CHEMISTRY

BOOKS - U-LIKE CHEMISTRY (HINGLISH)

COORDINATION COMPOUNDS

Ncert Intext Questions

1. Write the formulas for the following coordination compounds :

Tetraamminediaquacobalt(III) chloride

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2. Write the formulas for the following coordination compounds :

Potassium tetracyanonickelate(II)

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3. Write the formulas for the following coordination compounds :

Tris(ethane-1, 2-diamine)chromium(III) chloride

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4. Write the formulas for the following coordination compounds :

Amminebromidochloridonitrito-N-platinate(II)

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5. Write the formulas for the following coordination compounds :

Dichloridobis(ethane-1, 2-diamine)platinum(IV) nitrate

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6. Write the formulas for the following coordination compounds :

Iron (III) hexacyanoferrate(II)

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7. Write the IUPAC names of the following coordination compounds :

$[Co(NH_3)_6]Cl_3$

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8. Write the IUPAC names of the following coordination compounds :

$[Co(NH_3)_5Cl]Cl_2$

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9. Write the IUPAC names of the following coordination compounds :

$K_3[Fe(CN)_6]$

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10. Write the IUPAC names of the following coordination compounds :

$K_3\left[Fe(C_2O_4)_3\right]$

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11. Write the IUPAC names of the following coordination compounds :

$K_2[PdCl_4]$

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12. Write the IUPAC names of the following coordination compounds :

$\left[Pt(NH_3)_2Cl(NH_2CH_3)\right]Cl$

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13. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :

$K\left[Cr(H_2O)_2(C_2O_4)_2\right]$

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14. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :

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

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15. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :

$\left[Co(NH_3)_5(NO_2)\right](NO_3)_2$

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16. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :

$[Pt(NH_3)(H_2O)Cl_2]$

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17. Give evidence that $\left[Co(NH_3)_5Cl\right]SO_4$ and $\left[Co(NH_3)_5SO_4\right]Cl$ are ionisation isomers.

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18. Explain on the basis of valence bond theory that $\left[Ni(CN)_4\right]^{2-}$ ion with square planar structure is diamagnetic and the $\left[NiCl_4\right]^{2-}$ ion with tetrahedral geometry is paramagnetic.

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

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20. $[Fe(H_2O)_6]^{3+}$ is strongly paramagnetic whereas $[Fe(CN)_6]^{3-}$ is weakly paramagnetic. Explain.

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21. Explain $[Co(NH_3)_6]^{3+}$ is an inner orbital complex whereas $[Ni(NH_3)_6]^{2+}$ is an outer orbital complex.

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22. Predict the number of unpaired electrons in the square planar $[Pt(CN)_4]^{2-}$ ion.

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23. The hexaaquo manganese (II) ion contains five unpaired electrons while the hexacyanoion contains only one unpaired electron. Explain using Crystal Field Theory.

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24. Calculate the overall complex dissociation equilibrium constant for the $Cu(NH_3)_4^{2+}$ ion, given that β_4 for this complex is 2.1×10^{13}.

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Ncert Textbook Exercises

1. $FeSO_4$ solution mixed with $(NH_4)_2SO_4$ solution in 1 : 1 molar ratio gives the test of Fe^{2+} ion but $CuSO_4$ solution mixed with aqueous

ammonia in 1 : 4 molar ratio does not give the test of Cu^{2+} ion. Explain, why ?

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2. What is meant by unidentate, didentate and ambidentate ligands ? Give two examples for each.

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3. Specify the oxidation numbers of the metals in the following coordination entities :

$\left[Co(H_2O)(CN)(en)_2\right]^{2+}$

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4. Specify the oxidation numbers of the metals in the following coordination entities :

$[PtCl_4]^{2-}$

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5. Specify the oxidation numbers of the metals in the following coordination entities :

$[Cr(NH_3)_3Cl_3]$

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6. Specify the oxidation numbers of the metals in the following coordination entities :

$[CoBr_2(en)_2]^+$

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7. Specify the oxidation numbers of the metals in the following coordination entities :

$K_3[Fe(CN)_6]$

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8. Using IUPAC norms write the formulas for the following:

Tetrahydroxozincate(II)

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9. Using IUPAC norms write the formulas for the following:

Potassium tetrachloridopalladate(II)

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10. Using IUPAC norms write the formulas for the following:

Diamminedichloridoplatinum(II)

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11. Using IUPAC norms write the formulas for the following:

Potassium tetracyanonickelate(II)

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12. Using IUPAC norms write the formulas for the following:

Pentaamminenitrito-O-cobalt(III)

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13. Using IUPAC norms write the formulas for the following:

Hexaamminecobalt(III) sulphate

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14. Using IUPAC norms write the formulas for the following:

Potassium trioxalatochromate(III)

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15. Using IUPAC norms write the formulas for the following:

Hexaammineplatinum(IV)

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16. Using IUPAC norms write the formulas for the following:

Tetrabromidocuprate(II)

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17. Using IUPAC norms write the formulas for the following:

Pentaamminenitrito-N-cobalt(III)

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18. Using IUPAC norms, write the systematic names of the following:

$[Co(NH_3)_6]Cl_3$

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19. Using IUPAC norms, write the systematic names of the following:

$[Pt(NH_3)_2Cl(NH_2CH_3)]Cl$

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20. Using IUPAC norms, write the systematic names of the following:

$[Ti(H_2O)_6]^{3+}$

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21. Using IUPAC norms, write the systematic names of the following:

$[Co(NH_3)_4Cl(NO_2)]Cl$

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22. Using IUPAC norms, write the systematic names of the following:

$[Mn(H_2O)_6]^{2+}$

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23. Using IUPAC norms, write the systematic names of the following:

$[NiCl_4]^{2-}$

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24. Using IUPAC norms, write the systematic names of the following:

$[Ni(NH_3)_6]Cl_2$

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25. Using IUPAC norms, write the systematic names of the following:

$[Co(en)_3]^{3+}$

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26. Using IUPAC norms, write the systematic names of the following:

$[Ni(CO)_4]$

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

$[Cr(C_2O_4)_3]^{3-}$

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

$[Co(NH_3)_3Cl_3]$

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29. Draw the structures of optical isomers of :

$[Cr(C_2O_4)_3]^{3-}$

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30. Draw the structures of optical isomers of :

$[PtCl_2(en)_2]^{2+}$

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31. Draw the structures of optical isomers of :

$[Cr(NH_3)_2Cl_2(en)]^+$,

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32. Draw all the isomers (geometrical and optical) of :

$[CoCl_2(en)_2]^+$

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33. Draw all the isomers (geometrical and optical) of :

$[Co(NH_3)Cl(en)_2]^{2+}$

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34. Draw all the isomers (geometrical and optical) of :

$[Co(NH_3)_2Cl_2(en)]^+$

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35. Write all the geometrical isomers of $[Pt(NH_3)(Br)(Cl)(py)]$ and how many of these will exhibit optical isomers ?

