CHEMISTRY

JEE (MAIN AND ADVANCED) CHEMISTRY

COMPLEX COMPOUNDS

Example

1. Which ions can be tested in a solution of Mohr's salt?

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2. Identify the ligands and central metal ion in $\left[Co\left(NH_3\right)_2(en)_2\right]^{3+}$,Calculate the oxidation number and coordination number of metal ion.

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3. Which type of complex is cryolite ?

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4. List out the wrong among the following according to IUPAC and write the correct formula: (a) $\left[Zn(OH)_4\right]K_2$, (b) $\left[CoCl\left(NH_3\right)_4\left(H_2O\right)\right]Cl_2$, (c) $\left[Ag(CN)_2\right]\left[Ag\left(NH_3\right)_2\right]$ and (d) $\left[Pt\left(NH_3\right)_2Cl\left(NO_2\right)\right]$.

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

(a) $\left[CoCl_2(en)_2\right]Cl$, (b) $\left[Ni(CO)_4\right]$, (c) $\left[Pt\left(NH_3\right)_2Cl\left(NO_2\right)\right]$, (d) $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$

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6. Write the formula of the following coordination compounds:

(a) Amminebromidochloridonitrito-O-platinum(II) ion

(b)Dichloridobis(ethane-1,2-diammine)platinum(IV) nitrate

(c) Diaquatetrahydroxoaluminate(III) ion

(d) Mercury(I) tetrathiocyanatocobaltate(III).

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7. Arrange the complexes $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$ and $CoCl_2.3NH_3$ in the descending order of conductivity of their aqueous solutions.

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8. When excess ammonia gas is passed through aq $CrCl_3$ solution, complexes A and B are formed. Complex A gives 2 particles and complex B gives 4 charges. Write the formula of complexes.

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9. When excess of silver nitrate solution is added to the aqueous solution containing 0.1 mole of $CoCl_3.xNH_3$, if 28.7g of silver chloride precipitated, what is the value of x ?

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10. The secondary valence of Pt^{4+} is six. Calculate the number of moles of AgCl participated, when excess of $AgNO_3$ solution is added to 2L of 0.1M $PtCl_4.4NH_3$ solution.

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11. If $\left[PtCl_6\right]^{x-}$ follows the Sidgwick rule of stability, what is the oxidation state of Pt and complex ?

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12. If $\left[Fe(CO)_x\right]$ follows the Sidgwick rule of stability, what is the value of 'x'?

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

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14. How the gem stones ruby exhibits red colour and emerald exhibits green colour ?

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15. Anhydrous copper sulphate is colourless, but hydrated copper sulphate is blue. Explain ?

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16. Why hexaquamanganese(II)ion contains five unpaired electrons, while the hexacyno manganese (II)ion contains only one unpaired electron ?

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17. How many unpaired electrons present in the square planar $\left[Pt(CN)_4\right]^{2-}$ ion ?

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18. Why $\left[Co\left(NH_3\right)_6\right]^{3+}$ is an inner orbital complex where is $\left[Ni\left(NH_3\right)_6\right]^{2+}$ is an outer orbital complex ?

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19. $Ag^+ + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)\right]^+, K_1 = 3.5 \times 10^{-3}$

, $\left[Ag\left(NH_3\right)\right]^+ + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)_2\right]^+, K_2 = 1.7 \times 10^{-3}$. Calculate the formation constant of $\left[Ag\left(NH_3\right)_2\right]^+$. What is the instability constant ?

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20. $CoCl_3.xNH_3$ exhibits geometrical isomerism. What is the value of x?

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21. What type of isomerism is exhibited by the complex $\left(Cr(gly)_3\right)$?

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22. Which type of isomerisms are possible with the molecular formula $Co\left(NO_2\right)_3.2H_2NCH_2CH_2NH_2.$

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23. How is the theory of complexes used to sperate Fe_2O_3 and Al_2O_3 ?

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24. How is the theory of complex compounds used in photography?

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25. What is Welkinson catalyst ?

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Subjective Exercise 1 Short Answer

1. What is a double salt? Give example.

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2. How is a complex compound differentiated from its constituents?

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3. What are the distinguishing features of complex compounds?

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4. Discuss the shapes of complex ions with coordination numbers 4 and 6.

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5. What do you understand by the term ligand? Discuss neutral and ionic ligands.

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6. Give examples for ionic and neutral complexes.

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Subjective Exercise 2 Short Answer

1. Write the structures of following compounds:

(i) Tetraamminecopper(II) sulphate, (ii) Trichlorotriammine cobalt(III) , (iii) Tetracarbonylnickel(0) ,(iv)Dichlorodiammineplatinum(II) and (v) Trinitrotriamminecobalt(III)

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2. Give the IUPAC name for the following compounds

$\left[Ag\left(NH_3\right)_2\right]Cl$

(ii) $K_3\left[Fe(CN)_5NO\right]$

(iii) $\left[Cr\left(PPh_3\right)(CO)_3\right]$

(iv) $\left[Ag\left(NH_3\right)_2\right]^+$

(v) $\left[FeF_6\right]^{4-}$

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Subjective Exercise 3 Long Answer

1. Explain Werner's theory. Give the Werner's structures of $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$ and $CoCl_3.3NH_3$.

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2. Define EAN. Calculate the EAN of the following metals in their respective complexes: $\left[Cu\left(NH_3\right)_4\right](OH)_2$ and $K_4\left[Fe(CN)_6\right]$

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3. Most important concept of valence bond theory is

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Subjective Exercise 3 Short Answer

1. Identify the primary valency of the central metal in the tetra coordinated $CuSO_4$ and hexa coordinated $Cr\left(NO_3\right)_3.6H_2O$

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2. A linear complex $AgCl.2NH_3$ undergoes complete ionizaiton. What are the ions formed?

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3. Explain the formation of $\left[Co\left(NH_3\right)_6\right]Cl_3$ and $\left[Cu\left(NH_3\right)_4\right]SO_4$ on the basis of VBT.

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4. How many chlorides will be precipitated from the compelx compounds $CoCl_3.4NH_3$?

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5. What kind of hybridization is undergone by 'Co' in the complex $\left[Co\left(NH_3\right)_6\right]^{3+}$?

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Subjective Exercise 3 Very Short Answer

1. Write the important features of Sidwick's EAN

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2. Write short notes on primary valency of a metal ion.

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3. Which of the following is a complex compound ? Potash alum, tetrammine copper (II) sulphate, Potasium hydrogen fluoride.

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4. On addition of $AgNO_3$ solution to 1M $CoCl_3.5NH_3$ solution, how many moles of AgCl are produced ?

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5. The compound $TiCl_4.2H_2O$ is a nonconductor of electricity. Give the Werner's structure.

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Subjective Exercise 4 Long Answer

1. Explain structural isomerism with examples.

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2. Explain geometrical isomerism in complexes with coordination number 4 and 6 with examples.

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Subjective Exercise 4 Short Answer

1. Explain optical isomerism in octahedral complexes.

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2. What kind of isomerism is shown by the pairs of following complex compounds ?

(a) $\left[Pt\left(H_2O\right)_4Cl_2\right]Cl_22H_2O$ and $\left[Pt\left(H_2O\right)_5Cl\right]Cl_3.H_2O$

(b) $\left[Cu\left(NH_3\right)_4\right]\left[Ni(CN)_4\right]$ and $\left[Ni\left(NH_3\right)_4\right]\left[Cu(CN)_4\right]$.

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Subjective Exercise 4 Very Short Answer

1. $Co\left(NH_3\right)_5Br.SO_4$, when it is treated with $AgNO_3$ gives yellow precipitate, give its structure.

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2. Mention the colours exhibited by $CrCl_3.6H_2O$ in its hydrate isomers

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3. Write a pair of optical isomers along with their structures .

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4. Define Racemic mixture

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Subjective Exercise 5 Short Answer

1. Give an example of a complex that is formed in qualitative analysis.

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2. How is silver halide used in photography? What is the complex formed?

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3. How is concept of complexes used in metallurgy ?

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4. Mention a complex that is present in biological systems. Is Heme-b, an example of complex compound?

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Subjective Exercise 5 Very Short Answer

1. Give the central metal and its oxidation state in haemoglobin and chlorophyll.

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2. What is Nessler's reagent ? Give its use.

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3. $CuSO_4$ is more soluble in ammonia. Why ?

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4. How is hardness of water estimated ?

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5. Give chemical reaction of silver halide with dilute hypo.

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6. How is nickel purified in Mond's process ?

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7. Mention one application of complex compound useful in biosystems.

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Objective Exercise 1

1. Carnallite is an example of

A. mixed salt

B. complex salt

C. basic salt

D. double salt

Answer: D

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2. Ligand in a metal carbonyl complex is

A. CO_2

B. CO

C. $CoCl_2$

D. $C_2O_4^{2-}$

Answer: B

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3. Which of the following is an example of a complex salt

A. Cuprammonium sulphate

B. Ferrous ammonium sulphate

C. Bleaching powder

D. Potassium bisulphate

Answer: A

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4. In complex compounds the metal atom or ion acts as a

A. Lewis acid

B. Lewis base

C. Bronsted acid

D. Bronsted base

Answer: A

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5. A ligand should contain

A. odd electrons

B. even number of electrons

C. lone pair of electrons to donate

D. vacant orbital to accept the lone pair

Answer: C

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6. The oxidation state of Fe in $\left[Fe(CN)_6\right]^{-3}$ ion is

A. $+1$

B. $+2$

C. $+3$

D. Zero

Answer: C

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7. In which of the following compounds iron has zero oxidation state

A. $Fe(CO)_5$

B. Fe_2O_3

C. FeO

D. Fe_3O_4

Answer: A

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8. The charge on cobalt in $\left[Co(CN)_6\right]^{3-}$ is

A. -3

B. $+3$

C. -6

D. $+6$

Answer: B

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9. A bidentate ligand is

A. pyridine

B. thiocyanate

C. ethylene diammine

D. water

Answer: C

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10. Which of the following is a polynuclear compound

A. $\left[Co\left(NH_3\right)_4Cl_2\right]Cl$

B. $NaFe\left[Fe(CN)_6\right]$

C. $\left[Cr\left(H_2O\right)_5Cl\right]Cl_2$

D. $\left[Co_2\left(NH_3\right)_6(OH)_3\right]Cl_3$

Answer: D

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11. A ligand can not be (A) neutral, (B) anionic , (C) anionic

A. B only

B. C only

C. A and B

D. none

Answer: D

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12. Example of neutral complex compound in the following list

A. $CoCl_3.6NH_3$

B. $CoCl_3.5NH_3$

C. $CoCl_3.4NH_3$

D. $CoCl_3.3NH_3$

Answer: D

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13. Which of the following is a complex salt ?

A. $KCl.MgCl_2.6H_2O$

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

C. $4KCN.Fe(CN)_2$

D. $K_2SO_4.Al_2\left(SO_4\right)_3.24H_2O$

Answer: C

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14. EDTA is a .....ligand.

A. tetradentate

B. Hexadentate

C. Bidentate

D. Tridentate

Answer: B

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15. Alum in aqueous solution gives positive test for (A)K^+ , (B) Al^{3+} , (C)SO_4^{2-}

A. A only

B. B only

C. A and B

D. A,B and C

Answer: D

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16. $Ni(CO)_4$ is an example of

A. cationic complex

B. neutral complex

C. anionic complex

D. poly nuclear complex

Answer: B

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17. Donor atoms in ethylenediamine are

A. N and N

B. N and H

C. N and C

D. C and H

Answer: A

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18. First theory to explain the formation of complexes was proposed by

A. Werner

B. Pauling

C. Sidgwick

D. Mullikan

Answer: A

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19. Primary valency denotes

A. coordination number

B. number of ligands

C. oxidation number

D. effective atomic number

Answer: C

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20. The coordination number of a central metal atom in a complex is determined by

A. the number of ligands around a metal ion bonded by dative bonds

B. he number of only anionic ligands bonded to the metal ion

C. the number of ligands around a metal ion bonded by ionic bonds

D. the number of ligands around a metal ion bonded by covalent bonds

Answer: A

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21. Primary valency is satsified by

A. only negative ligands

B. only positive ligands

C. negative and neutral ligands

D. positive and neutral ligands

Answer: A

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22. Structure of the complex with sp^3 hybridisation

A. planar triangular

B. square planar

C. tetrahedral

D. octahedral

Answer: C

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23. The effective atomic number of ${}_{24}Cr$ in $\left[Cr\left(NH_3\right)_6\right]Cl_3$ is

A. 24

B. 27

C. 30

D. 33

Answer: D

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24. The coordination number and oxidation number of M in the compound $\left[M\left(SO_4\right)\left(NH_3\right)_5\right]$ will be

A. 6 and 3

B. 2 and 6

C. 6 and 2

D. 3 and 6

Answer: C

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25. The oxidation number of Fe in $\left[Fe(CN)_6\right]^{4-}$ Cr in $\left[Cr\left(NH_3\right)_3\left(NO_2\right)_3\right]$ and Ni in $Ni(CO)_4$ are respectively

A. 0,+3,+2

B. $+3, \ +3, 0$

C. $+3, 0, \ +3$

D. $+2, \ +3, 0$

Answer: D

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26. Inner complex is also called

A. spin free complex

B. low spin complex

C. weak field complex

D. ionic complex

Answer: B

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27. The primary valency of 'Fe' in the complex $K_4\left[Fe(CN)_6\right]$ is

A. 2

B. 3

C. 6

D. 4

Answer: A

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28. The hybridisation of metal ion in square planar complexes in

A. dsp^2

B. sp^3d

C. d^3sp^3

D. sp^3

Answer: A

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29. The hybridisation of Iron in $K_4\left[Fe(CN)_6\right]$ is

A. dsp^2

B. sp^3

C. d^2sp^3

D. sp^3d^2

Answer: C

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30. One mole of the complex compound $CoCl_3xNH_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of $AgNO_3$ solution to yield two moles of AgCl. The value of x is

A. 5

B. 4

C. 3

D. 2

Answer: A

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31. Number of chlorides satisfying secondary valency in $CoCl_3.4NH_3$

A. 1

B. 2

C. 3

D. 6

Answer: B

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32. Total number of ions the complex $CoCl_3.6NH_3$ gives in water

A. 2

B. 3

C. 4

D. 6

Answer: C

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33. Effective atomic number of transition metal in potassium ferrocyanide

A. 24

B. 26

C. 35

D. 36

Answer: D

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34. Which of the following is homoleptic complex

A. $\left[Co\left(NH_3\right)_6\right]Cl_3$

B. $\left[Co\left(NH_3\right)_4Cl_2\right]Cl$

C. $\left[Co\left(NH_3\right)_3Cl_3\right]$

D. $\left[Co\left(NH_3\right)_5Cl\right]Cl_2$

Answer: A

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35. In the formation of some complexes, electrons in the metal orbital may undergo pairing against

A. Pauli's principle

B. Uncertainity principle

C. Hund's principle

D. Auf-bau rule

Answer: C

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36. According to pauling the orbitals involved in the hybridisation to form a complex are

A. Orbitals filled with two electrons each

B. Orbitals filled with one electron each

C. Orbitals not filled with electrons

D. Orbitals filled with one or two electrons

Answer: C

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37. Violet coloured complex among the following list of compounds is

A. $\left[Ni\left(H_2O\right)_6\right]^{2+}$

B. $\left[Ni\left(H_2O\right)(en)\right]^{2+}$

C. $\left[Ni\left(H_2O\right)_2(en)_2\right]^{2+}$

D. $\left[Ni(en)_3\right]^{2+}$

Answer: D

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38. Ethylendiamine (en)

A. Monodendate ligand and can occupy one position in coordination polyhedron

B. Bidendate ligand and can occupy two positions in coordinaton polyhedron

C. Polydendate ligand

D. Tridendate ligand and occupy three positions in coordination polyhedron

Answer: A

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39. Identify the correct statements from the following

(I)In $\left[CoCl\left(NH_3\right)_5\right]^{2+}$, the Lewis acid is Co^{3+}

(II)An example for heteroleptic complex is $\left[Co\left(NH_3\right)_6\right]^{3+}$

(III)The hybridisation of Mn in $\left[MnBr_4\right]^{2-}$ is dsp^2

(IV)In $\left[Ni(CO)_4\right]$, the metal-carbon bond possesses σ and π character

A. I,ii,iii,iv

B. I,iv

C. ii,iii

D. I,iii,iv

Answer: B

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40. Hydrazinium ion is chemically

A. $N_2H_3^-$

B. $N_2H_3^+$

C. $N_2H_5^+$

D. $N_2H_5^-$

Answer: C

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41. A prefix penta is used in naming the complex

A. $CrCl_3.6NH_3$

B. $CrCl_3.5NH_3$

C. $CrCl_3.4NH_3$

D. $CrCl_3.3NH_3$

Answer: B

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42. Tetrammine diaqua copper (II) hydroxide is given by the formula

A. $\left[Cu\left(NH_3\right)_4\right](OH)_2.2H_2O$

B. $\left[Cu\left(NH_3\right)_4\right](OH)_2.2H_2O$

C. $\left[Cu\left(NH_3\right)_4\right]\left(H_2O\right)_2(OH)_2$

D. $\left[Cu\left(NH_3\right)_4\left(H_2O\right)(OH)_2\right]$

Answer: C

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IUPAC Name	Formulae of ligand
i) Bromo	A) CO
ii) Carbonyl	B) C_6H_5COO
iii) Benzoato	C) H_2O
iv) Aquo	D) Br^-

43.

