



CHEMISTRY

BOOKS - SURA CHEMISTRY (TAMIL ENGLISH)

CO-ORDINATION CHEMISTRY

Evaluation

1. The sum of primary valency and secondary valance of the metal M in the complex $[M(en)_2(Ox)]Cl$ is L

A. 3

B. 6

C. -3

D. 9

Answer: D



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2. An excess of silver nitrate is added to 100 ml of a 0.02M solution of pentaaquachloridochromium (III) chloride. The number of moles of AgCl precipitated would be

- A. 0.02
- B. 0.002
- C. 0.01
- D. 0.2

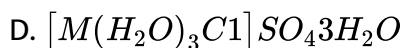
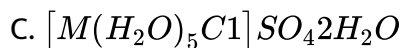
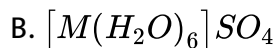
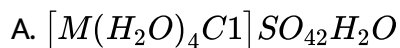
Answer: B



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3. A complex has molecular formula $\text{MSO}_4 \cdot 4\text{C}_6\text{H}_6$. The aqueous solution of it gives white precipitate with Barium chloride solution and no precipitate is obtained when it is treated with silver nitrate solution. If

the secondary valence of the metal is six ,which one of the following correctly represents the complex?

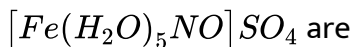


Answer: C



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4. Oxidation state of Iron and the charge on the ligand NO in



A. +2 and 0 respectively

B. +3 and 0 respectively

C. +3 and -1 respectively

D. +1 and +1 respectively

Answer: C

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5. As per IUPAC guidelines .the name of the complex $[Co(ONO)Cl] Cl$ is

- A. Chlorobisethlyenediaminenitritocobalt (III) chloride
- B. Chloridobis (ethane -1,2- diamine) nitro k-Ocobaltate (III) chloide
- C. Chloridobis (ethane -1,2-diamine) nitrito k-Ocobalt (II) chloride
- D. chloridobis (ethane -1,2-diamine)nitro k-Ocobalt (III) chloride

Answer: A

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6. IUPAC name of the complex $K_3 [Al(C_2O_4)_3]$ is

A. Potassiumtrioxalatoaluminium (III)

B. Potassiumtrioxalatoaluminate (II)

C. Potassiumtrisoxalatoaluminate (III)

D. Potassiumtrioxalatoaluminate (III)

Answer: D



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7. A magnetic moment of 1.73BM will be shown by one among the following

A. $TiCl_4$

B. $[CoCl_6]^{4-}$

C. $[Cu(NH_3)_4]^{2+}$

D. $[Ni(CN)_4]^{2-}$

Answer: C

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8. Crystal field stabilization energy for high spin d^5 octahedral complex is

A. $-0.6\delta_0$

B. 0

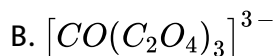
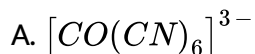
C. $2(P - \delta_0)$

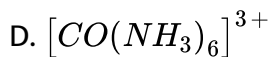
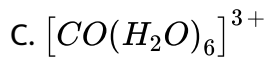
D. $2(P + \delta_0)$

Answer: B

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9. In which of the following coordinaton entities the magnitude of Δ_0 will be maximum?



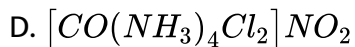
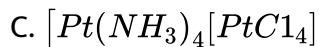
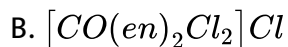
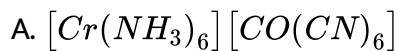


Answer: A



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10. Which one the following will give a pair of enantiomorphs?



Answer: B



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11. Which type of isomerism is exhibited by $[Pt(NH_3)_2Cl_2]$

- A. Coordination isomerism
- B. Linkage isomerism
- C. Optical isomerism
- D. Geomerical isomerism

Answer: D



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12. How many geometrical isomers are possible for



- A. 3
- B. 4
- C. 0
- D. 15

Answer: A



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13. Which one of the following pairs represents linkage isomers?

- A. $[Cu(NH_3)_4][PtCl_4]$ and $[Pt(NH_3)_4][CuCl_4]$
- B. $[Co(NH_3)_5(NO_3)SO_4]$ and $[Co(NH_3)_5(ONO)]$
- C. $[Co(NH_3)_4(NCS)_2]Cl$ and $[Co(NH_3)_4(SCN)_2]Cl$
- D. both (b) and (c)

Answer: C



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14. Which kind of isomerism is possible for a complex $[Co(NH_3)_4Br_2]Cl$

?

A. geometrical and ionization

B. geometrical and optical

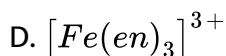
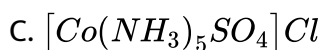
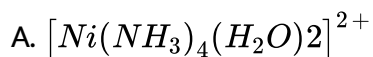
C. optical and ionization

D. geometrical only

Answer: A

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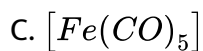
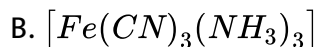
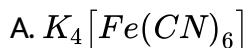
15. Which one of the following complex is not expected to exhibit isomerism?



