CHEMISTRY

BOOKS - MODERN PUBLICATION CHEMISTRY (KANNADA ENGLISH)

COORDINATION COMPOUNDS

Multiple Choice Questions Level I Basic Conceptual Qs Coordination Compounds Iupac Nomenclature

1. The number of monodentate ligands which are directly bonded to the metal ion is known as:

A. oxidation state

B. coordination sphere

C. coordination number

D. valency.

Answer: C

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2. Metalions which form the most stable complexes have each of the following properties except :

A. small size

B. large nuclear charge

C. at least one lone pair of electrons

D. empty orbitals.

Answer: C

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3. In the complex $[Co(NH_3)_5Cl]Cl_2$, the co-ordination sphere is :

A. Co^{3+}

B. $2Cl^-$

C. $(NH_3)_5Cl$

D. $[Co(NH_3)_5Cl]^{2+}$

Answer: D

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4. The IUPAC name for the compound :

$\left[Co(en)_2Cl(ONO)\right]Cl$ is :

A. Chloridonitrito-N-bis (ethylenediamine) cobalt (III) chloride.

B. Chloridonitrito-N-di (ethylenediamine) cobalt (III) chloride.

C. Chloridonitrito-N-bis (ethylenediamine) cobalt chloride.

D. Chloridobis (ethylenediamine)-nitrito-O-cobalt (III) chloride.

Answer: D

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5. In which of the following complexes, nickel is in the highest oxidation state ?

A. $K_4[Ni(CN)_4]$

B. K_2NiF_6

C. $[Ni(CO)_4]$

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

Answer: B

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6. The formula of the complex, tris (ethylenediamine) cobalt (III) sulphate is :

A. $\left[Co(en)_3\right]SO_4$

B. $\left[Co(en)_3SO_4\right]$

C. $\left[Co(en)_3\right]_2(SO_4)_3$

D. $\left[Co(en)_3\right](SO_4)_3$.

Answer: C

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7. Which of the following complexes is a chelate ?

A. $[Co(NH_3)_6]Br_3$

B. $K_3[Ag(S_2O_3)_2]$

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

D. $[Pt(\text{phen})_2][Pt(CO_3)_2]$.

Answer: C

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8. The oxidation states of the metal atoms in $[Fe(CO)_5]$ and $Na[Co(CO)_4]$ complexes are respectively :

A. 5 and 4

B. 0 and +3

C. $+3$ and $+4$

D. 0 and -1.

Answer: D

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9. The two complexes $PtCl_4.2NH_3$ and $PtCl_4.2KCl$ do not give precipitates of AgCl when treated with $AgNO_3$. The conductance studies indicate zero and three ions per mole of the complex respectively in their solutions. The structures of these complexes are :

A. $\left[Pt(NH_3)_2Cl_4\right]$, $K_2[PtCl_6]$

B. $\left[Pt(NH_3)_2\right]Cl_4,$ $K_2[PtCl_6]$

C. $\left[Pt(NH_3)_2Cl_2\right]Cl_2,$ $[K_2PtCl_4]Cl_2$

D. $\left[Pt(NH_3)_2Cl_4\right],$ $[K_2PtCl_6].$

Answer: A

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10. The number of ions per mole of the complex $CoCl_3.5NH_3$ in aqueous solution will be :

A. 3

B. 9

C. 2

D. 4

Answer: A

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11. In the complex $PtCl_4.4NH_3$, the number of ionisable chlorine ions is :

A. four

B. one

C. two

D. three.

Answer: C

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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. 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: B

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14. Oxidation number of iron in $K_4\left[Fe(CN)_6\right]$ is :

A. $+3$

B. $+2$

C. 0

D. $+1$.

Answer: B

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15. IUPAC name of $\left[Pt(NH_3)_2Cl(NO_2)\right]$ is :

A. Platinum diaminechloronitrite

B. Chloridonitrito-N-ammineplatinum (II)

C. Diamminechloridonitrito-N-platinum (II)

D. Diamminechloridonitrito-N-platinate (II)

Answer: C

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16. The oxidation state of Pt in $[Pt(C_2H_4)Cl_3]^-$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4.$

Answer: B

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17. Vitamin B_{12} complex contains the metal :

