CHEMISTRY

BOOKS - CHETANA PUBLICATION

COORDINATION COMPOUNDS

Exercise

1. What is a coordination compound?

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2. Define Ligard? What are ligands>

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3. Describe the nature of the bond in a coordination compound between metal and the ligands.

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4. What are Lewis acids and bases?

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5. What are the different types of Ligands? Give one example each. How are Ligands classified?

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6. What are bidentate ligands? Give one example.

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7. Draw Lewis structure of the following ligands and identify the donor atom in them NH_3, H_2O.

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8. Name the Lewis acids and bases in the complex $\left[PtC1_2(NH_3)_2\right]$.

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9. Explain the following terms (i) coordination sphere.

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10. Explain the following terms (ii) complex ion.

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11. Explain the following terms (i) charge number of the complex ion.

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12. Explain the following terms (iv) oxidation state of metal ion.

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13. Can you write ionisation of `[Ni(nh_3)_6]Cl_2 Identify coordination sphere and counter ions.

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14. A complex is made of Co(III) and cosists of four NH_3 molecules and two Cl ions as ligands. What is the charge number and formula of complex ion?

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15. What is Coordination number?

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16. What is Coordination number?

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17. What is the coordination number of Co in $\left[CoCl_2(en)_2\right]^+$, Ir in $\left[Ir(C_2O_4)_2C1_2\right]_3^+$ and of Pt in $\left[Pt(NO_2)_2(NH_3)_2\right]$?

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18. What is the coordination number and oxidation state of metal ion in the complex $[Pt(NH_3)C1_5] \odot$

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19. What is a double salt? Explain with an example.

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20. What is a coordination complex? Explain with an example.

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21. What is the different between double salt and coordination complex?

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22. Explain werner Theory of coordination complexes OR What are the postulates of Werner's Theory.

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23. What will happen when (i) $AgNO_3$ is added to $\left[Co(NH_3\right]_6C1_3$.

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24. What will happen when (ii) HCl is added to $[Co(NH_3)_6]Cl_3$, will NH_3 be evolved?

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25. One mole of a purple coloured complex $CoCl_3$ and $6NH_3$ on treatment with excess $AgNO_3$ produces three moles $AgCl$. Write the formula of the complex if the coordination number of Co is 6.

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26. One mole of a purple coloured complex $CoCl_3$ and $6NH_3$ on treatment with excess $AgNO_3$ produces three moles $AgCl$. Write the formula of the complex if the coordination number of Co is 6.

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27. How are complexes classified on the basis of types of ligands.

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28. Classify following complexes as homeleptic and heteroleptic.

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29. What are cationic, anionic and neutral complexes? Give one example each.

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30. Classify coordination complexes on the basis of the charge on the complex.

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31. Classifythe complexes as homoleptic and heteroptic $\left[Co(NH_3)_5C1\right]SO_4$, $\left[Co(ONO)(NH_3)_5\right]C1_2$ $\left[CoC1(NH_3)(en)_2\right]^{2\oplus}$ and $\left[Cu(C_2O_4)_3\right]^{3-}$

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32. Classify the complexes as cationic, anionic or neutral. $Na_4[Fe(CN)_6].[Co(NH_3)_6]Cl_2$, $[Cr(H_2O)_2(C_2O_4)_2]^{3-}$, $[PtCl_2(en)_2]$ and $[Cr(CO)_6]$

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33. What is the shape of a complex in which the coordination number of central metal ion is 4?

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34. Is the complex $[CoF_6]$ cationic or anionic if the oxidation state of cobalt ion is +3?

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35. Explain the rules while writing the formulae and naming coordination compounds.

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36. Write the representation of (i) Tricarbonatocobaltate (III) ion.

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37. Write the representation of (ii) Sodium hexacyanoferrate (III).

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38. Write the representation of (iii) Pottassium hexa cyanoferrate (II).

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39. Write the representation of Aquachlorobis (ethylenediamine) cobalt (III).

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40. Write the representation of (v) Tetraaquadichlorochromium (III) chloride.

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41. Write the representation of (vi) Diamminedichloroplatinum (II).

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42. Write formulae of the following complexes.