Answer: D

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16. A complex in which the oxidation number of the metal is zero is

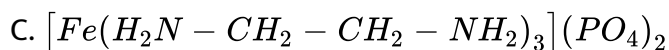
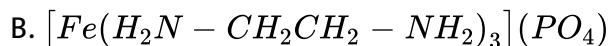
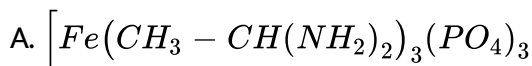


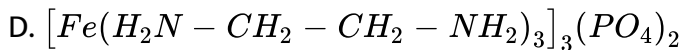
D. both (b) and (c)

Answer: C

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17. Formula of tris (ethane 1,2-diamine) iron (II) phosphate

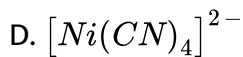
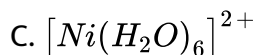
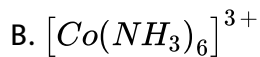
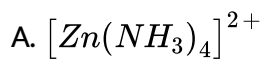




Answer: D

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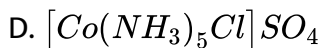
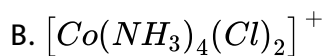
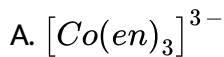
18. Which of the following is paramagnetic in nature?



Answer: C

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19. Fac-mer isomerism is shown by



Answer: C



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20. Choose the correct statement.

A. Square planar complex are more stable than octahedral complex

B. The spin only magnetic moment of $[Cu(Cl)_4]^{2-}$ is 1.732 BM and it has square planar structure

C. Crystal field splitting energy (Δ_0) of $[FeF_6]^{4+}$ is higher than the (Δ_0) of $[Fe(CN)_6]^{2+}$

D. Crystal field stabilization energy of $[V(H_2O)_6]^{2+}$ is higher than the crystal field stabilization of $[Ti(H_2O)_6]^{2+}$

Answer: D

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Answer The Following The Questions

1. (i) Write the IUPAC names for the following complexes.



(ii) What is meant by piezo electricity?

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2. Write the formula for the following coordination compounds.

(a) . Potassiumhexacyanidoferrate(II)

(b) . Pentacarbonyliron (0)

© . Pentaamminenitrito -k-N-cobalt (III) ion

(d) . Hexaamminecobalt (III) sulphate

(e) . Sodiumtetrafluoridodihydroxido chromate (III)

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3. Arrange the following in order of increasing molar conductivity

(i) . $Mg[Cr(NH_3)(Cl)_5]$

(b) $[Cr(NH_3)_5Cl]_3[CoF_6]_2$

(iii) $[Cr(NH_3)_3Cl_3]$

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4. Ni^{2+} is identified using alcoholic solution of dimethyl glyoxime. Write the structural formula for the rosy red precipitate of a complex formed in the reaction.

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5. $[CuCl_4]^{2-}$ exists while $[CuI_4]^{2-}$ does not exist why?

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6. Calculate the ratio of $\frac{[Ag^+]}{[Ag(NH_3)_2]^+}$ in 0.2M solution of NH_3 .If the stability constant for the complex $[Ag(NH_3)_2]^+$ is 1.7×10^7

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7. Give an example of coordination compound used in medicine and two examples of biologically important coordination compounds.

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8. Based VB theory explain why $[Cr(NH_3)_6]^{3+}$ is paramagnetic , while $[Ni(CN_4)]^{2-}$ is diamagnetic.

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9. Draw all possible geometrical isomers of the complex $[Co(en)_2Cl_2]^+$ and identify the optically active isomer.

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10. $[Ti(H_2O)_6]^{3+}$ is coloured, while $[Sc(H_2O)_6]^{3+}$ is colourless -explain

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11. Give an example of complex of the type $[Ma_2b_2c_2]$ where a,b,c are monodentate ligands and give the possible isomers.

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12. Give one test to differentiate

$[Co(NH_3)_5Cl]SO_4$ and $[Co(NH_3)_5SO_4]Cl$.

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13. In an octahedral crystal field, draw the figures to show splitting of d orbitals

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14. What is linkage isomerism ? Explain with an example.

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15. Write briefly about of the applications of coordination compouds in volumetric analysis.

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16. Calassify the following ligand based on the number of donor atoms.



(d) triaminotriethylamine

(e) pyridine

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17. Give the difference between double salts and coordination compounds.

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18. Write the postulates of Warner's theory.

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19. $[Ni(CN)_4]^{2-}$ is diamagnetic ,while $[NiCl_4]^{2-}$ is paramagnetic ,explain using crystal field theory.

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20. Why tetrahedral complex do not exhibit geometrical isomerism?

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21. Explain optical isomerism in coordination compounds with an example.

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22. What are hydrate isomers? Explain with an example.

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23. What is crystal field splitting energy?

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24. What is crystal field stabilization energy (CFSE) ?

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25. A solution of $[Ni(H_2O)_6]^{2+}$ is green whereas a solution of $[Ni(CN_4)]^{2-}$ is colorless -Explain.

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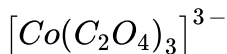
26. Discuss briefly the nature of bonding in metal carbonyls.

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27. What is the coordination entity formed when excess of liquid ammonia is added to an aqueous solution of copper sulphate?

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28. On the basis of VB theory explain the nature of bonding in



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29. What are the limitations of VB theory?



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30. Write the oxidation state, coordination number, natures of ligand magnetic property and electronic configuration in octahedral crystal field for the complex $K_4[Mn(CN)_6]$.



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Evaluation Yourself

1. When a coordination compounds $CrCl_3 \cdot 4H_2O$ is mixed with silver nitrate solution one mole of silver chloride is precipitated per mole of the compounds. There are no free solvent molecules in that compound. Assign the secondary valence to the metal and write the structural formula of the compounds.