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36. Aqueous copper sulphate solution (blue in colour) gives :

(i) a green precipitate with aqueous potassium fluoride and

(ii) a bright green solution with aqueous potassium chloride.

Explain these experimental results.

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37. What is the coordination entity formed when excess of aqueous KCN is added to an aqueous solution of copper sulphate ? Why is it

that no precipitate of copper sulphide is obtained when H_2S (g) is passed through this solution ?

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38. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :

$Fe(CN)_6]^{4-}$

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39. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :

$[FeF_6]^{3-}$

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40. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :

$[Co(C_2O_4)_3)]^{3-}$

View Text Solution

41. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :

$[CoF_6]^{3-}$

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42. What is spectrochemical series ? Explain the difference between a weak field ligand and a strong field ligand.

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43. What is crystal field splitting energy ? How does the magnitude of Δ_0 decide the actual configuration of d-orbitals in a coordination entity ?

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44. $[Cr(NH_3)_6]^{3+}$ is paramagnetic while $[Ni(CN)_4]^{2-}$ is diamagnetic. Explain, why ?

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

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46. $\left[Fe(CN)_6\right]^{4-}$ and $\left[Fe(H_2O)_6\right]^{2+}$ are of different colours in dilute solutions. Why ?

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47. Give the oxidation state, d-orbital occupation and coordination number of the central metal ion in the following complexes:

i) $K_3\left[Co(C_2O_4)_3\right]$ (ii) $(NH_4)_2[CoF_4]$

(iii) cis-$\left[Cr(en)_2Cl_2\right]Cl$ (iv) $\left[Mn(H_2O)_6\right]SO_4$

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48. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :

$K\left[Cr(H_2O)_2(C_2O_4)_2\right].3H_2O$

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49. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :

$CrCl_3(py)_3$

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50. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :

$[Co(NH_3)_5Cl]Cl_2$

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51. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :

$[Cs[FeCl_4]$

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52. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :

$K_4\left[Mn(CN)_6\right]$

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53. What is meant by the chelate effect ? Give an example.

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54. How many ions are produced from the complex $Co(NH_3)_6Cl_2$ in solution ?

A. 6

B. 4

C. 3

D. 2

Answer:

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55. Amongst the following ions, which one has the highest magnetic moment value ?

(i) $\left[Cr(H_2O)_6\right]^{3+}$ (ii) $\left[Fe(H_2O)_6\right]^{2+}$

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

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

A. $+1$

B. $+3$

C. -1

D. -3

Answer:

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57. Amongst the following, the most stable complex is :

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

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

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

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

Answer:

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58. What will be the correct order for the wavelengths of absorption in the visible region for the following:

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

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Case Based Source Based Integrated Question

1. The ions or molecules bound to the central atom/ion in the coordination entity are called ligands. These may be simple ions such as Cl^-, small molecules such as H_2O or NH_3, larger molecules such

as $H_2NCH_2CH_2NH_2$ or $N(CH_2CH_2NH_2)_3$ or even macromolecules, such as proteins.

When a ligand is bound to a metal ion through a single donor atom, as with Cl^-, H_2O or NH_3, the ligand is said to be unidentate. When a ligand can bind through two donor atoms as in $H_2NCH_2CH_2NH_2$ (ethane-1, 2-diamine) or $C_2O_4^{2-}$ (oxalate), the ligand is said to be didentate and when several donor atoms are present in single ligand as in $N(CH_2CH_2NH_2\_(3)$, the ligand is said to be polydentate Ethylenediamineteraacetate ion $[EDTA^{4-}]$ is an important hexadentate ligand. It can bind through two nitrogen and four oxygen atoms to a central metal ion.

What is meant by the term ligand ?

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Write the formula of ethylenediamine.

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What is meant by didentate ligand ? Give an example other than ethane-1,2-diamine.

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4. The ions or molecules bound to the central atom/ion in the coordination entity are called ligands. These may be simple ions such

as Cl^-, small molecules such as H_2O or NH_3, larger molecules such as $H_2NCH_2CH_2NH_2$ or $N(CH_2CH_2NH_2)_3$ or even macromolecules, such as proteins.

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What type of ligands are H_2O and NH_3 ?

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as Cl^-, small molecules such as H_2O or NH_3, larger molecules such as $H_2NCH_2CH_2NH_2$ or $N(CH_2CH_2NH_2)_3$ or even macromolecules, such as proteins.

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How many nitrogen atoms and oxygen atoms in ethylenediaminetetraacetate are bonded to the metal in the complex compounds ?

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6. The colour in the coordination compounds can be readily explained in terms of crystal field theory. Consider, for example, the complex $\left[Ti(H_2O)_6\right]^{3+}$, which is violet in colour. This is an octahedral complex where the single electron [Ti^{3+} is a $3d^1$ system] in the metal d-orbital is in the t_{2g} level in the ground state of the complex. The next higher state available for the electron is the empty e_g level. If light corresponding to the energy of blue-green region is absorbed by the complex, it would excite the electron from t_{2g} level to the e_g level $\left(t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1\right)$. Consequently, the complex appears violet in colour. The crystal field theory attributes the colour of the coordination compounds to d-d transition of the electron.

It is important to note that in the absence of ligand, crystal field splitting does not occur and hence the substance in colourless. For example, removal of water from $\left[Ti(H_2O)_6\right]Cl_3$ on heating renders it colourless. Similarly, anhydrous $CuSO_4$ is white, but $CuSO_4.5H_2O$ is blue in colour.

Which theory explains the colour of coordination compounds ?

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Show diagrammatically the excitation of electron in the coordination compound $\left[Ti(H_2O)_6\right]^{3+}$.

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Why is anhydrous $CuSO_4$ white but $CuSO_4$ dissolved in water gives a blue solution ?

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9. The colour in the coordination compounds can be readily explained in terms of crystal field theory. Consider, for example, the complex $[Ti(H_2O)_6]^{3+}$, which is violet in colour. This is an octahedral complex where the single electron [Ti^{3+} is a $3d^1$ system] in the metal d-orbital is in the t_{2g} level in the ground state of the complex. The next higher state available for the electron is the empty e_g level. If light corresponding to the energy of blue-green region is absorbed by the complex, it would excite the electron from t_{2g} level to the e_g level $\left(t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1\right)$. Consequently, the complex appears violet in colour. The crystal field theory attributes the colour of the coordination

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Out of the t_{2g} and e_g d-orbitals, which has a higher energy?