The correct match is

A. i-D,ii-A,iii-B,iv-C

B. i-D,ii-B,iii-A,iv-C

C. i-D,ii-A,iii-C,iv-B

D. i-D,ii-C,iii-A,iv-B

Answer: A

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44. The IUPAC name of $\left[Ni\left(NH_3\right)_4\right]\left[NiCl_4\right]$ is

A. Tetrachloronickel (II) - tetraamminenickel (II)

B. Tetraamminenickel (II) - tetrachloronickel(II)

C. Tetraamminenickel(II) - tetrachloronickelate(II)

D. Tetrachloronickel (II) - tetraamminenickelate(0)

Answer: C

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45. According to IUPAC sodium nitroprusside is named as

A. Sodium pentacyanonitrosyl ferrate(II)

B. Sodium pentacyanonitrosyl ferrate(III)

C. Sodium nitroferriccyanide

D. Sodium nitroferrocyanide

Answer: A

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46. The hypothetical complex chlorodiaquatriam minecobalt (III) chloride can be presented as

A. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3$

B. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_2Cl\right]Cl$

C. $\left[Co\left(NH_3\right)_3\left(H_2O\right)Cl_3\right]$

D. $\left[CoCl\left(NH_3\right)_3\left(H_2O\right)\right]Cl_2$

Answer: D

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47. In the IUPAC version, the ligand OH^- is named as

A. hydroxide

B. hydroxyl

C. hydroxo

D. ol

Answer: C

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48. Which of the following is an example of ambidentate ligand

A. CO

B. CN^-

C. H_2O

D. SO_4^{2-}

Answer: B

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49. Which of the following has maximum number of unpaired d-electrons

A. Zn

B. Fe^{2+}

C. Ni^{3+}

D. Cu^{+}

Answer: B

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50. Which one of the following is tris (ethane-1, 2-diammine) cobalt (III) sulphate?

A. $\left[Co_3(en)\right]SO_4$

B. $\left[Co(en)_3\right]SO_4$

C. $\left[Co(en)_3\right]_3\left(SO_4\right)_2$

D. $\left[Co(en)_3\right]_2\left(SO_4\right)_3$

Answer: D

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51. The formula of 'nitrosyl' group

A. NO

B. NO^+

C. NO^-

D. ONO

Answer: A

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52. Name of oxalate in IUPAC version changes to

A. Oxalite

B. Oxalato

C. Oxalito

D. Oxalide

Answer: B

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53. Metal-Isothiocyanato' is indicated by its chemical symbol as

A. M-NCS

B. M-SCN

C. M-CNS

D. M-CSN

Answer: A

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54. The IUPAC name of $\left[Co\left(NH_3\right)_4Cl\left(NO_2\right)Cl\right]$ is

A. Tetraamminechloridonitrito-N-cobalt(III) chloride

B. Tetraamminechloronitrocobalt(II) chloride

C. Tetraamminechloronitrocobalt(I) chloride

D. Tetraamminechloronitrocobalt(III) chloride

Answer: A

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55. In $Fe(CO)_5$, Fe-C bond possess

A. Sigma character only

B. Pi character only

C. Both sigma and pi character

D. Ionic character

Answer: C

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56. Considering H_2O as a weak field ligand, the number of unpaired electrons in $\left[Mn\left(H_2O\right)_6\right]^{2+}$ will be (Atomic no of Mn=25)

A. 2

B. 3

C. 4

D. 5

Answer: D

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57. Geometrical shapes of the complexes formed by the reaction of Ni^{2+} with Cl^-, CN^- and H_2O, respectively, are

A. Octahedral, tetrahedral and square planr

B. Tetrahedral, square planar and octahedral

C. Square planar, tetrahedral and octahedral

D. Octahedral, square planar and octahedral

Answer: B

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58. Which of the following complex species does not involve inner orbital hybridization?

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

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

C. $\left[CoF_6\right]^{3-}$

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

Answer: C

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59. Which one of the following high spin complexes has the largest crystal field stabilization energ?

A. $\left[Cr\left(H_2O\right)_6\right]^{2+}$

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

C. $\left[Mn\left(H_2O\right)_6\right]^{2+}$

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

Answer: B

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60. Which of the following system has maximum number of the unpaired electrons in an inner octahedral complex?

A. d^4

B. d^9

C. d^7

D. d^5

Answer: A

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61. Which of the following complex species does not involve d^2sp^3 hybridisation?

A. $\left[CoF_6\right]^{3-}$

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

C. $\left[Fe(CN)_6\right]^{3-}$

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

Answer: A

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62. Which of the following is an outer orbital complex

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

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

C. $\left[FeF_6\right]^{3-}$

D. $\left[Cr(CN)_6\right]^{3-}$

Answer: C

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63. Which of the following is low spin complex

A. $\left[NiCl_4\right]^{2-}$

B. $\left[CoF_6\right]^{3-}$

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

D. $\left[MnCl_4\right]^{2-}$

Answer: C

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64. In an octahedral crystal field, the correct set of low energy orbitals are

A. d_{xy}, d_{xz}, d_{z2}

B. $d_{x^2-y^2}, d_{z^2}$

C. d_{xy}, d_{xz}, d_{yz}

D. $d_{xy}, d_{x^2-y^2}$

Answer: C

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65. Which of the following is paramagnetic ?

A. $V(CO)_6$

B. $Fe(CO)_5$

C. $Fe_2(CO)_9$

D. $Cr(CO)_6$

Answer: A

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66. Which of the following has square planar geometry

A. $\left[FeCl_4\right]^{2-}$

B. $\left[NiCl_4\right]^{2-}$

C. $\left[PdCl_4\right]^{2-}$

D. $\left[CoCl_4\right]^{2-}$

Answer: C

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67. For the same metal, stabilisation energies of tetrahedral and octahedral complexes are related as

A. $\Delta_t = \Delta_0$

B. $\Delta_t \times 4 = \Delta_0 \times 6$

C. $\Delta_t \times 9 = \Delta_0 \times 4$

D. $\Delta t \times 6 = \Delta_0 \times 4$

Answer: C

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68. Both $\left[Ni(CO)_4\right]$ and $\left[Ni(CN)_4\right]^{2-}$, are diamagnetic. The hybridizations of nickel in these respectively, are

A. sp^3, sp^3

B. sp^3, dsp^2

C. dsp^2, sp^3

D. dsp^2, dsp^2

Answer: B

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69. The magnetic behaviour of complexes $K_4\left[Fe(CN)_6\right]$ and $K_3\left[Fe(CN)_6\right]$ is

A. Para, Dia

B. Dia, Para

C. Dia, Ferro

D. Both Dia

Answer: B

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70. Which one of the following cyano complexes exhibit the lowest value of paramagnetic behaviour ?

A. $\left[Cr(CN)_6\right]^{3-}$

B. $\left[Mn(CN)_6\right]^{3-}$

C. $\left[Fe(CN)_6\right]^{3-}$

D. $\left[Co(CN)_6\right]^{3-}$

Answer: D

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71. The hybridisation of nickel in tetracarbonyl nickel is

A. dsp^2

B. sp^3

C. sp^3d

D. sp^3d^2

Answer: B

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72. The oxidation state of the metal forming the complex $K_2\left[PtCl_6\right]$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: D

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73. In the complex $\left[Ni\left(H_2O\right)_2\left(NH_3\right)_4\right]^{2+}$ the number of unpaired electrons is

A. 0

B. 1

C. 3

D. 2

Answer: D

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74. The correct order of increasing field strengths

A. $Br^- > SCN^- > Cl^- > I^-$

B. $Br^- > SCN^- > Cl^- > I^-$

C. $I^- < Br^- < SCN^- < Cl^-$

D. $I^- < Cl^- < SCN^- < Br^-$

Answer: C

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75. In which of the following octahedral complexes of cobalt (atomic number = 27) will the magnitude of Δ_0 be the highest?

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

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

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

D. $\left[Co(CN)_6\right]^{3-}$

Answer: D

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76. According to crystal field theory, the M-L bond in a complex is

A. partially covalent

B. purely ionic

C. purely covalent

D. purely co-ordinate

Answer: B

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77. The number of unpaired electron in $\left[Pt(CN)_4\right]^{2-}$ ion having square planar geometry (At.No. of Pt=78) is

A. 0

B. 1

C. 2

D. 3

Answer: A

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78. Which one of the following is square planar in structure and has diamagnetic property ?

A. $\left[Ni\left(H_2O\right)_6\right]^{2+}$

B. $\left[Ni(CO)_4\right]$

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

D. $\left[NiCl_4\right]^{2-}$

Answer: D

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79. $\left[Cr\left(H_2O\right)_6\right]Cl_3$ and $\left[Cr\left(H_2O\right)_4Cl_2\right]Cl.H_2O$ are hydrate isomers. Their colours are respectively

A. violet and green

B. yellow and green

C. red and blue

D. blue and green

Answer: A

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80. Which of the following does not has an optical isomer?

A. $\left[Co(en)_2Cl_3\right]$

B. $\left[Co(en)_2Cl_2\right]Cl$

C. $\left[Co\left(NH_3\right)_3Cl_3\right]$

D. $\left[Co(en)\left(NH_3\right)_2Cl_2\right]Cl$

Answer: C

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81. Which of the following has an optical isomer ?

A. $\left[Co(en)\left(NH_3\right)_2\right]^{2+}$

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

C. $\left[Co(en)_2\left(NH_3\right)_2\right]^{3+}$

D. $\left[Co\left(NH_3\right)_3Cl\right]^{+}$

Answer: C

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82. Which of the following pairs represents linkage isomers ?

A. $\left[Pd\left(PPh_3\right)_2(NCS)_2\right], \left[Pd\left(PPh_3\right)_2(SCN)_2\right]$

B. $\left[Co\left(NH_3\right)_5NO_3\right]SO_4, \left[Co\left(NH_3\right)_5SO_4\right]NO_3$

C. $\left[PtCl_2\left(NH_3\right)_4\right]Br_2, \left[PtBr_2\left(NH_3\right)_4\right]Cl_2$

D. $\left[Cu\left(NH_3\right)_4\right]\left[PtCl_4\right], \left[Pt\left(NH_3\right)_4\right]\left[CuCl_4\right]$

Answer: A

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83. Which of the following will exhibit geometrical isomerism? (M stands for a metal, and a and b are achiral ligands (1) Ma_2b_2 , (2)Ma_4b_2 , (3)Ma_5b , (4) Ma_6

A. 1 and 2

B. 2 and 3

C. 1 and 3

D. 2 and 4

Answer: A

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84. The ionization isomer of $\left[Cr\left(H_2O\right)_4Cl\left(NO_2\right)\right]Cl$ is given as

A. $\left[Cr\left(H_2O\right)_4\left(O_2N\right)\right]Cl_2$

B. $\left[Cr\left(H_2O\right)_4Cl_2\right]NO_2$

C. $\left[Cr\left(H_2O\right)_4Cl(ONO)\right]Cl$

D. $\left[Cr\left(H_2O\right)_4Cl_2\left(NO_2\right)\right].H_2O$

Answer: B

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85. Ionisation isomerism is possible with

A. $\left[Co\left(NH_3\right)_6\right]Cl_3$

B. $\left[Co\left(NH_3\right)_3Cl_3\right]$

C. $\left[Co\left(NH_3\right)_5Cl\right]Br$

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

Answer: C

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86. $\left[PtBrCl\left(NO_2\right)\left(NH_3\right)\right]$ I on ionisation gives the ion

A. Cl^-

B. Br^-

C. I^-

D. NO_2^-

Answer: C

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87. Structural differences are main in the following isomers

(A) ionisation isomerism, (B) ligand isomerism ,(C) hydrate isomerism, (D) geometrical isomerism

A. A,B,C

B. A,C,D

C. B,C,D

D. A,B,D

Answer: A

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88. Which of the following is not an example of the isomerism in complex compounds

A. Ionisation isomerism

B. Hydrate isomerism

C. Position isomerism

D. Ligand isomerism

Answer: C

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89. The complex ion $\left[Co(en)_2Cl_2\right]^+$ exhibits

A. optical isomerism and linkage isomerism

B. Cis-trans isomerism and optical isomerism

C. cis-trans isomerism and linkage isomerism

D. Cis-trans isomerism only

Answer: B

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90. Optical isomers differ in

A. chemical properties

B. molecular formulae

C. physical properties

D. optical properties

Answer: D

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91. A racemic mixture has a net rotation

A. to right of original plane

B. to left of original plane

C. to right or left of original plane

D. zero

Answer: D

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92. Geometrical isomerism may be possible with

A. tetrahedral complex

B. square planar complex

C. pentagonal pyramidal complex

D. square pyramidal complex

Answer: B

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93. $\left[Fe\left(NO_2\right)_3Cl_3\right]$ and $\left[Fe(O\text{ - }NO)_3Cl_3\right]$ shows

A. Linkage isomerism

B. Geometrical isomerism

C. Optical isomerism

D. Hydrate isomerism

Answer: A

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94. In metallurgy the metal used to displace silver from its cyano complex is

A. Zn

B. Au

C. F_2

D. Cl_2

Answer: A

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95. Which of the following releases metal slowly which gives uniform coating in electroplating

A. Metal salts

B. Double salts

C. Complex salts

D. Alums

Answer: C

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96. In $\left[Ti\left(H_2O\right)_6\right]^{+3}$ complex the energy absorbed for excitation of $3d^1$ electron is

A. Purple

B. Blue

C. Blue-green

D. Red

Answer: C

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97. Number of dative bonds around Ag^+ ion in $\left[Ag\left(NH_3\right)_2\right]^+$

A. 2

B. 3

C. 4

D. 6

Answer: A

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98. Which of the following exhibits purple colour in solutions

A. $\left[Fe\left(H_2O\right)_6\right]^{2+}$

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

C. $\left[Cu\left(H_2O\right)_6\right]^{2+}$

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

Answer: B

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99. Haemoglobin, a complex containing iron is a constituent of blood. The oxidation state of iron in the complex is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: B

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100. Which of the following is an organometallic compound?

A. Lithium methoxide

B. Lithium acetate

C. Lithium dimethylamide

D. Methyl lithium

Answer: D

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101. In photography, hypo is used in the reduction of

A. Ag from AgBr

B. AgBr into Ag_2SO_4

C. AgBr into soluble thiosulphate complex

D. Both (2) and (3)

Answer: C

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102. The polydentate ligand used in the treatment of lead poisoning

A. EDTA

B. Glycinate

C. Oxalate

D. Ethylene diammine

Answer: A

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103. The ligand used in the identification of cupric copper in the laboratory

A. NH_3

B. I^-

C. CN^-

D. $S_2O_3^{2-}$

Answer: A

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104. Hydrometallurgy is a technique used

A. for extracting silver from aqueous solutions

B. for extracting sodium from aqueous solutions

C. for extracting silver from its fused salt

D. for extracting sodium from its fused salt

Answer: A

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105. Which of the following silver halide is insoluble in water but soluble in liquid ammonia

A. Silver fluoride

B. Silver chloride

C. Silver bromide

D. Silver Iodide

Answer: B

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106. The number of moles of KI required to prepare one mole of $K_2\left[HgI_4\right]$ is

A. 4

B. 3

C. 2

D. 1

Answer: A

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107. Geometry of orbitals around the transition metal ion in hexacyanoferrate

A. square planar arrangement

B. tetrahedral arrangement

C. plane trigonal arragement

D. octahedral arrangement

Answer: D

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108. The complex compound that gives a preciptate with $BaCl_2$ solution is

A. $\left[Co\left(NH_3\right)_5SO_4\right]Br$

B. $\left[Co\left(NH_3\right)_5Br\right]SO_4$

C. $\left[Co\left(NH_3\right)_5Br\right]\left(NO_3\right)_2$

D. $\left[Co\left(NH_3\right)_5SO_4\right]Cl$

Answer: B

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109. Which of the following has magnesium ?

A. Carbonic anhydrase

B. Haemocyanin

C. Chlorophyll

D. Vitamin B_{12}

Answer: C

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110. Ziegler-Natta catalyst is

A. Solution of $SnCl_4$ + trialkylaluminium

B. Solution of $TiCl_4$ + trialkylaluminium

C. Solution of $TiCl_4$ + trialkylchromium

D. Solution of $SnCl_4$ + Tollen's reagent

Answer: B

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Objective Exercise 2

1. The primary valency of the central transition metal ion in a complex compound $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

A. 3

B. 2

C. 1

D. 0

Answer: A

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2. The number of ions given by $\left[CO\left(NH_3\right)_3Cl_3\right]$ in aqueous solution is

A. 1

B. 2

C. 3

D. 0

Answer: D

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3. The oxidation state of Cr in $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

A. $+3$

B. $+2$

C. $+1$

D. 0

Answer: A

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4. When 1 mole of $\left[Co\left(NH_3\right)_3Cl_3\right]$ is added to excess of $AgNO_3$ solution the weight of AgCl precipitated is

A. 13.5 g

B. 108 g

C. 0

D. 54g

Answer: C

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5. The secondary valency of Chromium in $\left[Cr(en)_3\right]Cl_3$ is

A. 6

B. 3

C. 2

D. 4

Answer: A

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6. The deep blue complex produced by adding excess of Ammonia to $CuSO_4$ solution is

A. $\left[Cu\left(NH_3\right)_2\right]^{2+}$

B. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

C. $\left[Cu\left(NH_3\right)_6\right]^{2+}$

D. $\left[Cu\left(NH_3\right)_4\right]^{+}$

Answer: B

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7. $K_2SO_4.Al_2\left(SO_4\right)_3.24H_2O$ is

A. a complex salt

B. a double salt

C. a complex salt & double salt

D. a basic salt

Answer: B

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LIST - I (complex)	LIST - II (Charge on co-ord. sphere)
A) $CoCl_3.6NH_3$	1) + 1
B) $CoCl_3.5NH_3$	2) + 2
C) $CoCl_3.4NH_3$	3) + 3
D) $CoCl_3.3NH_3$	4) + 4
	5) 0

8.

The correct match in terms of the charge on the complex

A. A-3,B-2,C-5,D-1

B. A-3,B-1,C-2,D-5

C. A-3,B-2,C-1,D-5

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

Answer: C

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9. Number of dative bonds in the complex $CoCl_3.5NH_3$ is

A. 5

B. 6

C. 3

D. 4

Answer: B

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10. A complex compound of Co^{3+} with molecular formula $COCl_x.yNH_3$ gives a totall of 3 ions when dissolved in water. How many Cl^- ions when the primary and secondary valency in this complex ?

