CHEMISTRY

BOOKS - BRILLIANT PUBLICATION

COORDINATION COMPOUNDS

Questions

1. Write the formula for potassium amminetrichloridoplatinate (II).

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2. Write the formula for tetraammineaquachloridocobalt(III) chloride.

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Level I

1. The pair of the compounds in which both the metals are in the highest oxidation state is

A. CrO_2Cl_2, MnO_4^-

B. $\left[Co(CN)_6\right]^{3-}$, MnO_3

C. TiO_3, MnO_2

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

Answer: A

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2. In the complex $K_2Fe\left[Fe(CN)_6\right]$

A. the complex is high spin complex

B. both Fe atoms are in the same oxidation state

C. the coordination number of iron is 4

D. both Fe atoms are in different oxidation state

Answer: B

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3. The correct name of $[Pt(NH_3)4Cl_2][PtCl_4]$ is .

A. tetrachloridoplatinum (II) dichloridotetrammineplatinate

B. dichloridotetrammineplatinum (IV) tetrachlorido platirate (II)

C. tetramminedichloridoplatinum (IV) tetrachlorido platinate (I)

D. tetrachloridoplatinum (II) tetrammineplatinate (IV)

Answer: C

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4. The complexes $\left[Co(NH_3)_6\right]\left[Cr(C_2O_4)_3\right]$ and $\left[Cr(NH_3)_6\right]\left[Co(C_2O_4)_3\right]$ exhibit

A. geometrical isomerism

B. ionisation energy

C. coordination isomerism

D. linkage işomerisen

Answer: C

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5. Optical isomerism is shown by octahedral complexes

A. having all monodentate ligands

B. having all the three bidentate ligands

C. having two trans bidentate ligands

D. having two trans monodentate ligands

Answer: B

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6. Which of the following pairs represents linkage isomers?

A. $\left[Cu(NH_3)_4\right]\left[PtCl_4\right]$ and $\left[Pt(NH_3)_4\right]\left[CuCl_4\right]$

B. $\left[Pb(PPh_3)_2(NCS)_2\right]$ and $\left[Pd(PPh_3)_2(SCN)_2\right]$

C. $\left[Co(NH_3)_5NO_3\right]SO_4$ and $\left[Co(NH_3)_5SO_4\right]NO_3$

D. $\left[PtCl_2(NH_3)_4\right]Br_2$ and $\left[PtBr_2(NH_3)_4\right]Cl_2$

Answer: B

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7. In which of the following octahedral complexes of Co (at. no. 27), will the magnitude of Δ_o be the highest?

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

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

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

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

Answer: A

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8. 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 carriès negative charge

D. It forms low spin complexes

Answer: D

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9. How many EDTA (ethylene diaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion?

A. One

B. Two

C. Six

D. Three

Answer: A

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10. Which of the following statements is not correct?

A. Weak ligands like F^-, Cl^- form high-spin complexes

B. Strong ligands like CN form low-spin complexes

C. $[FeF_6]^{3-}$ is a high-spin complex .

D. $Ni(CO)_4$ is a high-spin complex

Answer: D

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11. Which of the following statements regarding the complex $\left[M(AA)_2a_2\right]$ is correct?

A. cis -form is optically active while trans - form is inactive

B. cis-form is optically inactive while trans - form is active'

C. Both cis - and trans - forms are optically active

D. Both cis - and trans - forms are optically inactive .

Answer: A

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12. The sum of coordination number and oxidation number of the metal M in the complex $\left[M(en)_2(C_2O_4)\right]Cl$ (where en is ethylenediamine) is:

A. 7

B. 8

C. 9

D. 6

Answer: C

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13. The ligand $N(CH_2CH_2NH_2)_3$ is

A. tridentate

B. pentadentate

C. tetradentate

D. bidentate

Answer: C

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14. Which one of the following is a homoleptic complex?

A. tris(ethane-1, 2-diamine) cobalt(III) chloride

B. triamminetriaquachromium(III) chloride

C. diamminechloridonitro-N-platinum (II)

D. dịchlorido bis(ethane-1,2-diamine) cobalt(III) chloride

Answer: A

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

A. tricyanoferrate(III) ion

B. hexacyanidoferrate(III) ion

C. hexacyanoiron(II) ion

D. hexacyanitroferrate(III) ion

Answer: B

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16. Which of the following statements about the complex $[CoF_6]^{3-}$ which is paramagnetic in nature is correct?

A. The cobalt involves d^2sp^3 hybridization

B. The cobalt involves sp^3d^2Hybridization

C. The primary valencies of cobalt are nine

D. The ligands present in the complex are neutral fluorine atoms

Answer: B

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

A. Ionization isomerism

B. Linkage isomerism

C. Geometrical isomerismn

D. Coordination isomerism

Answer: C

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18. Square planar complexes of the type MABXL (where A, B, X and L are unidentates).show

A. two cis and one trans isomers

B. two trans and one cis isomers

C. two cis and two trans isomers

D. one cis and one trans isomers

Answer: A

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19. Number of possible isomers forthe complex $\left[Co(en)_2Cl_2\right]CI$ will be: (en=ethylenediamine)

A. 3

B. 4

C. 2

D. 1

Answer: A

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20. Which one of the following complex ions has geometrical isomers?

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

B. $\left[Ni(NH_3)_5Br^+\right]$

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

D. $\left[Cr(NH_3)_4(en)\right]^{3+}$

Answer: C

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21. Which of the following complex species is not expected to show optical isomerism ?

A. $\left[Co(en)(NH_3)_2Cl_2\right]^+$

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

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

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

Answer: D

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22. Among $[Ni(CO)_4], [Ni(CN)_4]^{2-}, [NiCl_4]^{2-}$ species, the hybridisation states at the Ni atom are, respectively (Atomic number.of Ni=28)

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

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

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

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

Answer: B

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23. The pair having the same magnetic moment is :

(Atomic Nos : $Cr = 24, Mn = 25, Fe = 26, Co = 27$) [M n (H 2 O) 6] 2 + & [C r (H 2 O) 6] 2 + [C o C l 4] 2 − & [F e (H 2 O) 6] 2 + [C r (H 2 O) 6] 2 + & [C o C l 4] 2 − [C r (H 2 O) 6] 2 + & [F e (H 2 O) 6] 2 +

A. $\left[Cr(H_2O)_6\right]^{2+}$ and $[CoCl_4]^{2-}$

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

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

D. $[CoCl_4]^{2-}$ and $\left[Fe(H_2O)_6\right]^{2+}$

Answer: B

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24. Hybridisation, shape and magnetic moment of $K_3[Co(CO)_6]$ is

A. d^3sp^3, octahedral 4.9 BM

B. sp^3d^2, octahedral, 4.9 B.M.

C. dsp^2 square planar, 4.9B.M.

D. sp^3, tetrahedral, 4.9 B.M.

Answer: B

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

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

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

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

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

Answer: A

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26. Which one of the following is wrongly matched?

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

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

C. $\left[Fe(CN)_6\right]^{3-} - sp^3d^2$

D. $\left[Co(en)_3\right]^{3+}$ - follows EAN rule

Answer: C

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27. Geometrical shape of the most stable complexes formed by the reaction of Ni^{2+} with Cl^-, CN^- and H_2O respectively are

A. Octahedral, tetrahedral and square planar

B. Tetrahedral, square planar and octahedral

C. Square planar, tetrahedral and octahedral

D. Octahedral, square planar and octahderal

Answer: B

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28. The low spin complex of d^6 metal ion in an octahedral field will have the following CFSE :

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

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

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

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

Answer: D

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29. Which ofthe following complexions is expected to absorb visible light?

A. $\left[Ti(en)_2(NH_3)_2\right]^{4+}$

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

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

D. $\left[Sc(H_2O)_3(NH_3)_3\right]^{3+}$

Answer: B

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30. $\left[Cr(H_2O)_6\right]Cl_3$ has a spin only magnetic moment of $3.83BM$. The correct distribution of $3d$ electrons in the chromium of this complex is

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

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

C. $3d_{(x^2-y^2)}^1, 3d_{z^2}^1, 3d_{xy}^1$

D. $3d_{xy}^1, 3d_{x^2-y^2}^1, 3d_{yz}^1$

Answer: A

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31. Among the following complexes, the one which shows zero CFSE is

(Atomic Nos : $Mn = 25, Fe = 26, Co = 27$)

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

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

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

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

Answer: B

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32. EAN of cobalt is 36 in $\left[Co(NH_3)_2O_2(en)Cl\right]$. Knowing that atomic number of Co is 27, O_2 is present as

A. peroxide ion

B. dioxide ion

C. superoxide ion

D. oxide ion

Answer: A

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33. $Fe_2(CO)_9$ is diamagnetic. Which of the following is the correct reason? .

A. One CO is present as bridge group

B. CO is a π-acceptor ligand

C. CO can form π -bond with Fe by back bonding

D. Metal-metal (Fe-Fe) bonding takes place

Answer: D

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34. Among the following metal carbonyls, the C–O bond order is lowest in

A. $\left[Mn(CO)_6\right]^+$

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

C. $\left[Cr(CO)_6\right]$

D. $\left[V(CO)_6\right]^-$

Answer: D

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

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

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

C. $cis - K_2[PtCl_2Br_2]$

D. Na_2CoCl_4

Answer: B

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36. Sodium nitroprusside reacts with sulphide ion to give a purple colour due to the formation of

A. $\left[Fe(CN)_5NO\right]^{3-}$

B. $\left[Fe(NO)_5CN\right]^{-}$

C. $\left[Fe(CN)_5NOS\right]^{4-}$

D. $\left[Fe(CN)_5NOS\right]^{3-}$

Answer: C

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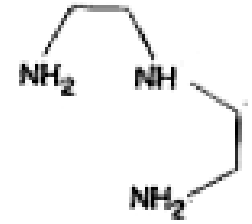
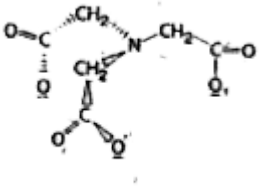
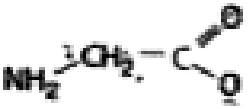
37. Find the ligand having the highest denticity from the following options:

A. $CH_3 - \underset{\underset{NH_2}{|}}{CH} - \underset{\underset{NH_2}{|}}{C}\ H_2$

B. 

C. 

D. 

Answer: C

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38. Which of the following ligands is tridentate type?

A. Butane-1,2-diamine (bn)

B. Propane-1,3-diamine (tn)

C. Diethylenetriamine (dien)

D. Triethylenetetraamine (trien)

Answer: C

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39. Which of the following complex has highest EAN value?

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

B. $\left[Ti(\sigma - C_2H_5)_2(\pi - C_5H_5)_2\right]$

C. $\left[Ni(en)_3\right]Cl_2$

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

Answer: C

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40. Which of the following complexes contains a cationic ligand?

A. $\left[Ni\left(\eta^5 - C_5H_5\right)_2\right]^+$

B. $\left[V\left(\eta^6 - C_7H_8\right)\left(\eta^7 - C_7H_7\right)\right]^+$

C. $\left[Fe(CO)_2(NO)_2\right]^0$

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

Answer: B

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41. In all the following complexes, the coordination number of iron is six. In which of them is the oxidation state of iron the lowest?

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

B. $Fe(CO)_6$

C. $Fe[(EDTA)]^-$

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

Answer: B

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42. Consider the coordination compound, $\left[Co(NH_3)_6\right]Cl_3$. In the formation of this complex, the species which acts as the Lewis acid is:

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

B. Cl^-

C. Co^{3+}

D. NH_3

Answer: C

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43. The IUPAC name for the complex $\left[Co(NO_2)(NH_3)_5\right]Cl_2$ is

A. nitrito-N-pentaamminecobalt(III) chloride

B. nitrito-N-pentaamminecobalt(II) chloride

C. pentaammine nitrito-N-cobalt(II) chloride

D. pentaammine nitrito-N-cobalt(III) chloride

Answer: D

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44. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide?