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What will happen to $\left[Ti(H_2O)_6\right]Cl_3$ on heating ?

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11. There is a growing interest in the use of chelate therapy in medicinal chemistry. An example is the treatment of problems caused by the presence of metals in toxic proportions in plants/animals. Thus, excess of copper and iron are removed by chelating ligands D-penicillarnine and desferrioxime.

B via the formation of coordination compounds. EDTA is used in the

treatment of lead poisioning. Some coordination compounds of platinum effectively inhibit the growth of tumours. Examples are cis-platin and related compounds. Coordination compounds are of great importance in biological systems. The pigment responsible for photosynthesis, chlorophyll, is a coordination compound of magnesium. Haemoglobin, the red pigment of blood which acts as oxygen carrier is a coordination compound of iron. Vitamin B_{12}, cyanocobalam.ine, the antipernicious anaemia factor is a coordination compound of cobalt.

How do we remove excess of copper and iron using chelating ligands ?

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A person has accidently consumed a material containing lead. How can we treat the person using a chelating compound ?

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Name the coordination compound that can be used to cure tumours.

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A compound of magnesium is vital for an important process in sunlight. Name the process and the compound.

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Name the coordination compound that has a role to play as oxygen carrier.

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Multiple Choice Questions

1. Conductivity of a solution of $\left[CoBr(NH_3)_5\right]Cl_2$ corresponds to

A. 2 : 1 electrolyte.

B. 1 : 2 electrolyte.

C. 1 : 3 electrolyte.

D. 2 : 3 electrolyte.

Answer: B

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2. $FeCl_3$ and $CoCl_2$ have primary valencies of

A. 2 and 2

B. 2 and 1

C. 3 and 2

D. 2 and 3

Answer: C

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3. Which of the following is a coordination compound ?

A. Alum

B. Iron pyrite

C. Zinc blende

D. Vitamin B_{12}

Answer: D

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4. Which of the following is not a unidentate ligand ?

A. NH_3

B. H_2O

C. Cl^-

D. $NH_{2CH_2CH_2NH_2}$

Answer: D

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5. Choose the incorrect option regarding VB theory of coordination compounds :

A. It does not give quantitative interpretation of magnetic data.

B. It distinguishes between weak and strong ligands.

C. It does not explain the colour exhibited by coordination compounds.

D. It does not explain stabilities of coordination compounds.

Answer: B

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

A. 6

B. 5

C. 4

D. 3

Answer: A

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7. Primary and secondary valences in coordination compounds are respectively

A. both ionisable.

B. both non-ionisable.

C. both non-ionisable.

D. ionisable, non-ionisable.

Answer: D

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8. The following spin and hybridisation characteristics are applicable to $[CoF_6]^{3-}$

A. high spin, sp^3d^2

B. low spin, sp^3d^2

C. high spin, d^2sp^3

D. low spin, d^2sp^3

Answer: A

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9. The shape of $[PtCl_4]^{2-}$ is

A. tetrahedral

B. square planar

C. linear

D. triangular bipyramidal

Answer: B

View Text Solution

10. $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ present an example of

A. linkage isomerism

B. ionisation isomerism

C. coordination isomerism

D. solvate isomerism

Answer: C

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11. The complex $[Fe(H_2O)_5NO]^{2+}$ is formed in the brown ring test for nitrates when freshly prepared $FeSO_4$ solution is added to aqueous solution of NO_3 followed by addition of cone. H_2SO_4. Select correct statement about this complex.

A. Colour change due to charge transfer.

B. It has iron in +1 oxidation state and nitrosyl as NO^+.

C. It has magnetic moment of 3.87 BM confirming three unpaired electrons in Fe.

D. All are correct statements.

Answer: D

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12. The compounds $\left[Co(SO_4)(NH_3)_5\right]Br$ and $\left[Co(SO_4)(NH_3)_5\right]Cl$ represent

A. linkage isomerism.

B. ionisation isomerism.

C. coordination isomerism.

D. No isomerism.

Answer: D

View Text Solution

13. When 1 mol $CrCl_3.6H_2O$ is treated with excess of $AgNO_3$, 3 mol of AgCl are obtained. The formula of the complex is

A. $\left[CrCl_3(H_2O)_3\right].3H_2O$

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

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

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

Answer: D

View Text Solution

14. The CFSE for octahedral $[CoCl_6]^{4-}$ is 18,000 cm^{-1}. The CFSE for tetrahedral $[CoCl_4]^{2-}$ will be

A. $1800cm^{-1}$

B. $16,000cm^{-1}$

C. $8000cm(-1)$

D. $20,000cm^{-1}$

Answer: C

View Text Solution

15. As per IUPAC nomenclature, the name of the complex $[Co(H_2O)_4(NH_3)_2]Cl_3$ is

A. tetraaquadiaminecobalt(III) Chloride.

B. tetraaquadiamminecobalt(III) Chloride.

C. diaminetetraaquacobalt(III) Chloride.

D. diamminetetraaquacobalt(III) Chloride.

Answer: D

View Text Solution

16. The correct IUPAC name of $\left[Pt(NH_3)_2Cl_2\right]$ is

A. Diamminedichloridoplatinum (11).

B. Diamminedichloridoplatinum (IV).

C. Diamminedichloridoplatinum (IV).

D. Dichloridodiammineplatinum (IV).

Answer: A

View Text Solution

17. 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

View Text Solution

18. Due to the presence of ambidentate ligands coordination compounds show isomerism. Palladium complexes of the type $\left[Pd(C_6H_5)_2(SCN)_2\right]$ and $\left[Pd(C_6H_5)_2(NCS)_2\right]$ are

A. linkage isomers.

B. coordination isomers.

C. ionisation isomers.

D. geometrical isomers.

Answer: A

View Text Solution

19. Which of the following complexes are homoleptic ?

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

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

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

D. $\left[Ni(NH_3)_4Cl_2\right.$

Answer: A::C

View Text Solution

20. The stabilisation of coordination compounds due to chelation is called the chelate effect. Which of the following is the most stable complex species ?

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

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

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

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

Answer: C

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Assertion Reason Question

1. Assertion (A) : Coordination compounds find extensive applications in metallurgical processes, analytical and medicinal chemistry.