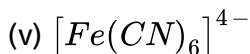
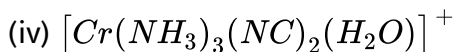
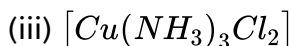
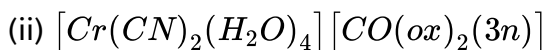
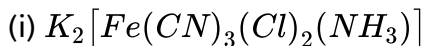
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2. In the complex $[Pt(NO_2)(H_2O)(NH_3)_2]Br$, identify the following

- i. Central metal atom/ ion
- ii. Ligands (s) and their types
- iii. Coordination entity
- iv. Oxidation number of the central metal ion
- v. Coordination number

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3. Write the IUPAC name for the following compounds.



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4. A solution of $[Co(NH_3)_4I_2]Cl$ when treated with $AgNO_3$ gives a white precipitate. What should be the formula of isomer of the dissolved complex that gives yellow precipitate with $AgNO_3$? What are the above isomers called?

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5. The spin only magnetic moment of Tetrachloridomanganate (II) ion is 5.9 BM. On the basis of VBT, predict the type of hybridisation and

geometry of the compound.

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6. Predict the number of unpaired electrons in $[CoCl_4]^{2-}$ ion on the basis of VB

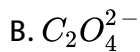
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7. The mean pairing energy and octahedral field splitting energy of $[Mn(CN)_6]^{3-}$ are $28,800\text{cm}^{-1}$ and 38500cm^{-1} respectively. Whether this complex is stable in low spin or high spin?

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Choose The Correct Answers

1. Identify the ambidentate ligand among the following.



Answer: C and D



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2. An aqueous solution of $(PdCl_2)4NH_3$ when treated with excess of $AgNO_3$ precipitated 2 moles of $AgCl$. Predict the secondary valency of the compound.

A. 2

B. 3

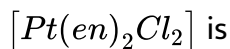
C. 4

D. 6

Answer: C

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3. The total number of electrons donate by ligand to platinum ion in



A. 8

B. 10

C. 12

D. 14

Answer: C

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4. Primary and secondary valencies of Cu in $[Cu(NH_3)_4]SO_4$ is

A. 4,4

B. 2,4

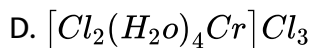
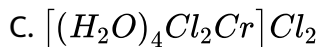
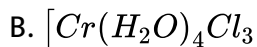
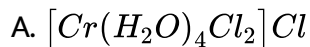
C. 4,1

D. 4,2

Answer: B

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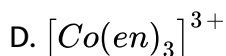
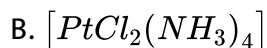
5. Structural formula of tetra aquadichlorido Chromium (III) chloride .



Answer: A

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6. Which of the following octahedral complexes do not show geometrical isomerism?

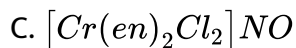
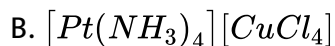
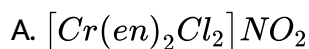


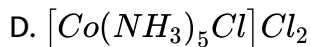
Answer: D



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7. Co-ordination isomerism is exhibited by





Answer: B



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8. The spin only magnetic moments of $[MnBr_4]^{2-}$ is 5.9 BM .Geometry of the complex ion is

- A. Tetrahedral
- B. Octahedral
- C. Square planar
- D. Pentagonal pyramidal

Answer: A



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9. $[Fe(H_2O)_6]^{3+}$ and $[Fe(CN)_6]^{3-}$ differ in

- A. magnetic nature
- B. co-ordination number
- C. oxidation number
- D. Structure

Answer: A



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10. According to CFT, five d-orbitals of an octahedral complex split to give

- A. One orbital with lower energy and four orbitals with higher energy
- B. Two orbitals with lower energy and three orbitals with higher energy

C. Three orbitals with lower energy and two orbitals with higher energy

D. Four orbitals with energy and one orbitals with higher energy .

Answer: C

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11. IUPAC name of $H_2[PtCl_6]$ is

A. Hexa chloridoplatinum (IV) acid

B. Hexa chloridoplatinum (IV) acid

C. Hexachloridoplatinic (IV) acid

D. Dihydrogenhexachloro platinate (IV)

Answer: D

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12. Which of the following is correct statement?

- A. $[Ti(H_2O)_6]^{3+}$ is coloured complex
- B. $[Sc(H_2O)_6]^{3+}$ is colourless complex
- C. d-d transition is not possible in $[Sc(H_2O)_6]^{3+}$ complex
- D. All of these

Answer: D

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13. Naming the ligand in $[M(en)_2]^{n+}$ starts with

- A. Di
- B. Bi
- C. Bis
- D. any of these

Answer: C

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14. Ligand Which is used to treat hard water

A. NH_3

B. Ox

C. en

D. EDTA

Answer: D

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15. The name of complex ion, $[Fe(CN)_6]^{3-}$ is

A. Tricyanoferrate (III) ion

- B. Hexacyano ion (III) ion
- C. Hexacyanitoferrate (III) ion
- D. Hexacyanido ferrate (III) ion

Answer: D

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16. Which of these statement about $[Co(CN)_6]^{3-}$ is true?

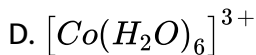
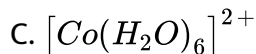
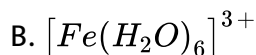
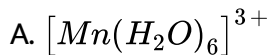
- A. $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a high spin configuration
- B. $[Co(CN)_6]^{3-}$ has four unpaired electrons and will be in a low spin configuration
- C. $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be in a high spin configuration

D. $[Co(CN)_6]^{3-}$ has no unpaired electrons and will be low spin configuration

Answer: D

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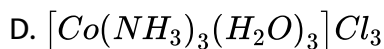
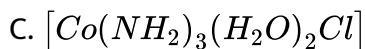
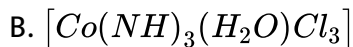
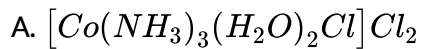
17. Among the following complexes the one which shows zero crystal field stabilisation energy is



Answer: B

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18. The hypothetical complex triamminediaqua chloridocobalt (III) chloride can be represented as



Answer: A



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19. Which of the following co-ordination compounds would exhibit optical isomerism?