A. $\left[Cr(en)_3\right]Br_3$

B. $\left[Cr(en)_2Br_2\right]Br$

C. $[Cr(en)Br_4]^-$

D. $[Cr(en)Br_2]Br$

Answer: B

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45. The IUPAC name of the complex $\left[Ni(NH_3)_4\right]\left[NiCl_4\right]$

A. tetrachloronickel (II) - tetraamminenickel (II)

B. tetraamminenickel (II) - tetrachloronickel (II)

C. tetraamminenickel (II) - tetrachloridonickelate (II)

D. tetrachloronickel (II) - tetraamminenickelate (II)

Answer: C

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46. The correct statement about the magnetic properties of $\left[Fe(CN)_6\right]^{3-}$ and $\left[FeF_6\right]^{3-}$ is : $(Z = 26)$

A. both are paramagnetic

B. both are diamagnetic

C. $\left[Fe(CN)_6\right]^{3-}$ is diamagnetic, $\left[FeF_6\right]^{3-}$ is paramagnetic

D. $\left[Fe(CN)_6\right]^{3-}$ is parainagnetic, $\left[FeF_6\right]^{3-}$ is diamagnetic

Answer: A

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47. Among the following species, the one which causes the highest $CFSE$, Δ_0 as a ligand is

A. CN^-

B. NH_3

C. F^-

D. CO

Answer: D

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

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

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

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

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

Answer: B

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49. Choose the correct order for Δ_o for the following complexes.

I) $\left[Co(H_2O)_6\right]^{2+}$ II) $\left[Co(H_2O)_6\right]^{3+}$ III) $\left[Fe(H_2O)_6\right]^{3+}$ IV) $\left[Fe(CN)_6\right]^{3-}$

A. $I < II < III < IV$

B. $I < III < II < IV$

C. $I < II = III < IV$

D. $I < II < IV < III$

Answer: B

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50. The IUPAC name of $\left[Pt(NH_3)_4(NO_2)Cl\right]SO_4$ is

A. tetramminechloronitroplatinum (II) sulphate

B. tetramminechloronitroplatinum (IV) sulphate

C. chlorotetrammineritroplatinum (IV) sulphate

D. chloronitrotetrammineplatinum (IV) sulphate

Answer: B

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51. Which of the following is not an example of σ-bonded organometallic compound? $[Cr(NH_3)_6]^{3+}, [FeF_6]^{3-}, [Co(NO_2)_6]^{3-}, [TiF_6]^{3-}$

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

B. $[FeF_6]^{3-}$

C. $[Co(NO_2)_6]^{3-}$

D. $[TiF_6]^{3-}$

Answer: D

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52. Which of the folowing complex ions possesses sp^3d^2 hybridization?

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

B. $[FeF_6]^{3-}$

C. $[Co(NO_2)_6]^{3-}$

D. $[Ti(H20)_6]^{3-}$

Answer: B

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53. The complex $\left[Ni(dmg)_2\right]$, where dmg is dimethylgloxime,

A. has square planar geometry and is paramagnetic in nature

B. has square planar geometry and is diamagnetic

C. has tetrahedral.geometry and is paramagnetic

D. has tetrahedral geometry and is diamagnetic

Answer: B

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54. Which of the following facts about the complex $\left[Cr(NH_3)_6\right]Cl_3$, is wrong?

A. The complex involves d^2sp^3 hybridization and is octahedral in shape

B. the complex is paramagnetic

C. the complex is diamagnetic

D. The complex gives white precipitate with silver nitrate

Answer: C

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55. The spectrochemical series of ligands is

A. $I^- < F^- < H_2O < NH_3 < CN^- < Cl$

B. $F^- < Cl^- < Br^- < I^- < H_2O < CN^-$

C. $I^- < Br^- < Cl^- < H_2O < NH_3 < CN^-$

D. $I^- < H_2O < F^- < Br^- < CN^- < NH_3$

Answer: C

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Level Ii

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

A. $CuCN$

B. $K_3\left[Cu(CN)_6\right]$

C. $K\left[Cu(CN)_4\right]$

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

Answer: D

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2. An aqueous solution of $CoCl_2$ on addition of excess of conc. HCl turns blue due to formation of

A. $[CoCl_4]^{2-}$

B. $\left[Co(H_2O)_2Cl_4\right]^{2-}$

C. $\left[Co(H_2O)_22Cl_4\right]^{2-}$

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

Answer: A

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3. In which of the following pairs both the complex show optical isomerism? . (a) cis- [Cr(C2O4)2CI2] 3-,cis-[Co(NH3)4CI2] b)[Co(en)3] CI3 , cis-[Co(en)2 CI2] CI (c) [Co(NO3)3(NH3) 3] ,cis-[Pt(en)2 CI2] (d) [PtCI(en)CI] , [NiCI2Br2]2-

A. $Cis-\left[Cr(C_2O_4)_2Cl_2\right]^{3-}, cis-\left[Co(NH_3)_4Cl_2\right]$

B. $[PtCl(dien)]Cl, [NiCl_2Br_2]^{2-}$

C. $\left[Co(NO_3)_3(NH_3)_3\right], cis-\left[Pt(en)_2Cl_2\right]$

D. $\left[Co(en)_3\right]Cl_3, cis-\left[Co(en)_2Cl_2\right]Cl$

Answer: D

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4. Which of the following facts about the complex $\left[Cr(NH_3)_6\right]Cl_3$ is wrong?

A. The complex involves d^2sp^3 hybridisation and is octahedral in shape

B. The complex is paramagnetic

C. The complex is an outer orbital complex

D. The complex gives white precipitate with silver nitrate solution

Answer: C

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5. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electrons in the nickel and geometry of this complex ion are, respectively

A. one, tetrahedral

B. two, tetrahedral

C. one, square planar

D. two, square planar

Answer: B

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6. i) $K_2[Fe(H_2O)_6]$ ii) $K_3[Cr(CN)_6]$ iii) $K_3[Fe(CN)_6]$ iv) $K_2[Ni(CN)_4]$

Choose the complex which is paramagnetic

(i), (ii) and (iii)

(i) ,(iii) and (iv)

(i) and (iv)

(ii) and (iii)

A. (i), (ii) and (ii)

B. (i) ,(iii) and (iv)

C. (ii), (ii) and (iv)

D. (i), (ii) and (iv)

Answer: A

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7. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammonical Ni(II).

Which of the following statement is not true

A. Red complex has a square planar geometry

B. Complex has symmetrical H-bonding :

C. Red complex has a tetrahedral geometry

D. Dimethylglyoxime functions as bidentate ligand

Answer: C

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8. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium(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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9. Consider the following complex ions P, Q and R: $P = [FeF_6]^{3-}, Q = [V(H_2O_6)]^{2+}, R = \left[Fe(H_2O)_6\right]^{2+}$ The correct order of the complex ionis, according to their spin-only magnetic moment values (in BM)is

A. $R < Q < P$

B. $Q < R < P$

C. $R < P < Q$

D. $Q < P < R$

Answer: B

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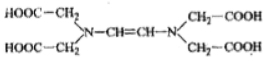
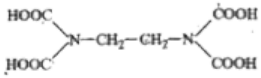
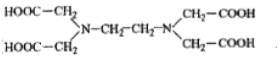
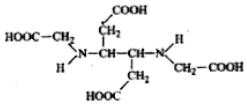
10. The correct structure of ethylenediamineteraacetic acid (EDTA) is

A. 

B. 

C. 

D. 

Answer: C

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11. For the given complex $\left[CoCl_2(en)(NH_3)_2\right]^+$, the number of geometrical isomers, the number of optical isomers and total numbêr of isomers of all type possible respectively are

A. 2, 2 and 4

B. 2,2 and 3

C. 2,0 and 2

D. 0, 2 and 2

Answer: B

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

A. ionization isomerim, geometrical isomerism and optical isomerism

B. linkage isomerişma, geometrical isomerism and optical iosmerism

C. linkage isomerism, ionization isomerism and optical isomerism .

D. linkage isomerism, ionization isomerism and geometrical isomerism

Answer: D

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13. 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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14. The d-electron.configurations of Mn^{2+}, Fe^{2+}, Co^{3+} and Ni^{2+} are $3d^5$, $3d^6$, $3d^6$, $3d^8$ respectively. Which of the following aqua complexes will exhibit the minimum paramagnetic behaviour?

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

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

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

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

Answer: B

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15. Crystal field splitting energy (CFSE) for the complex $\left[Cr(H_2O)_6\right]^{2+}$ is when $P = 20925cm^{-1}$ and $\Delta_o = 10462.5cm^{-1}\left(1kJmol^{-1} = 83.7cm^{-1}\right)$

A. $-75kJmol^{-1}$

B. $75kJmol^{-1}$

C. $750kJmol^{-1}$

D. $-750kJmol^{-1}$

Answer: A

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16. Amongst $Ni(CO)_4$, $\left[Ni(CN)_4\right]^{2-}$ and $[NiCl_4]^{2-}$

A. $Ni(CO)_4$ and $[NiCl_4]^{2-}$ are diamagnetic and $\left[Ni(CN)_4\right]^{2+}$ is paramagnetic

B. $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic

C. $Ni(CO)_4$ and $\left[Ni(CN)_4\right]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramagnetic

D. $Ni(CO)_4$ is diamagnetic and $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ are paramagnetic

Answer: C

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17. Which of the following complexes are not correctly matched with the hybridisation of their central metal ion?

(i) $\left[Ni(CO)_4\right], sp^3$ (ii) $\left[Ni(CN)_4\right]^{2-}, sp^3$ (iii) $[CoF_6]^{3-}, d^2sp^3$

(iv) $\left[Fe(CN)_6\right]^{3-}$, sp^3d^2

Select the correct answer using the codes given below:

A. (i) and (ii)

B. (i) and (iii)

C. (ii)and (iv)

D. (ii),(iii) and (iv)

Answer: D

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18. Among $\left[Ni(CO)_4\right]$, $[NiCl_4]^{2-}$, $\left[Co(NH_3)_4Cl_2\right]Cl$, $Na_3[CoF_6]$, Na_2O_2 and CsO_2 the total number of paramagnetic compounds is . : 2, 3, 4, 5

A. 2

B. 3

C. 4

D. 5

Answer: B

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19. Which of these statements 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 unpäired 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 low-spin 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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20. $\left[NiCl_2\left\{P(C_2H_5)_2(C_6H_5)\right\}_2\right]$ exhibits temperature dependent magnetic behaviour (paramagnetic/diamagnetic). The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are respectively

A. tetrahedral and tetrahedral

B. square planar and square planar

C. tetrahedral and square planar

D. square planarand tetrahedral

Answer: C

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21. The octahedral complex of a metal ion , M^{3+}, with four monodentate ligand L_1, L_2, L_3 and L_4 absorb wavelengths in the region of red, green ,

yellow and blue respectively. The increasing order of field strength

A. $L_1 < L_2 < L_4 < L_3$

B. $L_4 < L_3 < L_2 < L_1$

C. $L_1 < L_3 < L_2 < L_4$

D. $L_3 < L_2 < L_4 < L_1$

Answer: C

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22. If the length of CO bond in carbon monoxide is. 1.128 Å, then what is the value of CÓ bond length in $Fe(CO)_5$?

A. $1.15Å$

B. $1.128Å$

C. $1.72Å$

D. $1.118Å$

Answer: A

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23. Which of the following statements is correct?

