



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)



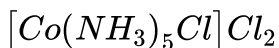
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7. Write the IUPAC names of the following coordination compounds :



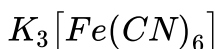
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8. Write the IUPAC names of the following coordination compounds :



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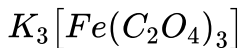
9. Write the IUPAC names of the following coordination compounds :





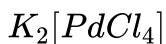
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10. Write the IUPAC names of the following coordination compounds :



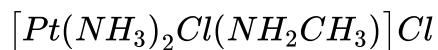
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11. Write the IUPAC names of the following coordination compounds :



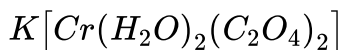
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12. Write the IUPAC names of the following coordination compounds :



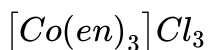
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13. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :



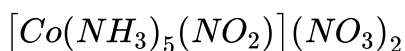
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14. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :



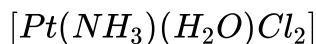
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15. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers :



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



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



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



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19. $[NiCl_4]^{2-}$ is paramagnetic while $[Ni(CO)_4]$ is diamagnetic 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 hexaquo 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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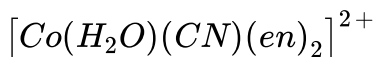
2. What is meant by unidentate, didentate and ambidentate ligands ?

Give two examples for each.



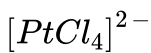
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3. Specify the oxidation numbers of the metals in the following coordination entities :



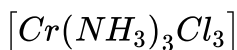
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4. Specify the oxidation numbers of the metals in the following coordination entities :



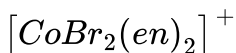
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5. Specify the oxidation numbers of the metals in the following coordination entities :



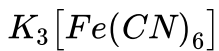
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6. Specify the oxidation numbers of the metals in the following coordination entities :



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



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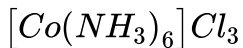
17. Using IUPAC norms write the formulas for the following:

Pentaamminenitrito-N-cobalt(III)



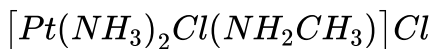
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18. Using IUPAC norms, write the systematic names of the following:



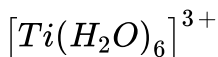
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19. Using IUPAC norms, write the systematic names of the following:



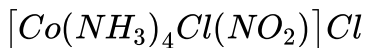
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20. Using IUPAC norms, write the systematic names of the following:



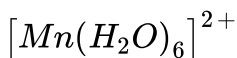
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21. Using IUPAC norms, write the systematic names of the following:



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



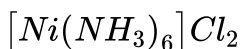
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23. Using IUPAC norms, write the systematic names of the following:



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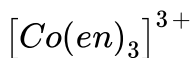
24. Using IUPAC norms, write the systematic names of the following:





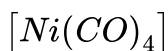
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25. Using IUPAC norms, write the systematic names of the following:



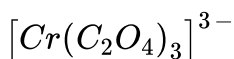
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26. Using IUPAC norms, write the systematic names of the following:



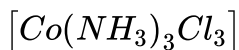
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27. How many geometrical isomers are possible in the following coordination entities ?



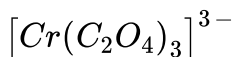
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28. How many geometrical isomers are possible in the following coordination entities ?



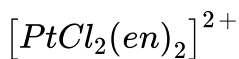
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29. Draw the structures of optical isomers of :



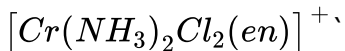
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30. Draw the structures of optical isomers of :



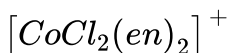
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31. Draw the structures of optical isomers of :



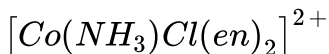
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32. Draw all the isomers (geometrical and optical) of :



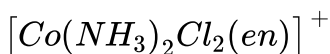
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33. Draw all the isomers (geometrical and optical) of :



[View Text Solution](#)

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





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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 ?