Reason (R) : In black and white photography, the developed film is fixed by washing with hypo solution.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: B

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2. Assertion (A) : Haemoglobin, the red pigment of blood which acts as an oxygen carrier is a coordination compound.

Reason (R) : The excess of copper is removed by the chelating ligand desferrioxime B.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: C

View Text Solution

3. Assertion (A) : Linkage isomerism arises in a coordination compound containing ambidentate ligand.

Reason (R) : Coordination isomerism arises from the interchange of ligands between cationic and anionic entities of different metal ions present in the complex.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: B

View Text Solution

4. Assertion (A) : $\left[Co(NH_3)_5(SO_4)\right]Br$ and $\left[Co(NH_3)_5Br\right]SO_4$ are examples of ionisation isomerism.

Reason (R) : Hydrate isomers have water molecules only as water of crystallisation.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: C

View Text Solution

5. Assertion (A) : Linkage isomerism is studied under stereoisomerism.

Reason (R) : The names of coordination compounds are derived by following the principles of additive nomenclature.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: D

View Text Solution

6. Assertion (A) : In the complex ion $[PtCl_6]^{2-}$, the coordination number of Pt is 6.

Reason (R) : Both double salts as well as complexes are formed by the combination of two or more stable compounds in stoichiometric ratio.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: C

View Text Solution

7. Assertion (A) : Pauling was the first to formulate his ideas about the structure of coordination compounds.

Reason (R) : In coordination compounds, metals show two types of linkages, primary and secondary.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: C

View Text Solution

8. Assertion (A) : The primary valencies are ionizable and are satisfied by positive ions.

Reason (R) : Central atoms/ions in coordination compounds are also referred to as Lewis acids.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: D

View Text Solution

9. Assertion (A) : In the complex ions $\left[Fe(C_2O_4)_3\right]^{3-}$, the coordination number of Fe is six.

Reason (R) : Complexes in which a metal is bound to only one kind of groups are called hornoleptic.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: B

View Text Solution

10. Assertion (A) : Optical isomers are mirror images that cannot be superimposed on one another.

Reason (R) : Outer orbital complexes are also called high spin complexes.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is the correct explation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct explation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: A

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Fill In The Blanks

1. Excess of copper and iron are removed by chelating ligands like _____

View Text Solution

2. The _____ is successful in explaining the formation, structures, colour and magnetic properties of coordination compounds.

View Text Solution

3. Linkage isomerism arises in· a coordination compound containing _____ ligand.

View Text Solution

4. The stability of coordination compounds is related to _____ , _____ and exotropy terms.

View Text Solution

5. _____ is used in the treatment of lead poisoning.

View Text Solution

6. Ligands can be arranged in a series called _____ in order of increasing field strength.

View Text Solution

7. The metal-carbon bond in metal _____ possess both σ and π character.

View Text Solution

8. The magnetic moment of coordination compounds can be measured by magnetic _____ experiments.

View Text Solution

9. The colours produced by electronic transitions with the _____ of a transition metal ion occur frequently in everyday life.

View Text Solution

10. Haemoglobin, the red pigment of blood acts as _____.

View Text Solution

True Or False

1. The pigment responsible for photosynthesis is a coordination compound of magnesium.

View Text Solution

2. Valence bond theory does not give quantitative interpretation of magnetic data.

View Text Solution

3. In coordination compounds, the primary valences are normally satisfied by negative ions.

View Text Solution

4. Ligands for which Δ_0 < P are known as weak field ligands and form high spin complexes.

View Text Solution

5. $\left[(Ph_3P)_3RhCI\right]$, a rhodium complex is used for the hydrogenation of alkenes.

View Text Solution

6. Coordination compounds find applications in electroplating, textile dyeing and medicinal chemistry.

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Very Short Answer Questions 1 Mark Each

1. Write the coordination number and oxidation state of Platinum in the complex $\left[Pt(en)_2Cl_2\right]$.

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2. A coordination compound with molecular formula $CrCl_3.4H_2O$ precipitates one mole of AgCl with $AgNO_3$ solution. Its molar conductivity is found to be equivalent to two ions. What is the structural formula and name of the compound ?

View Text Solution

3. Zn^{2+} salts are white while Cu^{2+} salts are coloured. Why ?

View Text Solution

4. Which of the following is more stable complex and why ?

$[Co(NH_3)_6]^{3+}$ and $[Co(en)_3]^{3+}$

View Text Solution

5. What is the effect of synergic bonding interactions in a metal carbonyl complex ?

View Text Solution

6. Write the IUPAC name of $[Pt(NH_3)_4Cl_2]Cl_2$.

View Text Solution

7. Give an example of linkage isomerism.

View Text Solution

8. Among octahedral and tetrahedral crystal fields, in which case the magnitude of crystal field splitting is higher ?

View Text Solution

9. What happens to the colour of coordination compound $\left[Ti(H_2O)_6\right]Cl_3$ when heated gradually ?

View Text Solution

10. Why does a tetrahedral complex of the type $[MA_2B_2]$ not show geometrical isomerism ?

View Text Solution

11. A coordination compound $CrCl_3.4H_2O$ precipitates silver chloride when treated with silver nitrate. The molar conductance of its solution corresponds to a total of two ions. Write structural formula of the compound and name it.

View Text Solution

12. Arrange the following complexes in the increasing order of conductivity of their solution: $[Co(NH_3)_3Cl_3], [Co(NH_3)4Cl_2]Cl, [Co(NH_3)_6]Cl_3, [Cr(NH_3)5Cl]Cl_2$.

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13. Arrange the following complex ions in increasing order of crystal field splitting energy (Δ_0) :

$[Cr(Cl)_6]^{3-}, [Cr(CN)_6]^{3-}, [Cr(NH_3)_6]^{3+}$

View Text Solution

14. If the geometry of $[PtCl_4]^{2-}$ is square planar, which orbitals of Pt are involved in the bonding ?

View Text Solution

15. Name the following complex using IUPAC norms:

$[Co(en)_2(ONO)Cl]Cl$

View Text Solution

16. Write IUPAC name of the complex:

$Na_3[Cr(OH)_2F_4]$

View Text Solution

17. Write IUPAC name of the complex:

$\left[Co(NH_3)_5SCN\right]Cl_2$

View Text Solution

18. Describe briefly the following :

Isomerism shown by $\left[Cr(H_2O)_5(NCS)\right]^{2+}$.