A. $[NiCl_4]^{2-}$ complex is more stable than $[Ni(dmg)_2]$ due to higher CFSE value

B. With d^2sp^3 hybridisatión $[FeCl(CN)_4(O_2)]^{4-}$ complex is diamagnetic

C. $[V(CO_6)]$ is not very stable and easily reduces to $[V(CO)_6]^{\Theta}$

D. Ligands such as $CO, CN^{\Theta}, NO^{\oplus}$ are electron donor due to the presence of filled-molecular orbital

Answer: C

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24. Dipole moment will be zero in the complexes

I. $\left[Ni(CN)_4\right]^{2-}$ II. $cis-Pt\left[(NH_3)_2Cl_2\right]$ III. $\text{trans}-\left[Pt(NH_3)_2Cl_2\right]$

A. I and II

B. I and III

C. II and III

D. I, II and II

Answer: B

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

A. estimating 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. Which of the following statements is/are correct for $\left[Cr(NH_3)_5Br\right]SO_4$ and $\left[Cr(NH_3)_5SO_4\right]Br$

(I) Co-ordination number of the central atom is 6 for both

(II) In both the cases, the anionic ligand satisfies the primary valency in equal manner.

(III) Electrical conductivities of both the complexes are equal

A. (I), (II)

B. (I), (III)

C. (II), (III)

D. (I) only

Answer: D

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27. A solution containing 2.675g of $CoCl_3.6NH_3$ (molar mass= $267.5gmol^{-1}$) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of $AgNO_3$ to give $4.78g$of AgCI (molar mass $= 143.5gmol^{-1}$). The formula of the complex is (atomic mass of Ag=108a).

A. $\left[CoCI(NH_3)_6\right]Cl_2$

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

C. $\left[CoCl_2(NH_3)_4\right]Cl$

D. $\left[CoCl_3(NH_3)_3\right]$

Answer: B

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28. One mole of the coinplex compound $Co(NH_3)_5Cl_3$ gives three 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 $AgCl(s)$. The structure of the complex is

A. $\left[Co(NH_3)_5, Cl\right]Cl_2$

B. $\left[Co(NH_3)_3Cl_3\right].2NH_3$

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

D. $\left[Co(NH_3)_4Cl\right]Cl_2.NH_3$

Answer: A

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29. Which of the following name formula combinations is not correct?

A.

Formula	Name
$K_2\left[Pt(CN)_4\right]$	Potassium tetracyanoplatinatė (II)

B.

Formula	Name
$\left[Mn(CN)_5\right]^{2-}$	Pentacyanomagnate (II) ion

C.

Formula	Name
$K[Cr(NH_3)_2Cl_4]$	Potassium diammine tetra-chlorochromate (III)

D.

Formula	Name
$[Co(NH_3)_4, (H_2O)I]SO_4$	Tetraammine aquaiodo cobalt (III) sulph

Answer: B

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30. What is the correct name for the following complex?

$[Co(NH_2)_2(NH_2 - CH_3)_2]Cl$

A. Diamidodimethylaminecobalt(III) chloride.

B. bis(Methylamine) diamidocobalt (II) chloride

C. Diamidobis (methylamine) cobalt (II) chloride

D. Diaminedimethylaminecobalt(III) chloride

Answer: C

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31. The no.of geometrical isomers that can exist for the square planar complex $[Pt(NH_3)Cl(NH_2OH)(py)]^+$ is

A. 3

B. 4

C. 6

D. 2

Answer: A

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32. Which of the electrònic configuration according to crystál field theory of the compound is correct $[MnF_6]^{4-}$?

A. $\left(t_{2g}^5 e_g^0\right)$

B. $\left(t_{2g}^3 e_g^2\right)$

C. $\left(e_g^2 t_{2g}^3\right)$

D. $\left(t_{2g}^4 e_g^1\right)$

Answer: B

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33. Which of the following complex is heteroleptic as well as unable to show geometrical isomerism

[Co(NH3)6]Cl3

[Co(NH3)3]Cl3

[Co(NH3)5]Cl2

[Co(en2)Cl2]Cl

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

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

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

D. $[Co(en_2)Cl_2]Cl$

Answer: C

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34. Ammonia forms the complexion $\left[Cu(NH_3)_4\right]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. What is the reason for it?

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 pot available

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

D. Copper hydroxide iş an amphoteric substance

Answer: B

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35. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electrons in the nickel and geometry of this complex ion are, respectively

A. one, tetrahedral

B. two, tetrahedral Cone,

C. square planar

D. two, square planar

Answer: B

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36. The correct order of magnetic moments (spin only values in B.M.) among is

A. $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$

B. $\left[Fe(CN)_6\right]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

C. $\left[Fe(CN)_6\right]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

D. $[MnCl_4]^{2-} > \left[Fe(CN)_6\right]^{4-} > [CoCl_4]^{2-}$

Answer: A

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37. Which of the following options is correct when six ligands are approaching towards central metal ion along axis?

A. Energy of t_{2g} set of d-orbitals increases and that of e_g set decreases as compared to that in free metal ion.

B. Energy of t_{2g} set of d-orbitals decreases and that of e_g set increases-as compared to that in free metal ion.

C. Energy of both sets of d-orbitals increases, equally as compared to that in free metal ion.

D. Energy of e_g set of d-orbitals increases more than t_{2g} set of d-orbitals, but the energy of both sets of d-orbitals increases as compared to that in free metal ion.

Answer: D

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38. Two compounds $Co(NO_2)_3$ and KNO_2 are mixed together in 1 : 3 proportion to form a complex which produces four particles in solution. What is the correct formula for the complex?

A. $K_2\left[Co(NO_2)_6\right]$

B. $K_2\left[Co(NO_2)_4\right]_3$

C. $K_3\left[Co(NO_2)_6\right]$

D. $K_2\left[Co(NO_2)_3\right]_3$

Answer: C

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39. Select the true statement from the following for metal carbonyls?

A. The π back bonding strengthens M-C bond order as well as CO bond order

B. The π bạck bonding weakens M-C bond order as well as CO bond-order

C. The π back bonding weakens M - C-bónd order but strengthens CO bond order.

D. The π back bonding strengthens M-C bond order and weakens CO bond order

Answer: D

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40. Which of the following complexes has magnetic moment of 2.83 Bohr magneton?

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

B. $\left[Ni(H_2O)_6\right]Cl_2$

C. $\left[Cu(NH_3)_6\right]Cl_2$

D. $\left[Mn(H_2O)_6\right]Cl_2$

Answer: B

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41. Which of the following statement is not correct?

A. $Ti(NO_3)_4$ is a colourless compound

B. $\left[Cu(NCCH_3)_4\right]^+BF_4^-$ is a colourless compound

C. $\left[Cr(NH_3)_6\right]^{3+}3Cl^-$ is a coloured compound

D. $K_3[VF_6]$ is a colourless compound

Answer: D

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42. Relative to the average energy in the spherical crystal field, the eg orbitals in octahedral field is

A. raised by $(2/5)\Delta_0$

B. lowered by $(2/5)\Delta_0$

C. raised by $(3/5)\Delta_0$

D. lowered by $(3/5)\Delta_0$

Answer: C

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43. Of the following statements, which one is correct?

A. $[CoF_6]^{3-}$ is a high spin complex and $\left[Co(NH_3)_6\right]^{3+}$ is a low spin complex

B. $[CoF_6]^{3-}$ is a low spin complex and $\left[Co(NH_3)_6\right]^{3+}$ is a high spin complex

C. Both $[CoF_6]^{3+}$ and $\left[Co(NH_3)_6\right]^{3+}$ are low spin complexes

D. Both $[CoF_6]^{3-}$ and $\left[Co(NH_3)_6\right]^{3+}$ are high spin complexes

Answer: A

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44. Which of the following statements is not correct?

A. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the state of hybridization of nickel

B. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the magnetic properties

C. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the geometry

D. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in primary valencies of nickel

Answer: D

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45. The complexes $[FeCl_4]^{2-}$, $[CoCl_4]^{2-}$ and $[Cu(CN)_4]^{2-}$ respectively, have number of unpaired electrons , equal to

A. 3, 3.and 0

B. 4,2 and 0

C. 1,3 and 4

D. 4,3 and 1

Answer: D

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46. Which of the following statements regarding the complex $[M(AA)_2a_2]$ is correct?

A. cis-form is optically active while trans-form is inactive

B. cis-form is optically inactive while trans-form is active

C. Both cis-and trạns-forms are optically active

D. Both cis-and trans-forms are optically inactive

Answer: A

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47. Which of the following statements is not correct?

A. The stability constant of $[CO(NH_3)_6]^{3+}$ is larger than that of $[Co(NH_3)_6]^{2+}$

B. The cyano complexes are far more stable than those formed by halide ions

C. The stability of halide complexes follows in the order $I^- > Br^- > Cl^-$

D. The stability constant of $\left[Cu(NH_3)_4\right]^{2+}$ is larger than that of $\left[Cu(NH_3)_4\right]^{2+}$

Answer: C

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48. One mole of the coinplex compound $Co(NH_3)_5Cl_3$ gives three 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 $AgCl(s)$. The structure of the complex is

A. $\left[Cr(NH_3)_4Cl\right]Cl_2.NH_3$

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

C. $\left[Cr(NH_3)_5Cl\right]Cl_2$

D. $\left[Cr(NH_3)_3Cl_3\right].2NH_3$

Answer: C

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49. Of the following complexes, the correct statement is

1. trans-$\left[Co(NH_3)_4I_2\right]^{\oplus}$ 2. $cis-\left[Co(NH_3)_2(en)_2\right]^{3+}$

3. trans – $\left[Co(NH_3)_2(en)2\right]^{3+}$ 4. $[NiI_4]^{2-}$

5. $[TiF_6]^{2-}$ 6. $[CoF_6]^{3-}$: 4,5 are coloured, 6 is colourless; 2 is optically active, 1, 3 are optically inactive; 1, 2 are optically active, 3 optically inactive; 4 is coloured, 5,6 are colourless

A. 4,5 are coloured, 6 is colourless

B. 2 is optically active, 1, 3 are optically inactive

C. 1, 2 are optically active, 3 optically inactive

D. 4 is coloured, 5,6 are colourless

Answer: B

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50. The complex $[Pt(py)(NH_3)(NO_2)ClBrl]$ has

A. 10 geometrical isomers, each is optically active

B. 10 geometrical isomers, five of them are optically active

C. 15 geometrical isomers, each is optically active

D. 15 geometrical isomers, each is optically inactive

Answer: C

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Level Ii Assertion Reason Type

1. Assertion : $\left[Co(NO_2)_3(NH_3)_3\right]$ does not show optical isomerism.

Reason : It has a plane of symmetry.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: B

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2. Assertion : $\left[Ti(H_2O)_6\right]^{3+}$ is coloured while $\left[Sc(H_2O)_6\right]^{3+}$ is colourless.

Reason : d-d transition is not possible in $\left[Sc(H_2O)_6\right]^{3+}$

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: A

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3. Assertion : $\left[Ni(CN)_4\right]^{2-}$ is square planar and diamagnetic.

Reason : It has no unpaired electrons due to presence of strong ligand.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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4. Assertion : In crystalline solids, the value of resistance is different in different directions.

Reason : Crystalline solids are isotropic in nature.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: A

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

Reason : $\left[Fe(CN)_6\right]^{3-}$ has +3 oxidation state while $\left[Fe(CN)_6\right]^{4-}$ has $+2$ oxidation state.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: B

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6. Assertion : Aqueous solution of the compound $CoCl_3.4NH_3$ when treated with excess of $AgNO_3$ 1 mole of AgCl is precipitated.

Reason : The compound $CoCl_3.4NH_3$ has six primary valencies and one secondary valency.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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7. Assertion : The complex $K_3[Cr(C_2O_4)_3]$ when present in aqueous solution, will give test for K^+, Cr^{3+} and oxalate ions.

Reason : The complex $K_3[Cr(C_2O_4)_3]$ will dissociate completely in solution.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: D

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8. Assertion : Tetrahedral complexes having two different types of unidentate ligands coordinated with central metal ion will show geometrical isomerism.

