\left[Fe\left(H_2O\right)_6\right]^{2+}$ are of different colours in dilute solutions why?

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22. Bonding In Metal Carbonyls

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23. Give the oxidation state , d-orbital occupation and coordination number iof the central metal ion in the following complexes :

(a) $K_3\left[Co\left(C_2O_4\right)_3\right]$ (b) $\left(NH_4\right)_2\left[CoF_4\right]$ (c) Cis - $\left[CrCl_2(en)_2\right]Cl$ (d) $\left[Mn\left(H_2O\right)_6\right]SO_4$

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24. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complexes :

(a) $K\left[Cr\left(H_2O\right)_2\left(C_2O_4\right)_2\right]3H_2O$ (b) $\left[CrCl_3(py)_3\right]$ (c) $K_4\left[Mn(CN)_6\right]$

(d) $\left[Co\left(NH_3\right)_5Cl\right]Cl_2$ (e) $Cs\left[FeCl_4\right]$

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25. Name the three factors which determine the stability of a particular oxidation state in solution.

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26. What is meant by the chelate effect? Give and example.

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27. Discuss briefly giving an example in each case the role of coordination compounds in: (i) biological systems (ii) medicinal chemistry (iii) analytical chemistry and (iv) extraction/metallurgy of metals

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28. How many ions are produced from $\left[Co\left(NH_3\right)_6\right]Cl_3$ in solution ?

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29. Amongst the following ions which one has the highest magnetic movement value ?

(a) $\left[Cr\left(H_2O\right)_6\right]^{3+}$ (b) $\left[Fe\left(Nh_3\right)_6\right]^{3+}$ (c) $\left[Zn\left(H_2O\right)_6\right]^{2+}$

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30. The oxidation number of cobalt in $K\left[Co(CO)_4\right]$ is

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31. Amongst the following , the most stable complex is :

(a) $\left[Fe\left(H_2O\right)_6\right]^{3+}$ (b) $\left[Fe\left(NH_3\right)_6\right]^{3+}$ (c) $\left[Fe\left(C_2O_4\right)_3\right]^{3-}$ (d) $\left[FeCl_6\right]^{3-}$.

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32. What will be the correct order for the wavelengths of absorption in the visible region for the following:

$\left[Ni\left(NO_2\right)_6\right]^{4-}, \left[Ni\left(NH_3\right)_6\right]^{2+}, \left[Ni\left(H_2O\right)_6\right]^{2+}$?

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Multiple choise questions

1. Which of the following complexes formed by Cu^{2+} ions is most stable ?

A. $Cu^{2+} + 4NH_3 < \Rightarrow \left[Cu(NH)_3 \_ (4)\right]^{2+}. \log K = 11.6$

B. $Cu^{2+} + 4CN^- < \Rightarrow \left[Cu(CN)_4\right]^{2-}. \log K = 27.3$

C. $Cu^{2+} + 4H_2O < \Rightarrow \left[Cu\left(H_2O\right)_4\right]^{2+}. \log K = 15.4$

D. $Cu^{2+} + 4H_2O < \Rightarrow \left[Cu\left(H_2O\right)_4\right]^{2+}. \log K = 8.9$

Answer: B

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2. The colour of the coordination compounds depends on the crystal field splitting. What will be the correct order of absorption of wavelength of light of the visible region, for the complexes, $\left[Co\left(NH_3 \_ (6)\right]^{3+}. \left[Co(CN)_6\right]^{3+}. \left[Co\left(H_2O\right)_6\right]^{3+}$

A. $[Co)CN)_6]^{3-} > \left[Co\left(NH_3\right)_6\right]^{3+} > \left[Co\left(H_2O\right)_6\right]^{3+}$

B. $\left[Co\left(NH_3\right)_6\right]^{3+} > \left[Co\left(H_2O\right)_6\right]^{3+} > \left[Co(CN)_6\right]^{3-}$

C. $\left[CoH_2O\right)_6]^{3+} > Co\left(NH_3\right)_6]^{3+} > \left[Co(CN)_6\right]^{3-}$

D. $\left[Co(CN)_6\right]^{3-} > \left[Co\left(NH_3\right)\right]^{3+} > \left[Co\left(H_2O\right)_6\right]^{3+}$

Answer: C

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3. When 0.1 mol $CoCl_3\left(NH_3\right)_5$ is treated with excess of $AgNO_3$, 0.2 mole of AgCl are obtained. The conductivity of solution will correspond to

A. $1:3$ electrolyte

B. $1:2$ electrolyte

C. $1:1$ electrolyte

D. $3:1$ electrolyte

Answer: B

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4. When 1 mol $CrCl_3.6H_2O$ is treated with excess of $AgNO_3$, 3 mol of $AgCl$ are obtained. The formula of the coplex is

A. $\left[CrCl_3\left(H_2O_3\right)\right].3H_2O$

B. $\left[CrCl_2\left(H_2O\right)_4\right]Cl.2H_2O$

C. $\left[CrCl\left(H_2O\right)_5\right]Cl_2.\ H_2O$

D. $\left[CrCl\left(H_2O\right)_6\right]Cl_3$

Answer: D

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5. The correct IUPAC name of $\left[Pt\left(NH_3\right)_2Cl_2\right]$ is

A. Diamminedichloridoplatinum (ii)

B. diamminedichloridoplatinum (IV)

C. Diamminedichloridioplatinum (0)

D. dichloridodiammineplatinum (IV)

Answer: A

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6. The stabilization of coordination compound due to chelation is called the chelate effect. Which of the following is the most stable complex species?

A. $\left[Fe(CO)_5\right]$

B. $\left[Fe(CN)_6\right]^{2-}$

C. $\left[Fe\left(C_2O_4\right)_3\right]^{-}$

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

Answer: C

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7. Indicate the complex ion which shows geometrical isomerism.

A. $\left[Cr\left(H_2O\right)_4Cl_2\right]^{-}$

B. $\left[Pt\left(NH_3\right)_3Cl\right]$

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

D. $\left[Co(CN)_5(NC)\right]^{3-}$

Answer: A

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8. The CFSE for octahedral $\left[CoCl_6\right]^{4-}$ is $18,000cm^{-1}$. The CFSE for tetrahedral $\left[CoCl_4\right]^{2-}$ will be

A. $18,000cm^{-1}$

B. $16,000cm^{-1}$

C. $8,000cm^{-1}$

D. $20,000cm^{-1}$

Answer: C

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9. Due to the presence of ambidenate ligands coordination compounds show isomerism. Palladium complexes of the type $\left[Pd\left(C_6H_5\right)_2(SCN)_2\right]$ & $\left[Pd\left(C_6H_5\right)_2(NCS)_2\right]$ are

A. Linkage isomerism

B. ionisation isomerism

C. coordination isomerism

D. no isomerism

Answer: A

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10. The two compounds $\left[Co(SO_4)(NH_3)_5\right]Br$ and $\left[Co(SO_4)(NH_3)_5\right]Cl$ represent:

A. Linkage isomerism

B. ionisation isomerism

C. coordination isomerism

D. no isomerism

Answer: D

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11. A chelating agent has two or more than two donor atoms to bind to a single metal ion. Which of the following is not a chelating agent?

A. thiosulphato

B. oxalato

C. glycinato

D. ethane-1,2-diamine.

Answer: A

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12. Which of the following species is not expected to be a ligand?

A. NO

B. NH_4^+

C. $NH_2CH_2CH_2NH_2$

D. CO

Answer: B

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13. What kind of the following species is not expand to be a ligand?

A. linkage isomerism

B. solvate isomerism

C. ionisation isomerism

D. coordination isomerism

Answer: B

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14. IUPAC name of $\left[Pt(NH_3)_2Cl(NO_2)\right]$ is

A. Platinum diaminechloronitrite

B. Chloronitrito-N-ammineplatinum (II)

C. Diamminechloridonitrito-N-platinum (II)

D. Diamminechloronitrito-N-platinate (II)

Answer: C

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15. Atomic number of Mn. Fe and Co are 25, 26 and 27 respectively. Which of the following inner orbital octahedral complex ions are diamagnetic ?

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

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

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

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

Answer: A::C

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16. Atomic number of Mn, Fe, Co and Ni are 25, 26, 27 and 28 respectively. Which of the following outer orbital octahedral complexes have same number of unpaired electrons ?

A. $\left[MnCl_6\right]^{3-}$

B. $\left[FeF_6\right]^{3-}$

C. $\left[CoF_6\right]^{3-}$

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

Answer: A::C

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17. Which of the following options are correct for $\left[Fe(CN)_6\right]^{3-}$ complex ?

A. d^2sp^3 hybridisation

B. sp^3d^2 hybridisation

C. Paramagnetic

D. diamagnetic

Answer: A::C

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18. An aqueous pink solution of cobalt (II) chloride changes to deep blue on addition of excess of HCl. This is because ....

A. $\left[Co\left(H_2O\right)_6\right]^{2+}$ is transformed into $\left[CoCl_6\right]^{4-}$

B. $\left[Co\left(H_2O\right)_6\right]^{2+}$ is transformed into $\left[CoCl_4\right]^{2+}$

C. `tetrahedral complexes have smaller crystal field splitting than octahedral complexes.

D. tetrahedral complexes have larger crystal field splitting than octahedral complex.

Answer: B::C

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19. Which of the following complexes are homoleptic ?

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

B. $\left[Co\left(NH_3\right)_4Cl_2\right]^{+}$

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

D. $\left[Ni\left(NH_3\right)_4Cl_2\right]$

Answer: A::C

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20. Which of the following complexes are heteroleptic ?

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

B. $\left[Fe\left(NH_3\right)_4Cl_2\right]^{+}$

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

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

Answer: B::D

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21. Identify the optically active compounds from the following

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

B. trans-$\left[Co(en)_2Cl_2\right]^{+}$

C. cis - $\left[Co(en)_2Cl_2\right]^{-}$

D. $\left[Cr\left(NH_3\right)_5Cl\right]$

Answer: A::C

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22. Identify the correct statements for the behaviour of ethane-1, 2-diamine as a ligand.

A. It is a neutral ligand

B. It is a didenate ligand

C. It is a chelating ligand

D. It is a unidenate ligand.

Answer: A::B::C

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23. Which of the following complexes show linkage isomerism ?

A. $\left[Co\left(NH_3\right)_5\left[NO_2\right)\right]^{2+}$

B. $\left[Co\left(H_2O\right)_5CO\right]^{3+}$

C. $\left[Cr\left(NH_3\right)_5SCN\right]^{2+}$

D. $\left[Fe(en)_2Cl_2\right]^{+}$

Answer: A::C

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Matching Type questions

1. Match the complex ions given in Column I with the Column II.

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2. Match the coordination compounds given in Column I with the central metal atoms given Column II.

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3. Match the complex ions given in Column I with the hybridisation and number of unpaired electrons given in Column II.

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4. Match the complex species given un Column I with the possibvle isomerism given in Column II.

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5. Match the compounds given in Column I with the oxidation state of cobalt present in it (given in Column II)

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6. Assertion (A) Toxic metal ions are removed by the chelating ligands.

Reason (R) Chelate complexes tend to be more stable.

A. Assertion and reason both are true, reason is correct explanation of assertion.

B. Assertion and reason both are true but reason is not the correct explanation of assertion.

C. Assertion is true, reason is false

D. Assertion is false, reason is true.

Answer: a

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7. Assertion (A) $\left[Cr\left(H_2O_6\right)\right]Cl_2$ and $\left[Fe\left(H_2O\right)_6\right]Cl_2$ are reducing in nature.

Reason (R) Unpaired electrons are present in their d-orbitals.

A. Assertion and reason both are true, reason is correct explanation of assertion.

B. Assertion and reason both are true but reason is not the correct explanation of assertion.

C. Assertion is true, reason is false

D. Assertion is false, reason is true.

Answer: b

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8. Assertion (A) Linkage isomerism arises in coordination compounds containing ambidnetate ligand.

Reason (R) Ambidentate ligand has two different donor atoms.

A. Assertion and reason both are true, reason is correct explanation of assertion.

B. Assertion and reason both are true but reason is not the correct explanation of assertion.

C. Assertion is true, reason is false

D. Assertion is false, reason is true.

Answer: a

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9. Assertion (A) Complexes of MX_6 and MX_5L type (X and L are unidentate) do not show geometrical isomerism.

Reason (R) Geometrical isomerism is not shown by complexes of coordination number 6.

A. Assertion and reason both are true, reason is correct explanation of assertion.

B. Assertion and reason both are true but reason is not the correct explanation of assertion.

C. Assertion is true, reason is false

D. Assertion is false, reason is true.

Answer: b

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10. Assertion: Geometrical isomerism is shown by complexes with coordination number 6.

Reason: Because it has d^2sp^3 type hybridisation.

A. Assertion and reason both are true, reason is correct explanation of assertion.

B. Assertion and reason both are true but reason is not the correct explanation of assertion.

C. Assertion is true, reason is false

D. Assertion is false, reason is true.

Answer: d

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Short Answer Type Questions

1. Arrange the following complexes in the increasing order of conductivity of their solution

$$\left[Co\left(NH_3\right)_3Cl_3\right], \left[Co\left(NH_3\right)_4Cl_2\right]Cl, \left[Co\left(NH_3\right)_6\right]Cl_3, \left[Co\left(NH_3\right)_5Cl\right]Cl_2$$

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2. A coordination compound $CrCl_3.4H_2O$ precipitates $AgCl$ when treated with $AgNO_3$. The molar conductance of its solution corresponds to a total of two ions. Write the structural formula of the compound and name it.

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3. A complex of the type $\left[M(AA)_2X_2\right]$ is known to the optically active. What does this indicate about the structure of the complex? Give one example of such complex .

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4. Magnetic moment of $\left[MnCl_4\right]^{2-}$ is 5.92 BM. Explain giving reason present.

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5. On the basis of crystal field theory explain why Co(III) Forms paramagnetic octahedral complex with weak field ligands whereas it forms diamagnetic octahedral complex with strong field ligands.

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6. Why are low spin tetrahedral complexes not formed ?

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7. Give the electronic configuration of the following complexes on the basis of crystal field splitting theory. $\left[CoF_6\right]^{3-}$, $\left[Fe(CN)_6\right]^{4-}$ and $\left[Cu\left(NH_3\right)_6\right]^{2+}$.

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8. Explain why $\left[Fe\left(H_2O\right)_6\right]^{3+}$ has magnetic moment value of 5.92 BM whereas $\left[Fe(CN)_6\right]^{3-}$ has a value of only 1.74 BM ?

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9. Arrange following complex ions in increasing order of crystal field splitting energy $\left(\Delta_0\right)$,

$Cr(Cl)_6]^{3-}$, $\left[Cr(CN)_3\right]^{3-}$, $\left[Cr\left(NH_3\right)_6\right]^{3+}$

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10. Why do compounds having similar geometry have different magnetic moment ?

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11. $CuSO_4.5H_2O$ is blue in colour while $CuSO_4$ is colourless. Why ?

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12. Name the type of isomerism when ambidentate ligands are attached to central metal ion. Give two examples of ambidentate ligands.

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Long Answer type questions

1. Using crystal field theory, draw energy level diagram, write electronic configuration of the central metal atom/ion and determine the magnetic moment value in the following

(a) $\left[CoF_6\right]^{3-}$, $\left[Co\left(H_2O\right)_6\right]^{2+}$, $\left[Co(CN)_6\right]^{3-}$

(b) FeF_6^{3-}, $\left[Fe\left(H_2O\right)_6\right]^{2+}$, $\left[Fe(CN)_6\right]^{4-}$

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2. Using valence bond theory, explain the following in relation to the complexes given below

$\left[Mn(CN)_6\right]^{3-}$, $\left[Co\left(NH_3\right)_6\right]^{3+}$, $\left[Cr\left(H_2O\right)_6\right]^{3+}$, $\left[FeCl_6\right]^{4-}$

(a) type of hybridisation

(b) Inner or outer orbital complex

(c) Magnetic behaviour

(d) Spin only magnetic moment value.