A. Iron

B. Cobalt

C. Magnesium

D. Nickel.

Answer: B

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18. IUPAC name of $K_3\left[Fe(C_2O_4)_3\right]$ is

A. potassium trisoxalato ferrate (III)

B. potassium trioxalato ferrate (III)

C. potassium trioxalato ferrate (II)

D. potassium trisoxalato ferrate (II)

Answer: B

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19. The donor atom in isothiocyanato ligand is :

A. N

B. S

C. C

D. O.

Answer: A

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20. AgCl dissolves in NH_4OH due to the formation of :

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

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

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

D. $\left[Ag(NH_3)_2OH\right].$

Answer: C

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21. Which one of the following is not a coordination compound ?

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

B. $NaFeCl_4$

C. $FeSO_4.(NH_4)_2SO_4$

D. $Fe(H_2O)_6Cl_3.$

Answer: C

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

A. $+1$

B. 0

C. $+3$

D. $+4$.

Answer: B

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23. The number of ions present in $K_3\left[Fe(CN)_6\right]$ are:

A. 10

B. 4

C. 3

D. 2

Answer: B

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24. Which of the following has magnesium?

A. Chlorophyll

B. Haemocyanin

C. Carbonic anhydrase

D. Vitamin B_{12}.

Answer: A

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25. According to IUPAC nomenclature, sodium nitro prusside is named as:

A. sodium nitro ferricyanide

B. sodium nitro ferrocyanide

C. sodium pentacyanonitrosyl ferrate (II)

D. sodium pentacyanonitrosyl ferrate (III)

Answer: D

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26. Vitamin B_{12} contains:

A. magnesium

B. cobalt

C. iron

D. nickel.

Answer: B

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27. Which of the following complexes is non-conducting electricity?

A. $CoCl_3.3NH_3$

B. $CoCl_3.6NH_3$

C. $CoCl_3.4NH_3$

D. $CoCl_3.5NH_3$.

Answer: A

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28. The oxidation state of Fe in $\left[Fe(NO)(H_2O)_5\right]SO_4$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$.

Answer: B

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29. The IUPAC name of the complex $\left[Pt(NH_3)_3Br(NO_2)Cl\right]Cl$ is

A. Triamminechlorobromonitroplatinum (IV) chloride

B. Triamminebromonitrochloroplatinum (IV) chloride

C. Triamminebromidochloridonitrito-n-platinum (IV) chloride

D. Triamminenitrochlorobromoplatinum (IV) chloride

Answer: C

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30. A coordination complex compound of cobalt has molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three mole ions in an aqueous solution. On reacting this solution with excess of silver nitrate solution, two moles of AgCl get precipitated. The formula of this compound would be

A. $\left[Co(NH_3)_4(NO_2)Cl\right][NH_3Cl]$

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

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

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

Answer: C

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Multiple Choice Questions Level I Basic Conceptual Qs Isomerism In Coordination Compounds

1. The compounds $[Co(NO_2)(NH_3)_5]Cl_2$ and $[Co(ONO)(NH_3)_5]Cl_2$ are examples of :

A. Geometrical isomers

B. Ligand isomers

C. Ionisation isomers

D. Linkage isomers.

Answer: D

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2. The complex $\left[Co(NH_3)_4Cl_2\right]Br$ can exhibit :

A. Linkage isomerism

B. Ionisation isomerism

C. Coordination isomerism

D. Ligand isomerism.

Answer: B

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3. The compounds $\left[Cr(H_2O)_6\right]Cl_3$ and :

$\left[Cr(H_2O)_5Cl\right]Cl_2.\ H_2O$ are example of

A. Linkage isomerism

B. Ionisation isomerism

C. Coordination isomerism

D. Hydrate isomerism.

Answer: D

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4. Which of the following square planar complexes has two geometrical isomers ?

A. MA_4

B. MA_3B

C. $MABCD$

D. MA_2B_2.

Answer: B

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5. Which of the following will not show geometrical isomerism ?