Reason : Geometrical isomerism arises in homoleptic complexes due to different possible geometric arrangement of the ligands.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: D

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9. Assertion : Inner orbital complexes are low spin complexes.

Reason : In low spin complexes, inner d-orbital(3d) is used in hybridisation.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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10. Assertion : According to crystal field theory, during complex formation, the d-orbitals split in octahedral field to form two sets of orbitals t_{2g} and

e_g.

Reason : Splitting of d-orbitals occurs only in case of strong field ligands.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: C

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11. Assertion : $\left[Fe(H_2O)_6\right]^{3+}$ is strongly paramagnetic whereas $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic.

Reason : H_2O is a weak field ligand and CN^- is a strong field ligand.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are incorrect.

Answer: A

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12. Assertion : EDTA is a hexadentate ligand.

Reason : Denticity of a ligand is given by number of lone pairs donated to central atom by aligand.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: A

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13. Assertion . : The $\left[Ni(en)_3\right]Cl_3$ has lower stability than $\left[Ni(NH_3)_6\right]Cl.$

Reason : In $\left[Ni(en)_3\right]Cl_2$ the geometryis trigonal bipyramidal.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: D

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14. Assertion : Potassium ferrocyanide is diamagnetic whereas potassium ferricyanide is paramagnetic.

Reason : Crystal field splitting in ferrocyanide ion is greater than that off erricyanide ion.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: C

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15. Assertion : Oxidation state of Fe in $Fe(CO)_3$ is zero.

Reason : EAN of Fe in this complex is 36.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: B

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16. Assertion : When NO reacts with $FeSO_4$, a brown coloured complex is formed.

Reason : In the complex, the coordination number of Fe is +6.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: B

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17. Assertion : $\left[Fe(H_2O)_5NO\right]SO_4$ is paramagnetic.

Reason : The Fe in $\left[Fe(H_2O)_5NO\right]SO_4$ has three unpaired electrons.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: A

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

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

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: A

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19. Assertion : Complexes of MX_6 and MX_5L type (X and L are unidentate) do not show geometrical isomerism.

Reason : Geometrical isomerism is not shown by complexes of coordination number 6.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: C

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20. Assertion : Co-ordination number of complex in $[HgI_3]^-$, $[Fe(CO)_5]$ and $[TaF_8]^{3-}$ are three, five and eight respectively.

Reason : Co-ordination number always represents the number of ligands attached on central metal atom.

A. If both (A) and (R) are correct and (R) is the correct explanation of (A).

B. If both (A) and (R) are correct, but (R) is not the correct explanation of (A).

C. If (A) is correct, but(R) is incorrect.

D. If both (A) and (R) are.incorrect.

Answer: C

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Level I

1. The pair of the compounds in which both the metals are in the highest oxidation state is

A. CrO_2Cl_2, MnO_4^-

B. $\left[Co(CN)_6\right]^{3-}, MnO_3$

C. TiO_3, MnO_2

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

Answer: A

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2. In the complex $K_2Fe\left[Fe(CN)_6\right]$

A. the complex is high spin complex

B. both Fe atoms are in the same oxidation state

C. the coordination number of iron is 4

D. both Fe atoms are in different oxidation state

Answer: B

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3. The correct name of $[Pt(NH_3)4Cl_2][PtCl_4]$ is .

A. tetrachloridoplatinum (II) dichloridotetrammine platinate

B. dichloridotetrammineplatinum (IV) tetrachlorido platinate (II)

C. tetramminedichloridoplatinum(IV) tetrachlorido platinate (II)

D. tetrachloridoplatinum (II) tetrammineplatinate (IV)

Answer: C

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4. The complexes $\left[Co(NH_3)_6\right]\left[Cr(C_2O_4)_3\right]$ and $\left[Cr(NH_3)_6\right]\left[Co(C_2O_4)_3\right]$ exhibit

A. geometrical isomerism

B. ionisation energy

C. coordination isomerism

D. linkage isomerism

Answer: C

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5. Optical isomerism is shown by octahedral complexes

A. having all monodentate ligands

B. having all the three bidentate ligands

C. having two trans bidentate ligands

D. having two trans monodentate ligands

Answer: B

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6. Which of the following pairs represents linkage isomers?

A. $\left[Cu(NH_3)_4\right][PtCl_4]$ and $\left[Pt(NH_3)_4\right][CuCl_4]$

B. $\left[Pd(PPh_3)_2(NCS)_2\right]$ and $\left[Pd(PPh_3)_2(SCN)_2\right]$

C. $\left[Co(NH_3)_5NO_3\right]SO_4$ and $\left[Co(NH_3)_5SO_4\right]NO_3$

D. $\left[PtCl_2(NH_3)_4\right]Br_2$ and $\left[PtBr_2(NH_3)_4\right]Cl_2$

Answer: B

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7. In which of the following octahedral complexes of Co (at. no. 27), will the magnitude of Δ_o be the highest?

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

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

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

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

Answer: A

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8. 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. It forms low spin complexes

Answer: D

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9. How many EDTA (ethylene diaminetetraacetic acid) molecules are required to make an octahedral complex with a Ca^{2+} ion?

A. One

B. Two

C. Six

D. Three

Answer: A

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10. Which of the following statements is not correct?

A. Weak ligands like F^-, Cl^- form high-spin complexes

B. Strong ligands like CN^- form low-spin complexes

C. $[FeF_6]^{3-}$ is a high-spin complex

D. $Ni(CO)_4$ is a high-spin complex

Answer: D

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11. Which of the following statements regarding the complex $[M(AA)_2a_2]$ is correct?

A. cis - form is optically active while trans - form is inactive

B. cis - form is optically inactive while trans - form is active

C. Both cis - and trans - forms are optically active

D. Both cis -and trans - forms are optically inactive

Answer: A

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12. The sum of coordination number and oxidation number of the metal M in the complex $\left[M(en)_2(C_2O_4)\right]Cl$ (where en is ethylenediamine) is:

A. 7

B. 8

C. 9

D. 6

Answer: C

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13. The ligand $N(CH_2CH_2NH_2)_3$ is

A. tridentate

B. pentadentate

C. tetradentate

D. bidentate

Answer: C

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14. Which one of the following is a homoleptic complex?

A. tris(ethane-1,2-diamine) cobalt(III) chloride

B. triamminetriaquachromium(III) chloride

C. diainminechloridonitro-N-platinum (II)

D. dichlorido bis (ethane-1,2-diamine) cobalt(III) chloride

Answer: A

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

A. tricyanoferrate (III) ion

B. hexacyanidoferrate (III) ion

C. hexacyano iron (III) ion

D. hexacyanitroferrate (III) ion

Answer: B

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16. Which of the following statements about the complex $[CoF_6]^{3-}$ which is paramagnetic in nature is correct?

A. The cobalt involves d^2sp^3 hybridization

B. The cobalt involves sp^3d^2 -hybridization

C. The primary valencies of cobalt are nine

D. The ligands present in the complex are neutral fluorine atoms

Answer: B

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

A. Ionization isomerism

B. Linkage isomerism

C. Geometrical isomerism

D. Coordination isomerism

Answer: C

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18. Square planar complexes of the type MABXL (where A, B, X and L are unidentates).show

A. two cis and one trans isomers

B. two trans and one cis isomers

C. two cis and two trans isomers

D. one cis and one trans isomers

Answer: A

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19. Number of possible isomers forthe complex $\left[Co(en)_2Cl_2\right]CI$ will be: (en=ethylenediamine)

A. 3

B. 4

C. 2

D. 1

Answer: A

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20. Which one of the following complex ions has geometrical isomers?

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

B. $\left[Ni(NH_3)_5Br^+\right]$

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

D. $\left[Cr(NH_3)_4(en)\right]^{3+}$

Answer: C

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21. Which of the following complex species is not expected to show optical isomerism ?

A. $\left[Co(en)(NH_3)_2Cl_2\right]^+$

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

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

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

Answer: D

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22. Among $\left[Ni(CO)_4\right]$, $\left[Ni(CN)_4\right]^{2-}$, $[NiCl_4]^{2-}$ species, the hybridisation states at the Ni atom are, respectively (Atomic number.of Ni=28)

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

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

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

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

Answer: B

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23. The pair having the same magnetic moment is :

(Atomic Nos : $Cr = 24, Mn = 25, Fe = 26, Co = 27$) [M n (H 2 O) 6] 2 + & [C r (H 2 O) 6] 2 + [C o C l 4] 2 − & [F e (H 2 O) 6] 2 + [C r (H 2 O) 6] 2 + & [C o C l 4] 2 − [C r (H 2 O) 6] 2 + & [F e (H 2 O) 6] 2 +

A. $\left[Cr(H_2O)_6\right]^{2+}$ and $[CoCl_4]^{2-}$

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

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

D. $[CoCl_4]^{2-}$ and $\left[Fe(H_2O)_6\right]^{2+}$

Answer: B

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24. Hybridization, shape and magnetic moment of $K_3\left[Co(CO)_3\right]$ is

A. d^2sp^3, octahedral, 4.9 B.M.

B. sp^3d^2, octahedral, 4.9 B.M

C. dsp^2, square planar, 4.9 B.M.

D. sp^3, tetrahedral, 4.9 B.M.

Answer: B

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

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

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

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

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

Answer: A

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26. Which one of the following is wrongly matched?

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

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

C. $\left[Fe(CN)_6\right]^{3-} - sp^3d^2$

D. $\left[Co(en)_3\right]^{3+}$ - follows EAN rule

Answer: C

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27. Geometrical shape of the most stable complexes formed by the reaction of Ni^{2+} with Cl^-, CN^- and H_2O respectively are

A. Octahedral, tetrahedral and square planar

B. Tetrahedral, square planar and octahedral

C. Square planar, tetrahedral and octahedral

D. Octahedral, square planar and octahderal

Answer: B

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28. The low spin complex of d^6 metal ion in an octahedral field will have the following CFSE :

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

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

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

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

Answer: D

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29. Which ofthe following complexions is expected to absorb visible light?

A. $\left[Ti(en)_2(NH_3)_2\right]^{4+}$

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

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

D. $\left[Sc(H_2O)_3(NH_3)_3\right]^{3+}$

Answer: B

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30. $\left[Cr(H_2O)_6\right]Cl_3$ has a spin only magnetic moment of $3.83BM$. The correct distribution of $3d$ electrons in the chromium of this complex is

A. $3d^1_{xy}, 3d^{xz}\ \hat{}\ 1, 3d^1_{xz}$

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

C. $3d^1_{(x^2-y^2)}, 3d^1_{x^2}, 3d^1_{xz}$

D. $3d^1_{xy}, 3d^1_{(x^2-y^2)}, 3d^1_{yz}$

Answer: A

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31. Among the following complexes, the one which shows zero CFSE is

(Atomic Nos : $Mn = 25, Fe = 26, Co = 27$)

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

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

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

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

Answer: B

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32. EAN of cobalt is 36 in $\left[Co(NH_3)_2O_2(en)Cl\right]$. Knowing that atomic number of Co is 27, O_2 is present as

A. peroxide ion

B. dioxide ion

C. superoxide ion

D. oxide ion

Answer: A

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33. $Fe_2(CO)_9$ is diamagnetic. Which of the following is the correct reason? .