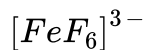
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38. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :



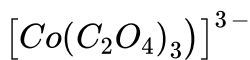
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39. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :



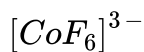
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40. Discuss the nature of bonding in the following coordination entities on the basis of Valence Bond Theory :



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



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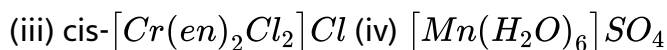
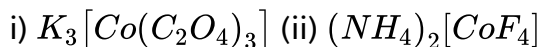
45. A solution of $[Ni(H_2O)_6]^{2+}$ is green but a solution of $[Ni(CN)_4]^{2-}$ is colourless. Explain.

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

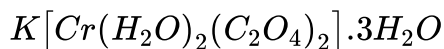
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47. Give the oxidation state, d-orbital occupation and coordination number of the central metal ion in the following complexes:



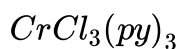
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48. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :



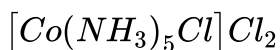
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49. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :



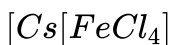
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50. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :



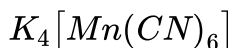
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51. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give stereochemistry and magnetic moment of the complex :



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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 :



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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) $[Cr(H_2O)_6]^{3+}$
- (ii) $[Fe(H_2O)_6]^{2+}$
- (iii) $[Zn(H_2O)_6]^{2+}$



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

A. +1

B. +3

C. -1

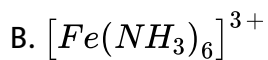
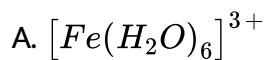
D. -3

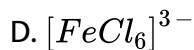
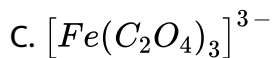
Answer:



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

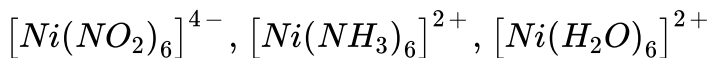




Answer:

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



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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. Ethylenediaminetetraacetate 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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2. 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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Write the formula of ethylenediamine.



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3. 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 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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5. 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

Ethylenediaminetetraacetate ion $[EDTA^{4-}]$ is an important hexadentate ligand. It can bind through two nitrogen and four oxygen atoms to a central metal ion.

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 $[Ti(H_2O)_6]^{3+}$, 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 ($t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1$). 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 is colourless. For example, removal of water from $[Ti(H_2O)_6]Cl_3$ on heating renders it colourless. Similarly, anhydrous $CuSO_4$ is white, but $CuSO_4 \cdot 5H_2O$ is blue in colour.

Which theory explains the colour of coordination compounds ?



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7. 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 ($t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1$). 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.

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



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8. 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 ($t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1$). 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.

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example, removal of water from $[Ti(H_2O)_6]Cl_3$ on heating renders it colourless. Similarly, anhydrous $CuSO_4$ is white, but $CuSO_4 \cdot 5H_2O$ is blue in colour.

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 ($t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1$). 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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10. 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

$(t_{2g}^1 e_g^0 \rightarrow t_{2g}^0 e_g^1)$. 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 is colourless. For example, removal of water from $[Ti(H_2O)_6]Cl_3$ on heating renders it colourless. Similarly, anhydrous $CuSO_4$ is white, but $CuSO_4 \cdot 5H_2O$ is blue in colour.

What will happen to $[Ti(H_2O)_6]Cl_3$ 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-penicillamine and desferrioxime.

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

treatment of lead poisoning. 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} , cyanocobalamin, 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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12. 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.

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



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13. 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.

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



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14. 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 poisoning. 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} , cyanocobalamine, the antipernicious anaemia factor is a coordination compound of cobalt.

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



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15. 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 poisoning. 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} , cyanocobalamine, the antipernicious anaemia factor is a coordination compound of cobalt.

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 $[CoBr(NH_3)_5]Cl_2$ 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 ?



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

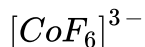
- A. both ionisable.
- B. both non-ionisable.
- C. both non-ionisable.
- D. ionisable, non-ionisable.

Answer: D



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8. The following spin and hybridisation characteristics are applicable to



- A. high spin, sp^3d^2
- B. low spin, sp^3d^2

C. high spin, $d^2 sp^3$

D. low spin, $d^2 sp^3$

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

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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 $[Co(SO_4)(NH_3)_5]Br$ and $[Co(SO_4)(NH_3)_5]Cl$ represent

- A. linkage isomerism.
- B. ionisation isomerism.
- C. coordination isomerism.
- D. No isomerism.