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3. $CoSO_4Cl.5NH_3$ exists in two isomeric forms 'A' and 'B'. Isomer 'A' reacts with $AgNO_3$ to give white precipitate, but does not react with

$BaCl_2$. Isomer 'B' gives white precipitate with $BaCl_2$ but does not react with $AgNO_3$. Answer the following questions.

(a) Identify 'A' and 'B' and write their structural formulae.

(b) Name the type of isomerism involved.

(c) Give the IUPAC name of 'A' and 'B'.

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4. what is the relationshphip between observed colour of the complex and the wavelength of light absorbed by the complex ?

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5. Why are different colours observed in octahedral and tetrahedral complexes for the same metal and same ligands ?

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Additional Important Questions

1. Which type of metals normally take part in the formation of co-ordination compounds?

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2. What does 'en' represent? How many co-ordinate sites does it have?

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3. Draw cis nd trans isomers of $\left[Co\left(NH_3\right)_4Cl_2\right]^+$ ion.

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4. What is the co-ordination number?

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5. Do transition metal atoms act as Lewis bases in the co-ordination compounds?

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6. What do the abbreviations i) dien and ii) gly represent?

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7. Both σ^{-} and π-bonds are present in which type of organometallic compounds?

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8. What does EDTA stand for?

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9. Write the structrue and the name of the co-oridnate isomer of

$\left[Co(en)_3\right]Cr(CN)_6\left.\right]$

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10. Is aluminium isopropoxide an organometallic compound?

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11. What type of hybridisation is involved in the geometry of the i) square planar ii) tetrahedral iii) octahedral complexes?

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12. Formation constant K_f for the two complex ions are :

$\left[Ni(en)_3\right]^{2+}, K_f = 1.1 \times 10^{18}$ and $\left[Ni\left(NH_3\right)_6\right]^{2+}, K_f = 5.3 \times 10^{8}$

Explain the relative stability of these complexes.

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13. Calculate the oxidation state of metal ion in:

i) $\left[Ag(CN)_2\right]^{-}$

ii) $\left[Ni(CO)_4\right]$

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

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14. Give the molecular formulae of the following complexes.

i) hexaamine iron (III) nitrate.

ii) ammonium tetrachloridocuprate (ii)

iii) Sodium monochloridopentacyanoferrate (III)

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15. Given the IUPAC names of the following complex compounds. ltbr.

i) $\left[CoBr\left(NH_{3\,-}\,(5)\right]SO_4\right.$

$\left[Fe\left(NH_3\right)_6\right]\left[Cr(CN)_6\right]$

iii) $Na_3\left[FeCl(CN)_5\right]$

iv) $\left[Fe(OH)\left(H_2O\right)_5\right]^{2+}$

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16. How does en ect as a cheating ligand with Cu(II) ion?

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17. Are the bidentate ligands same as the ambidentate ligands ?

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18. Describe a simple test that will allow you to distinguish between the compounds:

$\left[Co\left(NH_3\right)_5Br\right]SO_4$ and $\left[Co\left(NH_3\right)_5SO_4\right]Br$.

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19. One mole of aqueous solution of the complex $CoCl_3 5H_2O$ when treated with excess of aqueous $AgNO_3$ solution gave one mole of white pptof AgCl. What is the complex?

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20. How does EDTA help as a cure for lead poisoning?

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21. How many geometrical isomers are possible for the complex $\left[Ni(CO)_4\right]$ which is tetrahedral in nature?

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22. Is the name potassium tris(oxalato) aluminium(III) for the complex $\left[K_3Al\left(C_2O_4\right)_3\right]$ correct?

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23. Is the complex $\left[Ni(CO)_4\right]$ paramagnetic in nature?

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24. The EAN of each Mn(Z=25) in its carbonyl compound is 36. What is the structure of the carbonyl compound with molecular formula $Mn_2\left(CO_{10}\right)$?

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25. Write equations to represent the following observations: When NaOH is added to aqueous $CuSO_4$ solutin, a pale blue precipitate is formed. On adding aqeous NH_3 solution, When NaOH is added to give a deep blue solution. If the solution is made acidic with dilute HNO_3, the colour is converted back to pale blue solution.

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26. Out of NH_3 and 'en' which ligand forms a more stable complex with metal and why?

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Questions from board examinations

1. How many ions are formed by the complex $\left[Co\left(NH_3\right)_6\right]Cl_3$ in aqueous solution?

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2. Which complex compound is used in chemotherapy?

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3. Write the formula and IUPAC name of prussian blue.

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4. Which compounds used to estimate the hardness of water volumetrically ?

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5. If the geometry of the complex $\left[PtCl_4\right]^{2-}$ is square planar, which type of orbitals are involved in its hybridisation?

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6. Write the IUPAC names of i) $\left[Cr\left(NH_3\right)_4Cl_2\right]^{2-}$ ii) $\left[Pt\left(NH_3\right)_2Cl_2\right]Cl_2$

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7. What is the CN of central metal ion in $\left[Fe\left(C_2O_4\right)_3\right]^{3-}$?

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8. In the formula $Fe\left(\eta^5 - C_5H_5\right)$, what does the prefix η^5 denote?

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9. $\left[Ni(CO)_4\right]$ possess tetrahedral geometry while $\left[Pt\left(NH_3\right)_2Cl_2\right]$ has square planar geometry. Explain.

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10. Write the IUPAC names of the complexes (i) $Na_3\left[CrF_4(OH)_2\right]$ ii) $\left[Cr\left(H_2O\right)_5Cl\right]Cl_2$.

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11. Give a ligand which is bidentate and given an example of the complex formed by the ligand..

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12. Which isomerism is shown by hte complex $\left[Cr\left(H_2O\right)_5NCS\right]^{2+}$?

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13. Write the formula ofthe compounds i) hexaammineplatinum(IV) chloride (ii) dechlorido tetraamminecobalt (III) ion.

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14. (a) Write the IUPAC name of $K_3\left[Fe(CN)_5NO\right]$

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

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15. Give names of two complexes which are used in medicines.

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16. What aer ambidentate ligands? Give an example.

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17. Draw the structure of $\left[Pt\left(Cl_3\right)\left(C_2H_4\right)\right]$

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18. Write the IUPAC name and hybridisation of $K_2[CoCl_4(en)]$

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19. Draw structures of geometrical isomers of $\left[Fe(CN)_4(NH_3)_2\right]^{\Theta}$.

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20. Write the name of $\left[Co(NH_3)_4(H_2O)_2\right]Cl_3$

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21. Draw the structure of isomes of $Pt(NH_3)_2Cl_2$

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22. IUPAC name of $K_4\left|Fe(CN)_6\right|$ is

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23. Explain how two complexes of nickel, $\left[Ni(CN)_4\right]^{2-}$ and $Ni(CO)_4$ have different structures but do not differ in magnetic behaviour.

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24. Write the formula of i) tetraamminedichloridochromium (III) Chloride (ii) pentaamminechloridoplatinum (IV) chloride.

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25. Write the IUPAC name of complex: $\left[Fe(en)_2Cl_2\right]Cl$ and mention the oxidation of iron.

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26. Why are π - complexes known for transition metals only?

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27. CO is a stronger ligand than NH_3 for many metals. Explain.

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28. Give the IUPAC name of $\left[Cr\left(H_2O\right)\right)_4Cl_2\right]Cl$.

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29. Give the number of unpaired electrons in the following complex ions:

$\left[FeF_6\right]^{4-}$ and $\left[Fe(CN)_6\right]^{4-}$

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30. Name the isomerism exhibited by the co-ordination compounds?

$\left[Co\left(NH_3\right)_5Br\right]SO_4$ and $\left[Co\left(NH_3\right)_5SO_4\right]Br$

Give ne test to distinguish between these two compounds.

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31. A metal ion M^{n+} having d^4 valence electrode configuration combines with three ligands to form a complex compound. Assuming $\Delta_0 > P$.

i) Draw the diagram assuming d-orbital splitting during the complex formation.

ii) Write the electronic configuration of valence electrons of the metal M^{n+} ion in terms t_{2g} and e_g.

iii) What type of of hybrisation will M^{n+} ion have?

iv) Name the type of isomerism exhibited by the complex.

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32. a) Give the electronic configuration of the d-orbitals of Ti in $\left[Ti\left(H_2O\right)_6\right]^{3+}$ ion in the octahedral crystal field.

b) Why is this complex coloured. Explain on the basis of distribution of electrons in d-orbitals.

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33. Give an example of linkage isomerism.

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34. Name the following compounds according to IUPAC system

i) $\left[Co\left(NH_3\right)_4\left(H_2O\right)_2\right]Cl_2$

ii) $\left[CrCl_2(en)_2\right]Cl$

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35. Give the shape and behaviour of the following complexes:

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

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

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36. Explain the following given appropriate reason:

i) Nickel does not form low spin octahedral complexes.

ii) The π-complexes are known for the transition metals only.

iii) Co^{2+} is easily oxidised to Co^{3+} in the presence of a strong ligand.

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37. Write the name, the state of hybridization, the shape and the magnetic behaviour of the following complexes :

$\left[CoCl_4\right]^{2-}$, $\left[Ni\left(CN_4\right]^{2-}\right.$, $\left[Cr\left(H_2O\right)_2\left(C_2O_4\right)_2\right]^{-}$

(At.No.: $Co = 27$, $Ni = 28$, $Cr = 24$)

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38. a) Give the electronic configuration of the d-orbitals of Ti in $\left[Ti\left(H_2O\right)_6\right]^{3+}$ ion and explain why the complex is coloured? [At. No. Of Ti=22]

b) Write IUPAC name of $\left[Cr\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3$

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39. a) State the hybridisation & magnetic behaviour of $\left[Cr(CO)_6\right]$

b) What are the various factors affecting crystal field splitting energy?

c) Which of the two is more stable and why?

$K_4\left[Fe(CN)_6\right]$ or $\left[K_3\left[Fe(CN)_6\right]\right]$

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40. Among the octahedral and tetrahedral crystal fields, In which case the magnitude of crystal field splitting is larger?

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41. (a) Define a ligand.

(b) Discuss the magnetic behaviour, nature and geometry of $\left(NiCl_4\right)^{2-}$ ion on the basis of valence bond theory (VBT).

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42. Write the stucture and names of all steresiomers fo the following compounds:

(i) $\left[Co\left(en_3\right)\right]Cl_3$

(ii) $\left[Pt\left(NH_3\right)_2Cl_2\right]$

(iii) $\left[Fe\left(NH_3\right)_4Cl_2\right]Cl$

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43. Draw the structure of isomers if any and write the names of the following complexes?

i) $\left[Cr\left(NH_3\right)_4Cl_2\right]^+$

ii) $\left[Co(en)_3\right]^{3+}$

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44. Give the formula of each of the following coordination entities :

(i) Co^{3+} ions is bound to one Cl^{-} one NH_3 molecules and two bidentate ethylene diamine (en) molecules.

(ii) Ni^{2+} ions is bound to two water molecules and two oxalate ions.

Write the name and magnetic behaviour of each of the abvoe coordination entities.

(At. nos. $Co = 27, Ni = 28$)

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45. Write the name , structure and magnetic behaviour of the following complexes

(i) $\left[Pt(NH_3)_2Cl(NO_2)\right]$ (ii) $\left[Co(NH_3)_4Cl_2\right]Cl$

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46. Give the electronic configurations of d-orbitals of $K_3\left[Fe(CN)_6\right]$ and $K_3\left[FeF_6\right]$ and explain why these complexes give different colours with the same solution .

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47. Give the names of the followng complexes according to IUPAC system

(i) $\left[CoCl_2(en)_2\right]Cl$ (ii) $K_3\left\{Fe(CN)_6\right\}$.

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48. Give an account of the valence bond theory . Explain the geometry and magnetic behaviour of the complex ion $\left[Fe(CN)_6\right]^{4-}$ on the basis of the theory .

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49. Give the oxidation states of the central matal in the following complex compounds , (i)$K_3\left[Fe(CN)_6\right]$ (ii) $\left[PtCl_4\right]^{2-}$ (iii) $\left[Co(en)_2Cl_2\right]^+$.

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50. The compound used in the treatment of lead poisoning is :

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51. Write the IUPAC name of $K_3\left[Cr\left(C_2O_4\right)_3\right]$

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52. Discuss the geometry of the complex $\left[Fe(CN)_6\right]^{3-}$ on the basis of valence bond theory.

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53. Write the IUPAC names of :

(a)$K_4[Fe(CN)_6]$ (b)$[Co(NH_3)_6]Cl_3$ (c) $Na[AIF_6]$

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54. For the complexes $[NiCl_4]^{2-}$

(i) Write the IUPAC name

(ii) the state of the hybridisation

(iii) the shape of the complex.

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55. Which of the following complexes is more stable and why ?

$[Co(en)_3]^{3+}$ and $[Co(NH_3)_6]^{3+}$

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56. What type of isomerism is shown by the complex $\left[Co(en)_3\right]^{3+}$?

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57. $\left[NiCl_4\right]^{2-}$ is paramagnetic while $\left[Ni(CO)_4\right]$ is diamagnetic though both are tetrahedral. Why?

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58. Discuss the geometry of the complex $\left[Fe(CN)_6\right]^{3-}$ on the basis of valence bond theory.

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59. Write the IUPAC names of the complexes :

$\left[Ag\left(NH_3\right)_2\right]Cl$ and $K\left[Ag(CN)_2\right]$

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60. Define the following :

(i) Linkage isomerism (ii) Hydrate isomerism .

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61. What is basic difference between a double salt and a co-ordination complex ?

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62. Write the IUPAC name of the complex

(i) $\left[Ag\left(NH_3\right)_2\right]\left[Ag(CN)_2\right]$

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63. (a) Write the IUPC names of the following co-ordination compounds (i) $\left[Ce\left(NH_3\right)_4\left(H_2O\right)_2\right]Cl_3$ (ii) $\left[PtCl_2\left(NH_3\right)_4\right]\left[PtCl_4\right]$

(b) State the hybridisation and magnetic property of $\left[Fe(CN)_6\right]^{3-}$ ion according to the valence bond theory .

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64. (i) predict the number of unpaired electrons in the tetrahedral $\left[MnBr_4\right]^{2-}$

(ii) Draw the structures of geometrical isomers of $\left[Co\left(NH_3\right)_4Cl_2\right]^+$

(iii) Writ the formula of the following co-ordinate compound : amminebromidochloridonitrito-N-platinate (II)

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65. What is the effect of synergic bonding interactions in a metal carbonyl complex ?

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66. (i) write the IUPAC name of the following complex : $\left[Cr(en)_3\right]Cl_3$

(ii) Write the formula for the following complex potassium trioxalatochromate.

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67. (i) Write the geometrical isomer of the complex $\left[Co(en)_2Cl_2\right]^+$.

(ii) $\left[NiCl_4\right]^{2-}$ is paramagnetic while $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic through both are tetrahedral . Why ?

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68. (i) Write the IUPAC name of the complex : $\left[Ce\left(NH_3\right)_2Cl_2(en)Cl\right]$.

(ii) Write the formula of the complexes : pentamminenitrito-o-cobalt (III) .

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69. Write hybridisation and magnetic behaviour of the complex $\left[Ni(CO)_4\right]$.

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70. Out of CN^- and CO , which ligands forms a more stable complex with metal and why ?