A. One CO is present as bridge group

B. CO is a π-acceptor ligand

C. CO can form π-bond with Fe by back bonding

D. Metal-metal (Fe-Fe) bonding takes plac

Answer: D

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34. Among the following metal carbonyls, the C–O bond order is lowest in

A. $\left[Mn(CO)_6\right]^+$

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

C. $\left[Cr(CO)_6\right]$

D. $\left[V(CO)_6\right]$

Answer: D

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

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

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

C. $cis - K_2[PtCl_2Br]$

D. Na_2CoCl_4

Answer: B

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36. Sodium nitroprusside reacts with sulphide ion to give a purple colour due to the formation of

A. $\left[Fe(CN)_5NO\right]^{3-}$

B. $\left[Fe(NO)_5CN\right]^{-}$

C. $\left[Fe(CN)_5NOS\right]^{4-}$

D. $\left[Fe(CN)_5NOS\right]^{3-}$

Answer: C

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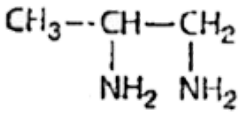
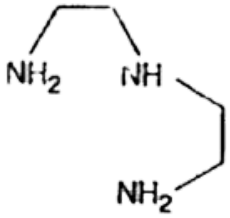
37. Find the ligand having the highest denticity from the following options:

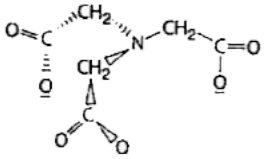
A.



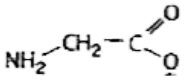
B.



C.



D.



Answer: C

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38. Which of the following ligands is tridentate type?

A. Butane-1,2-diamine (bn)

B. Propane-1,3-diamine (tn)

C. Diethylenetriamine (dien)

D. Triethyitetraamine (trien)

Answer: C

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39. Which of the following complex has highest EAN value?

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

B. $\left[Ti(\sigma - C_2H_5)_2(\pi - C_5H_5)_2\right]$

C. $\left[Ni(en)_3\right]Cl_2$

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

Answer: C

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40. Which of the following complexes contains a cationic ligand?

A. $\left[Ni\left(\eta^5 - C_5H_5\right)_2\right]^+$

B. $\left[V\left(\eta^6 - C_7H_8\right)(\eta_7 - C_7H_7)\right]^+$

C. $\left[Fe(CO)_2(NO)_2\right]^0$

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

Answer: B

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41. In all the following complexes, the coordination number of iron is six. In which of them is the oxidation state of iron the lowest?

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

B. $Fe(CO)_6$

C. $\left[Fe[(EDTA)\right]^-$

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

Answer: B

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42. Consider the coordination compound, $\left[Co(NH_3)_6\right]Cl_3$. In the formation of this complex, the species which acts as the Lewis acid is:

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

B. Cl^-

C. Co^{3+}

D. NH_3

Answer: C

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43. The IUPAC name for the complex $\left[Co(NO_2)(NH_3)_5\right]Cl_2$ is

A. nitrito-N-pentaamminecobalt(III) chloride

B. nitrito-N-pentaamminecobalt(II) chloride

C. pentaammine nitrito-N-cobalt(II) chloride

D. pentaammine nitrito-N-cobalt(III) chloride

Answer: D

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44. Which among the following will be named as dibromidobis (ethylene diamine) chromium (III) bromide?

A. $\left[Cr(en)_3\right]Br_3$

B. $\left[Cr(en)_2Br_2\right]Br$

C. $[Cr(en)Br_4]^-$

D. $[Cr(en)Br_2]Br$

Answer: B

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45. The IUPAC name of the complex $\left[Ni(NH_3)_4\right][NiCl_4]$

A. tetrachloronickel (II) - tetraamminenickel (II

B. tetraamminenickel (II) - tetrachloronickel (II)

C. tetraamminenickel (II) - tetrachloridonickelate (II)

D. tetrachloronickel (II) - tetraamminenickelate (II)

Answer: C

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46. The correct statement about the magnetic properties of $\left[Fe(CN)_6\right]^{3-}$ and $[FeF_6]^{3-}$ is : $(Z = 26)$

A. both are paramagnetic

B. both are diamagnetic

C. $\left[Fe(CN)_6\right]^{3-}$ is diamagnetic, $[FeF_6]^{3-}$ is paramagnetic

D. $\left[Fe(CN)_6\right]^{3-}$ is paramagnetic, $[FeF_6]^{3-}$ is diamagnetic.

Answer: A

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47. Among the following species, the one which causes the highest $CFSE$, Δ_0 as a ligand is

A. CN^-

B. NH_3

C. F^-

D. CO

Answer: D

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

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

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

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

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

Answer: B

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49. Choose the correct order for $\Delta_{\circ}$ for the following complexes.

I) $\left[Co(H_2O)_6\right]^{2+}$ II) $\left[Co(H_2O)_6\right]^{3+}$ III) $\left[Fe(H_2O)_6\right]^{3+}$ IV) $\left[Fe(CN)_6\right]^{3-}$

A. $I < Ii < III < IV$

B. $I < III < II < IV$

C. $I < II = III < IV$

D. $I < II < IV < III$

Answer: B

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50. The IUPAC name of $\left[Pt(NH_3)_4(NO_2)Cl\right]SO_4$ is

A. tetramminechloronitroplatinum (II) sulphate

B. tetramminechloronitroplatinum (IV) sulphate

C. chlorotetramminenitroplatinum (IV)sulphate

D. chloronitrotetrammineplatinum(IV) sulphate

Answer: B

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51. Which of the following is not an example of σ-bonded organometallic compound?

A. $Al_2(CH_3)_6$

B. $Pb(CH_3)_4$

C. $Zn(C_2H_5)_2$

D. Ferrocene

Answer: D

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52. Which of the folowing complex ions possesses sp^3d^2 hybridization?

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

B. $[FeF_6]^{3-}$

C. $\left[Co(NO_2)_6\right]^{3-}$

D. $[TiF_6]^{3-}$

Answer: B

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53. The complex $\left[Ni(dmg)_2\right]$, where dmg is dimethylgloxime,

A. has square planar geometry and is paramagnetic in nature

B. has square planar geometry and is diamagnetic

C. has tetrahedral geomètry and is paramagnetic

D. has tetrahedral geometry and is diamagnetic

Answer: B

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54. Which of the following facts about the complex $\left[Cr(NH_3)_6\right]Cl_3$ is wrong?

A. The complex involves d^2sp^3 hybridization and is octahedral in shape

B. the complex is paramagnetic

C. the complex is diamagnetic

D. The complex gives white precipitate with silver nitrate

Answer: C

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55. The spectrochemical series of ligands is

A. $I^- < F^- < H_2O < NH_3 < CN^- < Cl$

B. $F^- < Cl^- < Br^- < I^- < H_2O < CN^-$

C. $I^- < Br^- < Cl^- < H_2O < NH_3 < CN^-$

D. $I^- < H_2O < F^- < Br^- < CN^- < NH_3$

Answer: C

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Level Ii

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

A. $CuCN$

B. $K_3\left[Cu(CN)_6\right]$

C. $K\left[Cu(CN)_4\right]$

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

Answer: D

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2. An aqueous solution of $CoCl_2$ on addition of excess of conc. HCl turns blue due to formation of

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

B. $\left[Co(H_2O)_2Cl_4\right]^{2-}$

C. $\left[Co(H_2O)_22Cl_4\right]^{2-}$

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

Answer: A

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3. In which of the following pairs both the complex show optical isomerism? . (a) cis- [Cr(C2O4)2CI2] 3-,cis-[Co(NH3)4CI2] b)[Co(en)3] CI3 , cis-[Co(en)2 CI2] CI (c) [Co(NO3)3(NH3) 3] ,cis-[Pt(en)2 CI2] (d) [PtCI(en)CI] , [NiCI2Br2]2-

A. C is $-\left[Cr(C_2O_4)_2Cl_2\right]^{3-}, cis-\left[Co(NH_3)_4Cl_2\right]$

B. $[PtCl(dien)]Cl, [NiCl_2Br_2]^{2-}$

C. $\left[Co(NO_3)_3(NH_3)_3\right], cis-\left[Pt(en)_2Cl_2\right]$

D. $\left[Co(en)_3\right]Cl_3, cis-\left[Co(en)_2Cl_2\right]Cl$

Answer: D

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4. Which of the following facts about the complex $\left[Cr(NH_3)_6\right]Cl_3$ is wrong?

A. The complex involves d^2sp^3 phybridisation and is octahedral in shape

B. The complex is paramagnetic

C. The complex is an outer orbital complex

D. The complex gives white precipitate with silver nitrate solution

Answer: C

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5. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electrons in the nickel and geometry of this complex ion are, respectively

A. one, tetrahedral

B. two, tetrahedral

C. one, square planar

D. two, square planar

Answer: B

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6. i) $K_2\left[Fe(H_2O)_6\right]$ ii) $K_3\left[Cr(CN)_6\right]$ iii) $K_3\left[Fe(CN)_6\right]$ iv) $K_2\left[Ni(CN)_4\right]$

Choose the complex which is paramagnetic

A. (i) , (ii) and (iii)

B. `(i), (iii) and (iv)

C. (ii) , (iii) and (iv)

D. (i), (ii) and (iv)

Answer: A

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7. Red precipitate is obtained when ethanol solution of dimethylglyoxime is added to ammonical Ni(II).

Which of the following statement is not true

A. Red complex has a square planar geometry

B. Complex has symmetrical H-bonding

C. Red complex has a tetrahedral geometry

D. Dimethylglyoxime functions as bidentate ligand

Answer: C

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8. An excess of $AgNO_3$ is added to 100 mL of a 0.01 M solution of dichlorotetraaquachromium(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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9. Consider the following complex ions P, Q and R: $P = [FeF_6]^{3-}, Q = [V(H_2O_6)]^{2+}, R = \left[Fe(H_2O)_6\right]^{2+}$ The correct order of the complex ionis, according to their spin-only magnetic moment values (in BM)is

A. $R < Q < P$

B. $Q < R < P$

C. $R < P < Q$

D. $Q < P < R$

Answer: B

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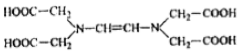
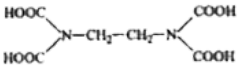
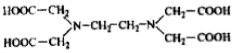
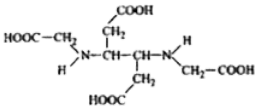
10. The correct structure of ethylenediamineteraacetic acid (EDTA) is

A. 

B. 

C. 

D. 

Answer: C

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11. For the given complex $\left[CoCl_2(en)(NH_3)_2\right]^+$, the number of geometrical isomers, the number of optical isomers and total numbêr of isomers of all type possible respectively are

A. 2,2 and 4

B. 2, 2 and 3

C. 2,0 and 2

D. 0,2 and 2

Answer: B

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

A. ionization isomerim, geometrical isomerism and optical isomerism

B. linkage isomerism, geometrical isomerisin and optical iosmerisin

C. linkage isomerism, ionization isomerism and optical isomerism

D. linkage isomerism, ionization isomerism and geometrical isomerism

Answer: D

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13. 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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14. The d-electron.configurations of Mn^{2+}, Fe^{2+}, Co^{3+} and Ni^{2+} are $3d^5$, $3d^6$, $3d^6$, $3d^8$ respectively. Which of the following aqua complexes will exhibit the minimum paramagnetic behaviour?

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

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

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

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

Answer: B

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15. Crystal field splitting energy (CFSE) for the complex $\left[Cr(H_2O)_6\right]^{2+}$ is when $P = 20925cm^{-1}$ and $\Delta_o = 10462.5cm^{-1}\left(1kJmol^{-1} = 83.7cm^{-1}\right)$

A. $-75kJmol^{-1}$

B. $75kJmol^{-1}$

C. $750kJmol^{-1}$

D. $-750kJmol^{-1}$

Answer: A

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16. Amongst $Ni(CO)_4$, $[Ni(CN)_4]^{2-}$ and $[NiCl_4]^{2-}$

A. $Ni(CO)_4$ and $[NiCl_4]^{2-}$ are dimagnetic and $[Ni(CN)_4]^{2-}$ is paramagnetic

B. $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $Ni(CO)_4$ is paramagnetic

C. $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamgnetic and $[NiCl_4]^{2-}$ is paramagnetic

D. $Ni(CO)_4$ and $[Ni(CN)_4]^{2-}$ are diamagnetic and $[NiCl_4]^{2-}$ is paramgnetic

Answer: C

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17. Which of the following complexes are not correctly matched with the hybridisation of their central metal ion?