A. $\left[PtCl_2\{P(C_6H_5)_3\}_2\right]$

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

C. $\left[Cr(gly)_3\right]$

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

Answer: D

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6. The complexes $\left[Co(NH_3)_4Cl_2\right]NO_2$ and :

$\left[Co(NH_3)_4Cl.\ NO_2\right]Cl$ are isomers

A. geometrical

B. optical

C. linkage

D. ionisation.

Answer: D

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7. The number of geometrical isomers for $\left[Pt(NH_3)_2Cl_2\right]$ is :

A. 1

B. 2

C. 3

D. 4

Answer: B

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8. The number of possible geometrical isomers for the complex $[Pt(NH_3)(py)(NH_2OH)(NO_2)]$ is :

A. 2

B. 3

C. 4

D. 0

Answer: B

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9. Which one of the following is expected to exhibit optical isomerism (en = ethylene diamine) ?

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

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

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

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

Answer: C

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10. Indicate the complex ion which shows geometrical isomerism.

A. $\left[Cr(H_2O)_4Cl_2\right]^+$

B. $\left[Pt(NH_3)_3Cl\right]$

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

D. $\left[Co(CN)_5(NC)\right]^{3-}$

Answer: A

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11. The compounds $\left[Cr(H_2O)_6\right]Cl_3$ and :

$\left[Cr(H_2O)_5Cl\right]Cl_2.\ H_2O$ are example of

A. linkage isomerism

B. solvate isomerism

C. ionisation isomerism

D. coordination isomerism

Answer: B

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12. Select the correct statement about the complex $[Co(NH_3)SO_4]Br$.

A. Its ionisation isomer is $\left[Co(NH_3)_5Br\right]SO_4$

B. Its gives yellow precipitate with $AgNO_3$.

C. Its ionisation isomer gives white precipitate with

$BaCl_2$

D. All the above are correct statements.

Answer: D

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13. Which of the following ligand can exhibit linkage isomerism?

A. CN^-

B. NO_2^-

C. SCN^-

D. All of these

Answer: D

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Multiple Choice Questions Level I Basic Conceptual Qs Theories Of Bonding And Applications Of Coordination Compounds

1. The number of unpaired electrons in $\left[Fe(CN)_6\right]^{3-}$ is :

A. three

B. one

C. four

D. six.

Answer: B

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2. What is the number of unpaired electrons in tetrahedral $\left[Ni(CO)_4\right]$ complex ?

A. 2

B. 4

C. 0

D. 8

Answer: C

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3. The square planar $\left[Ni(CN)_4\right]^{2-}$ complex :

A. contains 2 unpaired electrons.

B. contains 1 unpaired electron.

C. contains 3 unpaired electrons.

D. is diamagnetic.

Answer: D

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4. Which of the following ligands causes maximum crystal field splitting ?

A. SCN^-

B. en

C. $C_2O_4^{2-}$

D. NH_3.

Answer: B

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5. Dimethylglyoxime is used for estimation of

A. Nickel

B. Cobalt

C. Manganese

D. Aluminium.

Answer: A

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6. The complex $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic and it involves the following hybridisation of nickel :

A. sp^3

B. dsp^2

C. d^2sp^3

D. sp^3d .

Answer: B

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7. Which of the following has tetrahedral geometry?

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

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

C. $[NiCl_4]^{2-}$

D. $Fe(CO)_5$.

Answer: C

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8. The number of unpaired electrons in outer orbital $\left[Fe(H_2O)_6\right]^{3+}$ complex is :

A. 1

B. 3

C. 5

D. 2

Answer: C

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9. Which of the following complexes does not obey EAN rule ?

A. $Cr(CO)_6$

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

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

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

Answer: C

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10. The complex $\left[Cu(NH_3)_4\right]^{2+}$ is :

A. tetrahedral with one unpaired electron

B. square planar with one unpaired electron

C. square planar and diamagnetic

D. tetrahedral and diamagnetic.

Answer: B

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11. Which of the following is used as a heterogeneous catalyst in the polymerization of ethylene into polyethylene?

A. Walker's catalyst

B. Ziegler Natta catalyst

C. Wilkinson's catalyst

D. Ruthenium catalyst.

Answer: B

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12. Which is paramagnetic ?

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

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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13. Which of the following is used in cancer chemotherapy?

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

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

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

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

Answer: D

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14. The spin magnetic moment of $[MnBr_4]^{2-}$ is 5.9 B.M.

