



CHEMISTRY

BOOKS - ARIHANT PUBLICATION

COORDINATION COMPOUNDS

Questions For Practice Part I Multiple Choice Questions 1 Mark

1. The coordination number of cobalt in $[Co(NH_3)_3Cl_3]$ is

- A. 3
- B. 2
- C. 4
- D. 6

Answer: D



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2. Which of the following is the IUPAC name of $K_4[Fe(CN)_6]$?

- A. Potassium ferricyanide
- B. Potassium ferrocyanide
- C. Potassium hexacyanoferrate (III)
- D. Potassium hexacyanoferrate (II)

Answer: D



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3. To which isomers the following compounds belong?



- A. Geometrical isomerism
- B. Linkage isomerism

C. Ionisation isomerism

D. Ligand isomerism

Answer: B

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4. Which kinds of isomerism are exhibited octahedral $[Co(NH_3)_4Br_2]Cl$

?

A. Geometrical and ionisation

B. Geometrical and optical

C. Optical and Ionisation

D. Geometrical only

Answer: A

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1. Potash alum is an example of

(simple, salt, double salt, complex salt)

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

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3. The oxidation number of 'Co' in the complex $K[Co(CO)_4]$ is ____

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4. Write the IUPAC name of $K_2[CrCO(CN)_5]$

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5. Write the IUPAC name of $Na[Al(OH)_4]$.

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6. Write the IUPAC name of $[Cr(NH_3)_6][Co(CN)_6]$.

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7. Write the IUPAC name of $K_3[Fe(CN)_5NO]$.

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8. Write the IUPAC name of $K_2[PtCl_6]$.

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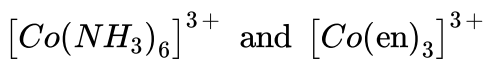
9. Write the IUPAC name of $[Ni(en)_3]Cl_2$.

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10. Write the IUPAC name of $[Pt(NH_3)_4][PtCl_4]$.

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



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12. Why is geometrical isomerism not possible for tetrahedral complexes?

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13. Why is optical isomerism not shown by square planar complexes?



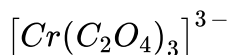
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14. What type of isomerism is exhibited by the complex $[Co(en)_3]^{3+}$?



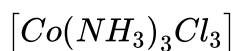
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15. How many geometrical isomers are possible in the following coordination entities?



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



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17. Which type of ligand is EDTA.

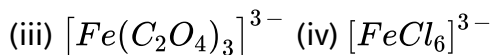
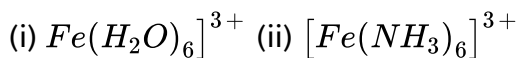
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Questions For Practice Part I Short Answer Type I Questions 2 Marks

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

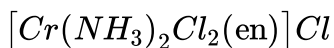
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2. Amongst the following, the most stable complex is



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3. Write the IUPAC name of the following complex.





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4. Write the formula for the following complex.

Pentaamminenitrito-O-cobalt (III)



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



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6. Write the IUPAC name of the complex $[Cr(NH_3)_4Cl_2]^+$. What type of isomerism does it exhibit?



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

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8. A complex of the type $[M(AA)_2X_2]^{n+}$ is known to be optically active. What does this indicate about the structure of complex? Give one example of such complex.

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

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10. $FeSO_4$, solution mixed with $(NH_4)_2SO_4$, solution in 1:1 molar ratio gives the test for Fe^{2+} ion but $CuSO_4$, solution mixed with aqueous ammonia in 1:4 molar ratio does not give the test for Cu^{2+} ion. Explain.

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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 the structural formula of the compound and name it.

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Questions For Practice Part I Short Answer Type II Questions 3 Marks

1. Explain with two examples each of the following. Coordination entity, ligand, coordination number, coordination polyhedron.

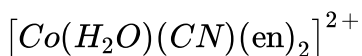
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2. What is meant by unidentate, didentate and ambidentate ligand? Give two examples for each.

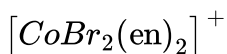
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3. Specify the oxidation number of metal in the following coordination entities.



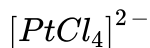
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4. Specify the oxidation number of metal in the following coordination entities.



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5. Specify the oxidation number of metal in the following coordination entities.

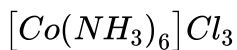


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6. Explain the bonding in coordination compounds in terms of Werner's postulates.