Answer: D



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

- A. $[CrCl_3(H_2O)_3] \cdot 3H_2O$
- B. $[CrCl_2(H_2O)_4]Cl \cdot 2H_2O$
- C. $[CrCl(H_2O)_5]Cl_2 \cdot H_2O$
- D. $[Cr(H_2O)_6]Cl_3$

Answer: D



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

A. 1800 cm^{-1}

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

C. 8000 cm^{-1}

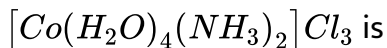
D. $20,000\text{ cm}^{-1}$

Answer: C



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15. As per IUPAC nomenclature, the name of the complex



A. tetraaquadiaminocobalt(III) Chloride.

B. tetraaquadiamminecobalt(III) Chloride.

C. diaminetetraaquacobalt(III) Chloride.

D. diamminetetraaquacobalt(III) Chloride.

Answer: D

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

A. Diamminedichloridoplatinum (II).

B. Diamminedichloridoplatinum (IV).

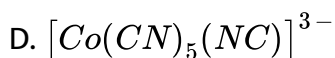
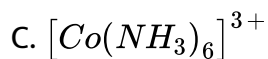
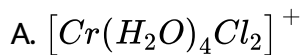
C. Diamminedichloridoplatinum (IV).

D. Dichloridodiammineplatinum (IV).

Answer: A

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17. Indicate the complex ion which shows geometrical isomerism.

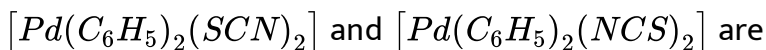


Answer: A



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18. Due to the presence of ambidentate ligands coordination compounds show isomerism. Palladium complexes of the type



A. linkage isomers.

B. coordination isomers.

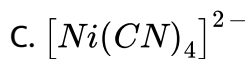
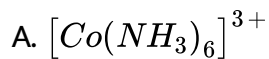
C. ionisation isomers.

D. geometrical isomers.

Answer: A

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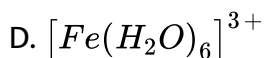
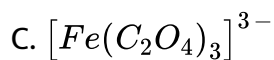
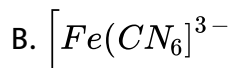
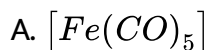
19. Which of the following complexes are homoleptic ?



Answer: A::C

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



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



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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 explanation of the Assertion (A).
- B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct 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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4. Assertion (A) : $[Co(NH_3)_5(SO_4)]Br$ and $[Co(NH_3)_5Br]SO_4$ 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 explanation of the Assertion (A).
- B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct 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: C

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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 explanation of the Assertion (A).

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

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

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

- B. Both Assertion (A) and Reason (R) are correct statements, but Reason (R) is not the correct 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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9. Assertion (A) : In the complex ions $[Fe(C_2O_4)_3]^{3-}$, the coordination number of Fe is six.

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

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

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

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

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Fill In The Blanks

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

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

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

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

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

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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.



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



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True Or False

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



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



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

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4. Ligands for which $\Delta_0 < P$ are known as weak field ligands and form high spin complexes.

 [View Text Solution](#)

5. $[(Ph_3P)_3RhCl]$, a rhodium complex is used for the hydrogenation of alkenes.

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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 $[Pt(en)_2Cl_2]$.



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2. A coordination compound with molecular formula $CrCl_3 \cdot 4H_2O$ 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 ?



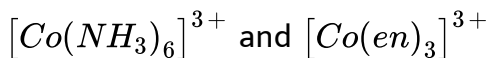
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3. Zn^{2+} salts are white while Cu^{2+} salts are coloured. Why ?



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



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



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



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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 $[Ti(H_2O)_6]Cl_3$ when heated gradually ?