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71. What type of isomerism is shown by $\left[Co\left(NH_3\right)_5ONO\right]Cl_2$?

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72. Write the IUPAC names of the complex $\left[Pt(en)_2Cl_2\right]^{2+}$. What type of isomerism is shown by the complex ?

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73. Give the chemical formula of the following complexes : (i) diaminesilver (I) chloride

(ii) potassium hexacyanoferrate (II)

(iii) tetraiodomercurate (II) ion

(iv) tetramminecopper (II) ion .

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74. When a co-ordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated per mole of the compound. Write

(i) Structural formula of the complex.

(ii) IUPAC name of the complex.

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75. (a) For the complex $\left[Fe(CN)_6\right]^{3-}$, write the hybridisation type, magnetic character and spin nature of the complex .(At. Number : Fe = 26)

(b) Draw one of the geometrical isomers of the complex $\left[Pt(en)_2Cl_2\right]^{2+}$ which is optically active .

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76. When a coordination complex $PtCl_4.6NH_3$ is mixed with $AgNO_3$, 4 moles of AgCl are precipitated per mole of the complex ? Write :

(i) structural formula of the complex

IUPACname of the complex .

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77. Why is the complex $\left[CoF_6\right]^{3-}$ less stable than the complex $\left[Co(en)_3\right]^{3+}$?

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78. For the complex , $\left[Co(en)_3\right]^{3+}$, write the hybridisation type, magnetic character and spin nature of the complex.

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79. (a) For the complex $\left[Fe(CO)_5\right]$ write the hybridisartion , magnetc character and the spin of the complex .

Define crystal fiweld splitting energy .

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80. Explain linkage , isomerism in co-ordinate compounds .

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81. How does $K_2\left[PtCl_4\right]$ get ionised when dissolved in water ? Will it form precipitate when $AgNO_3$ solution is added to it ? Give reason for your answer ?

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82. (i) What type of isomerism is shown by the complex $\left[Co\left(NH_3\right)_6\right]\left[Cr(CN)_6\right]$?

(ii) Why a solution of $\left[Ni\left(H_2O\right)_6\right]^{2+}$ is colored while a solution of $\left[Ni(CN)_4\right]^{2-}$ colourless ? (At. No. of Ni = 28)

(iii) Write the IUPAC name of the following complex : $\left[Co\left(NH_3\right)_5(CO)\right]Cl_3$

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83. A metal ion M^{n+} HAVING D^4 valence electronic configuration combines with three bidentate ligands to form a complex compound . Assuming $\Delta_0 > P$:

(i) write the electronic configuration of d^4 ion .

(ii) what type of hybridisation will M^{n+} ion has ?

(iii) Nmae the type of isomerism exhibited by this complex .

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84. (a) What type of isomerism is shown by the complex $\left[Co\left(NH_3\right)_5(SCN)\right]^{2+}$?

(b) why is $\left[NiCl_4\right]^{2-}$ paramagnetic while $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic ? (Atomic number of Ni=28)

(c) Why are low spin tetrahedral complexes rarely observed?

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85. Write IUPAC names of (i) $K_3\left[Fe(CN)_5NO\right]$ (II) $K_3\left[Al\left(C_2O_4\right)_3\right]$.

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86. Write geometrical isomers of $\left[CoCl_3\left(NH_3\right)_3\right]$.

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87. (a) Write the formula of the following coordination compound : Iron (III) hexacyanoferrate (II)

(b) What type of isomerism is exhibited by the complex $\left[Co\left(NH_3\right)_5Cl\right]SO_4$?

(c) Write the hybridisation and number of unpaired electrons in the complex $\left[CoF_6\right]^{3-}$.

(Atomic No. of Co = 27)

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88. (a) Write the co-ordination number and oxidation state of platinum in the complex $\left[Pt(en)_2Cl_2\right]$

(b) Low spin configuration are rarely observed in tetrahedral co-ordination entity formation . Explain .

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89. A metal complex having composition $Cr(NH_3)_4CI_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia.

(i) Write the formulae of isomers A and B.

(ii) State the hybridisation of chromium in each of them.

(iii) Calculate the magnetic moment (spin only) of the isomer A.

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90. (a) Define a ligand .

(b) Discuss the magnetic behaviour , nature and geometry of $(NiCl_4)^{2-}$ ion on the basis of valence bond theory (VBT)

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91. What is basic difference between a double salt and a co-ordination complex ?

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92. Write the structural formula of the following compounds :

(i) Dichloridobis (ethylenediamine) cobalt (IV) sulphate

(ii) tetraminechloridonitrocobalt (III) sulphate

(iii) tetraaquodichloridochromium (III) nitrate

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93. (a) Write the IUPAC name of the complex : $\left[Co\left(NH_3\right)_4\left(H_2O\right)Cl\right]Cl_2$.

(b) Explain linkage isomerism with example .

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94. $\left[NiCl_4\right]^{2-}$ is paramagnetic while $\left[Ni(CO)_4\right]$ is diamagnetic though both are tetrahedral. Why?

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HIGH ORDER THINKING SKILLS (HOTS) QUESTIONS

1. An cationic complex has two isomers A and B . Each has one Co^{3+}, five NH_3 , one Br^- and one SO_4^{2-} . A gives a white precipitate with $BaCl_2$ solution while B gives a yellow precipitate with $AgNO_3$ solution.

(a) What are the possible structures of the complexes A and B ?

(b) Will the two complexes have same colour ?

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2. A, B and C are three complexes of chromium(III) with the empirical formula $H_{12}O_6C_{13}Cr$ All the three complexes not react with concentrated H_2SO_4 whereas complexes B and C lose 6.75% and 13.5% of their original mass respectively, on treatment on treatment with conectrated H_2SO_4 Identify A, B and C .

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3. Combination between Pt(IV), NH_3 and Cl^- results in the formation of seven complexes. One of these complexes is $\left[Pt\left(NH_3\right)_6\right]Cl_4$

(i) Write the formulae and IUPAC names of the other six complexes .

(ii) Which will have highest molar conductivity ?

(iii) Which of these is non-ionic ?

(iv) What is the the C.N of Pt in these complexes ?

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4. An octahedral complex is prepared by mixing $CoCl_3$ and NH_3 in the molar ratio of 1 : 4 . 0.1 m solutioin of this complex was found to freeze at -$0.372\,^\circ C$. What is the formula of the complex ? Given the molal depression content (K_f) for water = $1.86\,^\circ$ cm

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5. A metal complex having composition $Cr(NH_3)_4CI_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia.

(i) Write the formulae of isomers A and B.

(ii) State the hybridisation of chromium in each of them.

(iii) Calculate the magnetic moment (spin only) of the isomer A.

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6. Give the electronic configuration of the d-orbitals in the complex $\left[MnF_6\right]^{3-}$ according to CFT through diagram.

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7. How will you account for the following ?

(a) $K_4\left[Fe(CN)_6\right]$ is not toxic whereas KCN is highly toxic.

(b) Oxalic acid is commonly used to remove rust stains.

(c) Tetrahedral complexes used do not show any geometrical isomerism.

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8. How will you account for the indicated molecular geometry of the following compounds in terms of valence bond theory ?

$\left[ArCl_4\right]^-$ is square planar while $\left[GaCl_4\right]^-$ is tetrahedral .

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9. A solution containing 2.665 g of $CrCl_{3.6}H_2O$ is passed through a cation exchanger. The chloride ions obtained in solution react with $AgNO_3$ and 2.87g of $AgCl_3$ is precipitated. Determine the structure of the complex.

(Cr = 52 , Cl = 35.5 , Ag = 108 , N = 14)

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10. The ammonia prepared by treating ammonium sulphate with calcium hydroxide is completely used by $\mathrm{NiCl}_2.6H_2O$ to form a stable coordination compound. Assume that both the reactions are 100% complete. If 1584 g of ammonium sulphate and 952 g of $\mathrm{NiCl}_2.6H_2O$ are used in the preparation, the combined weight (in grams) of gypsum and the nickel- ammonia coordination compound thus produced is ____.

(Atomic weights in gmol^{-1} : H = 1, N = 14, O = 16, S = 32, Cl = 35.5, Ca = 40, Ni = 59)

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Assignment

1. Give the IUPAC name of the following complexes :

(i) $\left[CoCl(en)_2(ONO)\right]Cl$

(ii) $\left(NH_4\right)_3\left[Co(ONO)_6\right]$

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2. How will you account for the following :

(i) $\left[Fe(CN)_6\right]^{-}$ is weakly paramagnetic while $\left[Ni(CN)_4\right]^{2+}$ diamagnetic.

(ii) $\left[Ni(CO)_4\right]$ possess tetrahedral geometry while $\left[Ni(CN)_4\right]^{2-}$ is square planar.

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3. Using valence bond approach, deduce the shape and magnetic character of $\left[Cr(CO)_6\right]$.

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4. Using valence approach, predict the shape and magnetic character of $\left[Fe(CN)_6\right]^{3-}$ ion.

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5. Draw the structure and write the hybridisation :

(i) Cis-$\left[Co\left(NH_3\right)_4Cl_2\right]^+$ (ii) $Ni(CO)_4$.

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6. (a) Give IUPAC name of $k\left[Ag(CN)_2\right]$

(b) Define the terms :

(i) Ligand (ii) Co-ordiante sphere.

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7. (a) Give the IUPAC name of $\left[pt\left(NH_3\right)_2Cl\left(NH_2Ch_3\right)\right]Cl.$

(b) Compare the magnetic behavious of the complex entities $\left[Fe(CN)_6\right]^{4-}$ and $\left[FeF_6\right]^{3-}$.

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8. (a) Write the IUPAC name of $\left[Co(en)_2F_2\right]ClO_4$

(b) Illustrate linkage isomerism with example.

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9. (a) Write the IUPAC name of $K_3\left[Fe(CN)_5NO\right]$

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

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10. (a) Write the IUPAC name of $K_3\left[Fe(CN)_6\right]$.

(b) By using valence bond theory discuss the geometry of $\left[Co(NH)_3\right)_6]^{3+}$ ion.

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11. Using valence bond theory , explain the geometry and magnetic behaviour of pentacarbonyl irom (0).

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12. Write the IUPAC names of :

(i) $K_3[Fe(C_2O_4)]$ (ii) $[Pt(NH_3)_6]Cl_4$.

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13. Using valence bond theory, predict the geometry and magnetic behaviour of $[Cr(NH_3)_6]^+$ ion.

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14. With the help of valence bond theory explain the bonding and shape of complex ion $[Zn(NH_3)_4]^{2+}$.

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15. Describe the structure and magnetic behaviour of $\left[Ni(CN)_4\right]^{2-}$ ion on the basis of valence bond theory.

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16. Explain with the help of valence bond theory, the geometry and magnetic nature of $\left[MnCl_6\right]^{4-}$

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17. Write IUPAC name of $Fe_4\left[Fe(CN)_6\right]$

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18. Account for the fact that $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic while $\left[Fe(CN)_6\right]^{2+}$ is diamagnetic.

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19. Describe for any two of the following complex ions , the type of hybridisation , shape and magnetic property.

(i) $\left[Fe\left(H_2O\right)_6\right]^{2+}$ (ii) $\left[Co\left(NH_3\right)_6\right]^{3+}$ (iii) $\left[NiCl_4\right]^{2-}$

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20. Write the names and draw the structures of complex compounds

It(i) $\left[Co\left(NH_3\right)_4\left(H_2O_2\right]Cl_3\right.$

(ii) $\left[Pt\left(NH_3\right)_4\right]^{2+}$ (iii) $\left[NiCl_4\right]$

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21. What is a ligand ? Give example of bidentate ligand.

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22. Explain how two complexes of nickel, $\left[Ni(CN)_4\right]^{2-}$ and $Ni(CO)_4$ have different structures but do not differ in magnetic behaviour.

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23. LIMITATIONS OF VALENCE BOND THEORY

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24. Explain the following types of isomerism in co-ordination compounds.

(i) Ionisation isomerism (ii) Hydrate isomerism.

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25. What is the C.N of cobalt in $\left[Co\left(NH_3\right)_4Cl\left(NO_2\right)\right]Cl$?

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26. Write the formula of pentaaquachloridochromium (II) chloride.

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27. (a) Name the hybridisation of Co in $\left[Co\left(NH_3\right)_6\right]^{3+}$

(b) $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic . Explain .

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28. $\left[Ni(CO)_4\right]$ possess tetrahedral geometry while $\left[Pt\left(NH_3\right)_2Cl_2\right]$ has square planar geometry. Explain.

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29. Using valence bond approach, deduce the shape and magnetic character of $\left[Co\left(NH_3\right)_6\right]^+$ ion .

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30. Give a suitable example for each, explain the following :

(i) Crystal field splitting . (ii) Linkage isomerism.

(iii) Ambident ligand.

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31. Explain the following complexes with respect to structural shapes of units, magnetic behaviour and hybrid orbitals involved in the units

:

$\left[Cr\left(NH_3\right)_6\right]^{3+}$, $\left[Cr\left(NH_3\right)_6\right]^{3+}$, $\left[Ni(CO)_4\right]$

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32. Explain the following :

(i) Low spin octahedral complexes of nickel are not known.

(ii) The π - complexes are known for transition elememts only.

(iii) CO is a stroger ligand than NH_3 for many metals.

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33. Describe the type of hybridisation , shape and magnetic property of complex $\left[Co\left(NH_3\right)Cl_2\right]Cl.$

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34. Give one example each of

(i) Co-ordination isomerism

(ii) Ionisation isomerism.

(iii) Linkage isomerism.

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35. Give the IUPAC names of the following compounds :

(i) $\left[Co\left(NH_3\right)_4\left(H_2O\right)Cl\right]CL_2$

(ii) $\left[CrCl_2(en)_2\right]Cl$

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36. Explain the following given appropriate reason:

i) Nickel does not form low spin octahedral complexes.

ii) The π-complexes are known for the transition metals only.

iii) Co^{2+} is easily oxidised to Co^{3+} in the presence of a strong ligand.

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37. Give the IUPAC name of :

(i) $K_2\left[Ni(CN)_4\right]$

ii) $\left[CoCL_2\left(NH_3\right)_4\right]Cl$

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38. What is the CN of the metal atom in the complex salt $\left[Co\left(NH_3\right)_4\left(H_2O\right)Cl\right]Cl_2$?

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39. Explain the following terms giving suitable examples in each case

(i) Ambident ligand

(ii) Denticity of a ligand

(iii) Crystal field splitting in an octahedral field.

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40. Write the state of hybridisation, the shape and the magnetic behaviour of the following complexes.

i) $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

ii) $\left[Co(en)_3\right]Cl_3$

(iii) $K_2\left[Ni(CN)_4\right]$

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41. Define the following terms with examples :

(i) Co-ordiantion complex.

(ii) Bidentate ligand.

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42. Give the formula of each of the following coordination entities :

(i) Co^{3+} ions is bound to one Cl^{-} one NH_3 molecules and two bidentate ethylene diamine (en) molecules.

(ii) Ni^{2+} ions is bound to two water molecules and two oxalate ions.

Write the name and magnetic behaviour of each of the abvoe coordination entities.

(At. nos. $Co = 27, Ni = 28$)

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43. Give the names of the followng complexes according to IUPAC system

(i) $\left[CoCl_2(en)_2\right]Cl$ (ii) $K_3\left\{Fe(CN)_6\right\}$.

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44. Give an account of the valence bond theory . Explain the geometry and magnetic behaviour of the complex ion $\left[Fe(CN)_6\right]^{4-}$ on the basis of the theory .

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45. Give the oxidation states of the central matal in the following complex compounds , (i)$K_3\left[Fe(CN)_6\right]$ (ii) $\left[PtCl_4\right]^{2-}$ (iii) $\left[Co(en)_2Cl_2\right]^+$.