(i) $\left[Ni(CO)_4\right], sp^3$ (ii) $\left[Ni(CN)_4\right]^{2-}, sp^3$ (iii) $[CoF_6]^{3-}, d^2sp^3$

(iv) $\left[Fe(CN)_6\right]^{3-}, sp^3d^2$

Select the correct answer using the codes given below:

A. (i) and (ii)

B. (i) and (iii)

C. (ii) and (iv)

D. (ii),(iii) and (iv)

Answer: D

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18. Among $[Ni(CO)_4], [NiCl_4]^{2-}, [Co(NH_3)_4Cl_2]Cl, Na_3[CoF_6], Na_2O_2$ and CsO_2 the total number of paramagnetic compounds is . : 2, 3, 4, 5

A. 2

B. 3

C. 4

D. 5

Answer: B

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

A. $[Co(CN)_6]^{3-}$ has foru 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 low-spin 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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20. $\left[NiCl_2\left\{P(C_2H_5)_2(C_6H_5)\right\}_2\right]$ exhibits temperature dependent magnetic behaviour (paramagnetic/diamagnetic). The coordination geometries of Ni^{2+} in the paramagnetic and diamagnetic states are respectively

A. tetrahedral and tetrahedral

B. square planar and square planar

C. tetrahedral and square planar

D. square planar and tetrahedra

Answer: C

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21. The octahedral complex of a metal ion , M^{3+}, with four monodentate ligand L_1, L_2, L_3 and L_4 absorb wavelengths in the region of red, green , yellow and blue respectively. The increasing order of field strength

A. $L_1 < L_2 < L_4 < L_3$

B. $L_4 < L_3 < L_2 < L_1$

C. $L_1 < L_3 < L_2 < L_4$

D. $L_3 < L_2 < L_4 < L_1$

Answer: C

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22. If the length of CO bond in carbon monoxide is. 1.128 Å, then what is the value of CÓ bond length in $Fe(CO)_5$?

A. 1.15Å

B. 1.128Å

C. 1.72Å

D. 1.118Å

Answer: A

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23. Which of the following statements is correct?

A. $[NiCl_4]^{2-}$ complex is more stable than $[Ni(dmg)_2]$ due to higher CFSE value

B. With d^2sp^3 hybridisation $\left[FeCl(CN)_4(O_2)\right]^{4-}$ complex is diamgnetic

C. $[V(CO_6)]$ is not very stable and easily reduces to $\left[V(CO)_6\right]^{\Theta}$

D. Ligands such as $CO, CN^{\Theta}, NO^{\oplus}$ are electron donor due to the presence of filled -molecular orbital

Answer: C

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24. Dipole moment will be zero in the complexes

I. $\left[Ni(CN)_4\right]^{2-}$ II. $cis-Pt\left[(NH_3)_2Cl_2\right]$ III. $\text{trans}-\left[Pt(NH_3)_2Cl_2\right]$

A. I and II

B. I and III

C. II and III

D. I, II and III

Answer: B

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

A. estimating 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. Which of the following statements is/are correct for $[Cr(NH_3)_5Br]SO_4$ and $[Cr(NH_3)_5SO_4]Br$

(I) Co-ordination number of the central atom is 6 for both

(II) In both the cases, the anionic ligand satisfies the primary valency in equal manner.

(III) Electrical conductivities of both the complexes are equal

A. I, II

B. I, III

C. II, III

D. I only

Answer: D

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27. A solution containing 2.675g of $CoCl_3.6NH_3$ (molar mass= $267.5gmol^{-1}$) is passed through a cation exchanger. The chloride ions obtained in solution were treated with excess of $AgNO_3$ to give $4.78g$of AgCI (molar mass $= 143.5gmol^{-1}$). The formula of the complex is (atomic mass of Ag=108a).

A. $\left[CoCl(NH_3)_6\right]Cl_2$

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

C. $\left[CoCl_2(NH_3)_4\right]^Cl$

D. $\left[CoCl_3(NH_3)_3\right]$

Answer: B

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28. One mole of the coinplex compound $Co(NH_3)_5Cl_3$ gives three 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 $AgCl(s)$. The structure of the complex is

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

B. $\left[Co(NH_3)_3Cl_3\right].2NH_3$

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

D. $\left[Co(NH_3)_4Cl\right]Cl_2.NH_3$

Answer: A

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29. Which of the following name formula combinations is not correct?

	Formula	Name
A)	$K_2[Pt(CN)_4]$	Potassium tetracyanoplatinate (II)
B)	$[Mn(CN)_5]^{2-}$	Pentacyanomagnate (II) ion
C)	$K[Cr(NH_3)_2Cl_4]$	Potassium diammine tetra-chlorochromate (III)
D)	$[Co(NH_3)_4(H_2O)I]SO_4$	Tetraammine aquaiodo cobalt (III) sulphate

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30. What is the correct name for the following complex?

$[Co(NH_2)_2(NH_2-CH_3)_2]Cl$

A. Diamidodimethylaminecobalt(III) chloride

B. bis(Methylamine) diamidocobalt (III) chloride

C. Diamidobis (methylamine) cobalt(III) chloride

D. Diaminedimethylaminecobalt(III) chloride)

Answer: C

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31. The number of geometric isomers that can exist for square planar $[Pt(Cl)(py)(NH_3)(NH_2OH)]^+$ is (py = pyridine)

A. 3

B. 4

C. 6

D. 2

Answer: A

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32. Which of the electrònic configuration according to crystál field theory of the compound is correct $[MnF_6]^{4-}$?

A. $3\left(t_{2g}^5 e_g^0\right)$

B. $\left(t_{2g}^3 e_g^2\right)$

C. $4\left(e_g^2 t_{2g}^3\right)$

D. $4\left(t_{2g}^3 e_g^2\right)$

Answer: B

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33. Which of the following complex is heteroleptic as well as unable to show geometrical isomerison

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

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

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

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

Answer: C

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34. Ammonia forms the complexion $\left[Cu(NH_3)_4\right]^{2+}$ with copper ions in alkaline solutions but not in acidic solutions. What is the reason for it?

A. In acidic solutions hydration protects copper ions

B. In acidic solutions protons coordinate with ammonia molecules forming NH_4^+ ion 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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35. Nickel (Z = 28) combines with a uninegative monodentate ligand X^- to form a paramagnetic complex $[NiX_4]^{2-}$. The number of unpaired electrons in the nickel and geometry of this complex ion are, respectively

A. one, tetrahedral

B. two, tetrahedral

C. one, square planar

D. two, square planar

Answer: B

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36. The correct order of magnetic moments (spin only values in B.M.) among is

A. $[MnCl_4]^{2-} > [CoCl_4]^{2-} > [Fe(CN)_6]^{4-}$

B. $[Fe(CN)_6]^{4-} > [CoCl_4]^{2-} > [MnCl_4]^{2-}$

C. $\left[Fe(CN)_6\right]^{4-} > [MnCl_4]^{2-} > [CoCl_4]^{2-}$

D. $[MnCl_4]^{2-} > \left[Fe(CN)_6\right]^{4-} > [CoCl_4]^{2-}$

Answer: A

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37. Which of the following options is correct when six ligands are approaching towards central metal ion along axis?

A. Energy of t_{2g} set of d-orbitals increases and that of e_g set decreases as compared to that in free metal ion.

B. Energy of t_{2g} set of d-orbitals decreases and that of e_g set increases as compared to that in free metal ion.

C. Energy of both sets of d-orbitals increases, equally as compared to that in free metal ion.

D. Energy of e_g set of d-orbitals increases more than t_{2g} set of d-orbitals, but the energy of both sets of d-orbitals increases as compared to that in free metal ion.

Answer: D

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38. Two compounds $Co(NO_2)_3$ and KNO_2 are mixed together in 1 : 3 proportion to form a complex which produces four particles in solution. What is the correct formula for the complex?

A. $K_2\left[Co(NO_2)_6\right]$

B. $K_2\left[Co(NO_2)_4\right]_3$

C. $K_3\left[Co(NO_2)_6\right]$

D. $K_2\left[Co(NO_2)_3\right]_3$

Answer: C

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39. Select the true statement from the following for metal carbonyls?

A. The π back bonding strengthens M-Cbond order as well as CO bond order

B. The π back bonding weakens M-C bond order as well as CO bond order

C. The π back bonding weakens M-Cbond order but strengthens CO bond order.

D. The π back bonding strengthens M-C bond order and weakens CO bond order

Answer: D

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40. Which of the following complexes has magnetic moment of 2.83 Bohr magneton?

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

B. $\left[Ni(H_2O)_6\right]Cl_2$

C. $\left[Cu(NH_3)_6\right]Cl_2$

D. $\left[Mn(H_2O)_6\right]Cl_2$

Answer: B

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41. 'Which of the following statement is not correct?

A. $Ti(NO_3)_4$ is a colourless compound

B. $\left[Cu(NCCH_3)_4\right]^+ BF_4^-$ is a colourless compound

C. $\left[Cr(NH_3)_6\right]^{3+} 3Cl^-$ is a coloured compound

D. $K_3[VF_6]$ is a colourless compound

Answer: D

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42. Relative to the average energy in the spherical crystal field, the eg orbitals in octahedral field is

A. raised by $(2/5)\Delta_0$

B. lowered by $(2/5)\Delta_0$

C. raised by $(3/5)\Delta_0$

D. lowered by $(3/5)\Delta_0$

Answer: C

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43. Of the following statements, which one is correct?

A. $[CoF_6]^{3-}$ is a high spin complex and $\left[Co(NH_3)_6\right]^{3+}$ is alow spin complex

B. $[CoF_6]^{3-}$ is a low spin complex and $\left[Co(NH_3)_6\right]^{3+}$ is a high spin complex

C. Both $[CoF_6]^{3-}$ and $\left[Co(NH_3)_6\right]^{3+}$ are low spin complexs

D. Both $[CoF_6]^{3-}$ and $\left[Co(NH_3)_6\right]^{3+}$ are high spin compolexs

Answer: A

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44. Which of the following statement is not correct?

A. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the state of hybridization of nickel

B. The complexes $[NiCl_4]^{2-}$ and $\left[Ni(CN)_4\right]^{2-}$ differ in the magnetic properties

C. the complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in the geometry

D. The complexes $[NiCl_4]^{2-}$ and $[Ni(CN)_4]^{2-}$ differ in primary valencies of nickel

Answer: D

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45. The complexes $[FeCl_4]^{2-}$, $[CoCl_4]^{2-}$ and $[Cu(CN)_4]^{2-}$ respectively, have number of unpaired electrons , equal to

A. 3,3 and 0

B. 4, 2 and 0

C. 1, 3 and 4

D. 4, 3 and 1

Answer: D

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46. Which of the following statements regarding the complex $[M(AA)_2a_2]$ is correct?

A. cis-form is optically active while trans-form is inactive

B. cis-form is optically inactive while trans-form is active

C. Both cis-and trans-forms are optically active

D. Both cis-and trans-forms are optically inactive

Answer: A

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47. Which of the following statements is not correct?