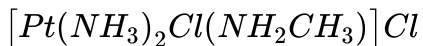
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7. Using IUPAC norms, write the systematic names of the following.



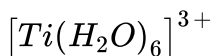
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8. Using IUPAC norms, write the systematic names of the following.



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9. Using IUPAC norms, write the systematic names of the following.



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10. Write the formulae for the following coordination compounds.

Tetraamminediaquacobalt(III) chloride

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11. Write the formulae for the following coordination compounds.

Potassium tetracyanonickelate(II)



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12. Write the formulae for the following coordination compounds.

Amminebromidochloridonitrito-N-platinate(II)



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13. Write the formulae for the following coordination compounds.

Dichlorido bis-(ethane-1, 2-diamine) paltinum(IV) nitrate



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14. Write the formulae for the following coordination compounds.

Iron(III) hexacyanoferrate(II)

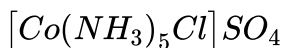


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15. Write the formulae for the following coordination compounds.

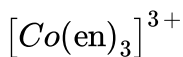
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16. Write the types of isomerism exhibited by the following complexes.



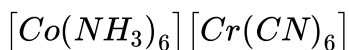
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17. Write the types of isomerism exhibited by the following complexes.



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18. Write the types of isomerism exhibited by the following complexes.

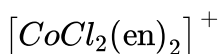


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19. What type of isomerism is exhibited by $[Co(NH_3)_4Cl_2]^+ Br^-$? Write the structures of the possible isomers and the state of hybridisation of the central metal atom.

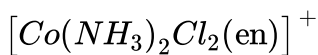
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20. Draw all the isomers (geometrical and optical) of



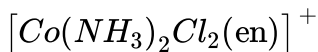
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21. Draw all the isomers (geometrical and optical) of



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22. Draw all the isomers (geometrical and optical) of



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Questions For Practice Part I Long Answer Type Questions 7 Marks

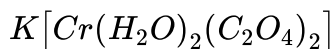
1. Write short notes on : Werner's theory of co-ordination compounds.

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2. List various types of isomerism possible for coordination compounds, giving an example of each.

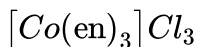
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3. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



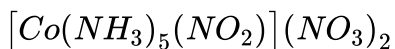
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4. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



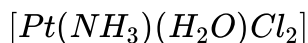
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5. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



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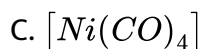
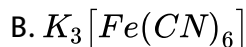
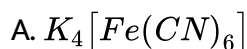
6. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



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Questions For Assessment Part I Multiple Choice Type Questions 1 Mark

1. A complex compound in which the oxidation number of a metal is zero, is



Answer: C



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2. The primary and secondary valencies of chromium in the complex ion, dichlorodioxalatochromium (III), respectively are

A. 3, 4

B. 4, 3

C. 3, 6

D. 4, 3

Answer: A



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Questions For Assessment Part I Very Short Answer Type Questions 1 Mark

1. Write the oxidation number of Pt in $[PtCl_2(NH_3)_2]$.



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2. Write the IUPAC name of $[PtCl_6]^{2-}$.

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3. How many ions are produced from the complex, $[Cr(H_2O)_6]Cl_3$ in solution ?

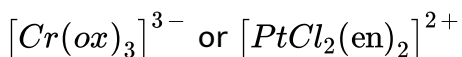
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4. Give the examples of two coordination complexes where central metal atom has coordination number

(i) 5 (ii) 6

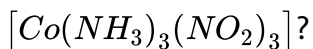
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5. Which of the following complex is more stable and why?



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6. Which type of isomerism is exhibited by



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Questions For Assessment Part I Short Answer Type I Questions 2 Marks

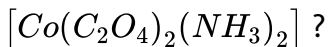
1. What are ambidentate ligand? How these ligands affects the coordination complex?

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2. What is the primary and secondary valency of chromium in the complex ion, dichlorodioxalatochromium(III) ?

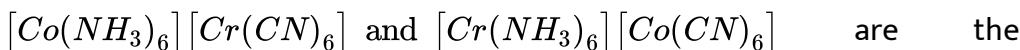
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3. How many isomers can be formed for the complex



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4. The complexes

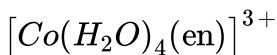


examples of which type of isomerism? State its definition.

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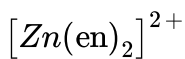
Questions For Assessment Part I Short Answer Type II Questions 3 Marks

1. Write the IUPAC name of the following coordination compounds.



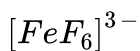
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2. Write the IUPAC name of the following coordination compounds.