Its expected geometry is :

A. Square planar

B. Octahedral

C. Trigonal bipyramidal

D. Tetrahedral.

Answer: D

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15. Among the following which is strongest field ligand?

A. CO

B. CN^-

C. NH_3

D. en.

Answer: A

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16. Which of the following is diamagnetic ?

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

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

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

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

Answer: D

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17. Which statement is incorrect ?

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

B. $Ni(CN)_4^{2-}$ - square planar, diamagnetic.

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

D. $NiCl_4^{2-}$ - tetrahedral, paramagnetic.

Answer: A

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

A. five

B. two

C. four

D. three.

Answer: A

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19. Which one of the following is an inner orbital complex as well as diamagnetic in behaviour ?

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

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

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

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

Answer: C

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

electrons in the chromium of the complex is :

A. $3d_{xy}^1, \left(3d_{x^2-y^2}\right)^1, 3d_{yz}^1$

B. $3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1$

C. $3d_{xy}^1, 3d_{zy}^1, 3d_{z^2}^1$

D. $\left(3d_{x^2-y^2}\right)^1, 3d_{z^2}^1, 3d_{xy}^1.$

Answer: B

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21. The crystal field splitting energy for octahedral (Δ_o) and tetrahedral (Δ_t) complexes is related as:

A. $\Delta_t = \frac{1}{2}\Delta_o$

B. $\Delta_t = \frac{4}{9}\Delta_o$

C. $\Delta_t = \frac{3}{5}\Delta_o$

D. $\Delta_t = \frac{2}{5}\Delta_o$.

Answer: B

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22. In the complexes $[Fe(H_2O)_6]^{3+}$, $[Fe(CN)_6]^{3-}$, $[Fe(C_2O_4)_3]^{3-}$ and $[FeCl_6]^{3-}$, more stability is shown by

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

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

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

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

Answer: C

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Multiple Choice Questions Level Ii Comprehensive Qs

1. Which of the following ligands can act as hexadentate ligand?

A. acetylacetonato

B. ethylenediamine

C. EDTA

D. 1-10-phenanthroline.

Answer: C

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2. Which of the following names is not correct for the corresponding complex according to IUPAC system ?

A. $\left[Cr(H_2O)_4Cl_2\right]NO_3$ - Tetraaquodichloridochromium (III) nitrate

B. $\left[Ag(NH_3)_2\right]^+$ - Diamminesilver (I) ion

C. $Na_3[AIF_6]$ - Sodium hexafluoridoaluminium (III)

D. $\left[Co(en)_3\right]Cl_3$ - Tris (ethylenediamine) cobalt (III) chloride.

Answer: C

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3. The total number of geometrical and optical isomers for the complex ion dichlorobis (ethylenediamine)rhodium (III) is :

A. four

B. three

C. two

D. six.

Answer: B

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4. The complex $\left[Co(NH_3)_6\right]^{3+}$ is an inner orbital complex whereas the $\left[CoF_6\right]^{3-}$ is an outer orbital complex. The number of unpaired electrons in these two complexes are respectively :

A. Zero and 4

B. 4 and 4

C. 6 and 2

D. 3 and 4.

Answer: A

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5. Which of the following has least conductivity in aqueous solution ?

A. $Co(NH_3)_4Cl_3$

B. $Co(NH_3)_3Cl_3$

C. $Co(NH_3)_5Cl_3$

D. $Co(NH_3)_6Cl_3$.

Answer: B

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6. The correct IUPAC name of the compound $K_3\left[Al(C_2O_4)_3\right]$ is :

A. Potassium trioxalato aluminate (III)

B. Potassium tris (oxalato) aluminium (III).

C. Potassium tris (oxalato) aluminate (III).

D. Potassium trioxalato aluminium (III).

Answer: A

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7. The complex $Hg[Co(CNS)_4]$ is named as :

A. Mercury tetrasulphocyanide cobaltate (III)

B. Mercury tetrathiocyanato cobaltate (II)

C. Mercury tetrathiocyanato cobalt (III)

D. Mercury tetrathiocyanato cobaltate (O).

Answer: B

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8. The brown ring complex compound is formulated as $[Fe(H_2O)_5(NO)]SO_4$. The oxidation state of iron is :

A. $+1$

B. $+2$

C. $+3$

D. 0

Answer: B

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

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

Answer: C

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10. The number of geometrical isomers possible for the square planar complex MABCD is :

A. 2

B. 3

C. 4

D. 6

Answer: B

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11. Which of the following is not optically active?