A. The stability constant of $[Co(NH_3)_6]^{3+}$ is larger than that of $[Co(NH_3)_6]^{2+}$

B. The cyano complexes are far more stable than those formed by halide ions

C. The stability of halide complexes follows in the order $I^- > Br^- > Cl^-$

D. The stability constant of $\left[Cu(NH_3)_4\right]^{2+}$ is larger than that of $\left[Cd(NH_3)_4\right]^{2+}$

Answer: C

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48. One mole of complex compound 'Co(NH3)5Cl3 gives 3 moles of ions on dissolution in water. One mole of the same complex reacts with 2 moles of AgNO3 solution to yield 2 moles of AgCl .The structure of the complex is

A. $\left[Cr(NH_3)_4Cl\right]Cl_2.NH_3$

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

C. $\left[Cr(NH_3)_5Cl\right]Cl_2$

D. $\left[Cr(NH_3)_3Cl_3\right].2NH_3$

Answer: C

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49. Of the following complexes, the correct statement is

1. trans-$\left[Co(NH_3)_4I_2\right]^{\oplus}$ 2. $cis-\left[Co(NH_3)_2(en)_2\right]^{3+}$

3. trans – $\left[Co(NH_3)_2(en)2\right]^{3+}$ 4. $[NiI_4]^{2-}$

5. $[TiF_6]^{2-}$ 6. $[CoF_6]^{3-}$: 4,5 are coloured, 6 is colourless; 2 is optically active, 1, 3 are optically inactive; 1, 2 are optically active, 3 optically inactive; 4 is coloured, 5,6 are colourless

A. 4, 5 are coloured, 6 is colourless

B. 2 is optically active, 1, 3 are optically inactive

C. 1,2 are optically active, 3 optically inactive

D. 4 is coloured, 5, 6 are colourless

Answer: B

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50. The complex $[Pt(py)(NH_3)(NO_2)ClBrl]$ has

A. 10 geometrical isomers, each is optically active

B. 10 geometrical isomers, five of them are optically active

C. 15 geometrical isomers, each is optically active

D. 15 geometrical isomers, each is optically inactive

Answer: C

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Level Iii Single Correct Answer Type

1. A co-ordination complex compound of cobalt has the molecular formula containing five ammonia molecules, one nitro group and two chlorine atoms for one cobalt atom. One mole of this compound produces three mole ions in an aqueous solution, on reacting with excess of $AgNO_3$, $AgCl$ is precipitated. The ionic formula for this complex would be:

A. $\left[Co(NH_3)_5(NO_2)\right]Cl_2$

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

C. $\left[Co(NH_3)_4(NO_2)Cl\right]$

D. $\left[Co(NH_3)_5\right]$

Answer: A

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2. A solution containing 0.319 of complex $CrCl_3.6H_2O$ was passed through cation exchange and the solution given out was neutralised by

2.85 mL of $0.125M$ NaOH. What is the correct formula of the complex.

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

B. $\left[Cr(H_2O)_5\right]H_2O.\,Cl_2$

C. $\left[Cr(H_2O)_4Cl_2\right]Cl.\,2H_2O$

D. $\left[Cr(H_2O)_3Cl_3\right].\,3H_2O$

Answer: A

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3. The two isomers X and Y with the formula $Cr(H_2O)_5ClBr_2$ were taken for experiment on depression in freezing point. It was found that one mole of X gave depression corresponding to 2 moles of particles and one mole of Y gave depression due to 3 moles of particles. The structural formulae of X and Y respectively are

A. $\left[Cr(H_2O)_5Cl\right]Br_2,\ \left[Cr(H_2O)_4Br_2\right]Cl.\,H_2O$

B. $\left[Cr(H_2O)_5Cl\right]Br_2,\ \left[Cr(H_2O)_3ClBr\_2\right].\,2H_2O$

C. $\left[Cr(H_2O)_5Br\right]BrCl$, $\left[Cr(H_2O)_4\right]Br.\ H_2O$

D. $\left[Cr(H_2O)_4Br_2\right]Cl.\ H_2O$, $\left[Cr(H_2O)_5Cl\right]Br_2$

Answer: D

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4. An octahedral complex with the molecular composition $M.5NH_3.\ Cl.\ SO_4$ has two isomers A and B. The solution of A gives a white precipitate with $AgNO_3$ solution and the solution of B gives white precipitate with $BaCl_2$ solution. The type of isomerism exhibited by the complex is

A. Linkage isomerism

B. lonization isomerism

C. Coordinate isomerisi

D. Geometrical isomerism

Answer: B

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5. Identify the correct trend given below:

(Atomic No. Ti: 22, Cr: 24 and Mo: 42)

A) Δ_0 of $\left[Cr(H_2O)_6\right]^{2+} > \left[Mo(H_2O)_6\right]^{2+}$ and Δ_0 of $\left[Ti(H_2O)_6\right]^{3+} > \left[Ti(H_2O)_6\right]^{2+}$

B) Δ_0 of $\left[Cr(H_2O)_6\right]^{2+} > \left[Mo(H_2O)_6\right]^{2+}$ and Δ_0 of $\left[Ti(H_2O)_6\right]^{3+} > \left[Ti(H_2O)_6\right]^{3+}$

C) Δ_0 of $\left[Cr(H_2O)_6\right]^{2+} < \left[Mo(H_2O)_6\right]^{2+}$ and Δ_0 of $\left[Ti(H_2O)_6\right]^{3+} > \left[Ti(H_2O)_6\right]^{2+}$

D) Δ_0 of $\left[Cr(H_2O)_6\right]^{2+} < \left[Mo(H_2O)_6\right]^{2+}$ and Δ_0 of $\left[Ti(H_2O)_6\right]^{3+} > \left[Ti(H_2O)_6\right]^{2+}$

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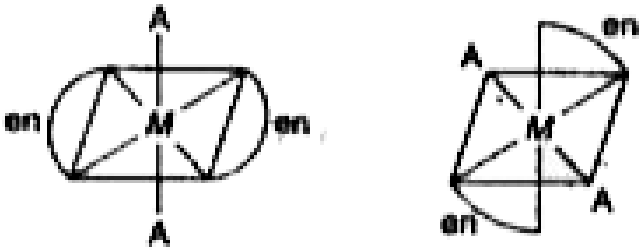
6. Two complexes given below are:



A. geometrical isomers

B. position isomers

C. optical isomers

D. identical

Answer: D

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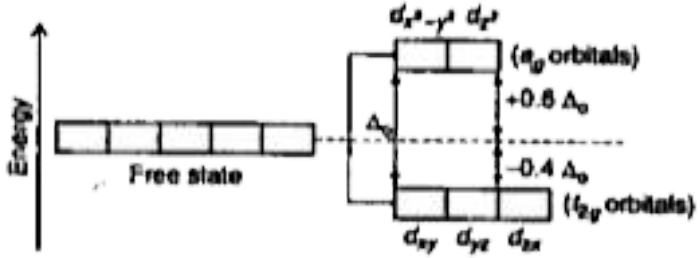
7.



The above splitting of d-orbitals takes place in the formation of

A. tetrahedral complexes

B. square-planar complexes

C. octahedral complexes

D. both tetrahedral and square-planar complexes

Answer: C

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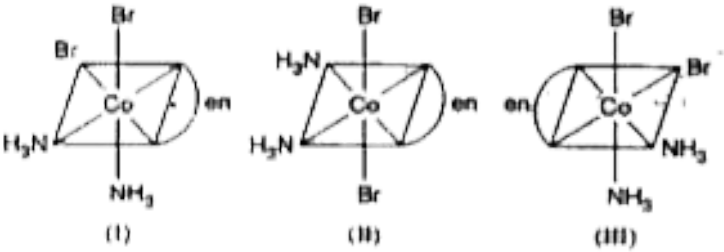
8. Three arrangements are shown for the complex, $\left[Co(en)(NH_3)_2Br_2\right]^+$. which one is the wrong statement?



A. I and II are geometrical isomers

B. II and III are optical isomers

C. I and III are opitcal isomers

D. II and III are geometrical isomers

Answer: B

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9. Which of the following statements is not correct?

A. Higher the charge density on the central ion, the greater is the stability of its complexes

B. Chelating ligands form more stable complexes as compared to monodentate ligands

C. The higher the oxidation state of the metal, the more stable is the complex

D. The cyano and ammine complexes are less stable than those formed by halide ions

Answer: D

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10. The enthalpy of hydration of Cr^{2+} is $-460 kcal mol^{-1}$. In the absence of CFSE, the value for $\Delta H = -424 kcal mol^{-1}$. What is the value of Δ_0 for $\left[Cr(H_2O)_6\right]^{2+}$

A. $60 \text{ kcal mole}^{-1}$

B. $-60 \text{ kcal mole}^{-1}$

C. $25.7 \text{ kcal mole}^{-1}$

D. $-25.7 \text{ kcal mole}^{-1}$

Answer: A

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Level Iii Multiple Correct Answer Type

1. The compound(s) that exhibit(s) geometrical isomerism is (are)

A. $\left[Cr(NH_3)_5Cl\right]Cl_2$ and $\left[Cr(NH_3)_4Cl_2\right]Cl$

B. $\left[Co(NH_3)_4Cl_2\right]^+$ and $\left[Pt(NH_3)_2(H_2O)Cl\right]^+$

C. $[CoBr_2Cl_2]^{2+}$ and $[PtBr_2Cl_2]^{2-}$

D. $\left[Pt(NH_3)_3(NO_3)\right]Cl$ and $\left[Pt(NH_3)_3Cl\right]Br$

Answer: B::D

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2. Which of the following statements is/are false?

A. $[Ni(CO_4)]$ is high spin complex

B. Weak ligands like F^-, Cl^- and OH^- usually form low spin complexes

C. $[FeF_6]^{3-}$ is a high spin complex

D. Strong ligand like CN^- and NO_2^-, generally form high spin complexes

Answer: A::B::D

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3. Which of the following are true for ligand-metal complex?

A. a.Larger the ligand, the more stable is the metal-ligand bond

B. b. Larger the permanent dipole moment of ligand, the more stable is the bond

C. c. Greater the ionization potential of central metal, the stronger is the bond

D. d. Highlycharged ligand forms strong bond

Answer: A::B::C

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4. Which of the following ligand(s) is/are ambidentate?

A. NOS^{Θ}

B. SCN^{Θ}

C. NO_2^{Θ}

D. CH_3COO^{Θ}

Answer: A::B::C

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5. Which of the following complex(s) is/are having correct name?

A. $Cs[Pt(NH_3)I_5]$ Ceasium amminepentaiodidoplatinate (IV)

B. $\left[Ag(CN)_2\right]^{\Theta}$ - Dicyanidoargentate (I) ion

C. $Rb_3\left[Cr(C_2O_4)_3\right]$ -Rubidium trioxalatochromate (III)

D. $K_2[Ni(EDTA)]$ Potassium ethylenediaminetetraacetatonickel (II)

Answer: A::B::C

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6. Which of the following statement(s) is/are correct?

A. Primary valency of the central metal of a complex is always satisfied by anions

B. Secondary valency of the central metal of a complex may be satisfied by either negative ions or netural molecules

C. Species which satisfy primary valencies in a complex compound in many cases can be precipitated out by using suitable reagents

D. None of these

Answer: A::B::C

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7. The compound(s) that exhibit(s) geometrical isomerism is (are)

A. $[Pt(en)Cl_2]$

B. $\left[Pt(en)_2\right]Cl_2$

C. $\left[Pt(en)_2Cl_2\right]Cl_2$

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

Answer: C::D

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8. Which of the following complexes have square planar shape?

A. $[Pt(en)Cl_2]$

B. $[PtCl_4]^{2-}$

C. $[NiCl_4]^{2-}$

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

Answer: A::B

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9. Which of the following isomerisms are shown by the complex $[CoCl_2(OH)_2(NH_3)_2]Br$?

A. Ionization

B. Linkage

C. Geometrical

D. Optical

Answer: A::C::D

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10. A complex compound consists of 1 mole of Co^{3+} ion, 6 moles of NH_3, 6 moles of NO_2^- and 1 mole of Cr^{3+} ion. The complex has neither the highest value nor the lowest value of electrical conductivily. The possible formula for the complex is/are

A. $[Cr(NH_3)_5(NO_2)][Co(NH_3)(NO_2)_5]$

B. $\left[Co(NH_3)_6\right]\left[Cr(NO_2)_6\right]$

C. $\left[Cr(NH_3)_4(NO_2)_2\right]\left[Co(NH_3)_2(NO_2)_4\right]$

D. $\left[Co(NH_3)_5(NO_2)\right]\left[Cr(NH_3)(NO_2)_5\right]$

Answer: A::D

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11. Which of the following are correct about $\left[Cu(NH_3)_4\right]SO_4$?