A. 3

B. 1

C. 4

D. 0

Answer: B

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11. Neutral complex among the following

A. $CuSO_4.4NH_3$

B. $\left[Co\left(NH_3\right)_6\right]Cl_3$

C. $Ni(CO)_4$

D. $\left[Pt\left(NH_3\right)_2\right]Cl_2$

Answer: C

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12. Pick up true statement about the complex compound with formula

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

A. IUPAC name is triamminecobalt(III)chloride

B. The complex can exhibit fac and mer isomerism

C. The complex can show optical isomerism

D. The hybrid state of cobalt is dsp

Answer: B

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13. Cationic complex is

A. Potassium ferrocyanide

B. Cryolite

C. Cuprammonium (II) sulphate

D. Sodium argentothiosulphate

Answer: C

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14. Number of unpaired electrons in $\left[Fe(CN)_6\right]^{4-}$ ion

A. 6

B. 5

C. 4

D. 0

Answer: D

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15. Which of the following is diamagnetic

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

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

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

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

Answer: A

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16. The number of ions formed when cupra ammonium sulphate is dissolved in water

A. 1

B. 2

C. 4

D. zero

Answer: B

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. Property of transition element

1) Colour of ion
2) Variable oxdation states
3) Formation of alloys
4) Paramagnetic

Reason for the property

A) unpaired e^- in (n-1)d orbital
B) same crystal structure
C) d-d- transition
D) high magnitude of positive charge
E) slight energy between ns and (n–1)d shells

17.

The correct match is

A. 1-C,2-E,3-A,4-B

B. 1-C,2-E,3-B,4-A

C. 1-C,2-B,3-E,4-A

D. 1-B,2-A,3-E,4-B

Answer: B

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18. In which of the following complexes the metal ion is in zero oxidation state ?

A. $\left[Cu\left(NH_3\right)_4\right]Cl_2$

B. $Zn_2\left[Fe(CN)_6\right]$

C. $Mn_2(CO)_{10}$

D. $\left[Ag\left(NH_3\right)_2\right]Cl$

Answer: C

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19. Which of the following represents chelating ligand?

A. Cl^-

B. DMG

C. OH^-

D. H_2O

Answer: B

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20. The liquid hydrazinium is denoted as

A. N_2H_4

B. $N_2H_5^+$

C. $N_2H_3^-$

D. $N_2H_3^+$

Answer: B

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21. Nickel combines with a uninegative monodentate ligand X to form a paramagnetic complex $\left[NiX_4\right]^{2-}$. The number of unpaired electron/s in the nickel and geometry of this complex ion are respectively

A. two, square planar

B. one, tetrahedral

C. two, tetrahedral

D. one, square planar

Answer: C

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22. Ammonia forms the complex ion $\left[Cu\left(NH_3\right)_4\right]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. The reason is

A. In acidic solutions hydration protects copper ions

B. In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available

C. In alkaline solutions insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali

D. Copper hydroxide is an amphoteric substance.

Answer: B

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23. $\left[PdBr_4\right]^{2-}$ is a sqaure planar complex. The hybridisation of Pd^{2+} is

A. sp^3

B. dsp^2

C. sp^3d

D. sp^3d^2

Answer: B

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24. The colour exhibited by one of the iron ions in aqueous solutions is pale green. The primary valency and secondary valency respectively in the green complex are

A. 2,4

B. 2,6

C. 3,4

D. 3,6

Answer: B

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25. In nitroprusside ion, the iron and NO exist as Fe^{II} and NO^{+} rather than Fe^{III} and NO. These forms can be differentiated by

A. estimatinng the concentration of iron

B. measuring the concentration of CN^{-}

C. measuring the solid state magnetic moment

D. thermally decomposing the compound

Answer: C

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26. $Ag^{+} + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)\right]^{+}, K_1 = 3.5 \times 10^{-3}$

, $\left[Ag\left(NH_3\right)\right]^{+} + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)_2\right]^{+}, K_2 = 1.7 \times 10^{-3}$. Calculate the formation constant of $\left[Ag\left(NH_3\right)_2\right]^{+}$. What is the instability constant ?

A. 1.7×10^{-3}

B. 5.92×10^{-6}

C. 1.8×10^{3}

D. 1.7×10^{7}

Answer: B

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27. The co-ordination number and the oxidation state of the element 'M' in the complex $\left[M(en)_2\left(C_2O_4\right)\right]NO_2$ [where (en) is ethan-1, 2 diamine] are respectively

A. 6 and 3

B. 4 and 3

C. 6 and 2

D. 4 and 2

Answer: A

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28. In the separation of Cu^{2+} and Cd^{2+} in 2nd group qualitiative analysis of cations, tetrammine copper (II) sulphate and tetrammine cadmium (II) sulphate react with KCN to form the corresponding cyano complexes. Which one of the following pairs of the complexes and their relaive stability enalbles the separation of Cu^{2+} ad Cd^{2+} ?

A. $K_2\left[Cu(CN)_4\right]$ more stable and $K_2\left[Cd(CN)_4\right]$ less stable

B. $K_2\left[Cu(CN)_4\right]$ less stable and $K_2\left[Cd(CN)_4\right]$ more stable

C. $K_2\left[Cu(CN)_4\right]$ more stable and $K_2\left[Cd(CN)_4\right]$ less stable

D. $K_2\left[Cu(CN)_4\right]$ less stable and $K_2\left[Cd(CN)_4\right]$ more stable

Answer: A

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29. The number of bridging carbonyls respectively in $Mn_2(CO)_{10}$ and $CO_2(CO)_8$ are

A. 0,0

B. 1,1

C. 1,0

D. 0,2

Answer: D

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30. Which complex has square planar structure?

A. $Ni(CO)_4$

B. $\left[NiCl_4\right]^{2-}$

C. $\left[Ni\left(H_2O\right)_6\right]^{2+}$

D. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

Answer: D

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31. Among $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{-2}$ and $\left[NiCl_4\right]^{-2}$ species the hybridisation state of the Ni atom are respectively?

A. sp^3, dsp^2 and dsp^2

B. sp^3, dsp^2 and sp^3

C. sp^3, sp^3 and dsp^3

D. dsp^2, sp^3 and sp^3

Answer: B

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32. Which of the following statement is incorrect for metals involving in formation of alloys

A. must have almost same atomic radii

B. must have similar chemical properties, especially number of valency electrons

C. must have similar crystal structures

D. must belong to same 'd' series

Answer: D

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33. Compound that is both paramagnetic and coloured is

A. $K_2Cr_2O_7$

B. $\left[TiCl_6\right].\left(NH_4\right)_2$

C. $VOSO_4$

D. $K_3\left[Cu(CN)_4\right]$

Answer: C

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34. Correct matching from the codes given below

List -I (complex)	List -II (Structure and magnetic moment)
a) $[Ag(CN)_2]^-$	1) square planar and 1.73 BM
b) $[Cu(CN)_4]^{3-}$	2) Linear and zero
c) $[Cu(CN)_6]^{4-}$	3) Octahedral and zero
d) $[Cu(NH_3)_4]^{2+}$	4) tetrahedral and zero
e) $[Fe(CN)_6]^{4-}$	5) octahedral and 1.73BM

A. a-2,b-4,c-5,d-1,e-3

B. a-5,b-4,c-1,d-3,e-2

C. a-1,b-3,c-4,d-2,e-5

D. a-4,b-5,c-2,d-1,e-3

Answer: A

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35. Strongest oxidant among the following is

A. VO_2^+

B. $Cr_2O_7^{-2}$

C. MnO_4^-

D. MnO_4^{-2}

Answer: C

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36. Tetraaminecopper (II) ion is square planar complex with one unpaired electron. According to valence bond theory the hybrid state of copper should be

A. sp^3

B. sp^2

C. dsp^2

D. sp^3d

Answer: C

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37. Which of the following shall form an octahedral complex ?

A. d^4 (Low spin)

B. d^8 (High spin)

C. d^6 (High spin)

D. None of these

Answer: B

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38. Which of the following species represent the example of dsp hybridization ?

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

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

C. $\left[Ag(CN)_2\right]^{-}$

D. $\left[Co(CN)_6\right]^{3-}$

Answer: B

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39. Consider the following complex

$$\left[Co\left(NH_3\right)_5CO_3\right]ClO_4$$

The coordination number, oxidation number, number of d-electrons and number of unpaired d-electrons, respectively, on the metal are

A. 6,3,6,0

B. 7,2,7,1

C. 7,1,6,4

D. 6,2,7,3

Answer: A

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40. Which of the following set is incorrect ?

A. $Ni(CO)_4$ - - Tetrahedral, paramagnetic

B. $\left[Ni(CN)_4\right]^{2-}$ - Square planar, diamagnetic

C. $Ni(CO)_4$ - Tetrahedral, diamagnetic

D. $\left[NiCl_4\right]^{2-}$ - Tetrahedral, paramagnetic

Answer: B

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41. Stabilisation energy of octahedral complex with d^7 configuration

(A)1.8 Δ_0 with one unpaired electron

(B)1.8 Δ_0 with three unpaired electron

(C)0.8 Δ_0 with one unpaired electron

(D)0.8 Δ_0 with three unpaired electron

A. A and D

B. A and B

C. C and D

D. B and C

Answer: A

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42. The incorrect statement with respect to valence bond theory

A. The electrons in the metal orbitals may undergo regrouping even against Hund's rule.

B. The electrons in an incompletely filled orbitals give rise to the resultant magnetic moment.

C. Ligand orbitals overlap the vacant metal orbitals to form a strong coordinate covalent bond to the extent possible.

D. The number of electrons lost is equal to the coordination number of the metal

Answer: D

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43. Which of the following complexes is an outer orbital complex?

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

B. $\left[Ni\left(NH_3\right)_6\right]^{2+}$

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

D. $\left[Mn(CN)_6\right]^{4-}$

Answer: B

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44. In octahedral complexes having co-ordination number 6, the degeneracy of the d-orbitals of central atom is removed due to ligand

electron metal electron repulsions. In the octahedral complex three orbitals have lower energy, t_{2g} set and two orbitals have higher energy, eg set. This phenomenon is formed as crystal field splitting and the energy seperation is denoted by Δ_0. Thus the energy of the two eg orbitals will increase by $(3/5)\Delta_0$ and that of the three t_{2g} will decrease by $(2/5)\Delta_0$. The erystal field splitling, Δ_0 depends upon the field produced by the ligand and charge on the metal ion. Some ligands are able to produce strong field and in these cases, the splitting will be large whereas other produce weak fields and consequently result in small splitting of d-orbitals.

If $\Delta_0 < P$, the correct electronic configuration of d^4 system will be

A. $t_{2g}^4 e_g^0$

B. $t_{2g}^3 e_g^1$

C. $t_{2g}^0 e_g^4$

D. $t_{2g}^4 e_g^2$

Answer: A

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45. Some statements on $\left[Co\left(NH_3\right)_6\right]^{3+}$

(a) oxidation number of Co is +3

(b) octahedral shape

(c) high spin complex

d) hybridization of cobalt is d^2sp^3

The correct set of statements

A. a,b,c

B. a,b,d

C. b,c,d

D. a,d

Answer: B

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46. Which of the following is not a bidentate ligand?

A. Ethylene diammine

B. Acetyl acetone

C. Carbonate

D. Chloro

Answer: D

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47. Hybridization of Fe in $\left[Fe\left(H_2O\right)_5NO\right]SO_4$ (brown ring complex) is

A. dsp^2

B. sp^3d

C. sp^3d^2

D. d^2sp^3

Answer: C

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48. Trans-diglycinatoplatinum (II) has a shape

A. trigonal

B. tetrahedral

C. square planar

D. octahderal

Answer: C

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49. The pair of compounds having metals in their highest oxidation state is

A. $\left[Fe(CN)_6\right]^{3-}, \left[Co(CN)_6\right]^{3-}$

B. CrO_2Cl_2, MnO_4^-

C. TiO_2, MnO_2

D. $\left[Co(CN)_6\right]^{3-}, MnO_2$

Answer: B

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50. When ammonia is added to cupric salt solution, the deep blue colour formed is

A. Due to double salt formed

B. Due to complex salt formed

C. Due to mixed salt formed

D. Due to basic salt formed

Answer: B

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51. Which of the following is diamagnetic

A. $\left[Zn\left(NH_3\right)_4\right]^{2+}$

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

C. $\left[NiCl_4\right]^{2-}$

D. $\left[Ni\left(NH_3\right)_4\right]^{2+}$

Answer: A

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52. Which one of the following sets correctly represents the increase in the paramagnetic property of the ions ?

A. $Cu^{2+} < V^{2+} < Cr^{2+} < Mn^{2+}$

B. $Cu^{2+} < Cr^{2+} < V^{2+} < Mn^{2+}$

C. $Cu^{2+} < V^{2+} < Cr^{2+} < Mn^{2+}$

D. $V^{2+} < Cu^{2+} < Cr^{2+} < Mn^{2+}$

Answer: A

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53. The number of unpaired electron in the complex ion $\left[CoF_6\right]^{3-}$ is

A. 0

B. 4

C. 2

D. 3

Answer: B

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54. Crystal field theory does not explain which of the following property of coordination compounds ?

A. The covalent character of the band between metal and the ligand

B. Magnetic property

C. colour

D. Structure of coordination compounds

Answer: A

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55. Which of the following hybrid state is associated with low spin complex ?

A. sp^3

B. sp^3d^2

C. d^2sp^3

D. sp^3d

Answer: C

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56. If $\Delta_0 < P$, the correct electronic configuration for d^4 system will be

A. $t_{2g}^4 e_g^0$

B. $t_{2g}^3 e_g^1$

C. $t_{2g}^0 e_g^4$

D. $t_{2g}^2 e_g^2$

Answer: A

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57. Indicate the hydbridisation and Magnetic nature of $Ni(CO)_4$

A. dsp^2 , Diamagnetic

B. sp^3 , Paramagnetic

C. sp^3, Diamagnetic

D. dsp^2 Paramagnetic

Answer: B

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58. Which of the following compounds is paramagnetic ?

A. Tetracyanonickelate (II) ion

B. Tetraammine zinc (II) ion

C. Hexaammine chromium (III) ion

D. Diammine silver (I) ion

Answer: C

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59. The number of unpaired electrons in the square planar complex $\left[Pt(CN)_4\right]^{2-}$ is

A. 2

B. 3

C. 0

D. 1

Answer: C

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60. Which of the following are true for the complex $Ni(CN)_4^{2-}$ ion

(A) Hybridisation of Ni^{2+} ion is dsp^2

(B) Shape of the complex ion is planar square

(C) Magnetic moment of the complex is 2.83 BM

(D) The complex is an example for a high spin complex

A. A and B

B. C and D

C. A and C

D. B and D

Answer: A

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61. Which one of the following ionic species will impart colour to an aqueous solution ?

A. Ti^{4+}

B. Cu^{+}

C. Zn^{2+}

D. Cr^{3+}

Answer: D

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62. The spin only magnetic moment $\left[Mn(Br)_4\right]^{2+}$ is 5.9BM. Then possible hybridisation of Mn in the complex is

A. sp^3d

B. dsp^2

C. d^2sp^3

D. sp^3

Answer: D

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63. Match the following

complex	colour
I) $[Ni(H_2O)_4en]_{aq}^{2+}$	A) Grey-green
II) $[Ni(H_2O)_2(en)_2]_{aq}^{2+}$	B) Violet
III) $[Ni(en)_3]_{aq}^{2+}$	C) Blue/Purple
IV) $Cr[(H_2O)_5Cl]Cl_2.H_2O$	D) Pale blue

The correct match is

A. I-D,II-C,III-B,IV-A

B. I-B,II-A,III-C,IV-D

C. I-A,II-D,III-B,IV-C

D. I-C,II-A,III-D,IV-B

Answer: A

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64. In the complexes $\left[Fe\left(H_2O\right)_6\right]^{3+}$, $\left[Fe(CN)_6\right]^{3-}$, $\left[Fe\left(C_2O_4\right)_3\right]^{3-}$ and $\left[FeCl_6\right]^{3-}$, more stability is shown by

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

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

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

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

Answer: C

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65. The correct statement regarding $\left[Co\left(C_2O_4\right)_3\right]^{3+}$ complex is

A. It is inner orbital complex and diamagnetic

B. It is outer orbital complex and diamagnetic

C. It is inner orbital complex and para magnetic

D. It is outer orbital complex and para magnetic

Answer: A

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66. The complex $K_3\left[Fe(CN)_6\right]$ should have a spin only magnetic moment of

A. $\sqrt{3}$ B.M.

B. $2\sqrt{5}$ B.M.

C. $\sqrt{5}$ B.M.

D. $\sqrt{6}$ B.M.

Answer: A

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67. Which of the following complex compounds is not coloured

A. $Na_2\left[CuCl_4\right]$

B. $Na_2\left[CdCl_4\right]$

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

D. $K_3\left[Fe(CN)_6\right]$

Answer: B

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68. Potassium hexachloroplatinate (IV) is given with the chemical formula

A. $Pt_2\left[K(Cl)_6\right]$

B. $K\left[Pt(Cl)_6\right]$

C. $K_2\left[Pt(Cl)_6\right]$

D. $K_4\left[Pt(Cl)_6\right]$

Answer: C

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69. IUPAC name of $Li\left[AlH_4\right]$ is

A. Lithium aluminium hydride

B. Lithium tetrahydrido aluminate [III]

C. Tetrahydride aluminium lithionate

D. Aluminium lithium hydride

Answer: B

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70. The IUPAC name of the coordination compound $K_3\left[Fe(CN)_6\right]$

A. Potassium hexacyanoferrate(II)

B. Potassium hexacyanoferrate (III)

C. Potassium hexacyanoiron (II)

D. Tropotassium hexacyano iron (II)

Answer: B

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71. When $AgNO_3$ solution is added in excess to 1M solution of $CoC1_3cxNH_3$ one mole of AgCl is formed ? What is the value if 'X'?