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46. Write the IUPAC names of the complex $K_3\left[Cr\left(C_2O_4\right)_3\right]$

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47. Discuss the geometry of the complex $\left[Fe(CN)_6\right]^{3-}$ on the basis of valence bond theory.

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48. Write the IUPAC names of the following complexes

(i) $K_3\left[Fe(CN)_6\right]$ (ii) $\left[Co\left(NH_3\right)_6\right]Cl_3$ ltBrgt (iii) $Na_3\left[AlF_6\right]$

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49. For the complexes $\left[NiCl_4\right]^{2-}$

(i) Write the IUPAC name

(ii) the state of the hybridisation

(iii) the shape of the complex.

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50. (i) Give the IUPAC names of the complex $\left[Co\left(Br_2\right)(en)_2\right]^+$

(ii) What type of isomerism is shown by the complex $\left[Co\left(NH_3\right)_5SO_4\right]Br$?

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51. Write IUPAC name of the following complexes $\left[Cr\left(NH_3\right)_4Cl_2\right]^+$.

What type of isomerism does it exhibit ?

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52. Which of the following complexes is more stable and why ?

$\left[Co(en)_3\right]^{3+}$ and $\left[Co\left(NH_3\right)_6\right]^{3+}$

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53. What type of isomerism is shown by the complex $\left[Co(en)_3\right]^{3+}$?

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54. $\left[NiCl_4\right]^{2-}$ is paramagnetic while $\left[Ni(CO)_4\right]$ is diamagnetic though both are tetrahedral. Why?

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55. Discuss the geometry of the complex $\left[Fe(CN)_6\right]^{3-}$ on the basis of valence bond theory.

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56. Write the formula of the complex pentaamminesulphatocobalt (III) chloride.

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57. Write the IUPAC names of the complexes :

$\left[Ag\left(NH_3\right)_2\right]Cl$ and $K\left[Ag(CN)_2\right]$

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58. Define the following :

(i) Linkage isomerism (ii) Hydrate isomerism .

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59. Write the IUPAC name of the complex

(i) $\left[Ag\left(NH_3\right)_2\right]\left[Ag(CN)_2\right]$

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60. What is basic difference between a double salt and a co-ordination complex ?

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61. Write the IUPAC name of the complex :

$\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]\left[NO_3\right]_2$.

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62. (i) Draw the geometrical isomer of the complex $Pt\left(NH_3\right)_2Cl_2$

(ii) Write the hybridisation and magnetic behaviour of the complex $\left[Ni(CO)_4\right]$.

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63. Write hybridisation and shape of the following complexes .

(i) $\left[FeF_6\right]^{3-}$ (ii) $\left[Ni(CO)_4\right]$

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64. Write the hybridisation and shape of the following complexes.

(i) $\left[Co\left(NH_3\right)_6\right]^{3+}$ (ii) $\left[NICl_4\right]^{2-}$

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65. (i) Write the IUPAC name of the following complex : $\left[Pt\left(NH_3\right)_3\left(H_2O\right)Cl_2\right]$. (ii) Write the formula for the following complex :

tris(ethane-1,2-diamine) chromium (III) chloride.

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66. Write the *IUPAC* names for the following coordination compounds:

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

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

(iii). $K_2\left[Fe(CN)_6\right]$

(iv). $K_3\left[Fe\left(C_2O_4\right)_3\right]$

(v). $K_2\left[PdCl_4\right]$

(vi). $\left[Pt\left(NH_3\right)_2Cl\left(NH_2CH_3\right)\right]Cl$

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67. For the complex $\left[Fe(CN)_6\right]^{3-}$, write the hybridisation type, magnetic type and spin nature of the complex

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68. Why is the complex $\left[CoF_6\right]^{3-}$ less stable than the complex $\left[Co(en)_3\right]^{3+}$?

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69. Define crystal field splitting energy ?

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70. (a) Explain linkage isomerism in Co-ordination compounds by giving an example .

(b) Write the IUPAC names of this following :

(i) $\left[Co\left(NH_3\right)_6\right]Cl_3$ (ii) $\left[Co(en)_2(ONO)Cl\right]^{-}$

(iii) $K\left[Ag(CN)_2\right]$ (iv) $\left[Cd(NCS)_4\right]^{2-}$

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71. What type of isomerism is exhibuted by the following pairs of compounds ?

(i) $\left[PtCl_2\left(NH_3\right)_4\right]Br_2$ and $\left[PtBr_2\left(NH_4\right)_4\right]Cl_2$.

(ii) $\left[Cr(SCN)\left(H_2O\right)_5\right]^{2+}$ and $\left[Cr(NCS)\left(H_2O\right)_5\right]^{2+}$

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72. Define ligands. Give one example each of bidentate adn hexadentate ligansds.

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73. Write the IUPAC name of $K_3\left[Cr\left(C_2O_4\right)_3\right]$

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74. Write down the type of isomerism shown by the following complex compounds .

(a) $\left[Pt\left(NH_3\right)_4Cl_2Br_2\right.$ and $\left[Pt\left(NH_3\right)_4Br_2\right]Cl_2$

(b) $\left[Cu\left(NH_3\right)_4\right]\left[PtCl_4\right]$ and $\left[Pt\left(NH_3\right)_4\right]\left[CuCl_4\right]$

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75. With the help of valence bond theory (VBT) , explain hybridisation geometry and magnetic behaviour of $(NiCl_4)^{2-}$ complex .

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76. $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic though both are tetrahedral Why?

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Select the correct answers

1. A coordination compound of cobalt has the molecular, formula containing five ammonia molecules, one nitro group and two chlorine atoms for onew cobalt atom. One mole of this compounds three ions in an aqueous solution. On reacting this solution with excess of

$AgNO_3$ solution, we get two moles of AgCl precipitate. The ionic formula for this complex would be

A. $\left[Co\left(NH_3\right)_4ClNO_2\right]\left[NH_3Cl\right]$

B. $\left[Co\left(NH_3\right)Cl\right]\left[ClNO_2\right]$

C. $\left[Co\left(NH_3\right)_5NO_2\right]Cl_2$

D. $\left[Co\left(NH_3\right)_5\right]\left(NO_2\right)_2Cl_2\right]$

Answer: C

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2. $\left[Co\left(NH_3\right)_5SO_4\right]Br$ and $\left[Co\left(NH_3\right)_5Br\right]SO_4$ shown ________isomerism .

A. Ionisatioin

B. Linkage

C. Co-ordination

D. Optical

Answer: A

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3. Which one of the following complexes will have four isomers?

A. $\left[CoCl_2(en)\left(NH_3\right)_2\right]Cl$

B. $\left[Co\left(NH_3\right)_2Cl_2\left(PPh_3\right)_2\right]Cl$

C. $\left[Co(en)_3\right]Cl_3$

D. $\left[CoCl_2(en)_2\right]Br$

Answer: D

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4. The correct structure of $Fe(CO)_5$ is ?

A. octahedral

B. tetrahedral

C. square pyramidal

D. trigonal bipyramidal

Answer: D

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5. Which of the following has magnesim?

A. Chlorophyll

B. Haemocyanin

C. Carbonic anhydrase

D. photosynthesis

Answer: A

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6. Which of the following shall form an octahedral complex ?

A. d^4 (Low spin)

B. d^8 (high spin)

C. d^6 (low spin)

D. All of these

Answer: C

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

A. double salt

B. complex compound

C. neutral molecule

D. none of these

Answer: B

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8. The oxidation of Cr in the complex $\left[Cr(H_2O)_4Cl_2\right]^+$ is

A. $+1$

B. $+3$

C. $+5$

D. $+6$

Answer: B

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9. Which of the following is expected to be a paramagnetic complex?

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

B. $\left[NI(CO)_4\right]$

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

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

Answer: A

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10. IUPAC name of $Na_3\left[Co\left(NO_2\right)_6\right]$ is

A. sodium cobaltinitrite

B. sodium hexanitritocobaltale(III)

C. sodium hexanitrocobalt (III)

D. sodium hexanitricobaltate(II)

Answer: B

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11. Generally, a group of atoms can function as a ligand if

A. it is a small molecule

B. it has an unshared pair of electrons

C. it is a positively charged ion

D. none of these

Answer: B

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12. According to the postulates of Werner for cooedination compounds

A. Primary valency is ionizable

B. Secondary valency is ionizable

C. Primary and secondary valencies are non-ionizable

D. Only primary valency is non-ionizable

Answer: A

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13. Which of the following will give maximum number of isomer ?

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

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

C. $\left[Ni(en)_2\left(C_2O_4\right)\right]^{2-}$

D. $\left[Cr\left(NH_3\right)_4(SCN)_2\right]^{+}$

Answer: D

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14. $\left[Ti\left(H_2O\right)_6\right]^{3+}$ is paramagnetic in nature due to

A. one unpaired electron

B. two unpaired electrons

C. 5t vt

D. no unpaired electrons

Answer: A

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15. According to IUPAC nomenclature sodium nitroprusside is named as

A. sodium nitroferricyanide

B. sodium nitroferrocyanide

C. sodium pentacyanonitrosylferrate (II)

D. sodium pentacyanonitrosylferrate (III)

Answer: D

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16. Which one of the following forms with an excess of CN^- (Cyanide) a complex having coordination number two

A. Cu^+

B. Ag^+

C. Ni^{2+}

D. Fe^{2+}

Answer: B

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17. Which of the following is not considered as an organometallic compounds ? .

A. Cis-platin

B. ferrocene

C. Zeise's salt

D. Grignard reagent.

Answer: A

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18. When each of the following complex salts is treated with excess of $AgNO_3$ solution, which will give the maximum amount of AgCl

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

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

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

D. $Na_2\left[PtCl_6\right]$

Answer: A

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19. Which one of the following is an inner orbital complex as well as diamagnetic in nature?

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

B. $\left[Cr\left(NH_3\right)_5Cl\right]Cl_2$

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

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

Answer: C

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20. The diamagnetic species is

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

B. $\left[NiCl_4\right]^{2-}$

C. $\left[CoCl_4\right]^{2-}$

D. $\left[CoF_6\right]^{2-}$

Answer: A

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21. Copper sulphate dissolved in excess of KCN to give:-

A. $Cu(CN)_2$

B. $CuCN$

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

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

Answer: C

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22. $\left[Cr\left(H_2O\right)_6\right]Cl_3$ (at no. of Cr = 24) has a magnetic moment of $3.83B.M.$ The correct distribution of $3d$ electrons the chromium of the complex.

A. $3d^1_{xy}, 3d^1_{yz}, 3d^1_{z2}$

B. $3d^{1}_{zx^{-2}-y^{2}}, 3d^{\frac{1}{2}}_{z}, 3d^{1}_{xz}$

C. $3d^{1}_{xy}, 3d^{1}_{x^{2}-y^{2}}, 3d^{1}_{z}$

D. $3d^{1}_{xy}, 3d^{1}_{yz}, 3d^{1}_{xz}$

Answer: D

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23. The complex exhibits :

A. linkage isomerism, geometrical isomerism and optical isomerism

B. linkage isomerism, ionisatiion isomerism and geometrical isomerism

C. linkage isomerism, ioniasation isomerism and optical isomerism

D. ionisation isomerism , optical isomerism and geometrical isomerism

Answer: B

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24. What is the number of possible isomers for the octahedral complex $\left[Co(NH_3)_2(C_2O_4)_2\right]$?

A. 1

B. 2

C. 3

D. 4

Answer: C

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25. The ligands in anti - cancer drug cisplatin are

A. NH_3, Cl

B. NH_3, H_2O

C. Cl, H_2O

D. NO, Cl

Answer: A

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26. Fac, mer isomerism is associated with which of the following general formula ?

A. $\left[M(\forall)_2\right]$

B. $\left[M\left(A_3B_3\right)\right]$

C. $\left[M(\forall)_3\right]$

D. $[MABCD]$

Answer: B

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27. The increasing order of the crystal field splitting power of some common ligands is :

A. $H_2O < OH^- < Cl^- < F^- < CN^-$

B. $H_2O < Cl^- < OH^- < CN^- < F^-$

C. $CN^- < H_2O < OH^- < F^- < Cl^-$

D. $F^- < CN^- < OH^- < CL^- < H_2O$

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28. the d -electronic configuration of and are :and respectively. Which onne of the following aqua complexes will exhibit the maximum paramageneic character?

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

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

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

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

Answer: B

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29. Which of the following will give a pair of enantiomorphs? .

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

B. $\left[CoCl_2(en)_2\right]Cl$

C. $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_6\right]$

D. $\left[Co\left(NH_3\right)_4Cl_2\right]NO_2$

Answer: B

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30. In which of the following coordination entites the magnitude of Δ_0 (CFSE in octehedral field) will be maximum.

$(At. No. Co = 27)$

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

B. $\left[Co\left(C_2O_4\right)_3\right]^{3-}$

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

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

Answer: A

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31. Among $\left[TiF_6\right]^{2-}$, $\left[CoF_6\right]^{3-}$, Cu_2Cl_2 and $\left[NiCl_4\right]^{2-}$ [Atomic number $Ti = 22, Co = 27, Cu = 29, Ni = 28$] the Colourless species are:

A. Cu_2Cl_2 and $NiCl_4^{2-}$

B. TiF_4^{2-} and Cu_2Cl_2

C. CoF_6^{3-} and $NiCl_4^{2-}$

D. TiF_6^{2-} and CoF_6^{3-} .

Answer: B

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32. which of the following sdoes not show optical isomerism ?

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

B. $\left[Co(en)Cl_2\left(NH_3\right)_2\right]^+$

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

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

(e = ethylenediammine)

Answer: A

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33. Which of the following complex ion is not expected to absorb visible light?

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

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

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

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

Answer: A

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

A. $-1.8\Delta_0$

B. $-1.6\Delta_0 + P$

C. $-1.2\Delta_0$

D. $-1.6\Delta_0$.

Answer: D

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35. which of the folllowing coordination compound will give precipitate with an aqueous solution of $AgNO_3$?

A. $\left[CR\left(NH_3\right)_6\right]Cl_3$

B. $\left[Cr\left(NH_3\right)_3Cl_3]\right.$

C. $\left[Cr\left(NH_3\right)_5Cl\right]SO_4$

D. $Na_3\left[Cr(CN)_6\right)\right]$.

Answer: A

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36. violet coloured complex obtained in the detectiomn of sulphur is :

A. $Na_2\left[Fe(NO)(CN)_5\right]$

B. $Na_3\left[Fe(ONSNa)(CN)_5\right]$

C. $Na_4\left[Fe(CN)_5NOS\right]$

D. Both (b) and (c)

Answer: D

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37. out of the following complexes, which is diamagenitic in nature ?

A. $\left[NiCl_4\right]^{2-}$

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

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

D. $\left[CoF_6\right]^{3-}$

Answer: B

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

A. Linkage isomerism

B. Ionization isomerism

C. Co-ordination isomerism

D. Geometrical isomerism .

Answer: C

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39. The complex, $\left[Pt(py)\left(NH_3\right)BrCl\right]$ will have how many geometrical isomers?

A. 3

B. 4

C. 0

D. 2

Answer: A

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40. Strongest C-O bond is present in

A. $\left[Mn(CO)_6\right]^+$

B. $\left[Cr(CO)_6\right]$

C. $\left[V(CO)_6\right]^-$

D. $\left[Fe(CO)_5\right]$

Answer: A

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41. which of the following compounds would have the highest molar conducitivity?

A. diamminedichloridoplatinum (II)

B. tetraamminedichloridocobalt (III)

C. potassium hexacynoferrate (II)

D. hexaquachromium (III) chloride

Answer: C

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42. Red precipitae is obtained when ethanol solution of dimethylglyoxime is added to ammoniacal $Ni(II)$. Which of the following statement is not true?