[View Text Solution](#)

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

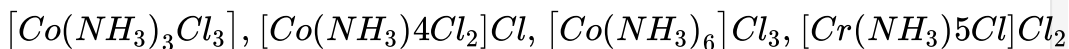


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11. A coordination compound $CrCl_3 \cdot 4H_2O$ precipitates silver chloride when treated with silver nitrate. The molar conductance of its solution corresponds to a total of two ions. Write structural formula of the compound and name it.

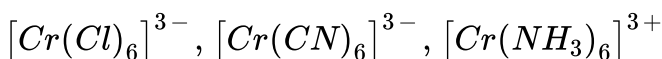
 [View Text Solution](#)

12. Arrange the following complexes in the increasing order of conductivity of their solution:



 [View Text Solution](#)

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



 [View Text Solution](#)

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

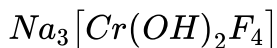
 [View Text Solution](#)

15. Name the following complex using IUPAC norms:



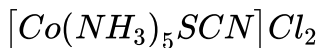
 [View Text Solution](#)

16. Write IUPAC name of the complex:



 [View Text Solution](#)

17. Write IUPAC name of the complex:



 [View Text Solution](#)

18. Describe briefly the following :

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

 [View Text Solution](#)

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

 [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 $[Co(NH_3)_5NO_2]^{2+}$.

 [View Text Solution](#)

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

 [View Text Solution](#)

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

 [View Text Solution](#)

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





[View Text Solution](#)

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



[View Text Solution](#)

26. Write the IUPAC name for any of the isomers with the molecular formula $[Pt(NH_3)_2Cl_2]Cl_2$.



[View Text Solution](#)

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

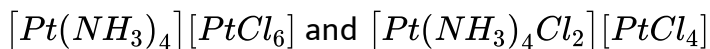


[View Text Solution](#)

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

 [View Text Solution](#)

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



 [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 $[Pt(NH_3)_2Cl_4]^{2-}$.



[View Text Solution](#)

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



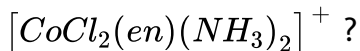
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35. Give the chemical formula for the compound potassium hexacyanocobaltate(III).



[View Text Solution](#)

36. How many isomers are there for octahedral complex



 [View Text Solution](#)

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

 [View Text Solution](#)

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

 [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 $[Co(NH_3)_4Cl_2]Cl$?

 [View Text Solution](#)

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

 [View Text Solution](#)

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

 [View Text Solution](#)

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

?

 [View Text Solution](#)

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

 [View Text Solution](#)

45. Write IUPAC name of the linkage isomer of

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

 [View Text Solution](#)

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

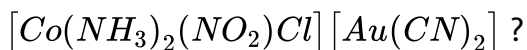
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47. Write IUPAC name of the coordination isomer of the complex

$[Co(en)_3][Cr(CN)_6]$.

 [View Text Solution](#)

48. What is the oxidation state of Co in complex



 [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 $[Co(NH_3)_6][Cr(C_2O_4)_3]$.

 [View Text Solution](#)

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

 [View Text Solution](#)

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

 [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 $[CrCl(H_2O)_5]Cl_2$?

 [View Text Solution](#)

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

 [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 $[Co(NH_3)_4Cl_2]^+$?

 [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)

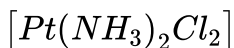
 [View Text Solution](#)

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 :



 [View Text Solution](#)

4. Write the formula for the following :

Tetraammineaquachloridocobalt(III) nitrate

 [View Text Solution](#)

5. When a co-ordination compound $CrCl_3 \cdot 6H_2O$ 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 $CrCl_3 \cdot 6H_2O$ 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 $CoCl_3 \cdot 4NH_3$ 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 $CoCl_3 \cdot 4NH_3$ is mixed with $AgNO_3$, 1 mole of $AgCl$ is precipitated per mole of the compound.

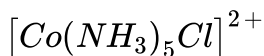
Write

IUPAC name of the complex.



[View Text Solution](#)

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



[View Text Solution](#)

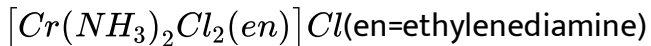
10. Write the formula for the following complex :

Potassium tetrachloridonickelate(II)



[View Text Solution](#)

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



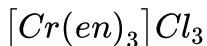
 [View Text Solution](#)

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:



 [View Text Solution](#)

14. Write the formula for the following complex :

Potassium trioxalatochromate(III).