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3. Write the IUPAC name of the following coordination compounds.



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4. Using IUPAC norms, write the formulae for the following?

Sodium tetrafluoridosilicate (IV)

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5. Using IUPAC norms, write the formulae for the following?

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

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6. Using IUPAC norms, write the formulae for the following?

Hexa aquachromium (III) chloride



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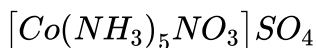
7. Draw all the possible isomers (structural and stereoisomeric) having the composition $CrBr_2Cl(NH_3)_4$.



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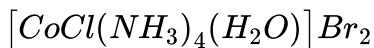
Questions For Assessment Part I Long Answer Type Questions 7 Marks

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



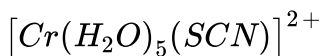
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2. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



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



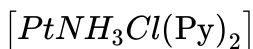
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4. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



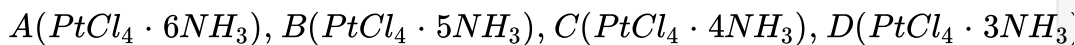
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5. Indicate the types of isomerism exhibited by the following complexes and draw the structures for these isomers.



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6. $PtCl_4$ and NH_3 may form five complexes,

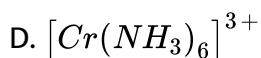
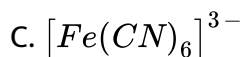
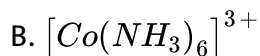


. One mole of each A, B, C, D and E reacts with excess of $AgNO_3$ to yield 4, 3, 2 and 1 mole(s) of $AgCl$ respectively, while E gives, no $AgCl$. The conductance of their solutions are in the order $A > B > C > D > E$. On the basis of Werner's theory, write their structure and give the total number of ions given by one complex.

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Questions For Practice Part II Multiple Choice Type Questions 1 Mark

1. Which of the following complex species does not involve in the inner orbital hybridisation?

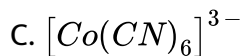
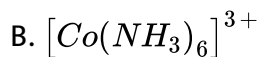
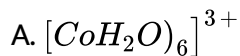


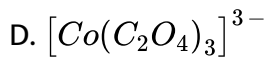
Answer: A



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2. In which of the following coordination entities the magnitude of Δ_0 (CFSE in octahedral field) will be maximum? (At. no. of Co = 27)





Answer: C

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3. In spectrochemical series, chlorine is above than water, i.e. $Cl > H_2O$, this is due to

- A. good π -acceptor properties of Cl
- B. strong σ -donor and good π -acceptor properties of Cl
- C. good π -donor properties of Cl
- D. larger size of Cl than H_2O

Answer: B

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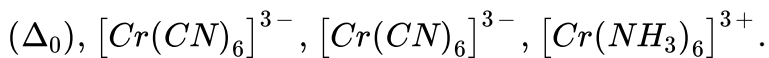
1. In which case splitting will be larger, 3d-orbital or 4d-orbital?

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2. Why are low spin tetrahedral complexes not formed?

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3. Arrange the following complex ions in the increasing order of crystal field splitting energy



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4. Why is CO a stronger ligand than Cl^- ?

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5. Magnetic moment of $[MnCl_4]^{2-}$ is 5.92 BM. Give reason.

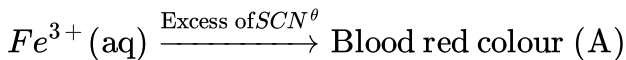
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6. Anhydrous $CuSO_4$ is white while hydrated $CuSO_4$ is blue. Why?

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Questions For Practice Part II Short Answer Type I Questions 2 Marks

1. Identify A and B in the given sequence of reaction. Also, write their IUPAC names and calculate spin only magnetic moment of B.



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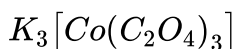
2. Why do compounds having similar geometry have different magnetic moment?

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3. 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.

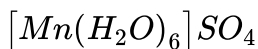
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4. Give the oxidation state, d-orbital occupation and coordination number of the central metal ion in the following complexes:



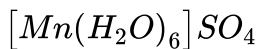
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5. Give the oxidation state, d-orbital occupation and coordination number of the central metal ion in the following complexes:



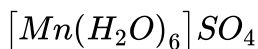
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6. Give the oxidation state, d-orbital occupation and coordination number of the central metal ion in the following complexes:



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

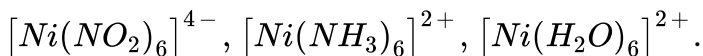


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8. Why are different colours observed in octahedral and tetrahedral complex for the same metal and same ligands?