A. It is a square planar complex

B. It is paramagnetic with one unpaired electron in the d-subshell

C. It gives white precipitate with $BaCl_2$ solution

D. Its aqueous solution does not conduct electricity

Answer: A::C

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12. Which of the following are π-bonded organometallic compounds?

A. Zeise's salt

B. Trimethyl aluminimum

C. Dibenzene chromium

D. Grignard reagent

Answer: A::C

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Level Iii Numerical Type

1. For the octahedral complexes of Fe^{3+} in SCN^- (thiocyanato-S) and in CN^- ligand environments, the difference between the spin-only magnetic moments in B.M. (when approximated to the nearest integar)

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2. Among the complex ions,

$[Co(NH_2CH_2CH_2NH_2)_2Cl_2]^+$, $[CrCl_2(C_2O_4)_2]^{3-}$, $[Fe(H_2O)_4(OH)_2]^+$

the number of complex ion(s) that show(s) cis-trans isomerism is

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3. In the complex acetylbromidodicarbonylbis (triethyl phosphine) iron (II), the number of Fe-C bond(s) is

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4. The number of geometrical isomers possible for the complex $[CoL_2Cl_2]^-\left(L = H_2NCH_2CH_2O^-\right)$ is

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5. The possible number of stereoisomers for the formula $[Ma_2b_3]^{n\pm}$ is

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6. The EAN of $M(CO)_x$ is 36. If atomic number of metal is 24, then x is .....

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Level Iii Matching Column Type

1.

Column I	Column II
A) $K_2[Cr(CN)_4(NH_3)(NO)]$	p) d^2sp^3
B) $[Co(OX)_3]^{-3}$	q) Chelation
C) $Cu(en)_2]^{-2}$	r) +3
D) $[Mn(CN)_6]^{3-}$	s) Paramagnetic

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2. Match the coloumns.

Column I		Column II	
A)	$[Co(NH_3)_4(H_2O)_2]Cl_2$	p)	Geometrical isomers
B)	$[Pt(NH_3)_2Cl_2]$	q)	Paramagnetic
C)	$[Co(H_2O)_5Cl]Cl$	r)	Diamagnetic
D)	$[Ni(H_2O)_6]Cl_2$	s)	Metal ion with +2 oxidation state

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3. Match the ligand with its type .

Column I		Column II	
A)	Cyanide ion	p)	Unidentate ligand
B)	Glycinate	q)	Bidentate ligand
C)	Ehtylenediamine	r)	Ambidentate ligand
D)	Carbonate ion	s)	Chelating ligand

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4. Match the coloumns.

	Column I		Column II
A)	$[M(AA)b_2cd]$	p)	Complex molecule which shows optical isomerism
B)	$[M(AA)b_2c_2]$	q)	Only one cis and one trans isomer
C)	$[M(AA)_2b_2]$	r)	Only one cis and two trans isomers
D)	$[M(AA)_3]$	s)	Complex in which any cis isomer is optical active

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Level Iii Statement Type

1. Statement-1 : According to crystal field theory, during complex formation, the d-orbitals split and form two. sets of orbitals t_{2g} and e_g.

Statement-2 : Splitting ofd-orbitals occurs only in case of strong field ligands.

A. Statement 1 is True, Statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer: C

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2. Statement-1 : $\left[Fe(H_2O)_6\right]^{3+}$ is strongly paramagnetic whereas $\left[Fe(CN)_6\right]^{3-}$ is weakly paramagnetic.

Statement-2 : H_2O is a weak field ligand and CN^- is a strong field ligand.

A. Statement 1 is True, Statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer: A

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3. Statement-1 : $\left[Ni(CO)_4\right]$ has square planar geometry while $\left[Ni(CN)_4\right]^{4-}$ has tetrahedral geometry.

Statement-2 : Geometry of above complexes depends upon the nature of ligands attached.

A. Statement 1 is True, Statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer: D

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4. Statement-1 : $H_2N - NH_2$ is a chelating ligand.

Statement-2 : A chelating ligand must possess two or more lone pairs at such a distance that it may form suitable strain free rings at the metal ion.

A. Statement 1 is True, Statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer: D

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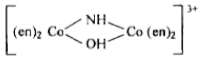
5. Statement-1 : In polynuclear complexes, the bridging group is indicated in the formula of the complex by separating it from the rest of complex by hyphens and writing letter u before its name.

Statement-2 : The complex  is named as tetrakis (ethylenediamine)

μ - hydroxo- μ - imidodi cobalt(III) ion or bis (ethylene diamine) cobalt (III) μ - hydroxo - μ imido bis (ethylene diamine) cobalt (III) ion.

A. Statement 1 is True, Statement 2 is True, Statement 2 is Correct explanation for Statement 1.

B. Statement 1 is True, Statement 2 is True, Statement 2 is NOT a correct explanation for Statement 1.

C. Statement 1 is True, Statement 2 is False.

D. Statement 1 is False, Statement 2 is True.

Answer: B

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Level Iii Linked Comprehension Type Paragraph I

1.

Which is correct in the case of $\left[Fe(CN)_6\right]^{4-}$ complex ?

A. diamagnetic

B. octahedral

C. d^2sp^3- hybridised

D. all are correct

Answer: D

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2. Which has the highest paramagnetic character?

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

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

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

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

Answer: B

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3. Which statement is incorrect?

A. $[Ni(CO_4)]$: Tetrahedral, paramagnetic

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

C. $\left[Ni(CO)_4\right]$: Tetrahedral, diamagnetic

D. $[NiCl_4]^{2-}$: Tetrahedral, paramagnetic

Answer: A

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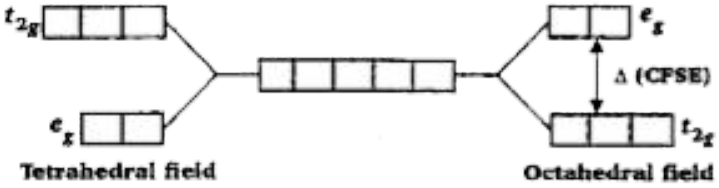
Level Iii Linked Comprehension Type Paragraph Ii

1. When degenerate d-orbitals of an isolated atom/ion come under influence of magnetic field of ligands, the degeneracy is lost. The two sets $t_{2g}\left(d_{xy}, d_{yz}, d_{xz}\right)$ and $e_g\left(d_{x^2}, d_{x^2-y^2}\right)$ are either stabilised or destabilised depending upon the nature of magnetic field. It can be expressed diagramatically as:

Value of CFSE depends upon nature of ligand and a spectro-chemical series has been made experimentally, for tetrahedral complexes Δ_t is about 4/9 times to Δ_0 (CFSE for octahedral complexes).



This energy lies in visible region and ie, why electronic transition $t_{2g} \Leftrightarrow e_g$ are responsible for colour. Such transitions are not possible d^0 and d^{10} configuration.

Cr^{3+} form four complexes with four different ligands which are

$[Cr(Cl)_6]^{3-}$, $[Cr(H_2O)_6]^{3+}$, $[Cr(NH_3)_6]^{3+}$ and $[Cr(CN)_6]^{3-}$. The order of CFSE (Δ_0) in these complexes is :

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2.

For an octahedral complex, which of the following d-electron configuration will give maximum CFSE?

A. High spin d^6

B. Low spin d^4

C. Low spin d^5

D. High spin d^7

Answer: C

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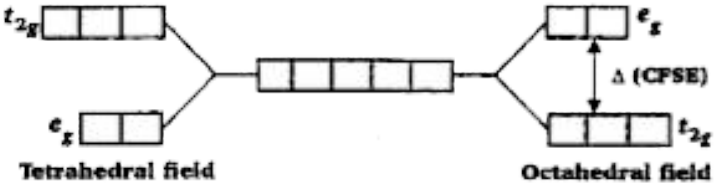
3.



This energy lies in visible region and ie, why electronic transition $t_{2g} \Leftrightarrow e_g$ are responsible for colour. Such transitions are not possible d^0 and d^{10} configuration.

$Ti^{3+}_{(aq.)}$ is purple while$Ti^{4+}_{(aq.)}$ is colourless because :

A. There is no crystal field effect in Ti_{4+}

B. The energy difference between t_{2g} and e_g of Ti^{4+} is quite high and does not fall in the visible region.

C. Ti^{4+} had d^0 configuration

D. Ti^{4+} is very small in comparison to Ti^{3+} and hence does not absorb any radiation.

Answer: C

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4.

The Δ_0 for $[CoCl_6]^{4-}$ is $18000cm^{-1}$. The Δ_t for $[CoCl_4]^{2-}$ will be

A. $18000cm^{-1}$

B. $16000cm^{-1}$

C. $8000cm^{-1}$

D. $2000cm^{-1}$

Answer: C

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Level Iii Linked Comprehension Type Paragraph Iii

1. A metal complex having the composition $Cr(NH_3)_4Cl_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B

gives a pale yellow precipitate soluble in concentrated ammonia.

The hybridization of Cr in the complexes A and B, respectively, is

A. d^2sp^3 and sp^3d^2

B. sp^3d^2 and d^2sp^3

C. sp^3d and dsp^3

D. d^2sp^3 and d^2sp^3

Answer: D

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2. A metal complex having the composition $Cr(NH_3)_4Cl_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia whereas B gives a pale yellow precipitate soluble in concentrated ammonia.

The oxidation state of Cr in complex A is

A. $+1$

B. $+2$

C. $+3$

D. 0

Answer: C

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3. A metal complex having composition $Cr(NH_3)_4Cl_2Br$ has been isolated in two forms A and B. The form A reacts with $AgNO_3$ to give a white precipitate readily soluble in dilute aqueous ammonia, whereas B gives a pale yellow precipitate soluble in concentrated ammonia. Write the formula,of A and B

A. $\left[Cr(NH_3)_4Br\right]Cl_2$

B. $\left[Cr(NH_3)_4ClBr\right]Cl$

C. $\left[Cr(NH_3)_4Cl_2\right]Br$

D. $\left[Cr(NH_3)_4\right]BrCl_2$

Answer: C

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Level Iii Linked Comprehension Type Paragraph Iv

1.

Select the correct order of $M - C$ bond order in the following molecule and ions :

I. $\left[Ni(CO)_4\right]$ II. $\left[Co(CO)_4\right]^{\Theta}$ III. $\left[Fe(CO)_4\right]^{2-}$

A. $I > II > III$

B. $I = II = III$

C. $II > III > I$

D. $I < II < III$

Answer: D

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2. If in the mixed carbonyl, the other ligand is also π acceptor, it would complete with the ligand CO for gaining the metal d_π electron charge. The higher is the extent of back donationin CO, the lesser will be the stretching vibration frequency for C - O bond. If PPh_3 is better π - acceptor than CO, then answer the following.

Select correct order of stretching vibration frequency C - O bond in following molecules

I. $\left[Ni(CO)_4\right]$ II. $[Ni(PF_3)(CO_3)]$

A. $I > II$

B. $I < II$

C. $I = II$

D. cannot be predicted

Answer: B

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3.

Select the correct order of C - O bond length in the following molecules

I. $\left[Mo(CO)_3(PF_3)_3\right]$ II. $\left[Mo(CO)_3(PCl_3)_3\right]$ III. $\left[Mo(CO)_3\left(P(Me)_3\right)_3\right]$

A. $I > II > III$

B. $III > I > II$

C. $II > III > I$

D. $I < II < III$

Answer: D

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