CHEMISTRY

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COORDINATION COMPOUNDS

Example

1. The primary valency of iron In $K_4[Fe(CN)_6]$ is.

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2. Both geometrical and optical isomerisms are exhibited by.

A. pentaaminechlorocobalt (III) Ion

B. tetraamlnedlchlorocobalt (III) Ion

C. Dlaaminedlchlorocobalt (III) Ion

D. dichlorobiscobalt (III) Ion

Answer:

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3. What Is the colour of $CoCI_{3.5}NH_3.\ H_2O$?

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4. How many chloride Ions are produced In the aqueous solution by tetraamminechloroplatinum (IV)chloride.?

A. 3

B. 2

C. 4

D. 1

Answer:

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5. The charge on the central metal Ion In $[Ni(CO)_4]$ Is

A. $+1$

B. $+2$

C. 0

D. $+4$

Answer:

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6. Choose the correctly matched pair.

A. $\left[Ni(CO)_4\right] : sp^3$

B. $\left[Ni(CN)_4\right]^2 - \ : sp^3$

C. $[COF_5]^{3-} : d_2sp^3$

D.

Answer:

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7. Which is an example of ambidendate ligand?

A. chloro

B. aquo

C. ammlne

D. thiocyanato

Answer:

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8. What Is the colour of $CoCI_{3.5}NH_3.\ H_2O$?

A. violet

B. pink

C. red

D. green

Answer:

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9. " The cordination compound $[Co(en)_2Cl_2]$ Cl exhibits IoNisation Isomerism:State whether this statement is true or false?

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10. In $K_4[Fe(CN)_6]$ central metal Ion is .....

A. Fe^{2+}

B. Fe^{3+}

C. CN^-

D. CN^{2-}

Answer:

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11. Which one of the following complexes is not dlamagnet?

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

B. $[Ti(H_2O_6)]^{3+}$

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

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

Answer:

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12. The charge on the central metal Ion In $\left[Ni(CO)_4\right]$ Is

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13. Both geometrical and optical isomerisms are exhibited by.

A. dichlorobls (ethylenadiammlne) cobalt (III) Ion

B. pentaammlnechloro cobalt (III) Ion

C. triammlnotrichloro cobalt (III)

D. tetraammlne dlchloro cobalt (ill) Ion

Answer:

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14. NO_2^- Is an _____ ligand.

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15. If solvent Insolvate Isomerism Is water, it is called_____.

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16. _____ is an inorganic metal complex In which there Is a close ring of atoms caused by attachment of a ligand to a metal atom at two points.

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17. A metal Ion and the ligands Immediately attached to it Is called _____ entity.

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18. When two salts In equimolar ratio are crystalised together from their saturated solution they are called _____.

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19. Observe the relationship between the first two terms and fill in the blanks. $UNidentateLig$ and $s: NH_3$ Didentate ligands : _____.

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20. Name the optical isomers are those which are not superimposable on their mirror images.

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21. A coordination compound has the formula $COCI_{3.4}NH_3$. It does not liberate AmmoNia but precipitates chloride Ions as silver chloride. Give the IUPAC name of complex.

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22. Give the IUPAC names of the following compounds:- $\left[Pt(NH_3)_2Cl^2\right]$

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23. Give the IUPAC names of the following compounds:- $K_4\left[Fe(CN)_6\right]$.

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24. Stereo Isomerism Is observed in the complex, $\left[Cr(en)_2Cl_2\right]^+$ Give the structures of ail possible stereoisomers.

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25. The following are two coordination compound: I. $\left[Co(NH_3)_6\right]CI_3$ II. $Na_3\left[Cr(CN)_6\right]$ Read the following statements and identify the wrong ones:- The IUPAC names of both end in 'ate'.

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26. The following are two coordination compound: I. $\left[Co(NH_3)_6\right]CI_3$ II. $Na_3\left[Cr(CN)_6\right]$ Read the following statements and identify the wrong ones:- Secondary valency of both Is equal to 3.

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27. The following are two coordination compound: I. $\left[Co(NH_3)_6\right]CI_3$ II.