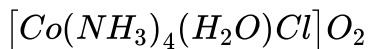
[View Text Solution](#)

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



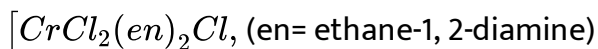
[View Text Solution](#)

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



[View Text Solution](#)

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





[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 $[M(AA)_{2x-2}]^{n+}$ 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 $[Ti(H_2O)_6]^{3+}$ ion and explain why this complex is coloured ?



[View Text Solution](#)

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

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



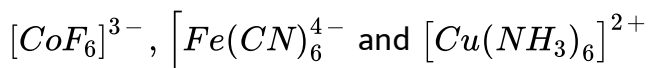
[View Text Solution](#)

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.



[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. $CuSO_4 \cdot 5H_2O$ 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 central metal ion. Give two examples of ambidentate ligands.

 [View Text Solution](#)

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



[View Text Solution](#)

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



[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 $[Cr(CO)_6]$.



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

[Atomic number of Co = 27]

 [View Text Solution](#)

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

 [View Text Solution](#)

38. Using the valence bond approach, predict the shape and magnetic character of $[Fe(CN)_6]^{3-}$ 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 $[Cr(NH_3)_6]^{3+}$ ion.

 [View Text Solution](#)

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



[View Text Solution](#)

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



[View Text Solution](#)

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



[View Text Solution](#)

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



[View Text Solution](#)

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

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

 [View Text Solution](#)

46. Explain the following :

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

 [View Text Solution](#)

47. Explain the following :

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

 [View Text Solution](#)

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

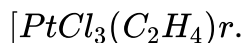


[Atomic number of Pt = 78]



[View Text Solution](#)

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



[Atomic number of Pt = 78]



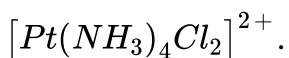
[View Text Solution](#)

50. Using valence bond approach, explain the shape and magnetic behaviour of $[Ni(NH_3)_6]^{2+}$.



[View Text Solution](#)

51. Illustrate the geometrical isomerism with the help of an example



[View Text Solution](#)

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



[View Text Solution](#)

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



[View Text Solution](#)

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].



[View Text Solution](#)

Long Answer Questions | 3 Marks Each

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

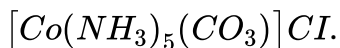


[View Text Solution](#)

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

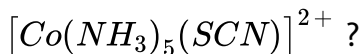
 [View Text Solution](#)

3. Write the IUPAC name of the following complex :



 [View Text Solution](#)

4. What type of isomerism is shown by the complex



 [View Text Solution](#)

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

 [View Text Solution](#)

6. Why are low spin tetrahedral complexes rarely observed ?

 [View Text Solution](#)

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

 [View Text Solution](#)

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

 [View Text Solution](#)

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



[View Text Solution](#)

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 $[Fe(CO)_5]$, 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 $[Cr(H_2O)_6]Cl_3$?

 [View Text Solution](#)

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

 [View Text Solution](#)

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

 [View Text Solution](#)

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]

 [View Text Solution](#)

[View Text Solution](#)

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

 [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 $[Ni(CN)_4]^{2-}$. [Atomic number of Ni = 28]

 [View Text Solution](#)

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



 [View Text Solution](#)

25. What type of isomerism is exhibited by the complex $[Co(en)_3]^{3+}$?
(en = ethane-1, 2-diamine)

 [View Text Solution](#)

26. Why is $[NiCl_4]^{2-}$ paramagnetic but $[Ni(CO)_4]$ is diamagnetic ?
[At. nos : Cr = 24, Co = 27, Ni = 28]

 [View Text Solution](#)

27. Write the IUPAC name of the complex $[Cr(NH_3)_4Cl_2]^+$.

 [View Text Solution](#)

28. What type of isomerism does it exhibit ?

 [View Text Solution](#)

29. Draw the structures of these geometrical isomers.

 [View Text Solution](#)

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

$$\Delta_0 > P$$

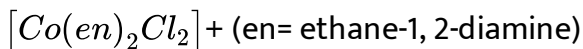
 [View Text Solution](#)

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

$$\Delta_0 < P$$

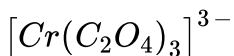
 [View Text Solution](#)

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



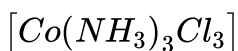
 [View Text Solution](#)

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



 [View Text Solution](#)

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



 [View Text Solution](#)

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

Oxidation number of iron.