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9. What will be the correct order for the wavelength of absorption in the visible region for the following?



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Questions For Practice Part I Short Answer Type II Questions 3 Marks

1. Explain 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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2. 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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3. Predict the number of unpaired electrons in the square planar $[Pt(CN)_4]^{2-}$ ion.

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4. Write the assumptions of crystal field theory. Discuss the pattern of splitting of d-orbitals under the effect of an octahedral crystal field.

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



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6. What is the crystal field stabilisation energy? How does the magnitude of Δ_0 decide the actual configuration of d-orbital in a coordination entity?

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7. 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

(i) $\Delta_0 > P$ (ii) $\Delta_0 < P$

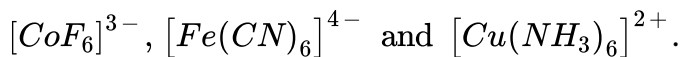
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8. The hexamanganate (II) ion contains five unpaired electrons, while the hexacyano ion contains only one unpaired electron. Explain using crystal field theory.



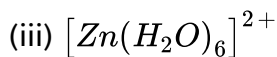
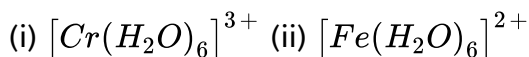
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9. Give the electronic configuration of the following complexes on the basis of crystal field splitting theory.



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



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11. $[Fe(CN)_6]^{4-}$ and $[Fe(H_2O)_6]^{2+}$, are of different colours in dilute solution, although in both the cases iron is in +2 oxidation state explain.



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

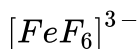
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Questions For Practice Part II Long Answer Type Questions 7 Marks

1. Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory.

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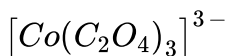
2. Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory.





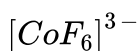
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3. Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory.



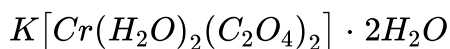
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4. Discuss the nature of bonding in the following coordination entities on the basis of valence bond theory.



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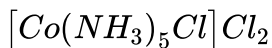
5. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give magnetic moment of the complex.





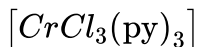
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6. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give magnetic moment of the complex.



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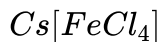
7. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give magnetic moment of the complex.



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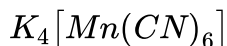
8. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination

number. Also give magnetic moment of the complex.



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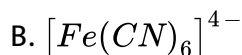
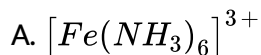
9. Write down the IUPAC name for each of the following complexes and indicate the oxidation state, electronic configuration and coordination number. Also give magnetic moment of the complex.

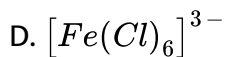
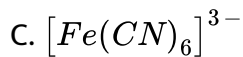


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Questions For Assessment Part II Multiple Choice Type Questions 1 Mark

1. Which complex compound possesses sp^3d^2 hybridisation ?





Answer: D

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2. Crystal field stabilisation energy for high spin d^4 octahedral complex is

A. $-0.6\Delta_0$

B. $-1.8\Delta_0$

C. $-1.6\Delta_0 + P$

D. $-1.2\Delta_0$

Answer: A

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1. Give one example for.

Neutral ligand of carbon

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2. Give one example for .

Positive ligand of nitrogen

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3. What are the factors on which internal energy depends ?

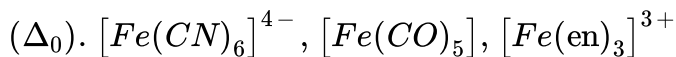
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4. An elements 'X' has one unpaired eelctron. Calculate its magnetic moment.

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5. Arrange the following complex ions in the increasing order of crystal field splitting energy



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Questions For Assessment Part II Short Answer Type I Questions 2 Marks

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

(Atomic number of Co = 27)

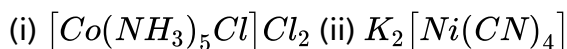
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2. deduce the structure of $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ considering the hybridisation of the metal ion. Calculate the magnetic moment (spin

only) of the species.

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3. Give the name, stereochemistry and the magnetic behaviour of the following complexes.