A. Pentaamminenitrocobalt (III) iodide

B. Diamminedichloroplatinum (II)

C. Tris-(ethylenediamine)cobalt (III) bromide

D. Transdicyanobis(ethylenediamine) chromium (III) chloride

Answer: C

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20. In Co-ordination compound s. $[Cr(en)_3][CrF_6]$

A. a)ligand is en (ethylenediamine)

B. b)Oxidation state of central atom is +3

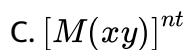
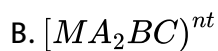
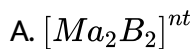
C. c)Central metal is Cr (in anionic complex)

D. d)Cation complex is $[Co(NH_3)_4Cl_2]^+$

Answer: D

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21. Which among the following square planar complex will exhibit geometrical isomerism?



D. all the above

Answer: D



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22. Predict the geometry and hybridisation of $Fe(CO)_5$

A. Trigonal planar dsp^3

B. Trigonal bipyramidal dsp^3

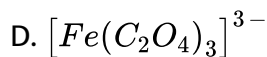
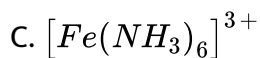
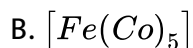
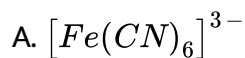
C. Square planar dsp^2

D. Octahedral d^2p^3

Answer: B

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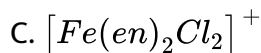
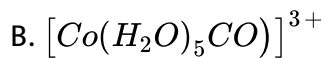
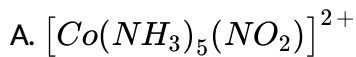
23. Coordination compounds are stabilised by Chelate effect . Which among the following is the most stable complex?



Answer: D

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24. Which of the following will exhibit linkage isomerism?

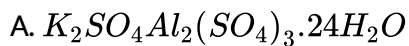


D. all the above

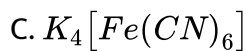
Answer: A

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25. Which is a double salt ?



B. NaCl

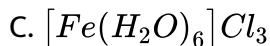
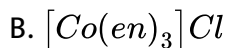
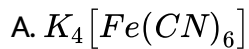


D. KCl

Answer: A

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26. An example of complex compound having coordination number 4



Answer: D



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27. The geometry of $[Cu(NH_3)_4]^{2+}$ complex ion

A. Linear

B. Tetrahedral

C. Square planar

D. Angular

Answer: C



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28. An example of a chelating ligand is

A. NO_2^-

B. chloro

C. Bromo

D. en

Answer: D



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29. The geometry of complex ion $[Fe(CN)_6]^{4-}$ is

- A. tetrahedral
- B. square planar
- C. octahedral
- D. triangular

Answer: C

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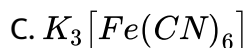
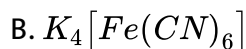
30. The oxidation number of nickel in the complex ion $[NiCl_4]^{2-}$ is

- A. +1
- B. -1
- C. +2
- D. -2

Answer: C

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31. Which is not an anionic complex?



Answer: A



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32. The geometry of $[Ni(CN)_4]^{2-}$ is

A. Tetrahedral

B. square planar

C. Triangular

D. Octahedral

Answer: B

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33. An example of an ambidentate ligand is

A. CN^-

B. Cl^-

C. NO^-

D. I^-

Answer: C

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34. $[FeF_6]^{4-}$ Paramagnetic because

- A. F^- is a weaker ligand
- B. F^- is a strong ligand
- C. F^- is a flexdentate ligand
- D. F^- is a chelating ligand

Answer: A

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35. In $[Fe^{11}(CN)_6]^{4-}$ the central metal ion is

- A. Fe
- B. Fe^{+2}
- C. Fe^{+3}
- D. CN^-

Answer: B

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36. The coordination number of Ni(II) in $[Ni(CN)_4]^{2-}$ is

- A. 2
- B. 4
- C. 5
- D. 6

Answer: B



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37. The name of $[Pt^{IV}(NH_3)_2Cl_2]^{2+}$ is

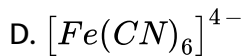
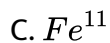
- A. Diamminedichloroplatinum (IV) ion
- B. Diamminedichloroplatinate (IV)
- C. Diamminedichloroplatinum

D. Dichlorodiammineplatinum (IV)ion

Answer: A

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38. For a compound $K_4[Fe(CN)_6] \rightarrow 4K^+ + [Fe(CN)_6]^{4-}$ the complex ion is



Answer: D

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39. A metal ion from the first transition series forms an octahedral complex with magnetic moment of 4.9 BM and another octahedral complex which is diamagnetic .The metal ion is



Answer: A



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40. Paramagnetic moment is expressed in

A. Debye unit

B. K Joules

C. BM

D. ergs

Answer: C

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41. The type of isomerism found in the complex



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

Answer: D

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42. What is the electronic configuration of Cr in $K_3[Cr(C_2O_4)_3H_2O]$.

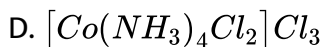


Answer: A



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43. Which of the following complex does not give white precipitate with $AgNO_3$?



Answer: B

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44. Consider the following statement and identify the incorrect statement(s)

(i) . CN^- is a powerful ligand.

(ii) . Hemoglobin is a monomer and myoglobin is a tetramer.

(iii). Cis -Pt $(NH_3)_2Cl_2$ is an anti -tumour drug.