A. red complex has a square planar geometry

B. complex has symmetrical H-bonding

C. Red complexes has a tetrahedral geometry

D. Dimethylglyoxime functions as bidentate ligand.

Answer: C

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43. Which of the following is an outer orbital complex and certain para-magnetic character ?

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

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

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

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

Answer: A

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44. An excess of $AgNO_3$ is added to $100 mL$ of a $0.01 M$ solution of dichlorotetraaquachromin (III) chloride. The number of moles of $AgCl$ precipitated would be:

A. 0.01

B. 0.001

C. 0.002

D. 0.003

Answer: B

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45. The structure of diamagnetic nickel complex , is :

A. triagonal bipyramidal

B. tetrahedral

C. square planar

D. distorted octahedral

Answer: C

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46. In $\left[Ni\left(H_2O\right)_6\right]^{2+}$, the hybridisation of central metal ion is :

A. dsp^3

B. sp^3d^2

C. sp^3

D. dsp^2 .

Answer: B

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47. The hybridisation of Ni in $\left[Ni(CO)_4\right]$ is

A. sp^2

B. sp^3 and sp^3d hybridised Ni

C. dsp^2

D. sp^3d

Answer: B

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48. The complex used as an anticancer agent is

A. cis - $\left[PtCl_2\left(NH_3\right)_2\right]$

B. cis - $K_2\left[PtCl_2Br_2\right]$

C. Na_2CoCl_4

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

Answer: A

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49. In a square planar complex of the type [Mabex], the number of geometrical isomers can be :

A. No geometrical isomers

B. Three

C. Two

D. Four

Answer: B

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50. Among the following complexes, the one which shows zero crystal field stabilization energy (CFSE) is

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

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

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

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

Answer: A

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51. Number of possible isomer for the complex $\left[Co(en)_2CI_2\right]CI$ will be: (em = ethylenediamine)

A. 1

B. 3

C. 4

D. 2

Answer: B

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52. The sum of coordination number and oxidation number of the metal M in the complex $\left[M(en)_2\left(C_2O_4\right)\right]CI$ (where en is ethylenediamine) is:

A. 6

B. 7

C. 8

D. 9

Answer: D

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53. Cobalt (III) chloride forms several octahedral complexes with amonia. Which of the following will not give test for chloride ions with silver nitrate at $25\,^{\circ}C$?

A. $CoCl_3, 5NH_3$

B. $CoCl_3.\ 6NH_3$

C. $CoCl_3.\ 3NH_3$

D. $CoCl_3.\ 4NH_3$

Answer: C

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54. Which of these statements about $\left[Co(CN)_6\right]^{3-}$ is true?

A. $\left[Co(CN)_6\right]^{3-}$ has four unpaired electrons and will be in a high-spin configuration

B. $\left[Co(CN)_6\right]^{3-}$ has no unpaired electrons and will be in a high-spin configuration

C. $\left[Co(CN)_6\right]^{3-}$ has no unpaired electrons and will be in a low-spin configuration

D. $\left[Co(CN)_6\right]^{3-}$ has four unpaired electrons and will be in a low-spin configuration

Answer: C

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55. The compound $\left[Pt\left(NH_3\right)_2Cl_2\right]$ can exhibit

A. linkage isomerism

B. optical isomerism

C. geometrical isomersim

D. ionisation isomerism

Answer: D

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56. Which among the following is a homoleptic complex ?

A. tris (ethane-1,2-diamine) cobalt (III) chloride

B. triamminetriaquachromium (III) chloride

C. diamminechloridonitrito-N-platinum (II)

D. pentamminecarbonatocobalt (III) chloride

Answer: A

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57. The coordination number,oxidation number and the number of d-electrons in the metal ion in the complex $\left[CoCl_2(en)_2\right]Cl$, are respectively (atomic number of CO= 27)

A. 4,3 and 6

B. 6,2 and 6

C. 6, 6 and 3

D. 4, 2 and 6

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58. Which of the following is formed when excess of KCN is added to an aqueous solution of copper sulphate?

A. $\left[Cu(CN)_2\right]$

B. $K_2\left[Cu(CN)_4\right]$

C. $K\left[Cu(CN)_4\right]$

D. $K_3\left[Cu(CN)_4\right]$

Answer: D

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59. Which of the following has the longest C-O bond length? (C-O bond length of CO is 1.128 A)

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

B. $\left[Mn(CO)_6\right]^{+}$

C. $Ni(CO)_4$

D. $\left[Co(CO)_4\right]^{-}$

Answer: A

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60. AlF_3 is soluble in HF only in presence of KF. It is due to the formation of

A. $K_3[AlF_3H_3]$

B. $K_3[AlF_6]$

C. AlH_3

D. $K[AlF_3H]$

Answer: B

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61. The correct order of the stoichiometries of $AgCl$ formed when $AgNO_3$ in excess is treated with the complexes: $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.\ 4NH_3$ respectively is:

A. 3AgCl, 1AgCl, 2AgCl

B. 3AgCl, 2AgCl, 1AgCl

C. 2AgCl, 3AgCl, 2AgCl

D. 1AgCl, 3AgCl, 2AgCl

Answer: B

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62. Correct increasing order for the wavelengths of absorption in the visible region by the complexes of Co^{3+} is:

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

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

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

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

Answer: D

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63. Pick out the correct statement with respect to $\left[Mn(CN)_6\right]^{4-}$

A. 6

B. It is $d^2sp(3)$ hybridised and octahedral

C. It is dsp^2 hybridised and square planar

D. It is $sp^3d(2)$ hybridised and octahedral

Answer: B

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64. The type of isomersim shown by the complex $\left[CoCl_2(en)_2\right]$ is

A. geometrical isomerism

B. coordination isomerism

C. ionization isomerism

D. linkage isomerism

Answer: A

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65. The geometry and magnetic behaviour of the complex $\left[Ni(CO)_4\right]$ are

A. square planar and geometry and diamagnetic

B. tetrahedral geometry and diamagnetic

C. tetrahedral geometry and paramagnetic

D. tetrahedral geometry and paramagnetic.

Answer: B

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66. Iron carbonyl, $Fe(CO)_5$ is

A. tetranuclear

B. mononuclear

C. trinuclear

D. dinuclear

Answer: B

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67. Which of the following is a pair of diamagnetic complexes ?

A. $\left[Co\left(NH_3\right)_6\right]^{3+}$, $\left[Fe(CN)_6\right]^{4-}$

B. $\left[Co(\otimes)_3\right]^{3-}$, $\left[FeF_6\right]^{3-}$

C. $\left[Fe(\otimes)_3\right]^{3-}$, $\left[FeF_6\right]^{3-}$

D. $\left[Fe(CN)_6\right]^{3-}$, $\left[CoF_6\right]^{3-}$

Answer: A

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68. The oxidation state of Cr in $\left[Cr\left(NH_3\right)_4Cl_2\right]^+$ is:

A. $+2$

B. $+3$

C. $+4$

D. $+5$

Answer: A

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

A. $NH_3 > CN^- > Br^- > C_6H_5^-$

B. $CN^- > C_6H_5^- > Br^- > NH_3$

C. $Br^- > CN^- > NH_3 > C_6H_5^-$

D. $CN^- > Br^- > C_6H_5^- > NH_3$

Answer: A

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70. In the separation of Cu^{2+} and Cd^{2+} of IInd group in qualitative analysis of cations, tetraamminecopper (II) sulphate and tetramminecadmium (II) sulphate react with KCN to form the corresponding cyano complex. Which one of the following pairs of the complexes and their relative stability enables the separation of Cu^{2+} and Cd^{2+} ?

A. $K_3\left[Cu(CN)_4\right]$: more stable and

$K_2\left[Cd(CN)_4\right]$: less stable

B. $K_2\left[Cu(CN)_4\right]$: less stable

and $K_2\left[Cd(CN)_4\right]$: more stable

C. $K_2\left[Cu(CN)_4\right]$: more stable and

$K_2\left[Cd(CN)_4\right]$: less stable

D. $K_3\left[Cu(CN)_4\right]$: less stable and

$K_2\left[Cd(CN)_4\right]$: more stable

Answer: A

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71. Which of the following complex ions is diamagnetic ?

A. $\left[FeF_6\right]^{3-}$

B. $\left[CoF_6\right]^{3-}$

C. $\left[Co\left(C_2O_4\right)_3\right]^{3-}$

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

Answer: C

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72. When 0.01 mole of a cobalt complex is treated with excess of silver nitrate solution 4.035 g of silver chloride is precipitated. The formula of the complex is :

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

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

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

D. $\left[Co\left(NH_3\right)_4Cl_2\right]NO_3$

Answer: C

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73. The ratio of magnetic moment (spin only value) between $\left[FeF_6\right]^{3-}$ and $\left[Fe(CN)_6\right]^{3-}$ is approximately

A. 4

B. 2

C. 5

D. 3

Answer: D

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74. Consider the following two complex ions : $\left[CoF_6\right]^{3-}$ and $\left[Co\left(C_2O_4\right)_3\right]^{3-}$. Which of the following statement(s) is/are false ?

I. Both are octahedral

II. $\left[Co\left(C_2O_4\right)_3\right]^{3-}$ is diamagnetic while $\left[CoF_6\right]^{3-}$ is paramagnetic .

III. Both are outer orbital complexes .

IV. In both the complexes the central metal is in the same oxidation state .

A. II and III

B. II, III and IV

C. II only

D. III and IV

Answer: C

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75. $\left[Cr\left(H_2O\right)_6\right]Cl_3$ (at no. of Cr = 24) has a magnetic moment of $3.83B.M.$ The correct distribution of $3d$ electrons the chromium of the complex.

A. $3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1$

B. $3d_{xy}^1, 3d_{yz}^1, 3d_{z^2}^1$

C. $3d_{x^2-y^2}^1, 3d_{z^2}^1, 3d_{xz}^1$

D. $3d_{xy}^1, 3dx^2-y^2, 3d_{yz}^1$

Answer: A

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76. According to Werner's theory, the primary valencies of the central metal atom

A. are satisfied by negative ions or neutral molecules

B. are satisfied by negative ions

C. are equal to its coordination number

D. decide the geometry of the complex .

Answer: A

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77. A complex compound of Cu^{3+} with molecular formula $CoCl_x . yH_2O$ gives a total of 3 ions on dissolving in water. To satisy both the primary and secondary valencies in the complex , the number of Cl^- ions required is :

A. one

B. four

C. three

D. zero

Answer: A

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78. Which of the following complexes are not correctly matched with the hybridisation of their central metal ion ?

(a) $\left[Ni(CO)_4\right]$, sp^3 (b) $\left[Ni(CN)_4\right]^{2-}$, sp^3

(c) $\left[CoF_6\right]^{3-}$, d^2sp^3 (d) $\left[Fe(CN)_6\right]^{3-}$, sp^3d^2

Select the correct option :

A. (i) and (ii)

B. (i)and (iii)

C. (i) ,(iii) and (iv)

D. (ii), (iii) and (iv)

Answer: D

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79. Complex $\left[CoCl_2(en)_2\right]^+$ can

A. exist as cis and trans isomers

B. exist as pair of optical isomers

C. both are correct

D. none is correct.

Answer: C

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

A. linkage isomers

B. ionisatioin isomers

C. co-ordinate isomers

D. none of these

Answer: C

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81. Which of the following ligands can exhibit linkage isomerism ?

A. NO_2^-

B. CN^-

C. SCN^-

D. all of the above

Answer: D

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82. Which complex gives three chloride ions per formula unit ?

A. $CrCl_3.6H_2O$

B. $CrCl_3.5H_2O$

C. $CrCl_3.4H_2O$

D. All of these

Answer: A

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83. In the complex $CoCl_3.4NH_3$

A. Co-ordiantion entity is $\left[Co\left(NH_3\right)_4.Cl_2\right]^+$

B. Counter ion is Cl^-

C. Both are correct

D. None is correct.

Answer: C

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84. $\left[Ni(CN)_4\right]^{2-}$ and $\left[Ni(CO)_4\right]$ have

A. sp^3 hybridised Ni in both cases

B. sp^3 and $sp^{(3)d}$ hybridised Ni

C. dsp^2 and sp^3 hybridised Ni

D. dsp^2 hybridised Ni in both cases .

Answer: C

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85. A square planar complex is formed by hybridisation of which atomic orbitals?

A. s, px, py, d_{yz}

B. $s, px, py, d_{x^2-y^2}$

C. s, p_x, p_y, d_{z2}

D. s, p_y, p_z, d_{xy}

Answer: B

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86. CH_3MgBr is an organometallic compound due to

A. Mg-Br bond

B. C-Mg bond

C. C-Br bond

D. C-H bond

Answer: B

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87. The most stable ion is :

A. $\left[Fe(OH)_3\right]^{3-}$

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

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

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

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88. One mole of complex compound $Co\left(NH_3\right)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of same complex reacts with two moles of $AgNO_3$ to yield two moles of $AgCl(s)$. The complex is:

A. $\left[Co\left(NH_3\right)_3Cl_3\right].2NH_3$

B. $\left[Co\left(NH_3\right)_4Cl.\,NH_3\right]$

C. $\left[Co\left(NH_3\right)_4Cl\right]Cl_2.\,NH_3$

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

Answer: D

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89. The oxidation state of nickel in $K_4Ni(CN)_4$ is:

A. 0

B. $+1$

C. $+2$

D. -1

Answer: A

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90. Coordination compounds have great importance in biological system. In this context which of the following statements is incorrect ?

A. Cynacobalamin is and contains cobalt

B. Haemoglobin is the red pigment of blood and contains iron

C. Chlorophylls are green pigments in plants and contain calcium

D. Carbodypeptide-A is an enzyme and contains zinc

Answer: C

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91. Which of the following compounds shows optical isomerism ?

A. $\left[Cu\left(NH_3\right)_4\right]^{3-}$

B. $\left(ZnCl_4\right)^{2-}$

C. $\left[Cr\left(C_2O_4\right)_3\right]^{3-}$

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

Answer: C

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92. Which one of the following has lowest value of paramagnetic behaviour?

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

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

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

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

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93. Which of the following has a square planar geometry? .

A. $\left[PtCl_4\right]^{2-}$

B. $\left[CoCl_4\right]^{2-}$

C. $\left[FeCl_4\right]^{2-}$

D. $\left[NiCl_4\right]^{2-}$

Answer: A

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

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

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

C. the number of ligands around a metal ion bonded by sigma bonds

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

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95. The correct order of magnetic moments (spin values in B.M.) among is:

A. $\left[Fe(CN)_6\right]^{4-} > \left[MnCl_4\right]^{2-} > \left[CoCl_4\right]^{2-}$

B. $\left[MnCl_4\right]^{2-} > \left[Fe(CN)_6\right]^{4-} > \left[CoCl_4\right]^{2-}$

C. $\left[MnCl_4\right]^{2-} > \left[CoCl_4\right]^{2-} > \left[Fe(CN)_6\right]^{4-}$

D. $\left[Fe(CN)_6\right]^{4-} > \left[CoCl_4\right]^{2-} > \left[MnCl_4\right]^{2-}$

Answer: C

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96. Nickel $(Z = 28)$ combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $\left[NiX_4\right]^{2-}$. The number of unpaired electron(s) in the nickel and geometry of this complex ion are, respectively:

A. one, tetrahedral

B. two, tetrahedral

C. one, square planar

D. two, square planar.

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97. In $Fe(CO)_5$, the Fe - C bond possesses:

A. π character only

B. both σ and π-characters

C. ionic character

D. σ character .

Answer: B

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98. In which of the following octahedral complexes of Co (at. no. 27), will the magnitude of Δ_o be the highest?