View Text Solution

19. Give the IUPAC name of $\left(NH_4MCo(ONO)_6\right]$.

View Text Solution

20. Give the chemical formula of potassium hexacyanoferrate(II). What is the common name for this compound?

View Text Solution

View Text Solution

21. Write the IUPAC name for one of the isomers of $\left[Co(NH_3)_5NO_2\right]^{2+}$.

View Text Solution

22. Write the IUPAC name of $\left[Co(en)_2(NH_3)_2\right]Cl_3$.

View Text Solution

23. Write the IUPAC name for the ionisation isomer of $\left[Co(NH_3)_5SO_4\right]Br$.

View Text Solution

24. Write the IUPAC name of $\left[Ni(H_2O)_6\right](ClO_4)_2$.

View Text Solution

25. Name an ionisation isomer of $\left[Cr(H_2O)_5Br\right]SO_4$.

View Text Solution

26. Write the IUPAC name for any of the isomers with the molecular formula $\left[Pt(NH_3)_2Cl_2\right]CI_2$.

View Text Solution

27. What is the coordination number of central metal ion in $\left[Fe(C_2O_4)_3\right]^{3-}$

View Text Solution

28. Define a 'ligand'. Give an example also.

View Text Solution

29. Name the type of isomerism exhibited by the following isomers :

$[Pt(NH_3)_4][PtCl_6]$ and $[Pt(NH_3)_4Cl_2][PtCl_4]$

View Text Solution

30. In the geometry of a complex compound, the molecule is trigonal bipyramidal. What is the hybridisation of the central atom ?

View Text Solution

31. Write the formula of copper hexacyanoferrate(II).

View Text Solution

32. What is the oxidation state of nickel in $Ni(CO)_4$?

View Text Solution

33. Write IUPAC name for $\left[Pt(NH_3)_2Cl_4\right]^{2-}$.

View Text Solution

34. Write IUPAC name of coordination isomer of $\left[Co(NH_3)_6\right]\left[Cr(CN)_6\right]$.

View Text Solution

35. Give the chemical formula for the compound potassium hexacyanocobaltate(III).

View Text Solution

36. How many isomers are there for octahedral complex $\left[CoCl_2(en)(NH_3)_2\right]^+$?

View Text Solution

37. Write the formula of tetrachlorocuprate(II) ion.

View Text Solution

38. Write IUPAC name for the linkage isomer of $\left[Co(NH_3)_5ONO\right]Cl_2$.

View Text Solution

39. Write an anion whose shape can be explained by the scheme of sp^3d^2 hybridisation.

View Text Solution

40. How many isomers are there for the complex $\left[Co(NH_3)_4Cl_2\right]Cl$?

View Text Solution

41. Write all the isomers of $\left[Co(NH_3)_5SCN\right]Cl_2$.

View Text Solution

42. What is the shape of $\left[Ni(CN)_4\right]^{2-}$?

View Text Solution

43. What scheme of hybridisation is proposed for Co in $\left[Co(NH_3)_6\right]^{3+}$?

View Text Solution

44. Write IUPAC name for $\left[Ag(NH_3)_2\right]NO_3$.

View Text Solution

45. Write IUPAC name of the linkage isomer of

(i) $\left[Co(NH_3)_5NO_2\right]Cl_2$. (ii) $\left[Cr(H_2O)_5SCN\right]^{2+}$.

View Text Solution

46. Write IUPAC name of $\left[Ni(CN)_4\right]^{2-}$ ion.

View Text Solution

47. Write IUPAC name of the coordination isomer of the complex $\left[Co(en)_3\right]\left[Cr(CN)_6\right]$.

View Text Solution

48. What is the oxidation state of Co in complex $[Co(NH_3)_2(NO_2)Cl][Au(CN)_2]$?

View Text Solution

49. Write all isomers of $[Pt(SCN)(NH_3)_3]SCN$.

View Text Solution

50. Give IUPAC name of linkage isomer of $[(NH_3)Pt(NO_2)]Cl$.

View Text Solution

51. Write IUPAC name of $[Co(NH_3)_5ONO]^{2+}$.

View Text Solution

52. Write all the isomers of $\left[Co(NH_3)_6\right]\left[Cr(C_2O_4)_3\right]$.

View Text Solution

53. Write IUPAC name of $\left[Ag(NH_3)_2\right]Cl$.

View Text Solution

54. Give IUPAC name of the ionisation isomer of $\left[Pt(NO_2)(H_2O)(NH_3)_2\right]Br$.

View Text Solution

55. How many moles of AgCl will be precipitated when an excess of $AgNO_3$ is added to a molar solution of $\left[CrCl(H_2O)_5\right]Cl_2$?

View Text Solution

56. Give IUPAC name of the ionisation isomer of $\left[(NH_3)_3PtNO_2\right]Cl$.

View Text Solution

57. Which valency in coordination compounds is satisfied by neutral molecules or negative ions ?

View Text Solution

58. Which name is given to spatial arrangements in coordination compounds ?

View Text Solution

59. What type of ligand is Cl^-, H_2O or NH_3 ?

View Text Solution

60. What type of ligand has two different donor atoms ?

View Text Solution

61. What kind of complex is $\left[Co(NH_3)_4Cl_2\right]^+$?

View Text Solution

62. Give the full form of mer in isomerism.

View Text Solution

63. Out of t_{2g} and e_g orbitals, which have lower energy ?

View Text Solution

64. Ligands can be arranged in a series in order of increasing field strength. What is that series called ?

View Text Solution

65. What is the relation between Δ_t and Δ_0 ?

View Text Solution

66. Name the pigment responsible for photosynthesis.

View Text Solution

67. Give the common name for cyanocobalamine.

View Text Solution

68. Name a coordination compound of platinum which is used to inhibit growth of tumours.

View Text Solution

69. Name the catalyst, which is a coordination compound that is used for hydrogenation of alkenes.

View Text Solution

Short Answer Questions 2 Marks Each

1. Using IUPAC norms write the formulae for the following :

Sodium dicyanidoaurate(I)

View Text Solution

2. Using IUPAC norms write the formulae for the following :

Tetraamminechloridonitrito-N-platinum(IV)sulphate

View Text Solution

3. Write the IUPAC name of the isomer of the following complex :

$[Pt(NH_3)_2Cl_2]$

View Text Solution

4. Write the formula for the following :

Tetraammineaquachloridocobalt(III) nitrate

View Text Solution

5. When a co-ordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated per mole of the compound. Write

structural formula of the complex.

View Text Solution

6. When a co-ordination compound $CrCl_3.6H_2O$ is mixed with $AgNO_3$, 2 moles of AgCl are precipitated per mole of the compound. Write IUPAC name of the complex.