A. 1

B. 2

C. 3

D. 4

Answer: D

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72. The hypothetical complex chlorodiaquatriam minecobalt (III) chloride can be presented as

A. $\left[CoCl\left(NH_3\right)_3\left(H_2O\right)_2\right]Cl_2$

B. $\left[Co\left(NH_3\right)_3\left(H_2O\right)Cl_3\right]$

C. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_2Cl\right]$

D. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3$

Answer: A

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73. The IUPAC name of $\left[Co\left(NH_3\right)_4Br_2\right]^+\left[ZnCl_4\right]^-$ is

A. Dibromo tetraammine cobalt (III) tetrachlorozinc (II)

B. Tetrammine dibromo cobalt (III) tetrachlorozinc

C. Tetra ammine dibromocobalt (III) tetrachlorozincate (II)

D. Tetrachlorozinc (II) tetra ammine dibromo cobaltate (III)

Answer: C

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74. The correct structural formula of potassium tri oxalate aluminate (III) is

A. $K_3\left[Al\left(C_2O_4\right)_3\right]$

B. $K_3\left[Al\left(C_2O_4\right)_2\right]$

C. $K_2\left[Al\left(C_2O_4\right)_2\right]$

D. $K_2\left[Al\left(C_2O_4\right)_3\right]$

Answer: A

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75. The hypothetical complex chlorodiaquatriam minecobalt (III) chloride can be presented as

A. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_2Cl\right]Cl_2$

B. $\left[Co\left(NH_3\right)_3\left(H_2O\right)Cl_3\right]$

C. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_2Cl\right]$

D. $\left[Co\left(NH_3\right)_3\left(H_2O\right)_3\right]Cl_3$

Answer: A

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76. IUPAC name of the complex, $Ni(CO)_4$ is

A. tetracarbonyl Nickel (II)

B. tetracarbonyl Nickel (0)

C. tetracarbonyl Nickelate (II)

D. tetracarbonyl Nickelate (0)

Answer: B

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77. Ligands with which linkage isomerism is possible

A) NO_2 B) CN^- C) SCN^-

A. A only

B. A & B

C. B & C

D. A,B & C

Answer: D

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78. The types of isomerism exhibited by $\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]\left(NO_3\right)_2$ is

A. Geometrical and linkage

B. Geometrical and ionization

C. Optical and ionization

D. Co-ordination and hydrate

Answer: B

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79. Which of the following compound shows optical isomerism?

A. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

B. $\left[Zn(Cl)_4\right]^{2-}$

C. $\left[Cr\left(C_2O_4\right)_3\right]^{2-}$

D. $\left[Co(CN)_6\right]^{3-}$

Answer: C

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80. Identify the correct statements among the following

I) Cr in first series of d-block has highest oxidation state.

II) Colour of MnO_4^- is due to charge transfer phenomenon.

III) Zn can show variable oxidation state.

IV) Ferromagnetism disappears in the solution of Fe

A. All

B. I & II only

C. II & IV only

D. II & III only

Answer: C

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81. Both geometrical and optical isomerisms are shown by

A. $\left[Co(en)_2Cl_2\right]^+$

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

C. $\left[Co\left(NH_3\right)_4Cl_2\right]^+$

D. $\left[Cr(ox)_3\right]^{3-}$

Answer: A

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82. Which of the following represents largest number of possible isomers?

A. $\left[Ru\left(NH_3\right)_4Cl_2\right]^+$

B. $\left[Co(en)_2Cl_2\right]^+$

C. $\left[Ni(CO)_4\right]$

D. $\left[Co\left(NH_3\right)_4Cl_2\right]^+$

Answer: B

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83. $\left[Co(en)_2\left(NH_3\right)_2\right]Cl_3$ can exhibit

(A) ionisation isomerism

(B) geometrical isomerism

(C) optical isomerism

A. A,B

B. B,C

C. A,C

D. A,B,C

Answer: B

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84. Coordination isomerism is exhibited by

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

B. $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$

C. $\left[Cr(en)_2\right]NO_2$

D. $\left[Ni\left(NH_3\right)_6\right]\left[BF_4\right]_2$

Answer: B

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85. Geometrical isomerism in square planar complexes is given by

A. Ma_4 type complex

B. Ma_3b type complex

C. Ma_2b_2 type complex

D. Mb_4 type complex

Answer: C

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86. Which of the following compounds is expected to be coloured :

A. Ag_2SO_4

B. CuF_2

C. MgF_2

D. CuCl

Answer: B

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87. The orbitals having lower energy in tetrahedral complexes according to CFT are

A. d_{xy}, d_{xz}, d_{z^2}

B. $d_{xy}, d_{yz}, d_{x^2-y^2}$

C. d_{xy}, d_{yz}, d_{zx}

D. $d_{x^2-y^2}, d_{z^2}$

Answer: D

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88. $K_3\left[Fe(CN)_6\right]$ is a

A. double salt

B. complex compound

C. neutral molecule

D. Simple salt

Answer: B

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89. According to CFT the energy of t_{2g} orbitals in an octahedral complex

A. decrease by $\frac{2}{5}\Delta_0$

B. increase by $\frac{2}{5}\Delta_0$

C. increase by $\frac{3}{5}\Delta_0$

D. decrease by $\frac{3}{5}\Delta_0$

Answer: A

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90. A similarity between optical and geometrical isomerism is that

A. Each gives equal number of isomers for a given compound

B. If in a compound one is present then so is the other

C. Both are included in stereoisomers

D. They have no similarity

Answer: C

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91. Which one of the following will not show geometrical isomerism ?

A. $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

B. $\left[Co(en)_2Cl_2\right]Cl$

C. $Co\left(NH_3\right)_6NO_3\Big]Cl_2$

D. $\left[Pt\left(NH_3\right)_2Cl_2\right]$

Answer: C

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92. Transition elements form complexes due to

A. Small size

B. High nuclear charge

C. Presence of vacant d orbitals

D. All the above

Answer: D

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93. Select the correct IUPAC name of $\left[Co\left(NH_3\right)_5C\left(CO_3\right)\right]CI.$

A. Penta ammine chloro cobalt (III) chloride

B. Penta amino chloro cobalt (III) carbonate

C. Penta ammine carbonato cobalt (III) chloride

D. Penta amino carbonato chloro cobalt (III)

Answer: C

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94. $\left[Co\left(NH_3\right)_6SO_4\right]Br$ and $\left[Co\left(NH_3\right)_6Br\right]SO_4$ are a pair of _____ isomers .

A. Ionization

B. Ligand

C. Co-ordination

D. Hydrate

Answer: A

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95.

A) Ionisation	a) $[Pt(NH_3)_3Cl]_2[PtCl_4]$ & $[Pt(NH_3)_2Cl_2]$
B) Linkage	b) $[Cr(NH_3)_6][Co(CN)_6]$ & $[Co(NH_3)_6][Cr(CN)_6]$
C) Coordination	c) $[Co(NH_3)_5(NO_2)]Cl_2$ & $[Co(NH_3)_5(ONO)]Cl_2$
D) Polymerisation	d) $[Co(SO_4)(NH_3)_4]Br$ & $[Co(Br)(NH_3)_5]SO_4$

A. A-a,B-b,C-c,D-d

B. A-b,B-a,C-d,D-c

C. A-d,B-c,C-b,D-a

D. A-d,B-b,C-c , D-a

Answer: C

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96. Which of the following statements is true

A) Ma_3b_3 type of complex exhibits fac-mer isomerism

B) Tetrahedral complexes do not exhibit optical isomerism C)

$\left[Co(en)_3\right]^{3+}$ shows optical isomerism

D) $\left[Pt(en)_2Cl_2\right]$ does not exhibit optical isomerism

A. A,B,C are correct

B. B, C, D are correct

C. A, C, D are correct

D. All are correct

Answer: A

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97. Example showing ionisation isomerism

A. $\left[Co\left(NO_3\right)\left(NH_3\right)_5\right]SO_4$ & $\left[Co\left(SO_4\right)\left(NH_3\right)_5\right]NO_3$

B. $\left[Co\left(NH_3\right)_4Cl_2\right]Cl$ & $\left[Co\left(NH_3\right)_5Cl\right]Cl_2$

C. $\left[Cr\left(H_2O\right)_5Cl\right]Cl_2.H_2O$ & $\left[Cr\left(H_2O\right)_4Cl_2\right]Cl.2H_2O$

D. $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_4\right]$ & $\left[Pt\left(NH_3\right)_3Cl\right]_2\left[PtCl_4\right]$

Answer: A

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98. Which of the following exhibits linkage isomerism ?

A. $\left[Co\left(NH_3\right)_5SO_4\right]Br$

B. $\left[CO\left(H_2O\right)_6\right]Cl_3$

C. $\left[CO\left(NH_3\right)_5\left(NO_2\right)\right]Cl_2$

D. $\left[CO\left(NH_3\right)_6\right]\left[Cr(CN)_6\right]$

Answer: C

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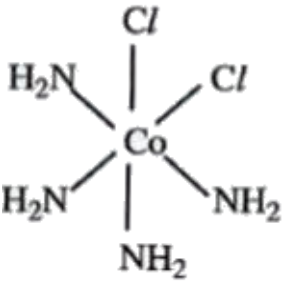
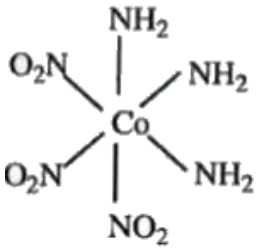
99. Which one of the following structures is indicative of meridonial isomer ?

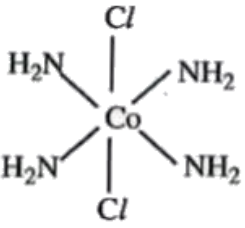
A.



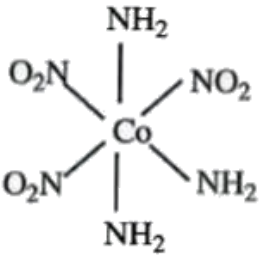
B.



C.



D.



Answer: C

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100. The number of geometrical isomers of $\left[Co\left(NH_3\right)_3\left(NO_3\right)_3\right]$ is

A. 4

B. 2

C. 6

D. 3

Answer: A

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101. The number of isomers possible for the octahedral complex $\left[CoCl_2(en)\left(NH_3\right)_2\right]^+$ is ,

A. Two

B. Three

C. No isomer

D. Four isomers

Answer: D

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102. Which of the following can exhibit geometrical isomerism?

A. Tetrahedral - $\left[Zn\left(NH_3\right)_2Cl_2\right]$

B. Square planar - $\left[Pt\left(NH_3\right)_2Cl_2\right]$

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

D. Linear - $\left[Cu(CN)_2\right]^+$

Answer: B

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103. How do we differentiate between Fe^{3+} and Cr^{3+} in group III ?

A. By adding excess of NH_4OH solution

B. By increasing NH_4^+ ion concentration

C. By decreasing OH^- ion concentration

D. Both (2) and (3)

Answer: D

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104. Nickel is purified using the concept of complex compounds. The complex related is

A. $Ni(CO)_6$

B. $\left[Ni\left(NH_3\right)_4\right]^{2+}$

C. $Ni(CO)_4$

D. $\left[Ni\left(NH_3\right)_6\right]^{2+}$

Answer: C

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105. $\left[\left(Ph_3P\right)_3RhCl\right]$ is a familiar catalyst used in

A. hydrogenation of oils

B. hydrogenation of alkenes

C. dehydration of alcohols

D. dehydration of aldehydes

Answer: B

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106. $\left(Ph_3P\right)_3RhCl$ is

A. Zieglar nutta catalyst

B. Wilkinsons catalyst

C. Developer in photography

D. Bio catalyst

Answer: B

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107. Ammonium cations can be detected using the complex

A. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

B. $\left[HgI_4\right]^{2-}$

C. $\left[Ag(CN)_2\right]^{-}$

D. $\left[HgI_2\right]$

Answer: B

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108. Hardness of water is estimated by simple titration using

A. formate

B. acetate

C. edta

D. glyoxile

Answer: C

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109. In photography silver bromide dissolves in hypo to give

A. $Na_2\left[Ag\left(S_2O_3\right)_2\right]$

B. $Na\left[Ag\left(S_2O_3\right)_2\right]$

C. $Na_3\left[Ag\left(S_2O_3\right)_2\right]$

D. $Na_4\left[Ag\left(S_2O_3\right)_2\right]$

Answer: C

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110. Organometallic compound used in purification of its metals is

A. $Ni(CO)_4$

B. $Pb\left(C_2H_5\right)_4$

C. Li - C_4H_9

D. $Na_2\left[Ni(CN)_4\right]$

Answer: A

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Objective Exercise 3 Previous Neet Aipmt

1. Among the following, which is not the π- bonded organomentallic compound

A. $\left(CH_3\right)_4Sn$

B. $K[PtCl]_3\left(\eta^2 - C_2H_6\right)$

C. $Fe\left(\eta^5 - C_5H_5\right)_2$

D. $Cr\left(\eta^6 - C_6H_6\right)_2$

Answer: A

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2. The number of unpaired electron in the complex ion $\left[CoF_6\right]^{3-}$ is

A. 0

B. 2

C. 3

D. 4

Answer: D

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3. Which of the following coordination compounds would exhibit optical isomerism ?

A. trans-dicyanobis (ethylenediamine) chromium (III) chloride

B. tris-ethylenediamine) cobalt (III) bromide

C. pentaamminenitrocobalt (III) iodide

D. diamminedichloroplatinum (II)

Answer: B

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4. Among $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{-2}$ and $\left[NiCl_4\right]^{-2}$ species the hybridisation state of the Ni atom are respectively?

A. sp^3, sp^3, dsp^2

B. dsp^2, sp^3, sp^3

C. sp^3, dsp^3, dsp^2

D. sp^3, dsp^2, sp^3

Answer: D

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5. CN^- is a strong field ligand. This is due to the fact that

A. it can accept electron from metal species

B. it forms high spin complexes with metal species

C. it carries negative charge

D. none of the above

Answer: D

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6. Considering H_2O as a weak field ligand, the number of unpaired electrons in $\left[Mn\left(H_2O\right)_6\right]^{2+}$ will be (Atomic no of Mn=25)

A. 2

B. 4

C. 3

D. 5

Answer: D

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7. Which of the following does not have a metal carbon bond ?

A. $K\left[pt\left(C_2H_4\right)Cl_3\right]$

B. $Ni(CO)_4$

C. $Al\left(OC_2H_5\right)_3$

D. C_2H_5MgBr

Answer: C

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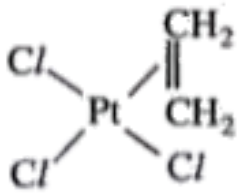
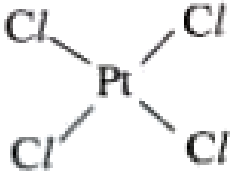
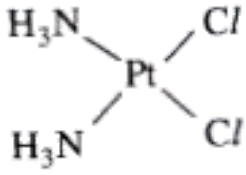
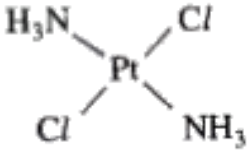
8. Which of the following is considered to be an anti cancer species.

A. 

B. 

C. 

D. 

Answer: C

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9. Which one of the following is expected to exhibit optical isomerism ?

A. trans-$\left[Co(en)_2Cl_2\right]$

B. trans-$\left[Pt\left(NH_3\right)_2Cl_2\right]$

C. cis-$\left[Pt\left(NH_3\right)_2Cl_2\right]$

D. cis-$\left[Co(en)_2Cl_2\right]$

Answer: D

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10. Which of the following is an inner orbital complex as well as diamagnetic in nature ?

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

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

C. $\left[Ni\left(NH_3\right)_6\right]^{2+}$

D. $\left[Zn\left(NH_3\right)_6\right]^{2+}$

Answer: B

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11. $\left[Cr\left(H_2O\right)_6\right]Cl_3$ (at. no. of Cr=24) has a magnetic moment of 3.83 BM. The correct distribution of 3d-electrons in the chromium of the complex

A. $3d_{xy}^1, 3d_{yz}^1, 3d_{xz}^1$

B. $3d_{xy}^1, 3d_{yz}^1, 3d_{z^2}^1$

C. $\left(3d_{x^2-y^2}^1\right), 3d_{z^2}^1, 3d_{xz}^1$

D. $3d_{xy}^1, \left(3d_{x^2-y^2}^1\right), 3d_{xz}^1$

Answer: A

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12. $\left[Co\left(NH_3\right)_4\left(NO_2\right)_2\right]Cl$ exhibits

A. ionization isomerism, geometrical isomerism and optical isomerism

B. linkage isomerism, geometrical isomerism and optical isomerism

C. linkage isomerism, ionization isomerism and optical isomerism

D. linkage isomerism, ionization isomerism and geometrical isomerism

Answer: D

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13. The d-electron configuration of $Cr^{2+}, Mn^{2+}, Fe^{2+}$ and Co^{2+} are d^4, d^5, d^6 and d^7 respectively. Which one of the following will exhibit

minimum paramagnetic behaviour ? (At. Nos. Cr=24 , Mn=25 , Fe=26 , Co=27)

A. $\left[Fe\left(H_2O\right)_6\right]^{2+}$

B. $\left[Ni\left(H_2O\right)_6\right]^{2+}$

C. $\left[Cr\left(H_2O\right)_6\right]^{2+}$

D. $\left[Mn\left(H_2O\right)_6\right]^{2+}$

Answer: B

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14. Which of the following will give a pair of enantiomorphs ?

A. $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$

B. $\left[Co(en)_2Cl_2\right]Cl$

C. $\left[Pt\left(NH_3\right)_4\right]\left[PtCl_6\right]$

D. $\left[Co\left(NH_3\right)_4Cl_2\right]NO_2$

Answer: B

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15. Which of the following complexes exhibits the highest paramagnetic behaviour ? (gly = glycine, en = ethylenediamine and bipy = bipyridyl)

A. $\left[Fe(en)(bipy)\left(NH_3\right)_2\right]^{2+}$

B. $\left[Co(Ox)_2(OH)_2\right]^-$

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

D. $\left[V(gly)_2(OH)_2\left(NH_3\right)_2\right]^+$

Answer: A

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16. Out of TiF_6^{2-}, Cu_2Cl_2, $NiCl_4^{2-}$ and CoF_6^{3-} (Z of Ti=22 , Co=27 , Cu=29, Ni=28) the colourless species are

A. CoF_6^{3-} and $NiCl_4^{2-}$

B. TiF_6^{2-} and Cu_2Cl_2

C. Cu_2Cl_2 and $NiCl_4^{2-}$

D. TiF_6^{2-} and CoF_6^{3-}

Answer: D

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17. Which one of he following complexes is not expected to exhibit isomerism ?