A. cis - $\left[Rh(en)_2Cl_2\right]$

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

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

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

Answer: C

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12. Coordination number and oxidation state of Cr in $K_3\left[Cr(C_2O_4)_3\right]$ are respectively :

A. 6 and +3

B. 3 and 0

C. 4 and +2

D. 3 and +3.

Answer: A

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13. Which of the following isomeric pairs shows ionisation isomerism ?

A. $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$

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

C. $[Pt(NH_3)_2Cl_2]$ and $[Pt(NH_3)_4][PtCl_4]$

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

Answer: D

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14. The following represents a pair of enantiomers:

A. cis $\left[CrCl_2(en)_2\right]^+$

B. cis $\left[CrCl_2(NH_3)_4\right]^+$

C. trans $\left[CrCl_2(en)_2\right]^+$

D. trans $\left[CrCl_2(NH_3)_4\right]^+$

Answer: A

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15. Which of the following statement is not correct for $\left[Ni(CN)_4\right]^{2-}$ and $\left[NiCl_4\right]^{2-}$ complexes.

A. Both have Ni in + II oxidation state.

B. $[NiCl_4]^{2-}$ is a low spin while $\left[Ni(CN)_4\right]^{2-}$ is a high spin complex.

C. $[NiCl_4]^{2-}$ is tetrahedral while $\left[Ni(CN)_4\right]^{2-}$ is square planar.

D. $[NiCl_4]^{2-}$ involves sp^3 hybridisation and $[NiCN_4]^{2-}$ involves dsp^2 hybridisation.

Answer: B

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16. An octahedral complex of the type MX_4Y_2 has

A. 3 geometrical isomers

B. 2 geometrical isomers

C. 4 geometrical isomers

D. no geometrical isomer.

Answer: B

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

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

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

C. $[ZnCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$

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

Answer: B

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18. Which of the following is not true for CoF_6^{3-} ?

A. It is paramagnetic due to the presence of 4 unpaired electrons.

B. It has coordination number of 6.

C. It is outer orbital complex.

D. It involves d^2sp^3 hybridisation.

Answer: D

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19. Which of the following will give maximum number of isomers ?

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

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

C. $\left[Ni(C_2O_4)(en)_2\right]^{2-}$

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

Answer: D

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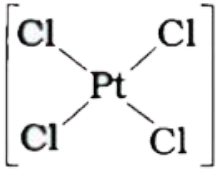
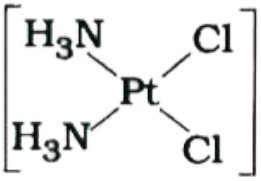
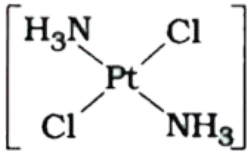
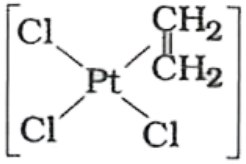
20. Which of the following is considered to be an anticancer species ?

A. 

B. 

C. 

D. 

Answer: B

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21. For the given complex $\left[CoCl_2(en)(NH_3)_2\right]^+$, the number of geometrical isomers, 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 2.

Answer: A

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22. The IUPAc name of $\left[Co(NH_3)_5ONO\right]^{2+}$ ion is

A. Pentaamminenitritocobalt (III) ion

B. Pentaamminenitrocobalt (III) ion

C. Pentaamminenitrocobalt (IV) ion

D. Pentaamminenitritocobalt (IV) ion.

Answer: A

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23. Facial and meridional isomerism will be exhibited by:

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

B. $[Co(NH_3)_4Cl_2]Cl$

C. $[Co(en)_3]Cl_3$

D. $[Co(NH_3)_5Cl]Cl_2$

Answer: A

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24. The compounds $[Co(SO_4)(NH_3)_5]Br$ and $[Co(SO_4)(NH_3)_5]Cl$ represent

A. linkage isomerism

B. ionisation isomerism

C. coordination isomerism

D. no isomerism

Answer: D

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

(i) + 1 (ii) + 3 (iii)-1 (vi) - 3

A. $+1$

B. $+3$

C. -1

D. -3

Answer: C

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26. When one mole of each of the following complex salts is treated with excess of $AgNO_3$, which of them gives maximum amount of AgCl ?