View Text Solution

7. When a co-ordination compound $COCl_3.4NH_3$ is mixed with $AgNO_3$. 1 mole of AgCl is precipitated per mole of the compound. Write

Structural formula of the complex.

View Text Solution

8. When a co-ordination compound $COCl_3.4NH_3$ is mixed with $AgNO_3$. 1 mole of AgCl is precipitated per mole of the compound. Write

IUPAC name of the complex.

View Text Solution

9. Write down the IUPAC name of the following complex:

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

View Text Solution

10. Write the formula for the following complex :

Potassium tetrachloridonickelate(II)

View Text Solution

11. Write down the IUPAC name of the following complex:

$\left[Cr(NH_3)_2Cl_2(en)\right]Cl$(en=ethylenediamine)

View Text Solution

12. Write the formula for the following complex :

Pentaamminenitrito-O-Cobalt(III)

View Text Solution

13. Write down the IUPAC name of the following complex:

$\left[Cr(en)_3\right]Cl_3$

View Text Solution

14. Write the formula for the following complex :

Potassium trioxalatochromate(III).

View Text Solution

15. Give the electronic configuration of d-orbitals of $K_3\left[Fe(CN)_6\right]$ and $K_3[FeF_6]$ and explain why these complexes give different colours with same solution.

View Text Solution

16. Name the following coordination compounds according to IUPAC system of nomenclature:

$\left[Co(NH_3)_4(H_2O)Cl\right]O_2$

View Text Solution

17. Name the following coordination compounds according to IUPAC system of nomenclature:

$\left[CrCl_2(en)_2Cl\right]$, (en= ethane-1, 2-diamine)

View Text Solution

18. Using the valence bond theory predict the geometry and magnetic behaviour of $[CoF_6]^{3-}$.

[At. no. of Co = 27]

View Text Solution

19. A complex of the type $\left[M(\mathrm{AA})_{2}^{n+}\right._{X-(2)}$ is known to be optically active. What does this indicate about the structure of the complex ? Give one example of such complex.

View Text Solution

20. Give the electronic configuration of the d-orbitals of Ti in $\left[Ti(H_2O)_6\right]^{3+}$ ion and explain why this complex is coloured ?

View Text Solution

21. Write IUPAC name of $\left[Cr(NH_3)_3(H_2O)_3\right]Cl_3$.

View Text Solution

22. Magnetic moment of $[MnCl_4]^{2-}$ is 5.92 BM. Explain giving reason.

View Text Solution

23. On the basis of crystal field theory explain why Co(III) forms paramagnetic octahedral complex with weak field ligands whereas it forms diamagnetic octahedral complex with strong field ligands.

View Text Solution

24. Explain why $\left[Fe(H_2O)_6\right]^{3+}$ has magnetic moment value of 5.92 BM whereas $\left[Fe(CN)_6\right]^{3-}$ has a value of only 1.74 BM.

View Text Solution

25. Describe briefly the nature of bonding in metal carbonyl.

View Text Solution

26. Give the electronic configuration of the following complexes on the basis of Crystal field splitting theory.

$[CoF_6]^{3-}$, $\left[Fe(CN)_6^{4-}\right.$ and $\left[Cu(NH_3)_6\right]^{2+}$

View Text Solution

27. Why do compounds having similar geometry have different magnetic moments?

View Text Solution

28. The spin only magnetic moment of $[MnBr_4]^{2-}$ is 5.9 BM. Predict the geometry of the complex ion.

View Text Solution

29. $CuSO_4.5H_2O$ is blue in colour while $CuSO_4$ is colourless, why ?

View Text Solution

30. Name the type of isomerism when ambidentate ligands are attached to control metal ion. Give two examples of ambidentate ligands.

View Text Solution

31. Write the IUPAC name and draw the structure of coordination entities of $[PtCI(NH_3)_5]Cl_3$.

View Text Solution

32. Using valence bond theory, predict the shape and magnetism (paramagnetic or diamagnetic) of $\left[Co(CO)_4\right]^-$.

View Text Solution

33. Why are low spin tetrahedral complexes not formed ?

View Text Solution

34. Using the valence bond approach, deduce the shape and magnetic character of $\left[Cr(CO)_6\right]$.

View Text Solution

35. How is the magnitude of Δ_0 affected by (i) nature of ligand and (ii) oxidation state of metal ion ?

View Text Solution

36. Using the valence bond approach, deduce the shape and magnetic character of $\left[Co(NH_3)_6\right]^{3+}$.

[Atomic number of Co = 27]

View Text Solution

37. Using valence bond approach, deduce the shape and magnetic behaviour of $\left[Fe(CN)_6\right]^{4-}$

View Text Solution

38. Using the valence bond approach, predict the shape and magnetic character of $\left[Fe(CN)_6\right]^{3-}$ ion.

View Text Solution

39. Using the valence bond approach, predict the shape and magnetic behaviour of $[CoCl_4]^{2-}$.

View Text Solution

40. Using the valence bond approach, deduce the shape and magnetic behaviour of $\left[Cr(NH_3)_6\right]^{3+}$ ion.

View Text Solution

41. Deduce the shape and magnetic behaviour of the complex ion $\left[Co(NH_3)_5NO_2\right]^{2+}$.

View Text Solution

42. Among $\left[Ag(NH_3)_2\right]Cl$, $\left[Ni(CN)_4\right)^{2-}$ and $[CuCl_4]^{2-}$ which has square planar geometry ?

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43. Among $\left[Ag(NH_3)_2\right]Cl$, $\left[Ni(CN)_4\right)^{2-}$ and $[CuCl_4]^{2-}$ which remains colourless in aqueous solutions and why ?

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44. Square planar complexes with coordination number 4 exhibit geometrical isomerism whereas tetrahedral complexes do not. Why ?

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45. Using valence bond approach, predict the shape and magnetic character of :

(i) $\left[Ni(CO)_4\right]$ (ii) $\left[NiCl_4\right]^{2-}$ [Atomic number of Ni = 28]

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46. Explain the following :

$\left[Co(NH_3)_6\right]^{3+}$ is diamagnetic, whereas $\left[CoF_6\right]^{3-}$ is paramagnetic.

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47. Explain the following :

$\left[Fe(H_2O)_6\right]^{3+}$ is more paramagnetic than $\left[Fe(CN)_6\right]^{3-}$.

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48. Write the state of hybridisation and the oxidation state of the central atom in each of the following species :

cis-$\left[Co(NH_3)_4Cl_2\right]^+$

[Atomic number of Pt = 78]

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49. Write the state of hybridisation and the oxidation state of the central atom in each of the following species :

$[PtCl_3(C_2H_4)r.$

[Atomic number of Pt = 78]

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50. Using valence bond approach, explain the shape and magnetic behaviour of $\left[Ni(NII_3)_6\right]^{2+}$.