A. $\left[Ni\left(NH_3\right)_4\left(H_2O\right)_2\right]^{2+}$

B. $\left[Pt\left(NH_3\right)_2Cl_2\right]$

C. $\left[Ni\left(NH_3\right)_2Cl_2\right]$

D. $\left[Ni(en)_3\right]^{2+}$

Answer: C

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18. The existence of two different coloured complexes with the composition of $\left[Co\left(NH_3\right)_4Cl_2\right]^{+1}$ is due to the isomerism

A. linkage

B. geometrical

C. coordination

D. ionisation

Answer: D

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19. Which of the following does not show geometrical isomerism ?

A. $\left[Co(en)_3\right]^{3+}$

B. $\left[Co(en)_2Cl_2\right]^{+}$

C. $\left[Co\left(NH_3\right)_3Cl_3\right]^{0}$

D. $\left[Co(en)Cl_2\left(NH_3\right)_2\right]^{+}$

Answer: C

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

A. $-1.8\Delta_0$

B. $-1.6\Delta_0 + P$

C. $-1.2\Delta_0$

D. $-1.6\Delta_0$

Answer: D

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21. Which of the following complex ion is not expected to absorb visible light ?

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

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

C. $\left[Fe\left(H_2O\right)_6\right]^{2+}$

D. $\left[Ni\left(H_2O\right)_6\right]^{2+}$

Answer: A

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22. The complex, $\left[Pt(py)\left(NH_3\right)BrCl\right]$ will have how many geometrical isomers ?

A. 2

B. 3

C. 4

D. 0

Answer: B

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23. The complexes $\left[Co\left(NH_3\right)_6\right]\left[Cr(CN)_6\right]$ and $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$ are the example of which type of isomerism ?

A. Geometrical

B. Linkage

C. Ionization

D. Coordination

Answer: D

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24. The d-electron configuration of $Cr^{2+}, Mn^{2+}, Fe^{2+}$ and Co^{2+} are d^4, d^5, d^6 and d^7 respectively. Which one of the following will exhibit minimum paramagnetic behaviour ? (At. Nos. Cr=24 , Mn=25 , Fe=26 , Co=27)

A. $\left[Cr\left(H_2O\right)_6\right]^{2+}$

B. $\left[Mn\left(H_2O\right)_6\right]^{2+}$

C. $\left[Fe\left(H_2O\right)_6\right]^{2+}$

D. $\left[Co\left(H_2O\right)_6\right]^{2-}$

Answer: D

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25. Of the following complex ions, which is diamagnetic in nature ?

A. $\left[CoF_6\right]^{3-}$

B. $\left[NiCl_4\right]^{2-}$

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

D. $\left[CuCl_4\right]^{2-}$

Answer: C

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26. Which one of the following is an outer orbital complex and exhibits paramagnetic behaviour ?

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

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

C. $\left[Ni\left(NH_3\right)_6\right]^{2+}$

D. $\left[Zn\left(NH_3\right)_6\right]^{2+}$

Answer: C

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27. Low spin complex of d^6- cation in an octahedral field willhave the following energy. (Δ_0 = crystal field splitting energy in an octahedral field, P= Electron pairing energy)

A. $\frac{-12}{5}\Delta_0 + P$

B. $\frac{-12}{5}\Delta_0 + 3P$

C. $\frac{-2}{5}\Delta_0 + 2P$

D. $\frac{-2}{5}\Delta_0 + P$

Answer: B

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28. A magnetic moment of 1.73 B.M. will be shown by a complex among the following

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

B. $TiCl_4$

C. $\left[CoCl_6\right]^{4-}$

D. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

Answer: D

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29. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaqua chromium (III) chloride. The number of moles of AgCl precipitated would be

A. 0.002

B. 0.003

C. 0.01

D. 0.001

Answer: D

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

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

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

C. $\left[Co\left(H_2O\right)_6\right]^{2+}$

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

Answer: B

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31. Which of the following complexes is used as an anti-cancer agent ?

A. mer-$\left[Co\left(NH_3\right)_3Cl_3\right]$

B. cis-$\left[PtCl_2\left(NH_3\right)_2\right]$

C. cis-$K_2\left[PtCl_2Br_2\right]$

D. Na_2CoCl_4

Answer: B

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

A. $\left[Co(CN)_6\right]^{3-}$ has four unpaired electrons and will be in a high-spin configuration

B. $\left[Co(CN)_6\right]^{3-}$ has no unpaired electrons and will be in a high-spin configuration

C. $\left[Co(CN)_6\right]^{3-}$ has no unpaired electrons and will be in a lowspin configuration

D. $\left[Co(CN)_6\right]^{3-}$ has four unpaired electrons and will be in a low-spin configuration

Answer: C

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33. Cobalt (III) chloride forms several octahedral complexes with ammonia. Which of the following will not give test for chloride ions with silver nitrate at $25^{\circ}C$?

A. $CoCl_3.5NH_3$

B. $CoCl_3.6NH_3$

C. $CoCl_3.3NH_3$

D. $CoCl_3.4NH_3$

Answer: C

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34. The name of complex ion $\left[Fe(CN)_6\right]^{3-}$ is

A. Tricyanoferrate (III) ion

B. Hexacyanidoferrate (III) ion

C. Hexacyanoiron (III) ion

D. Hexacyanitoferate (III) ion

Answer: B

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35. The hybridization involved in the complex $\left[Ni(CN)_4\right]^{2-}$ is (At. No. Ni = 28)

A. d^2sp^2

B. d^2sp^3

C. dsp^2

D. sp^3

Answer: C

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36. The co-ordination number and the oxidation state of the element 'M' in the complex $\left[M(en)_2\left(C_2O_4\right)\right]NO_2$ [where (en) is ethan-1, 2 diamine] are respectively

A. 7

B. 8

C. 9

D. 6

Answer: C

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37. Number of possible isomers for the complex $\left[co(en)_3Cl_3\right]Cl$ will be : (en = ethylenediamine)

A. 3

B. 4

C. 2

D. 1

Answer: A

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38. Which of the following has longest C - O bond length ? (Free C - O bond length in CO is 1.128 A°)

A. $\left[Fe(CO)_4\right]^{2-}$

B. $\left[Mn(CO)_6\right]^{+}$

C. $Ni(CO)_4$

D. $\left[Co(CO)_4\right]^{\ominus}$

Answer: A

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39. Jahn-Teller effect is not observed in high spin complexes of

A. d^7

B. d^8

C. d^4

D. d^9

Answer: B

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40. Pick out the correct statement with respect to $\left[Mn(CN)_6\right]^{3-}$

A. It is dsp^2 hybridised and square planar

B. It is sp^3d^2 hybridised and octahedral

C. It is sp^3d^2 hybridised and tetrahedral

D. It is d^2sp^3 hybridised and Octahedral

Answer: D

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41. The correct order of the stiochiometers of AgCl formed when $AgNO_3$ in excess is treated with the complexes. $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl.4NH_3$ respectively is :

A. 2AgCl, 3AgCl, 1AgCl

B. 1AgCl, 3AgCl, 2AgCl

C. 3AgCl, 1AgCl, 2AgCl

D. 3AgCl, 2AgCl, 1AgCl

Answer: D

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42. An example of a sigma bonded organometallic compounds is

A. Cobaltocene

B. Ruthenocene

C. Grignard's reagent

D. Ferrocene

Answer: C

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43. Correct increasing order for the wavelength of absorption in the visible region for the complexes of Co^{3+} is

A. $\left[Co\left(NH_3\right)_6\right]^{3+}, \left[Co(en)_3\right]^{3+}, \left[Co\left(H_2O\right)_6\right]^{3+}$

B. $\left[Co(en)_3\right]^{3+}, \left[Co\left(NH_3\right)_6\right]^{3+}, \left[Co\left(H_2O\right)_6\right]^{3+}$

C. $\left[Co\left(H_2O\right)_6\right]^{3+}, \left[Co(en)_3\right]^{3+}, \left[Co\left(NH_3\right)_6\right]^{3+}$

D. $\left[Co\left(H_2O\right)_6\right]^{3+}, \left[Co\left(H_2O\right)_6\right]^{3+}, \left[Co(en)_3\right]^{3+}$

Answer: B

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44. Iron carbonyl, $Fe(CO)_5$ is

A. trinuclear

B. mononuclear

C. tetranuelear

D. dinuclear

Answer: B

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45. The type of isomerism shown by the complex $\left[CoCl_2(en)_2\right]$ is

A. Ionization isomerism

B. Coordination isomerism

C. Geometrical isomerism

D. Linkage isomerism

Answer: C

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46. The geometry and magnetic behavior of the complex $\left[Ni(CO)_4\right]$ are

A. square planar geometry and paramagnetic

B. tetrahedral geometry and diamagnetic

C. square planar geometry and diamagnetic

D. tetrahedral geometry and paramagnetic

Answer: B

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Objective Exercise 4

1. (A) : Structure of $\left[Co\left(NH_3\right)_6\right]^{+3}$ ion is octahedral

(R) : The coordination number of the metal ion is 6

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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2. Assertion : The IUPAC name of the complex compound $\left[Co\left(H_2O\right)_4Cl_2\right]Cl.\,2H_2O$ is tetra aquadichlorocobalt (III) chloride.

Reason: Tetrahedral complexes exhibit geometrical isomerism.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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3. (A) : $\left[Co_2(OH)_3\left(NH_3\right)_6\right]Cl_3$ is an example of polynuclear complex compound

(R) : Compound in which the number of central metal atoms is more than one is called polynuclear compound

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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4. (A): IUPAC name of [Pt Br (en) Cl, is dibromobis (1, 2-ethane diamine) platinum (IV) chloride.

(R): (en) represents ethylenediamine and it is a ligand where prefix di- is already included in its designation.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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5. Assertion: Chlorophyll is a magnesium corrin complex

Reason : Chlorophyll is not useful to perform photosynthesis in plants

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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6. Assertion: A cis-isomer has a net dipole moment zero.

Reason: cis- isomers has two ligands of the different type occupying adjacent positions.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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7. Assertion: The complex $CoCl_3.6NH_3$ gives white precipitate with silver nitrate solution.

Reason: chlorine is present Outside co-ordination sphere of the complex $CoCl_3.6NH_3$.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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8. Assertion:Co-ordination compounds are generally formed by transition metals.

Reason : Transition metals generally have partly filled d-orbitals in n^{th} shell.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: C

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9. Assertion: Complexes containing ambidentate ligands exhibit co-ordination isomerism.

Reason: Co-ordination isomerism is shown by anionic complexes only.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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10. Assertion: The complex $\left[Co\left(NH_3\right)_3Cl_3\right]$ gives no precipitate with $AgNO_3$ solution

Reason: The given complex is non-ionizable

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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11. Assertion: $\left[Cu(CN)_4\right]^{2-}$ is more stable than $\left[Cu\left(H_2O\right)_4\right]^{2+}$

Reason: On heating $\left[Cu\left(H_2O\right)_4\right]^{2+}$ with NH_3, $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is formed.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: B

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12. (A): [Fe(edta)] complex is octahedral in shape

(R): edta ligand is hexadentate and forms six bonds with the metal atom undergoing d^2sp^3 hybridization

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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13. Assertion:$Ni(CO)_4$ complex is tetrahedral in shape

Reason: Ni atom undergoes sp^3 hybridization in $Ni(CO)_4$.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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14. (A): All square planar complexes can exhibit geometrical isomerism

(R): In square planar complexes metal generally assumes dsp^2 hybrid state.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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15. Assertion: $\left(Ph_3P\right)_3RhCl$ is Wilkinson's catalyst.

Reason: $\left(Ph_3P\right)_3RhCl$ can show optical isomerism but does not show

geometrical isomerism.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: C

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16. Assertion: Willkinson's catalyst contains Ti^{4+} as the metal cation

Reason: Willkinson's catalyst has the composition $\left[\left(C_6H_5\right)_3P\right]_3PhCl.$

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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17. Assertion: Optical isomerism is not shown by square planar complexes.

Reason: Square planar complexes do not possess chiral structures.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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18. Assertion: $\left[Cu(en)_2\right]^{2+}$ is more stable than $\left[Cu\left(NH_3\right)_4\right]^{2+}$

Reason: Both these complexes have a square planar shape.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: B

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19. Assertion: The ligands nitro and nitrito are called ambidentate ligands

Reason: Nitro and nitrite ligands give linkage isomers.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: B

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20. Assertion: The total number of isomers shown by $\left[Co(en)_2Cl_2\right]^+$ complex ion is three

Reason: $\left[Co(en)_2Cl_2\right]^+$ complex ion has an octahedral geometry.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: B

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21. Assertion: Number of unpaired electrons present in $\left[Cu\left(NH_3\right)_2\right]^{(+)}$ complex is zero

Reason: The complex $\left[Cu\left(NH_3\right)_2\right]^{+}$ is linear with sp-hybridization.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: B

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22. Assertion: The number of unpaired electrons in $Ni(CO)_4$ complex is zero.

Reason : 4s electrons of Ni atom enter the inner d-orbitals to facilitate the sp^3 hybridization in Ni atom.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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23. Assertion: The coordination entity of the type $\left[PtCl_2(en)_2\right]^{+2}$ shows geometrical isomerism.

Reason: Trans isomer of $\left[PtCl_2(en)_2\right]^{+2}$ shows optical activity.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: C

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24. Assertion: The spin only magnetic moment of $\left[MnBr_4\right]^{2-}$ is 5.9 BM

Reason: $\left[MnBr_4\right]^{2-}$ is tetrahedral with sp^3 hybridisation of Mn^{2+} having $3d^5$ configuration

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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25. Assertion: $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic while $\left[Fe(CN)_6\right]^{4-}$ is diamagnetic

Reason: Both $\left[Fe(CN)_6\right]^{3-}$ and $\left[Fe(CN)_6\right]^{4-}$ involve d^2sp^3 hybridisation. In $\left[Fe(CN)_6\right]^{3-}$ singly occupied d-orbital is available but in $\left[Fe(CN)_6\right]^{4-}$ paired electrons are present

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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26. Assertion:In a complex prefixes cis- and trans - are used to designate adjacent and opposite geometric location of the ligands

Reason: With in the coordination sphere ligands are named after the metal atom (or) ion

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: C

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27. Assertion: The geometrical isomers of the complex $\left[M\left(NH_3\right)_4Cl_2\right]$ are optically inactive

Reason: Both geometrical isomers of the complex $\left[M\left(NH_3\right)_4Cl_2\right]$ possess axis of symmetry

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: A

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28. Assertion: The number of unpaired electrons present in $\left[CuCl_2\right]^-$ complex is zero

Reason: The complex is linear in the solid state with sp- hybridization

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: B

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29. Assertion: IUPAC name of $K_3\left[Fe(CN)_6\right]$ is potassium hexacyanoferrate (II)

Reason: $K_3\left[Fe(CN)_6\right]$ is commonly called potassium ferricyanide

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: D

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30. Assertion: Geometrical isomers of $Co\left(NH_3\right)_4Cl_2^+$ differ in their colours

Reason: All geometrical isomers of compounds have different colours.

A. Both Assertion & Reason are true ,Reason is the correct explanation of Assertion

B. Both Assertion & Reason are true, Reason is not correct explanation of Assertion

C. Assertion is true , Reason is false

D. Assertion is false , Reason is false

Answer: C

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Problem

1. Which ions can be tested in a solution of Mohr's salt?

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2. Identify the ligands and central metal ion in $\left[Co\left(NH_3\right)_2(en)_2\right]^{3+}$,Calculate the oxidation number and coordination number of metal ion.

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3. Which type of complex is cryolite ?

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4. List out the wrong among the following according to IUPAC and write the correct formula: (a) $\left[Zn(OH)_4\right]K_2$, (b) $\left[CoCl\left(NH_3\right)_4\left(H_2O\right)\right]Cl_2$, (c) $\left[Ag(CN)_2\right]\left[Ag\left(NH_3\right)_2\right]$ and (d) $\left[Pt\left(NH_3\right)_2Cl\left(NO_2\right)\right]$.

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

(a) $\left[CoCl_2(en)_2\right]Cl$, (b) $\left[Ni(CO)_4\right]$, (c) $\left[Pt\left(NH_3\right)_2Cl\left(NO_2\right)\right]$, (d) $\left[Cr\left(NH_3\right)_6\right]\left[Co(CN)_6\right]$

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6. Write the IUPAC names of the following coordination compound

$\left[Ni(CO)_4\right]$

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7. Write the IUPAC names of the follow coordination compounds.

$\left[Pt\left(NH_3\right)_2Cl\left(NO_2\right)\right]$

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8. Write the IUPAC names of the following coordination compound

$\left[Cr\left(NH_3\right)_5\right]\left[Co(CN)_6\right]$

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9. Write the formula of the following coordination compounds:

(a) Amminebromidochloridonitrito-O-platinum(II) ion

(b)Dichloridobis(ethane-1,2-diammine)platinum(IV) nitrate

(c) Diaquatetrahydroxoaluminate(III) ion

(d) Mercury(I) tetrathiocyanatocobaltate(III).

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10. Write the formulae for the follow Co-ordination compounds

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

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11. Write the formula of the following coordination compounds:

(a) Amminebromidochloridonitrito-O-platinum(II) ion

(b)Dichloridobis(ethane-1,2-diammine)platinum(IV) nitrate

(c) Diaquatetrahydroxoaluminate(III) ion

(d) Mercury(I) tetrathiocyanatocobaltate(III).

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12. Write the formula of the following coordination compound

Mercury(I) tetrathiocyanatocobaltate (III).

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13. Arrange the complexes $CoCl_3.6NH_3, CoCl_3.5NH_3, CoCl_3.4NH_3$ and $CoCl_2.3NH_3$ in the descending order of conductivity of their aqueous solutions.

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14. When excess ammonia gas is passed through aq $CrCl_3$ solution, complexes A and B are formed. Complex A gives 2 particles and complex B gives 4 charges. Write the formula of complexes.

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15. When excess of silver nitrate solution is added to the aqueous solution containing 0.1 mole of $CoCl_3.xNH_3$, if 28.7g of silver chloride precipitated, what is the value of x ?

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16. The secondary valence of Pt^{4+} is six. Calculate the number of moles of AgCl participated, when axcess of $AgNO_3$ solution is added to 2L of 0.1 M $PtCl_4.4NH_3$ solution.

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17. If $\left[PtCl_6\right]^{x-}$ follows the Sidgwick rule of stability, what is the oxidation state of Pt and complex ?