A. $\left[Co(NH_3)_6\right]Cl_3$

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

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

D. $Na_2[PtCl_6]$

Answer: A

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27. Which of the following will give a pair of enantiomorphs?

$(en = NH_2CH_2CH_2NH_2)$

A. $[Cr(NH_3)_6][Co(CN)_6]$

B. $[Co(en)_2Cl_2]Cl$

C. $[Pt(NH_3)_4][PtCl_6]$

D. $[Co(NH_3)_4Cl_2]NO_2$

Answer: B

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28. What is crystal field splitting energy (CFSE)?

A. $-1.2\Delta_0$

B. $-0.6\Delta_0$

C. $-1.8\Delta_0$

D. $-1.6\Delta_0 + P$

Answer: B

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29. The hybridization states of $[Ni(CO)_4]$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$ species are respectively

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

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

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

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

Answer: D

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30. Which of the following is an outer orbital complex ?

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

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

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

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

Answer: B

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31. Among the following which one is paramagnetic and has tetrahedral geometry?

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

B. $[NiCl_4]^{2-}$

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

D. $\left[CoCl_2(en)_2\right]^{+}$

Answer: B

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32. Formula of hexaaquamanganese (II) phosphate is

A. $\left[Mn(H_2O)_6\right](PO_4)$

B. $\left[Mn(H_2O)_6\right]_3(PO_4)$

C. $\left[Mn(H_2O)_6\right]_3(PO_4)_2$

D. $\left[Mn(H_2O)_6\right](PO_4)_3$

Answer: C

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

A. Linkage isomerism

B. Ionisation isomerism

C. Coordination isomerism

D. Geometrical isomerism

Answer: C

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

A. 3

B. 4

C. 0

D. 2

Answer: A

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35. One mole of complex compound $Co(NH_3)_5Cl_3$ gives 3 moles of ions on dissolution in water. One mole of the

same complex reacts with two moles of $AgNO_3$ solution to yield two moles of AgCl(s). The structure of the complex is :

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

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

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

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

Answer: D

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36. Which one of the following complexes is outer orbital complex ?

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

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

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

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

Answer: D

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37. Which of the following cyano complexes would exhibit the lowest value of paramagnetic behaviour?

[At. Nos. 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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38. The value of 'spin only' magnetic moment for one of the following configurations is 2.84 BM. The correct one is :

A. d^4 (in strong liquid field)

B. d^2 (in weak ligand field)

C. d^3 (in weak as well as in strong fields)

D. d^5 (in strong ligand field).

Answer: A

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39. Which kind of isomerism is exhibited by octahedral $Co(NH_3)_4Br_2Cl$?

A. Geometrical and ionization

B. Geometrical and optical

C. Optical and ionization

D. Geometrical only.

Answer: A

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40. The "spin only" magnetic moment of Ni^{2+} in aqueous solution would be [At No. of Ni = 28]

A. 4.90

B. 0

C. 1.73

D. 2.84

Answer: D

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41. Which one of the following has a square planar geometry?

(At. nos. Co = 27, Ni = 28, Fe = 26, Pt = 78)

A. $[FeCl_4]^{2-}$

B. $[NiCl_4]^{2-}$

C. $[PtCl_4]^{2-}$

D. $[CoCl_4]^{2-}$

Answer: C

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42. The co-ordination number and the oxidation state of an element 'E' in the complex $\left[E(en)_2(C_2O_4)\right]NO_2$ (where (en) is ethylene diamine), respectively are

A. 6 and 3

B. 6 and 2

C. 4 and 2

D. 4 and 3

Answer: A

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43. In which of the following octahedral complexes of Co(Z = 27) will the magnitude of Δ_0 be the highest?