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

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

C. $\left[Co\left(C_2O_4\right)_3\right]^{3-}$

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

Answer: B

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99. The co-ordination number and the oxidation state of the element E in the complex.

are respectively ?

A. 6 and 3

B. 6 and 2

C. 4 and 2

D. 4 and 3

Answer: A

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100. Which of the following complexes will give a pair of enantiomers ?

A. $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_6\right]$

B. $\left[Co\left(NH_4\right)Cl_2\right]NO_2$

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

D. $\left[Co(en)_2Cl_2\right]Cl$

Answer: D

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101. Which of the following pairs represents linkage isomers ?

A. $\left[Cu\left(NH_3\right)_4\right]\left[PtCl_4\right]$ and $\left[Co(en)_3\right]^{2+}$

B. $\left[Pd\left(PPh_3\right)_2(NCS)_2\right]$ and $\left[Pd\left(PPh_3\right)_2(SCN)_2\right]$

C. $\left[Co\left(NH_3\right)_5\left(NO_3\right)\right]SO_4$ and $\left[Co\left(NH_3\right)_5\left(SO_4\right)\right]NO_3$

D. $\left[PtCl_2\left(NH_3\right)_4\right]Br_2$ and $\left[PtBr_2\left(NH_3\right)_4\right]Cl_2$

Answer: B

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102. Which of the following exists as an optical isomer ?

A. $\left[Zn(en)\left(NH_3\right)_2\right]^{3+}$

B. $\left[Co(en)_3\right]^{2+}$

C. $\left[Co\left(H_2O\right)_4(en)\right]^{2+}$

D. $\left[Zn(en)_2\right]^{2+}$

Answer: B

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103. A solution containing 2.675 g of $CoCl_3.6NH_3$ (molar mass = 267.5 g mol^{-1} is passed through a cation exchanger. The chloride ions obtained in solution are treated with excess of $AgNO_3$ to give 4.78 g of AgCl (molar mass = 143.5 g mol^{-1}). The formula of the complex is (At.mass of Ag = 108 u) .

A. $\left[CoCl\left(NH_3\right)_5\right]Cl_2$

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

C. $\left[CoCl_2\left(NH_3\right)_4Cl\right.$

D. $\left[CoCl_3\left(NH_3\right)_3\right]$

Answer: B

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104. The IUPAC name of the $K_2\left[Ni(CN)_4\right]$ is :

A. potassium tetracyanonickelate (II)

B. potassium tetracynonickelate (III)

C. potassium tetracyanotonickelate (II)

D. Potassium tetracyanonickel (III)

Answer: A

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105. The oxidation number , d-orbital occupation and co-ordination number of cr in the complex

Cis-$\left[Cr(en)_2Cl_2\right]Cl$ are respectively .

A. $+3, 3d$ and 4

B. $+3, 4d$ and 6

C. $+3, 3d$ and 6

D. $+2, 3d$ and 6

Answer: C

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106. Which of the following facts about the complex $\left[Cr\left(NH_3\right)_6\right]Cl_3$ is wrong ?

A. The complex involves d^2sp^3 hybrdisation and is octahedral in shape

B. The complex is paramagnetic in nature

C. The complex gives a while precipitate with solution .

D. The complex gives a white precipitate with $AgNO_3$ solution.

Answer: C

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107. The correct statement with respect to the complexes $Ni(CO)_4$ and $\left[Ni(CN)_4\right)^{2-}$ is :

A. nickel is in same oxidation state in both

B. both have tetrahedral geometry

C. both have square planar geometry

D. have square planar and tetrahedral geometry respectively

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108. The complex with maximum magnetic in the following is :

A. $[CoF_6]^{3-}$

B. $[Co(NH_3)_6]^{3+}$

C. $[Ni(NH_3)_4]^{2+}$

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

Answer: A

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109. Which among the following will be named as dibromobis (ethane-1,2-diamine) chromium (III) bromide ?

A. $\left[Cr(en)_3\right]Br_3$

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

C. $\left[Cr(en)Br_4\right]^-$

D. $\left[Cr(en)Br_2\right]Br$

Answer: B

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110. Which of the following complex species is not expected to exhibit optical isomerism ?

A. $\left[Co(en)\left(NH_3\right)_2Cl_2\right]^+$

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

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

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

Answer: D

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111. $d^2sp(3)$ hybridisation of the atomic orbital gives :

A. Square planar complex

B. Triangular structure

C. Tetrahedral structure

D. Octahedral structure.

Answer: D

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112. Which one of the following forms with an excess of CN^- (Cyanide) a complex having coordination number two

A. Cu^{2+}

B. Ag^{+}

C. Ni^{2+}

D. Fe^{2+}

Answer: B

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113. Which of the following has a regular tetrahedral structure ?

A. SF_4

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

C. XeF_4

D. $\left[NiCl_4\right]^{2-}$

Answer: D

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114. AgCl reacts with aqueous solution of sodium thiosulphate and potassium cyanide solutions to give :

A. $Na\left[Ag\left(S_2O_3\right)_2\right]$ and $K\left[Ag(CN)_2\right]$

B. $Na\left[Ag\left(S_2O_3\right)_2\right]$ and $K_3\left[Ag(CN)_2\right]$

C. $Na_3\left[Ag\left(S_2O_3\right)_2\right]$ and $K\left[Ag(CN)_2\right]$

D. $Na_3\left[Ag\left(S_2O_3\right)_2\right]$ and $K\left[Ag(CN)_2\right]$

Answer: C

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115. Homoleptic octahedral complexes of a metal ion 'M^{3+}' with three monodentate ligands L_1, L_2 and L_3 absorb wavelengths in the region

of green, blue and red respectively. The increasing order of the ligand strength is :

A. $L_4 < L_3 < L_2 < L_1$

B. $L_1 < L_2 < L_2 < L_4$

C. $L_3 < L_2 < L_4 < L_1$

D. $L_1 < L_2 < L_4 < L_3$

Answer: B

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116. Which of the following complexes has lowest molar conductance ?

A. $CoCl_3.3NH_3$

B. $CoCl_3.4NH_3$

C. $CoCl_3.5NH_3$

D. $CoCl_3.6NH_3$

Answer: A

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117. The colour of the co-ordination compounds is explained in terms of :

A. spectrochemical series

B. chelate effect

C. crystal field theory

D. none of these

Answer: C

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118. In which of the pairs of ions given, there is an ion that forms a co-ordination compound both aqueous sodium hydroxide and ammonia and another ion that forms a co-ordination compound only with aqueous sodium hydroxide ?

A. $Pb^{2+}. Cu^{2+}$

B. Zn^{2+}, Al^{3+}

C. Cu^{2+}, Zn^{2+}

D. Al^{3+}, Cu^{2+}

Answer: B

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119. The bond order between Ni-C bond in $Ni(CO)_4$ is :

A. one

B. two

C. less than two

D. more tha two

Answer: C

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120. The complex having minimum Δ_0 value is :

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

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

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

D. $\left[CoCl_6\right]^{3-}$

Answer: D

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121. Which of the following will be able to show geometrical isomerism ?

A. MA_2B_2- Tetrahedral

B. MABCD - Tetrahedral

C. MA_3B - Square planar

D. MABCD - square planar

Answer: D

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122. The number of geometrical isomers that can exist for the square planar complex is :

A. 4

B. 6

C. 2

D. 3

Answer: D

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123. Which of the following compounds is not yellow coloured ?

A. $(NH_3)_3[As(MO_3O_1)_4]$

B. $BaCrO_4$

C. $Zn_2[Fe(CN)_6]$

D. $K_3[Co(NO_2)_6]$

Answer: C

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124. Which of the following complexes is paramagnetic

A. $\left[Ni\left(CO_4\right]\right.$

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

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

D. $\left[NiCl_4\right]^{2-}$

Answer: D

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125. Which one of the following complexes shows optical isomerism ?

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

B. cis $\left[Co(en)_2Cl_2\right]Cl$

C. trans $\left[Co(en)_2Cl_2\right]Cl$

D. $\left[Co\left(NH_3\right)_4Cl_3\right]Cl$(en = ethylenediamine)

Answer: B

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126. In aqueous solution Cr^{2+} is stronger reducing agent than Fe^{2+}.

This is because

A. Cr^{2+} ion is more stable than Fe^{2+}

B. Cr^{3+} ion with d^3 configuraion has favourable crystal field stabilisation energy

C. Cr^{3+} has half-filled configuration and hence more stable

D. Fe^{3+} in aqueous solution more stable than Cr^{3+}

Answer: B

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127. Chlorophyll is co-ordination compund is

A. iron

B. magnesium

C. chromium

D. zinc.

Answer: B

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128. The complex formed when Al_2O_3 is leached from bauxite using concentrated NaOH is :

A. $Na\left[Al(OH)_4\right]$

B. $\left[NaAl_2O_4\right]$

C. $Na_2[Al(OH)_3]$

D. Na_2ALO_2

Answer: A

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129. Which of the following ligands are correctly represented in an spectrochemical series ? .

A. SCN^- lt F^- lt CN^- lt CO

B. F^- lt SCN^- lt CN^- lt CO

C. CN^- lt F^- lt CO lt SCN^-

D. SCN^- lt CO lt F^- lt CN^-

Answer: A

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130. As per IUPAC name , the name of the complex $\left[Co(en)_2(ONO)Cl\right]Cl$ is

A. chloridobis(ethane-1,2-diamine)nitro-O-cobalt(III) chloride.

B. chlorobis(ethylenediammine)nitro-O-cobalt(III) chloride.

C. chlordodi(ethylenediamine) nitrocobalt(III) chloride

D. chloroethylenediaminetro-O-cobalt(III) chloride.

Answer: A

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131. The number of unpaired electron in

respectively are :

A. 2,2,1

B. 2,0,1

C. 0,2,1

D. 2,2,1

Answer: B

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132. $PbCl_2$ is insoluble in cold water. Addition of HCl increases its solubility due to

A. formation of soluble complex anions like

B. oxidation of Pb(II) to Pb(IV)

C. formation of

D. formation of polymeric lead complexes .

Answer: A

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133. On treatment of 100 mL of 0.1 M solution of $COCl_3.6H_2O$ with excess of $AgNO_3$, 1.2×10^{22} ions are precipitated. The complex is

A. $\left[Co\left(H_2O\right)_6\right]Cl_3$

B. $\left[Co\left(H_2O\right)_5Cl\right]Cl_2.\,H_2O$

C. $\left[Co\left(H_2O\right)_4Cl_2\right]Cl.2H_2O$

D. $\left[Co\left(H_2O\right)_4Cl_2\right]Cl.2H_2O$

Answer: B

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134. The oxidation states of

Cr in $\left[Cr\left(H_2O\right)_6\right]Cl_3.\,\left[Cr\left(C_6H_6\right)_2\right]$ and $K_2\left[Cr(CN)_2(O)_2\left(O_2\right)\left(NH_3\right)\right]$ respectively are

A. $+3,\ +2$ and $+4$

B. $+3, 0$ and $+6$

C. $+3, 0$ and $+4$

D. $+3, \ +4$ and $+6$

Answer: B

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135. Consider the following reaction and statements:

$$\left[Co(NH_3)_4Br_2\right]^+ + Br^- \rightarrow \left[Co(NH_3)_3Br_3\right] + NH_3$$

Two isomers are produced if the reactant complex ion is a cis-isomer

Two isomers are produced if the reactant complex ion is a trans-isomer

Only one isomer is produced if the reactant complex ion is a trans-isomer

Only one isomer is produced if the reactant complex ion is a cis –

isomer

The correct statements are

A. (I) and (III)

B. (III) and (IV)

C. (II) and (IV)

D. (I) and (II)

Answer: A

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136. Identity the correct increasing order of crystal field stabilisation energy value for the given complexes .

A. $\left[Ir\left(nH_3\right)_6\right]^{3+} < \left[Rh\left(NH_3\right)_6\right]^{3+} < \left[Co\left(NH_3\right)_6\right]^{3+}$

B. $\left[Rh\left(NH_3\right)_6\right]^{3+} < \left[Co\left(NH_3\right)_6\right]^{3+} < \left[Ir\left(NH_3\right)_6\right]^{3+}$

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

D. $\left[Co\left(NH_3\right)_6\right]^{3+} < \left[Rh\left(NH_3\right)_6\right]^{3+} < \left[Ir\left(NH_3\right)_6\right]^{3+}$

Answer: D

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137. The IUPAC name of $\left[Co\left(NH_3\right)_4Cl\left(NO_2\right)\right]Cl$ is

A. tetraaminechloridonitrito-N-cobalt(III) chloride

B. tetraminechloridonitrioicobalt(II) chloride

C. tetraaminechloridonitriocobalt(I) chloride

D. tetraaaminechloridonitrocobalt(III) chloride

Answer: A

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Comprehension types

1. Co-ordiantion compounds show structural isomerism and it is different from the nature of the isomerism which we generally come across in organic compounds. The co-ordination and linkage isomers depending upon their upon the number of ions which they furnish upon dissociation in aqueous solution . The isomers belonging to a particular type can also be distinguished from each structural isomerism, the co-ordination compounds are also involved in geometrical and optical isomerism. Whereas optical octahedral and square planar complexes can exhibit geometrical isomerism.

1 . Aqueous solutions of on addition of excess of concentrated HCl turns blue due to the formation of

A. $\left[Co\left(H_2O\right)_4Cl_2\right]$

B. $\left[Co\left(H_2O\right)_4Cl_4\right]^{2-}$

C. $\left[CoCl_4\right]^{2-}$

D. $\left[Co\left(H_2O\right)_2Cl_2\right]$

Answer: c

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2. Co-ordiantion compounds show structural isomerism and it is different from the nature of the isomerism which we generally come across in organic compounds. The co-ordination and linkage isomers depending upon their upon the number of ions which they furnish upon dissociation in aqueous solution . The isomers belonging to a particular type can also be distinguished from each structural isomerism, the co-ordination compounds are also involved in geometrical and optical isomerism. Whereas optical octahedral and square planar complexes can exhibit geometrical isomerism.

Which one is the most likely structure of if 1/3 of the total chloride in the compound is precipitated by adding solution ?

A. $CrCl_3.6H_2O$

B. $\left[Cr\left(H_2O\right)_3\right]Cl_3\left]\left(H_2O\right)_3\right.$

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

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

Answer: c

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3. Co-ordiantion compounds show structural isomerism and it is different from the nature of the isomerism which we generally come across in organic compounds. The co-ordination and linkage isomers depending upon their upon the number of ions which they furnish upon dissociation in aqueous solution . The isomers belonging to a particular type can also be distinguished from each structural isomerism, the co-ordination compounds are also involved in geometrical and optical isomerism. Whereas optical octahedral and square planar complexes can exhibit geometrical isomerism.

One mole of the complex compound gives 3 mole of ions on dissolution in water. One mole of the same complex reacts with two moles of to yield two moles of . The structure of the complex is :

A. $\left[Co\left(NH_3\right)_3Cl_3\right].2NH_3$

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

C. $\left[Co\left(NH_3\right)_4Cl\right]Cl_2. NH_3$

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

Answer: d

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4. Co-ordiantion compounds show structural isomerism and it is different from the nature of the isomerism which we generally come across in organic compounds. The co-ordination and linkage isomers depending upon their upon the number of ions which they furnish upon dissociation in aqueous solution . The isomers belonging to a particular type can also be distinguished from each structural isomerism, the co-ordination compounds are also involved in geometrical and optical isomerism. Whereas optical octahedral and square planar complexes can exhibit geometrical isomerism.

Which of the following will not show geometrical isomerism ?