A. only (i)

B. only (ii)

C. only (iii)

D. both (i) and (iii)

Answer: B

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45. Which of the following is wrong about double salts?

- A. retains their properties only in solid state
- B. contains two or more salt in stoichiometric proportions
- C. they don't dissociate into its constituent ions
- D. none of the above

Answer: C



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46. An example of cationic complex is

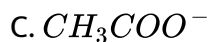
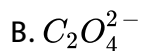
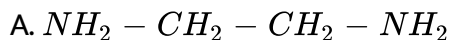
- A. $[Co(NH_3)_6]Cl_3$
- B. $K_2[CoCl_4]$
- C. $[Pt(NH_3)_4][CuCl_4]$
- D. $K_3[Fe(CN)_6]$

Answer: A



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47. An example of unidentate ligand is



D. both (b) and (c)

Answer: C



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48. Which of the following is not true about secondary valency?

A. It corresponds to the co-ordination number of metal

- B. It is satisfied by negative ions or neutral molecule
- C. They are non directional in nature
- D. both a and b

Answer: C

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49. A 'd' block metal ion has magnetic moment of $1.7332BM$. The number of unpaired electrons are

- A. 1
- B. 2
- C. 3
- D. 4

Answer: A

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50. Paramagnetism is the property of

- A. Paired electrons
- B. completely filled electronic sub-shells
- C. unpaired electrons
- D. completely vacant electronic sub-shells

Answer: C



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51. The sum of primary valency and secondary valance of the metal M in the complex $[M(en)_2(Ox)]Cl$ is L

- A. 3
- B. 6
- C. - 3

D. 9

Answer: D

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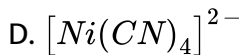
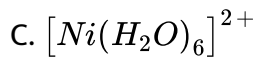
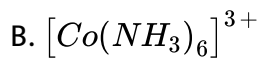
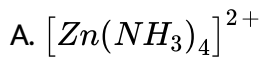
52. IUPAC name of the complex $K_3 [Al(C_2O_4)_3]$ is

- A. Potassiumtrioxalatoaluminium (III)
- B. Potassiumtrioxalatoaluminate (II)
- C. Potassiumtrioxalatoaluminate (III)
- D. Potassiumtrioxalatoaluminate (III)

Answer: D

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53. Which of the following is paramagnetic in nature?



Answer: C

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54. How many geometrical isomers are possible for $[Pt(Py)(NH_3)(Br)(Cl)]$?

A. 3

B. 4

C. 0

D. 15

Answer: A

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55. In $CoCl_3 \cdot 6NH_3$, the no of ionisable Cl^- ions in the complex is

A. $3Cl^-$

B. $2Cl^-$

C. Cl^-

D. 0

Answer: A



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Fill In The Blanks

1. The isomerism exhibited by the complexes

$[Co(NH_3)_6][Cr(CN)_6]$ and $[Cr(NH_3)_8][Co(CN)_6]$ is

A. Geometrical

B. Coordination

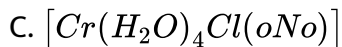
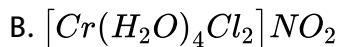
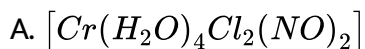
C. linkage

D. Ionisation

Answer: B

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2. The ionisation isomers of $[Cr(H_2O)_4(NO_2)]Cl$ is



D. both (a) and (b)

Answer: B

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3. Werner's theory was not able to explainof coordination compounds

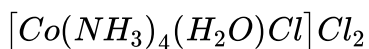
- A. colour
- B. magnetic properties
- C. both (a) and (b)
- D. neither (a) nor (b)

Answer: C

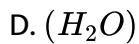
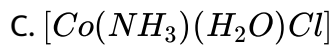


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4. Identify the Co-ordination entity in the given complex



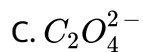
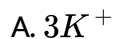
- A. Cl_2
- B. $(NH_3)_4$



Answer: C

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5. Pickout the central metal ion in the complex $K_3[Al(C_2O_4)_3]$



D. both (a) and (b)

Answer: B

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6. The coordination polyhedron of the complex $[Cr(H_2O)_6]Cl_3$ is

A. square planar

B. Tetrahedral

C. trigonal

D. octahedral

Answer: D



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7. The primary and secondary valencies of $[CoCl_2(en)_2]SO_4$ are respectively

A. 4,6

B. 2,4

C. 4,4

D. 6,4

Answer: A



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8. $[Ni(CO)_4]$ is acomplex.

- A. anionic
- B. cationic
- C. neutral
- D. ambidentate

Answer: C



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9. According to IUPAC NO is

- A. nitro

B. nitrosyl

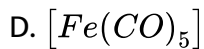
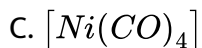
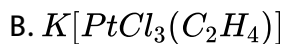
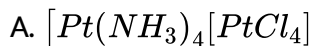
C. nitrate

D. nitrite

Answer: B

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10. Magnu's green salt in



Answer: A

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11. The ligand capable of coordinating in two or more ways with the central metal ion are calledligands.

- A. didentate
- B. tridentate
- C. ambidentate
- D. none of the above

Answer: C



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12. An example of ambidentate ligand is

- A. cyano
- B. nitro
- C. chloro
- D. triphenyl phosphine

Answer: A and B

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13. _____ is used as an antitumor drug in cancer treatment.