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18. If $\left[Fe(CO)_x\right]$ follows the Sidgwick rule of stability, what is the value of 'x'?

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

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20. How the gem stones ruby exhibits red colour and emerald exhibits green colour ?

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21. Anhydrous copper sulphate is colourless, but hydrated copper sulphate is blue. Explain ?

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22. Why hexaquamanganese(II)ion contains five unpaired electrons, while the hexacyno manganese (II)ion contains only one unpaired electron ?

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23. How many unpaired electrons present in the square planar $\left[Pt(CN)_4\right]^{2-}$ ion ?

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24. Why $\left[Co\left(NH_3\right)_6\right]^{3+}$ is an inner orbital complex where is $\left[Ni\left(NH_3\right)_6\right]^{2+}$ is an outer orbital complex ?

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25. $Ag^+ + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)\right]^+, K_1 = 3.5 \times 10^{-3}$

, $\left[Ag\left(NH_3\right)\right]^+ + NH_3 \Leftrightarrow \left[Ag\left(NH_3\right)_2\right]^+, K_2 = 1.7 \times 10^{-3}$. Calculate the formation constant of $\left[Ag\left(NH_3\right)_2\right]^+$. What is the instability constant ?

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26. $CoCl_3.xNH_3$ exhibits geometrical isomerism. What is the value of x?

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27. Which type of isomerisms are possible with the molecular formula $Co\left(NO_2\right)_3.2H_2NCH_2CH_2NH_2$.

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28. How is the theory of complexes used to sperate Fe_2O_3 and Al_2O_3 ?

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Subjective Exercise 1 Short Answer Questions

1. What are double salts ? Write examples.

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2. How is a complex compound differentiated from its constituents?

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3. Discuss the shapes of complex ions with coordination numbers 4 and 6.

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4. What do you understand by the term ligand? Discuss neutral and ionic ligands.

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5. Give examples for ionic and neutral complexes.

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Subjective Exercise 2 Short Answer Questions

1. Write the structures of following compounds:

(i) Tetraamminecopper(II) sulphate, (ii) Trichlorotriammine cobalt(III) , (iii) Tetracarbonylnickel(0) ,(iv)Dichlorodiammineplatinum(II) and (v) Trinitrotriamminecobalt(III)

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2. Write the structures of following compounds:

Trichlorotriammine cobalt (III)

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3. Write the structures of following compounds:

Trichloronylnickel (0)

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4. Write the structures of following compounds:

(i) Tetraamminecopper(II) sulphate, (ii) Trichlorotriammine cobalt(III) , (iii) Tetracarbonylnickel(0) ,(iv)Dichlorodiammineplatinum(II) and (v) Trinitrotriamminecobalt(III)

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5. Write the structures of following compounds:

Trichlorotriammine cobalt (III)

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6. $K_3\left[Fe(CN)_6\right]$ is a

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7. Write the IUPAC names of the following complexes

$\left[Pt\left(NH_3\right)_6\right]\left(SO_4\right)_2$

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8. Write the IUPAC names of the following complexes

$KFe^{III}\left[Fe(CN)_6\right]$

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9. Write the IUPAC names of the following complexes

$Cs_2\left[Co^{I}ICl_4\right]$

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10. Write the IUPAC names of the following complexes

$\left[CoF_6\right]^{-3}$

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Subjective Exercise 3 Long Answer Questions

1. Explain Werner's theory. Give the Werner's structures of $CoCl_3.6NH_3$, $CoCl_3.5NH_3$, $CoCl_3.4NH_3$ and $CoCl_3.3NH_3$.

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2. Define EAN. Calculate the EAN of the following metals in their respective complexes: $\left[Cu\left(NH_3\right)_4\right](OH)_2$ and $K_4\left[Fe(CN)_6\right]$

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3. Most important concept of valence bond theory is

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Subjective Exercise 3 Short Answer Questions

1. Identify the primary valency of the central metal in the tetra coordinated $CuSO_4$ and hexa coordinated $Cr\left(NO_3\right)_3.6H_2O$

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2. A linear complex $AgCl.2NH_3$ undergoes complete ionizaiton. What are the ions formed?

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3. Explain the formation of $\left[Co\left(NH_3\right)_6\right]Cl_3$ and $\left[Cu\left(NH_3\right)_4\right]SO_4$ on the basis of VBT.

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4. How many chlorides will be precipitated from the compelx compounds $CoCl_3.4NH_3$?

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5. What kind of hybridization is undergone by 'Co' in the complex $\left[Co\left(NH_3\right)_6\right]^{3+}$?

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Subjective Exercise 3 Very Short Answer Questions

1. Write the important features of Sidwick's EAN

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2. Write short notes on primary valency of a metal ion.

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3. Which of the following is a complex compound ? Potash alum, tetrammine copper (II) sulphate, Potasium hydrogen fluoride.

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4. On addition of $AgNO_3$ solution to 1M $CoCl_3.5NH_3$ solution, how many moles of AgCl are produced ?

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5. The compound $TiCl_4.2H_2O$ is a nonconductor of electricity. Give the Werner's structure.

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Subjective Exercise 4 Long Answer Questions

1. Explain structural isomerism with examples.

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2. Explain geometrical isomerism in complexes with coordination number 4 and 6 with examples.

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Subjective Exercise 4 Short Answer Questions

1. Explain optical isomerism in octahedral complexes.

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2. What kind of isomerism is shown by the pairs of following complex compounds ?

(a) $\left[Pt\left(H_2O\right)_4Cl_2\right]Cl_22H_2O$ and $\left[Pt\left(H_2O\right)_5Cl\right]Cl_3.H_2O$

(b) $\left[Cu\left(NH_3\right)_4\right]\left[Ni(CN)_4\right]$ and $\left[Ni\left(NH_3\right)_4\right]\left[Cu(CN)_4\right]$.

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Subjective Exercise 4 Very Short Answer Questions

1. $Co\left(NH_3\right)_5Br.SO_4$, when it is treated with $AgNO_3$ gives yellow precipitate, give its structure.

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2. Mention the colours exhibited by $CrCl_3.6H_2O$ in its hydrate isomers

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3. Write a pair of optical isomers along with their structures .

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4. Define Racemic mixture

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Subjective Exercise 5 Short Answer Questions

1. Give an example of a complex that is formed in qualitative analysis.

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2. How is silver halide used in photography? What is the complex formed?

Watch Video Solution

3. How is concept of complexes used in metallurgy ?

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4. Mentio a complex that is present in biological systems.Is Heme-b, a complex compound ?

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Subjective Exercise 5 Very Short Answer Questions

1. Give the central metal and its oxidation state in haemoglobin and chlorophyll.

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2. What is Nessler's reagent ? Give its use.

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3. $CuSO_4$ is more soluble in ammonia. Why ?

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4. Give chemical reaction of silver halide with dilute hypo

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Objective Exercise 1 Complex Comounds

1. Carnallite is an example of

A. mixed salt

B. complex salt

C. basic salt

D. double salt

Answer: D

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2. Which of the following is an example of a complex salt

A. Cuprammonium sulphate

B. Ferrous ammonium sulphate

C. Bleaching powder

D. Potassium bisulphate

Answer: A

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3. Ligand in a metal carbonyl complex is

A. CO_2

B. CO

C. $CoCl_2$

D. $C_2O_4^{2-}$

Answer: B

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4. In complex compounds the metal atom or ion acts as a

A. Lewis acid

B. Lewis base

C. Bronsted acid

D. Bronsted base

Answer: A

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5. A ligand should contain

A. odd electrons

B. even numer of electrons

C. lone pair of electrons to donate

D. vacant orbital to accept the lone pair

Answer: C

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6. The oxidation state of Fe in $\left[Fe(CN)_6\right]^{-3}$ ion is

A. $+1$

B. $+2$

C. $+3$

D. zero

Answer: C

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7. In which of the following compounds iron has zero oxidation state

A. $Fe(CO)_5$

B. Fe_2O_3

C. FeO

D. Fe_3O_4

Answer: A

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8. The charge on cobalt in $\left[Co(CN)_6\right]^{3-}$ is

A. -3

B. $+3$

C. -6

D. $+6$

Answer: B

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9. A bidentate ligand is

A. pyridine

B. thiocyanate

C. ethylene diammine

D. water

Answer: C

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10. Which of the following is a polynuclear compound

A. $\left[Co\left(NH_3\right)_4\right]Cl$

B. $NaFe\left[Fe(CN)_6\right]$

C. $\left[Cr\left(H_2O\right)_5Cl\right]Cl_2$

D. $\left[Co_2\left(NH_3\right)_6(OH)_3\right]Cl_3$

Answer: D

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11. A ligand can not be (A) neutral, (B) anionic , (C) anionic

A. B only

B. C only

C. A and B

D. none

Answer: D

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12. Example of neutral complex compound in the following list

A. $CoCl_3.6NH_3$

B. $CoCl_3.5NH_3$

C. $CoCl_3.4NH_3$

D. $CoCl_3.3NH_3$

Answer: D

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13. Alum in aqueous solution gives positive test for (A)K^+ , (B) Al^{3+} , (C)SO_4^{2-}

A. A only

B. B only

C. A and B

D. A, B and C

Answer: D

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14. $Ni(CO)_4$ is an example of

A. cationic complex

B. neutral comolex

C. anionic complex

D. poly nuclear complex

Answer: B

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15. Donor atoms in ethylenediamine are

A. N and N

B. N and H

C. N and C

D. C and H

Answer: A

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16. First theory to explain the formation of complexes was proposed by

A. Werner

B. Pauling

C. Sidgwick

D. Mullikan

Answer: A

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17. Primary valency denotes

A. coordination number

B. number of ligand

C. oxidation number

D. effective atomic number

Answer: C

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18. Primary valency is satsified by

A. only negative ligands

B. only positive ligands

C. negative and neutral ligands

D. positive and neutral ligands

Answer: A

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19. The coordination number of a central metal atom in a complex is determined by

A. the number of ligands around a metal ionbonded by dative bonds

B. the number of only anionic ligands bonded to the metal ion

C. the number of ligands around a metal ion bonded by ionic bonds

D. the number of ligands around a metal ion bonded by covalent bonds

Answer: A

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20. Structure of the complex with sp^3 hybridisation

A. planar triangular

B. square planar

C. tetrahedral

D. octahedral

Answer: C

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21. Inner complex is also called

A. spin free complex

B. low spin complex

C. weak field complex

D. ionic complex

Answer: B

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22. The primary valency of 'Fe' in the complex $K_4\left[Fe(CN)_6\right]$ is

A. 2

B. 3

C. 6

D. 4

Answer: A

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23. The hybridisation of metal ion in square planar complexes in

A. dsp^2

B. sp^3d

C. d^3sp^3

D. sp^3

Answer: A

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24. The hybridisation of Iron in $K_4\left[Fe(CN)_6\right]$ is

A. dsp^2

B. sp^3

C. d^2sp^3

D. sp^3d^2

Answer: C

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25. One mole of the complex compound $CoCl_3xNH_3$ gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with two moles of $AgNO_3$ solution to yield two moles of AgCl. The value of x is

A. 5

B. 4

C. 3

D. 2

Answer: A

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26. Number of chlorides satisfying secondary valency in $CoCl_3.4NH_3$

A. 1

B. 2

C. 3

D. 6

Answer: B

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27. Total number of ions the complex $CoCl_3.6NH_3$ gives in water

A. 2

B. 3

C. 4

D. 6

Answer: C

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28. Effective atomic number of transition metal in potassium ferrocyanide

A. 24

B. 26

C. 35

D. 36

Answer: D

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29. According to pauling the orbitals involved in the hybridisation to form a complex are

A. Orbitals filled with two electrons each

B. Orbitals filled with one electron each

C. Orbitals not filled with electrons

D. Orbtials filled with one or two electrons

Answer: C

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30. In the formation of some complexes, electrons in the metal orbital may undergo pairing against

A. Pauli's principle

B. Uncertainity principle

C. Hund's principle

D. Auf -bau rule

Answer: C

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Objective Exercise 1 Iupac Notations

1. The formula of 'nitrosyl' group

A. NO

B. NO^{+}

C. NO^{-}

D. ONO

Answer: A

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2. Name of oxalate in IUPAC version changes to

A. Oxalite

B. Oxalato

C. Oxalito

D. Oxalide

Answer: B

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3. In the IUPAC version, the ligand OH^- is named as

A. hydroxide

B. hydroxyl

C. hydroxo

D. ol

Answer: C

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4. $K_3\left[Fe(CN)_6\right]$ is a

A. potassium ferrocyanide

B. potassium ferricyanide

C. potassium hexacyanoferrate (II)

D. potassium hexacyanoferrate (III)

Answer: D

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5. Hydrazinium ion is chemically

A. $N_2H_3^-$

B. $N_2H_3^+$

C. $N_2H_5^+$

D. $N_2H_5^-$

Answer: C

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6. A prefix penta is used in naming the complex

A. $CrCl_3.6NH_3$

B. $CrCl_3.5NH_3$

C. $CrCl_3.4NH_3$

D. $CrCl_3.3NH_3$

Answer: B

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7. Tetrammine diaqua copper (II) hydroxide is given by the formula

A. $\left[Cu\left(NH_3\right)_4\right](OH)_2.2H_2O$

B. $\left[Cu\left(NH_3\right)_4\right](OH)_2.2H_2O$

C. $\left[Cu\left(NH_3\right)_4\right]\left(H_2O\right)_2(OH)_2$

D. $\left[Cu\left(NH_3\right)_4\left(H_2O\right)(OH)_2\right]$

Answer: C

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IUPAC Name	Formulae of ligand
i) Bromo	A) CO
ii) Carbonyl	B) C_6H_5COO
iii) Benzoato	C) H_2O
iv) Aquo	D) Br

8. The correct match is

The correct match is

A.

i	*ii*	*iii*	*iv*
D	*A*	*B*	*C*

B.
i	ii	iii	iv
D	B	A	C

C.
i	ii	iii	iv
D	A	C	B

D.
i	ii	iii	iv
D	C	A	B

Answer: A

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9. Metal-Isothiocyanato' is indicated by its chemical symbol as

A. M-NCS

B. M-SCN

C. M-CNS

D. M-CSN

Answer: A

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10. Which of the following is an example of ambidentate ligand

A. CO

B. CN^-

C. H_2O

D. SO_4^{2-}

Answer: B

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11. Which of the following has maximum number of unpaired d-electrons

A. Zn

B. Fe^{2+}

C. Ni^{3+}

D. Cu^{+}

Answer: B

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12. Which one of the following is tris (ethane-1, 2-diammine) cobalt (III) sulphate?

A. $\left[Co_3(en)\right]SO_4$

B. $\left[Co(en)_3\right]SO_4$

C. $\left[Co(en)_3\right]_3\left(SO_4\right)_2$

D. $\left[Co(en)_3\right]_2\left(SO_4\right)_3$

Answer: D

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Objective Exercise 1 Theories

1. Which of the following is paramagnetic ?

A. $V(CO)_6$

B. $Fe(CO)_5$

C. $Fe_2(CO)_9$

D. $Cr(CO)_6$

Answer: A

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2. The magnetic behaviour of complexes $K_4\left[Fe(CN)_6\right]$ and $K_3\left[Fe(CN)_6\right]$ is

A. Para, Dia

B. Dia, Para

C. Dia, Ferro

D. Both Dia

Answer: B

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3. Which one of the following cyano complexes exhibit the lowest value of paramagnetic behaviour ?

A. $\left[Cr(CN)_6\right]^{3-}$

B. $\left[Mn(CN)_6\right]^{3-}$

C. $\left[Fe(CN)_6\right]^{3-}$

D. $\left[Co(CN)_6\right]^{3-}$

Answer: D

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4. Which of the following has square planar geometry

A. $\left[FeCl_4\right]^{2-}$

B. $\left[NiCl_4\right]^{2-}$

C. $\left[PdCl_4\right]^{2-}$

D. $\left[CoCl_4\right]^{2-}$

Answer: C

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5. In $Fe(CO)_5$, Fe-C bond possess

A. sigma character only

B. Pi character only

C. both sigma and pi character

D. ionic character

Answer: C

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6. Which of the following system has maximum number of the unpaired electrons in an inner octahedral complex?

A. d^4

B. d^9

C. d^7

D. d^5

Answer: A

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7. Which of the following complex species does not involve d^2sp^3 hybridisation?

A. $\left[CoF_6\right]^{3-}$

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

C. $\left[Fe(CN)_6\right]^{3-}$

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

Answer: A

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8. Which of the following is an outer orbital complex

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

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

C. $\left[FeF_6\right]^{3-}$

D. $\left[Cr(CN)_6\right]^{3-}$

Answer: C

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9. Which of the following is low spin complex

A. $\left[NiCl_4\right]^{2-}$

B. $\left[CoF_6\right]^{3-}$

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

D. $\left[MnCl_4\right]^{2}$

Answer: C

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10. In an octahedral crystal field, the correct set of low energy orbitals are

A. d_{xy}, d_{xz}, d_{z2}

B. $d_{x^2.y^2}, d_{z^2}$

C. d_{xy}, d_{xz}, d_{yz}

D. d_{xy}, d_{x2-y2}

Answer: C

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11. The correct order of increasing field strengths

A. $Br^- > SCN^- > Cl^- > I^-$

B. $Br^- < SCN^- < Cl^- < I^-$

C. $I^- < Br^- < SCN^- < Cl^-$

D. $I^- > Cl^- > SCN^- > Br^-$

Answer: C

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12. In which of the following octahedral complexes of cobalt (atomic number = 27) will the magnitude of Δ_0 be the highest?