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

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

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

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

Answer: B

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44. Both $\left[Ni(CO)_4\right]$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic. The hybridisations 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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45. The IUPAC name of $\left[Ni(NH_3)_4\right]\left[NiCl_4\right]$ is :

A. Tetrachloronickel (II) tetraamminenickel (II)

B. Tetraamminenickel (II) tetrachloronickel (II)

C. Tetraamminenickel(II)tetrachloronickelate(II)

D. Tetrachloronickel (II) tetraamminenickelate (0).

Answer: C

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Multiple Choice Questions Level Iii Question From Aieee Jee Examinations

1. Which of the following pairs represents linkage isomers?

A. $\left[Cu(NH_3)_4\right][PtCl_4]$ and $\left[Pt(NH_3)_4\right][CuCl_4]$

B. $Pd(PPh_3)_2(NCS)_2\big]$ and $\left[Pd(PPh_3)_2(SCN)_2\right]$

C.

$[Co(NH_3)_5(NO_3)]SO_4$ and $[Co(NH_3)_5(SO_4)]NO_3$

D. $[PtCl_2(NH_3)_4]Br$ and $[PtBr_2(NH_3)_4]Cl_2$.

Answer: B

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2. 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 were 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 = 108u)

A. $\left[CoCl_3(NH_3)_3\right]$

B. $\left[CoCl(NH_3)_5\right]Cl_2$

C. $\left[Co(NH_3)_6\right]Cl_3$

D. $\left[CoCl_2(NH_3)_4\right]Cl.$

Answer: C

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3. Which one of the following has an optical isomer ?

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

B. $\left[Zn(en)_2\right]^{2+}$

C. $\left[Zn(en)(NH_3)_2\right]^{2+}$

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

Answer: D

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4. The magnetic moment (spin only) of $[NiCl_4]^{2-}$ is :

A. 2.82 BM

B. 1.41 BM

C. 1.82 BM

D. 5.46 BM

Answer: A

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5. Which of the following facts about the complex $[Cr(NH_3)_6]Cl_3$ is wrong ?

A. The complex is an outer orbital complex

B. The complex gives white precipitate with silver nitrate solution

C. The complex involves d^2sp^3 hybridisation and is octahedral in shape.

D. The complex is paramagnetic.

Answer: A

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6. Among the ligands NH_3, en, CN^- and CO the correct order of their increasing field strength, is :

A. $NH_3 < en < CN^- < CO$

B. $CN^- < NH_3 < CO < en$

C. $en < CN^- < NH_3 < CO$

D. $CO < NH_3 < en < CN^-$

Answer: A

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7. Which one of the following complex ions has geometrical isomers?

(en = ethylenediamine)

A. $\left[Ni(NH_3)_5Br\right]^+$

B. $\left[Co(NH_3)_2(en)_2\right]^{3+}$

C. $\left[Cr(NH_3)_4(en)\right]^{3+}$

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

Answer: B

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

A. $[Cr(en)Br_2]Br$

B. $\left[Cr(en)_3Br_3\right]$

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

D. $[Cr(en)Br_4]^-$

Answer: C

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9. Which of the following complex species is not expected to exhibit optical isomerism ?

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

B. $\left[Co(en)_2Cl_2\right]^{+}$

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

D. $\left[Co(en)(NH_3)_2Cl_2\right]^{+}$.

Answer: C

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10. The octahedral complex of a metal ion M^{3+} with four monodentate ligands L_1, L_2, L_3 and L_4 absorb

wavelength in the region of red, green, yellow and blue respectively. The increasing order of ligand strengths of the four ligands is :

A. $L_4 < L_3 < L_2 < L_1$

B. $L_1 < L_3 < L_2 < L_4$

C. $L_3 < L_2 < L_4 < L_1$

D. $L_1 < L_2 < L_4 < L_3$

Answer: B

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11. The number of geometric isomers that can exist for square planar $[Pt(Cl)(py)(NH_3)(NH_2)OH]^+$ is (py =

pyridine) :

A. 2

B. 3

C. 4

D. 6

Answer: B

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Recent Examination Questions

1. The IUPAc name of $\left[Co(NH_3)_5ONO\right]^{2+}$ ion is

A. Pentaamminenitritocobalt (III) ion

B. Pentaamminenitrocobalt (III) ion

C. Pentaamminenitrocobalt (IV) ion

D. Pentaamminenitritocobalt (IV) ion.

Answer: A

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2. The oxidation state of Fe in the brown ring complex $\left[Fe(H_2O)_5No\right]SO_4$ is

A. 0

B. $+2$

C. $+1$

D. $+3$

Answer: C

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3. The IUPAC name of $K_2\left[Ni(CN)_4\right]$ is :

A. potassium tetracyanonickelate (II)

B. potassium tetracyanonickelate(III)

C. potassium tetracyanatonickel(II)

D. potassium tetracyanonickel(III).

Answer: A

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4. Which one of the following is wrongly matched?