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4. 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 ethylenediamine (en) molecules.

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5. 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. (Atomic number of, Ni = 28)

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Questions For Assessment Part II Short Answer Type II Questions 3 Marks

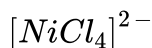
1. Compare the following complexes with respect to structural shapes of entities, magnetic behaviour and hybrid orbitals involved in units.



(Atomic number of Ni = 28, Co = 27).

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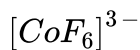
2. deduce the following complex with respect to structural shapes of entities, magnetic behaviour and hybrid orbitals involved in units.



(Atomic number of Ni = 28).

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



(Atomic number of Ni = 28, Co = 27).

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4. Explain the following.

Low spin octahedral complexes of nickel are not known.

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5. Explain the following.

CO is a stronger ligand than NH_3 for many metals.

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6. $[Ti(H_2O)_6]^{3+}$ absorbs light of wavelength 500 nm. Name one ligand which would form a Ti(III) complex absorbing light of lower wavelength than 500 nm and one ligand which would form a complex absorbing light of wavelength higher than 500 nm.

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7. $[Co(H_2O)_4]^{2+}$, $[CoCl_4]^{2-}$ and $[Co(dmg)_2]$ are complexes of Co(II) but magnetic moments of $[Co(H_2O)_4]^{2+}$ and $[CoCl_4]^{2-}$ are higher ($\mu = 3.87$ Bm for each) than $[Co(dmg)_2]$ [$\mu = 1.73$ BM], explain.

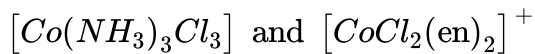
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Questions For Assessment Part II Long Answer Type Questions 7 Marks

1. What is spectrochemical series ?

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



(en = ethylene diamine and atomic number of Co is 27).

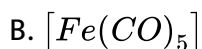
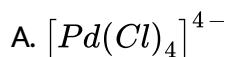
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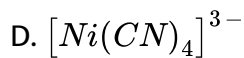
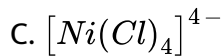
3. Describe the limitations of valence bond theory.

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Questions For Practice Part Iii Multiple Choice Type Questions 1 Mark

1. The most stable complex among the following is





Answer: D

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2. In metal carbonyl (organometallic) complexes, the M-C bond is

A. ionic

B. covalent with ionic character

C. covalent

D. coordinate covalent

Answer: D

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3. Give an example of a metal carbonyl having metal-metal bond.

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Questions For Practice Part Iii Very Short Answer Type Questions 1 Mark

1. CO is a stronger complexing agent than NH_3 , why?

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2. Which of the following complex is used for treatment of cancer ?

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3. Name the complex used as oxygen carrier in the blood.

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4. What is Wilkinson catalyst?

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5. Name the complex which is responsible for photosynthesis.

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6. $Ni(CO)_4$ is an example of _____ and _____ bonded organo metallics.

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7. Use EAN rule and predict the molecular formula of nickel carbonyl?

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1. Discuss the nature of bonding in metal carbonyls.

 [Watch Video Solution](#)

2. What is meant by stability of a coordination compound in solution?

State the factors which govern stability of complexes.

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3. What do you understand by stepwise stability constant and overall stability constant of a coordination compound? How are these two constants related?

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4. Discuss briefly giving an example in each case, the role of coordination compounds in

(i) biological systems (ii) medical chemistry

(iii) analytical chemistry

(iv) extraction / metallurgy of metals

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5. What are organometallic compounds? Give two examples.

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Questions For Practice Part Iii Short Answer Type Ii Questions 3 Marks

1. Calculate

The ratio of $[Ag(NH_3)_2]^+$ and $[Ag^+]$ in 0.1 M NH_3 solution.

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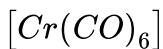
2. Calculate

The ratio of $[Ag(S_2O_3)_2]^{3-}$ and $[Ag^+]$ in 0.1 M $S_2O_3^{2-}$ solution. Given that the stability / formation constants (K_f) for $[Ag(NH_3)_2]^{2+}$ and $[Ag(S_2O_3)_2]^{3-}$ are 1.7×10^7 and 1.0×10^{13} respectively.

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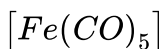
Questions For Practice Part Iii Long Answer Type Questions 7 Marks

1. Draw the structure of following homoleptic metal carbonyl.



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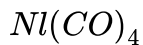
2. Draw the structure of following homoleptic metal carbonyl.