A. Ca-EDTA

B. Cis-platin

C. Sodium thio sulphate

D. Nickel chloride

Answer: B

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14. In an octahedral complex the $(n-1)$ d orbital are involved in hybridization. The complex is called _____ complex

A. inner orbital

B. low spin

C. spin paired

D. all the above

Answer: D

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15. According to crystal field theory ,The bond between the ligand and central metal atom is _____

A. Purely ionic

B. Purely covalent

C. Coordinate

D. 50 % ionic and 50 % covalent

Answer: A

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16. A Cobaltous complex $[Co(H_2O)_6]^{3+}$ absorbs orange light of 5900\AA

The colour of the complex is _____

- A. orange
- B. yellow orange
- C. blue yellow
- D. yellow

Answer: C

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17. Phthalo blue -a bright blue pigment is a complex of _____

- A. Copper (I) ion
- B. Copper (II) ion

C. Nickel (II) ion

D. Nickel (IV) ion

Answer: B

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18. The magnetic moment of $Cr(CO)_6$ is _____ BM

A. 0

B. 2.84

C. 4.90

D. 5.92

Answer: A

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19. Crystal field stabilization energy for high spin d^4 octahedral complex is

A. $-0.6\Delta_0$

B. $-1.8\Delta_0$

C. $-1.6\delta_0$

D. $-1.4\delta_0$

Answer: A



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20. The ambidentate ligands are _____

A. SCN⁻ and NCS

B. NO_2^- and ONO

C. both (a) and (b)

D. None

Answer: C



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21. _____ valencies are directional in nature

- A. Primary
- B. Secondary
- C. tertiary
- D. None

Answer: D



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22. In co-ordination complex ligand ammonia is written as _____

- A. ammine

B. amine

C. ammonal

D. none of these

Answer: A



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23. The number of trans positions in a octahedral complex is _____

A. 6

B. 4

C. 3

D. 2

Answer: C



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24. In co-ordination complex geometrical isomerism is possible for _____ complex

- A. square planar
- B. tetrahedral
- C. octahedral
- D. both (a) and (c)

Answer: D



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25. The chemical formula for diammine silver (I) chloride is _____

- A. $[Ag(NH_3)_2]Cl$
- B. $[Ag(NH_3)]Cl$
- C. $[Ag(NH_2)_2]Cl$
- D. $[Ag(NH_4)_2]Cl$

Answer: A

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26. Primary valency corresponds to the

A. oxidation state of the metal

B. co-ordination number

C. number of ligands

D. charge on the complex

Answer: A

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27. Magnetic moment is given by the formula _____

A. $\sqrt{n(n + 1)}$

B. $\sqrt{n(n+2)}$

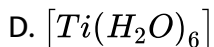
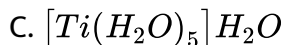
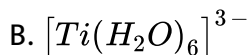
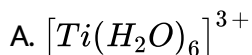
C. $\sqrt{(n+2)}$

D. $\sqrt{n^2 + (n+2)}$

Answer: B

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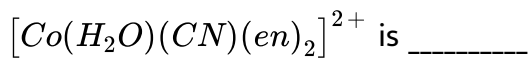
28. The structure of hexaquatitanium (III) ion is _____



Answer: A

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29. The oxidation state of the central metal ion in the complex



A. 0

B. +1

C. +2

D. +3

Answer: D



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30. The oxidation state of nickel in $[Ni(CO)_4]$ is _____

A. 0

B. +1

C. +2

D. +3

Answer: A

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Assertion Reason

1. Assertion : $[Cr(H_2O)_6]^{3+}$ is inner orbital complex.

Reason : H_2O is strong ligand.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: D

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2. Assertion :Tetrahedral complex do not show geometrical isomerism

Reason: The relative position of the ligand attached to the central metal atom is same with respect to each other.

- A. Both assertion and reason are true and the reason is the correct explanation of the assetion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: A



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3. Assertion: Complexes having ambidentate ligands exhibit linkage isomerism

Reason: Ambidentate ligands atom through either of its two different donor atoms.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: A



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4. Assertion : $[Co(NH_3)_4Cl_2(NO_2)]$ does not give a white precipitate with $AgNO_3$

Reason : Chlorine is present within the coordination sphere

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: A



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5. Assertion : Octahedral complex of type $[MABCDEF]^{n\pm}$ exhibits only two geometrical isomers.

Reason: As the number of different ligands increase the number of possible isomers decreases.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: D

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6. Assertion : According to Werner, The outer sphere of the complex is called the ionisation sphere .

Reason : The groups present in ionisation sphere are loosely bound to the central metal ion and do not ionize in solution.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false.

Answer: C

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7. Assertion : In $[Ni(en)_3]Cl_2$ the Coordination number of Ni^{2+} is 6.

Reason : en is a bidentate ligand.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion

- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false.

Answer: A

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8. Assertion : $[\text{Pt}(\text{NH}_3)_2\text{Cl}_2]$ is a heteroleptic complex.

Reason: NH_3 and Cl^- are weak ligands.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false

D. Both assertion and reason are false

Answer: C

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9. Assertion: $[FeFe_6]^{4-}$ is an inner orbital complex.

Reason: Coordination number of the complex is 4 and exhibits d^2sp^3 hybridisation.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: D



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10. Assertion: Octahedral complex $[Fe(CN)_6]^{3-}$ is a low spin complex .

Reason : It has a negative CFSE value.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: A



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11. Assertion: $[Ti(H_2O)_6]^{3+}$ colourless

Reason : d-d transition is not possible since the central metal has d^0

configuration.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false

Answer: D

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12. Assertion : $\text{Trans } [\text{CoCl}_2(\text{en})_2]^{2+}$ is optically inactive.

Reason: The coordination numbers of the complex is 6.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion

B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.