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

B. $\left[CoCl_2(en)_2\right]Cl$

C. $\left[Co\left(NH_3\right)_5NO_2\right]Cl_2$

D. $\left[Pt\left(NH_3\right)_2 \cdot Cl_2\right]$

Answer: c

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5. Different theories have been put forward to explain the geometrical of co-ordianation compounds. Out of them , the most practical is the valence bond theory which is based upon the concept of hybridisation . According to this , the complexes with C.N.4 may be either tetrahedral (sp^3 hybridised) or square planar (dsp^2 hybridised) in nature. Similarly , in the octahedral complexes , the metal atom or ion is either paramagnetic if one or more orbitals are half-filled and diamagnetic if all are filled in nature.

5. Which is correct in the case of complex ?

A. diamagnetic

B. octahedral

C. ds^2p^3 hybridised

D. all are correct.

Answer: d

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6. Different theories have been put forward to explain the geometrical of co-ordianation compounds. Out of them , the most practical is the valence bond theory which is based upon the concept of hybridisation . According to this , the complexes with C.N.4 may be either tetrahedral (sp^3 hybridised) or square planar (dsp^2 hybridised) in nature. Similarly , in the octahedral complexes , the metal atom or ion is either paramagnetic if one or more orbitals are half-filled and diamagnetic if all are filled in nature.

Which has the highest paramagnetic character ?

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

B. $\left[Fe\left(H_2\right)O\right)_6]^{2+}$

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

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

Answer: b

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7. Different theories have been put forward to explain the geometrical of co-ordianation compounds. Out of them , the most practical is the valence bond theory which is based upon the concept of hybridisation . According to this , the complexes with C.N.4 may be either tetrahedral (sp^3 hybridised) or square planar (dsp^2 hybridised) in nature. Similarly , in the octahedral complexes , the metal atom or ion is either paramagnetic if one or more orbitals are half-filled and diamagnetic if all are filled in nature.

Which statements is incorrect ?

A. $\left[Ni(CO)_4\right]$: Tetrahedral, paramagnetic

B. $\left[Ni(CN)_4\right]^{2-}$: Square planar , diamagnetic

C. $\left[Ni(CO)_4\right]$: Tetrahedral , diamagnetic

D. $\left[NiCl_4\right]^{2-}$: Tetrahedral , paramagnetic

Answer: c

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8. When a metal rod 'M' is dipped into an aqueous colourless concentrated aqueous solution of compound 'N' , the solutions becomes light blue . Addition of aqueous NaCl to the blue solution gives a white precipitate 'O' and gives an intense blue solution .

8. The metal rod M is :

A. Fe

B. Cu

C. Ni

D. Co

Answer: a

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9. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous $NaCl$ to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

The compound N is

A. $AgNO_3$

B. $Zn(NO_3)_2$

C. $Al(NO_3)_2$

D. $Pb(NO_3)_2$

Answer: b

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10. When a metal rod M is dipped into an aqueous colourless concentrated solution of compound N, the solution turns light blue. Addition of aqueous $NaCl$ to the blue solution gives a white precipitate O. Addition of aqueous NH_3 dissolves O and gives an intense blue solution.

The metal rod M is

A. $\left[Pb\left(NH_3\right)_4\right]^{2+}$ and $\left[CoCl_4\right]^{2+}$

B. $\left[Al\left(NH_3\right)_4\right]^{3+}$ and $\left[Cu\left(NH_3\right)_4\right]^{2+}$

C. $\left[Ag\left(NH_3\right)_2\right]^{+}$ and $\left[Cu\left(NH_3\right)_4\right]^{2+}$

D. $\left[Ag\left(NH_3\right)_2\right]^{+}$ and $\left[Ni\left(NH_3\right)_6\right]^{2+}$

Answer: c

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11. Stereoisomerism arises on account of different positions and arrangement of lignads in space around the metal ion . These are classified into two types : (i) Geometrical isomerism is exhibited by octahedral and square planar complexes . (ii) Optical isomerism is shown when mirror images are non superimposable.

Choose the correct answer :

11. Which of the following will not show geometrical isomerism ?

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

B. $\left[Co\left(OH_2\right)_4Cl_2\right]Cl$

C. $\left[Co\left(NH_3\right)_5NO_2\right]Cl_2$

D. $\left[Pt\left(NH_3\right)_2 . Cl_2\right]$

Answer: c

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12. Stereoisomerism arises on account of different positions and arrangement of lignads in space around the metal ion . These are classified into two types : (i) Geometrical isomerism is exhibited by octahedral and square planar complexes . (ii) Optical isomerism is shown when mirror images are non superimposable.

The compound(s) that exhibi(s) geometrical isomerism is(are) :

A. $\left[Pt(en)Cl_2\right]$

B. $\left[Co\left(OH_2\right)_4Cl_2\right]Cl$

C. $\left[Pt(en)_2Cl_2\right]Cl_2$

D. $\left[Pt\left(NH_3\right)_2. Cl_2\right]$

Answer: c,d

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13. Stereoisomerism arises on account of different positions and arrangement of lignads in space around the metal ion . These are classified into two types : (i) Geometrical isomerism is exhibited by octahedral and square planar complexes . (ii) Optical isomerism is shown when mirror images are non superimposable.

Both geometrical and optical isomerism are shown by

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

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

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

D. $\left[Cr(OX)_3\right]^{3-}$

Answer: a

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14. Stereoisomerism arises on account of different positions and arrangement of lignads in space around the metal ion . These are classified into two types : (i) Geometrical isomerism is exhibited by octahedral and square planar complexes . (ii) Optical isomerism is shown when mirror images are non superimposable.

The total number of possible isomers for the complex compound $\left[Cu\left(NH_3\right)_4\right]\left[PtCl_4\right]$ are :

A. 3

B. 6

C. 5

D. 4

Answer: d

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15. When crystals of $CuSO_4$ are dissolved in water, there is hardly any evidence for the presence of Cu^{2+} ions or ammonia molecules. A new ion $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is furnished in which ammonia molecules are directly linked with the metal ion . Similarly the aqueous solution of

$Fe(CN)_2.4KCN$ does not give tests of Fe^{2+} and CN^- ions but gives test of a new ion, $\left[Fe(CN)_6\right]^{4-}$ also called complex ions.

15. The hybrid state of $Cu\left[Cu\left(NH_3\right)_4\right]^{2+}$ is

A. sp^3

B. sp^3d

C. sp^3d^2

D. dsp^2

Answer: d

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16. When crystals of $CuSO_4$ are dissolved in water, there is hardly any evidence for the presence of Cu^{2+} ions or ammonia molecules. A new ion $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is furnished in which ammonia molecules are directly linked with the metal ion . Similarly the aqueous solution of

$Fe(CN)_2.4KCN$ does not give tests of Fe^{2+} and CN^- ions but gives test of a new ion, $[Fe(CN)_6]^{4-}$ also called complex ions.

Which one of the following statements is correct ?

A. $[Cu(NH_3)_4]^{2+}$ is paramagnetic while $[Fe(CN)_6]^{4-}$ is paramagnetic .

B. $[Cu(NH_3)_4]^{2+}$ is paramagnetic while $[Fe(CN)_6]^{4-}$ is diamagnetic .

C. Both are paramagnetic

D. Both are diamagnetic

Answer: b

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17. When crystals of $CuSO_4$ are dissolved in water, there is hardly any evidence for the presence of Cu^{2+} ions or ammonia molecules. A new ion $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is furnished in which ammonia molecules are directly linked with the metal ion . Similarly the aqueous solution of $Fe(CN)_2.4KCN$ does not give tests of Fe^{2+} and CN^- ions but gives test of a new ion, $\left[Fe(CN)_6\right]^{4-}$ also called complex ions.

Predict the incorrect statements from the options given below :

A. $\left[Ni(CN)_6\right]^{3-}$ is weakly paramagnetic while $\left[Fe(CN)_6\right]^{4-}$ is diamagnetic

B. $\left[Ni(CO)_4\right]$ possesses tetrahedral geometry while $\left[Ni(CN)_4\right]^{2-}$ is square planar

C. $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic while $\left[NiCl_4\right]^{2-}$ is paramagnetic

D. $\left[Cu(en)_2\right]^{2+}$ is less stable than $\left[Cu\left(NH_3\right)_4\right]^{2+}$

Answer: d

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18. In Aqueous solution, metal ion M_1 reacts separately with reagents Q and R in excess to give tetrahedral and square planar complexes respectively. An aqueous solution of another metal ion M_2 always froms tetrahedral complexes with these reagents. Aqueous solution of M_2 on reaction with reagent S gives white precipitate which dissolves in excess of S. The reactions are summarized in the scheme given ahead

M_1, Q and R respectively are

A. Zn^{2+} , KCN and HCl

B. Ni^{2+} , HCl and KCN

C. Cd^{2+} , KCN and HCl

D. Co^{2+} , HCl and KCN

Answer: b

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19. In Aqueous solution, metal ion M_1 reacts separately with reagents Q and R in excess to give tetrahedral and square planar complexes respectively. An aqueous solution of another metal ion M_2 always froms tetrahedral complexes with these reagents. Aqueous solution of M_2 on reaction with reagent S gives white precipitate which dissolves in excess of S. The reactions are summarized in the scheme given ahead

Reagent S is

A. $K_4\left[Fe(CN)_6\right]$

B. Na_2HPO_4

C. K_2CrO_4

D. `KOH

Answer: d

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Straight objective type mcqs

1. Among the following complexes the one which shows Zero crystal field stabilization energy (CFSE) is

A. $[Ni(CO)_4]$ and $[NiCl_4]^{2-}$ are diamagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic

B. $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[Ni(CO)_4]$ is paramagnetic

C. $[Ni(CO)_4]$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic

D. $[Ni(CN)_4]$ is diamagnetic while $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are paramagnetic .

Answer: c

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2. Which of the following is formed when excess of KCN is added to an aqueous solution of copper sulphate?

A. $Cu(CN)_2$

B. $K_2[Cu(CN)_4]$

C. $k[Cu(CN)_2]$

D. $K_3[Cu(CN)_4]$

Answer: b

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3. The geometry of $[Ni(CO)_4]$ and $[NiCl_2(PPh_3)_2]$ are :

A. both square planar

B. tetrahedral and square planar respectively

C. both tetrahedral

D. square planar and tetrahedral respectively .

Answer: c

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4. The complex which has no d-electron in the central metal atom is .

A. $\left[MnO_4\right]$

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

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

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

Answer: a

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5. A mixture x containing 0.02 mol of $\left[Co\left(NH_3\right)_5SO_4\right]Br$ and 0.02 mol of $\left[Co\left(NH_3\right)_5Br\right]SO_4$ was prepared in $2L$ of solution.

$1L$ of mixture $X+$ excess $AgNO_3 \rightarrow Y$

$1L$ of mixture $X+$ excess $BaCl_2 \rightarrow Z$

The number of moles of Y and Z are

A. 0.01, 0.01

B. 0.02, 0.01

C. 0.01, 0.02

D. 0.02, 0.02

Answer: a

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6. The compound having tetrahedral geometry is

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

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

C. $\left[PdCl_4\right]^{2-}$

D. $\left[NiCl_4\right]^{2-}$

Answer: d

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7. Which kind of isomerism is shown by $Co\left(NH_3\right)_4Br_2Cl$?

A. geometrical and ionisation

B. optical and ionisation

C. geometrical and optical

D. only geometrical .

Answer: a

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8. $Ag^{+} + NH_3 < \Rightarrow \left[Ag\left(NH_3\right)\right]^{+}, k_1 = 6.8 \times 10^{-5}$

$\left[Ag\left(NH_3\right)\right]^{+} + NH_3 < \Rightarrow \left[Ag\left(NH_3\right)_2\right]^{+},$

$k_2 = 1.6 \times 10^{-3}$

The formation constant of $\left[Ag\left(NH_3\right)_2\right]^{+}$ is :

A. 1.08×10^{-7}

B. 1.08×10^{-5}

C. 1.08×10^{-9}

D. none of these

Answer: a

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9. The magnetic moment of salt containing Zn^{2+} ion is :

A. 0

B. 1.87

C. 5.92

D. 2

Answer: a

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10. Both and are diamagnetic . The hybridisation of nickel in these complexes respectively are :

A. sp^3, sp^3

B. sp^3, dsp^2

C. dsp^2, sp^3

D. dsp^2, dsp^2

Answer: b

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11. The IUPAC name of is :

A. tetrachloridoronickel (II) tetramminenickel (II)

B. tetraaminnenickle (II) tetrachloridonickel (II)

C. tetraamminenickel (II) tetrachlorido-nickelate (II)

D. tetrachloridonickel (II) tetramminenic-kelate (0).

Answer: c

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12. The ionisation isomer of $\left[Cr\left(H_2O\right)_4 Cl\left(NO_2\right)\right]Cl$

A. $\left[Cr\left(H_2O\right)_4\left(O_2N\right)\right]Cl_2$

B. $\left[Cr\left(H_2O\right)_4 Cl(ONO)\right]Cl$

C. $\left[Cr\left(H_2O\right)_4 Cl(ONO)\right]Cl$

D. $\left[Cr\left(H_4O\right)_4 Cl_2\left(NO_2\right)\right]H_2O$

Answer: b

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13. The correct struture of complex ethylenediaminetetracetic acid (EDTA) is :

A.

B.

C.

D.

Answer: c

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14. Geometrical shapes of the complexes fromed by the reaction of Ni^{2+} with CO, CN^- and H_2O, respecitively , are :

A. octahedral, tetrahedral and square planar

B. tetrahedral, square planar and octahedral

C. square planar , tetrahedral and octahedral

D. octahedral, square planar and octahedral

Answer: c

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15. As per IUPAC nomenclature , the name of the complex is :

A. tetraaquadiaminecobalt (III) chloride

B. tetraaquadimminecobalt (III) chloride

C. diaminetetraquacobalt (III) chloride

D. diamminetetraquacobalt (III) chloride

Answer: b

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16. $\left[NiCl_2\left\{P\left(C_2H_5\right)_2\left(C_6H_5\right)\right\}_2\right]$ exhibits temperature dependent magnetic behaviour. The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are:

A. tetrahedral and tetrahedral

B. square planar and square planar

C. tetrahedral and square planar

D. square planar and tetrahedral .

Answer: c

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17. The geometries of the ammonia complexes of Ni^{2+}, Pt^{2+} and Zn^{2+}, respectively, are

A. octahedral , square planar and tetrahedral

B. square planar, octahedral and tetrahedral

C. tetrahedral, square planar and octahedral

D. octahedral , tetrahedral and square planar

Answer: a

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Multiple correct option type mcqs

1. A ligand having an unshared pair of electrons may be a

A. neutral molecule

B. positively charged ion

C. negatively charged ion

D. group containing a lone pair of electrons.

Answer: a,b,c,d

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2. The oxidation number of metal atom is zero in

A. $[Ni(CO)_4]$

B. $[Fe_2(CO)_5]$

C. $Na[Co(CO)_4]$

D. Cu

Answer: a,b,c,d

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3. The complex $Na_2[Fe(CN)_5NO]$ is called :

A. sodium pentacyanonitrosoniumferrate (II)

B. sodium nitroprusside

C. sodium pentacyanonitrosylferrate

D. sodium nitrosoferrocyanide

Answer: a,b

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4. $K_4\left[Fe(CN)_6\right]$ is used for detection of

A. Fe^{2+} ions

B. Fe^{3+} ions

C. Cu^{2+} ions

D. Cd^{2+} ioins.

Answer: a,c

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5. Which of the following can act as catalysts ?