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3. Draw the structure of following homoleptic metal carbonyl.



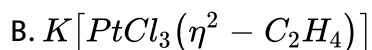
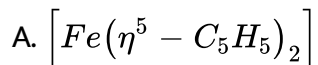
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4. Discuss important of coordination compounds in boilgical system.

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Questions For Assessment Part Iii Multiple Choice Type Questions 1 Mark

1. Which of the following organometallic compound has σ and π - bonds?



C. Both (a) and (b)

D. None of the above

Answer: B



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2. Match the Column and choose the correct option from the codes given below.

	Column I (Coordination compounds)		Column II (Elements)
A.	Chlorophyll	1.	Cobalt
B.	Vitamin B ₁₂	2.	Iron
C.	Haemoglobin	3.	Magnesium

Codes

A. $A \ B \ C$
1 2 3

B. $A \ B \ C$
3 1 2

C. $A \ B \ C$
3 2 1

D. $A \ B \ C$
2 3 1

Answer: B

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Questions For Assessment Part Iii Very Short Answer Type Questions 1 Mark

1. If an element have high positive charge then what will be its effect on the stability of complex?

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2. What is the reason for wide application and significance of coordination complex?

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Questions For Assessment Part Iii Short Answer Type I Questions 2 Marks

1. Write the structure of $Cr(CO)_6$ and $V(CO)_6$.

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2. Explain the following.

Complex that is used as an anti-knock.

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3. Explain the following.

Complex of calcium used in the treatment of lead poisoning.

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Questions For Assessment Part Iii Short Answer Type Ii Questions 3 Marks

1. What do you understand by stepwise stability constant and overall stability constant of a coordination compound? How are these two

constants related?

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Questions For Assessment Part Iii Long Answer Type Questions 7 Marks

1. Name the following:

Ring that is attached to Fe^{2+} in haemoglobin.

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2. Name the following:

Vitamin B_{12} is a coordination compound of which element.

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3. Name the following:

Complex that is used in homogeneous and heterogeneous catalysis.



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4. Give an example for each when coordination compounds play an important role in photosynthesis by plant.



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5. Give an example for each when coordination compounds play an important role in removal of excess of iron present in our body.



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6. Give an example for each when coordination compounds play an important role in development of photographic film.



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Very Short Answer Type Questions

1. Fill in the blanks

Ethylene diamine is an example of ligand.

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2. Fill in the blanks

The IUPAC name of $Fe(CO)_5$ is

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3. Fill in the blanks

Dimethyl glyoxime is used for the gravimetric estimation of ... ion.

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4. Fill in the blanks

EDTA is a ligand.

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5. Fill in the blanks

$K_4[Fe(CN)_6]$ is a complex compound, but potash alum is a

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6. Fill in the blanks

One molecule of $[Pt(NH_3)_6]Cl_4$ gives ions in solution and requires of $AgNO_3$ for complete precipitation of chloride ions.

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7. Fill in the blanks

Geometrical isomerism is not observed in complex of coordination number 4 of geometry.

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8. Fill in the blanks

The type of magnetism exhibited by $[Mn(H_2O)_6]^{2+}$ ion is

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9. Match the following

- | | |
|------------------------|--------------------------------------|
| I. Double salt | (a) $[Co(NH_3)_3Cl_3]$ |
| II. Neutral molecule | (b) Hexadentate |
| III. EDTA | (c) Bidentate |
| IV. $Ni(CO)_4$ | (d) Paramagnetic |
| V. $[Cr(NH_3)_6]^{3+}$ | (e) $FeSO_4(NH_4)_2SO_4 \cdot 6H_2O$ |
| VI. Low spin complex | (f) $K_4[Fe(CN)_6]$ |
| VII. Glycine | (g) Diamagnetic |

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10. What type of isomers are the following



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11. What type of isomers are the following



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12. What type of isomers are the following



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13. What type of isomers are the following



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Short Answer Type I Questions

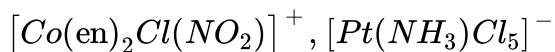
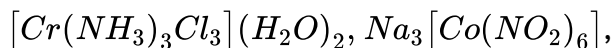
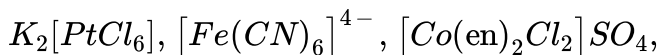
1. What is the difference between molecular compound and complex compound?

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2. Define the terms : central ion, complex ion, ligand, coordination number.