 [View Text Solution](#)

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

Hybrid orbitals and shape of the complex.

 [View Text Solution](#)

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

Magnetic behaviour of the complex.

 [View Text Solution](#)

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

Magnetic behaviour of the complex.

 [View Text Solution](#)

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

Magnetic behaviour of the complex.

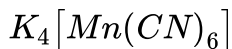
 [View Text Solution](#)

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

Name of the complex.

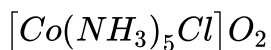
 [View Text Solution](#)

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



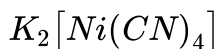
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42. Write the name, stereochemistry and magnetic behaviour of the following :



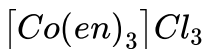
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43. Write the name, stereochemistry and magnetic behaviour of the following :



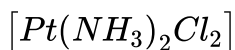
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44. Write the structures and names of all the stereoisomers of the following compounds:



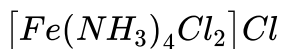
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45. Write the structures and names of all the stereoisomers of the following compounds:



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



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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 ?



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49. Give the electronic configuration of the

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



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



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

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

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

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



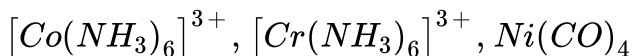
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55. For the complex $[Fe(en)_2Cl_2]Cl$, (en = ethylene diamine), identify name of the complex.



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



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

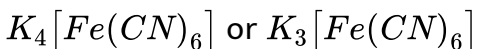


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58. What are the various factors affecting crystal field splitting energy ?

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

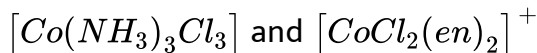


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60. What is the basis of formation of spectrochemical series ?

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



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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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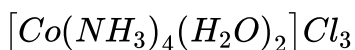
63. Give the formula of each of the following coordination entities :

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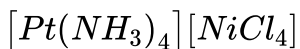
64. Write the name and draw the structure of each of the following complex compounds :





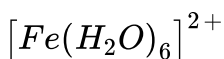
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65. Write the name and draw the structure of each of the following complex compounds :



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



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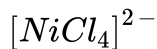
67. Describe for any two of the following complex ions, the type of hybridisation, shape and magnetic property :





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



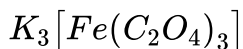
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69. What are ambidentate ligands ? Give an example.



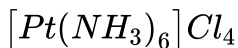
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70. Write IUPAC names of the following :



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71. Write IUPAC names of the following :



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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 $CoCl_3 \cdot 4NH_3$. 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 $[CrCl_2(en)(NH_3)_2]^+$.



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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 $[Pt(NH_3)_2Cl_2]Cl_2$.



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78. Answer the following :

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

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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 $[Cu(NH_3)_4]^{2+}$ and $[Co(NH_3)_6]^{3+}$ 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 $[Co(en)_2Cl_2]Cl$ 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 :

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

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

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



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

$CrCl_3 \cdot 6H_2O$ (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

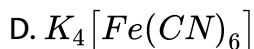
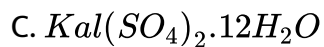
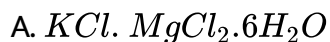
C. Triangular

D. Square planar

Answer: C

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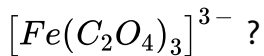
2. Which of the following is not a double salt?



Answer: D

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3. What is the coordination number of metal in the complex ion



A. 2

B. 3

C. 4

D. 6

Answer: D



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4. Which type of isomerism is shown by $[Cr(H_2O)_6]Cl_3$ and



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 the correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements,, but

Reason (R) is not the correct 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 the correct explanation of the Assertion (A).

B. Both Assertion (A) and Reason (R) are correct statements,, but

Reason (R) is not the correct 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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