A. $\left(Ph_3P\right)_3RhCl$

B. $TiCl_4$ and $\left(C_2H_5\right)_3Al$

C. Cu^{2+} ions

D. $\left(CH_3\right)_2Zn$

Answer: a,b

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6. Which of the following statements are correct regarding $\left[Fe\left(H_2O\right)_5NO\right]SO_4$?

A. it gives a brown ring test for nitrates

B. oxidation state of Fe is +2

C. charge on NO is +1

D. C.N . Fe is 6.

Answer: a,b,d

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7. Which of the following statements are not correct ?

A. If Δ_0 lt P , low spin state is more stable .

B. CO is a very weak ligand.

C. The colour of a complex depends only on the nature of metal ion.

D. Tetrahedral complexes have nearly 50% CFSE value than octahedral complexes .

Answer: b,c

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8. Which of the following statements are false ?

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

B. Weak ligands like F^- , Cl^- and OH^- usually from low spin complexes

C. $\left[FeF_6\right]^{3-}$ is a high spin complex

D. Strong ligand like CN^- and NO_2^- , generally from high spin complexes.

Answer: a,b,d

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9. The compound(s) that exhibits(s) geometrical isomerism is/are

A. $\left[Pt(en)Cl_2\right]$

B. $\left[Pt(en)_2\right]$

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

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

Answer: c,d

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10. Which of the following complexes are paramagnetic in nature ?

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

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

C. $\left[C_0F_6\right]^{3-}$

D. $Ni(CO)_4$

Answer: a,c

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11. Which of the following complexes can exhibit square planar geometry ?

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

B. $\left[Zn\left(NH_3\right)_2Cl_2\right]$

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

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

Answer: a,c

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12. When the valence d-orbitals of the central metal ion split in energy in an octahedral ligand field, which orbitals are raised least in energy ?

A. $d_{x^2-y^2}$

B. d_{xz}

C. d_{yz}

D. d_z^2

Answer: b,c

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13. Which of the following complexes has ENA equal to 36 ?

A. $K_4\left[Fe(CN)_6\right]$

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

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

D. $\left[Cu\left(NH_3\right)_4\right]SO_4$

Answer: a,b,c

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14. The magnitude of orbital splitting energy depends upon :

A. Nature of the ligand

B. Oxidation state of metal

C. Principle quantum no. of d-orbitals

D. Geometry of co-ordiantion entity.

Answer: a,b,c,d

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15. Which of the following will not give test for Fe^{3+} ions ?

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

B. $Fe_2\left(SO_4\right)_3$

C. $Na_3\left[Fe\left(C_2O_4\right)_3\right]$

D. $FeCl_3$

Answer: a,c

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16. The pair of coordination complex exhibiting the same kind of isomerism is .

A. $\left[Cr(NH_3)_5Cl\right]Cl_2$ and $\left[Cr(NH_3)_4Cl_2\right]Cl$

B. $\left[Co(NH_3)_4Cl_2\right]^{2+}$ and $\left[Pt(NH_3)_2(H_2O)Cl\right]^{+}$

C. $\left[CoBr_2Cl_2\right]^{2-}$ and $\left[PtBr_2Cl_2\right]^{2-}$

D. $\left[Pt(NH_3)_3(NO_3)\right]Cl$ and $\left[Pt(NH_3)_3Cl\right]Br$

Answer: b,d

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17. Addition of excess aqueous ammonia to a pink coloured aqueous solution of and gives an octahedral complex Y in the presence of air . In aqueous solution, complex Y behaves as 1:3 electrolyte . The reaction of X with excess HCl at room temperature results in the formation of a blue coloured complex Z. The calculated spin only magnetic moment of X and Z is 3.87 B.M whereas it is zero for complex Y. Among the following options , which statement(s) is(are) correct ?

A. The hybridisation of the central metal ion in Y is d^2sp^3

B. Addition of silver nitrate to Y gives only two equivalents of silver chloride

C. When X and Z are in equilibrium at $0\,^\circ$C , the colour of the solution is pink

D. Z is a tetrahedral complex.

Answer: a,c,d

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18. The correct statement (s) regarding the binary transition metal carbonyl compounds is (are)

(Atomic numbers: Fe = 26, Ni = 28)

A. Total number of valence shell electrons at metal centre in $Fe(CO)_5$ or $Ni(CO)_4$ is 16

B. These are predominantly low spin in nature

C. Metal-carbon bond strengthens when the oxidationary state of the metal is lowered

D. The carbonyl C-O bond weakens when the oxidation state of the metal is increased .

Answer: b,c

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Assertion-Reason type question

1. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : Tetrahedral complexes donot show geometrical isomerism

Reason : The relative positions of the ligands in the tetrahedral complexes are the same with respect to each other .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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2. The question 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:

Assertion: $Co\left(NH_3\right)_2Cl_2$ gives white precipitate with $AgNO_3$ solution.

Reason: Chlorine is not present in the ionising sphere.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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3. The questions given below consist of Assertion (A) and Reason (R) .

Use the following key to select the correct answer.

assertion : Cis $\left[CoCl_2(en)_2\right]^{2+}$ is optically active in nature .

Reason : It has no plane of symmetry .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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4. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : The ligand N_3^- is named as nitrido.

Reason : It is derived from NH_3.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: d

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5. The questions given below consist of Assertion (A) and Reason (R) .

Use the following key to select the correct answer.

Assertion : The complex $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic in nature .

Ni^{2+} ion in the complex is dsp^2 hybridised .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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6. The questions given below consist of Assertion (A) and Reason (R) .

Use the following key to select the correct answer.

Assertion : The ligands nitrio-N and nitrio-O are ambident in nature .

Reason : The ligands give linkage isomers.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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7. The questions given below consist of Assertion (A) and Reason (R) .

Use the following key to select the correct answer.

Assertion : The complex $\left[Ni(en)_3\right]Cl_2$ has lower stability than $\left[Ni\left(NH_3\right)_6\right]Cl_2$.

Reason : In $\left[Ni(en)_3\right]Cl_2$, the geometry of Ni is triagonal bipyramidal .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: d

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8. 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:

Assertion: Potassium ferrocyanide is diamagnetic whereas potassium ferricyanide is paramagnetic.

Reason: Crystal field splitting in ferrocyanide ion is greater than that of ferricyanide ion.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: c

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9. 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:

Assertion: $\left[Co\left(NO_2\right)_3\left(NH_3\right)_3\right]$ does not show optical isomerism.

Reason: It has a plane of symmetry.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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10. The question 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:

Assertion: $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ is paramagnetic.

Reason: The Fe in $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ has three unpaired electrons.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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11. 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:

Assertion: The geometrical isomers of the complex $\left[M\left(NH_3\right)_4Cl_2\right]$ are optically inactive.

Reason: Both geometrical isomer of the complex $\left[M\left(NH_3\right)_4Cl_2\right]$ possess axis of symmetry.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

12. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is sp^3 hybridised tetrahedral complex .

Reason : $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is diamagnetic in nature .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: d

13. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

$\left[FeF_6\right]^{4-}$ is a paramagnetic complex while $\left[Fe(CN)_6^{4-}\right]$ is a diamagnetic complex .

Reason : $\left[FeF_6\right]^{4-}$ is an outer orbital complex whereas $\left[Fe(CN)_6\right]^{4-}$ is an inner orbital complex .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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14. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

$\left[Cu(en)_2\right]^{2+}$ is more stable than $\left[Cu\left(NH_3\right)_2\right]^{2+}$ ltReason : Ethylene diamine is a π-bonded complex .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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15. STATEMENT-1: Zeise's salt contain C_2H_4 molecule as one of the ligands

and

STATEMENT-2: Zeise's salt is an organometallic compound .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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16. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : Oxidation state of Fe in $Fe(CO)_5$ is zero . ltbegt Reason : EAN of Fe in its complex is always 36.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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17. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : $Ni(\text{dmg})_2$ is a square planar complex.

Reason : Chelation effect is present in $Ni(\text{dmg})_2$.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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18. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : Linkage isomerism arises in co-ordination complexes containing an ambident ligand.

Reason : Ambidentate ligand has two donor atoms .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: a

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19. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : EDTA forms a complex with divalent metals of 3d series in the ratio 1:1 .

Reason : EDTA has four -COOH groups.

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: b

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20. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : $\left[Fe(CN)_6\right]^{3-}$ has $d^2sp(3)$ hybridisation .

Reason : $\left[Fe(CN)_6\right]^{3-}$ shows magnetic moment corresponding to two unpaired electrons .

Reason : $\left[Fe(CN)_6\right]^{3-}$ shows magnetic moment corresponding to two unpaired electrons .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: c

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21. The questions given below consist of Assertion (A) and Reason (R) . Use the following key to select the correct answer.

Assertion : In Zeise's salt, co-ordianation number of Pt is five.

Reason : Ethene is a bidentate lignad .

A. If both assertion and reason are correct and reason is correct explanation for assertion .

B. If both assertion and reason are correct but reason is not correct explanation for assertion .

C. If assertion is correct but reason is incorrect

D. If both assertion and reason are incorrect

Answer: d

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INTEGER ANSWER TYPE QUESTIONS

1. The oxidation state of Fe in brown complex $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ is

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2. Find out the maximum number of possible isomers of the octahedral complex $\left[Co\left(C_2O_4\right)_2\left(NH_3\right)_2\right]$

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3. A complex compound of chromium has magnetic moment 3.83 BM. Calculate the number of unpaired electrons.

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4. In the complex , $K_4\left[Ni(CN)_4\right]$, what is the oxidation state of nickel ?

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5. What is CN of metal atom in an octahedral complex ?

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6. The magnetic moment is associated with its spin angular momentum and orbital angular momentum. Spin only magnetic moment value of Cr^{3+} ion is

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7. The oxidation state of Fe in $Fe(CO)_5$ is

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8. What is sum of oxidation number and coordination number of Al in Cryolite?

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9. How many H-bonds are present in the complex entity formed by Ni^{2+} and dimethylglyoximato ligands ?

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10. What is the total number of ions due to the ionisation of complex $CoCl_{3.6}H_2O$?

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11. CFSE of high-spin complex d^5Mn^{2+} complex is â€¦â€¦.

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12. The denticity of the complex EDTA is â€¦â€¦.

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13. For the octahedral complexes of Fe^{3+} is SCN^- (thiocyanato-S) and in CN^- ligand environments , the difference between the spin only magnetic moments in Bohr magnetons (when approximated to the nearest integer) is [atomic number of Fe = 26]

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14. In the complex acetylbromidodicarbonylbis (triethylphosphine) iron (II), the number of $Fe - C$ bond (s) is

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15. Among the complex ions,

$\left[Co\left(NH_2 - CH_2 - CH_2 - NH_2\right)_2Cl_2\right]^+$, $\left[CrCl_2\left(C_2O_4\right)_2\right]^{3-}$

$\left[Fe\left(H_2O\right)_4(OH)_2\right]^+$, $\left[Fe\left(NH_3\right)_2(CN)_4\right]^-$,

$\left[Co\left(NH_2 - CH_2 - CH_2 - NH_2\right)_2\left(NH_3\right)Cl\right]^{2+}$ and

that show(s) cis-trans isomerism is

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16. The possible number of geometrical isomers for the complex

$\left[CoL_2Cl_2\right]^-\left(L = H_2NCH_2CH_2O^-\right)$ is (are)....

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17. The co-ordination number of the element M in the complex $M(DMG)_2$ (where DMG is dimethylglyoxime ?

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18. The number of bridged CO groups present in octacarbonylldicobalt (O) is :

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Math the following

1. Match each coordination compound in List I with an appropriate pair of characteristics from List II and select the correct answer using the code below in the lists (en=$H_2NCH_2CH_2NH_2$, atomic number, Ti=22, Cr=24, Co=27, Pt=78)

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2. Match list I (complexes) with list-II(Hybridisation) and select correct answer using codes.

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3. Match each set of hybrid orbitals from List-I with complex given in list II

A. P-5, Q-4,6, R--2,3, S--1

B. P--5,6, Q--4, R--3, S--1,2,

C. P--6, Q--4,5, R--1, S--2,3,

D. P--4,6, Q--5,6, R--1,2, S--3

Answer: (P–6); (Q–4,5); (R–1); (S–2,3);

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Brain storming multiple choice question

1. When excess of ammonia is added to $CuSO_4$ solution, the deep blue coloured complex is formed. Complex is

A. tetrahedral and paramagnetic

B. tetrahedral and diamagnetic

C. square planar and diamagnetic

D. square planar and paramagnetic

Answer: D

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2. Select the correct statements(s) :

A. Complex ions in which ligands can be inte-changed rapidly are said to non-lable

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

C. $\left[Fe(CN)_6\right]^{4-}$ and $\left[Fe\left(H_2O\right)_6\right]^{2+}$ can be distinguished by magnetic moment .

D. For a particular ligand or ligands, greater the charge on the metal ion , more the stability of the complex.

Answer: B::C::D

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

A. $\left[Co\left(NH_3\right)_5Cl_2\right]Cl$

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

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

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

Answer: B

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4. In the above question

A. All Cl atoms show primary valencies

B. Two Cl atoms show primary valencies & one Cl atom shows primary as well as secondary valency

C. All the Cl atoms show secondary valencies.

D. all the above

Answer: C

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5. Which is true for the complex $\left[Ni(en)_2\right]^{2+}$?

A. paramagnetic , dsp^2 , square planar , Cn of Ni = 2

B. diamagnetic , dsp^2 , square planar , CN of Ni = 4

C. diamagnetic , sp^3 , tetrahedral , CN of Ni = 4

D. paramagnetic , sp^3 , square planar , CN of Ni = 4

Answer: B

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6. The isomerism exhibited by the co-ordination complex $\left[Cr\left(NH_3\right)_2\left(H_2O\right)_2Cl_2\right]^+$ are :

A. ionisation, optical

B. hydrate , optical

C. co-ordinate , geometrical

D. geometrical , optical

Answer: D

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7. The pair in which both species have same magnetic moment (spin only value) is .

A. $\left[Cr\left(H_2O\right)_6\right]^{2+}$, $\left[CoCl_4\right]^{2-}$

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

C. $\left[Mn\left(H_2O\right)_6\right]^{2+}$. $\left[Cr\left(H_2O\right)_6\right]^{2+}$

D. $\left[CoCl_4\right]^{2-}$, $\left[Fe\left(H_2O\right)_6\right]^{2+}$

Answer: B

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8. The ligands in anti - cancer drug cisplatin are

A. NH_3, Cl

B. NH_3, H_2O

C. H_2O, Cl

D. H_2O , OH

Answer: A

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9. Which of the following is not correct ?

A. $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic

B. $\left[Fe(CN)_6\right]^{4-}$ is strongly paramagnetic.

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

D. $\left[NiCl_4\right]^{2-}$ is diamagnetic.

Answer: B

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10. The two complexes given below are

A. geometrical isomers

B. psition isomers

C. optical isomers

D. identical

Answer: D

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11. Ammonia forms the complex $\left[Cu\left(NH_3\right)_4\right]^{2+}$ with copper ions in alkaline solution but not in acid solution. The reasons for it is:

A. In acidic solutions, hydration protects copper ions.

B. In acidic solutions, protons co-ordiante with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available.

C. In alkaline solutions, insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali.

D. Copper hydoxide is an amphoteric substance .

Answer: B

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12. The complex $\left[Fe\left(H_2O\right)_5NO\right]^{2+}$ is formed in the brown ring test for nitrates when freshly prepared $FeSO_4$ solution is added to aqueous solution of NO_3^- followed by addition of conc.H_2SO_4 . Select the correct statement about this complex.

A. Colour change is due to charge transfer.

B. It has iron in +1 oxidate state and nitrosyl as NO^+

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

D. All the above are correct statements.

Answer: A::B::C

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