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3. Give IUPAC names of the following compounds



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4. Write the formula of the following complexes:

Hexaamminaenickel (II) chloride,



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5. Write the formula of the following complexes:

Hexaammine chromium (III) nitrate,



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6. Write the formula of the following complexes:

Potassium hexachloroplatinate (IV),

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7. Write the formula of the following complexes:

Trinitratoamminecobalt (III),

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8. Potassium hexacyanoferrate (II) is:

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9. Write the formula of the following complexes:

Potassium hexocyanoferrate (III),

 [Watch Video Solution](#)

10. Write the formula of the following complexes:

Potassium trioxalatoaluminate (III),

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11. Write the formula of the following complexes:

Dichlorobis(ethylenediamine)-cobalt(III)sulphate

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12. Write the formula of the following complexes:

Ammonium tetrathiocyanatodiamminechromate (III),

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13. Write the formula of the following complexes:

Potassium pentachloromonoammine platinate (IV).



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14. Write a note on Werner's theory of coordination compounds.

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15. Give some examples of molecular (non-ionic) complexes.

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16. Give some examples of ionic complexes.

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17. What is the symbol used before the bridging ligand while naming a complex.

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18. Give the order of naming the ligands.

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19. What type of numeral is used to indicate oxidation state of central ion? Write the structure of $Fe(CO)_5$.

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20. Give examples of cis-trans isomerism exhibited by complexes of coordination number 4 and 6.

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21. Give some examples of optical isomerism exhibited by complexes of coordination number 6.

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22. What are primary and secondary valencies?

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23. How optical isomers are designated?

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24. $[Co(NH_3)_5Br]SO_4$ and $[Co(NH_3)_5SO_4]Br$ show isomerism.

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25. $KCl \cdot MgCl_2 \cdot 6H_2O$ is a ... , but $K_4[Fe(CN)_6]$ is a ...

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26. $[Co(NH_3)_4Cl_2]Cl$ give ... Cl^- ions in solution.

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27. Whether cis-trans isomerism is exhibited by $[Co(en)_2Cl_2]Cl$?

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28. Whether $[Cr(en)_3Cl_3]$ exhibits optical isomerism or not?

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29. Complexes of type MA_4B_2 can exist as ... isomers.

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30. Write the possible isomers of the following compounds.

(i) $[Cr(en)_3]Cl_3$ (ii) $[Cr(en)_2Cl_2]Cl$



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31. How many isomers are there for the complex $[Co(NH_3)_3Cl_3]$?



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32. Which type of octahedral complexes show geometrical isomerism ?



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33. Which type of octahedral complexes show geometrical isomerism ?



[Watch Video Solution](#)

34. Does $[Co(NH_3)_6]Cl_3$ show optical isomerism?



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35. Give an example of two hydrate isomers.

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36. Give an example of two ionisation isomers.

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37. What do you understand by hydrogen bond ?

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38. Give an example of two coordination isomers.

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39. Draw all possible isomers of $[Cr(NH_3)_3Cl_3]$.



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40. Give one example of both ionisation and hydrate isomerism in single compound.



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41. Draw the structure of triamminetrichloroplatinum (IV) chloride.



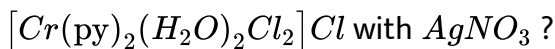
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42. $[Rh(en)_3][IrCl_6]$ and $(Rh(en)_2Cl_2)Ir(en)Cl_4$ are which type isomers ?



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43. How many chloride ions can be precipitated from an aqueous solution of



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44. How a double salt can be distinguished from a complex salt?

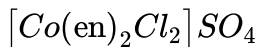
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Short Answer Type II Questions 3 Marks

1. What is the coordination number of each atom in ccp structure?

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2. Write the name of the compound :



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3. Write the formula of the following complexes:

Potassium pentachloromonoammine platinate (IV).

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4. What is the IUPAC name of the following compound $K_3[Fe(CN)_6]$

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5. Write the formula of the following complexes:

Ammonium tetrathiocyanatodiamminechromate (III),

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6. Write the formula of the following complex:

Tris (ethylene diamine) cobalt (III) sulphate.

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7. Write short notes on : Werner's theory of co-ordination compounds.

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8. Write the name of the compound : $[(C_2H_5)_5N]_2[ZnCl_4]$

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Long Answer Type Questions 7 Marks

1. Write various postulates and applications of valence bond theory in coordination compounds.

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2. Distinguish between inner and outer orbital complex with suitable examples.