$Na_3[Cr(CN)_6]$ Read the following statements and identify the wrong ones:- Both can show optical Isomerism.

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28. The following are two coordination compound: I. $[Co(NH_3)_6]CI_3$ II. $Na_3[Cr(CN)_6]$ Read the following statements and identify the wrong ones:- Oxidation no. of central metal In both is +3.

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29. The coordination compound $CoCl_3.5NH_3$ dissolves in water to give two chloride Ions per uNit formula. Designate the coordination entity In the coordnation compound.

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30. Cisplatin Is used for the treatment of cancer. What is Cisplatin?

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31. Give the IUPAC names and Draw the structures of the following:- $Ni(CO)_4$.

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32. Give the IUPAC names and Draw the structures of the following:- $Fe(CO)_6$

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33. Draw the figure to show the splitting of d-orbitals in an octahedral crystal field.

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34. Construct two complex ions using Fe as the central metal ion and CN as the ligands, such that one Is paramagnetic and the other Is diamagnetic. Give their IUPAC name.

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35. Consider the coordination compound $[Co(NH_3)_5Cl]Cl_2$ what is the primary valence and secondary valence of the central metal ion in the above co ordination compound.

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36. IUPAC name of the co-ordination compound $[CO(NH_3)_5CI]CI_2$ is pentamminechlorido cobalt (III) choloride:-

Write the name of isomerism exhibited by the complex $[Pt(NH_3)_2(Cl_4]$.

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37. With the help of valence bond theory answer the following questions related to the complexes.

$[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$ and $[CoF_6p]^{3-}$

:- Which among these form outer orbital complex ?

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38. With the help of valence bond theory answer the following questions related to the complexes.

$[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$ and $[CoF_6p]^{3-}$

:- Predict the magnetic properties.

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39. With the help of valence bond theory answer the following questions related to the complexes.

$[Fe(CN)_6]^{4-}$, $[Fe(CN)_6]^{3-}$ and $[CoF_6p]^{3-}$

:- Predict the hybridisation state of central metal Ions.

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40. Listen the following conversation. Student A: $[Ni(CO)_4]$ Is diamagnetic since it undergoes sp^3 hybridisation. Student B: $[Ni(Cl)_4]^{2-}$ is also diamagnetic as it also undergoes sp^3 hybridisation. Do you agree

with the above conversation? Justify your answer.

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41. Give the IUPAC name of the coordination compound. $[Cr(NH_3)_3(H_2O)_3]Cl_3$

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42. Identify the type of isomerism exhibited by $[Co(NH_3)_4CI_2]^+$.Draw the possible isomeric

structure.

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43. some chemical species are given below.

$NH_3, K^+, Co, Co^{3+}, H_2O, CI, CO, SO_4^{2-}$

By using the above species, form a cationic coordination complex.

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44. some chemical species are given below.

$NH_3, K^+, Co, Co^{3+}, H_2O, CI, CO, SO_4^{2-}$

By using the above species, form:- An aNioNic complex.

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45. some chemical species are given below.

$NH_3, K^+, Co, Co^{3+}, H_2O, CI, CO, SO_4^{2-}$

By using the above species, form:- A neutral complex.

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46. A list of coordination compounds are given below. 'PtCl_2(NH_3)_2', Which type of isomerism, do these compòunds exhibit?

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47. A and B are two Isomeric coordination compounds with molecular formula $CoCI_3.6H_2O$. A gives 2 moles of AgCI and B

gives 3 moles of AgCI with $AgNO_3$ solution:-

Write the structural formula of A and B.

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48. A and B are two Isomeric coordination compounds with molecular formula $CoCI_3.6H_2O$. A gives 2 moles of AgCI and B gives 3 moles of AgCI with $AgNO_3$ solution:-

Give the IUPAC names of A and B.

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49. A and B are two Isomeric coordination compounds with molecular formula $CoCI_3.6H_2O$. A gives 2 moles of AgCI and B gives 3 moles of AgCI with $AgNO_3$ solution:- What type of isomers are A and B ?