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51. Illustrate the geometrical isomerism with the help of an example $\left[Pt(NH_3)_4Cl_2\right]^{2+}$.

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52. Explain why a chelating complex is more stable than unchelated complex.

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53. The two complexes of nickel, $\left[Ni(CN)_4\right]^{2-}$ and $\left[Ni(CO)_4\right]$, have different structures but possess same magnetic behaviour. Explain.

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54. A chloride of fourth group cation in qualitative analysis gives a green coloured complex [A] in aqueous solution which when treated with ethane-1, 2-diamine (en) gives pale-yellow solution [B] which on subsequent addition of ethane-1, 2-diamine turns to blue/purple [C] and finally to violet [D]. Write the structures of complexes [A], [B], [C] and [D].

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Long Answer Questions I 3 Marks Each

1. What type of isomerism is shown by the complex $\left[Co(NH_3)_6\right]\left[Cr(CN)_6\right]$?

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2. Why a solution of $\left[Ni(H_2O)_6\right]^{2+}$ is green while a solution of $\left(Ni(CN)_4\right]^{2-}$ is colourless ?

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3. Write the IUPAC name of the following complex : $\left[Co(NH_3)_5(CO_3)\right]CI.$

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4. What type of isomerism is shown by the complex $\left[Co(NH_3)_5(SCN)\right]^{2+}$?

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5. Why is $\left[NiCl_4\right]^{2-}$ paramagnetic while $\left[Ni(CN)_4\right]^{2-}$ is diamagnetic ?

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6. Why are low spin tetrahedral complexes rarely observed ?

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7. Define crystal field splitting energy. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_0 < P$.

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8. $\left[Ni(CN)_4\right]^{2-}$ is colourless whereas $\left[Ni(H_2O)_6\right)^{2+}$ is green. Why?

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9. For the complex $\left[Fe(CN)_6\right]^{3-}$, write the hybridisation type, magnetic character and spin nature of the complex.

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10. Draw one of the geometrical isomers of the complex $[Pt(en)_2Cl_2]^{2+}$ which is optically active.

View Text Solution

11. For the complex $[Fe(H_2O)_6]^{3+}$, write the hybridisation, magnetic character and spin of the complex.

View Text Solution

12. Draw one of the geometrical isomers of the complex $[Pt(en)_2Cl_2]^{2+}$ which is optically inactive.

View Text Solution

13. For the complex $\left[Fe(CO)_5\right]$, write the hybridisation, magnetic character and spin of the complex.

View Text Solution

14. Define crystal field splitting energy.

View Text Solution

15. What type of isomerism is shown by the complex $\left[Cr(H_2O)_6\right]Cl_3$?

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16. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_0 > P$.

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17. Write the hybridisation and shape of $[CoF_6]^{3-}$. [Atomic number of Co= 27]

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18. Draw the geometrical isomers of complex $[Pt(NH_3)_2Cl_2]$.

View Text Solution

19. On the basis of crystal field theory, write the electronic configuration for d^4 ion if $\Delta_0 < P$.

View Text Solution

20. Write the hybridisation and magnetic behaviour of the complex $[Ni(CO)_4]$. [At. no. of Ni = 28)

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View Text Solution

21. Draw the geometrical isomers of complex $\left[Pt(en)_2Cl_2\right]^{2+}$.

View Text Solution

22. On the basis of crystal field theory, write the electronic configuration for d^4 ion, if $\Delta_0 > P$.

View Text Solution

23. Write the hybridisation type and magnetic behaviour of the complex $\left[Ni(CN)_4\right]^{2-}$. [Atomic number of Ni = 28]

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24. Write the IUPAC name of the complex $[Cr(NH_3)4Cl_2]Cl$.

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25. What type of isomerism is exhibited by the complex $\left[Co(en)_3\right]^{3+}$?

(en = ethane-1, 2-diamine)

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26. Why is $\left[NiCl_4\right]^{2-}$ paramagnetic but $\left[Ni(CO)_4\right]$ is diamagnetic ?

[At. nos : Cr = 24, Co = 27, Ni = 28]

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27. Write the IUPAC name of the complex $\left[Cr(NH_3)_4Cl_2\right]^{+}$.

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28. What type of isomerism does it exhibit ?

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29. Draw the structures of these geometrical isomers.

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30. What is meant by crystal field splitting energy ? On the basis of crystal field theory, write the electronic configuration of d^4 in terms of t_{2g} and e_g in an octahedral field when

$\Delta_0 > P$

View Text Solution

31. What is meant by crystal field splitting energy ? On the basis of crystal field theory, write the electronic configuration of d^4 in terms of t_{2g} and e_g in an octahedral field when

$\Delta_0 < P$

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32. Name the following coordination entities and draw the structures of their stereoisomers:

$[Co(en)_2Cl_2]$+ (en= ethane-1, 2-diamine)

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33. Name the following coordination entities and draw the structures of their stereoisomers:

$[Cr(C_2O_4)_3]^{3-}$

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34. Name the following coordination entities and draw the structures of their stereoisomers:

$[Co(NH_3)_3Cl_3]$

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35. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, identify the following :

Oxidation number of iron.

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36. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, identify the following :

Hybrid orbitals and shape of the complex.

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37. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, identify the following :

Magnetic behaviour of the complex.

View Text Solution

38. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, identify the following :

Magnetic behaviour of the complex.

View Text Solution

39. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, identify the following :

Magnetic behaviour of the complex.

View Text Solution

40. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, identify the following :

Name of the complex.

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41. Write the name, stereochemistry and magnetic behaviour of the following :

$K_4[Mn(CN)_6]$

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42. Write the name, stereochemistry and magnetic behaviour of the following :

$[Co(NH_3)_5Cl]O_2$

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43. Write the name, stereochemistry and magnetic behaviour of the following :

$K_2[Ni(CN)_4]$

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44. Write the structures and names of all the stereoisomers of the following compounds:

$[Co(en)_3]Cl_3$

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45. Write the structures and names of all the stereoisomers of the following compounds:

$[Pt(NH_3)_2Cl_2]$

View Text Solution

46. Write the structures and names of all the stereoisomers of the following compounds:

$[Fe(NH_3)_4Cl_2]Cl$

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47. Give the electronic configuration of the d-orbitals of Ti in $[Ti(H_2O)_6]^{3+}$ ion in an octahedral crystal field.