C. Assertion is true but reason is false

D. Both assertion and reason are false

Answer: B

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13. Assertion $[Pt(NH_3)_2Cl_2]$ is optically inactive

Reason: It has a plane of symmetry.

A. Both assertion and reason are true and the reason is the correct explanation of the assertion

B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.

C. Assertion is true but reason is false

D. Both assertion and reason are false

Answer: A

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14. Assertion $K_2[Ni(EDTA)]$ is more stable than $K_3[Al(C_2O_4)_3]$

Reason: Ni is a transition element whereas Al is non-transition element.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false.

Answer: B

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15. Assertion : Cis Platin is $[Pt(NH_3)_2Cl_2]$ is a square planar coordination complex

Reason: It is anti cancer drug.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false.

Answer: B



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16. Assertion: EDTA is used to remove lead poisoning.

Reason: EDTA is a chelating ligand.

- A. Both assertion and reason are true and the reason is the correct explanation of the assertion
- B. Both the assertion and reason are true but the reason is not the correct explanation of the assertion.
- C. Assertion is true but reason is false
- D. Both assertion and reason are false.

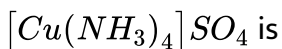
Answer: A



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Correct Statement S

1. Pick the correct statement, The IUPAC nomenclature for



- A. Tetrammine copper (II) sulphate
- B. Tetrammine Carbonate cobalt (III) chloride

C. Triamminetronitro -k N cobalt (III)

D. Triamminetriaquachromium (III) Chloride

Answer: A

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2. Which among the following statement is correct?

A. Magnitude of crystal field splitting energy depends only on ligand field.

B. Lower CFSE favour formation of low spin complex.

C. t_{2g} orbitals are three fold degenerate while eg orbitals are two fold degenerate

D. all the above

Answer: C

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Incorrect Statement S

1. Incorrect statement

- A. Polynuclear metal carbonyls are homonuclear
- B. Polynuclear metal carbonyls are heteronuclear
- C. Metal carbonyls contain carbonyls ligand
- D. Non-bridged metal carbonyls contains terminal carbonyl.

Answer: C



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Match The Following

1. Match the complex in Column I with the geometry and hybridisation in Column II.

`(##SUR_CHE_XII_V01_C05_E09_005_Q01.png" width="80%")>

A. 1 2 3 4
d c a b

B. 1 2 3 4
a b c d

C. 1 2 3 4
d b a c

D. 1 2 3 4
d a c b

Answer: A



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2. Match the list-I with list -II and select the correct answers using the code given below the list:

`(##SUR_CHE_XII_V01_C05_E09_008_Q01.png" width="80%")>

A. 1 2 3 4
d a b c

B. 1 2 3 4
d c b a

C. 1 2 3 4
b c d a

- D. $\begin{matrix} 1 & 2 & 3 & 4 \\ b & d & a & c \end{matrix}$

Answer: C



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3. Match the list -I with list -II and select the correct answers using the code given below the list.

`(##SUR_CHE_XII_V01_C05_E09_009_Q01.png" width="80%")>

- A. $\begin{matrix} 1 & 2 & 3 & 4 \\ b & c & d & a \end{matrix}$
- B. $\begin{matrix} 1 & 2 & 3 & 4 \\ c & b & a & d \end{matrix}$
- C. $\begin{matrix} 1 & 2 & 3 & 4 \\ c & a & d & b \end{matrix}$
- D. $\begin{matrix} 1 & 2 & 3 & 4 \\ d & c & b & a \end{matrix}$

Answer: C



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4. Pick the odd man out

A. Co

B. CN^-

C. Cl^-

D. NH_3

Answer: C



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5. Which one of the following is wrongly matched.

A. $[Cu(NH_3)_4]$ Plumbate

B. $[Fe(CN)_6]^{3-}$ sp^3d^2

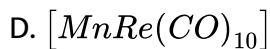
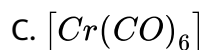
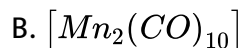
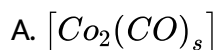
C. $[Ni(CO)_4]$ neutral ligand

D. $[Fe(H_2O)_6]^{3+}$ High spin complex

Answer: B

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6. Pick out the mononuclear carbonyl among the following

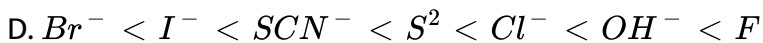
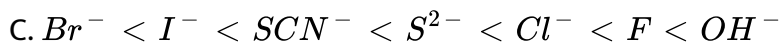
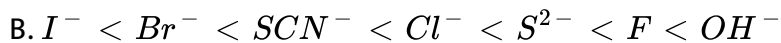


Answer: C

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7. Ionic radius of alkali metals are in the following order





Answer: B

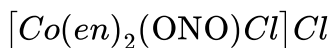
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Very Short Answer

1. Write a neutral molecule in which the central atom is sp^3d^2 hybridised

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2. Name the following complex using IUPAC norms.



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

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4. Give the names of two complex which are used in medicines

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5. Write the IUPAC names of the complex.

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6. Write the IUPAC name of $[Ni(H_2O)_6](Cl)_2$

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7. Define 'Ligand 'Give an example of neutral ligand.

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

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

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10. Pick the correct statement, The IUPAC nomenclature for

$[Cu(NH_3)_4]SO_4$ is

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11. Give the chemical formula of potassium trioxalato ferrate (III)

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12. Name the type of isomerism that occurs in complex in which both cation and anion are complex ions.

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13. Define coordination number

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14. Give the geometry and magnetic character of $[NiCl_4]^{2-}$

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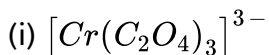
15. Name a complex used in the treatment of cancer .