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

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

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

D. $\left[Co(CN)_6\right]^{3-}$

Answer: D

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13. For the same metal, stabilisation energies of tetrahedral and octahedral complexes are related as

A. $\Delta_t = \Delta_0$

B. $\Delta_t \times 4 = \Delta_0 \times 6$

C. $\Delta_t \times 9 = \Delta_0 \times 4$

D. $\Delta_t \times 6 = \Delta_0 \times 4$

Answer: C

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Objective Exercise 1 Isomerism

1. Which of the following is not an example of the isomerism in coordination compounds

A. ionisation isomerism

B. hydrate isomerism

C. Position isomerism

D. ligand isomerism

Answer: C

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2. Ionisation isomerism is possible with

A. $\left[Co\left(NH_3\right)_6\right]Cl_3$

B. $\left[Co\left(NH_3\right)_3Cl_3\right]$

C. $\left[Co\left(NH_3\right)_5Cl\right]Br$

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

Answer: C

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3. $\left[PtBrCl\left(NO_2\right)\left(NH_3\right)\right]$ I on ionisation gives the ion

A. Cl^-

B. Br^-

C. I^-

D. NO_2^-

Answer: C

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4. Structural differences are main in the following isomers

(A) ionisation isomerism, (B) ligand isomerism ,(C) hydrate isomerism, (D) geometrical isomerism

A. A, B, C

B. A, C, D

C. B, C, D

D. A, B, D

Answer: A

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5. Optical isomers differ in

A. chemical properties

B. molecular formulae

C. physical properties

D. optical properties

Answer: D

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6. A racemic mixture has a net rotation

A. to right of original plane

B. to left of original plane

C. to right or left of original plane

D. zero

Answer: D

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7. Geometrical isomerism may be possible with

A. tetrahedral complex

B. square planar complex

C. pentagonal pyramidal complex

D. square pyramidal complex

Answer: B

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8. $\left[Cr\left(H_2O\right)_6\right]Cl_3$ and $\left[Cr\left(H_2O\right)_4Cl_2\right]Cl.H_2O$ are hydrate isomers. Their colours are respectively

A. violet and green

B. yellow and green

C. red and blue

D. blue and green

Answer: A

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Objective Exercise 1 Applications

1. Hydrometallurgy is a technique used

A. for extracting silver from aqueous solutions

B. for extracting sodium from aqueous solutions

C. for extracting silver from its fused salt

D. for extracting sodium from its fused salt

Answer: A

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2. Which of the following silver halide is insoluble in water but soluble in liquid ammonia

A. Silver fluoride

B. Silver chloride

C. Silver bromide

D. Silver Iodide

Answer: B

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3. The number of moles of KI required to prepare one mole of $K_2[HgI_4]$ is

A. 4

B. 3

C. 2

D. 1

Answer: A

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4. Geometry of orbitals around the transition metal ion in hexacyanoferrate

A. square planar arrangement

B. tetrahedral arrangement

C. plane trigonal arragement

D. octahedral arrangement

Answer: D

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5. The complex compound that gives a preciptate with $BaCl_2$ solution is

A. $\left[Co\left(NH_3\right)_5SO_4\right]Br$

B. $\left[Co\left(NH_3\right)_5Br\right]SO_4$

C. $\left[Co\left(NH_3\right)_5Br\right]\left(NO_3\right)_2$

D. $\left[Co\left(NH_3\right)_5SO_4\right]Cl$

Answer: B

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6. In metallurgy the metal used to displace silver from its cyano complex is

A. Zn

B. Au

C. F_2

D. Cl_2

Answer: A

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7. Which of the following releases metal slowly which gives uniform coating in electroplating

A. Metal salts

B. Double salts

C. Complex salts

D. Alums

Answer: C

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8. In $\left[Ti\left(H_2O\right)_6\right]^{+3}$ complex the energy absorbed for excitation of $3d^1$ electron is

A. Purple

B. Blue

C. Blue-green

D. Red

Answer: C

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9. Number of dative bonds around Ag^+ ion in $\left[Ag\left(NH_3\right)_2\right]^+$

A. 2

B. 3

C. 4

D. 6

Answer: A

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10. Which of the following exhibits purple colour in solutions

A. $\left[Fe\left(H_2O\right)_6\right]^{2+}$

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

C. $\left[Cu\left(H_2O\right)_6\right]^{2+}$

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

Answer: B

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11. The polydentate ligand used in the treatment of lead poisoning

A. EDTA

B. Glycinate

C. Oxalate

D. Ethylene diammine

Answer: A

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12. The ligand used in the identification of cupric copper in the laboratory

A. NH_3

B. I^-

C. CN^-

D. $S_2O_3^{2-}$

Answer: A

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13. (A) : Structure of $\left[Co\left(NH_3\right)_6\right]^{+3}$ ion is octahedral

(R) : The coordination number of the metal ion is 6

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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14. (A) : IUPAC name of $\left[Co\left(H_2O\right)_4Cl_2\right]Cl.2H_2O$ is tetraaquadichlorocobalt(III) chloride.

(R) : Water of crystallisation is represented by Arabic numerical before its name

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: D

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15. (A) : $\left[Co_2(OH)_3\left(NH_3\right)_6\right]Cl_3$ is an example of polynuclear complex compound

(R) : Compound in which the number of central metal atoms is more than one is called polynuclear compound

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

Watch Video Solution

16. (A): IUPAC name of [Pt Br (en) Cl, is dibromobis (1, 2-ethane diamine) platinum (IV) chloride.

(R): (en) represents ethylenediamine and it is a ligand where prefix di- is already included in its designation.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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17. (A): Chlorophyll contains one magnesium atom

(R): Chlorophyll is useful to perform photosynthesis in plants

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: B

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18. Why is Cr^{2+} reducing and Mn^{3+} oxidizing even though both have the same d^4 electronic configuration.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: B

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19. (A): One mole of $CrCl_3.5NH_3$ in aqueous solutions can give two moles of AgCl on addition with excess $AgNO_3$ solution

(R) : $CrCl_3.5NH_3$ has octahedral shape.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: B

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20. (A) : $CoCl_3.3NH_3$ does not ionise in aqua solution.

(R): $CoCl_3.3NH_3$ is an example of aionic compounds.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: C

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21. (A): A cis-isomer has a net dipole moment zero.

(R): A cis-isomers has two ligands of the same type occupying adjacent positions.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: D

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22. Assertion:Co-ordination compounds are generally formed by transition metals.

Reason : Transition metals generally have partly filled d-orbitals in n^{th} shell.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: C

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23. (A) : Aqueous solution of Mohr's salt exhibits the test for NH_4^+, Fe^{2+} and SO_4^{2-} ions.

(R): Mohr's salt is a double salt .

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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24. (A): Complexes containing ambidentate ligands exhibit co-ordination isomerism.

(R) : Co-ordination isomerism is shown by the compounds in which both cation and anions are complexes.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: D

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25. (A): Metalcarbonyls can be called organometallics.

(R): Metal carbonyls do contain metal-carbon bond.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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26. Assertion: The complex $\left[Co\left(NH_3\right)_3Cl_3\right]$ gives no precipitate with $AgNO_3$ solution

Reason: The given complex is non-ionizable

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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27. Assertion: $\left[Cu(CN)_4\right]^{2-}$ is more stable than $\left[Cu\left(H_2O\right)_4\right]^{2+}$

Reason: On heating $\left[Cu\left(H_2O\right)_4\right]^{2+}$ with NH_3, $\left[Cu\left(NH_3\right)_4\right]^{2+}$ is formed.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: B

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28. (A): Chelates are relatively more stable than non-chelated complexes.

(R): Complexes containing ligands which can be easily replaced by other ligands are called labile complexes.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: B

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29. (A): [Fe(edta)] complex is octahedral in shape

(R): edta ligand is hexadentate and forms six bonds with the metal atom undergoing d^2sp^3 hybridization

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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30. Assertion:$Ni(CO)_4$ complex is tetrahedral in shape

Reason: Ni atom undergoes sp^3 hybridization in $Ni(CO)_4$.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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31. (A): All square planar complexes can exhibit geometrical isomerism

(R): In square planar complexes metal generally assumes dsp^2 hybrid state.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: D

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32. (A): Ethylenediaminetetraacetate ion forms a 1:1 stoichiometric complex with Co^{2+} ion

(R): It has six donor atoms which coordinate simultaneously to the metal ion.

A. Both A & R are true, R is the correct explanation of A

B. Both A & R are true, R is not correct explanation of A

C. A is true, R is false

D. A is false, R is true

Answer: A

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1. The primary valency of the central transition metal ion in a complex compound $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$

A. 3

B. 2

C. 1

D. 0

Answer: A

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2. The number of ions given by $\left[CO\left(NH_3\right)_3Cl_3\right]$ in aqueous solution is

A. 1

B. 2

C. 3

D. zero

Answer: D

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3. The oxidation state of Chromium in the complex, $\left[Cr\left(NH_3\right)_4Cl_2\right]Cl$ is

A. $+3$

B. $+2$

C. $+1$

D. 0

Answer: A

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4. When 1 mole of $\left[Co\left(NH_3\right)_3Cl_3\right]$ is added to excess of $AgNO_3$ solution the weight of AgCl precipitated is

A. 143.5g

B. 108g

C. zero

D. 54 g

Answer: C

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5. The secondary valency of Chromium in $\left[Cr(en)_3\right]Cl_3$ is

A. 6

B. 3

C. 2

D. 4

Answer: A

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6. The deep blue complex produced by adding excess of Ammonia to $CuSO_4$ solution is

A. $\left[CuNH_3\right)_2]^{2+}$

B. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

C. $\left[Cu\left(NH_3\right)_6\right]^{2+}$

D. $\left[Cu\left(NH_3\right)_4\right]^{+}$

Answer: B

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7. $K_2SO_4.Al_2\left(SO_4\right)_3.24H_2O$ is

A. a complex salt

B. a double salt

C. a complex salt & double salt

D. a basic salt

Answer: B

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8. Number of dative bonds in the complex $CoCl_3.5NH_3$ is

A. 5

B. 6

C. 3

D. 4

Answer: B

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LIST - I (complex)	LIST - II (Charge on co-ord. sphere)
A) $CoCl_3.6NH_3$	1) +1
B) $CoCl_3.5NH_3$	2) +2
C) $CoCl_3.4NH_3$	3) +3
D) $CoCl_3.3NH_3$	4) +4
	5) 0

9.

The correct match in terms of the charge on the complex

A.

A	*B*	*C*	*D*
3	2	5	1

B.

A	*B*	*C*	*D*
3	1	2	5

C.

A	*B*	*C*	*D*
3	2	1	5

D.

A	*B*	*C*	*D*
4	3	2	1

Answer: C

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10. A complex compound of Co^{3+} with molecular formula $COCl_x.yNH_3$ gives a totall of 3 ions when dissolved in water. How many Cl^- ions when the primary and secondary valency in this complex ?

A. 3

B. 1

C. 4

D. zero

Answer: B

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11. Pick up true statement about the complex compound with formula

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

A. IUPAC name is triamminecobalt (III) chloride

B. The complex can exhibit fac and mer isomerism

C. The complex can show optical isomerism

D. The hybrid state of cobalt is dsp^3

Answer: B

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12. Neutral complex among the following

A. $CuSO_4.4NH_3$

B. $\left[Co\left(NH_3\right)_6\right]Cl_3$

C. $Ni(CO)_4$

D. $\left[Pt\left(NH_3\right)_2\right]Cl_2$

Answer: C

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13. Cationic complex is

A. Potassium ferrocyanide

B. Cryolite

C. Cuprammonium (II) sulphate

D. Sodium argentothiosulphate

Answer: C

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14. Number of unpaired electrons in $\left[Fe(CN)_6\right]^{4-}$ ion

A. 6

B. 5

C. 4

D. zero

Answer: D

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15. Which of the following is diamagnetic

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

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

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

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

Answer: A

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16. The number of ions formed when cupra ammonium sulphate is dissolved in water

A. 1

B. 2

C. 4

D. zero

Answer: B

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Property of transition element	Reason for the property
1) Colour of ion	A) unpaired e^- in (n-1)d orbital
2) Variable oxdation states	B) Same crystal structure
3) formation of alloys	C) d-d- transition
4) paramagnetic	D) high magnitude of positive charge
	E) slight energy between ns and (n–1)d shells

17.

A. 1-C, 2-E, 3-A, 4-B

B. 1-C, 2-E, 3-B, 4-A

C. 1-C, 2-B, 3-E, 4-A

D. 1-B, 2-A, 3-E, 4-B

Answer: B

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18. The complex ion $\left[Cu\left(NH_3\right)_4\right]^{2+}$ has :

A. In acidic solutions hydration protects copper ions

B. In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ions and NH_3 molecules are not available

C. In alkaline solutions insoluble $Cu(OH)_2$ is precipitated which is soluble in excess of any alkali

D. Copper hydroxide is an amphoteric substance.

Answer: B

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19. Nickel combines with a uninegative monodentate ligand X to form a paramagnetic complex $\left[NiX_4\right]^{2-}$. The number of unpaired electron/s in the nickel and geometry of this complex ion are respectively

A. two, square planar

B. one, tetrahedral

C. two, tetrahedral

D. one, square planar

Answer: C

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20. $\left[PdBr_4\right]^{2-}$ is a sqaure planar complex. The hybridisation of Pd^{2+} is

A. sp^3

B. dsp^2

C. sp^3d

D. sp^3d^2

Answer: B

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Objective Exercise 2 Theories

1. Stabilisation energy of octahedral complex with d^7 configuration

(A)1.8 Δ_0 with one unpaired electron

(B)1.8 Δ_0 with three unpaired electron

(C)0.8 Δ_0 with one unpaired electron

(D)0.8 Δ_0 with three unpaired electron

A. A and D

B. A and B

C. C and D

D. B and C

Answer: A

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2. If $\Delta_0 < P$, the correct electronic configuration for d^4 system will be

A. $t_{2g}^4 e_g^0$

B. $t_{2g}^3 e_g^1$

C. $t_{2g}^0 e_g^4$

D. $t_{2g}^2 e_g^2$

Answer: B

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3. Which of the following is an outer orbital complex

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

B. $\left[Ni\left(NH_3\right)_6\right]^{2+}$

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

D. $\left[Mn(CN)_6\right]^{4-}$

Answer: B

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4. Which of the following statement is incorrect for metals involving in formation of alloys

A. must have almost same atomic radii

B. must have similar chemical properties, especially number of valency electrons

C. must have same crystal structures

D. must belong to same 'd' series

Answer: D

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5. Match the lists I and II and pick the correct matching from the codes given below

List -I (*complex*)	List -II (*Structure and magnetic moment*)
a) $[Ag(CN)_2]^-$	1) square planar and 1.73 BM
b) $[Cu(CN)_4]^{3-}$	2) Linear and zero
c) $[Cu(CN)_6]^{4-}$	3) Octahedral and zero
d) $[Cu(NH_3)_4]^{2+}$	4) tetrahedral and zero
e) $[Fe(CN)_6]^{4-}$	5) octahedral and 1.73BM

A. a-2, b-4, c-5, d-1, e-3

B. a-5,b-4,c-1,d-3,e-2

C. a-1,b-3,c-4,d-2,e-5

D. a-4,b-5,c-2,d-1,e-3

Answer: A

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6. Compound that is both paramagnetic and coloured is

A. $K_2Cr_2O_7$

B. $\left[TiCl_6\right].\left(NH_4\right)_2$

C. $VOSO_4$

D. $K_3\left[Cu(CN)_4\right]$

Answer: C

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7. Strongest oxidant among the following is

A. VO_2^+

B. $Cr_2O_7^{-2}$

C. MnO_4^-

D. MnO_4^{-2}

Answer: C

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Objective Exercise 2 Properties

1. The number of unpaired electrons in the square planar complex $\left[Pt(CN)_4\right]^{2-}$ is

A. 2

B. 3

C. 0

D. 1

Answer: C

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2. The correct statement regarding $\left[Co\left(C_2O_4\right)_3\right]^{3+}$ complex is

A. It is inner orbital complex and diamagnetic

B. It is outer orbital complex and diamagnetic

C. It is inner orbital complex and paramagnetic

D. It is outer orbital complex and para magnetic

Answer: A

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3. Match the following

complex	colour
I) $[Ni(H_2O)_4en]_{aq}^{2+}$	A) Grey-green
II) $[Ni(H_2O)_2(en)_2]_{aq}^{2+}$	B) Violet
III) $[Ni(en)_3]_{aq}^{2+}$	C) Blue/Purple
IV) $Cr[(H_2O)_5Cl]Cl_2.H_2O$	D) Pale blue

The correct match is

A.
I	II	III	IV
D	C	B	A

B.
I	II	III	IV
B	A	C	D

C.
I	II	III	IV
A	D	B	C

D.
I	II	III	IV
C	A	D	B

Answer: A

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4. The spin only magnetic moment $\left[Mn(Br)_4\right]^{2+}$ is 5.9BM. Then possible hybridisation of Mn in the complex is

A. sp^3d

B. dsp^2

C. d^2sp^3

D. sp^3

Answer: D

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Objective Exercise 2 Nomenclature

1. Write the IUPAC names of $\left[Ni(CO)_4\right]$ co-ordination compounds.

A. tetracarbonyl Nickel(II)

B. tetracarbonyl Nickel (O)

C. tetracarbonyl Nickelate (II)

D. tetracarbonyl Nickelate (O)

Answer: B

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2. Potassium hexachloroplatinate (IV) is given with the chemical formula

A. $Pt\left[K(Cl)_6\right]$

B. $K\left[Pt(Cl)_6\right]$

C. $K_2\left[Pt(Cl)_6\right]$

D. $K_4\left[Pt\left(Cl_6\right)\right]$

Answer: C

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3. IUPAC name of $Li\left[AlH_4\right]$ is

A. Lithium aluminium hydride

B. Lithium tetrahydrido aluminate[III]

C. Tetrahydride aluminium lithionate

D. Aluminium lithium hydride

Answer: B

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4. When $AgNO_3$ solution is added in excess to 1M solution of $CoC1_3cxNH_3$ one mole of AgCl is formed ? What is the value if 'X'?