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50. Tetrahedral complexés, do' nọt show geometrical isomerism. Why?

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51. Write the IUPAC name of the complex $K_3\left(Cr(C_2O_4)_3\right]$ .Draw the figure to show the splitting of 'd' orbitals in octahedral crystal field.

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52. Draw the figure to show the splitting of d-orbitals in an octahedral crystal field.

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53. $\left[Fe(H_2O)_6\right]^{3+}$ is strongly paramagnetic whereas $\left\{Fe(CN)_6\right]^{3-}$ is weakly paramagnetic Expain?

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54. Illustrate with examples the following terms:-Ambidentate ligand.

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55. Illustrate with examples the following terms:- Chelate ligand.

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56. A list of coordination compounds are given: I. $K_4[Fe(CN)_6]$ II. $K_2[Pt(CN)_6]$ III. $[Ni(CO)_4]$:- Designate the coordination entities and counter ions in the compounds.

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57. A list of coordination compounds are given: I. $K_4[Fe(CN)_6]$ II. $K_2[Pt(CN)_6]$ III. $[Ni(CO)_4]$:- Give the oxidation number and coordination number of central metal atom in each compound.

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58. Werner's coordination theory is usefulfor explaiNing the formation of coordination compound. Give the main postulates of Werner's theory.

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59. Illustrate the following with examples:- Homoleptic and heteroieptic complexes.

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60. Illustrate the following with examples:- Double salt and coordination compound.

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61. Suggest the shape of the complexes $Ni(CO)_4$ and $[CoF_6]^{3-}$

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62. The central ion $Co^{+}3$ with coordination number 6 is bonded to the ligands NH_3 and Br to form a dipositive complex ion.Write the formula or IUPAC name of the complex.

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63. Using VBT explain the diamagnetism and square planar shape of $\left[Ni(CO)_4\right]^{2-}$.

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64. The central ion Ag^+ with coordination number 2 form a positive complex ion with NH_3 ligand.Also Ag^+ forms a negative complex ion with CN^- ligand.Write the formula of above positive and negative complex ions Give the IUPAC name of each

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65. The central ion Ag^+ with coordination number 2 form a positive complex ion with NH_3 ligand.Also Ag^+ forms a negative complex ion with CN^- ligand. Give the denticity of NH_3 and CN^- ligands.

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66. The central ion Ag^+ with coordination number 2 forms a positive complex Ion with NH_3 ligand. Also $Ag+$ foms a negative

complex with CN ligand:- Give the denticity of NH_3 and CN^- ligands:- Write the formula and name of a hexadentate ligand.

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67. When $CuSO_4$ is mixed with excess of NH_3, a deep blue coloured solution is obtained.Write the formula of the compound formed.

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68. When $CuSO_4$ is mixed with excess of NH_3, a deep blue coloured solution is obtained.What do you understand by the term coordination number

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69. Write down the ionisation isomer of $[Co(NH_3)_5Cl]SO_4$

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70. $[NiCl_4]^{2-}$ is paramagnetic while $Ni(CO)_4$ is diamagnetic though both are tetrahedral.Why?

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71. Many theories have been put forth to explain the nature of bonding in co-ordination compounds:- On the basis of valence bond theory account for the diamagnetic behaviour of $[Ni(CN)_4]^{2-}$.

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72. Many theories have been put forth to explain the nature of bonding in co-ordination compounds:- What is the geometry of the [N i (C N) 4] 2 − . complex?

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73. How many geometrical isomers are possible in the following coordination entities.

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

ii) $\left[Co(NH_3)_3Cl_3\right]$

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74. How many geometrical isomers are possible in the following coordination entities.

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

ii) $\left[Co(NH_3)_3Cl_3\right]$

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75. Discuss the nature of bonding in metal carbonyls.

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76. How many ions are produced from the complex $[Co(NH_3)_6]Cl_2$ in solution?

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77. Discuss briefly giving an example in each case the role of coordination compounds in: i) biological systems ii) analytical chiemistry iii) medicinàl chemistry iv) extraction metallurgy of metals

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78. Discuss briefly giving an example in each case the role of coordination compounds in: i) biological systems ii) analytical chiemistry iii) medicinàl chemistry iv) extraction metallurgy of metals

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79. Discuss briefly with an example in each case the role of coordination compounds:- Analytical chemistry.