(i) Potassium amminetrichloroplatinate

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43. Write formulae of the following complexes.

(ii) Dicyanoaurate (I) ion.

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44. Write the formulae for tetraammineplatinum (II) chloride.

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45. Explain in brife EAN rule.

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46. Find out the EAN of the following compounds. (i) $Zn(NH_3)_4^{+2}$

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47. Find out the EAN of the following compounds. (ii) $\left[Fe(CN)_6\right]^{-4}$

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48. Give examples of complexes which shows deviation from EAN rule.

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49. Do the following complexes follow the EAN rule?

$Cr(CO)_6, Ni(CO)_4, Mn(CO)_5, Fe(CO)_5.$

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50. Define Isomerism.

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51. Define: Isomers.

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52. Explain Stereo isomerism in coordination complexes.

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53. Explain Stereo isomerism in coordination complexes.

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54. Draw structures of the cis and trans isomers of $\left[Fe(NH_3)_2(CN)_4\right]^-$.

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55. Predict whether the $\left[Cr(en)_2(H_2O)_2\right]^{3+}$ complex is chiral. Write structure of its enantiomer.

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56. (i) Draw enantiomers of $\left[Cr(ox)_3\right]^{3+}$.

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57. (ii) Draw enantiomers and cis and trans isomers of $\left[Cr(H_2O)_2(ox)_2\right]^{\odot}$ (whereox= `C_2O_4^(2o.).

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58. Explain constitutional (structural) isomerism in coordination complexes.

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59. Consider the complexes $[Cu(NH_3)_4][PtC1_4]$ and $[Pt(NH_3)_4][CuC1_4]$. What type of isomrism these two complexes exhibit?

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60. Write linkage isomers of $[Fe(H_2O)_5SCN]^{\oplus}$. Write their IUPAC names.

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61. Can you write IUPAC names of isomers I and II? $\left[Co(NH_3)_5SO_4\right]Br$ and $\left[Co(NH_3)_5Br\right]SO_4$

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62. Write applications of coordination compounds in medicine & electroplating.

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63. What are the factors affecting heat of reaction?

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64. Name the theories which explain bonding in complexes.

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65. Explain valence bond theory (VBT).

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66. Give VBT description of bonding in each of following complexes. Predict their magnetic behavior. (i) $[ZnCl_4]^{2\odot}$

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67. Give VBT description of bonding in each of following complexes. Predict their magnetic behavior. (ii) $\left[Co(H_2O)_6\right]^{2\odot}$ (high spin)

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68. Give VBT description of bonding in each of following complexes. Predict their magnetic behavior. (iii) $\left[Pt(CN)_4\right]^{2-}$ (square planar).

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69. Give VBT description of bonding in each of following complexes. Predict their magnetic behavior. (iv) $\left[CoC1_4\right]^{2\odot}$ (tetrahedral)

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70. Give VBT description of bonding in each of following complexes. Predict their magnetic behavior. (ii) $\left[Co(H_2O)_6\right]^{2\odot}$ (high spin)

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71. Indicate the number of unpaired electrons in :

Si (Z=14)

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72. Explain the structures of the complexes with box orbital diagram and orbital hybridisation. (i) $\left[Co(NH_3)_6\right]^{3+}$ low spin

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73. Explain the structures of the complexes with box orbital diagram and orbital hybridisation. $\left(Ni(CN_4)^{2-}\right.$

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74. Explain the structures of the complexes with box orbital diagram and orbital hybridisation. $\left(Ni(CN_4)^{2-}\right.$

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75. Explain the structures of the complexes with box orbital diagram and orbital hybridisation. $\left(Ni(CN_4)^{2-}\right.$

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76. Based on the VBT predict structure and magnetic behavior of the $\left[Ni(NH_3)_6\right]^{3\oplus}$ complex.

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77. $\left[CoC1_4\right]^{2\odot}$ is tetrahedral complex. Draw its box obital diagram. State which orbitals participate in hybridization.

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78. What are the limitation of VBT.

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79. Write a note an Crystal Field Theory.

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80. Explain the splitting of a Tetrahedral complexes.

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81. What are the different types of Ligands? Give one example each. How are Ligands classified?