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3. Account of the following on the basis of valence bond theory

$[Ni(CN)_4]^{2-}$ is diamagnetic and square planar.

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4. Explain 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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5. Discuss in brief the crystal field theory. How does it differ from valence bond theory?

Explain the fact that $[CoF_6]^{3-}$ is paramagnetic whereas $[Co(NH_3)_6]^{3+}$ is diamagnetic although both are octahedral.

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6. Between $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ which is a low spin complex and why?

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7. Tetrahedral complexes do not show low spin configuration. Explain.

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8. Discuss briefly how crystal field theory explains the magnetic properties of complexes of transition metals.

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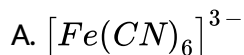
9. Discuss the structure of following complexes on the basis of CFT.

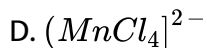
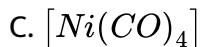
(a) $[Cu(NH_3)_6]^{3+}$ (b) $[Fe(CN)_6]^{4-}$

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Chapter Practice Multiple Choice Type Questions 1 Mark

1. Which of the following is diamagnetic ?





Answer: B

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2. The complexes $[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_6][Co(CN)_6]$ are the examples of which type of isomerism? State its definition.

- A. Ionisation isomerism
- B. Linkage isomerism
- C. Coordination isomerism
- D. Solvate isomerism

Answer: C

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1. The coordination number of Fe in $[Fe(CN)_6]^{4-}$ is

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

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3. Write the ionisation isomer of $[Pt(NH_3)NO_2]Cl$.

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4. What is the role of synergic bonding in metal-carbonyl complexes?

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1. Discuss the role of complex in analytical chemistry

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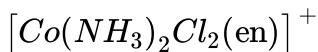
2. Discuss the role of complex in medicines

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3. What is crystal field splitting among octahedral and tetrahedral crystal fields? In which case, the magnitude of crystal field splitting is larger?

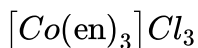
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4. Draw all the isomers (geometrical and optical) of



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



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



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7. A complex of the type $[M(AA)_2X_2]^{n+}$ is known to be optically active. What does this indicate about the structure of complex? Give one example of such complex.

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Chapter Practice Short Answer Type II Questions 3 Marks

1. Differentiate between weak field and strong field coordination entity.

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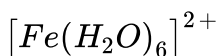
2. Write the assumptions of crystal field theory. Discuss the pattern of splitting of d-orbitals under the effect of an octahedral crystal field.

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3. The most stable oxidation state of iron is

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4. Using crystal field theory draw energy level diagram, write electronic configuration of the central metal atom or ion and determine the magnetic moment value in the following:



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5. Using crystal field theory draw energy level diagram, write electronic configuration of the central metal atom or ion and determine the magnetic moment value in the following:



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6. Using valence bond theory, explain the following in relation to the complexes, given below: $[Mn(CN)_6]^{3-}$, $[Cr(H_2O)_6]^{3+}$.

Type of hybridisation

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7. Using valence bond theory, explain the following in relation to the complexes, given below: $[Mn(CN)_6]^{3-}$, $[Cr(H_2O)_6]^{3+}$.

Magnetic behaviour

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8. Using valence bond theory, explain the following in relation to the complexes, given below: $[Mn(CN)_6]^{3-}$, $[Cr(H_2O)_6]^{3+}$.

Magnetic behaviour

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1. Give detailed description of CFT for different types of ligand and explain how CFT explain colour of coordination compound? Use suitable examples to explain.

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2. Explain the hybridisation, geometry, magnetic properties, IUPAC nomenclature and comparative stability of $[Fe(CN)_6]^{4-}$ and $[Fe(CN)_6]^{3-}$.

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

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4. Giving a suitable example for each, explain the following.

(i) Linkage isomerism (ii) Chelating ligand

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5. $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ contain cobalt in +3 oxidation state, but $[Co(NH_3)_6]^{3+}$ is diamagnetic while $[CoF_6]^{3-}$ is paramagnetic with magnetic moment 4.90 BM. Explain.

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6. $[Co(NH_3)_6]^{3+}$ and $[CoF_6]^{3-}$ contain cobalt in +3 oxidation state, but $[Co(NH_3)_6]^{3+}$ is diamagnetic while $[CoF_6]^{3-}$ is paramagnetic with magnetic moment 4.90 BM. Explain.

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