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80. Discuss briefly with an example in each case the role of coordination compounds:- Extraction of metals.

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81. Aqueous copper sulphate solution(blue In colour) gives:- a green precipitate with aqueous potassium fluoride and

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82. Aqueous copper sulphate solution(blue In colour) gives:- a bright green solution with aqueous potassium chloride. Explain these experimental results.

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83. What is spectro chemical series ? Explain the difference betweena weak field ligand and a strong field ligand.

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84. A solution of $\left[Ni(H_2O)_6\right]^{2+}$ is green but a solution of $\left[Ni(CN)_4\right]^{2-}$ is colourless. Explain.

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85. Amongst the following which one.has the highest magnetic moment value? 1) (Cr(H2O)6)^3+ 2) (Fe(H2O)6)^2+ 3) (Zn(H2O))^2+

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86. Amongst the following which one.has the highest magnetic moment value? 1) (Cr(H2O)6)^3+ 2) (Fe(H2O)6)^2+ 3) (Zn(H2O))^2+

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87. Amongst the following which one.has the highest magnetic moment value? 1) (Cr(H2O)6)^3+ 2) (Fe(H2O)6)^2+ 3) (Zn(H2O))^2+

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88. What will be the correct order for the wavelengths of absorption in the visible

region for the following: '$[Ni(NO_2)_6]^{4-}$,$[Ni(NH_3)_6]^{2+}$,[Ni(H_2O)]^2+

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89. Assign the primary valence and secondary valence of the central metal in $[Ni(CO)_4]$.

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90. Cis isomer of $[Pt(NH_3)_2Cl_2]$ Is used to inhibit the growth of tumours:-Give the IUPAC

name of $\left[Pt(NH_3)_2Cl_2\right]$

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91. Cis isomer of $\left[Pt(NH_3)_2CI_2\right]$ is used to inhibit the growth of tumours.Give the structure of cis and trans isomers of $\left[Pt(NH_3)_2CI_2\right]$

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92. Identify the co-ordination compound which can exhibit linkage isomerism, among the following.

A. $\left[Pt(NH_3)_2CI_2\right]$

B. $\left[CO(NH_3)_5(S0_4)\right]Br$

C. $\left[CO(NH_3)_6(NO_2)\right]CI_2$

D. $\left[Cr(NH_3)_5\right]\left[COF_6\right]$

Answer:

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93. With the help of a diagram, give the splitting of d-orbitals of Mn^{2+} Ion in an octahedral crystal field.

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94. On the basis of crystal field theory, explain why $\left[Mn(H_2O)_6\right]^{2+}$ contains five unpaired electrons while $\left[Mn(CN)_6\right)^{4-}$ contains oNiy one unpaired electron.

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95. Explain how the complexes of Nickel. $\left[Ni(CN)_4\right]^{2-}$ and [Ni$(CO)_4$] have different structure, but do not differ In their magnetic behaviour. (Ni, Atomic No : 28).

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96. Draw the structure of geometrical Isomers of $\left[Fe(NH_3)_2(CN)_4\right]^+$:-

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97. Write the formula of pentaammine carbonatocobalt (III) chloride.

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98. Write any two limitations of valance bond theory.

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99. $[Co(NH_3)_5SO_4]CI$ and $[Co(NH_3)_5CI]SO_4$ are co-ordination compounds:- Identify the isomerism shown by the above compounds.

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100. $[Co(NH_3)_5SO_4]Cl$ and $[Co(NH_3)_5Cl]SO_4$ are coordination compounds.Write the IUPAC names of the above compounds.

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101. $[Co(NH_3)_5SO_4]Cl$ and $[Co(NH_3)_5Cl]SO_4$ are coordination compounds.Identify the ligands in each of the above compounds.