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16. Calculate the magnetic moments of $[Fe(H_2O)_6]^{2+}$,if atomic number of Fe is 26

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



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18. Give an example for the complexes possessing co-ordination number 8 and 7.

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19. Give reason for the following: optical isomerism is not shown by square planar complexes.

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20. Arrange the following complex ions the increasing order of crystal field splitting energy (δ_0) $[CrCl_6]^{3-}$, $[Cr(CN)_6]^{3-}$, $[Cr(NH_3)_6]^{3+}$

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21. Name the following :

(i) Ring that is attached to Fe^{2+} in hameoglobin

(ii) Vitamin B_{12} is a co-ordination compound of this element.

(iii) Complex that is used in the hydrogenation of alkenes.

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22. What is Co-ordination entity?

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23. What is a central atom or ion?

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24. What are ligands?

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25. What is Co-ordination sphere?



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26. What is Co-ordination polyhedron?



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27. What is Co-ordination number?



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28. What is oxidation state of a central atom in a co-ordination entity?



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29. Calculate the Oxidation number of

(i) iron in $[Fe(CN)_6]^{4-}$

(ii) Cobalt in $[Co(NH_3)_5Cl]^{2+}$

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30. Give the formula and IUPAC ligand name for Ethylenediamine.

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31. Identify the ligand and the central metal in the Co-ordination compounds $[Co(NH_3)_4Cl_6]Cl$

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32. What are structural isomers?

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33. What are Co-ordination isomers ? Give examples

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34. What are solvate isomers?

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35. What are stereoisomers?

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36. Draw the C is and trans isomers of MA_2B_2 type

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37. What is facial isomer?

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38. What is mer isomer?

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39. Give the two isomers of $Co_2(CO)_8$.

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40. What are enantiomers?

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41. What are ionisation isomers?

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42. What are anionic & cationic complex? Give an example.



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43. What is hydrate isomerism ? Give an example.



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44. $[Co(NH_3)_6]^{3+}$ is diamagnetic where as $[CoF_6]^{3-}$ is paramagnetic explain.



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Short Answer

1. How is magnitude of δ_0 affected by (i) nature of ligands (ii) oxidation state of metal ion.



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2. Draw the structures of geometrical isomers of $[Fe(NH_3)_2(CN)_4]^-$

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3. Aqueous copper sulphate solution (blue) gives

(i) a green precipitate with aqueous potaassium fluoride.

(ii) a bright green solution with aqueous potassium chloride . Explain these experimental results.

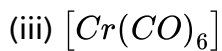
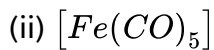
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4. What is meant by inidentate , didentate and ambidentate ligands ?Give two examples for each.

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5. Draw the structure of the following homoleptic metal carbonyl.

(i) $[Ni(CO)_4]$



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6. Match the common name with formula and the IUPAC ligand name.



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7. Describe optical isomerism with suitable example.

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8. What are the limitations of VB theory?

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9. Discuss briefly the nature of bonding in metal carbonyls.

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10. What is π back bonding?

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11. What is stability constant ?

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12. What is the significance of stability constants?

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13. Name some metal complex that are present in our biological system and their role in it.

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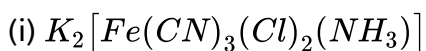
14. Draw and explain the structure of Cisplatin

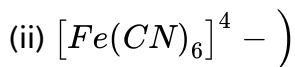
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15. Mohr's salt answers the presence of Fe^{2+} NH_4^+ and SO_4^{2-} ions . Whereas the potassium ferrithiocyanate will not answer Fe^{3+} and SCN ions give reason.

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16. Write the IUPAC name for the following





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Longer Answer

1. Mention the type of hybridisation and magnetic property of the following complex using VB theory a $[FeF_6]^{4-}$ b $[Fe(CN)_6]^{4-}$

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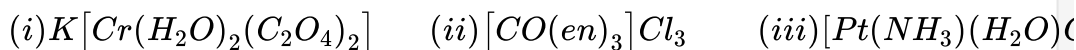
2. Write the postulates of Werner's theory.

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3. What are the important features of valence bond theory?

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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. For the complex $[NiCl_4]^{2-}$ Write (i) the IUPAC name (ii) The hybridisation type (iii) The shape of the complex

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6. What is meant by stability of a co-ordination compound in solution? State the factors which govern stability of complexes.

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7. How are Co-ordination compounds classified?

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8. What are the important features of valence bond theory?

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9. What are the salient feature of crystall field theory ?

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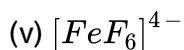
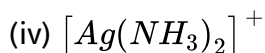
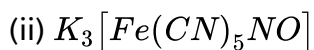
10. How are metal carbonyls classified depending on the number of metal atoms?

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11. How are metal carbonyls classified depending on the number of metal atoms?

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12. Give the IUPAC name for the following compounds

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13. Give the structure for the following compounds

(i) Pentaamminechlorocobalt (III) ion

(ii) Triamminetrinitrito -kN Cobalt (III)

(iii) tetraammineaquabromidocobalt (III) nitrate

(iv) Dichloridobis (ethane-1,2-diamine)cobalt (III) chloride

(v) Tetraamminecopper(II) sulphate

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Hots

1. $CuSO_4$ on mixing with NH_3 (1:4 ratio) does not give test for Cu^{2+} ions but gives test for SO_4^{2-} ions why?

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2. Name the metal present in

(i) Chlorophyll

(ii) Haemoglobin

(iii) Vitamin B_{12}

(iv) Cis-platin

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Answer In Paragraph

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

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2. What is crystal field stabilization energy (CFSE) ?

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Long Answer

1. Write the postulates of Warner's theory.

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