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82. What are the high-spin and low-spin complexes?

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83. Explain in brief the factors affecting blood pressure.

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84. Explain in brief hybrid cars

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85. With the help of crystal field energy level diagram explain why the complex

$\left[Cr(en)_3\right]^{3\oplus}$ is coloured?

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86. Explain the splitting of a Tetrahedral complexes.

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87. A Sketch qualitatively crystal field d orbital energy level diagrams for each of the following complexes: (c) $\left[Fe(H_2O)_6\right]^{2\oplus}$

Predict whether each of the complexes is diamagnetic or paramagnetic.

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88. A Sketch qualitatively crystal field d orbital energy level diagrams for each of the following complexes: (c) $\left[Fe(H_2O)_6\right]^{2\oplus}$ Predict whether each of the complexes is diamagnetic or paramagnetic.

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89. A Sketch qualitatively crystal field d orbital energy level diagrams for each of the following complexes: (a) $\left[Ni(en)_3\right]^{2\oplus}$ Predict whether each of the complexes is diamagnetic or paramagnetic.

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90. Draw qualitatively energy-level diagram showing d-orbital splitting in the octahedral environment. Predict the number of unpaired electrons in the complex $\left[Fe(CN)_6\right]^{4-}$. Is the

complex diamagnetic or paramagnetic? Is it coloured? Explain.

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91. Write applications of coordination compounds in medicine & electroplating.

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92. Draw isomers in each of the following. (i) $Pt(NH_3)_2C1.NO_2$

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93. Draw isomers in each of the following.(ii)

$Ru(NH_3)_4C1_2$

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94. Draw isomers in each of the following. (iii)

$\left[Cr(en)^2Br^2\right]^+$

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95. Draw geometric isomers and enatiomers of the following complexes. (i) $\left[Pt(en)_3\right]^{+4}$

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96. Draw geometric isomers and enatiomers of the following complexes. (ii) $\left[Pt(en)_2C1Br\right]^{+2}$

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97. What is the coordination number and oxidation state of metal ion in the complex $[Pt(NH_3)C1_5] \odot$

A. $+2$

B. $+3$

C. $+1$

D. $+4$

Answer:

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98. IUPAC name of the complex $\left[Pt(en)_2(SCN)_2\right]^{2+}$ is

A. bis (ethylenediamine dithiocyanatoplatinum (IV) ion

B. bis (ethylenediamine) dithiocyanatoplatinum (IV) ion

C. dicyanatobis (ethylenediamine) platinate IV ion

D. bis (ethylenediammine) dithiocynato platinate (IV) ion

Answer:

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99. Formula for the compound sodium hexacynoferrate (III) is

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

B. $Na_2\left[Fe(CN)_6\right]$

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

D. $Na_3\left[Fe(CN)_6\right]$

Answer:

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100. On the basis of CFT predict the number of unpaired electrons in $[CrF_6]^{3-}$

A. 1

B. 2

C. 3

D. 4

Answer:

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101. When an excessof $AgNO_3$ is added to the complex one mole of AgCI is precipitated. The formula of the complex is

A. $\left[CoC1_2(NH_3)_4\right]C1$

B. $\left[CoC1(NH_3)_4\right]C1_2$

C. $\left[CoC1_3(NH_3)_3\right]$

D. $\left[Co(NH_3)_4\right]C1_3$

Answer:

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102. The sum of coordination number and oxidation number of M in $\left[M(en)_2C_2O_4\right]C1$ is

A. 6

B. 7

C. 9

D. 8

Answer:

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103. The complex ions $\left[Co(NH_3)_5(ONO)\right]^{2+}$ and $\left[Co(NH_3)_5(NO_2)\right]^{2+}$ are called

A. linkage isomers

B. ionisation isomers

C. coordination isomers

D. geometrical isomers

Answer:

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104. Primary and secondary valency of platinum in the complex $\left[Pt(en)_2C1_2\right]$ are

A. 4,6

B. 2,6

C. 4,4

D. 6,4

Answer:

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105. Which one of the following is NOT a ligand?

A. PH_3

B. NO^+

C. Br^-

D. BF_3

Answer:

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106. Which complex has square planar structure?