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102. Write down the ionisation isomer of $[Co(NH_3)_5Cl]SO_4$

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103. $[NiCl_4]^{2-}$ is paramagnetic while $Ni(CO)_4$ is diamagnetic though both are tetrahedral.Why?

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104. Coordination compounds contains central metal ion and ligands:- Primary valency of central metal in $[Co(NH_3)_6]CI_3$ is.

A. 3

B. 6

C. 4

D. 9

Answer:

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105. Coordination compounds contains central metal and ligands:- What are the postulates of Werner's theory?

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106. Coordination compounds contains central metal ions and ligands:- Write the IUPAC names of $K_3[Fe(CN)_6]$, $[Co(NH_3)_6]CI_3$.

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107. $[Co(NH_3)_5SO_4]Cl$ is an octahedral coordination compound Write the IUPAC name of the compound

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108. $[Co(NH_3)_5SO_4]Cl$ is an octahedral coordination compound write the formula of the ionisation isomer of the above compound

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109. Draw the figure to show the splitting of d-orbitals in an octahedral crystal field.

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110. Draw the diagram which indicate through splitting of d orbits in tetrahedral field.

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111. Write the Werner's formula for the following coordination compounds:- Tetraamminediaqua cobalt (III) chloride.

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112. Write the formula of the following coordination compound Tris(ethane-1,2-diamine)chromium(III)chloride

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113. How many ions are produced from the complex $\left[Co(NH_3)_6\right]Cl_2$ in solution?

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114. The primary valency of iron In $K_4[Fe(CN)_6]$ is.

A. 1

B. 2

C. 3

D. 4

Answer:

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115. What is spectrochemlcal series? Give one example each for strong field and weak field ligand.

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116. The magnetic behaviour of a complex can be expained on the basis of VB theory $[CO(NH_3)_6)]^{3+}$ is a diamagnetic complex and $[CoF_6]^3-$ is a paramagnetic complex.Substantiate the above statement using VB theory.

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117. Consider the coordination compound $[Co(NH_3)_5SO_4]Br$.Write the IUPAC name of the above coordination compound.

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118. Consider the coordination compound $[Co(NH_3)_5SO_4]Br$.What is the primary valance and secondary valance of the central

metal cobalt in the above coordination compound?

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119. Consider the coordination compound $[Co(NH_3)_5SO_4]Br$.Which type of structural isomerisms is exhibited by the above coordination compound?

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120. Consider the coordination compound $[Cr(NH_3)_5CO_3]Cl$.Name the central metal ion of the above compound.

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121. $[Cr(NH_3)_5Co_3]CI$ is a coordination compound:- What is Its IUPAC name?

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122. $[Cr(NH_3)_5Co_3]CI$ is a coordination compound:- Are the ligands present in the above compound ambidentate ligands? Why?

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123. $[Cr(NH_3)_5CO_3]CI$ is a coordination compound:- Write the ioNisation isomer of the above mentioned coordination compound.

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124. The octahedral complex $\left[Co(NH_3)_6\right]^{3+}$ is diamagnetic while the octahedral complex $[CoF_6]^{3-}$ is paramagnetic. Explain using VB theory.

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125. Name the central metal ion present in haemoglobin.

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126. Which type pf isomerism is shown by $[Co(NH_3)_5ONO]^{2-}$ and $[CO(NH_3)_5NO_2]^{2}+$?

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127. Why is CO a stronger ligand than Cl ?

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128. Name the metal present in:- Chlorophyll.

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129. Name the metal present in:- Vitamine B_{12}.

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130. What is a ligand? Give an example of a bidentate ligand.

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131. Consider the coordination compound $[Cr(NH_3)_5CO_3]Cl$.Name the central metal ion of the above compound.

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132. Consider the coordination compound $[Cr(NH_3)_5CO_3]Cl$.Write the IUPAC name of the above coordination compound.

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133. $[Cr(NH_3)_5CO_3]CI$ is a coordination compound:- Name the ligand present in the above compound.

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134. Lanthanoid contraction is a term often associated with the chemistry of transition and inner transition element. Explain the term Lanthanoid constractions. How does it affect the chemistry of Lanthanoid and that of Zr, Hf element.

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