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

B. $\left[Ni(CO)_4\right]$ - 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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5. Which of the following is a negatively charged bidentate ligand ?

A. Dimethyl glyoximato

B. Cyano

C. Ethylene diamine

D. Acetato.

Answer: A

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6. The secondary valency of platinum in tetraamminedichloroplatinum (IV) chloride is :

A. $+4$

B. $+2$

C. 3

D. 6

Answer: D

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7. Which one of the following has a magnetic moment of 1.75 B.M ?

A. Ti^{3+}

B. V^{3+}

C. Cr^{3+}

D. Fe^{3+}

Answer: A

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8. The atomic number of cobalt is 27 . The EAN of cobalt in $Na_3\left[Co(NO_2)_4Cl_2\right]$ is

A. 35

B. 24

C. 36

D. 34

Answer: C

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9. The "spin only" magnetic moment of Ni^{2+} in aqueous solution would be [At No. of Ni = 28]

A. $\sqrt{6}$ B.M.

B. $\sqrt{15}$ B.M.

C. $\sqrt{2}$ B.M.

D. $\sqrt{8}$ B.M.

Answer: D

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10. A ligand is

A. Lewis acid

B. Bronsted acid

C. either a Lewis acid or a Lewis base

D. Lewis base.

Answer: D

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11. Which one of the following shows highest magnetic moment?

A. Fe^{2+}

B. Co^{2+}

C. Cr^{3+}

D. Ni^{2+}.

Answer: A

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12. 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

13. The IUPAC name of the complex ion formed when gold dissolves in aquaregia is

A. tetrachloridoaurate(III)

B. tetrachloridoaurate(I)

C. tetrachloridoaurate(II)

D. dichloridoaurate(III)

Answer: A

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14. Which of the following will be able to show geometric isomerism ?

A. MABCD - Square planar

B. MA_3B - Square planar

C. MABCD - Tetrahedral

D. MA_2B_2 - Tetrahedral.

Answer: A

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15. How many ions per molecule are produced in the solution when Mohr salt is dissolved in excess of water ?

A. 6

B. 4

C. 10

D. 5

Answer: D

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16. The complex ion having minimum magnitude of $\Delta_o(CFSE)$ is

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

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

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

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

Answer: A

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17. $[Ti(H_2O)]^{2+}$ is a $3d^2$ system. The value of crystal field stabilization energy decreases by :

A. $4 \times 10^{-1}\Delta_0$

B. $4.0\Delta_0$

C. $8.0\Delta_0$

D. $8 \times 10^{-1}\Delta_0$.

Answer: D

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18. Among the complexes of Ni listed below, the following is the only correct statement :

$I - \left[Ni(CO)_4\right]$

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

$III - \left[Ni(Cl_4)\right]^{2-}$

A. All of them have tetrahedral geometry

B. I and III are tetrahedral and II has square planar geometry

C. I and II are tetrahedral and III is square planar

D. All of them have square planar geometry.

Answer: B

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19. The formula for sodium trioxalatoaluminate (III) is :

A. $Na_2\left[Al(C_2O_4)_3\right]$

B. $Na_3[Al(C_2O_4)]_3$

C. $Na_3\left[Al(C_2O_4)_3\right]$

D. $Na_2\left[Al(C_2O_4)_3\right]$.

Answer: C

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20. Mg is an important component of

A. Hemoglobin

B. Chlorophyll

C. ATP

D. Florigen.

Answer: B

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21. Which one of the following coordination entity is chiral?

A. trans-$\left[CrCl_2(ox)_2\right]^{3-}$

B. cis-$\left[Co(NH_3)_4Cl_2\right]^{+}$

C. cis-$\left[CrCl_2(ox)_2\right]^{3-}$

D. trans-$\left[Co(NH_3)_4Cl_2\right]^{+}$.

Answer: C

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