A. 1

B. 2

C. 3

D. 4

Answer: D

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5. The IUPAC name of the coordination compound $K_3\left[Fe(CN)_6\right]$

A. Potassium hexacyanoferrate(II)

B. potassium hexacyanoferrate (III)

C. potassium hexacyanoiron (II)

D. tropotassium hexacyano iron (II)

Answer: B

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Objective Exercise 2 Isomerism

1. Example showing ionisation isomerism

A. $\left[Co\left(NO_3\right)\left(NH_3\right)_5\right]SO_4\&\left[Co\left(SO_4\right)\left(NH_3\right)_5\right]NO_3$

B. $\left[Co\left(NH_3\right)_4Cl_2\right]Cl\&\left[Co\left(NH_3\right)_5Cl\right]Cl_2$

C. $\left[Cr\left(H_2O\right)Cl\right]Cl_2.H_2O\&\left[Cr\left(H_2O\right)_4Cl_2\right]Cl.2H_2O$

D. $\left[Pt\left(NH_3\right)_4\left[PtCl_4\right]\&\left[Pt\left(NH_3\right)_3Cl\right]_2\left[PtCl_4\right]\right.$

Answer: A

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2. Geometrical isomerism in square planar complexes is given by

A. Ma_4 type complex

B. Ma_3b type complex

C. Ma_2b_2 type complex

D. Mb_4 type complex

Answer: C

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3. Ligands with which linkage isomerism is possible

A) NO_2 B) CN^- C) SCN^-

A. A only

B. A & B

C. B &C

D. A, B &C

Answer: D

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4. Which of the following compound shows optical isomerism?

A. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

B. $\left[Zn(Cl)_4\right]^{2-}$

C. $\left[Cr\left(C_2O_4\right)_3\right]^{2-}$

D. $\left[Co(CN)_6\right]^{3-}$

Answer: C

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5. Identify the correct statements among the following

I) Cr in first series of d-block has highest oxidation state.

II) Colour of MnO_4^- is due to charge transfer phenomenon.

III) Zn can show variable oxidation state.

IV) Ferromagnetism disappears in the solution of Fe

A. All

B. I & II only

C. II & IV only

D. II & III only

Answer: C

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6. The types of isomerism exhibited by $\left[Co\left(NH_3\right)_5\left(NO_2\right)\right]\left(NO_3\right)_2$ is

A. Geometrical and linkage

B. Linkage and ionization

C. Optical and ionization

D. Co-ordination and hydrate

Answer: B

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7. Which of the following compounds is expected to be coloured :

A. Ag_2SO_4

B. CuF_2

C. MgF_2

D. $CuCl$

Answer: B

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8. The orbitals having lower energy in tetrahedral complexes according to CFT are

A. d_{xy}, d_{yz}, d_{z^2}

B. $d_{xy}, d_{yz}, d_{x^2-y^2}$

C. d_{xy}, d_{yz}, d_{zx}

D. $d_{x^2-y^2}, d_{z^2}$

Answer: D

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9. $K_3\left[Fe(CN)_6\right]$ is a

A. double salt

B. complex compound

C. neutral molecule

D. Simple salt

Answer: B

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10. According to CFT the energy of t_{2g} orbitals in an octahedral complex

A. decrease by $\frac{2}{5}\Delta_0$

B. increase by $\frac{2}{5}\Delta_0$

C. increase by $\frac{3}{5}\Delta_0$

D. decrease by $\frac{3}{5}\Delta_0$

Answer: A

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11. Transition elements form complexes due to

A. small size

B. high nuclear charge

C. Presence of vacant d orbitals

D. All the above

Answer: D

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12. The IUPAC name of $\left[Co\left(NH_3\right)_4Cl\left(NO_2\right)Cl\right]$ is

A.) Penta ammine chloro cobalt (III) chloride

B. Penta amino chloro cobalt (III) carbonate

C. Penta ammine carbonato cobalt(III) chloride

D. Penta amino carbonato chloro cobalt (III)

Answer: C

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13. $\left[Co\left(NH_3\right)_6SO_4\right]Br$ and $\left[Co\left(NH_3\right)_6Br\right]SO_4$ are a pair of _____ isomers .

A. Ionization

B. Ligand

C. Co-ordination

D. Hydrate

Answer: A

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Objective Exercise 2 Applications

1. Hardness of water is estimated by simple titration using

A. formate

B. acetate

C. edta

D. glyoxile

Answer: C

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2. In photography silver bromide dissolves in hypo to give

A. $Na_2\left[Ag\left(S_2O_3\right)_2\right]$

B. $Na\left[Ag\left(S_2O_3\right)_2\right]$

C. $Na_3\left[Ag\left(S_2O_3\right)_2\right]$

D. $Na_4\left[Ag\left(S_2O_3\right)_2\right]$

Answer: C

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3. Nickel is purified using the concept of complex compounds. The complex related is

A. $Ni(CO)_6$

B. $\left[Ni\left(NH_3\right)_4\right]^{2+}$

C. $Ni(CO)_4$

D. $\left[Ni\left(NH_3\right)_6\right]^{2+}$

Answer: C

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4. $\left[\left(Ph_3P\right)_3RhCl\right]$ is a familiar catalyst used in

A. hydrogenation of oils

B. hydrogenation of alkenes

C. dehydration of alcohols

D. dehydration of aldehydes

Answer: B

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5. Ammonium cations can be detected using the complex

A. $\left[Cu\left(NH_3\right)_4\right]^{2+}$

B. $\left[HgI_4\right]^{2-}$

C. $\left[Ag(CN)_2\right]^{-}$

D. $\left[HgI_2\right]$

Answer: B

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6. $\left(Ph_3P\right)_3RhCl$ is

A. Ziegler natta catalyst

B. Wilkinsons catalyst

C. Developer in photography

D. Bio catalyst

Answer: B

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Practice Exercise

1. The primary and secondary valencies of the central metal ion in the complex $\left[Co\left(NH_3\right)_6\right]Cl_3$ respectively are

A. 6 and 3

B. 6 and 6

C. 3 and 3

D. 3 and 6

Answer: D

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2. The complex compound which does not give precipitate with $AgNO_3$ solution is

A. $\left[Co\left(NH_3\right)_5Cl\right]Cl_2$

B. $\left[Co\left(NH_3\right)_6\right]Cl_3$

C. $\left[Co\left(NH_3\right)_4Cl_2\right]Cl$

D. $\left[Co\left(NH_3\right)_3Cl_3\right]$

Answer: D

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3. the configuration of an element 'X' is $4s^13d^{10}$. The wrong statement regarding the element 'X' is

A. it forms complexes

B. it exhibits variable valency

C. it forms paramagnetic ions only

D. It can form coloured salts

Answer: C

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4. The primary valency of Iron in $K_4\left[Fe(CN)_6\right]$ is satisfied by

A. Six CN^- ions

B. Two CN^- ion

C. Four K^+ ions

D. Two K^+ ions

Answer: B

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5. Which of the following is wrong with respect to $\left[Co\left(NH_3\right)_5Cl\right]Cl_2$

A. central metal ion is Co and the ligands are NH_3 and Cl^- ion

B. oxidation number of Co is +2

C. co-ordination number of Co is 6

D. the number of ions formed when I mole of the compound dissolves in water is 3 moles

Answer: B

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6. A complex in which central atom carries zero oxidation state is

A. $\left[Co\left(NH_3\right)_3Cl_3\right]$

B. $PtCl_4.2NH_3$

C. $Ni(CO)_4$

D. $Na_2\left[\left(Ni(CN)_4\right)\right]$

Answer: C

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7. Oxidation number of metal in the complex $\left[Co\left(NH_3\right)_4Cl_2\right]^+$ is

A. 6, + 3

B. + 6, + 2

C. 6, + 1

D. 4, + 3

Answer: A

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LIST - I	LIST - II
A)Ti^{3+}	1) Charge transfer phenomenon
B)MnO_4^-	2) Impurities
C)F_2	3) s-s transitions
D)Gems	4) d-d transitions
	5) Excitation of electrons

8.

The correct match which is responsible for colour

A.

A	*B*	*C*	*D*
4	1	2	5

B.

A	*B*	*C*	*D*
4	1	5	2

C.

A	*B*	*C*	*D*
4	5	1	2

D.

A	*B*	*C*	*D*
5	2	3	4

Answer: B

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9. Give the correct increasing order of electrical conductivity of aqueous solutions of following complex entities

I) $\left[Pt\left(NH_3\right)_6\right]Cl_4$ II) $\left[Cr\left(NH_3\right)_6\right]Cl_3$

III) $\left[Co\left(NH_3\right)_4Cl_2\right]Cl$ IV) $K_2\left[PtCl_6\right]$

A. $III < IV < II < I$

B. $IV < II < III < I$

C. $II < I < IV < III$

D. $I < II < IV < III$

Answer: A

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10. Coordination number of Cr is 6. A complete entity with $C_2O_4^{-2}$, en superoxide as ligands is $\left[Cr\left(C_2O_4\right)_x(en)_y\left(O_2\right)_z\right]^+$. The ratio of x: y : z

is

A. $1:1:2$

B. $1:1:1$

C. $1:2:2$

D. $2:1:1$

Answer: A

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11. In Aqueous solution meta aluminate ion exists as

A. Neutral complex

B. Cationic complex

C. Cationic double salt

D. Anionic complex

Answer: D

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12. How many EDTA molecules are required to make an octahedral complex with a Co^{2+} ion ?

A. Two

B. Six

C. Three

D. one

Answer: D

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13. Which of the following is neutral molecular complex

A. $CoCl_3.3NH_3$

B. $Ni(CO)_4$

C. $PtCl_4.2NH_3$

D. All

Answer: D

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14. The following complex representation violates IUPAC rule

A. $\left[Cu\left(NH_3\right)_4\right]SO_4$

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

C. $\left[Co\left(NH_3\right)_3\right]Cl$

D. $TiCl_3.6H_2O$

Answer: D

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15. Effective atomic number of central metal ion in $\left[Co\left(NH_3\right)_6\right]Cl_3$ is

A. 24

B. 27

C. 35

D. 36

Answer: D

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16. Complex in which effective atomic number is not equal to atomic number of the noble gas

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

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

C. $\left[Ni(CO)_4\right]$

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

Answer: A

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17. IUPAC name of $K_3\left[Al\left(C_2O_4\right)_3\right]$

A. potassium alumino oxalte

B. potassium trioxalato aluminate (III)

C. potassium aluminium oxalate (III)

D. potassium trioxalato aluminate (VI)

Answer: B

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18. The neutral complex, diamminedibromodichloroplatinum(IV) is best represented as

A. $\left[Pt\left(NH_3\right)_2Br_2Cl_2\right]$

B. $\left[PtCl_2Br_2\left(NH_3\right)_2\right]$

C. $PtBr_2Cl_2\left(NH_3\right)_2\Big]$

D. $\left[Pt\left(NH_3\right)_2Cl_2Br_2\right]$

Answer: A

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19. IUPAC name of `[Fe(CN)_(6)]^(4-) is

A. ferrocyanide

B. hexacyanoferrate(II)

C. ferricyanide

D. hexacyanoferrate (III)

Answer: B

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20.

Complex	Type
A) $CoCl_3 \cdot 3NH_3$	i) Anionic complex
B) Na_2ZnCl_4	ii) Cationic complex
C) $PtCl_4 \cdot 5NH_3$	iii) Neutral complex

The correct match is

A. A- ii, B-iii, C-i

B. A -iii, B -i, C-ii

C. A-ii, B-i, C-iii

D. A-iii,B-ii,C-i

Answer: B

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21. Consider the following complexes

1) K_2PtCl_6 2) $PtCl_4.2NH_3$

3) $PtCl_4.3NH_3$ 4) $PtCl_4.5NH_3$

Their electrical conducatance in aqueous solutions are

A. 256, 0, 97 and 404 respectively

B. 404, 0, 97 and 256 respectively

C. 256, 97, 0 and 404 respectively

D. 404, 97, 256 and 0 respectively

Answer: A

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22. The IUPAC name of the complex $\left[Co\left(NO_2\right)\left(NH_3\right)_5\right]Cl_2$ is

A. pentaammine nitrito-N-cobalt(III) chloride

B. nitrito-N-pentaamminecobalt(III) chloride

C. nitrito-N-pentaamminecobalt(II) chloride

D. pentaamminenitrito-N-cobalt(II) chloride

Answer: A

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23. When two ligands of the same type occupy opposite positions to each other in a coordination polyhydron, the isomer is called

A. trans-

B. cis-

C. fac-

D. mer-

Answer: A

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24. Both geometrical and optical isomerisms are shown by

A. $\left[Pt\left(NH_3\right)_2Cl_2\right]$

B. $\left[Pt\left(NH_3\right)_4Cl_2\right]$

C. $Pt\left[(en)_2Cl_2\right]$

D. $\left[Pt(en)_3\right]$

Answer: C

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25. Optical isomerism is exhibited by a complex with

A. coordination number 4, with a bidentate ligand

B. coordination number 4, with two bidentate ligands

C. coordination number 6, with a bidentate ligand

D. coordination number 6, with three tridentate ligands

Answer: C

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26. Optical isomers have

A) property of chirality

B) almost identical chemical properties

C) almost identical physical properties

D) similar rotation of plane polarised light

A. A,B,C are correct

B. B,C,D are correct

C. A,C,D are correct

D. A,B,D are correct

Answer: A

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27. What is wrong about the following pair of compounds?

$\left[Cr\left(H_2O\right)_6\right]Cl_3$ and $\left[Cr\left(H_2O\right)_5Cl\right]Cl_2.H_2O$

A. They are hydration isomers

B. They have different colours

C. Their 0.1M aqueous solutions have same molar conductivity

D. They have different IUPAC name

Answer: C

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28. Geometrical isomerism is possible in:

A. Tetrahedral complex

B. Square planar complex

C. Tined complexes

D. planar triangle complexes

Answer: B

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29. Which of the following has the maximum number of unpaired electrons

A. Mg^{+2}

B. Ti^{+3}

C. V^{+3}

D. Fe^{+2}

Answer: D

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30. The brown ring complex is formulated as $\left[Fe\left(H_2O\right)_5NO^+\right]SO_4$ The Oxidation state of Fe is X what is the value of X?

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: A

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31. The oxidation number of Pt in $\left[Pt\left(C_2H_4\right)Cl_3\right]^-$ is

A. $+1$

B. $+2$

C. $+3$

D. $+4$

Answer: B

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32. What is magnetic moment of $\left[FeF_6\right]^{-3}$?

A. 6.92 BM

B. 5.92BM

C. 7.62 BM

D. 3.14 BM

Answer: B

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33. The hybridisatio nand unpaired electrons in $\left[Fe\left(H_2O\right)_6\right]^{2+}$ ion are

A. $sp^3d^2, 4$

B. $d^2sp^3, 3$

C. $sp^3d, 4$

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

Answer: A

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34. $\left[Fe\left(H_2O\right)_6\right]^{2+}$ is

A. Pale green complex

B. Blue coloured complex

C. Red coloured complex

D. Violet coloured complex

Answer: A

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35. Metals those can be extracted with aqueous solution of sodium cyanide as complexes are

A. Au and Ag

B. Fe and Ag

C. Au and Hg

D. Hg and Fe

Answer: A

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36. In the process of electroplating, large amounts of Ag^+ ions can be used in the electrolyte as the complex

A. $K_3\left[Ag(CN)_4\right]$

B. $K\left[Ag(CN)_2\right]$

C. $K_2\left[Ag(CN)_3\right]$

D. $K_2\left[Ag(CN)_2\right]$

Answer: B

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37. In the qualitative analysis of group 3 cations blood red colouration is a test for

A. iron using cyanide as ligand

B. chromium using cyanide as ligand

C. iron using thiocyanide as ligand

D. chromium using thiocyanide as ligand

Answer: C

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38. A recemic substance is composed of

A. 25% D- form and 75% L - form

B. 50% D-form and 25% L - form

C. 75% d-form and 25% 1 - form

D. 50% d- form and 50% 1 - form

Answer: D

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39. Basic structure of all Chlorophylls comprises

A.

$-CH_3,\ -C_2H_5,\ -CH=CH_2,\ -COOCH_3$ and $-CH_2CH_2COOC_{20}H_{39}$

B.

$-CH_3,\ -C_2H_5,\ -CH=CH_2,\ -COCH_3$ and $-CH_2CH_2COOC_{20}H_{39}$

C.

$-CHO,\ -C_2H_5,\ -CH=CH_2,\ -COCH_3$ and $-CH_2CH_2COOC_{20}H_{39}$

D.

$-CHO,\ -C_2H_5,\ -CH=CH_2,\ -COOCH_3$ and $-CH_2CH_2COOC_{20}H_{39}$

Answer: D

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40. Explain the formation of $\left[Co\left(NH_3\right)_6\right]Cl_3$ and $\left[Cu\left(NH_3\right)_4\right]SO_4$ on the basis of VBT.

A. Ionisation isomers

B. Coordination isomers

C. Linkage isomers

D. Ligand isomers

Answer: B

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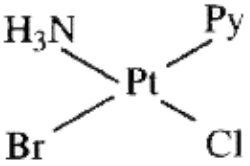
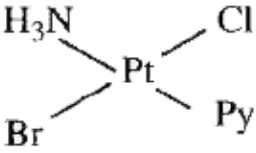
41. Which among the following arrangements are not geometrical isomers ?

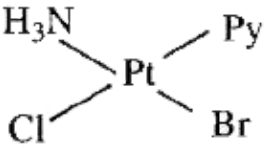
I)



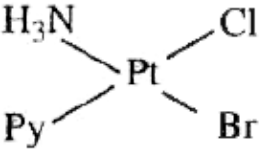
II)



III)



IV)



A. I and II only

B. II & III only

C. I, II, IV

D. III & IV only

Answer: D

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42. Linkage isomerism may be observed in

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

B. $Co\left(NH_3\right)_5NO_2^{2+}$

C. $Co\left(NH_3\right)Cl_3$

D. $Co\left(NH_3\right)_4Cl_2^{+}$

Answer: B

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43. Magnetic moment of the complex $\left[Fe(CN)_6^{3+}\right.$ is approximately

A. 5.91 BM

B. 4.89 BM

C. 2.84 BM

D. 1.73 BM

Answer: D

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44. The two compounds $\left[Cr\left(NH_3\right)_5Br\right]Cl$ and $\left[Cr\left(CN_3\right)_5Cl\right]Br$ can be distinguised by reagent A and the two compounds exhibit isomerism (B) . Then (A) and (B) are

A. $AgNO_3$, ionisation

B. $BaCl_2$, ionisation

C. $AgNO_3$, co-ordination

D. $BaCl_2$, Co-ordination

Answer: A

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45. The reaction of O_2 and CO with hemoglobin gives

A. only oxygen - heme complex

B. only Co - heme complex

C. both , but oxygen heme complex is more stable

D. both , but CO- heme complex is more stable

Answer: D

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