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

B. $\left[NiC1_4\right]^{2-}$

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

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

Answer:

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107. The number of ions formed when cuproammonium sulphate is dissolved in water is:

A. 1

B. 2

C. 4

D. Zero

Answer:

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

A. $+1$

B. $+2$

C. $+4$

D. $+3$

Answer:

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109. Which of the following complex will not show colour?

A. $\left[Cr(NH_3)_6\right]C1_3$

B. $K_3[VF_6]$

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

D. $[NiC1_4]^{2-}$

Answer:

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110. Coordination number of cobalt in $\left[Co(C_2O_4)_3\right]^{3-}$ is

A. 2

B. 6

C. 5

D. 4

Answer:

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111. In a coordination complex, the negative groups or neutral molecules attachedto the central atom is termed as:

A. charge of metal ion

B. lignands

C. coordination number

D. EAN

Answer:

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112. Oxidation number of Co in $\left[Co(NH_3)_3(H_2O)_2C1\right]^+$ is

A. 1

B. 2

C. 3

D. 4

Answer:

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113. The number of ions formed when $[Cu(NH_3)_4]SO_4$ is dissolved in water is

A. 1

B. 2

C. 4

D. Zero

Answer:

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114. Metal in the chlorophyll is :

A. zinc

B. magnesium

C. calcium

D. sodium

Answer:

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115. A complex involving dsp^2 hybridisation ion has:

A. a square planar complex

B. a tetrahedral geometry

C. an octahedral geometry

D. trigonal planar geometry

Answer:

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116. The total number of ions furnished by $K_4\left[Fe(CN)_6\right]$ in solution is:

A. 5

B. 4

C. 3

D. 6

Answer:

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117. Vitamin B_{12} is a complex of:

A. cobalt

B. zinc

C. vanadium

D. nickel

Answer:

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118. Cis platin compound is used in the treatment of

A. malaria

B. cancer

C. AIDS

D. yellow fever

Answer:

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119. Ligand used in the estimation of hardness of water is:

A. EDTA

B. DBG

C. chloride

D. bromo

Answer:

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120. The effective atomic number of chromium (At Number 24) in $\left[Cr(NH_3)_6\right]C1_3$ is

A. 35

B. 36

C. 33

D. 34

Answer:

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121. EAN is calculated by using the formula

A. x+y+z

B. x-z-y

C. z-x+y

D. y-x+z

Answer:

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122. The effective atomic number of platinum in $\left[Pt(NH_3)_4\right]^{2+}$ is

A. 36

B. 84

C. 54

D. 35

Answer:

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123. EAN rule is used to find

A. Geometry of the complex

B. Stability of complex

C. Number of isomers of complex

D. Number of possible ligands around metal in complex

Answer:

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

A. $+1$

B. $+3$

C. -1

D. -3

Answer:

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

A. 3

B. 4

C. 5

D. 6

Answer:

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126. The oxidation number of Cr in CrO_5 is

A. 4

B. 2

C. 6

D. 10

Answer:

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127. The coordination number of a metal in a coordination compound is

A. same as primary valency

B. same as secondary valency

C. sum of primary and secondary valency

D. none of the above

Answer:

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128. Example of double salt is

A. Washing soda

B. Hypo solution

C. Potash alum

D. $K_3Fe(CN)_6$

Answer:

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129. According to Lewis concept, ligands are

A. Acidic in nature

B. basic in nature

C. Neither acidic nor basic

D. Amphoteric in nature

Answer:

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130. Which of the following ligand is hexadentate?