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48. Give the electronic configuration of the

Why is this complex coloured ? Explain on the basis of distribution of electrons in the d-orbitals ?

View Text Solution

49. Give the electronic configuration of the

How does the colour change on heating $\left[Ti(H_2O)_6\right]^{3+}$ ion?

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50. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, (en = ethylene diamine), identify the oxidation number of iron

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51. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, (en = ethylene diamine), identify the hybrid orbitals and the shape of the complex

View Text Solution

52. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, (en = ethylene diamine), identify the magnetic behaviour of the complex

View Text Solution

53. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, (en = ethylene diamine), identify the number of geometrical isomers,

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54. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, (en = ethylene diamine), identify whether there is an optical isomer also

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55. For the complex $\left[Fe(en)_2Cl_2\right]Cl$, (en = ethylene diamine), identify name of the complex.

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56. Compare the following complexes with respect to structural shapes of units, magnetic behaviour and hybrid orbitals involved in units :

$\left[Co(NH_3)_6\right]^{3+}$, $\left[Cr(NH_3)_6\right]^{3+}$, $Ni(CO)_4$

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57. State the hybridisation and magnetic behaviour of $\left[Cr(CO)_6\right]$.

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58. What are the various factors affecting crystal field splitting energy ?

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59. Which of the two is more stable and why ?

$K_4\left[Fe(CN)_6\right]$ or $K_3\left[Fe(CN)_6\right]$

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60. What is the basis of formation of spectrochemical series ?

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61. Draw the structures of geometrical isomers of the following coordination complexes :

$\left[Co(NH_3)_3Cl_3\right]$ and $\left[CoCl_2(en)_2\right]^+$

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62. Give the formula of each of the following coordination entities : Co^{3+} ion is bound to one Cl^{-}, one NH_3 molecule and two bidentate ethylene diamine (en) molecules.

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63. Give the formula of each of the following coordination entities : Ni^{2+} ion is bound to two water molecules and two oxalate ions. Write the name and magnetic behaviour of each of the above coordination entities.

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64. Write the name and draw the structure of each of the following complex compounds :

$[Co(NH_3)_4(H_2O)_2]Cl_3$

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65. Write the name and draw the structure of each of the following complex compounds :

$[Pt(NH_3)_4][NiCl_4]$

View Text Solution

66. Describe for any two of the following complex ions, the type of hybridisation, shape and magnetic property :

$[Fe(H_2O)_6]^{2+}$

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67. Describe for any two of the following complex ions, the type of hybridisation, shape and magnetic property :

$[Co(NH_3)_6]^{3+}$

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68. Describe for any two of the following complex ions, the type of hybridisation, shape and magnetic property :

$[NiCl_4]^{2-}$

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69. What are ambidentate ligands ? Give an example.

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70. Write IUPAC names of the following :

$K_3[Fe(C_2O_4)_3]$

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71. Write IUPAC names of the following :

$[Pt(NH_3)_6]Cl_4$

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72. Draw the structure of cis-isomer of $[Co(NH_3)_4Cl_2]^+$.

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73. A coordination compound has the formula $CoCl_3.4NH_3$. It does not liberate ammonia but forms a precipitate with $AgNO_3$. Write the structure and IUPAC name of the complex compound.

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74. Name a ligand which is bidentate and give an example of the complex formed by this ligand.

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75. Write the name (IUPAC norm) and draw the possible optical isomers of $\left[CrCl_2(en)(NH_3)_2\right]^+$.

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76. Answer the following :

Differentiate between a bidentate ligand and a monodentate ligand.

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77. Answer the following :

Write the IUPAC name of $\left[Pt(NH_3)_2Cl_2\right]Cl_2$.

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78. Answer the following :

Draw the structures of geometrical isomers of $\left[Co(NH_3)_4Cl_2\right]^+$

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79. Write the formula of the following complexes :

Hexaammineplatinum(IV) chloride

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80. Write the formula of the following complexes :

Dichlorotetraamminecobalt(III) ion

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81. The values of dissociation constant of $\left[Cu(NH_3)_4\right]^{2+}$ and $\left[Co(NH_3)_6\right]^{3+}$ are 1.0×10^{-12} and 6.2×10^{-36}, respectively. Which

complex would be more stable and why ?

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82. Write the IUPAC name of $\left[Co(en)_2Cl_2\right]CI$ and draw the structures of all the isomers with this formula of complex.

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83. Write the correct formulae for the following coordination compounds :

$CrCl_3.6H_2O$ (violet with 3 chloride ions precipitated as AgCl)

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84. Write the correct formulae for the following coordination compounds :

$CrCl_3.6H_2O$ (light green colour, with 2 chloride ions precipitated as AgCl)

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85. Write the correct formulae for the following coordination compounds :

$CrCl_3.6H_2O$ (dark green colour, with 1 chloride ion precipitated as AgCl)

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Self Assessment Test

1. Which type of shapes are uncommon in coordination compounds ?

A. Octahedral

B. Tetrahedral

C. Triangular

D. Square planar

Answer: C

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2. Which of the following is not a double salt?

A. $KCl.\ MgCl_2.6H_2O$

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

C. $Kal(SO_4)_2.12H_2O$

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

Answer: D

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3. What is the coordination number of metal in the complex ion $\left[Fe(C_2O_4)_3\right]^{3-}$?

A. 2

B. 3

C. 4

D. 6

Answer: D

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4. Which type of isomerism is shown by $\left[Cr(H_2O)_6\right]Cl_3$ and $\left[Cr(H_2O)_5Cl\right]Cl_2.H_2O$?

A. Linkage isomerism

B. Coordination isomerism

C. Solvate isomerism

D. Ionisation isomerism

Answer: C

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5. Chlorophyll which is responsible for photosynthesis is a complex compound of

A. Mg

B. Fe

C. Ca

D. Al

Answer: A

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6. Assertion (A) : Valence bond theory does not give quantitative interpretation of magnetic data.

Reason (R) : A compound is paramagnetic if it contains unpaired electrons.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is tire correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements,, but Reason (R) is not the corret explanation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: B

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7. Assertion (A) : Coordination isomerism arises in a coordination compound containing ambidentate group.

Reason (R) : Optical isomers are mirror images that cannot be superimposed on each other.

A. Both Assertion (A) and Reason (R) are correct statements, and Reason (R) is tire correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements,, but Reason (R) is not the corret explanation of the Assertion (A).

C. Assertion (A) is correct, but Reason (R) is incorrect statement.

D. Assertion (A) is incorrect, but Reason (R) is correct statement.

Answer: D

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