A. EDTA

B. Pyridine

C. Acetate

D. Ethylenediamine

Answer:

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131. Ligand in complex salt are

A. cations joined to metal ion by coordination bond

B. anions joined to metal ion by coordination bond

C. molecules joined to metal ion by coordination bond

D. ions or molecules joined to metal ion by coordination bond

Answer:

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132. An ambidentate ligands is the one which

A. is a small molecule with positive charge

B. large molecule with positive charge

C. has two donor atoms capable of forming two

D. has two donor atoms, but only one can form a coordinate bond

Answer:

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

A. Pottassium Tri Oxalatoiridium (III)

B. Potassium Tri Oxalatoiridate (III)

C. Pottasium Tris (oxalato) tridium (IV)

D. Potassium Terakis (oxalato) iridate

Answer:

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134. Correct IUPAC name of $K_4\left[Fe(CN)_6\right]$

A. Tetra potassium ferrous cyanide

B. Potassium Ferricyanide

C. Potassium Ferrocyanide

D. Potassium hexacyanoferrate (II)

Answer:

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135. The name of the complex $\left[Pt(NH_3)_2C1_4\right]$ is

A. Platinum diammine tetrachloride

B. Platinum tetrachlorodiammine

C. Tetra chloro diammine platinum (IV)

D. Diammine tetrachloro platinum (IV)

Answer:

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136. The correct formula of the complex potassium tri oxalato aluminate (III) is

A. $K_3[A1_3(C_2O_4)]$

B. $K_3\left[A1(C_2O_4)_3\right]$

C. $K\left[(C_2O_4)_3A1_2O_3\right]$

D. $K_3\left[A1_2O_3(C_2O_2)_3\right]$

Answer:

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137. $Na_2[ZnC1_4]$ is named as _____ in IUPAC system.

A. Tetrachloro zincate sodium

B. Sodium Tetrachloro zincate (III)

C. Sodium Tetrachloro zincate (II)

D. Tetra chloro zincate sodium (II)

Answer:

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138. Potassium ferrocyanide is an example for

A. Complex salts

B. Normal salts

C. Double salts

D. Basic salts

Answer:

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139. Example for a coordination compound is

A. $KC1.\ MgC1_2.\ 6H_2O$

B. $K_2SO_4.\ A1_2(SO_4)_3.\ 24H_2O$

C. $CoC1_3.\ 6NH_3$

D. $FeSO_4.(NH_4)_2.6H_2O$

Answer:

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140. What is a double salt? Explain with an example.

A. Carnallite

B. Potassium ferrocyanide

C. Potassium ferricyanide

D. Nessler's reagent

Answer:

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141. Which answers are the tests of the constituent ions?

A. Mohr's salt

B. Nessler's reagent

C. Lithium aluminium hydride

D. Prussian blue coloured complex

Answer:

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142. In which of the following transition metal complexes does the metal exhibit zero oxidation state?

A. $\left[Co(NH_3)_6\right]C1_3$

B. $Fe(H_2O)_6\right]SO_4$

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

D. $Fe(H_2O)_6\rceil C1_3$

Answer:

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143. The number of moles of ions produced when one mole of Potassium Ferricyanide is dissolved in water is

A. 2

B. 4

C. 5

D. 6

Answer:

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144. Total number of moles of ions that can be obtained from each mole of $\left[Co(NH_3)_4C1_2\right]$ is

A. 2

B. 3

C. 0

D. 5

Answer:

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145. The following does not give a precipitate either with $AgNO_3$ and $BaC1_2$

A. $\left[Co(NH_3)_5C1\right]SO_4$

B. $\left[Co(NH_3)_3C1_3\right]$

C. $\left[Co(NH_3)_4C1_2\right]C1$

D. $\left[Co(NH_3)_2C1_4\right]C1$

Answer:

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146. Ethylene diamine is an example of a _____ ligand.

A. Monodentate

B. Bidentate

C. Tridentate

D. Hexadentate

Answer:

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147. Which of the following is cationic complex?

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

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

C. $\left[Co(NH_3)_3C1_3\right]$

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

Answer:

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148. The no.of moles of AgC1 obtained when excess $AgNO_3$ is added to one mole of $Cr(NH_3)_4C1_2\rceil C1$

A. 1

B. 2

C. 3

D. 4

Answer:

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149. Aqueous solution of $\left[Co(H_2O)_5SO_4\right]C1$ gives precipitate with

A. $BaC1_{2\,(aq)}$

B. $AgNO_{3\,(aq)}$

C. both 1 and 2

D. neither 1 or 2

Answer:

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150. According to Werner's theory of valency transition metals possesses

A. only one type of valency

B. two types of valencies

C. three types of valencies

D. four types of valencies

Answer:

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151. A bidentate ligand is

A. Oxalate ion

B. Carbon monoxide

C. Nitronium ion

D. Water

Answer:

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152. The groups satisfying the secondary valencies of a cation in a complex are called

A. Radicals

B. Electrondeficient Molecules

C. Primary valencies

D. Ligands

Answer:

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153. IUPAC name of the complex $CoC1_35NH_3$ is

A. Cobalt trichloride penta ammonium

B. Penta amine carbonyl chloride

C. Trichloro penta amino cobalt

D. Pentamine chloro cobalt (III0 Chloride

Answer:

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154. Copper sulphate solution forms blue coloured complex with excess of ammonia. Its formula is

A. $\left[Cu(NH_3)_4\right]^{+3}$

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

C. $\left[Cu(NH_4)_3\right]^{+2}$

D. $\left[Cu(NH_4)_3\right]^{+3}$

Answer:

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155. Which one of the following acts as a Lewis base in complexes?

A. $A1C1_3$

B. BF_3

C. NH_3

D. $BC1_3$

Answer:

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156. The square of $[CoF_6]^{-3}$ is

A. Square Planar

B. Trigonal bipyramidal

C. Octahedral

D. Tetrahedral

Answer:

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157. sp^3d^2 hybridisation is present in

A. $[CoF_6]^{-3}$

B. $[Ni(CO)_4]$

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

D. All

Answer:

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158. Which of the following does not obey octet rule ?

A. $Fe(CO)_5$

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

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

D. $\left[Co(NH_3)_6\right]C1_3$

Answer:

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

A. 34

B. 36

C. 37

D. 35

Answer:

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160. Mark the vitamin present in Rhodopsin

A. Co^{3+}

B. Co^{2+}

C. Fe^{2+}

D. Fe^{3+}

Answer:

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

A. 6

B. 4

C. 8

D. 10

Answer:

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162. Which of the following cannot show linkage isomerism?

A. NO_2^-

B. SCN^-

C. CN^-

D. NH_3

Answer:

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163. An example of double salt is

A. Cuprammonium sulphate

B. Mohr's salt

C. Pottassium ferricyanide

D. Cobalthexamine chloride

Answer:

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

A. Potassium alumino Oxalate

B. Potassium trioxalation aluminate (iii)

C. Potassium aluminium (III) oxalate

D. Potassium tri(oxalato) aluminate (III)

Answer:

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165. The shape of the complex $(NiC1_4)^{-2}$ is

A. Octahedral

B. Square Planar

C. Tetraheoral

D. Planer

Answer:

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166. Name the linkage of $\left[CO(NH_3)_5NO_2\right]^{2+}$

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167. How are complexes classified on the basis of types of ligands.

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168. Write the representation of (iii) Pottassium hexa cyanoferrate (II).

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169. What is EAN rule? Explain with an example.

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170. Draw geometric isomers and enatiomers of the following complexes. (i) $\left[Pt(en)_3\right]^{+4}$

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171. Draw geometric isomers and enatiomers of the following complexes. (ii) $\left[Pt(en)_2C1Br\right]^{+2}$

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172. Explain the structures of the complexes with box orbital diagram and orbital hybridisation.$(CoF6)^{3-}$ high spin

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173. Write applications of coordination compounds in medicine & electroplating.

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174. What are the limitation of VBT.

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175. With the help of crystal field energy level diagram explain why the complex $\left[Cr(en)_3\right]^{3\oplus}$ is coloured?

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176. Name the factors governing the equilibrium constants of the coordination compounds. State the factors affecting stability of complexes.

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177. Explain the term crystal field splitting parameter. What are the factors that affect it.

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178. Give valence bond description for the bonding in the complex $[VC1_4]^{-1}$. Draw box diagrams for free metal ion. Which hybrid orbitals are used by the metal? State the number of unpaired electrons.

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179. Draw qualitatively energy-level diagram showing d-orbital splitting in the octahedral environment. Predict the number of unpaired electrons in the complex $\left[Fe(CN)_6\right]^{4-}$. Is the

complex diamagnetic or paramagnetic? Is it coloured? Explain.

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